

TABLE OF CONTENTS

437-004-0710	Compressed Gases.....	H-1
437-004-0715	Acetylene.....	H-2
(1)	Cylinders.....	H-2
(2)	Piped systems.....	H-2
437-004-0716	Oxygen.....	H-2
(1)	Scope.....	H-2
(2)	Bulk oxygen systems.....	H-2
437-004-0717	Hydrogen.....	H-7
437-004-0720	Flammable Liquids.....	H-7
(1)	Definitions.....	H-7
(2)	Storage and transporting.....	H-8
(3)	Tanks and containers.....	H-9
(4)	Tanks elevated for gravity discharge.....	H-10
(5)	Tanks with top openings only.....	H-10
(6)	Dispensing and fueling.....	H-10
(7)	Handling and use of flammable liquids.....	H-11
(8)	Heating devices that use flammable liquids.....	H-11
(9)	Design, construction, and capacity of storage cabinets.....	H-12
(10)	Design and construction of inside storage rooms.....	H-12
Appendix A to OAR 437-004-0720	H-15
437-004-0725	Spray Finishing.....	H-17
437-004-0770	Explosives and Blasting Agents.....	H-17
437-004-0780	Storage and Handling of Liquefied Petroleum Gases.....	H-17
(1)	Definitions.....	H-17
(2)	Scope.....	H-18
(3)	Basic rules.....	H-19
(4)	Cylinder systems.....	H-45
(5)	Systems using containers other than DOT containers.....	H-49
(6)	Liquefied petroleum gas as a motor fuel.....	H-56
(7)	Storage of containers awaiting use.....	H-61
(8)	Liquefied petroleum gas dispensing.....	H-62

H HAZARDOUS MATERIALS

437-004-0790	Use of Liquefied Petroleum Gas or Natural Gas in Fields and Orchards.....	H-68
(1)	Scope.....	H-68
(2)	Definitions.....	H-68
(3)	Components.....	H-68
(4)	Installation.....	H-69
(5)	Welding.....	H-69
437-004-0800	Storage and Handling of Anhydrous Ammonia.....	H-69
(1)	Scope.....	H-69
(2)	Definitions.....	H-69
(3)	Basic rules.....	H-70
(4)	Systems using stationary, non-refrigerated storage containers.....	H-79
(5)	Refrigerated storage systems.....	H-81
(6)	Systems using portable DOT containers.....	H-84
(7)	Tank motor vehicles for the transportation of ammonia.....	H-85
(8)	Systems on farm vehicles other than for the application of ammonia.....	H-87
(9)	Systems on farm vehicles for the application of ammonia.....	H-88
437-004-0950	Hazardous Waste Operations and Emergency Response.....	H-89

437-004-0710 Compressed Gases.

(1) Employers are responsible to keep compressed gas cylinders under their control in a safe condition by doing visual inspections that cover these points:

- (a)** Corrosion or pitting which reduces the wall thickness.
- (b)** Cuts, gouges or digs.
- (c)** Dents, bulges or other distortion or unsymmetrical condition or appearance.
- (d)** Distortion, looseness or failure of welds in the cylinder rings.
- (e)** Evidence of having been burned or exposed to fire, arc or torch burns.
- (f)** Damage to cylinder neck threads or inability to obtain a gas-tight seal by reasonable methods.

(2) If a compressed gas cylinder or tank shows any of the above conditions, or any other condition that could affect its safety, do not use it. Do not return it to service until it is thoroughly inspected by a person qualified to do so and they find it to be safe and in compliance with the Compressed Gas Association directives.

(3) The handling, storage, and use of all compressed gases in cylinders, portable tanks or motor vehicle cargo tanks must comply with the following:

- (a)** Do not use cylinders without a legible label identifying the contents.
- (b)** Keep the cylinder caps on except when the gauges are on the cylinder.
- (c)** Do not use cylinders for rollers, supports or for any purpose other than to contain the product.
- (d)** Do not place cylinders where they may become part of an electrical circuit. Do not ground cylinders used in conjunction with electric welding.
- (e)** Do not subject cylinders to temperatures above 125 degrees F. If ice or snow accumulates on a cylinder, thaw at room temperature or with water less than 125 degrees F.
- (f)** Contact your gas supplier when in doubt about proper handling of the cylinder.
- (g)** When returning empty cylinders, close the valve and replace the valve protection cap.
- (h)** Do not drag or slide cylinders.
- (i)** Do not drop or permit cylinders to strike against each other or other surfaces violently.
- (j)** Do not lift cylinders by the protective cap or with magnets.

H

COMPRESSED GASES / ACETYLENE / OXYGEN

(k) Do not suspend cylinders from ropes, chains or slings unless the cylinder was manufactured with an appropriate lifting attachment or suitable cradles or platforms are used.

(l) Post the storage areas with the name of the gases to be stored.

(m) Store cylinders away from ignitable substances such as gasoline or waste or combustibles in bulk including oil.

(n) Store cylinders upright and secure to prevent them from being knocked over.

(o) Secure cylinders when in use.

(4) Compressed gas cylinders, portable tanks, and cargo tanks must have pressure relief devices.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.

437-004-0715 Acetylene.

(1) Cylinders. The transfer, handling, storage, and use of acetylene in cylinders must comply with the general requirements of compressed gases.

(2) Piped systems. The piped systems for the transfer and distribution of acetylene must comply with the Compressed Gas Association Pamphlet G-1.3-1970.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.

437-004-0716 Oxygen.

(1) Scope. This applies to the installation of bulk oxygen systems on agricultural establishments.

(2) Bulk oxygen systems.

(a) Definition. A bulk oxygen system is an assembly of equipment, such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds, and interconnecting piping, with storage capacity more than 13,000 cubic feet of oxygen, Normal Temperature and Pressure (NTP), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (NTP) including unconnected reserves on hand at the site. The bulk oxygen system ends where oxygen at service pressure first enters the supply line. The oxygen containers may be stationary or movable, and the oxygen may be gas or liquid.

(b) Location.

(A) General. Bulk oxygen storage systems must be aboveground, outdoors or in a noncombustible building, adequately vented and used exclusively for oxygen storage. Locate containers and associated equipment so there is no exposure to electric power lines, flammable or combustible liquid lines, or flammable gas lines.

(B) Accessibility. Locate the system so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel.

(C) Leakage. For liquid oxygen storage, provide noncombustible surfacing in the area where any leakage might fall during operation of the system and filling of the container. Asphalt or bituminous paving is combustible.

(D) Elevation. When locating bulk oxygen systems near aboveground flammable or combustible liquid storage that may be either indoors or outdoors, it is advisable to locate the system on ground higher than the flammable or combustible liquid storage.

(E) Dikes. When a bulk oxygen system must be lower than adjacent flammable or combustible liquid storage, there must be suitable means (such as diking, diversion curbs, or grading) to prevent accumulation of liquids under the bulk oxygen system.

(c) Distance between systems and exposures.

(A) The minimum distance from any bulk oxygen storage container to exposures, measured in the most direct line except as in **(2)(c)(A)(v)** and **(vii)** below, must be as follows:

(i) Fifty feet from combustible structures.

(ii) Twenty-five feet from structures with fire-resistive exterior walls or sprinklered buildings of other construction, but not less than one-half the height of the adjacent side wall of the structure.

(iii) At least 10 feet from any opening in adjacent walls of fire resistive structures. Spacing from such structures must be adequate to permit maintenance, but not be less than 1-foot.

(iv) Flammable liquid storage aboveground.

Distance (feet)	Capacity (gallons)
50	0 to 1000
90	1001 or more

(v) Flammable liquid storage belowground.

Distance measured horizontally from oxygen storage container to flammable liquid tank (feet)	Distance from oxygen storage container to filling and vent connections or openings to flammable liquid tank (feet)	Capacity (Gallons)
15	50	0 to 1000
30	50	1001 or more

(vi) Combustible liquid storage aboveground.

Distance (feet)	Capacity (gallons)
25	0 to 1000
50	1001 or more

(vii) Combustible liquid storage belowground.

Distance measured horizontally from oxygen storage container to combustible liquid tank (feet)	Distance from oxygen storage container to filling and vent connections or openings to combustible liquid tank (feet)
15	50
30	50

(viii) Flammable gas storage. (Such as compressed flammable gases, liquefied flammable gases and flammable gases in low pressure gas holders.)

Distance (feet)	Capacity (cu. ft. NTP)
50	Less than 5000
90	5000 or more

(ix) Fifty feet from solid materials that burn rapidly, such as excelsior or paper.

(x) Twenty-five feet from solid materials that burn slowly, such as coal and heavy timber.

(xi) Seventy-five feet in one direction and 35 feet in approximately 90 degree direction from confining walls (not including firewalls less than 20 feet high) to provide adequate ventilation in courtyards and similar confining areas.

(xii) Twenty-five feet from areas such as offices, lunchrooms, locker rooms, time clock areas, and similar locations where people may gather.

(B) Exceptions. The distances in (2)(c)(A)(i), (ii), (iv) to (x) above, do not apply where there are protective structures, like firewalls, between the bulk oxygen storage installation and the exposure high enough to safeguard the oxygen storage systems. In those cases, the bulk oxygen storage installation may be a minimum distance of 1-foot from the firewall.

(d) Storage containers.

(A) Permanently installed containers must be on substantial noncombustible supports on firm noncombustible foundations.

(B) Make liquid oxygen storage containers from materials meeting the impact test requirements of paragraph UG-84 of ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessels – 1968. Containers operating at pressures more than 15 pounds per square inch gage (p.s.i.g.) must comply with ASME Boiler and Pressure Vessel Code, Section VII – Unfired Pressure Vessels – 1968. Insulation on the liquid oxygen container must be noncombustible.

(C) High-pressure gaseous oxygen containers must comply with one of the following:

(i) ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessels – 1968.

(ii) DOT Specifications and Regulations.

(e) Piping, tubing, and fittings.

(A) Piping, tubing, and fittings must be suitable for oxygen service and for the pressures and temperatures involved.

(B) Piping and tubing must conform to Section 2 – Gas and Air Piping Systems of Code for Pressure Piping, American National Standard (ANSI), B31.1-1967 with addenda B31.10a-1969.

(C) Fabricate piping or tubing for operating temperatures below 20 degrees F. from materials meeting the impact test requirements of paragraph UG-84 of ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessels – 1968, when tested at the anticipated minimum operating temperature.

(f) Safety relief devices.

(A) Equip bulk oxygen storage containers, regardless of design pressure, with safety relief devices required by the ASME code or the DOT specifications and regulations.

(B) Bulk oxygen storage containers designed and constructed according to DOT specifications must have safety relief devices as required.

(C) Bulk oxygen storage containers that comply with the ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessel – 1968 must have safety relief devices that comply with the Compressed Gas Association Pamphlet “Safety Relief Device Standards for Compressed Gas Storage Containers,” S-1, Part 3.

(D) Equip insulation casings on liquid oxygen containers with suitable safety relief devices.

(E) Safety relief devices must not allow moisture that would interfere with proper operation to collect and freeze.

(g) Liquid oxygen vaporizers.

(A) Anchor the vaporizer and use connecting piping sufficiently flexible to compensate for expansion and contraction due to temperature changes.

(B) Adequately protect the vaporizer and its piping on the oxygen and heating medium sections with safety relief devices.

(C) Heat used in an oxygen vaporizer must be indirectly supplied only through media such as steam, air, water or water solutions that do not react with oxygen.

(D) If electric heaters provide the primary source of heat, ground the vaporizing system.

(h) Equipment assembly and installation.

(A) Remove oil, grease or other readily oxidizable materials before placing the system in service.

(B) Make joints in piping and tubing by welding or by using flanged, threaded, slip, or compression fittings. Gaskets or thread sealants must be suitable for oxygen service.

(C) Valves, gages, regulators, and other accessories must be suitable for oxygen service.

(D) People familiar with proper practices must supervise the installation of bulk oxygen systems.

(E) After installation test and prove tight all field erected piping at maximum operating pressure. Use oil-free, non-flammable substances for testing.

(F) Protect storage containers, piping, valves, regulating equipment, and other accessories from physical damage and tampering.

(G) Adequately ventilate enclosures for oxygen control or operating equipment.

(H) The bulk oxygen storage location must have permanent placards that say: **“OXYGEN – NO SMOKING – NO OPEN FLAMES,”** or an equivalent warning.

(I) Bulk oxygen installations are not hazardous locations as defined and covered in Division 4/S. Therefore, general purpose or weatherproof types of electrical wiring and equipment are acceptable depending on whether the installation is indoors or outdoors. Install this equipment according to Division 4/S.

(i) For installations that require operation of equipment by the user, keep legible instructions by the equipment.

OXYGEN / HYDROGEN / FLAMMABLE LIQUIDS

H

(j) Cut back or clear combustible growth 15 feet from any bulk oxygen storage container.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.

437-004-0717 Hydrogen.

Agricultural employers that use hydrogen in any part of their operation must comply with OAR 437-002-1910.103 in Subdivision 2/H.

For your convenience, this is the scope statement from that standard to help you know if your work falls under its jurisdiction.

(2) Scope

(i) Gaseous hydrogen systems.

(a) Paragraph (b) of this section applies to the installation of gaseous hydrogen systems on consumer premises where the hydrogen supply to the consumer premises originates outside the consumer premises and is delivered by mobile equipment.

(b) Paragraph (b) of this section does not apply to gaseous hydrogen systems having a total hydrogen content of less than 400 cubic feet, nor to hydrogen manufacturing plants or other establishments operated by the hydrogen supplier or his agent for the purpose of storing hydrogen and refilling portable containers, trailers, mobile supply trucks, or tank cars.

(ii) Liquefied hydrogen systems.

(a) Paragraph (c) of this section applies to the installation of liquefied hydrogen systems on consumer premises.

(b) Paragraph (c) of this section does not apply to liquefied hydrogen portable containers of less than 150 liters (39.63 gallons) capacity; nor to liquefied hydrogen manufacturing plants or other establishments operated by the hydrogen supplier or his agent for the sole purpose of storing liquefied hydrogen and refilling portable containers, trailers, mobile supply trucks, or tank cars.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f. 8/28/98, ef. 10/1/98.

437-004-0720 Flammable Liquids.

(1) Definitions:

Approved – See Universal Definitions in 4/B, OAR 437-004-0100.

Closed container – A container sealed with a lid or other device that prevents the loss of liquid or vapor at ordinary temperatures.

Combustible – A substance or material that is able or likely to catch fire and burn.

H FLAMMABLE LIQUIDS

Combustible liquids – See definition “Flammable liquids” below.

NOTE: When Oregon OSHA revised the Hazard Communication Standard to align with the Globally Harmonized System (GHS) of classification and labeling of chemicals, the term “combustible liquid” was eliminated. However, the term is still used by the National Fire Protection Association (NFPA) and by the Oregon State Fire Marshal. The NFPA system classifies some chemicals as “combustible liquids” that OSHA classifies as “flammable liquids.”

Explosive – something capable of causing damage to the surroundings by chemical reaction. Also, see Universal Definition in 4/B, OAR 437-004-0100.

Flammable – something capable of being easily ignited, burning intensely, or having a rapid rate of flame spread. Also, see Universal Definitions in 4/B, OAR 437-004-0100.

Flammable liquids – Flammable liquids – are liquids having a flash point at or below 199.4 degrees F. (93 degrees C.) As defined in the globally harmonized system of classification and labeling (GHS) adopted in OSHA’s Hazard Communication Standard, flammable liquids are divided into four categories as follows:

(A) Category 1 includes liquids that have a flashpoint below 73.4 degrees F. (23 degrees C.) and have a boiling point at or below 95 degrees F. (35 degrees C.)

(B) Category 2 includes liquids that have a flashpoint below 73.4 degrees F. (23 degrees C.) and have a boiling point above 95 degrees F. (35 degrees C.)

(C) Category 3 includes liquids that have a flashpoint in a temperature range from at or above 73.4 degrees F. (23 degrees C.) to at or below 140 degrees F. (60 degrees C.)

(D) Category 4 includes liquids that have a flashpoint in a temperature range from above 140 degrees F. (60 degrees C.) to at or below 199.4 degrees F. (93 degrees C.)

NOTE: See Appendix A to OAR 437-004-0720 Flammable Liquids for a comparison of the GHS/Hazard Communication classification system with the NFPA classification system.

Examples of flammable liquids include:

Category 1: Diethyl ether (solvent used in some starting fluids)

Category 2: Gasoline, Benzene

Category 3: Kerosene, Stoddard Solvent

Category 4: Diesel fuel

Portable tank – A closed container with a liquid capacity more than 60 U.S. gallons (230 liters) and not intended for fixed installation.

Safety can – An approved closed container, of not more than 5 gallons (20 liters) capacity, with a spring-closing lid and spout cover, and designed so that it will safely relieve internal pressure when subjected to fire.

FLAMMABLE LIQUIDS H

(2) Storage and transporting.

(a) The storage of flammable liquids in containers with a capacity of 60 gallons (230 liters) or more must be in fixed or portable tanks. Such tanks must meet the material and design requirements in NFPA 30, Flammable and Combustible Liquids Code, 1996 edition.

NOTE: Tanks meeting the requirements of a more recent edition of the NFPA 30 code will also be considered to be in compliance with this rule.

(b) Storage of flammable liquids in containers of less than 60 gallons (230 liters) capacity must be in one of the following listed in Table H-1:

Table H-1

Maximum Allowable Size of Portable Containers and
Portable Tanks for Flammable Liquids

Container type	Category 1	Category 2	Category 3	Category 4
Safety cans or Approved containers used for petroleum fuels ¹	2 gal.	5 gal.	5 gal.	5 gal.
Glass, or plastic containers approved for use with flammable liquids ² (other than "approved, containers used for petroleum fuels")	1 pint (pt.)	1 quart (qt.)	1 gallon (gal.)	1 gal.
DOT drums (Metal drums meeting Dept. of Transportation specifications)	60 gal.	60 gal.	60 gal.	60 gal.
Closed, metal containers (other than DOT drums)	1 gal.	5 gal.	5 gal.	5 gal.
Approved, portable tanks	660 gal.	660 gal.	660 gal.	660 gal.

NOTES:

¹Approved containers used for petroleum fuels – metal or plastic containers that bear an approval label stamped on or molded into the container; meeting the requirements of and used for petroleum products within the scope of one or more of the standards specified as an acceptable container in NFPA 30, 1996 (or a more recent edition.)

²The "Glass or plastic containers approved for use with flammable liquids" container size limits in Table H-1 do not apply to medicines, beverages, foodstuffs, cosmetics, and other common consumer items when they are packaged subject to consumer product safety standards or other accepted practices.

(c) Store flammable liquids in a manner that will not obstruct, impede, or limit use of exits, stairways, or areas normally used for safe exit routes.

(d) Flammable liquids transported in passenger-type vehicles (cars, trucks, buses, carry-alls, crew transporters, etc.) must be in safety cans, or approved containers used for petroleum fuels. Carry these containers outside the passenger compartment, secured in a ventilated area that prevents the accumulation of flammable or explosive vapors, and that protects against rupture in a collision.

H FLAMMABLE LIQUIDS

(3) Tanks and containers.

(a) Clearly mark tanks and containers as required in the Hazard Communication Standard, OAR 437-004-9800(5) Labels and other Forms of Warning. Mark fill-risers and pumps or discharge devices with the name of the product they contain.

NOTE: Division 4/L, 437-004-1440 requires employers to post signs reading, "No Smoking or Open Flame" (or "FLAMMABLE – KEEP FIRE AWAY") in areas used for fueling, and where flammable liquids are received, dispensed, used, or stored.

(b) Protect pumps, containers, tanks, and supports for tanks used for combustible or flammable liquids against collision damage.

(c) Mount aboveground tanks on supports that are strong and stable enough to safely support the load. Provide enough clearance to permit inspection and maintenance as well as clearance from the ground.

(4) Tanks elevated for gravity discharge.

(a) The gravity discharge outlet must have an approved hose with a self-closing valve at the discharge end.

(b) The bottom opening for gravity discharge must have a shut-off valve adjacent to the tank shell that can be closed manually. Underground tanks from which fuel flows under gravity must have a manual shut-off valve between the tank and the hose.

(5) Tanks with top openings only.

(a) Tanks with all openings in the top must have a firmly attached, approved pumping device and an approved hose.

(b) Do not use siphons and discharge devices requiring pressure in the container.

(c) There must be an effective anti-siphoning device in the pump discharge; tank plumbing must not permit fuel to siphon or flow from the tank when the pump is not operating, even though discharge nozzle valves or line valves are open.

(6) Dispensing and fueling.

(a) Maintain pumping devices or faucets used to dispense flammable liquids so they do not leak enough material to puddle or cause a fire hazard.

(b) Fuel tanks and pumps from which flammable liquids are dispensed must have an approved hose long enough to fill containers.

(A) Hoses must have a metal nozzle at the discharge end.

(B) Hoses must incorporate an effective electrical interconnect between the nozzle and the supply tank.

FLAMMABLE LIQUIDS H

(c) Do not dispense flammable liquids into or from portable or stationary metal tanks or drums unless there is an effective electrical interconnect (bond) between the source and the receiving containers.

NOTES:

The electrical interconnect may be made by assuring that the metal nozzle of the approved hose is in contact with the metal fill neck or bung of the receiving container during filling.

Both portable metal and portable plastic containers should be placed on a grounded surface when filling.

(d) Shut off internal combustion engines, except diesel engines, while refueling.

(7) Handling and use of flammable liquids.

(a) Control leakage or the escape of flammable liquids and use measures to prevent accidental spills. If a spill occurs, promptly clean any soaked or contaminated areas.

NOTE: If you have a release or spill of any hazardous substance at your workplace and you expect your employees to help clean it up, other rules may apply:

Division 4/Z, 437-004-9800, Hazard Communication Standard for Agricultural Employers.

Division 4/H, 437-004-0950 Hazardous Waste Operations and Emergency Response.

(b) Use flammable liquids, including gasoline, only where there is no open flame or other source of ignition within 50 feet of the operation, or within the possible path of vapor travel.

NOTES:

This rule does not prohibit the refueling of orchard heaters used outdoors while adjacent heaters are burning; or the field (outdoor) refueling of portable tools while other tools are in operation.

Division 4/L, 437-004-1430 requires employers to forbid smoking, open flames, the use of spark-producing devices or tools, and other sources of fire or ignition in fueling areas; where fuel systems for internal combustion engines are serviced; and where flammable liquids are received, dispensed, used, or stored.

(c) Do not use flammable liquids, including gasoline, indoors as a solvent or for cleaning purposes unless there is adequate ventilation to bring and keep the concentrations of explosive vapors in the atmosphere below 20 percent of its lower explosive limit (LEL).

(d) Keep flammable liquids, including gasoline, in closed containers when not in use.

H FLAMMABLE LIQUIDS

(8) Heating devices that use flammable liquids.

NOTE: The Oregon State Mechanical Specialty Code and the Oregon Fire Code have standards for space-heating devices and associated equipment.

(a) Set heaters, when in use, on a stable, level base; or mount them as specified by the manufacturer.

(b) Heaters not suitable for use on wood floors must rest on heat insulating material of at least 1-inch concrete, or equivalent. The insulating material must extend beyond the heater 2 feet or more in all directions.

(c) Locate heaters used near combustible tarpaulins, canvas, or similar coverings at least 10 feet from the coverings and securely fasten them to prevent ignition or upsetting of the heater due to wind action on the covering or other material.

(d) Liquid-fired heaters must have a primary safety control to stop the flow of fuel in the event of flame failure.

NOTE: Barometric or gravity oil feed is not a primary safety control.

(e) Do not use heating devices without built-in means to effectively control the fuel supply and the flame in occupied buildings.

(f) Vent heating devices (that use flammable fuels inside occupied buildings) to the outside atmosphere except when:

(A) The heating device has an "approval label" issued by the American Gas Association or a nationally recognized testing laboratory indicating it is approved for use as an unvented heater in occupied buildings; or,

(B) Prior to entry, test the atmosphere inside buildings where unvented heating devices are in use to assure it is free of hazardous levels of carbon monoxide.

(g) Fuel-burning devices must have means that prevent the emission of sparks or other sources of ignition.

(9) Design, construction, and capacity of storage cabinets.

(a) **Maximum capacity.** Maximum capacity. Do not store more than 60 gallons of Category 1, 2, or 3 flammable liquids, or more than 120 gallons of Category 4 flammable liquids in a storage cabinet.

(b) **Fire resistance.** Storage cabinets must meet NFPA 30, 1996 edition standards. Label storage cabinets with "**No Smoking or Open Flame.**"

NOTES:

Storage cabinets meeting the requirements of a more recent edition of the NFPA 30 code will also be considered to be in compliance with this rule.

Storage cabinets labeled "FLAMMABLE – KEEP FIRE AWAY" are also in compliance with this rule.

FLAMMABLE LIQUIDS H

(10) Design and construction of inside storage rooms.

(a) Construction.

(A) Construct inside storage rooms to meet the required fire-resistive rating in NFPA 30, 1996 edition.

(B) Such construction must comply with the test specifications in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251, 1969 edition.

(C) Where there is an automatic sprinkler system, design and install the system according to accepted engineering practices.

(D) Openings to other rooms or buildings must have noncombustible, liquid-tight, raised sills or ramps at least 4 inches high, or the floor in the storage area must be at least 4 inches below the surrounding floors. A permissible alternate to the sill or ramp is an open-grated trench inside the room that drains to a safe location.

(E) Openings must have approved self-closing fire doors. The room must be liquid-tight where the walls join the floor.

(F) Where other parts of the building or other properties are exposed, protect windows as required in the Standard for Fire Doors and Windows, NFPA 80, 1968 edition, for Class E or F openings.

(G) Wood at least 1-inch nominal thickness is acceptable for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

NOTES: The following will also be considered to be in compliance with this rule:
Inside storage rooms meeting the requirements of a more recent edition of the NFPA 30 code.

Construction materials meeting the specifications in a more recent edition of NFPA 251 code.

Windows and openings protected as required by a more recent edition of the NFPA 80 code.

(b) Rating and capacity. Storage in inside storage rooms must comply with Table H-2, below.

Table H-2 – Storage In Inside Rooms

Fire protection ¹ provided	Fire resistance	Maximum room size	Total Allowable quantities (gals/sq. ft./floor area)
Yes	2 hours	500 sq. ft.	10
No	2 hours	500 sq. ft.	5
Yes	1-hour	150 sq. ft.	4
No	1-hour	150 sq. ft.	2

¹ Fire protection system must have sprinklers, water spray, carbon dioxide, or other system.

H FLAMMABLE LIQUIDS

NOTES:

Division 4/L, 437-004-1430 Sources of Fire requires that electric lights, equipment, and wiring used where there may be flammable or explosive gases or vapors must comply with the State Electrical Specialty Code.

Division 4/S, 437-004-3075 Agricultural Buildings with Special Hazards has additional electrical requirements.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.
OR-OSHA Admin. Order 3-2014, f. 8/8/14, ef. 8/8/14.

FLAMMABLE LIQUIDS H

Appendix A to OAR 437-004-0720 Flammable Liquids (Nonmandatory)

A comparison of the Globally Harmonized System (GHS) of classification for Flammable Liquids and the National Fire Protection Association (NFPA) system of classification for Flammable and Combustible Liquids:

GHS Classification And Category	Flash Point (Boiling Point)	NFPA Classification	NFPA Term	Flash Point (Boiling Point)	Examples
Flammable Liquid Category 1	Below 73.4°F (At or below 95°F)	Class IA	Flammable Liquid	Below 73°F (Below 100°F)	Diethyl ether (solvent used in some starting fluids)
Flammable Liquid Category 2	Below 73.4°F (Above 95°F)	Class IB	Flammable Liquid	Below 73°F (At or above 100°F)	Gasoline, toluene, benzene, acetone, ethanol
Flammable Liquid Category 3	Between 73.4°F and 140°F	Class IC	Flammable Liquid	At or above 73°F (Below 100°F)	Kerosene; m-, o-, p-xylene
		Class II	Combustible Liquid	At or above 100°F	Stoddard solvent, hydrazine
Flammable Liquid Category 4	Above 140°F but not more than 199.4°F	Class IIIA	Combustible Liquid	At or above 140°F	Diesel fuel, naphthalene
Not a flammable liquid if Flash Point is greater than 199.4°F.		Class IIIB	Combustible Liquid	At or above 200°F	Glycerin (mist)

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 3-2014, f. 8/8/14, ef. 8/8/14.

SPRAY FINISHING / EXPLOSIVES & BLASTING AGENTS / STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

437-004-0725 Spray Finishing.

If you use a spray booth or a spray room or do production-level spray finishing, you must follow the rules in Division 2/H, OAR 437-002-0107, Spray Finishing.

NOTE: The Spray Finishing rules do not apply to outdoor spray applications to buildings, tanks, or other similar structures; or to small, portable, spray apparatus that is not used repeatedly in the same location.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.
OR-OSHA Admin. Order 3-2014, f. 8/8/14, ef. 8/8/14.

437-004-0770 Explosives and Blasting Agents.

Agricultural employers that use explosives and blasting agents must comply with OAR 437-002-1910.109 in Subdivision 2/H.

For your convenience, this is the scope statement from that standard to help you know if your work falls under its jurisdiction.

This section applies to the manufacture, keeping, storage, sale, transportation, and use of explosives, blasting agents, and pyrotechnics. The section does not apply to the sale and use (public display) of pyrotechnics, commonly known as fireworks, nor the use of explosives in the form prescribed by the official U.S. Pharmacopeia.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.

437-004-0780 Storage and Handling of Liquefied Petroleum Gases.

NOTE: OAR 437-004-0790, following this rule, covers the use of LPG and natural gas in fields and orchards. This rule (0780) does not cover those applications.

(1) Definitions.

API-ASME container – A container built to comply with **OAR 437-004-0780(3)(b)(C)**.

ASME container – A container built to comply with **OAR 437-004-0780(3)(b)(A)**.

Approved – See universal definition in 4/B.

Container assembly – An assembly of the container and fittings for all container openings, including shutoff valves, excess flow valves, liquid-level gaging devices, safety relief devices, and protective housing.

Containers – All vessels, such as tanks, cylinders, or drums, used to transport or store liquefied petroleum gases.

DOT – Department of Transportation.

DOT container – A container built to comply with 49 CFR Chapter 1.

DOT cylinders – cylinders meeting the requirements of 49 CFR Chapter I.

DOT Specifications – regulations of the Department of Transportation published in 49 CFR Chapter I.

Liquefied petroleum gases – “LPG” and “LP-Gas” – Any material made mostly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butane (normal butane or iso-butane), and butylenes.

Listed – see universal definition in 4/B.

Movable fuel storage tenders or farm carts – Containers not more than 1,200 gallons water capacity, with wheels for towing. They are not highway vehicles, but may occasionally be moved on public roads or highways. They are a fuel supply vehicle.

P.S.I.A. – pounds per square inch absolute.

P.S.I.G. – pounds per square inch gauge.

Systems – an assembly of the container or containers, major devices such as vaporizers, safety relief valves, excess flow valves, regulators, and connecting piping.

Vaporizer-burner – an integral vaporizer-burner unit, dependent on the heat generated by the burner as the source of heat to vaporize the liquid used for dehydrators or dryers.

Ventilation, adequate – when specified for the prevention of fire during normal operation, ventilation is adequate when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit.

(2) Scope.

(a) Application.

(A) Paragraph **OAR 437-004-0780(3)** applies to installations made according to **OAR 437-004-0780(4), (5), (6) and (8)**, except as noted in each of those paragraphs.

(B) Paragraphs **OAR 437-004-0780(4)** through **(8)** have their own application statements.

(b) Exclusions. This section does **not** apply to:

(A) LP-Gas refrigerated storage systems;

(B) LP-Gas used with oxygen. The requirements of OAR 437-004-2310 apply to that use;

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(C) Low-pressure (not more than 1/2-pound per square inch or 14 inches water column) LP-Gas piping systems, and the installation and operation of residential and commercial appliances including their inlet connections, supplied through such systems. For those systems, the National Fire Protection Association Standard for the Installation of Gas Appliances and Gas Piping, NFPA 54-1996 apply.

(c) **Retroactivity.** Unless otherwise stated, this section is not retroactive.

(A) Existing plants, appliances, equipment, buildings, structures, and installations for the storage, handling or use of LP-Gas, that met the National Fire Protection Association Standard for the Storage and Handling of Liquefied Petroleum Gases NFPA No. 58, 1995, at the time of manufacture or installation are acceptable, if their use does not cause a recognized hazard to employees.

(3) Basic rules.

(a) Approval of equipment and systems.

(A) Each system using DOT containers according to 49 CFR Part 178 must use approved container valves, connectors, manifold valve assemblies, and regulators.

(B) Each system for domestic or commercial use with containers of 2,000 gallons or less water capacity, other than those built according to 49 CFR Part 178, must have a container assembly and one or more regulators, and may include other parts. The system as a unit or the container assembly as a unit, and the regulator or regulators, must be individually listed.

(C) In systems using containers of more than 2,000 gallons water capacity, each regulator, container valve, excess flow valve, gaging device, and relief valve installed on or at the container, must be listed by a nationally recognized testing laboratory. Refer to 29 CFR 1910.7 for the definition of nationally recognized testing laboratory.

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

(A) Containers used with systems in **OAR 437-004-0780(5), (6) and (8)**, except in **(6)(c)(C)**, must comply 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 paragraphs U-2 through U-10 and U-19 of it. Do not use containers constructed according to paragraph U-70 in the 1949 and earlier editions.

(C) Containers designed, constructed, and tested before 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 are acceptable. 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.

(D) Paragraph (3)(b)(A) above does not prohibit the use or reinstallation of containers constructed and maintained according to 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 covered in **OAR 437-004-0780(3), (5)(c)(C), and (7)**, must comply with DOT specifications effective at the date of their manufacture.

(c) Welding of containers.

(A) Welding to the shell, head, or any other part of the container subject to internal pressure, must comply with the code under which the tank was built. Other welding is permitted only on saddle plates, lugs, or brackets attached to the container by the tank manufacturer.

(B) Welding of DOT containers, must be done by a qualified manufacturer making containers of the same type, and must comply with DOT regulations.

(d) Markings on containers.

(A) Each container in (3)(b)(A) above, except as in (3)(b)(D) above must have these markings:

(i) A mark 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 National Board of Boiler and Pressure Vessel Inspectors.

(ii) 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) The name and address of the supplier of the container, or with the trade name of the container.

(iv) The water capacity of the container in pounds or gallons, U.S. Standard.

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

(vi) The wording "This container must not contain a product with a vapor pressure in excess of – p.s.i.g. at 100 degrees F.," see (m)(G).

(vii) The tare weight in pounds or other identified unit of weight for containers with a water capacity of 300 pounds or less.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(viii) Marking indicating the maximum level to which the container may be filled with liquid at temperatures between 20 degrees F. and 130 degrees 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 degrees F. This marking may be located on the liquid level gaging device.

(ix) The outside surface area in square feet.

(B) Marks must be on a metal nameplate attached to the container and visible after installation of the container.

(C) When storing or using LP-Gas and one or more other gases in the same area, the containers must identify their content.

(e) Location of containers and regulating equipment.

(A) Containers, and first stage regulating equipment if used, must be outside 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) For portable use according to **OAR 437-004-0780(4)(e)**.

(iii) LP-Gas fueled engines according to **OAR 437-004-0780(6)(j)** or **(k)**.

(iv) LP-Gas fueled industrial trucks used according to **OAR 437-004-0780(6)(l)**.

(v) LP-Gas fueled vehicles garaged according to **OAR 437-004-0780(6)(m)**.

(vi) Containers awaiting use or resale when stored according to **OAR 437-004-0780(7)**.

(B) Place individual containers with respect to the nearest building or group of buildings according to Table 1.

Table 1

Water capacity per container	Minimum distances		
	Containers		Between above-ground containers
	Underground	Aboveground	
Less than 125 gals ¹	10 feet	None	None
125 to 250 gals	10 feet	10 feet	None
251 to 500 gals	10 feet	10 feet	3 feet
501 to 2,000 gals	25 feet ²	25 feet ²	3 feet
2,001 to 30,000 gals	50 feet	50 feet	5 feet
30,001 to 70,000 gals	50 feet	75 feet ³	
70,001 to 90,000 gals	50 feet	100 feet ³	

¹ If the aggregate water capacity of a multi-container installation at a consumer site is 501 gallons or more, the minimum distance must comply with this table, applying the aggregate capacity rather than the capacity per container. If doing more than one installation, separate each from another by at least 25 feet. Do not apply the MINIMUM DISTANCES BETWEEN ABOVEGROUND CONTAINERS to such installations.

² You can reduce the above distance requirements to not less than 10 feet for a single container of 1,200 gallons water capacity or less, if it is at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.

³ 1/4 of sum of diameters of adjacent containers.

(C) Do not stack containers on each other during use.

(D) Keep easily ignitable material such as weeds and long dry grass 10 feet away from containers.

(E) Keep at least 20 feet between liquefied petroleum gas containers and flammable liquid tanks. The minimum separation between a container and the centerline of the dike is 10 feet. This does not apply when LP-Gas containers of 125 gallons or less capacity are next to Class III flammable liquid tanks of 275 gallons or less capacity.

(F) Prevent the accumulation of flammable liquids under adjacent liquefied petroleum gas containers by diking, diversion curbs, grading or the equivalent.

(G) Do not put liquefied petroleum gas containers within the dikes around flammable liquid tanks.

(f) 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 be suitable for LP-Gas service. Do not use cast iron. 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 as close to the container as practicable.

(C) Excess flow valves, 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.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(D) Liquid level gaging devices do not need excess flow valves if their outward flow is less than would pass through a .055-inch opening.

(E) Openings from the container or through fittings attached directly to it with a pressure gauge connected do not need shutoff or excess flow valves if they are not larger than .055-inch.

(F) Except as in **OAR 437-004-0780(4)(e)(A)(ii)**, excess flow and back pressure check valves required here must be inside the container or at an outside point where the line enters the container. In the latter case, make installation so that strain beyond the excess flow or back pressure check valve will not cause a break between the container and the valve.

(G) Excess flow valves must have a bypass, not to exceed a .040-inch opening to allow equalization of pressures.

(H) Containers with water capacity between 30 gallons and 2,000 gallons, filled by volume and made after December 1, 1963, must fill into the vapor space.

(g) Piping – including pipe, tubing, and fittings.

(A) Pipe, except as in **OAR 437-004-0780(6)(f)(A)**, must be wrought iron or steel (black or galvanized), brass, copper, or aluminum alloy. Aluminum alloy pipe must be at least Schedule 40. Do not use alloy 5456. Protect aluminum alloy pipe against external corrosion when it contacts dissimilar metals other than galvanized steel. Also protect it when it is subject to repeated wetting by such liquids as water (except rainwater), 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, is good protection. The maximum nominal pipe size for aluminum pipe is 3/4-inch. Limit pressures to less than 20 p.s.i.g. Do not install aluminum alloy pipe within 6 inches of the ground.

(i) Vapor piping with operating pressures not more than 125 p.s.i.g. must be suitable for a working pressure of at least 125 p.s.i.g. It 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 more than 125 p.s.i.g. and all liquid piping must be suitable for a working pressure of at least 250 p.s.i.g. It must be at least Schedule 80 if it has threaded or threaded and back welded joints. It must be at least Schedule 40 (ASTM A-53-69 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal) if it has welded, or welded and flanged joints.

(B) Tubing must be seamless and of copper, brass, steel, or aluminum alloy. Copper tubing must be type K or L or equivalent as covered in the Specification for Seamless Copper Water Tube, ANSI H23.1-1970 (ASTM B88-69). Aluminum alloy tubing must be Type A or B or equivalent as in Specification ASTM B210-68. It must have markings every 18 inches indicating compliance with ASTM Specifications. The minimum nominal wall thickness of copper tubing and aluminum alloy tubing is in Table 2 and Table 3.

Protect aluminum alloy tubing against external corrosion when it contacts dissimilar metals other than galvanized steel. Also protect it when it 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, is good protection. The maximum outside diameter for aluminum alloy tubing is 3/4-inch. Limit pressures to less than 20 p.s.i.g. Do not install aluminum alloy pipe within 6 inches of the ground.

Table 2 - Wall Thickness of Copper Tubing ¹

Standard size (inches)	Nominal outside diameter (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 Tube, ANSI H23.1-1970 (ASTM B-88-69).

NOTE: The standard size to designate tubing is 1/8-inch smaller than its nominal outside diameter.

Table 3 - Wall Thickness of Aluminum Alloy Tubing ¹

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.

(C) Pipe joints may be screwed, flanged, welded, soldered, or brazed with a material with a melting point more than 1,000 degrees F. Joints on seamless copper, brass, steel, or aluminum alloy gas tubing must be made with approved gas tubing fittings, or soldered or brazed with a material having a melting point more than 1,000 degrees F.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

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

(E) You may not use threaded cast iron pipe fittings such as ells, tees, crosses, couplings, and unions. Use aluminum alloy fittings with aluminum alloy pipe and tubing. Use insulated fittings where aluminum alloy pipe or tubing connects with a dissimilar metal.

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

(G) All materials such as valve seats, packing, gaskets, diaphragms, etc., must be resistant to the action of liquefied petroleum gas.

(H) After assembly, test all piping, tubing, or hose at not less than normal operating pressures. After installation, test piping and tubing with a manometer or similar tester that shows a pressure drop. There must be no leaks. Do not test with a flame.

(I) Use flexible connections to compensate for expansion, contraction, jarring, vibration, and settling.

(J) Piping outside buildings may be buried, aboveground, or both. It must have good support and protection against physical damage. Where soil conditions warrant, protect piping against corrosion. Where condensation may occur, the piping must pitch back to the container, or there must be another way to change the condensate back to a vapor.

(h) Hose specifications.

(A) Hose must be made of materials that are resistant to the action of LP-Gas. If the hose has wire braid reinforcing, it must be corrosion-resistant.

(B) Mark hose for container pressure "LP-Gas" or "LPG" at least every 10 feet.

(C) Hose for container pressure must have a bursting pressure rating of not less than 1,250 p.s.i.g.

(D) Hose for container pressure must be listed (see definitions in subdivision B).

(E) Hose connections for container pressure must withstand, without leaks, a test pressure of at least 500 p.s.i.g.

(F) Hose and hose connections on the low-pressure side of the regulator or reducing valve must have a bursting pressure rating 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 is acceptable on the low-pressure side of regulators to connect to other than domestic and commercial gas appliances if:

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

(ii) For use inside buildings the hose must be of minimum practical length, but not more than 6 feet except as in **OAR 437-004-0780(4)(e)(A)(vii)**. It may not extend from one room to another, nor pass through any walls, partitions, ceilings, or floors. Such hose must be in view and not concealed. Outside buildings, the hose may be longer but must be as short as practical.

(iii) Use only approved hose. Do not use it where temperatures are likely to be more than 125 degrees F. Securely connect the hose to the appliance and do not use 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, take precautions to prevent operation of the wrong valve.

(v) Protect hose connected to wall outlets from physical damage.

(i) Safety devices.

(A) Every container except those meeting DOT specifications and every vaporizer (except motor fuel vaporizers and except vaporizers in **OAR 437-004-0780(3)(j)(B)(iii)** and **(5)(d)(E)(i)**) whether heated by artificial means or not, must have one or more spring loaded safety relief valves. These valves must allow free venting to the outer air with discharge not less than 5 feet horizontally away from any opening into nearby buildings. The rate of discharge must meet the requirements of **(3)(i)(B)** or **(3)(i)(C)** below for vaporizers.

(B) The minimum rate of discharge in cubic feet per minute of air at 120 percent of the maximum permitted start to discharge pressure for safety relief valves on containers other than DOT containers must be as follows:

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

Surface area (sq. ft.)	Flow rate CFM air	Surface area (sq. ft.)	Flow rate CFM air	Surface area (sq. ft.)	Flow rate CFM air
20 or less	626	170	3,620	600	10,170
25	751	175	3,700	650	10,860
30	872	180	3,790	700	11,550
35	990	185	3,880	750	12,220
40	1,100	190	3,960	800	12,880
45	1,220	195	4,050	850	13,540
50	1,330	200	4,130	900	14,190
55	1,430	210	4,300	950	14,830
60	1,540	220	4,470	1,000	15,470
65	1,640	230	4,630	1,050	16,100
70	1,750	240	4,800	1,100	16,720
75	1,850	250	4,960	1,150	17,350
80	1,950	260	5,130	1,200	17,960
85	2,050	270	5,290	1,250	18,570
90	2,150	280	5,450	1,300	19,180
95	2,240	290	5,610	1,350	19,780
100	2,340	300	5,760	1,400	20,380
105	2,440	310	5,920	1,450	20,980
110	2,530	320	6,080	1,500	21,570
115	2,630	330	6,230	1,550	22,160
120	2,720	340	6,390	1,600	22,740
125	2,810	350	6,540	1,650	23,320
130	2,900	360	6,690	1,700	23,900
135	2,990	370	6,840	1,750	24,470
140	3,080	380	7,000	1,800	25,050
145	3,170	390	7,150	1,850	25,620
150	3,260	400	7,300	1,900	26,180
155	3,350	450	8,040	1,950	26,750
160	3,440	500	8,760	2,000	27,310
165	3,530	550	9,470		

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

When the surface area is not on the nameplate or when the marking is not legible, calculate the area using one of the following formulas:

(1) Cylindrical container with hemispherical heads:

Area = Overall length X outside diameter X 3.1416.

(2) A 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.

(3) 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 degrees 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 2,000 square feet, calculate the required flow rate 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. Convert these to ratings in cubic feet per minute of air by multiplying the liquefied petroleum gas ratings by factors listed below. Convert air flow ratings 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

(C) Minimum Required Rate of Discharge for Safety Relief Valves for Liquefied Petroleum Gas Vaporizers (Steam Heated, Water Heated, and Direct Fired).

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 the 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 degrees F. and 14.7 p.s.i.a. from **(3)(i)(B)** above, for this total surface area.

(D) Container and vaporizer safety relief valves must be set to start-to-discharge, with relation to the design pressure of the container, according to Table 4.

(E) Safety relief devices used with systems having other than DOT containers must discharge at not less than the rates in **(3)(i)(B)** above, before the pressure is more than 120 percent of the maximum (not including the 10 percent in **(3)(i)(D)** above) permitted start to discharge pressure setting of the device.

Table 4

Containers	Minimum (percent)	Maximum (percent)
ASME Code; Par. U-68, U-69 – 1949 and earlier editions	110 ¹	25
ASME Code; Par. U-200, U-201 – 1949 editions	88 ¹	100
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 CFR Chapter I		

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

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(F) Some places have continuous high temperatures that require storage of a lower vapor pressure product or the use of a higher designed pressure vessel to prevent the safety valves opening. As an alternative use cooling devices like sprayers, shade or other methods.

(G) Place safety relief valves to discourage tampering. If pressure setting or adjustment is external, the relief valves must have approved means for sealing adjustment.

(H) Shutoff valves must not be between the safety relief devices and the container, or the equipment or piping to which the safety relief device is connected unless there is full required capacity flow through the safety relief device.

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

(J) Mark each container safety relief valve used with systems covered by **OAR 437-004-0780(5), (6), and (8)**, except as in **(6)(c)(C)** as follows:

(i) "Container Type" of the pressure vessel on which the valve is designed to be installed;

(ii) The pressure in p.s.i.g. at which the valve will discharge;

(iii) The actual rate of discharge of the valve in cubic feet per minute of air at 60 degrees F. and 14.7 p.s.i.a.;

(iv) 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

(v) That its rate of discharge is 4,050 cubic feet per minute of air as noted in **OAR 437-004-0780(i)(B)**.

(K) Safety relief valve assemblies, including their connections, must provide the rate of flow required for the container on which they are installed.

(L) A hydrostatic relief valve must be between each pair of shut-off valves on liquefied petroleum gas liquid piping to discharge into a safe atmosphere. The start-to-discharge pressure setting must not be more than 500 p.s.i.g. The minimum setting on relief valves in piping connected to other than DOT containers must not be lower than 140 percent of the container relief valve setting and in piping connected to DOT containers not lower than 400 p.s.i.g. The start-to-discharge pressure setting of a relief valve installed on the discharge side of a pump, must be more than the maximum pressure permitted by the recirculation device in the system.

(M) Safety relief devices must not discharge in or beneath a building, except devices covered by **OAR 437-004-0780(3)(f)(A)(i)** through **(iv)**, or **(4)(d)(A)** or **(e)**.

(N) Container safety relief devices and regulator relief vents must be at least 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(j) Vaporizer and housing.

(A) Indirect fired vaporizers using steam, water, or other heating medium must comply with the following:

(i) Vaporizers must comply with OAR 437-004-0780(3)(b)(A) through (C) and have permanent marks as follows:

(I) The code marking signifying the specifications of the vaporizer.

(II) The allowable working pressure and temperature for the vaporizer.

(III) The sum of the outside surface area and the inside heat exchange surface area in square feet.

(IV) The name or symbol of the manufacturer.

(ii) Vaporizers with an inside diameter of 6 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 no permanent marks.

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

(iv) Vaporizers are acceptable 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 in a structure or building not used exclusively for gas manufacturing or distribution, either attached to or within such a building, separate the structure or room from the rest of the building with a wall that will withstand a static pressure of at least 100 pounds per square foot. This wall must have no openings or pipe or conduit passing through it. Such structure or room must have enough ventilation and must have a roof or at least one exterior wall of lightweight construction.

(v) Vaporizers must have, at or near the discharge, a relief valve with a discharge rate complying with OAR 437-004-0780(3)(i)(C), except as in (4)(d)(F)(i).

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

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(vii) The device that supplies the necessary heat for producing steam, hot water, or other heating medium may be in a building, compartment, room, or lean-to that must have ventilation near the floorline and roof to the outside. A wall that can withstand a static pressure of at least 100 pounds per square foot must separate the device from all compartments or rooms that have liquefied petroleum gas vaporizers, pumps, and central gas mixing devices. This wall must have no openings or pipes or conduit passing through it. This requirement does not apply to the domestic water heaters that may supply heat for a vaporizer in a domestic system.

(viii) Gas-fired heating systems supplying heat exclusively for vaporization purposes must have automatic 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) Vaporizers must not have fusible plugs.

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

(B) Atmospheric vaporizers using heat from the ground or surrounding air must be as follows:

(i) Buried underground, or

(ii) Inside the building close to a point at which pipe enters the building if the capacity of the unit does not exceed 1-quart.

(iii) Vaporizers of less than 1-quart capacity heated by the ground or surrounding air, need not have relief valves if adequate tests show that the assembly is safe without them.

(C) Make, mark and install direct gas-fired vaporizers as follows:

(i)

(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 B.t.u. 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.

(ii)

(I) 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.

(II) Vaporizers with capacity not more than 35 gallons per hour must be at least 5 feet from container shutoff valves. Vaporizers with capacity of more than 35 gallons but not more than 100 gallons per hour must be at least 10 feet from the container shutoff valves. Vaporizers with a capacity more than 100 gallons per hour must be at least 15 feet from container shutoff valves.

(iii) Vaporizers may be in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. Vaporizing housing structures must be of non-combustible 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, such structure or room must be separated from the remainder of the building by a wall that can withstand a static pressure of at least 100 pounds per square foot. This wall must have no openings or pipes or conduit passing through it. Such structure or room must have adequate ventilation, and must have a roof or at least one exterior wall of lightweight construction.

(iv) Vaporizers must have at or near the discharge, a relief valve with an effective discharge rate complying with **OAR 437-004-0780(3)(i)(C)**. The relief valve must not be subjected to temperatures more than 140 degrees F.

(v) Vaporizers must have suitable automatic means to prevent liquid passing from the vaporizer to the gas discharge piping of the vaporizer.

(vi) Vaporizers must have means for manually turning off the gas to the main burner and pilot.

(vii) Vaporizers must have automatic devices to shut off the flow of gas to main burners if the pilot light should fail. When the flow through the pilot is more than 2,000 B.t.u. per hour, the pilot also must have an automatic device to shut off the flow of gas to the pilot if the pilot flame goes out.

(viii) Pressure regulating and pressure reducing equipment if within 10 feet of a direct fire vaporizer must be separated from the open flame by a substantially airtight noncombustible partition or partitions.

(ix) Except as in **(iii)**, keep the following minimum distances between direct fired vaporizers and the nearest building or group of buildings:

Ten feet for vaporizers with a capacity of 15 gallons per hour or less vaporizing capacity.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

Twenty-five feet for vaporizers with a vaporizing capacity of 16 to 100 gallons per hour.

Fifty feet for vaporizers with a vaporizing capacity more than 100 gallons per hour.

(x) Direct fired vaporizers must not raise the product pressure above the design pressure of the vaporizer equipment or raise the product pressure within the storage container above the pressure in the second column of Table H-8.

(xi) Vaporizers must not have fusible plugs.

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

(D) Install and use direct gas-fired tank heaters as follows:

(i) Direct gas-fired tank heaters, and tanks to which they are applied, must only be aboveground.

(ii) Tank heaters must have permanent markings with the name of the manufacturer, the rated B.t.u. input to the burner, and the maximum vaporizing capacity in gallons per hour.

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

(iv) Tank heaters must have a means for manually turning off the gas to the main burner and pilot.

(v) Tank heaters must have an automatic 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, the pilot also must have an automatic safety device to shut off the gas to the pilot if the pilot flame goes out.

(vi) Separate pressure regulating and pressure reducing equipment if within 10 feet of a direct fired tank heater, from the open flame by a substantially airtight noncombustible partition.

(vii) Keep these minimum distances between a storage tank heated by a direct fired tank heater and the nearest important building or group of buildings:

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

Twenty-five feet for storage containers of 500 to 1,200 gallons water capacity.

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

(viii) No direct fired tank heater must raise the product pressure within the storage container over 75 percent of the pressure set out in the second column of Table H-8.

(E) The vaporizer section of vaporizer-burners used for dehydrators or dryers must be outside of buildings and as follows:

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

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

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

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

(iv) The vaporizer section of vaporizer-burners must have a hydrostatic relief valve. The relief valve must not be subjected to temperatures more than of 140 degrees F. The start-to-discharge pressure setting must be set protect the components involved, but not less than 250 p.s.i.g. The discharge must be upward and away from component parts of the equipment and away from operating personnel.

(v) Vaporizer-burners must have means for manually turning off the gas to the main burner and pilot.

(vi) Vaporizer-burners must have automatic devices to shut off the flow of gas to the main burner and pilot if it goes out.

(vii) Locate or protect pressure regulating and control equipment so that the temperatures surrounding this equipment do not exceed 140 degrees F. except that you may use equipment components at higher temperatures if designed to withstand such temperatures.

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

(ix) The vaporizer section of vaporizer-burners must not have fusible plugs.

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

(xi) Equipment using vaporizer-burners must have automatic shutoff devices upstream and downstream of the vaporizer section connected to operate in case of excessive temperature, flame failure, and, if applicable, insufficient airflow.

(k) Filling densities.

(A) The “filling density” is the percent ratio of the weight of the gas in a container to the weight of water the container will hold at 60 degrees F. Fill containers according to the filling densities in Table 5.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

Table 5 - Maximum Permitted Filling Density

Specific gravity at 60° F. (15.6 ° C.)	Aboveground containers		Underground containers, all capacities
	0 to 1,200 U.S. gals. (1,000) imp. gal., 4,550 liters) total water cap.	0 to 1,200 U.S. gals. (1,000) imp. gal., 4,550 liters) total water cap.	
	Percent	Percent	Percent
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	40
.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 in **(3)(k)(C)** below, any container including mobile cargo tanks and portable tank containers, shipped under DOT jurisdiction or made according to 49 CFR Chapter I Specifications must be charged according to 49 CFR 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 in **OAR 437-004-0780(6)**, or containers recharged at the installation) may be filled either by weight, or by volume using a fixed length dip tube gaging device.

(l) LP-Gas in buildings.

(A) Pipe vapor into buildings at pressures more than 20 p.s.i.g. only if the buildings or separate areas, (a) comply with this section; (b) are used only for vaporization equipment, 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 with a similar hazard; (c) buildings, structures, or equipment under construction or undergoing major renovation.

(B) Liquid is 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 a similar hazard; and when such buildings, or separate areas are constructed according to this section.

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

(I) Liquid piping inside the building must conform to the requirements of **OAR 437-004-0780(3)(g)**, and must not exceed three-fourths iron pipe size. Copper tubing with an outside diameter of 3/4-inch or less is acceptable if it conforms to Type K of Specifications for Seamless Water Tube, ANSI H23.1-1970 (ASTM B88-69) (see Table 24). All such piping must have protection against construction hazards. Liquid piping inside buildings must be kept to a minimum. Fasten such piping securely to walls or other surfaces for adequate protection from breakage and place it to subject the liquid line to lowest ambient temperatures.

(II) There must be a shutoff valve in each intermediate branch line where it takes off the main line. A shutoff valve must also be at the appliance end of the intermediate branch line. Such shutoff valves must be upstream of any flexible connector used with the appliance.

(III) Suitable excess flow valves must be in the container outlet line supplying liquid LP-Gas to the building. A suitable excess flow valve must be immediately downstream of each shutoff valve. Suitable excess flow valves must be installed and sized where piping size is reduced.

(IV) Hydrostatic relief valves must comply with **OAR 437-004-0780(3)(i)(I)**.

(V) Do not use hose to carry liquid between the container and the building or at any point in the liquid line, except at the appliance connector.

(VI) Where flexible connectors are necessary for appliance installation, make them as short as practicable and they must comply with **OAR 437-004-0780(3)(g)(B)** or (h).

(VII) Minimize the release of fuel by either of the following methods when any section of piping or appliances is disconnected:

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

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

(E) Do not take portable containers into buildings except as in **OAR 437-004-0780(3)(e)(A)**.

(m) **Transfer of liquids.** The employer must assure that:

(A) At least one attendant stays close to the transfer connection, during the transfer of the product.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(B) Do not use or refill containers made according to 49 CFR Part 178 and authorized by 49 CFR Chapter 1 as a “single trip” or “nonrefillable container.”

(C) Do not vent gas or liquid to the atmosphere while transferring contents of one container to another, except as in **OAR 437-004-0780(6)(e)(D)**. This does not preclude the use of listed pumps that use LP-Gas vapor as a source of energy. They may vent to the atmosphere at a rate not more than that from a .1200-inch opening. Such venting and liquid transfer must be at least 50 feet from the nearest building.

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

(E) Filling of portable containers, containers on skids, fuel containers on farm tractors, or similar applications, from storage containers used in domestic or commercial service, must be at least 50 feet from the nearest building.

(F) The filling connection and the vent from the liquid level gages in containers, filled at point of installation, must be at least 10 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(G) Gage and charge fuel supply containers only in the open air or in buildings especially for that purpose.

(H) The maximum vapor pressure of the product at 100 degrees F. during transfer into a container must comply with paragraphs **OAR 437-004-0780(c)(2)** and **(d)(3)**. (For DOT containers use DOT requirements.)

(I) Use only gases for which the system is designed, examined, and listed, particularly regarding pressures.

(J) Pumps or compressors must be designed for use with LP-Gas. When using compressors they must take suction from the vapor space of the container being filled and discharge to the vapor space of the container being emptied.

(K) Pumping systems, with a positive displacement pump, must have a recirculating device that limits the differential pressure on the pump under normal operating conditions to its maximum differential pressure rating. Protect the discharge of the pumping system so that pressure is never more than 350 p.s.i.g. If a recirculation system discharges into the supply tank and has a manual shutoff valve, there must be an adequate secondary safety recirculation system that has no means of making it inoperative. Manual shutoff valves in recirculation systems must be open except during an emergency or when the system is under repair.

(L) When necessary, unloading piping or hoses must have suitable bleeder valves to relieve pressure before disconnection.

(M) Agricultural air moving equipment, including crop dryers, must be off when filling supply containers unless the air intakes and sources of ignition are at least 50 feet from the container.

(N) Agricultural equipment using open flames or equipment with integral containers, such as flame cultivators, weed burners, and, tractors, must be off during refueling.

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

(A) The track of tank car sidings must be relatively level.

(B) A "Tank Car Connected" sign, as covered by DOT rules, must be at the active end or ends of the siding while the tank car is connected.

(C) While cars are on sidetrack for loading or unloading, block the wheels at both ends.

(D) The employer must insure that an employee is always present during loading or unloading of tank cars or trucks.

(E) 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 must be close to the point where the liquid piping and hose or swing joint pipe connect.

(F) Except as in **(3)(n)(G)** below, when the size (diameter) of the loading or unloading hoses and/or piping is reduced below the size of the tank car or transport truck loading or unloading connections, the adaptors to which lines are attached must have either a backflow check valve, a properly sized excess flow valve, or shutoff valve with means of remote closing, to protect against uncontrolled discharge from the tank car or transport truck.

(G) The requirement of **(3)(n)(F)** above does not apply if the tank car or transport has a quick-closing internal valve that remotely closes.

(H) The location of the tank car or transport truck loading or unloading point must consider the following:

(i) Nearness to railroads and highway traffic.

(ii) With respect to buildings on installer's property.

(iii) Nature of occupancy.

(iv) Topography.

(v) Type of construction of buildings.

(vi) Number of tank cars or transport trucks that may be safely loaded or unloaded at one time.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(vii) Frequency of loading or unloading.

(I) Where practical, the distance of the unloading or loading point must conform to the distances in **OAR 437-004-0780(3)(e)(B)**.

(o) **Instructions.** Personnel performing installation, removal, operation, and maintenance work must have proper training.

(p) **Electrical equipment and other sources of ignition.**

(A) Fixed electrical equipment in classified areas must comply with **OAR 437-004-0780(q)**. Other electrical equipment and wiring must comply with Subdivision 4/S.

(B) There must be no open flames or other sources of ignition in vaporizer rooms (except those housing direct-fired vaporizers), pump houses, container charging rooms or other similar locations. Direct-fired vaporizers may not be in pump houses or container charging rooms.

(C) Liquefied petroleum gas storage containers do not require lightning protection.

(D) Since liquefied petroleum gas is in a closed system of piping and equipment, the system does not need to be electrically conductive or electrically bonded for protection against static electricity.

(E) Open flames, cutting or welding, portable electric tools, and extension lights capable of igniting LP-Gas, must not be in classified areas in Table 6 unless the LP-Gas facilities are free of all liquid and vapor.

Table 6

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

(continued on next page.)

H

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

Table 6 (Continued)

Part	Location	Extent of classification area ¹	Equipment shall be suitable for Class 1, Group D ²
D	Relief valve discharge other than those on DOT cylinders.	Within direct path of discharge	Division 1
		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.	Entire room and any adjacent room not separated by a gas-tight partition	Division 1
		Within 15 feet of the exterior side of any exterior wall or roof that is not vapor-tight or within 15 feet of any exterior opening	Division 2
	Indoors with adequate ventilation ⁴	Entire room and any adjacent room not separated by a gas-tight partition	Division 2
Outdoors in open air at or above grade.	Within 15 feet in all directions from this equipment and within the cylindrical volume between the horizontal equator of the sphere and grade. (See Figure 1)	Division 2	
F	Service Station Dispensing Units.	Entire space within dispenser enclosure, and 18 inches horizontally from enclosure exterior up to an elevation 4 feet above dispenser base. Entire pit or open space beneath dispenser	Division 1
		Up to 18 inches above grade within 20 feet horizontally from any edge of enclosure NOTE: For pits within this area, see Part F of this table.	Division 2
G	Pits or trenches containing or located beneath LP-Gas valves, pumps, compressors, regulators, and similar equipment.	
		Without mechanical ventilation	
	Without mechanical ventilation	Entire pit or trench	Division 1
		Entire room and any adjacent room not separated by a gas-tight partition	Division 1
		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 gas-tight partition		Division 2	
Within 15 feet in all directions from pit or trench when located outdoors		Division 2	

(continued on next page.)

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

Table 6 (Continued)

Part	Location	Extent of classification area ¹	Equipment shall be suitable for Class 1, Group D ²
H	Special buildings or rooms for storage of portable containers.	Entire room	Division 2
	Pipelines and connections containing operational bleeds, drips, vents or drains.	Within 5 feet in all directions from point of discharge Beyond 5 feet from point of discharge, same as Part E of this table	Division 1
J	Container filling: Indoors without ventilation	Entire room	Division 1
		Within 5 feet in all directions from connections regularly made or disconnected for product transfer	Division 1
	Indoors with adequate ventilation ⁴	Beyond 5 feet and entire room	Division 2
	Outdoors in open air	Within 5 feet in all directions from connections regularly made or disconnected for product transfer	Division 1
		Beyond 5 feet but within 15 feet in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade. (See Figure 1)	Division 2

¹ The classified area must not go beyond an unpierced wall, roof, or solid vapor-tight partition.

² See Subpart S of this part.

³ When classifying extent of hazardous area, consider 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 adequate when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit.

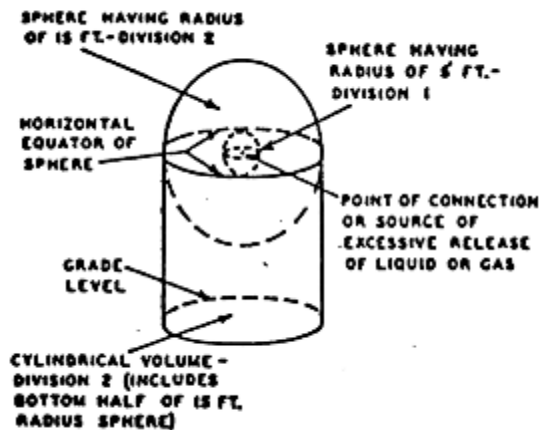


Figure 1

(q) **Fixed electrical equipment in classified areas.** Fixed electrical equipment and wiring in classified areas in Table 6 must comply with Table 6 and Subdivision 4/S. This provision does not apply to fixed electrical equipment at residential or commercial installations of LP-Gas systems or to systems covered by **OAR 437-004-0780(4)**.

(r) **Liquid-level gaging device.**

(A) Each container made after December 31, 1965, and filled on a volumetric basis must have a fixed liquid-level gage to indicate the maximum filling level as in **OAR 437-004-0780(b)(19)(v)**. Each container made 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 there is also a variable liquid-level gage, the fixed gage will also serve as a way to check the variable gage. **OAR 437-004-0780(b)(12)** requires these gages in charging containers.

(B) Arrange all variable gaging devices so that the maximum allowed liquid level for butane, for a 50 – 50 mixture of butane and propane, and for propane, is readily determinable. The markings indicating the various liquid levels from empty to full must be on the system nameplate or gaging device or part may be on the system nameplate and part on the gaging device. Dials of magnetic or rotary gages must show whether they are for cylindrical or spherical containers and whether for aboveground or underground service. The dials of gages intended for use only on aboveground containers of over 1,200 gallons water capacity must be so marked.

(C) Gaging devices that require bleeding of the product to the atmosphere, such as the rotary tube, fixed tube, and slip tube, must have a bleed valve maximum opening not larger than .0550-inch, unless they have an excess flow valve.

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

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(E) Length of tube or position of fixed liquid-level gage must indicate the maximum fill level of the container for the product contained. This level must be based on the volume of the product at 40 degrees F. at its maximum permitted filling density for aboveground containers and at 50 degrees F. for underground containers. The employer must calculate the filling point for which the fixed liquid level gage must be designed according to the method in this subdivision.

(i) 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:

$$[(\text{Water capacity (gals.) of container} \times \text{filling density}^{**}) \div (\text{Specific gravity of LP-Gas} \times \text{volume correction factor} \times 100)] = \text{Maximum volume of LP-Gas}$$

* Measured at 60 degrees F.

** From subparagraph **(12)** of this paragraph "Filling Densities."

For aboveground containers the liquid temperature is assumed to be 40 degrees F. and for underground containers the liquid temperature is assumed to be 50 degrees F. To correct the liquid volumes at these temperatures to 60 degrees F. the following factors shall be used.

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

Table 7 – 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

(iii) The maximum volume of LP-Gas that can be in a container when determining the length of the dip tube expressed as a percentage of total water content of the container is calculated by the following formula.

(iv) 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 (3)(r)(E)(i) above by the pounds of liquefied petroleum gas in a gallon at 40 degrees F. for aboveground and at 50 degrees F. for underground containers. For example, typical pounds per gallon are below:

Example: Assume a 100-gallon total water capacity tank for aboveground storage of propane having a specific gravity of 0.510 of 60° F.

$[(100 \text{ (gals.)} \times 42 \text{ (filling density from OAR 437-004-0780(3)(k))} \div (0.510 \times 1.031 \text{ (correction factor from Table 7)} \times 100)] = (4200 \div 52.6)$

$(4200 \div 52.6) = 79.8$ gallons propane, the maximum amount permitted to be placed in a 100-gallon total water capacity aboveground container with a fixed dip tube.

$[(\text{Maximum volume of LP-Gas (from formula in Table 7)} \times 100) \div \text{Total water content of container in gallons}] = \text{Maximum percent of LP-Gas}$

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

(F) Fixed liquid-level gages on containers other than DOT containers must be stamped on the exterior of the gage with the letters “DT” followed by the vertical distance (expressed in inches and carried out to one decimal place) from the top of container to the end of the dip tube or to the centerline of the gage when it is 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 the stamping must be 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 in percent of total tank contents and the marking must be on the container.

(G) Columnar gage glasses must be restricted to charging plants where the fuel is withdrawn in the liquid only. They must have valves with metallic handwheels, excess flow valves, and extra-heavy glass adequately protected with a metal housing applied by the gage manufacturer. They must be shielded against the direct rays of the sun. Do not use columnar gage glasses on tank trucks, motor fuel tanks or on containers used in domestic, commercial, and industrial installations.

(H) Gaging devices of the float, or equivalent type that do not require flow for their operation and with connections extending to a point outside the container do not have to have excess flow valves if the piping and fittings will withstand the container pressure and are properly protected against physical damage.

(s) Requirements for appliances.

(A) Except as in **(3)(s)(B)** below, new commercial and industrial gas consuming appliances must be approved.

(B) If an appliance was made to use a gas other than LP-Gas, it may be used with LP-Gas only after it is properly converted, adapted and tested for performance before placing it in use.

(C) Unattended heaters inside buildings for animal or poultry production or care must have an approved automatic device to shut off the gas if the flame goes out.

(D) Install all agricultural appliances or equipment according to the requirements of this section and 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.

(4) Cylinder systems.

(a) Application. This paragraph applies specifically to systems using DOT containers. All requirements of **OAR 437-004-0780(3)** apply to this paragraph unless otherwise noted in **OAR 437-004-0780(3)**.

(b) Marking of containers.

(A) Container markings must comply with DOT regulations. Additional markings not in conflict with DOT regulations are acceptable.

(B) Each container must show its water capacity in pounds or other identified unit of weight unless it is filled and maintained only by the owner or their representative and the water capacity is identified by a code.

(C) Each container must show its tare weight in pounds or other identified unit of weight including all permanently attached fittings but not the cap.

(c) Description of a system. A system includes the container base or bracket, containers, container valves, connectors, manifold valve assembly, regulators, and relief valves.

(d) Containers and regulating equipment outside of buildings or structures.

(A) Do not bury containers. This does not prohibit installation below grade level if the container and regulating equipment do not contact the ground. The area must have drainage and ventilate horizontally to the outside air from its lowest level. The outlet must be at least 3 feet away from any building opening that is below it.

(B) Except as in **OAR 437-004-0780(3)(i)(M)**, the discharge from safety relief devices must be at least 3 feet horizontally away from any building opening below the level of discharge and must not end beneath any building unless the space has good ventilation and only two enclosed sides.

(C) Containers must be on a firm foundation or otherwise firmly secured. Connect outlet pipes with a flexible or special fitting.

(e) Containers and equipment inside buildings or structures.

(A) When you must use portable containers inside buildings or structures follow **(i)** through **(xii)** below, and other parts of this subparagraph **(A)** that apply.

(i) Use containers with and connect only to compatible equipment or appliances.

(ii) Systems using containers with a water capacity more than 2 1/2 pounds (nominal 1-pound LP-Gas capacity) must have excess flow valves. The valves must be integral either with the container valves or in the connections to the container valve outlets. In either case, an excess flow valve must prevent strain beyond the excess flow valve from causing a break between the container and the valve.

(iii) Regulators must be connect directly either to the container valves or to manifolds connected to the container valves. The regulator must be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets must withstand at least 250 p.s.i.g. service pressure.

(iv) Protect valves on containers with a water capacity more than 50 pounds (nominal 20 pounds LP-Gas capacity) while in use.

(v) Containers must have markings that comply with **OAR 437-004-0780(3)(d)(C)** and **(4)(b)**.

(vi) Pipe or tubing must conform to **OAR 437-004-0780(3)(g)**. Do not use aluminum pipe or tubing.

(vii)

(I) Hose must have a working pressure of at least 250 p.s.i.g. Hose and hose connections must be listed by a nationally recognized testing laboratory. The hose length may be more than the length in **OAR 437-004-0780(3)(h)(G)(ii)**, but must be as short as practicable. Refer to §1910.7 for definition of nationally recognized testing laboratory.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(II) Hose must be long enough to permit compliance with spacing provisions of this subparagraph without kinking or straining or causing hose to be so close to a burner as to be damaged by heat.

(viii) Portable heaters, including salamanders, must have an approved automatic device to shut off the gas if the flame goes out. Heaters with inputs more than 50,000 B.t.u. made on or after May 17, 1967, and heaters with inputs more than 100,000 B.t.u. made before May 17, 1967, must have either:

(I) A pilot that must light before the main burner can be turned on; or

(II) An electric ignition system.

This paragraph (viii) does not apply to tar kettle burners, torches, melting pots, nor to portable heaters less than 7,500 B.t.u.h. input used with containers with a maximum water capacity of 2 1/2 pounds. Do not use container valves, connectors, regulators, manifolds, piping, and tubing as structural supports for heaters.

(ix) Locate containers, regulating equipment, manifolds, pipe, tubing, and hose to minimize exposure to abnormally high temperatures, physical damage, or tampering by unauthorized persons.

(x) Locate and use heat producing equipment in a way that minimizes the possibility of ignition of combustibles.

(xi) Containers with a water capacity more than 2 1/2 pounds (nominal 1-pound LP-Gas capacity) connected for use, must be upright on a firm and level surface.

(xii) Containers, including the valve protective devices, must be installed to minimize the probability of impingement of discharge of safety relief devices on containers.

(B) Containers with a maximum water capacity of 2 1/2 pounds (nominal 1-pound LP-Gas capacity) are allowed inside buildings as part of approved self-contained hand torch assemblies or similar appliances.

(C) You may use containers in buildings or structures under construction or major renovation and not occupied by the public, as follows:

(i) The maximum water capacity of individual containers is 245 pounds (nominal 100 pounds LP-Gas capacity).

(ii) For temporary heating such as curing concrete, drying plaster and similar applications, heaters (other than integral heater-container units) must be at least 6 feet from any LP-Gas container. This does not prohibit the use of heaters designed for attachment to the container or to a supporting standard, if they do not allow direct or radiant heat application onto the container. Blower and radiant type heaters must not point toward any LP-Gas container within 20 feet.

(iii) If two or more heater-container units, of either the integral or non-integral type, are in an unpartitioned area on the same floor, separate them by at least 20 feet.

(iv) Storage of containers awaiting use must comply with **OAR 437-004-0780(7)**.

(D) Containers are allowed in buildings for temporary emergency heating purposes, to prevent damage to the buildings or contents, when the permanent heating system is temporarily out of service, as follows:

(i) Containers and heaters must comply with and be used according to **OAR 437-004-0780(4)(e)(C)**.

(ii) Do not leave the temporary heating equipment unattended.

(f) Container valves and accessories.

(A) Valves in the assembly of multiple container systems must allow replacement of containers without shutting off the flow of gas in the system.

NOTE: This does not require an automatic changeover device.

(B) Firmly attach regulators and low-pressure relief devices to the cylinder valves, cylinders, supporting standards or the building walls. The weather must not affect their operation.

(C) Protect valves and connections to the containers while in transit, in storage, and while being moved into final use, as follows:

(i) By setting into the recess of the container to prevent their being struck if the container is dropped on a flat surface, or

(ii) By ventilated cap or collar, fastened to the container and strong enough to prevent the force of a blow from affecting the valve or other connection.

(D) Keep outlet valves tightly closed or plugged on unconnected containers, although the containers are empty.

(E) Containers with a water capacity more than 50 pounds (approximately 21 pounds LP-Gas capacity), recharged at the installation, must have excess flow or backflow check valves to prevent the discharge of contents in case of failure of the filling or equalizing connection.

(g) Safety devices.

(A) Containers must have safety devices as required by DOT regulations.

(B) A final stage regulator of an LP-Gas system (excluding any appliance regulator) must have on the low-pressure side with a relief valve set to start to discharge within the limits in Table 8.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

Table 8

Regulator delivery pressure	Relief valve start-to-discharge pressure setting (percent of regulator delivery pressure)	
	Minimum	Maximum
1 p.s.i.g. or less	200	300
Above 1 p.s.i.g. but not over 3 p.s.i.g	140	200
Above 3 p.s.i.g	125	200

(C) When using a regulator or pressure relief valve inside a building for other than purposes in **OAR 437-004-0780(3)(e)(A)(i) through (vii)**, vent the relief valve and the space above the regulator and relief valve diaphragms to the outside air with the discharge outlet at least 3 feet horizontally away from any building opening below the discharge. This does not apply to protected individual appliance regulators nor to **OAR 437-004-0780(4)(e)** and **(3)(i)(m)**.

(h) Reinstallation of containers. Do not reinstall containers unless they requalify according to DOT regulations.

(i) Permissible product. Do not put a product in a container marked with a service pressure less than four-fifths of the maximum vapor pressure of the product at 130 degrees F.

(5) Systems using containers other than DOT containers.

(a) Application. This paragraph applies specifically to systems using storage containers other than those that comply with DOT specifications. **OAR 437-004-0780(3)** applies unless otherwise noted in **OAR 437-004-0780(3)**.

(b) Design pressure and classification of storage containers. Storage containers must comply with Table 9.

Table 9

Container type	For gasses with vapor press. Not to exceed lb. per sq. in. gage at 100° F. (37.8° C.)	Minimum design pressure of container, lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division 1) editions of ASME Code
¹ 80	80	80	100
100	100	100	125
125	125	125	156
150	150	150	187
175	175	175	219
² 200	215	200	250

¹ Type 80 storage containers have not been legal since Dec. 31, 1947.

² The container type may increase in increments of 25. The minimum design pressure of containers is 100 percent of the container type designation when made under 1949 or earlier editions of the ASME Code (Par. U-68 and U-69). The minimum design pressure of containers is 125 percent of the container type designation when made under: (1) the 1949 ASME Code (Par. U-200 and U-201), (2) 1950, 1952, 1956, 1959, 1962, 1965, and 1968 (Division 1) editions of the ASME Code.

(c) Container valves and accessories, filler pipes, and discharge pipes.

(A) The filling pipe inlet terminal must not be inside a building. For containers with a water capacity of 125 gallons or more, such terminals must be at least 10 feet from any building, 5 feet or more from a driveway (see **OAR 437-004-0780(3)(e)(B)**) and in a protective housing built for the purpose.

(B) The filling connection must have one of the following:

(i) Combination back-pressure check valve and excess flow valve.

(ii) One double or two single back-pressure check valves.

(iii) A positive shutoff valve, with either:

(I) An internal back-pressure valve, or

(II) An internal excess flow valve.

(C) All openings in a container must have approved automatic excess flow valves except in the following: Filling connections in **OAR 437-004-0780(5)(c)(B)**; safety relief connections, liquid-level gaging devices **OAR 437-004-0780(3)(f)(D)**; pressure gage connections in **(3)(f)(E)**.

(D) If the following exist, you do not need an excess flow valve in the withdrawal service line:

(i) Such systems' total water capacity does not exceed 2,000 U.S. gallons.

(ii) Control of the discharge from the service outlet is by a manual shutoff valve that is:

(I) Threaded directly into the service outlet of the container; or

(II) Is an integral part of a substantial fitting threaded into or on the service outlet of the container; or

(III) Threaded directly into a substantial fitting threaded into or on the service outlet of the container.

(iii) The shutoff valve has an attached handwheel or the equivalent.

(iv) The controlling orifice between the contents of the container and the outlet of the shutoff valve is not more than 5/16-inch in diameter for vapor withdrawal systems and 1/8-inch in diameter for liquid withdrawal systems.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(v) An approved pressure-reducing regulator is directly attached to the outlet of the shutoff valve and is rigidly supported, or that an approved pressure-reducing regulator is attached to the outlet of the shutoff valve with a suitable flexible connection, if the regulator has adequate support and protection on or at the tank.

(E) All inlet and outlet connections except safety relief valves, liquid level gaging devices and pressure gages on containers of 2,000 gallons water capacity, or more, and on any container that supplies fuel directly to an internal combustion engine, must have labeling to show whether they communicate with vapor or liquid space. Labels may be on valves.

(F) Instead of an excess flow valve, openings may have a quick-closing internal valve that, except during operating periods remains closed. The internal mechanism for such valves may have a secondary control that must have a fusible plug (not more than 220 degrees melting point) that closes the internal valve automatically in case of fire.

(G) There can be only two plugged openings on a container of 2,000 gallons or less water capacity.

(H) Containers of 125 gallons water capacity or more made after July 1, 1961, must have an approved device for liquid evacuation. The minimum size is 3/4-inch National Pipe Thread minimum. A plugged opening does not satisfy this requirement.

(d) Safety devices.

(A) All safety devices must comply with the following:

(i) All container safety relief devices must be on the containers and have a direct link with the vapor space of the container.

(ii) Protect safety relief device discharge terminals against physical damage and such discharge pipes must have loose rain caps. There can be no return bends or restrictive pipe fittings.

(iii) Discharge lines from two or more safety relief devices on the same unit, or similar lines from two or more different units, may be run into a common discharge header, if the cross-sectional area of the header is at least equal to the sum of the cross-sectional areas of the individual discharge lines, and the setting of safety relief valves are the same.

(iv) Each storage container of more than 2,000 gallons water capacity must have a suitable pressure gage.

(v) A final stage regulator of an LP-Gas system (excluding any appliance regulator) must have, on the low-pressure side, a relief valve set to start to discharge within the limits in Table 8.

(vi) When a regulator or pressure relief valve is inside a building, it and the space above the regulator and relief valve diaphragms must vent to the outside air. The discharge outlet must be at least 3 feet horizontally away from any opening into the building that is below such discharge. (This does not apply to protected individual appliance regulators.)

(B) Provide safety devices for aboveground containers as follows:

(i) Containers aboveground of 1,200 gallons water capacity or less that may contain liquid fuel must have a spring-loaded relief valve or valves with a rate of discharge required by **OAR 437-004-0780(3)(i)(B)**. In addition to the required spring-loaded relief valve(s), you can use suitable fuse plug(s) if their total discharge area for each container is not more than 0.25 square inches.

(ii) The fuse plugs must melt between 208 degrees F. and 220 degrees F. Relief valves and fuse plugs must have a direct link with the container's vapor space.

(iii) On a container with a water capacity more than 125 gallons, but not more than 2,000 gallons, vent the discharge from the safety relief valves away from the container vertically upwards and unobstructed to prevent any impingement of escaping gas upon the container. Use loose-fitting rain caps. There must be a way to drain condensate that may accumulate in the relief valve or its discharge pipe.

(iv) On containers of 125 gallons water capacity or less, the discharge from safety relief devices must be at least 5 feet horizontally away from any opening into the building below the level of the discharge.

(v) On a container with a water capacity more than 2,000 gallons, the discharge from the safety relief valves must vent away from the container vertically upwards to a point at least 7 feet above the container, and unobstructed to the open air in a way that prevents any impingement of escaping gas upon the container. Use only loose-fitting rain caps. Condensation inside the safety relief valve or its discharge pipe must not make the valve inoperative. If there is a drain, there must be a way to protect the system against impingement of flame from ignition of any product escaping from the drain.

(e) **Vaporizers.** Safety devices for vaporizers must be provided as follows:

(A) Vaporizers of less than 1-quart total capacity, heated by the ground or the surrounding air, need not have safety relief valves if adequate tests certified by any of the authorities in **OAR 437-004-0780(3)(b)**, demonstrate that the assembly is safe without them.

(B) Vaporizers must not have fusible plugs.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(f) Reinstallation of containers. Containers may be reinstalled if they do not show any evidence of harmful external corrosion or other damage. Containers reinstalled underground, must have corrosion resistant coating in good condition (see **OAR 437-004-0780 (5)(h)(D)**). Containers reinstalled aboveground, must have safety devices and gaging devices that comply with **OAR 437-004-0780(5)(d)** and **OAR 437-004-0780(3)(r)** respectively.

(g) Capacity of containers. Maximum capacity for a storage container is 90,000 gallons water capacity.

(h) Installation of storage containers.

(A) Aboveground containers, except as in **(5)(h)(G)** below, must have substantial masonry or noncombustible structural supports on firm masonry foundation.

(B) Aboveground containers have support as follows:

(i) Horizontal containers must be on saddles in such a manner as to permit expansion and contraction. Use structural metal supports only with approved fire protection. There must be suitable means of preventing corrosion on the part of the container that contacts the foundations or saddles.

(ii) Containers of 2,000 gallons water capacity or less may have 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 concrete pad, footing, or the ground is not more than 24 inches.

(C) Any container may have 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 is not more than 5 feet, if the container is in an isolated location.

(D) Containers may be partially buried if the following requirements are met:

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

(ii) Spacing requirements must be as specified for underground tanks in **OAR 437-004-0780(3)(f)(B)**.

(iii) Relief valve capacity must be as required for aboveground containers.

(iv) Container is not subject to vehicular damage, or has adequate protection against such damage.

(v) Filling densities must be as required for aboveground containers.

(E) The top of buried containers must be at least 6 inches below grade. Where an underground container might be subject to abrasive action or physical damage due to vehicular traffic or other causes, it must be:

(i) Not less than 2 feet below grade, or

(ii) Otherwise protected against such physical damage.

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

(F)

(i) Containers must have a protective coating before being placed under ground. This coating must be equivalent to hot-dip galvanizing or to two coatings of red lead followed by a heavy coating of coal tar or asphalt. In lowering the container into place, do not damage to the coating. Repair any damage to the coating must be before backfilling.

(ii) Containers must be on a firm foundation (firm earth is OK) and surrounded with earth or sand firmly tamped in place.

(G) Containers with attached foundations (portable or semi-portable containers with suitable steel “runners” or “skids” known in the industry as “skid tanks”) must comply with these rules subject to the following:

(i) If they are for a given general location for a temporary period not longer than 6 months they need not have fire-resisting foundations or saddles but must have adequate ferrous metal supports.

(ii) The outside bottom of the container shell must not be more than 5 feet above the ground unless there are fire-resisting supports.

(iii) The bottom of the skids must be at least 2 inches but not more than 12 inches below the outside bottom of the container shell.

(iv) Flanges, nozzles, valves, fittings, and the like, having communication with the interior of the container, must have protection against physical damage.

(v) When not permanently on fire-resisting foundations, piping connections must be sufficiently flexible to minimize the possibility of breakage or leakage of connections if the container settles, moves, or is otherwise displaced.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(vi) Secure skids or lugs for attachment of skids, to the container according to the code or rules under which it was designed and built (with a minimum factor of safety of four) to withstand loading in any direction equal to four times the weight of the container and attachments when filled to the maximum permissible loaded weight.

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

(I) For aboveground containers, secure anchorage or adequate pier height must be provided against possible container flotation wherever sufficiently high floodwater might occur.

(J) When permanently installed containers are interconnected, compensate for expansion, contraction, vibration, and settling of containers, and interconnecting piping. Where flexible connections are used, they must be an approved type and must be designed for a bursting pressure of at least five times the vapor pressure of the product at 100 degrees F. Do not use nonmetallic hose for permanently interconnecting such containers.

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

(i) **Protection of container accessories.** Protect valves, regulating, gaging, and other container accessory equipment against tampering and physical damage.

(j) **Drips for condensed gas.** Where vaporized gas on the low-pressure side of the system may condense to a liquid at normal operating temperatures and pressures, there must be suitable means for revaporization of the condensate.

(k) **Damage from vehicles.** Protect LP-Gas systems from vehicle traffic.

(l) **Drains.** Do not direct drains or blowoff lines into or near sewer systems.

(m) **Lighting.** Electrical equipment and installations must comply with **OAR 437-004-0780(3)(n)** and **(o)**.

(n) **Vaporizers for internal combustion engines.** Paragraph **OAR 437-004-0780(6)(g)** applies.

(o) **Gas regulating and mixing equipment for internal combustion engines.** Paragraph **OAR 437-004-0780(6)(h)** applies.

(6) Liquefied petroleum gas as a motor fuel.

(a) Application.

(A) This applies to internal combustion engines, fuel containers, and equipment for the use of LPG as a motor fuel on portable units including self-propelled vehicles.

(B) Paragraph **OAR 437-004-0780(5)** covers fuel containers and equipment for stationary internal combustion engines using LPG. This does not apply to containers for transportation of liquefied petroleum gases. All of **OAR 437-004-0780(3)** applies to this paragraph, unless otherwise noted in **OAR 437-004-0780(3)**.

(b) General.

(A) Do not fuel vehicles while passengers are on board.

(B) Fuels industrial trucks (including forklifts) with permanently mounted fuel tanks outdoors. Charging equipment must comply with paragraph (8).

(C) LP-Gas fueled industrial trucks must comply with the Standard for Type Designations, Areas of Use, Maintenance and Operation of Powered Industrial Trucks, NFPA 505-1969.

(D) Engines on vehicles must be off while fueling if the fueling operation involves venting to the atmosphere.

(c) Design pressure and classification of fuel containers.

(A) Except as in (6)(c)(B) and (C) below, containers must comply with Table 10.

(B) Fuel containers for use in industrial trucks (including forklifts) must be either DOT containers authorized for LP-Gas service with a minimum service pressure of 240 p.s.i.g. or minimum Container Type 250. Under 1950 and later ASME codes, this means a 312.5 p.s.i.g. design pressure container.

Table 10

Container type	For gasses with vapor press. Not to exceed lb. per sq. in. gage at 100° F. (37.8° C.)	Minimum design pressure of container, lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division 1) editions of ASME Code
¹ 200	215Z	200	250

¹ Container type may be increased by increments of 25. The minimum design pressure of containers is 100 percent of the container type designation when built under 1949 or earlier editions of the ASME Code (Par. U-68 and U-69). The minimum design pressure of containers is 125 percent of the container type designation when built under: (1) the 1949 ASME Code (Par. U-200 and U-201), (2) 1950, 1952, 1956, 1959, 1962, 1965, and 1968 (Division 1) editions of the ASME Code.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(C) Containers made and maintained under DOT specifications and regulations are acceptable fuel containers. They must conform to all requirements of this paragraph.

(D) All container inlets and outlets except safety relief valves and gaging devices must have labels that designate whether they link to vapor or liquid space. Labels may be on valves.

(d) Installation of fuel containers.

(A) Containers must be in a place that minimize the possibility of damage. Containers in the rear of trucks and buses, when protected by bumpers, comply. Fuel containers on passenger-carrying vehicles must be as far from the engine as practicable. There must be a seal between the passenger space or any space with radio equipment and the container space to prevent direct seepage of gas to these spaces. The container compartment must vent to the outside. If the fuel container is near the engine or the exhaust system, shield it from direct heat.

(B) Mount all fuel containers to prevent jarring loose, slipping, or rotating. The fastenings must withstand static loading in any direction equal to twice the weight of the tank and attachments when filled using a safety factor of not less than four. Only do field welding on saddle plates, lugs or brackets, originally attached to the container by the manufacturer.

(C) Permanently install fuel containers on buses.

(e) Valves and accessories.

(A) Container valves and accessories must have a rated working pressure of at least 250 p.s.i.g., and suitable for use on a liquefied petroleum gas service.

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

(C) With the exceptions of (D)(iii) below, filling connections with approved automatic back-pressure check valves, and safety relief valves, all connections to containers with openings for the flow of gas more than .055-inch must have approved automatic excess flow valves.

(D) Liquid-level gaging devices:

(i) Do not use variable liquid-level gages that require the venting of fuel to the atmosphere on fuel containers of industrial trucks (including forklifts).

(ii) On portable containers that fill vertically and/or horizontally, the fixed liquid-level gage must show maximum permitted filling level for both vertical and horizontal filling with the container oriented to place the safety relief valve in communication with the vapor space.

(iii) For containers used only on farm tractors and charged at a point at least 50 feet from any building, the fixed liquid-level gaging device may equal that passed by a .1200-inch opening. You do not need an excess flow valve. Mark fittings with the restricted opening and the container they are on to show the size of the opening.

(iv) Protect all valves and connections on containers from damage. For farm tractors where parts of the vehicle protect the valves and fittings, this requirement is met. On removable containers the protection for the fittings must be permanently attached.

(v) For systems with removable fuel containers, there must be a way in the system to minimize the escape of fuel when exchanging containers. Either of these methods are acceptable:

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

(II) Closing the valve at the fuel container and allowing the engine to run until the fuel line is empty.

(f) Piping – including pipe, tubing, and fittings.

(A) Pipe from fuel container to first-stage regulator must be at least schedule 80 wrought iron or steel (black or galvanized), brass or copper; or seamless copper, brass, or steel tubing. Steel tubing must have a minimum wall thickness of 0.049-inch. Steel pipe or tubing must have protection against exterior corrosion. Copper tubing must be types K or L or equivalent with a minimum wall thickness of 0.032-inch. Approved flexible connections may be used between container and regulator or between regulator and gas-air mixer within the limits of approval. Do not use aluminum pipe or tubing. For removable containers use an approved flexible connection between the container and the fuel line.

(B) Install, brace and support all piping to reduce to a minimum the possibility of vibration strains or wear.

(g) Safety devices.

(A) Use only spring-loaded internal type safety relief valves on motor fuel containers.

(B) The discharge outlet from safety relief valves must be on the outside of enclosed spaces and as far as practicable from possible sources of ignition. It must vent upward within 45 degrees of the vertical to prevent impingement of escaping gas on containers, or parts of vehicles, or on vehicles in adjacent lines of traffic. Use a rain cap or other protector to keep water and dirt from collecting in the valve.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(C) When using a discharge line from the container safety relief valve, the line must be metallic, other than aluminum, and may not restrict the required flow of gas from the safety relief valve. Such discharge line must be able to withstand the pressure resulting from the discharge of vapor when the safety relief valve is fully open. When flexibility is necessary, use flexible metal hose or tubing.

(D) You can fill portable containers with volumetric filling in either the vertical or horizontal position only if the safety relief valve links with the vapor space.

(E) Paragraph **OAR 437-004-0780(3)(i)(L)** for hydrostatic relief valves applies.

(h) Vaporizers.

(A) Vaporizers and any part thereof and other devices that may be subjected to container pressure must have a design pressure of at least 250 p.s.i.g.

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

(C) Securely fasten vaporizers to minimize the possibility of their becoming loose.

(D) Permanently mark each vaporizer at a visible point as follows:

(i) With the design pressure of the fuel-containing portion in p.s.i.g.

(ii) With the water capacity of the fuel-containing portion of the vaporizer in pounds.

(E) Devices to supply heat directly to a fuel container must have an automatic device to cut off the supply of heat before the pressure inside the fuel container reaches 80 percent of the start to discharge pressure setting of the safety relief device on the fuel container.

(F) Engine exhaust gases are acceptable as a direct source of heat supply for the vaporization of fuel if the materials of construction of those parts of the vaporizer in contact with exhaust gases are resistant to the corrosive action of exhaust gases and the vaporizer system is designed to prevent excessive pressures.

(G) Vaporizers must not have fusible plugs.

(i) Gas regulating and mixing equipment.

(A) Approved automatic pressure reducing equipment must be between the fuel supply container and gas-air mixer to reduce the pressure of the fuel delivered to the gas-air mixer.

(B) An approved automatic shutoff valve must be in the fuel system ahead of the inlet of the gas-air mixer, to prevent flow of fuel to the mixer when the ignition is off and the engine is not running. For industrial trucks and engines operating in buildings other than those that exclusively house engines, the automatic shutoff valve must operate if the engine stops. Atmospheric type regulators (zero governors) are adequate as an automatic shutoff valve only in outdoor operation such as farm tractors, irrigation pump engines, and on other outdoor stationary engines.

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

(j) Capacity of containers. No single fuel container on passenger carrying vehicles can be more than 200 gallons water capacity. No single fuel container on other vehicles normally operating on the highway can be more than 300 gallons water capacity.

(k) Stationary engines in buildings. Stationary engines and gas turbines in buildings, including portable engines used instead of or to supplement stationary engines, must comply with the Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA 37-1970, and **OAR 437-004-0780(a), (b), and (c)**.

(l) Portable engines in buildings.

(A) Only use portable engines in buildings for emergencies, except as in **OAR 437-004-0780(10)**.

(B) Exhaust gases must discharge outside the building or to an area where they are not hazard.

(C) There must be sufficient air for combustion and cooling.

(D) An approved automatic shutoff valve must be in the fuel system ahead of the engine, to prevent flow of fuel to the engine when the ignition is off or if the engine stops.

(E) The capacity of LP-Gas containers used with such engines must comply with **OAR 437-004-0780(4)(e)**.

(m) Industrial trucks inside buildings.

(A) LP-Gas-fueled industrial trucks are permitted in buildings and structures.

(B) No more than two LP-Gas containers can be on an industrial truck for motor fuel purposes.

(C) Do not leave industrial trucks unattended near sources of ignition.

(n) Garaging LP-Gas-fueled vehicles.

(A) LP-Gas-fueled vehicles may be stored or serviced inside garages.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(B) Keep the shutoff valve closed on LP-Gas-fueled vehicles being repaired in garages except when the engine must run.

(7) Storage of containers awaiting use.

(a) **Application.** This paragraph applies to the storage of portable containers not more than 1,000 pounds water capacity, filled or partially filled, at user location but not connected for use.

(b) General.

(A) Do not store containers near sources of heat or ignition or near stairs or exits.

(B) Keep the outlet valves of stored containers closed.

(C) Empty containers, stored inside, that have held LP-Gas are treated like full containers when calculating the maximum quantity of LP-Gas permitted by this paragraph.

(c) **Storage within buildings not frequented by the public (such as agricultural buildings).** Do not store more than 300 pounds (approximately 2,550 cubic feet in vapor form) except as in (d) below.

(d) Storage within special buildings or rooms.

(A) Do not store more than 10,000 pounds of LP-Gas in special buildings or rooms.

(B) The walls, floors, and ceilings of container storage rooms that are within or next to other parts of the building must have at least a 2-hour fire resistance rating.

(C) Part of the exterior walls or roof with an area at least 10 percent of the combined area of the enclosing walls and roof must be of explosion relieving construction.

(D) Each opening from such storage rooms to other parts of the building must have a 1 1/2-hour (B) fire door listed by a nationally recognized testing laboratory. Refer to §1910.7 for definition of nationally recognized testing laboratory.

(E) There must be no open flames in the rooms.

(F) The rooms must have adequate ventilation both top and bottom to the outside only. The openings from such vents must be at least 5 feet away from any other opening into any building.

(G) The floors of such rooms must not be below ground level.

(H) The rooms may not adjoin a property line occupied by schools, churches, hospitals, athletic fields or other public gathering places.

(I) Fixed electrical equipment must comply with **OAR 437-004-0780(3)(o)**.

(e) Storage outside buildings.

(A) Storage outside buildings, for containers awaiting use, must comply with Table 11 with respect to:

- (i) The nearest building or group of buildings;
- (ii) Busy highways;

Quantity of LP-Gas Stored	Distances
500 pounds or less	0
501 to 2,500 pounds	¹ 0
2,501 to 6,000 pounds	10 feet
6,001 to 10,000 pounds	20 feet
Over 10,000 pounds	25 feet

¹ Containers must be at least 10 feet from any building on adjoining property, any sidewalk, or busy highway or road.

(B) Containers must be in a suitable enclosure or otherwise protected against tampering.

(f) Fire protection. Storage locations must have at least one approved portable fire extinguisher with rating of 8-B, C or more.

(8) Liquefied petroleum gas dispensing.

(a) Application. This paragraph applies to storage containers, dispensing devices, and equipment where LP-Gas is stored and dispensed into fuel tanks of motor vehicles. See **OAR 437-004-0780(6)** for requirements covering use of LP-Gas as a motor fuel. All requirements of **OAR 437-004-0780(3)** apply to this paragraph unless otherwise noted.

(b) Design pressure and classification of storage containers. Storage containers must comply with Table 12.

Container type	For gasses with vapor press. Not to exceed lb. per sq. in. gage at 100° F. (37.8° C.)	Minimum design pressure of container, lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division 1) editions of ASME Code
¹ 200	215Z	200	250

¹ Container type may be increased by increments of 25. The minimum design pressure of containers is 100 percent of the container type designation when constructed under 1949 or earlier editions of the ASME Code (Par. U-68 and U-69). The minimum design pressure of containers is 125 percent of the container type designation when constructed under: (1) The 1949 ASME Code (Paragraphs U-200 and U-201), (2) 1950, 1952, 1956, 1959, 1962, 1965, and 1968 (Division 1) editions of the ASME Code.

(c) Container valves and accessories.

(A) A filling connection on the container must have one of the following:

- (i)** A combination back-pressure check and excess flow valve.
- (ii)** One double or two single back-pressure valves.
- (iii)** A positive shutoff valve, in conjunction with either,
 - (I)** An internal back-pressure valve, or
 - (II)** An internal excess flow valve.

Instead of an excess flow valve, filling connections may have a quick-closing internal valve, that must remain closed except during operating periods. The mechanism for such valves may have a secondary control that causes it to close automatically in case of fire. When using a fusible plug, its melting point must not be more than 220 degrees F.

(B) A filling pipe inlet terminal not on the container must have a positive shutoff valve in conjunction with either;

- (i)** A back pressure check valve, or
- (ii)** An excess flow check valve.

(C) All openings in the container except those below must have approved excess flow check valves:

- (i)** Filling connections as in subparagraph **(A)** above.
- (ii)** Safety relief connections as in **OAR 437-004-0780(3)(f)(B)**.
- (iii)** Liquid-level gaging devices as in **OAR 437-004-0780(3)(f)(D)**.
- (iv)** Pressure gage connections as in **OAR 437-004-0780(3)(f)(E)**.

(D) All container inlets and outlets except those listed below must have labels to designate whether they connect with vapor or liquid (labels may be on valves):

- (i)** Safety relief valves.
- (ii)** Liquid-level gaging devices.
- (iii)** Pressure gages.

(E) Each storage container must have a suitable pressure gage.

(d) Safety-relief valves.

(A) All safety-relief devices must be as follows:

- (i)** On the container and directly connected with the vapor space.
- (ii)** Safety-relief valves and discharge piping must have protection against physical damage. The outlet must have loose-fitting rain caps. There must be no return bends or restrictions in the discharge piping.
- (iii)** The discharge from two or more safety relief valves with the same pressure settings may be run into a common discharge header. The cross-sectional area of the header must be at least equal to the sum of the cross-sectional areas of the individual discharges.
- (iv)** Safety relief devices must not discharge in or under a building

(B) Aboveground containers must have safety relief valves as follows:

- (i)** The rate of discharge, provided by one or more valves, must be not less than in **OAR 437-004-0780(3)(i)(B)**.
- (ii)** The discharge from safety relief valves must vent to open air unobstructed and vertically in a way that prevents any impingement of escaping gas on the container. Use loose-fitting rain caps. On a container with a water capacity more than 2,000 gallons, the discharge from the safety relief valves must vent away from the container vertically to a point at least 7 feet above it. Condensation inside the relief valve or its discharge pipe must not make the valve inoperative. If there is a drain, there must be a way protect the container, adjacent containers, piping, or equipment against impingement of flame from ignition of the product escaping from the drain.

(C) Underground containers must be provided with safety relief valves as follows:

- (i)** The discharge from safety-relief valves must be piped vertically upward to a point at least 10 feet above the ground. The discharge lines or pipes must be adequately supported and protected against physical damage.
- (ii)** If no liquid is put into a container until after it is buried and covered, the rate of discharge of the relief valves may be reduced to not less than 30 percent of the rate in **OAR 437-004-0780(3)(j)(B)**. If liquid fuel is present during installation of containers, the rate of discharge must be the same as for aboveground containers. Such containers must not be uncovered until emptied of liquid fuel.

(e) Capacity of liquid containers. Individual liquid storage containers must not exceed 30,000 gallons water capacity.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(f) Installation of storage containers.

(A)

(i) Each storage container used exclusively in dispensing operations must comply with the following table that specifies minimum distances to a building and groups of buildings.

Water capacity per Container (gallons)	Minimum distances	
	Aboveground (feet)	Between aboveground containers (feet)
Up to 2,000	25	3
Over 2,000	50	5

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

(ii) There must be a 10-foot area around containers that is free of combustibles.

(iii) The minimum separation between LP-Gas containers and flammable liquid tanks is 20 feet and the minimum separation between a container and the centerline of the dike is 10 feet.

(iv) LP-Gas containers near flammable liquid containers must have dikes, diversion curbs, or grading to protect against the flow or accumulation of flammable liquids.

(v) LP-Gas containers must not be within diked areas for flammable liquid containers.

(vi) Do field welding on saddle plates or brackets applied by the container manufacturer.

(vii) Where flexible connections are used, they must be approved type and have a bursting pressure of not less than five times the vapor pressure of the product at 100 degrees F. Do not use nonmetallic hose for interconnecting such containers.

(viii) Where there may be a high water table or flood conditions there must be protection against container flotation.

(B) Aboveground containers must comply with this subdivision.

(i) Containers may be horizontal or vertical.

(ii) Unless protected by location, there must be protective barriers around containers. Do not service vehicles within 10 feet of containers.

(iii) Container foundations must be masonry or other noncombustible material. Containers must be on saddles that permit expansion and contraction.

(C) Underground containers must be installed in accordance with this subdivision.

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

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

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

(g) Protection of container fittings. Valves, regulators, gages, and other container fittings must have protection against tampering and physical damage.

(h) Transport truck unloading point. The filling pipe inlet terminal must not be in a building nor within 10 feet of any building or driveway. It must be protected against physical damage.

(i) Piping, valves, and fittings.

(A) Piping may be underground, aboveground, or a combination of both.

(B) Piping beneath driveways must have protection from vehicle damage.

(C) Piping must be wrought iron or steel (black or galvanized), brass or copper pipe; or seamless copper, brass, or steel tubing and suitable for a minimum pressure of 250 p.s.i.g. Pipe joints may be screwed, flanged, brazed, or welded. Do not use aluminum alloy piping or tubing.

(D) All shutoff valves (liquid or gas) must be suitable for liquefied petroleum gas service and designed for not less than the maximum anticipated operating pressure. Valves that may experience container pressure must have a rated working pressure of at least 250 p.s.i.g.

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

(F) Fittings must be steel, malleable iron, or brass with a minimum working pressure of 250 p.s.i.g. Do not use cast iron pipe fittings.

STORAGE & HANDLING OF LIQUEFIED PETROLEUM GASES

H

(G) After assembly, test all piping to assure it is free of leaks at not less than normal operating pressures.

(j) Pumps and accessories. All pumps and accessory equipment must be suitable for LP-Gas service, and designed for not less than the maximum anticipated operating pressure. Accessories must have a minimum rated working pressure of 250 p.s.i.g. Positive displacement pumps must have suitable pressure actuated bypass valves permitting flow from pump discharge to storage container or pump suction.

(k) Dispensing devices.

(A) Meters, vapor separators, valves, and fittings in the dispenser must be suitable for LP-Gas service and have a minimum working pressure of 250 p.s.i.g.

(B) Vent LP-Gas in a dispensing device to a safe location.

(C) Pumps used to transfer LP-Gas must allow control of the flow and prevent leakage or accidental discharge. There must be a way outside the dispensing device to shut off the power in case of fire or accident.

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

(E)

(i) Dispensing hose must be resistant to the action of liquid LP-Gas and have a minimum bursting pressure of 1,250 p.s.i.g.

(ii) An excess flow check valve or automatic shutoff valve must be at the terminus of the liquid line at the point of attachment of the dispensing hose.

(F)

(i) LP-Gas dispensing devices must be at least 10 feet from aboveground storage containers more than 2,000 gallons water capacity. The dispensing devices must be at least 20 feet from any building (not including canopies), basement, cellar, pit, or line of adjoining property that may be developed and not less than 10 feet from sidewalks, streets, or thoroughfares. No drains or blowoff lines may discharge into or near to the sewer systems used for other purposes.

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

(iii) LP-Gas dispensing devices may not be in a building except that they may be under a weather shelter or canopy if it is not enclosed on more than two sides. If the enclosing sides are next to each other, the area must have proper ventilation.

**STORAGE & HANDLING OF LIQUEFIED
PETROLEUM GASES / USE OF LIQUEFIED
PETROLEUM GAS OR NATURAL GAS IN
FIELDS & ORCHARDS**

(G) The dispensing of LP-Gas into the fuel container of a vehicle must be done by a competent attendant who stays at the LP-Gas dispenser during the entire transfer operation.

(I) Smoking. There must be no smoking on the driveway of dispensing facilities or transport truck unloading areas. Post signs prohibiting smoking in places easily seen by facility users.

(m) Motors. The motors of all vehicles being fueled must be off during the fueling operations.

(n) Electrical. Electrical equipment and installations must conform to **OAR 437-004-0780(3)(n)** and **(o)**.

(o) Fire protection. Each dispensing facility must have at least one approved portable fire extinguisher with at least an 8-B, C, rating.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.

437-004-0790 Use of Liquefied Petroleum Gas or Natural Gas in Fields and Orchards.

(1) Scope. This applies to the storage and use of liquefied petroleum gas or natural gas, in fields and orchards, to fuel or power stationary orchard heaters, fans, and other such fixed equipment. It does not cover portable orchard and field equipment. OAR 437-004-0780 covers all other uses of these gases.

(2) Definitions.

Approved – See universal definition in 4/B.

Competent person – See universal definition in 4/B.

Labeled – See universal definition in 4/B.

Liquefied petroleum gases – “LPG” and “LP-Gas” – Any material made mostly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butane (normal butane or iso-butane), and butylenes.

Listed – See universal definition in 4/B.

(3) Components. The tank regulator and all components in between must be labeled, listed or approved.

(a) All piping and end use components, like fans and heaters, must be on the low pressure side of approved regulators.

**USE OF LIQUEFIED PETROLEUM GAS OR
NATURAL GAS IN FIELDS & ORCHARDS /
STORAGE & HANDLING OF ANHYDROUS AMMONIA**

H

(4) Installation. Installation of systems and equipment that use liquefied petroleum gas must only be by persons licensed according to ORS 480.410 through .460 and must conform to OAR 837, Division 30. (Contact the Office of State Fire Marshal for more information on these requirements.)

(5) Welding. Do not weld on parts of the system subject to pressure.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f. 8/28/98, ef. 10/1/98.

OR-OSHA Admin. Order 7-2001, f. 5/15/01, ef. 5/15/01.

437-004-0800 Storage and Handling of Anhydrous Ammonia.

(1) Scope.

(a) This standard applies to the operation of anhydrous ammonia systems including refrigerated ammonia storage systems.

(b) This standard does not apply to applications that use ammonia solely as a refrigerant.

(2) Definitions.

Appurtenances – All devices such as pumps, compressors, safety relief devices, liquid-level gaging devices, valves and pressure gages.

Capacity – Total volume of the container in standard U.S. gallons.

Certified – See universal definitions in Subdivision 4/B, OAR 437-004-0100.

Code – The Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels of the American Society of Mechanical Engineers (ASME) – 1968.

Container – Includes all vessels, tanks, cylinders, or spheres used for transportation, storage, or application of anhydrous ammonia.

Cylinder – A container of 1,000 pounds of water capacity or less built according to Department of Transportation specifications.

Design pressure – is identical to the term “Maximum Allowable Working Pressure” used in the Code.

DOT – U.S. Department of Transportation.

DOT specifications – Regulations of the Department of Transportation in 49 CFR Chapter I.

Farm vehicle (implement of husbandry) – A vehicle for use on a farm with a container of not more than 1,200 gallons water capacity on it.

Labeled – See universal definitions in Subdivision 4/B, OAR 437-004-0100.

Listed – See universal definitions in Subdivision 4/B, OAR 437-004-0100.

(3) Basic rules.

(a) Approval of equipment and systems. All systems, equipment and appurtenances must comply with one of the following three paragraphs.

(A) If installed before February 8, 1973, it must comply with American National Standard for the Storage and Handling of Anhydrous Ammonia, K61.1-1999 or CGA G-2.1-1999.

(B) It must be listed and labeled by a nationally recognized testing laboratory as defined in 29 CFR 1910.7.

(C) A registered engineer may test and certify custom designed and custom built systems as meeting the criteria in **OAR 437-004-0800(3)(a)(A)**. This certification must be on file with the employer for agency review. The certification must detail the test criteria, data and results along with the qualifications of the person doing the test.

(b) Requirements for construction, original test and recertification of non-refrigerated containers.

(A) Only competent persons and/or companies may design, install and maintain non-refrigerated containers.

(B) Containers used with systems in **OAR 437-004-0800(4), (7), (8) and (9)** must comply with the Code (Boiler and Pressure Vessel Code, Sec VIII, Unfired Pressure Vessels of the American Society of Mechanical Engineers (ASME) – 1968). Construction under Table UW 12 at a basic joint efficiency of less than 80 percent is not authorized.

(C) Containers more than 36 inches in diameter or 250 gallons water capacity must comply with one or more of the following:

- (i)** Containers must be stress relieved after fabrication according to the Code, or
- (ii)** Cold-form heads must be stress relieved, or
- (iii)** Use only hot-formed heads.

(D) Paragraph **(B)** above does not prohibit the continued use or reinstallation of containers constructed and maintained according to the 1949, 1950, 1952, 1956, 1959, and 1962 editions of the Code or any revisions in effect at the time of fabrication.

(E) Welding to the shell, head or any other part of the container subject to internal pressure must comply with the Code. Other welding is permitted only on saddle plates, lugs or brackets attached to the container by the container manufacturer.

(F) Containers used with systems in **OAR 437-004-0800(5)** must comply with DOT specifications.

(c) Marking of containers. Keep the original markings on refrigerated and non-refrigerated containers as they were at the time of installation.

(d) Location of containers.

(A) When selecting the location for the storage container consider the physiological effects as well as adjacent fire hazards. Locate containers outside buildings unless the building was built for this purpose.

(B) Locate permanent storage containers 50 feet from a dug well or other sources of potable water supply, unless the container is a part of a water-treatment installation.

(C) Keep storage areas free of readily ignitable materials such as waste, weeds and long dry grass.

(e) Container appurtenances.

(A) Design appurtenances to stand the maximum working pressure of that part of the system on which they are installed. Make appurtenances from material proved suitable for anhydrous ammonia service.

(B) All connections to containers except safety relief devices, gaging devices, or those fitted with a .0550-inch orifice must have shutoff valves as close to the container as practicable.

(C) Excess flow valves where required by these standards must close automatically at the rated flows of vapor or liquid specified by the manufacturer. The connections and line including valves and fittings protected by an excess flow valve must have a larger capacity than the rated flow of the excess flow valve so that the valve will close in case of failure of the line or fittings.

(D) Liquid-level gaging devices that require bleeding of the product to the atmosphere and are built so that outward flow will not be more than that passed by a .0550-inch opening do not need excess flow valves.

(E) Openings from the container or through fittings attached directly on the container to which pressure gage connections are made need do not need excess flow valves if they are not larger than .0550-inch.

(F) Excess flow and back pressure check valves where required by this section must be inside the container or if outside as close as practicable to where the line enters the container. In the latter case installation must prevent strain beyond the excess flow or back pressure check valve from causing a break between the container and the valve.

(G) Excess flow valves must have a bypass not to exceed a .0400-inch opening to allow equalization of pressures.

(H) All excess flow valves must have plain and permanent markings with the name or trademark of the manufacturer, the catalog number, and the rated capacity.

(f) Piping, tubing and fittings.

(A) All piping, tubing and fittings must be made of material suitable for anhydrous ammonia service.

(B) All piping, tubing and fittings must be designed for a pressure not less than the maximum pressure under which they might operate.

(C) All refrigerated piping must conform to the Refrigeration Piping Code, American National Standard, B31.5-1966 with addenda B31.5a-1968 as it applies to ammonia.

(D) Piping on non-refrigerated systems must be at least American Society for Testing and Materials (ASTM) A-53-69 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal. For welded or welded and flanged joints the pipe must be at least schedule 40. For threaded joints the pipe must be at least schedule 80. Do not back-weld threaded connections. Do not use brass, copper or galvanized steel pipe.

(E) Do not use tubing made of brass, copper, or other material subject to attack by ammonia.

(F) Do not use cast iron fittings but this does not prohibit the use of fittings made specifically for ammonia service or malleable, nodular, or high strength gray iron meeting American Society for Testing and Materials (ASTM) A47-68, ASTM 395-68 or ASTM A126-66 Class B or C.

(G) Use joint compounds that are resistant to ammonia.

(g) Hose specifications.7

(A) Hose used in ammonia service must conform to the joint Agricultural Ammonia Institute – Rubber Manufacturers Association Specifications for Anhydrous Ammonia Hose.

(B) Hose subject to container pressure must be designed for a minimum working pressure of 350 p.s.i.g. and a minimum burst pressure of 1,750 p.s.i.g. Hose assemblies, when made up, must be capable of withstanding a test pressure of 500 p.s.i.g.

(C) Hose and hose connections on the low-pressure side of flow control or pressure-bleeding valves must have a bursting pressure rating of not less than five times the pressure setting of the safety relief devices protecting that part of the system but not less than 125 p.s.i.g. All connections must not leak when connected.

(D) Where using hose to transfer liquid from one container to another, “wet” hose is recommended. Such hose must have approved shutoff valves at the discharge end. Prevent excessive pressure in the hose.

(E) On all hose 1/2-inch outside diameter and larger, used for the transfer of anhydrous ammonia liquid or vapor, there must be etched, cast, or impressed at 5-foot intervals the following information.

“Anhydrous Ammonia” xxx p.s.i.g. (maximum working pressure), manufacturer’s name or trademark, year of manufacture.

In place of this requirement the same information may be on a nameplate permanently attached to the hose.

Table 1

[Minimum required rate of discharge in cubic feet per minute of air at 120 percent of the maximum permitted start to discharge pressure of safety relief valves]

Surface area (sq. ft.)	Flow rate CFM air	Surface area (sq. ft.)	Flow rate CFM air	Surface area (sq. ft.)	Flow rate CFM air
20	258	185	1,600	900	5,850
25	310	190	1,640	950	6,120
30	360	195	1,670	1,000	6,380
35	408	200	1,710	1,050	6,640
40	455	210	1,780	1,100	6,900
45	501	220	1,850	1,150	7,160
50	547	230	1,920	1,200	7,410
55	591	240	1,980	1,250	7,660
60	635	250	2,050	1,300	7,910
65	678	260	2,120	1,350	8,160
70	720	270	2,180	1,400	8,410
75	762	280	2,250	1,450	8,650
80	804	290	2,320	1,500	8,900
85	845	300	2,380	1,550	9,140
90	885	310	2,450	1,600	9,380
95	925	320	2,510	1,650	9,620
100	965	330	2,570	1,700	9,860
105	1,010	340	2,640	1,750	10,090
110	1,050	350	2,700	1,800	10,330
115	1,090	360	2,760	1,850	10,560
120	1,120	370	2,830	1,900	10,800
125	1,160	380	2,890	1,950	11,030
130	1,200	390	2,950	2,000	11,260
135	1,240	400	3,010	2,050	11,490
140	1,280	450	3,320	2,100	11,720
145	1,310	500	3,620	2,150	11,950
150	1,350	550	3,910	2,200	12,180
155	1,390	600	4,200	2,250	12,400
160	1,420	650	4,480	2,300	12,630
165	1,460	700	4,760	2,350	12,850
170	1,500	750	5,040	2,400	13,080
175	1,530	800	5,300	2,450	13,300
180	1,570	850	5,590	2,500	13,520

"Surface Area = total outside surface area of container in square feet. When the surface area is not on the nameplate or when the marking is not legible calculate the area using one of the following formulas:

- (1) Cylindrical container with hemispherical heads:

Area = overall length in feet times outside diameter in feet times 3.1416.

- (2) Cylindrical container with other than hemispherical heads:

Area = (overall length in feet plus 0.3 outside diameter in feet) times outside diameter in feet times 3.1416.

(3) Spherical container:

Area = outside diameter in feet squared times 3.1416.”

“Flow Rate – CFM Air = cubic feet per minute of air required at standard conditions, 60 degrees 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 2,500 square feet, the required flow rate can be calculated using the formula: Flow Rate CFM Air = 22.11 A^{0.82}, where A = outside surface area of the container in square feet.”

(h) Safety relief devices.

(A) Every container in systems covered by **OAR 437-004-0800(4), (7), (8) and (9)** must have one or more safety relief valves of the spring-loaded or equivalent type. The discharge from safety-relief valves must vent away from the container, upward and unobstructed to the atmosphere. All relief-valve discharge openings must have suitable rain caps that allow free discharge of the vapor and prevent entrance of water. Accumulated condensation must drain away. The rate of the discharge must comply with Table 1.

(B) Container safety-relief valves must be set to start-to-discharge as follows, with relation to the design pressure of the container:

Containers	Minimum (percent)	Maximum (percent)
ASME-U-68, U-69	110	125
ASME-U-200, U-202	95	100
ASME 1959, 1956, 1952 or 1962	95	100
API-ASME	95	100
U.S. Coast Guard	95	100

(C) Safety relief devices in systems covered by **OAR 437-004-0800(4), (7), (8) and (9)** must discharge at not less than the rates in **(3)(h)(A)** above before the pressure is in excess of 120 percent (not including the 10 percent tolerance in **(3)(h)(B)** above) of the maximum permitted start-to-discharge pressure setting of the device.

(D) Arrange safety relief valves to minimize the possibility of tampering. If the pressure setting adjustment is external, the relief valves must have a means of sealing the adjustment.

(E) Shutoff valves must not be between the safety relief valves and the container; except, that a shutoff valve may be where the arrangement of this valve is such as to always afford full required capacity flow through the relief valves.

(F) Safety relief valves must have direct communication with the vapor space of the container.

(G) Each container safety relief valve used with systems covered by **OAR 437-004-0800(4), (7), (8) and (9)** must have plain and permanent markings with the symbol “NH₃” or “AA”; with the pressure in pounds-per-square-inch at which the valve is set to start-to-discharge; with the actual rate of discharge of the valve at its full open position in cubic feet per minute of air at 60 degrees F. and atmospheric pressure; and the manufacturer’s name and catalog number.

Example: “NH₃ 250-4050 Air” indicates that the valve is suitable for use on an anhydrous ammonia container, is set to start-to-discharge at a pressure of 250 p.s.i.g., and that its rate of discharge at full open position is 4,050 cubic feet per minute of air.

(H) There must be no connection on either the upstream or downstream side that restricts the flow capacity of the relief valve.

(I) A hydrostatic relief valve must be between each pair of valves in the liquid ammonia piping or hose to relieve into the atmosphere at a safe location.

(i) General.

(A) All stationary storage installations must have at least two readily accessible suitable gas masks. Full face masks with ammonia canisters, not cartridges, approved by the National Institute for Occupational Safety and Health (NIOSH), are suitable for emergency action for most leaks, particularly those that are outdoors. For protection in concentrated ammonia atmospheres the use of self-contained breathing air apparatus is mandatory. Refer to OAR 437-004-1041 Respiratory Protection 4/I for additional requirements for personal protective equipment.

(B) Stationary storage installations must have an easily accessible shower or a 50-gallon drum of water.

(C) Each vehicle transporting ammonia in bulk except farm applicator vehicles must carry a container of at least 5 gallons of water and a full face mask.

(j) Charging of containers.

(A) The filling densities for unrefrigerated containers must not be more than the following:

Containers	Percent by Weight	Percent by Volume
Aboveground – Uninsulated	56	82
Aboveground – Uninsulated		87.5
Aboveground – Insulated	57	83.5
Underground – Uninsulated	58	85
DOT – In accord with DOT regulations		

(B) Aboveground uninsulated containers may be charged 87.5 percent by volume if the temperature of the anhydrous ammonia being charged is not lower than 30 degrees F. or if the charging of the container stops at the first indication of frost or ice formation on its outside surface and does not resume until the frost or ice is gone.

(k) Transfer of liquids.

- (A)** Anhydrous ammonia must always be at a temperature suitable for the material of construction and the design of the receiving container.
- (B)** The employer must require the continuous presence of an attendant in the vicinity of the operation during ammonia transfer.
- (C)** Charge and use containers only with authorization of the owner.
- (D)** Gage and charge containers only in the open atmosphere or in buildings or areas for that purpose.
- (E)** Pumps used for transferring ammonia must be made for that purpose.
- (i)** Pumps must be designed for at least 250 p.s.i.g. working pressure.
 - (ii)** Positive displacement pumps must have, installed off the discharge port, a constant differential relief valve discharging into the suction port of the pump through a line of sufficient size to carry the full capacity of the pump at relief valve setting, which setting and installation must be according to the pump manufacturer's recommendations.
 - (iii)** On the discharge side of the pump, before the relief valve line, there must be a pressure gage graduated from 0 to 400 p.s.i.
 - (iv)** Plant piping must have shutoff valves as close as practical to pump connections.
- (F)** Compressors for transferring or refrigerating ammonia must be recommended for ammonia service by the manufacturer.
- (i)** Compressors must be designed for at least 250 p.s.i.g. working pressure.
 - (ii)** Plant piping must have shutoff valves located as close as practical to compressor connections.
 - (iii)** A relief valve large enough to discharge the full capacity of the compressor must be connected to the discharge before the shutoff valve.
 - (iv)** Compressors must have pressure gages at suction and discharge graduated to at least 1 1/2 times the maximum pressure.
 - (v)** Adequate means, such as a drainable liquid trap, must be on the compressor suction to minimize the entry of liquid into the compressor.

(G) In case the hose breaks, loading and unloading systems must have suitable devices to prevent emptying of the storage or supply container. Backflow check valves or properly sized excess flow valves must be where necessary to provide this protection. If such valves are not practical, remotely operated shutoff valves may be acceptable.

(I) Tank car unloading points and operations.

(A) Unloading of tank cars must conform to the applicable recommendations in DOT regulations.

(B) The employer must insure that unloading operations are done by reliable persons properly instructed and with the authority to monitor careful compliance with all applicable procedures.

(C) Caution signs must be on the track or car to give warning to people approaching the car from the open end or ends of the siding. They must be left up until after the car is empty and disconnected from discharge connections. Signs must be metal or other suitable material, at least 12 inches by 15 inches and bear the words "STOP – Tank Car Connected" or "STOP – Men at Work" the word, "STOP," being in letters at least 4 inches high and the other words in letters at least 2 inches high.

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

(E) Set the brakes and block the wheels on cars during unloading.

(m) Liquid-level gaging device.

(A) Each container except those filled by weight must have an approved liquid-level gaging device. A thermometer well must be in containers without a fixed liquid-level gaging device.

(B) All gaging devices must be arranged so that the maximum liquid level to which the container is filled is readily determined.

(C) Gaging devices that require bleeding of the product to the atmosphere such as the rotary tube, fixed tube, and slip tube devices must have a maximum opening of the bleed valve not larger than .0550-inch unless they have an excess flow valve. (This requirement does not apply to farm vehicles used for the application of ammonia as in **OAR 437-004-0800(9)**.)

(D) Gaging devices must have a design pressure equal to or greater than the design pressure of their host container.

(E) Fixed tube liquid-level gages must indicate the container's 85 percent fill level of its water capacity.

(F) Use columnar gage glasses only on stationary storage installations. They must have shutoff valves with metallic handwheels, excess-flow valves and extra heavy glass adequately protected with a metal housing applied by the gage manufacturer. They must be shielded from the direct rays of the sun.

(n) Electrical equipment and wiring.

(A) Electrical equipment and wiring for use in ammonia installations must be general purpose or weather resistant as appropriate.

(B) Electrical systems must comply with 4/S.

(4) Systems using stationary, non-refrigerated storage containers.

(a) Applies to all storage containers except portable DOT containers.

(A) The minimum design pressure and construction for non-refrigerated containers is 250 p.s.i.g.

(B) Each filling connection must have a combination back-pressure check valve and excess-flow valve; one double or two single back-pressure check valves; or a positive shutoff valve in conjunction with either an internal back-pressure check valve or an internal excess flow valve.

(C) All liquid and vapor connections to containers except filling pipes, safety relief connections, and liquid-level gaging and pressure gage connections with orifices not larger than .0550-inch required in **OAR 437-004-0800(3)(e)(D)** and **(E)** must have excess-flow valves.

(D) Each storage container must have a pressure gage graduated from 0 to 400 p.s.i. Gages must be designated for use in ammonia service.

(E) All containers must have vapor return valves.

(b) Safety-relief devices.

(A) Every container must have one or more safety-relief valves of the spring-loaded or equivalent type according to **OAR 437-004-0800(b)(9)**.

(B) The rate of discharge of spring-loaded safety relief valves on underground containers may be a minimum of 30 percent of the rate of discharge in Table 1. After installation, do not uncover containers with this protection until empty of liquid ammonia. Consider containers that may contain liquid ammonia before being installed underground and before being completely covered with earth to be aboveground containers when determining the rate of discharge requirements of the safety-relief valves.

(C) On underground installations where there is a probability of the manhole or housing becoming flooded, the discharge from vent lines must be above the high water level. All manholes or housings must have ventilated louvers or their equivalent, the area which equal or exceed the combined discharge areas of safety-relief valves and vent lines that discharge their content into the manhole housing.

(D) Do not restrict vent pipes. They may not be a smaller diameter than the relief-valve outlet connection.

(E) Vent pipes from two or more safety-relief devices on the same unit, or similar lines from two or more different units may run into a common discharge header, if the capacity of the header is at least equal to the sum of the capacities of the individual discharge lines.

(c) Reinstallation of containers.

(A) Containers that were installed underground must not be reinstalled aboveground or underground, unless they withstand hydrostatic pressure retests at their original rating required by the code under which they were made. They must show no serious corrosion.

(B) Containers reinstalled aboveground, must have safety devices or gaging devices that comply with **OAR 437-004-0800(i)** and this paragraph respectively for aboveground containers.

(d) Installation of storage containers.

(A) Aboveground containers, except as in **(4)(d)(E)** below must have substantial concrete or masonry supports, or structural steel supports on firm concrete or masonry foundations. All foundations must extend below the frost line.

(B) Horizontal aboveground containers must be on foundations that permit expansion and contraction. Containers must have supports that prevent the concentration of excessive loads on the supporting portion of the shell. That part of the container in contact with foundations or saddles must have corrosion protection.

(C) The top of underground containers must be below the frost line and at least 2 feet below the surface. If ground conditions make compliance with these requirements impracticable, installation methods must prevent physical damage. It is not necessary to cover the part of the container where there are manhole and other connections. Anchor or weight containers when necessary to prevent floating.

(D) Underground containers must be on a firm foundation (firm earth is OK) and surrounded with compacted earth or sand. The container must have a corrosion resisting protective coating. This coating must remain undamaged when placing the container into the ground.

(E) Containers with foundations (portable or semi-portable tank containers with suitable steel “runners” or “skids” and commonly known in the industry as “skid tanks”) must comply with **OAR 437-004-0800(4)(a)(A)**.

(F) There must be secure anchorage or adequate pier height to prevent container flotation where high flood water might occur.

(G) The distance between underground containers of over 2,000 gallons capacity must be at least 5 feet.

(e) Protection of appurtenances.

(A) Protect valves, regulators, gages and other appurtenances against tampering and physical damage. This also applies during transit of containers.

(B) All connections to underground containers must be within a dome, housing, or manhole and with access by means of a substantial cover.

(f) Damage from vehicles. Protect ammonia systems from vehicle damage.

(5) Refrigerated storage systems.

(a) Container design.

(A) The design temperature must be the minimum temperature to which the container will be refrigerated.

(B) Containers with a design pressure more than 15 p.s.i.g. must comply with **OAR 437-004-0800(3)(b)**, and the materials must be from those in API Standard 620, Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks, Fourth Edition, 1970, Tables 2.02, R2.2, R2.2(A), R2.2.1, or R2.3.

(C) Containers with a design pressure of 15 p.s.i.g. and less must comply with the applicable requirements of API Standard 620 including its Appendix R.

(D) Use the Code as a guide to select austenitic steels or non-ferrous materials to build containers for use at the design temperature.

(E) The filling density for refrigerated storage containers must be such that the container will not be liquid full at a liquid temperature corresponding to the vapor pressure at the start-to-discharge pressure setting of the safety-relief valve.

(b) Installation.

(A) Containers must be on suitable non-combustible foundations.

(B) There must be adequate protection against flotation or other water damage where high flood water might occur.

(C) Containers for product storage at less than 32 degrees F. must have protection from freezing and consequent frost heaving.

(c) **Shutoff valves.** When operating conditions make it advisable, there must be a check valve on the fill connection and a remotely operated shutoff valve on other connections below the maximum liquid level.

(d) **Safety relief devices.**

(A) Set safety relief valves to start-to-discharge at a pressure not more than the design pressure of the container. The valves must prevent a maximum pressure in the container of more than 120 percent of the design pressure. Relief valves for refrigerated storage containers must be self-contained spring-loaded, weight-loaded, or self-contained pilot-operated type.

(B) The total relieving capacity must be the larger of:

(i) Possible refrigeration system upset such as (1) cooling water failure, (2) power failure, (3) instrument air or instrument failure, (4) mechanical failure of any equipment, (5) excessive pumping rates.

(ii) Fire exposure determined by Compressed Gas Association (CGA) S-1, Part 3, Safety Relief Device Standards for Compressed Gas Storage Containers, 1959, except that "A" must be the total exposed surface area in square feet up to 25 feet above grade or to the equator of the storage container if it is a sphere, whichever is greater. If the relieving capacity required for fire exposure is greater than that required by **OAR 437-004-0800(a)**, the additional capacity may be provided by weak roof to shell seams in containers operating at essentially atmospheric pressure and having an inherently weak roof-to-shell seam. The weak roof-to-shell seam is not to provide any of the capacity required in **OAR 437-004-0800(a)**.

(C) If vent lines conduct the vapors from the relief valve, the back pressure under full relieving conditions must not be more than 50 percent of the start-to-discharge pressure for pressure balanced valves or 10 percent of the start-to-discharge pressure for conventional valves. The vent lines must prevent accumulation of liquid in the lines.

(D) The valve or valve installation must provide weather protection.

(E) Atmospheric storage must have vacuum breakers. Ammonia gas, nitrogen, methane, or other inert gases are acceptable to provide a pad.

(e) **Protection of container appurtenances.** Protect appurtenances against tampering and physical damage.

(f) Reinstallation of refrigerated storage containers. When reinstalling containers that require field fabrication, reconstruct and reinspect them according to their original construction requirements. Pressure retest the containers and if rerating is necessary, it must comply with applicable requirements.

(g) Damage from vehicles. Protect containers from damage by vehicles.

(h) Refrigeration load and equipment.

(A) Compute the total refrigeration load as the sum of the following:

(i) Load imposed by heat flow into the container caused by the temperature differential between design ambient temperature and storage temperature.

(ii) Load imposed by heat flow into the container caused by maximum sun radiation.

(iii) Maximum load imposed by filling the container with ammonia warmer than the design storage temperature.

(B) A single refrigeration system may serve more than one storage container.

(i) Compressors.

(A) There must be a minimum of two compressors either of which must be large enough to handle the loads. Where there are more than two compressors, there must be minimum standby equipment equal to the largest normally operating equipment. Filling compressors are acceptable as standby equipment for holding compressors.

(B) Compressors must be able to operate with a suction pressure at least 10 percent below the minimum setting of the safety valve(s) on the storage container and must withstand a suction pressure at least equal to 120 percent of the design pressure of the container.

(j) Compressor drives.

(A) Each compressor must have its individual driving unit.

(B) There must be an emergency power source that can handle the loads unless facilities are available to safely dispose of vented vapors while the refrigeration system is not operating.

(k) Automatic control equipment.

(A) The refrigeration system must have suitable controls to govern the compressor operation.

(B) There must be an emergency alarm system to function in case the container pressure rises to the maximum allowable operating pressure.

(C) An emergency alarm and shut-off must be in the condenser system to respond to excess discharge pressure caused by failure of the cooling medium.

(D) All automatic controls must be prevent operation of alternate compressors unless the controls will function with the alternate compressors.

(I) **Separators for compressors.** An entrainment separator of suitable size and design pressure must be in the compressor suction line of lubricated compression. The separator must have a drain and gaging device.

(m) **Condensers.** The condenser system may be air or water cooled or both. The condenser must have minimum design pressure of at least 250 p.s.i.g. There must be a way to purge noncondensibles either manually or automatically.

(n) **Receiver and liquid drain.** A receiver must have a liquid-level control to discharge the liquid ammonia to storage. The receiver must be able to operate at least 250 p.s.i.g. and have the necessary connections, safety valves, and gaging device.

(o) **Insulation.** Insulated refrigerated containers and pipelines must have covers of a material of suitable quality and thickness for the temperatures. Weatherproofing must be flame retardant.

(6) Systems using portable DOT containers.

(a) Cylinders must comply with DOT specifications and must comply with 49 CFR Chapter I and Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954 (R1970).

(b) Store cylinders in an area free from ignitable debris and in such manner as to prevent external corrosion. Storage may be indoors or outdoors.

(c) Cylinders filled according to DOT regulations will become liquid full at 145 degrees F. Protect cylinders from heat sources such as radiant flame and steam pipes. Do not apply heat directly to cylinders to raise the pressure.

(d) Store cylinders in a way that protects them from vehicles or external damage.

(e) Any cylinder designed to have a valve protection cap must have the cap securely in place when the cylinder is not in service.

(7) Tank motor vehicles for the transportation of ammonia.

(a) This paragraph applies to containers and equipment on tank motor vehicles including semitrailers and full trailers used to transport ammonia. This paragraph does not apply to farm vehicles. For requirements covering farm vehicles, refer to **OAR 437-004-0800 (8) and (9)**. Paragraph **(b)** below applies to this paragraph unless otherwise noted. Containers and pertinent equipment for tank motor vehicles for the transportation of anhydrous ammonia, must also comply with DOT requirements.

(b) Design pressure and construction of containers.

(A) The minimum design pressure for containers must comply with DOT regulations.

(B) The shell or head thickness of containers must be at least 3/16-inch.

(C) All container openings, except safety relief valves, liquid-level gaging devices, and pressure gages, must have labels that designate whether they communicate with liquid or vapor space.

(c) Container appurtenances.

(A) Protect appurtenances from physical damage.

(B) All connections to containers, except filling connections, safety relief devices, and liquid-level and pressure gage connections, must have suitable automatic excess flow valves, or may have quick-closing internal valves, that must remain closed except during delivery operations. The control mechanism for such valves may have a secondary control remote from the delivery connections and such control mechanism must have a fusible section (melting point 208 degrees F. to 220 degrees F.) that permits the internal valve to close automatically in case of fire.

(C) Filling connections must have automatic back-pressure check valves, excess-flow valves, or quick-closing internal valves, to prevent back-flow in case the filling connection breaks. You do not need an automatic valve where the filling and discharge connect to a common opening in the container shell and that opening has a quick-closing internal valve as in **OAR 437-004-0800(f)(3)(ii)**.

(D) All containers must be capable of spray loading (filling in the vapor space) or with an approved vapor return valve of adequate capacity.

(d) Piping and fittings.

(A) Securely mount all piping, tubing, and fittings and protect them from damage. Protect hoses while the vehicle is moving.

(B) Fittings must comply with **OAR 437-004-0800(3)(e)**. Pipe must be Schedule 80.

(e) Safety relief devices.

(A) The discharge from safety relief valves must vent upward away from the container and to the open air in such a manner as to prevent any impingement of escaping gas. Use loose-fitting rain caps. Size of discharge lines from safety valves must not be smaller than the nominal size of the safety-relief valve outlet connection. Condensate that accumulates in the discharge pipe must drain off.

(B) Any part of liquid ammonia piping that may close at both ends must have a hydrostatic relief valve.

(f) Transfer of liquids.

(A) Determine the content of tank motor vehicle containers by weight, by a suitable liquid-level gaging device, or other approved methods. If using a liquid-level measurement, the container must have a thermometer well. This volume when converted to weight must not be more than the filling density specified by the DOT.

(B) Any pump, except a constant speed centrifugal pump, must have a suitable pressure actuated bypass valve permitting flow from discharge to suction when the discharge pressure rises above a pre-determined point. Pump discharge must also have a spring-loaded safety relief valve set at a pressure not more than 135 percent of the setting of the bypass valve or more than 400 p.s.i.g., whichever is larger.

(C) Compressors must have manually operated shutoff valves on both suction and discharge connections. Pressure gages of bourdon-tube type must be on the suction and discharge of the compressor before the shutoff valves. The compressor must not operate if either pressure gage is removed or is inoperative. A spring-loaded, safety-relief valve capable of discharging to atmosphere the full flow of gas from the compressor at a pressure not more than 300 p.s.i.g. must be between the compressor discharge and the discharge shutoff valve.

(D) Valve functions have clear and legible identification by metal tags or nameplates permanently affixed to each valve.

(g) Full trailers and semitrailers.

(A) Securely attach full trailers to the vehicle drawing them with suitable drawbars and a safety chain (or chains) or safety cables.

(B) Every full trailer or semitrailer must have reliable brakes that operate from the driver's seat.

(C) Every full trailer must have self-energizing brakes.

(D) Full trailers must follow substantially in the path of their towing vehicle and will not whip or swerve dangerously from side to side.

(E) Where using a fifth wheel, securely fasten it to both units, and use a positive locking mechanism that prevents separation of the two units except by manual release.

(h) **Protection against collision.** Each tank motor vehicle must have properly attached bumpers or chassis extension that protects the tank, piping, valves, and fittings from physical damage.

(i) **Chock blocks.** There must be at least two chock blocks. Use these blocks to prevent rolling during loading and unloading.

(j) **Portable tank containers (skid tanks).** Where these tanks are for farm storage they must comply with **OAR 437-004-0800(4)(a)(A)**. When portable tank containers substitute for cargo tanks and are permanently on tank motor vehicles for the transportation of ammonia, they must comply with the requirements of this paragraph.

(8) Systems on farm vehicles other than for the application of ammonia.

(a) **Application.** This paragraph applies to containers of 1,200 gallons capacity or less and equipment on farm vehicles (implements of husbandry) not used to apply ammonia to the soil. **OAR 437-004-0800(4)** applies unless otherwise noted.

(b) Design pressure and classification of containers.

(A) The minimum design pressure for containers is 250 p.s.i.g.

(B) Container shell or head thickness must be at least 3/16-inch.

(c) Mounting containers.

(A) A suitable "stop" or "stops" must be on the vehicle or on the container so that the container does not become loose from its mounting.

(B) At one or more places on each side of the container, a "hold down" device must anchor the container to the vehicle.

(C) When containers are on four-wheel trailers, the weight must be even over both axles.

(d) Container appurtenances.

(A) All containers must have a fixed liquid-level gage.

(B) All containers with a capacity more than 250 gallons must have a pressure gage with a dial graduated from 0-400 p.s.i.

(C) The filling connection must have a combination back-pressure check valve and excess-flow valve; one double or two single back-pressure check valves; or a positive shutoff valve in conjunction with either an internal back-pressure check valve or an internal excess flow valve.

(D) All containers with a capacity more than 250 gallons must be equipped for spray loading or have an approved vapor return valve.

(E) All vapor and liquid connections except safety-relief valves and those specifically exempted in ANSI K61.1-1966, must have approved excess-flow valves or quick-closing internal valves that, except during operating periods, must be closed.

(F) Fittings must have protection from damage by a metal box or cylinder with an open top fastened to the container or by rigid guards welded to the container on both sides of the fittings or by a metal dome. If there is a metal dome, the relief valve must vent through the dome.

(G) If there is a liquid withdrawal line in the bottom of a container, its connections, including hose, must not be lower than the lowest horizontal edge of the vehicle axle.

(H) Secure both ends of the hose while in transit.

(e) **Marking the container.** The words, “**Caution – Ammonia**” must be on each side and the rear end of the container in letters at least 4 inches high or its markings must comply with DOT regulations.

(f) **Farm vehicles.** All vehicles must carry a container of at least 5 gallons of water for washing ammonia from the skin.

(9) Systems on farm vehicles for the application of ammonia.

(a) This applies to systems using containers of 250 gallons capacity or less on farm vehicles (implements of husbandry) used to apply ammonia to the soil. **OAR 437-004-0800(4)** applies unless otherwise noted. Larger containers must comply with ANSI K61.1-1966.

(b) Design pressure and classification of containers.

(A) The minimum design pressure for containers is 250 p.s.i.g.

(B) The shell or head thickness of a container is less than 3/16-inch.

(c) **Mounting of containers.** All containers and flow-control devices must have secure mountings.

(d) Container valves and accessories.

(A) Each container must have a fixed liquid-level gage.

STORAGE & HANDLING OF ANHYDROUS AMMONIA / HAZARDOUS WASTE OPERATIONS & EMERGENCY RESPONSE (HAZWOPER)

H

(B) The filling connection must have a combination back-pressure check valve and an excess-flow valve; one double or two single back-pressure check valves; or a positive shut-off valve in conjunction with an internal back-pressure check valve or an internal excess-flow valve.

(C) You can fill the applicator tank by venting to open air if the bleeder valve orifice is not more than 7/16-inch in diameter.

(D) Regulation equipment may connect directly to the tank coupling or flange only with a flexible connection between the regulating equipment and the rest of the liquid withdrawal system. Otherwise, connect the regulating equipment flexibly to the container shutoff valve.

(E) There need be no excess flow valve in the liquid withdrawal line if the controlling orifice between the contents of the container and the outlet of the shutoff valve is not more than 7/16-inch in diameter.

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, 1/8/28/98, ef. 10/1/98.
OR-OSHA Admin. Order 9-2006, f. 9/22/06, ef. 9/22/06.

437-004-0950 Hazardous Waste Operations and Emergency Response. (HAZWOPER)

(1) If an agricultural employer requires employees to respond to an emergency release of a hazardous chemical with a reasonable possibility for employee exposure to safety or health hazards, that response activity must be in compliance with the applicable sections of Division 2/H, 1910.120, Hazardous Waste Operations and Emergency Response.

(2) Agricultural employers whose activities include clean-up operations involving hazardous waste, including those conducted at a treatment, storage, and disposal (TSD) facility, are subject to the applicable requirements in Division 2/H, 1910.120, Hazardous Waste Operations and Emergency Response.

NOTES:

There are two primary considerations for most agricultural employers to determine if the HAZWOPER rules apply to you:

(1) Do you expect your employees to respond to spills of hazardous chemicals in a way that involves a reasonable possibility of exposure to safety or health hazards? (If NO, the HAZWOPER rules do not apply.)

(2) If YES, would your employees respond only to an incidental release of a hazardous chemical; or, to an emergency release of a hazardous chemical?

(a) IF you expect your employees to respond only to an incidental release (defined as a situation where the spilled substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate area, or by maintenance personnel;) and there is no potential safety or health hazard (such as fire, explosion, or chemical exposure;) THEN, the HAZWOPER RULES DO NOT APPLY. However, you must train and equip employees who are expected to respond to incidental releases to safely handle that type of non-routine task as required by Division 4/Z, 437-004-9800, Hazard Communication Standard for Agricultural Employers.)

(b) IF you expect your employees to respond to an emergency release (defined as an occurrence that results in, or is likely to result in an uncontrolled release of a hazardous substance; or, a situation that requires a response effort by employees from outside the immediate release area, or by other designated responders such as mutual-aid groups or local fire departments;) THEN, the HAZWOPER RULES APPLY. Agricultural employers who expect their employees to respond to these types of emergencies are required to follow the sections in the HAZWOPER rules that apply to emergency releases “without regard to the location of the hazard.” (See Division 2/H, 1910.120(q) Emergency responses to hazardous substance releases.)

The best source of information about any chemical in the workplace (including recommended personal protective equipment and procedures for spill-response) is often the chemical’s Safety Data Sheet (SDS).

Stat. Auth.: ORS 654.025(2) and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f/8/28/98, ef. 10/1/98.
OR-OSHA Admin. Order 3-2014, f. 8/8/14, ef. 8/8/14.

– END OF DOCUMENT –