

(F) Heating, if provided, shall be steam, hot water, or by other indirect means.

(4) Operating instruction.

(i) **Written instructions.** For installation which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

(ii) **Attendant.** A qualified person shall be in attendance at all times while the mobile hydrogen supply unit is being unloaded.

(iii) **Security.** Each mobile liquefied hydrogen supply unit used as part of a hydrogen system shall be adequately secured to prevent movement.

(iv) **Grounding.** The mobile liquefied hydrogen supply unit shall be grounded for static electricity.

(5) **Maintenance.** The equipment and functioning of each charged liquefied hydrogen system shall be maintained in a safe operating condition in accordance with the requirements of this section. Weeds or similar combustibles shall not be permitted within 25 feet of any liquefied hydrogen equipment.

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

Stats. Implemented: ORS 654.001 to 654.295.

Hist: OR-OSHA Admin. Order 2-1992, f. 2/6/92, ef. 5/1/92.
OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.
OR-OSHA Admin. Order 4-2004, f. 9/15/04, ef. 9/15/04.
OR-OSHA Admin. Order 7-2008, f. 5/30/08, ef. 5/30/08.

§1910.104 Oxygen.

(a) **Scope.** This section applies to the installation of bulk oxygen systems on industrial and institutional consumer premises. This section does not apply to oxygen manufacturing plants or other establishments operated by the oxygen supplier or his agent for the purpose of storing oxygen and refilling portable containers, trailers, mobile supply trucks, or tank cars, nor to systems having capacities less than those stated in paragraph (b)(1) of this section.

(b) Bulk oxygen systems.

(1) **Definition.** As used in this section: A bulk oxygen system is an assembly of equipment, such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds, and interconnecting piping, which has storage capacity of 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 terminates at the point where oxygen at service pressure first enters the supply line. The oxygen containers may be stationary or movable, and the oxygen may be stored as gas or liquid.

(2) Location.

(i) General. Bulk oxygen storage systems shall be located aboveground out-of-doors, or shall be installed in a building of noncombustible construction, adequately vented, and used for that purpose exclusively. The location selected shall be such that containers and associated equipment shall not be exposed by electric power lines, flammable or combustible liquid lines, or flammable gas lines.

(ii) Accessibility. The system shall be located so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel.

(iii) Leakage. Where oxygen is stored as a liquid, noncombustible surfacing shall be provided in an area in which any leakage of liquid oxygen might fall during operation of the system and filling of a storage container. For purposes of this paragraph, asphaltic or bituminous paving is considered to be combustible.

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

(v) Dikes. Where it is necessary to locate a bulk oxygen system on ground lower than adjacent flammable or combustible liquid storage suitable means shall be taken (such as by diking, diversion curbs, or grading) with respect to the adjacent flammable or combustible liquid storage to prevent accumulation of liquids under the bulk oxygen system.

(3) Distance between systems and exposures.

(i) General. The minimum distance from any bulk oxygen storage container to exposures, measured in the most direct line except as indicated in paragraphs (b)(3)(vi) and (viii) of this section, shall be as indicated in paragraphs (b)(3)(ii) to (xviii) of this section inclusive.

(ii) Combustible structures. Fifty feet from any combustible structures.

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

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

(v) Flammable liquid storage aboveground.

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

(vi) 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

(vii) Combustible liquid storage aboveground.

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

(viii) Combustible 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)
15.....	40

(ix) 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

(x) Highly combustible materials. Fifty feet from solid materials which burn rapidly, such as excelsior or paper.

(xi) Slow-burning materials. Twenty-five feet from solid materials which burn slowly, such as coal and heavy timber.

(xii) Ventilation. 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.

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

(xiv) (Reserved)

(xv) (Reserved)

(xvi) (Reserved)

(xvii) (Reserved)

(xviii) Exceptions. The distances in paragraphs (b)(3)(ii), (iii), (v) to (xi) inclusive, of this section do not apply where protective structures such as firewalls of adequate height to safeguard the oxygen storage systems are located between the bulk oxygen storage installation and the exposure. In such cases, the bulk oxygen storage installation may be a minimum distance of 1-foot from the firewall.

(4) Storage containers.

(i) Foundations and supports. Permanently installed containers shall be provided with substantial noncombustible supports on firm noncombustible foundations.

(ii) Construction – liquid. Liquid oxygen storage containers shall be fabricated from materials meeting the impact test requirements of paragraph UG-84 of ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessels – 1968, which is incorporated by reference as specified in §1910.6. Containers operating at pressures above 15 pounds per square inch gage (p.s.i.g.) shall be designed, constructed, and tested in accordance with appropriate requirements of ASME Boiler and Pressure Vessel Code, Section VII – Unfired Pressure Vessels – 1968. Insulation surrounding the liquid oxygen container shall be noncombustible.

(iii) Construction – gaseous. High-pressure gaseous oxygen containers shall comply with one of the following:

(A) Designed, constructed, and tested in accordance with appropriate requirements of ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessels – 1968.

(B) Designed, constructed, tested, and maintained in accordance with DOT Specifications and Regulations.

(5) Piping, tubing, and fittings.

(i) Selection. Piping, tubing, and fittings shall be suitable for oxygen service and for the pressures and temperatures involved.

(ii) Specification. Piping and tubing shall conform to Section 2 – Gas and Air Piping Systems of Code for Pressure Piping, ANSI, B31.1-1967 with addenda B31.10a-1969, which is incorporated by reference as specified in §1910.6.

(iii) Fabrication. Piping or tubing for operating temperatures below –20 degrees F. shall be fabricated 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 minimum operating temperature to which the piping may be subjected in service.

(6) Safety relief devices.

(i) General. Bulk oxygen storage containers, regardless of design pressure shall be equipped with safety relief devices as required by the ASME code or the DOT specifications and regulations.

(ii) DOT containers. Bulk oxygen storage containers designed and constructed in accordance with DOT specification shall be equipped with safety relief devices as required thereby.

(iii) ASME containers. Bulk oxygen storage containers designed and constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII – Unfired Pressure Vessel – 1968, shall be equipped with safety relief devices meeting the provisions of the Compressed Gas Association Pamphlet “Safety Relief Device Standards for Compressed Gas Storage Containers,” S-1, Part 3, which is incorporated by reference as specified in §1910.6.

(iv) Insulation. Insulation casings on liquid oxygen containers shall be equipped with suitable safety relief devices.

(v) Reliability. All safety relief devices shall be so designed or located that moisture cannot collect and freeze in a manner which would interfere with proper operation of the device.

(7) Liquid oxygen vaporizers.

(i) Mounts and couplings. The vaporizer shall be anchored and its connecting piping be sufficiently flexible to provide for the effect of expansion and contraction due to temperature changes.

(ii) Relief devices. The vaporizer and its piping shall be adequately protected on the oxygen and heating medium sections with safety relief devices.

(iii) Heating. Heat used in an oxygen vaporizer shall be indirectly supplied only through media such as steam, air, water, or water solutions which do not react with oxygen.

(iv) Grounding. If electric heaters are used to provide the primary source of heat, the vaporizing system shall be electrically grounded.

(8) Equipment assembly and installation.

(i) Cleaning. Equipment making up a bulk oxygen system shall be cleaned in order to remove oil, grease or other readily oxidizable materials before placing the system in service.

(ii) Joints. Joints in piping and tubing may be made by welding or by use of flanged, threaded, slip, or compression fittings. Gaskets or thread sealants shall be suitable for oxygen service.

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(iii) Accessories. Valves, gages, regulators, and other accessories shall be suitable for oxygen service.

(iv) Installation. Installation of bulk oxygen systems shall be supervised by personnel familiar with proper practices with reference to their construction and use.

(v) Testing. After installation all field erected piping shall be tested and proved gas-tight at maximum operating pressure. Any medium used for testing shall be oil free and nonflammable.

(vi) Security. Storage containers, piping, valves, regulating equipment, and other accessories shall be protected against physical damage and against tampering.

(vii) Venting. Any enclosure containing oxygen control or operating equipment shall be adequately vented.

(viii) Placarding. The bulk oxygen storage location shall be permanently placarded to indicate: "OXYGEN – NO SMOKING – NO OPEN FLAMES," or an equivalent warning.

(ix) Electrical wiring. Bulk oxygen installations are not hazardous locations as defined and covered in Subpart S of this part. Therefore, general purpose or weatherproof types of electrical wiring and equipment are acceptable depending upon whether the installation is indoors or outdoors. Such equipment shall be installed in accordance with the applicable provisions of Subpart S of this part.

(9) Operating instructions. For installations which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

(10) Maintenance. The equipment and functioning of each charged bulk oxygen system shall be maintained in a safe operating condition in accordance with the requirements of this section. Wood and long dry grass shall be cut back within 15 feet of any bulk oxygen storage container.

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Stat. Auth.: ORS 654.025(2) and ORS 656.726(3).

Stats. Implemented: ORS 654.001 to 654.295.

Hist: OR-OSHA Admin. Order 2-1992, f. 2/6/92, ef. 5/1/92.
OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.

§1910.105 Nitrous Oxide.

The piped systems for the in-plant transfer and distribution of nitrous oxide shall be designed, installed, maintained, and operated in accordance with Compressed Gas Association Pamphlet G-8.1-1964, which is incorporated by reference as specified in §1910.6.

Stat. Auth.: ORS 654.025(2) and ORS 656.726(3).

Stats. Implemented: ORS 654.001 to 654.295.

Hist: OR-OSHA Admin. Order 2-1992, f. 2/6/92, ef. 5/1/92.
OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.