shatterproof glass or plastic in metal frames.

(b) Ventilation shall be as provided in paragraph (c)(3)(ii)(b) of this section.

(c) Explosion venting shall be provided in exterior walls or roof only. The venting area shall be equal to not less than 1 square foot per 30 cubic feet of room volume and may consist of any one or any combination of the following: Walls of light noncombustible material; lightly fastened hatch covers; lightly fastened swinging doors opening outward in exterior walls; lightly fastened walls or roofs designed to relieve at a maximum pressure of 25 pounds per square foot.

(d) There shall be no sources of ignition.

(e) Electrical wiring and equipment shall comply with paragraph (c)(1)(ix)(a) and (b) of this section except that the provision of paragraph (c)(1)(ix)(b) of this section shall apply to all electrical wiring and equipment in the special room.

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

(4) Operating instructions—(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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(iv) Elevation. When locating bulk oxygen systems near above-ground 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-resistant 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 above-ground.

<table>
<thead>
<tr>
<th>Distance (feet)</th>
<th>Capacity (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0 to 1000</td>
</tr>
<tr>
<td>90</td>
<td>1001 or more</td>
</tr>
</tbody>
</table>

(vi) Flammable liquid storage below-ground.

<table>
<thead>
<tr>
<th>Distance measured horizontally from oxygen storage container to flammable liquid tank (feet)</th>
<th>Distance from oxygen storage container to filling and vent connections or openings to flammable liquid tank (feet)</th>
<th>Capacity gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>50</td>
<td>0 to 1000.</td>
</tr>
<tr>
<td>30</td>
<td>50</td>
<td>1001 or more.</td>
</tr>
</tbody>
</table>

(vii) Combustible liquid storage above-ground.

(xvii) 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.


(iii) Fabrication. Piping or tubing for operating temperatures below −20 °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.

(iv) 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—(1) 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—(1) 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.

(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.

§ 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.


§ 1910.106 Flammable liquids.

(a) Definitions. As used in this section:

(1) Aerosol shall mean a material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure.

(2) Atmospheric tank shall mean a storage tank which has been designed to operate at pressures from atmospheric through 0.5 p.s.i.g.

(3) Automotive service station shall mean that portion of property where flammable liquids used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles and shall include any facilities available for the sale and service of tires, batteries, and accessories, and for minor automotive maintenance work. Major automotive repairs, painting, body and fender work are excluded.

(4) Basement shall mean a story of a building or structure having one-half or more of its height below ground level and to which access for fire fighting purposes is unduly restricted.

(5) Boiling point shall mean the boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (p.s.i.a.) (760 mm.). Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for purposes of this section the 10 percent point of a distillation performed in accordance with the Standard Method of Test for Distillation of Petroleum Products, ASTM D–86–62, which is incorporated by reference as specified in §1910.6, may be used as the boiling point of the liquid.

(6) Boilover shall mean the expulsion of crude oil (or certain other liquids) from a burning tank. The light fractions of the crude oil burnoff producing a heat wave in the residue, which on reaching a water strata may result in the expulsion of a portion of the contents of the tank in the form of froth.

(7) Bulk plant shall mean that portion of a property where flammable liquids are received by tank vessel, pipelines, tank car, or tank vehicle, and are