NFPA

50

BULK OXYGEN SYSTEMS 1979

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
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SC-FM-79

Standard for
Bulk Oxygen Systems
at Consumer Sites

NFPA 50 – 1979

1979 Edition of NFPA 50

This 1979 edition of NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites*, was prepared by the Committee on Industrial and Medical Gases and was adopted by the National Fire Protection Association, Inc. on November 14, 1979, at its meeting in Phoenix, Arizona. It was released by the Standards Council for publication on December 3, 1979.

Amendments, other than editorial, are indicated by lines in the margin of the pages in which they appear.

Origin and Development of NFPA 50

Development of NFPA 50 was initiated by the Compressed Gas Association, Inc., who submitted a complete text to the NFPA Committee on Gases in 1955. Working responsibility for the project was assigned to the Sectional Committee on Industrial Gases and the standard was Tentatively Adopted in 1956. A revised edition was Officially Adopted in 1957 and subsequent revised editions were adopted in 1962 and 1965 as NFPA 566.

In June 1966 responsibility for NFPA 566 was reassigned to the Committee on Industrial and Medical Gases. With the 1971 edition, the standard was redesignated as NFPA 50.

Since the 1971 edition, editions were adopted in 1973, 1974 and 1979.

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Bulk Oxygen Systems at Consumer Sites

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Chapter 1 General

1-1 Introduction.

1-1.1 Oxygen gas is colorless, odorless, tasteless and nontoxic. It comprises about 21 percent of normal air and is about 10 percent heavier than air. At atmospheric pressure and temperatures below $-297\,°F$ ($-182.5\,°C$) oxygen is a liquid. Oxygen is stable in both gas and liquid phases. In the absence of moisture, oxygen in the gaseous or liquid form is noncorrosive.

1-1.2 Oxygen is nonflammable. Ignition of combustible materials may occur more readily in an oxygen-rich atmosphere than in air, and combustion proceeds at a faster rate although no more total heat is released. This standard therefore provides primarily for protection of the bulk oxygen system from involvement by fire from sources apart from the system itself. It is important to locate bulk oxygen systems in well-ventilated locations since oxygen-rich atmospheres may collect temporarily in confined areas in the event of functioning of a safety relief device or leakage from the system.

1-1.3 Oxygen system components, including, but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets and interconnecting equipment including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components may be exposed in the containment and use of oxygen. Easily ignitible materials shall be avoided unless they are parts of equipments or systems that are approved, listed, or proved suitable by tests or by past experience.[1]

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[1]Compatibility involves both combustibility and ease of ignition. Materials that burn in air will burn violently in pure oxygen at normal pressure and explosively in pressurized oxygen. Also many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Metals for containers and piping must be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions may call for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials may be ignited by friction at a valve seat or stem packing or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.

1-2 Application of Standard.

1-2.1 This standard covers the general principles recommended for the installation of bulk oxygen systems on industrial and institutional consumer premises where the supply to the consumer premises originates outside the consumer premises and is delivered by mobile equipment.

1-2.2 An existing system which is not in strict compliance with the provisions of this standard may be continued in use when such use does not constitute a distinct hazard to life or adjoining property.

1-2.3 This standard 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.

1-2.4 This standard does not apply to bulk oxygen storage systems having capacities less than those stated in the definition of Bulk Oxygen System in Section 1-3 since those systems are covered by the *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding and Cutting,* NFPA 51, and the *Standard for Nonflammable Medical Gas Systems,* NFPA 56F, and apply respectively to industrial and institutional installations.

1-3 Definitions. For the purpose of the standard, the following terms are defined:

Approved. Means "acceptable to the authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their

responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Bulk Oxygen System. 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 a storage capacity of more than 20,000 cu ft (566 m^3) 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.

Combustible Liquid. Combustible liquid shall mean a liquid having a closed cup flash point at or above 100°F (37.8°C) and shall be subdivided as follows: Class II liquids shall include those having a flash point at or above 100°F (37.8°C) and below 140°F (60°C). Class IIIA liquids shall include those having a flash point at or above 140°F (60°C) and below 200°F (93.4°C). Class IIIB liquids shall include those having flash points at or above 200°F (93.4°C).

Cubic Feet NTP. Cubic feet measured at normal atmospheric temperature and pressure.

Fire-Resistive Construction. A type of building construction as defined in *Standard on Types of Building Construction,* NFPA 220.

Flammable Liquid. Flammable liquid Class I shall mean any liquid having a closed cup flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 lb/sq in. absolute (276 kPa) at 100°F (37.8°C).

Gallon. A standard U.S. gallon.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize

equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Noncombustible/Limited-Combustible Construction. A type of building construction as defined in *Standard on Types of Building Construction,* NFPA 220.

Noncombustible Material (as defined in *Standard on Types of Building Construction,* NFPA 220). A material which, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials reported as noncombustible, when tested in accordance with the *Standard Method of Test for Noncombustibility of Elementary Materials,* ASTM E136 shall be considered noncombustible materials.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Wood Frame Construction. A type of building construction as defined in *Standard on Types of Building Construction,* NFPA 220.

Chapter 2 Siting

2-1 Location of Bulk Oxygen Systems.

2-1.1 Bulk oxygen storage systems shall be located aboveground out-of-doors, or shall be installed in a building of fire-resistive or noncombustible/limited-combustible construction, adequately vented, and used for that purpose exclusively. The location selected shall be such that containers and associated equipment shall not be beneath or exposed by the failure of electric power lines, piping containing all classes of flammable or combustible liquids (*see Definitions*), or piping containing flammable gases.

2-1.2 The system shall be located so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel.

2-1.3 Where oxygen is stored as a liquid, surfacing of noncombustible material shall be provided in an area extending at least 3 ft (1 m) from points at ground level upon which any leakage of liquid oxygen might fall during operation of the system and filling of a storage container. Such an area under liquid delivery connections of mobile supply equipment shall be at least the full width of the vehicle and at least 8 ft (2.5 m) in the transverse direction. For purposes of this standard, asphaltic or bitumastic paving is considered to be combustible. The slope, if any, of such areas shall consider possible flow of spilled liquid oxygen to adjacent combustible material.

2-1.4 Where it is necessary to locate a bulk oxygen system on ground lower than all classes of 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.[1]

2-2 Distance Between Bulk Oxygen Systems and Exposures.

2-2.1 Except as provided in 2-2.1.14, the minimum distance from any bulk oxygen storage container to exposures, measured in the most direct line (except as indicated in 2-2.1.5), shall be as indicated in 2-2.1.1 to 2-2.1.14 inclusive.

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[1]When locating bulk oxygen systems near all classes of 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.

2-2.1.1 50 ft (15 m) from buildings of wood frame construction.

2-2.1.2 Not less than 1 ft (0.3 m) (or other distance to permit system maintenance) from buildings of other than wood frame construction.

2-2.1.3 At least 10 ft (3 m) from any opening in walls of adjacent structures. This provision shall apply to all elements of a bulk oxygen system where the oxygen storage is high pressure gas. Where the storage is as liquid, this provision shall apply to only pressure regulators, safety devices, vaporizers, manifolds, and interconnecting piping.

2-2.1.4 All Classes of Flammable and Combustible Liquid Storage Aboveground.

Distance (ft)	(m)	Capacity (gal)	(L)
25*	(7.5)	1000 or less	(3785)
50*	(15)	1001 or more	(3789)

*May be reduced to 15 ft (4.6 m) for Class III B combustible liquids.

2-2.1.5 All Classes of Flammable and Combustible Liquid Storage Belowground.

Distance Measured Horizontally from Oxygen Storage Container to Tank		Distance from Oxygen Storage Container to Filling and Vent Connections or Openings to Tank	
(ft)	(m)	(ft)	(m)
15	(4.6)	25	(7.5)

2-2.1.6 Flammable Gases Aboveground.

Flammable Gas	Quantity	Distance (ft)	(m)
Liquefied Hydrogen*	Any	75	22.5
Other Liquefied Gases	1000 gallons (3785 L) or less	25	7.5
	Over 1000 gallons (3785 L)	50	15
Non-liquefied or Dissolved Gases	25,000 cubic feet (708 cubic meters) (NTP) or less	25	7.5
	Over 25,000 cubic feet (708 cubic meters) (NTP)	50	15

*See *Liquefied Hydrogen Systems at Consumer Sites*, NFPA 50B.

2-2.1.7 50 ft (15 m) from solid materials which burn rapidly, such as excelsior or paper.

2-2.1.8 25 ft (7.5 m) from solid materials which burn slowly, such as coal and heavy timber.

2-2.1.9 75 ft (22.5 m) in one direction and 35 ft (11 m) in approximately 90° direction from confining walls (not including protective structures having a minimum fire resistance rating of two hours less than 20 ft [6 m] high) to provide adequate ventilation in courtyards and similar confining areas.

2-2.1.10 50 ft (15 m) from places of public assembly.

2-2.1.11 50 ft (15 m) from areas occupied by nonambulatory patients.

2-2.1.12 10 ft (3 m) from any public sidewalk or parked vehicles.

2-2.1.13 5 ft (1.5 m) from any line of adjoining property which may be built upon.

2-2.1.14 The distances in 2-2.1.1, 2-2.1.4 to 2-2.1.8 inclusive, 2-2.1.12, and 2-2.1.13 do not apply where protective structures having a minimum fire resistance of two hours interrupt the line-of-sight between uninsulated portions of the bulk oxygen storage installation and the exposure. In such cases, the bulk oxygen installation shall be a minimum distance of 1 ft (0.3 m) (or greater distance if required for system maintenance) from the protective structure.

The protective structure (in lieu of distance) protects uninsulated oxygen storage containers or supports, control equipment enclosures, and system piping (or parts thereof) from external fire exposure. Liquid oxygen storage containers are insulated. Such containers can provide line-of-sight protection for uninsulated system components.

Protective structure configuration and dimensions will, therefore, vary depending upon the components of a particular system and their spatial relation to each other and to the exposure.

Chapter 3 System Fabrication

3-1 Bulk Oxygen Storage Containers.

3-1.1 Foundations and Supports. Permanently installed containers shall be provided with substantial supports of noncombustible material on firm foundations of noncombustible material.

3-1.2 Liquid oxygen containers shall comply with 3-1.2.1 or 3-1.2.2.

3-1.2.1 Be fabricated from materials meeting the impact test requirements of Paragraph UG-84 of the ASME *Boiler and Pressure Vessel Code,* Section VIII – Unfired Pressure Vessels. Containers operating at pressures above 15 psig (103 kPa) shall be designed, constructed and tested in accordance with appropriate requirements of the ASME *Boiler and Pressure Vessel Code,* Section VIII – Unfired Pressure Vessels. Insulation surrounding the liquid oxygen container shall be noncombustible.

3-1.2.2 Be designed, constructed, tested and maintained in accordance with U.S. Department of Transportation (DOT) Specifications and Regulations for 4L containers.

3-1.3 High pressure gaseous oxygen containers shall comply with 3-1.3.1 or 3-1.3.2.

3-1.3.1 Be designed, constructed and tested in accordance with appropriate requirements of the ASME *Boiler and Pressure Vessel Code,* Section VIII – Unfired Pressure Vessels.

3-1.3.2 Be designed, constructed, tested and maintained in accordance with U.S. Department of Transportation (DOT) Specifications and Regulations.

3-2 Piping, Tubing and Fittings.

3-2.1 Piping, tubing and fittings shall be suitable for oxygen service and for the pressures and temperatures involved.

3-2.2 Piping and tubing shall conform to American National Standard *Code for Pressure Piping, Chemical Plant and Petroleum Refinery Piping,* ANSI B31.3.

3-2.3 Piping or tubing for operating temperatures below −20°F (−28.9°C) 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, when tested at the minimum operating temperature to which the piping may be subjected in service.[1]

3-3 Safety Relief Devices.

3-3.1 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. (*See Section 3-1.*)

3-3.2 Bulk oxygen storage containers designed and constructed in accordance with a DOT Specification (*see 3-1.3.2*) shall be equipped with safety relief devices as required by the DOT.

3-3.3 Bulk oxygen storage containers designed and constructed in accordance with the ASME *Boiler and Pressure Vessel Code,* Section VIII − Unfired Pressure Vessels, shall be equipped with safety relief devices meeting the provisions of *Safety Relief Device Standards for Compressed Gas Storage Containers,* S-1.3.

3-3.4 Insulation casing on liquid oxygen containers shall be equipped with suitable safety relief devices.

3-3.5 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.

3-4 Liquid Oxygen Vaporizers.

3-4.1 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.

3-4.2 The vaporizer and its piping shall be adequately protected on the oxygen and heating medium sections with safety relief devices.

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[1]Some materials suitable for low temperature piping are austenitic chromium-nickel alloy steels, copper, copper-silicon alloys, aluminum, and some brasses and bronzes.

3-4.3 Heat used in an oxygen vaporizer shall be indirectly supplied only through mediums such as steam, air, water, or water solutions which do not react with oxygen.

3-4.4 If electric heaters are used to provide the primary source of heat, the vaporizing system shall be electrically grounded.

3-5 Equipment Assembly and Installation.

3-5.1 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.

3-5.2 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.

3-5.3 Valves, gages, regulators and other accessories shall be suitable for oxygen service.

3-5.4 Installation of bulk oxygen systems shall be supervised by personnel familiar with proper practices with reference to their construction and use.

3-5.5 After installation all field-erected piping shall be tested and proved gastight at maximum operating pressure. Any medium used for testing shall be oil-free and nonflammable.

3-5.6 Storage containers, piping, valves, regulating equipment, and other accessories shall be protected against physical damage and against tampering by the general public.

3-5.7 Any enclosure containing oxygen control or operating equipment shall be adequately vented.

3-5.8 The bulk oxygen storage location shall be permanently placarded to indicate: "OXYGEN – NO SMOKING – NO OPEN FLAMES," or an equivalent warning.

3-5.9 Bulk oxygen installations are not hazardous (classified) locations as defined and covered in Article 500 of the *National Electrical Code®* , NFPA 70. 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 the *National Electrical Code,* NFPA 70.

Chapter 4 Operation and Maintenance

4-1 Operating Instructions. For installations which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

4-2 Maintenance.

4-2.1 Each bulk oxygen system installed on consumer premises shall be inspected annually and maintained by a qualified representative of the equipment owner.

4-2.2 Weeds and long dry grass shall be cut back within 15 ft (4.6 m) of any bulk oxygen storage container.

Appendix A

This Appendix is not a part of the requirements of this NFPA document . . . but is included for information purposes only.

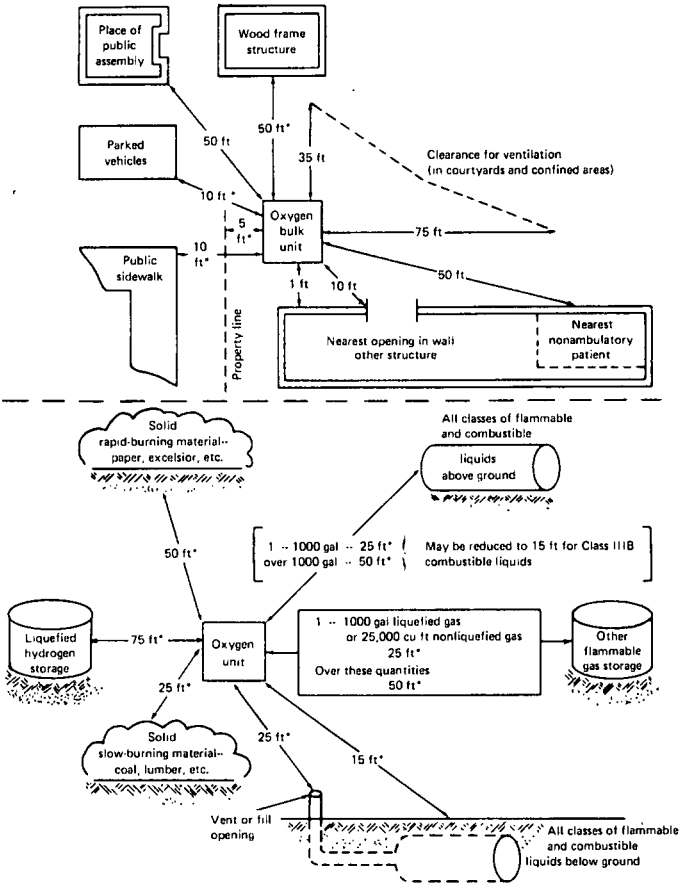

Illustration of Section 2-2, Distance Between Bulk Oxygen Systems and Exposures. (This diagram is not a part of NFPA 50 and the text shall govern.)

*NOTE: These distances do not apply where protective structures having a minimum fire resistance rating of two hours interrupt the line-of-sight between uninsulated portions of the bulk oxygen storage installation and the exposure. The protective structures protect uninsulated oxygen storage containers or supports, control equipment and system piping (or parts thereof) from external fire exposure. Liquid oxygen storage containers are insulated. Such containers may provide line-of-sight protection for uninsulated system components. (*See 2-2.1.14.*)