NFPA No.

50

BULK OXYGEN SYSTEMS 1974

NATIONAL FIRE PROTECTION ASSOCIATION

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Standard for

Bulk Oxygen Systems at Consumer Sites

NFPA No. 50 — 1974

1974 Edition of No. 50

This edition supersedes the 1973 edition. The 1974 edition contains amendments prepared by the Committee on Industrial and Medical Gases and adopted at the NFPA Annual Meeting on May 23, 1974. Amendments, other than editorial, are indicated by lines in the margin of the pages in which they appear.

Origin and Development of No. 50

Development of No. 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 No. 566.

In June 1966 responsibility for NFPA No. 566 was reassigned to the Committee on Industrial and Medical Gases. With the 1971 edition, the standard was redesignated as NFPA No. 50.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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Interpretation Procedure of the Committee on Industrial and Medical Gases

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

Standard for

Bulk Oxygen Systems at Consumer Sites

NFPA No. 50 — 1974

1. Introduction

1–1. Oxygen gas is colorless, odorless, tasteless and nontoxic. It comprises about 21 per cent of normal air and is about 10 per cent heavier than air. At atmospheric pressure and temperatures below –297° F. 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 non-corrosive.

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.

1–3. 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 ignitable 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.

2. Application of Standards

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.

2–2. The authority having jurisdiction may authorize the continued use of an existing bulk oxygen system which is not in strict compliance with the provisions of this Standard where such continued use will not constitute a hazard to life or adjoining property.

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.

2–4. This Standard does not apply to bulk oxygen storage systems having capacities less than those stated in Section 3–1 since those systems are covered by NFPA Standards No. 51 and No. 56F and apply respectively to industrial and institutional installations.

3. Definitions

For the purpose of this Standard, the following terms are defined:

3–1. 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 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.

3–2. Flammable Liquid. Flammable liquid shall mean any liquid having a closed cup flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 pounds per square inch absolute (2068.6 mm) at 100°F (37.8°C).

3–3. Combustible Liquid. Combustible liquid shall mean any liquid having a closed cup flash point at or above 100°F (37.8°C).

3–4. Cubic Feet NTP. Cubic feet measured at normal atmospheric temperature and pressure.

3–5. Gallon. A standard U. S. gallon.

4. Location of Bulk Oxygen Systems

4–1. 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 beneath or exposed by the failure of electric power lines, flammable or combustible liquid lines, or flammable gas lines.

4–2. The system shall be located so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel.

4–3. Where oxygen is stored as a liquid, noncombustible surfacing shall be provided in an area extending at least 3 feet 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 feet 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.

4–4. 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.

4–5. 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.

5. Distance Between Bulk Oxygen Systems and Exposures

5–1. Except as provided in 5–1–14, the minimum distance from any bulk oxygen storage container to exposures, measured in the most direct line (except as indicated in 5–1–5), shall be as indicated in 5–1–1 to 5–1–14 inclusive.

5–1–1. 50 feet from buildings of wood frame construction.[1]

5–1–2. Not less than one foot (or other distance to permit system maintenance) from buildings of other than wood frame construction, including fire resistive, heavy timber, noncombustible, and ordinary construction.[1]

5–1–3. At least 10 feet 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.

5–1–4. Flammable and Combustible Liquid Storage Aboveground:

Distance (feet)	Capacity (gallons)
25*	1000 or less
50*	1001 or more

*May be reduced to 15 feet for combustible liquids having closed cup flash points at or above 200°F (93.4°C).

5–1–5. Flammable and Combustible Liquid Storage Belowground:

Distance Measured Horizontally from Oxygen Storage Container to Tank (feet)	Distance from Oxygen Storage Container to Filling and Vent Connections or Openings to Tank (feet)
15	25

5–1–6. 25 feet from quantities of flammable gases not exceeding 1,000 gallons of liquefied gases, or 25,000 cubic feet NTP for nonliquefied or dissolved gases. For quantities in excess of these, the distance shall be 50 feet.

5–1–7. 50 feet from solid materials which burn rapidly, such as excelsior or paper.

5–1–8. 25 feet from solid materials which burn slowly, such as coal and heavy timber.

5–1–9. 75 feet in one direction and 35 feet in approximately 90° direction from confining walls (not including fire walls less than 20 feet high) to provide adequate ventilation in courtyards and similar confining areas.

[1]Refer to NFPA No. 220, Standard Types of Building Construction, for definitions of construction types.

5–1–10. 50 feet from places of public assembly.

5–1–11. 50 feet from areas occupied by nonambulatory patients.

5–1–12. 10 feet from any public sidewalk or parked vehicles.

5–1–13. 5 feet from any line of adjoining property which may be built upon.

5–1–14. The distances in 5–1–1, 5–1–4 to 5–1–8 inclusive, 5–1–12, and 5–1–13 do not apply where protective structures, such as fire walls, 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 foot (or greater distance if required for system maintenance) from the fire wall.

The fire wall (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.

Fire wall 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.

6. Bulk Oxygen Storage Containers

6–1. Foundations and Supports. Permanently installed containers shall be provided with substantial noncombustible supports on firm noncombustible foundations.

6–2. Liquid oxygen containers shall comply with 6–2–1 or 6–2–2.

6–2–1. 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 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.

6–2–2. Be designed, constructed, tested and maintained in accordance with U. S. Department of Transportation (DOT) Specifications and Regulations for 4L containers.

6–3. High pressure gaseous oxygen containers shall comply with 6–3–1 or 6–3–2.

6–3–1. Be designed, constructed and tested in accordance with appropriate requirements of the ASME Boiler and Pressure Vessel Code, Section VIII — Unfired Pressure Vessels.

6–3–2. Be designed, constructed, tested and maintained in accordance with U. S. Department of Transportation (DOT) Specifications and Regulations.

7. Piping, Tubing and Fittings

7–1. Piping, tubing and fittings shall be suitable for oxygen service and for the pressures and temperatures involved.

7–2. Piping and tubing shall conform to American National Standard Code for Pressure Piping, Petroleum Refinery Piping, ANSI B31.3 — 1973[1].

7–3. 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, when tested at the minimum operating temperature to which the piping may be subjected in service.[2]

8. Safety Relief Devices

8–1. 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 6.)

8–2. Bulk oxygen storage containers designed and constructed in accordance with a DOT Specification (see 6–3–2) shall be equipped with safety relief devices as required by the DOT.

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[1]Available from American National Standards Institute, 1430 Broadway, New York, New York 10018, or American Society of Mechanical Engineers, Inc., 345 East 47th Street, New York, New York 10017.

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

8–3. 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, Part 3.[1]

8–4. Insulation casings on liquid oxygen containers shall be equipped with suitable safety relief devices.

8–5. 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.

9. Liquid Oxygen Vaporizers

9–1. 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.

9–2. The vaporizer and its piping shall be adequately protected on the oxygen and heating medium sections with safety relief devices.

9–3. 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.

9–4. If electric heaters are used to provide the primary source of heat, the vaporizing system shall be electrically grounded.

10. Equipment Assembly and Installation

10–1. 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.

10–2. 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.

10–3. Valves, gages, regulators and other accessories shall be suitable for oxygen service.

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[1]Available from Compressed Gas Association, Inc., 500 Fifth Avenue, New York, N. Y. 10036.

10–4. Installation of bulk oxygen systems shall be supervised by personnel familiar with proper practices with reference to their construction and use.

10–5. 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.

10–6. Storage containers, piping, valves, regulating equipment, and other accessories shall be protected against physical damage and against tampering.

10–7. Any enclosure containing oxygen control or operating equipment shall be adequately vented.

10–8. The bulk oxygen storage location shall be permanently placarded to indicate: "OXYGEN — NO SMOKING — NO OPEN FLAMES", or an equivalent warning.

10–9. Bulk oxygen installations are not hazardous locations as defined and covered in Article 500 of the National Electrical Code (NFPA No. 70, ANSI C1). 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 No. 70, ANSI C1).

11. Operating Instructions

11–1. For installations which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

12. Maintenance

12–1. Each bulk oxygen system installed on consumer premises shall be inspected annually and maintained by a qualified representative of the equipment owner.

12–2. Weeds and long dry grass shall be cut back within 15 feet of any bulk oxygen storage container.