Nr. A No.

50

(Formerly No. 566)

BULK OXYGEN SYSTEMS 1971

$1.00

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch Street, Boston, Mass. 02110

10M-6-71-FP-WIN
Printed in U.S.A.

Official NFPA Definitions

Adopted Jan. 23, 1964; Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED means acceptable to the authority having jurisdiction. 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 nationally recognized testing laboratories,* i.e., laboratories qualified and equipped to conduct the necessary tests, in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Research Corp., the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LABELED: Equipment or materials to which has been attached a label, symbol or other identifying mark of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

AUTHORITY HAVING JURISDICTION: The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

Statement on NFPA Procedures

This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

Standard for

Bulk Oxygen Systems at Consumer Sites

NFPA No. 50 — 1971
(formerly NFPA No. 566)

1971 Edition of No. 50

This edition supersedes the 1965 edition. The 1971 edition contains amendments prepared by the Committee on Industrial and Medical Gases and adopted at the NFPA Annual Meeting on May 19, 1971. 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.

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.

Committee on Industrial and Medical Gases

L. G. Matthews, *Chairman,*
Union Carbide Corporation, Linde Division, Safety Affairs Dept.,
Old Saw Mill River Rd., Tarrytown, N. Y. 10591
(rep. Compressed Gas Association, Inc.)

W. L. Walls,† *Secretary,*
National Fire Protection Assn., 60 Batterymarch St., Boston, Mass. 02110

J. A. Cedervall, Underwriters' Laboratories, Inc.

John J. Crowe, Compressed Gas Association, Inc.

W. H. Doyle, Factory Insurance Assn.

L. H. Flanders, Factory Mutual Research Corp.

Charles B. Henrici, Fire Marshals Assn. of North America.

W. B. Howard, Manufacturing Chemists' Assn.

Robert E. Lenhard, Compressed Gas Assn., Inc.

D. S. Martin, Underwriters' Laboratories of Canada.

W. G. Meade, American Insurance Assn.

R. E. Poethig, National LP-Gas Assn.

E. C. Sommer, American Petroleum Institute.

A. A. Weintraub, U. S. Atomic Energy Commission.

Alternates.

W. H. Johnson, National LP-Gas Assn. (Alternate to R. E. Poethig)

Fred K. Kitson, Compressed Gas Assn., Inc. (Alternate to John J. Crowe)

A. C. Miller, Factory Mutual Research Corp. (Alternate to L. H. Flanders)

A. A. Mulliken, Jr., American Petroleum Institute. (Alternate to E. C. Sommer)

Edwin A. Olsen, Compressed Gas Association, Inc. (Alternate to L. G. Matthews and Robert E. Lenhard)

Floyd E. Ouellette, Manufacturing Chemists' Assn. (Alternate to W. B. Howard)

R. I. Spencer, Factory Insurance Assn. (Alternate to W. H. Doyle)

Nonvoting Member.

James M. McCormick, M.D., Hartford Anesthesiology Associates, Inc.
(rep. Committee on Hospitals)

SCOPE: To develop fire safety codes, standards, recommended practices and manuals, as may be considered desirable, covering the storage, transfer and use of industrial and medical gases. Included are the storage and handling of such gases in their gaseous or liquid phases, the installation of associated storage, piping and distribution equipment, and operating practices.

†Nonvoting.

Standard for

Bulk Oxygen Systems at Consumer Sites

NFPA No. 50 — 1971

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 noncorrosive.

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.

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 storage capacity of (a) more than 13,000 cubic feet of oxygen (NTP) connected in service or ready for service, or (b) 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.

3–2. FLAMMABLE LIQUID. Flammable liquid shall mean any liquid having a flash point below 140° F. and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100° F.

3–3. COMBUSTIBLE LIQUID. Combustible liquid shall mean any material that is a liquid under normal atmospheric temperature and pressure and having a flash point of 140° F. or above, and below 200° F. This corresponds to a Class III-A liquid, as defined in NFPA No. 321, Standard on Basic Classification of Flammable and Combustible Liquids. Where the term "combustible liquid" is used in this Standard, it shall mean only Class III-A liquids.

NOTE: The upper limit of 200° F. is given because the application of this Standard does not extend to liquids having flash points above 200° F. This should not be construed as indicating that liquids with higher flash points are noncombustible.

3–4. CUBIC FEET NTP shall mean cubic feet measured at normal atmospheric temperature and pressure.

3–5. GALLON shall mean 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 exposed by 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.

NOTE 1: For purposes of this Standard, asphaltic or bitumastic paving is considered to be combustible.

NOTE 2: 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 5–1–15, 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 5–1–15 inclusive.

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

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

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.*

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

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.

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

5–1–10. 25 feet from congested areas such as offices, lunchrooms, locker rooms, time clock areas, and similar locations where people may congregate.

5–1–11. 50 feet from places of public assembly.

5–1–12. 50 feet from areas occupied by nonambulatory patients.

5–1–13. 10 feet from any public sidewalk or parked vehicles.

5–1–14. 5 feet from any line of adjoining property which may be built upon.

5–1–15. The distances in 5–1–1, 5–1–4 to 5–1–8 inclusive, 5–1–13, and 5–1–14 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 storage installation may be a minimum distance of 1 foot (or other distance to permit system maintenance) from the fire wall.

NOTE: 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 may 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 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. Containers operating at pressures above 15 psig shall be designed, constructed, and tested in accordance with appropriate requirements of ASME Boiler and Pressure Vessel Code, Section VIII — Unfired Pressure Vessels. Insulation surrounding the liquid oxygen container shall be noncombustible.

6–3. High pressure gaseous oxygen containers shall comply with one of the following:

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

6–3–2. Designed, constructed, tested and maintained in accordance with U. S. Department of Transportation (DOT) (formerly ICC) 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 — 1966*.

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.

NOTE: Some materials suitable for low temperature piping are austenitic chromium-nickel alloy steels, and (in the wrought condition) copper, copper-silicon alloys, aluminum, and some brasses and bronzes.

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.

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.**

*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.

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

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.

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 periodically inspected and maintained by a qualified representative of the oxygen supplier.

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