

NFPA®

99B

**Standard for
Hypobaric Facilities**

2018



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NFPA® 99B

Standard for

Hypobaric Facilities

2018 Edition

This edition of NFPA 99B, *Standard for Hypobaric Facilities*, was prepared by the Technical Committee on Hyperbaric and Hypobaric Facilities and released by the Correlating Committee on Health Care Facilities. It was issued by the Standards Council on August 1, 2017, with an effective date of August 21, 2017, and supersedes all previous editions.

This edition of NFPA 99B was approved as an American National Standard on August 21, 2017.

Origin and Development of NFPA 99B

In 1965, when the Subcommittee on Hyperbaric Facilities was appointed, several hospitals were employing hypobaric therapy to treat respiratory diseases. Additionally, NASA and the U.S. Air Force were working with hypobaric chambers for space and air flight. The name of the subcommittee was then changed to Hyperbaric and Hypobaric Facilities, and the initial version of a document on this subject was prepared. A tentative standard on the subject, NFPA 56E-T, was adopted at the 1971 Annual Meeting. In May 1972, the document was adopted as an official standard. The document was revised again for the 1977 NFPA Annual Meeting.

A complete review of NFPA 56E was accomplished for the 1981 Fall Meeting. That edition was designated NFPA 56E-1982.

In 1984, NFPA 56E was combined with 11 other health care documents to form NFPA 99, *Standard for Health Care Facilities*. NFPA 56E essentially became Chapter 11 of NFPA 99. In that revision, the major change made to the 1982 edition of NFPA 56E was a complete revision of requirements for Class D chambers to reflect their use for high-altitude training purposes. (Such chambers do not require as extensive safety precautions as research and clinical chambers.)

During the revision for the 1987 edition of NFPA 99, it was brought to the attention of the Subcommittee on Hyperbaric and Hypobaric Facilities that hypobaric chambers were no longer used for medical purposes. As such, the material on hypobaric facilities really did not belong in NFPA 99. Thus, the subcommittee proposed that this material be separated from NFPA 99 and again published as a distinct NFPA document. It was designated NFPA 99B.

Minor revisions were made to editions adopted in 1987 and 1990.

For the 1993 edition of *Standard for Hypobaric Facilities*, the one significant change was the identification of the safety director as the person responsible for disseminating information on hazards associated with operating hypobaric facilities.

For the 1996 edition, the major changes included clarifying the application of the document (Chapters 1–4) and deleting a Class F-type chamber because the committee was unaware of hypobaric techniques involving artificial atmospheres.

The 1999 edition modified several paragraphs to conform to the *Manual of Style for NFPA Technical Committee Documents* for enforceable language. Other changes were editorial in nature.

The 2002 edition included format revisions. The *Manual of Style for NFPA Technical Committee Documents* was applied in this document's restructure and format. Introductory material in Chapter 1 was formatted for consistency among all NFPA documents. Referenced publications that applied to the document were relocated to Chapter 2, resulting in the renumbering of chapters. Informational references remained in the last annex. Appendices were designated as annexes. Definitions in Chapter 3 were reviewed for consistency with definitions in other NFPA documents, were systematically aligned, and were individually numbered. Paragraph structuring was revised with the intent of having one mandatory requirement per section, subsection, or paragraph. Information that

often accompanied many of the requirements was moved to Annex A. Exceptions were deleted or rephrased in mandatory text, unless the exception represented an allowance or required alternate procedure to a general rule when limited specified conditions existed. The revised format appearance and structure provided continuity among NFPA documents, clarity of mandatory text, and greater ease in locating specific mandatory text.

The 2005 edition was slightly modified to clarify some requirements. The ventilation rate was specified by the purchaser, detection in Class D chambers was made optional, the wiring method in Class E chambers was downgraded, aviation-type masks in chambers were made optional, the hazards of titanium were discussed, and fittings were listed for oxygen service.

The 2010 edition of the standard made minor changes in definitions to correlate with other definitions from the *Glossary of Terms*.

The 2015 edition of the standard was revised to update the referenced standards to the most current editions available and to correct several references to NFPA 99 to match the 2015 edition of that code.

The 2018 edition of the standard was revised to update the referenced standards to the most current editions available. It also changed language throughout the standard to better align with NFPA 99, specifically in regards to interior paint/coating and flooring for Class D and E chambers and changing the wording “flame resistant (hypobaric)” to “limited-combustible (material).”

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Joseph H. Versteeg, Versteeg Associates, CT [E]
Rep. DNV Health Care Inc.

Alternates

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(Alt. to Wayne L. Brannan)
Esteban Cota, Siemens Industry, Inc., IL [M]
(Alt. to Daniel P. Finnegan)
William E. Koffel, Koffel Associates, Inc., MD [SE]
(Alt. to Sharon S. Gilyeat)

Rodger Reiswig, Tyco/SimplexGrinnell, FL [M]
(Alt. to Denise L. Pappas)
Eric R. Rosenbaum, JENSEN HUGHES, MD [SE]
(Alt. to Michael A. Crowley)

Nonvoting

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Committee Scope: This Committee shall have primary responsibility for documents that contain criteria for safeguarding patients and health care personnel in the delivery of health care services within health care facilities: a) from fire, explosion, electrical, and related hazards resulting either from the use of anesthetic agents, medical gas equipment, electrical apparatus, and high frequency electricity, or from internal or external incidents that disrupt normal patient care; b) from fire and explosion hazards; c) in connection with the use of hyperbaric and hypobaric facilities for medical purposes; d) through performance, maintenance and testing criteria for electrical systems, both normal and essential; and e) through performance, maintenance and testing, and installation criteria: (1) for vacuum systems for medical or surgical purposes, and (2) for medical gas systems; and f) through performance, maintenance and testing of plumbing, heating, cooling, and ventilating in health care facilities.

Technical Committee on Hyperbaric and Hypobaric Facilities

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Intermountain Healthcare, UT [U]

Peter Atkinson, Royal Brisbane and Womens Hospital, Australia [C]
Rep. Hyperbaric Technicians & Nurses Association Inc.

Richard C. Barry, Healogics, FL [SE]

Chad E. Beebe, ASHE - AHA, WA [U]
Rep. American Society for Healthcare Engineering

W. Robert Bryant, Perry Baromedical Corporation, TX [M]

Mario Caruso, Hyperbaric Consulting LLC, FL [SE]

Keith Ferrari, Praxair, Inc., NC [M]

W. T. Gurnée, OxyHeal Medical Systems, Inc., CA [M]

Barry E. Newton, WHA International, Inc., NM [SE]

Kevin A. Scarlett, Washington State Department of Health, WA [E]
Rep. NFPA Health Care Section

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Deepak Talati, Sechrist Industries, Inc., CA [M]

Viky G. D. Verna, U.S. Food and Drug Administration, MD [E]

Wilbur T. Workman, Undersea & Hyperbaric Medical Society, TX [U]

Alternates

Justin Callard, Hyperbaric Technicians & Nurses Association Inc.,
Australia [C]
(Alt. to Peter Atkinson)

Paul Mario Caruso, Hyperbaric Consulting LLC, FL [SE]
(Alt. to Mario Caruso)

Mark Chipps, Life Support Technologies Group Inc., NY [U]
(Alt. to Michael W. Allen)

Kevin I. Posey, International ATMO, Inc., TX [U]
(Alt. to Robert B. Sheffield)

Chelsea Tuttle, NFPA Staff Liaison

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Committee Scope: This Committee shall have primary responsibility for documents or portions of documents covering the construction, installation, testing, performance, and maintenance of hyperbaric and hypobaric facilities for safeguarding staff and occupants of chambers.

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NFPA 99B**Standard for****Hypobaric Facilities**

2018 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex E. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex E.

Chapter 1 Administration**1.1 Scope.**

1.1.1* This standard shall apply to all hypobaric facilities in which humans will be occupants or are intended to be occupants of the hypobaric chamber.

1.1.2 This standard shall not apply to hypobaric facilities used for animal experimentation if the size of the hypobaric chamber does not allow for human occupancy.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to set forth minimum safeguards for the protection of personnel involved in the use of hypobaric facilities, when operated at pressures less than 760 mm Hg [101.3 kPa; 1 atmosphere absolute (ATA)].

1.2.2 The purpose shall also be to offer guidance for rescue personnel who are not ordinarily involved in the operation of hypobaric facilities, but who would become so involved in an emergency.

1.2.3 The purpose shall also be to provide minimum standards for the design, maintenance, and operation of hypobaric facilities.

1.2.4* Hypobaric chambers shall be classified according to the following criteria:

- (1) Class D — Human rated, air atmosphere not oxygen enriched
- (2) Class E — Human rated, oxygen-enriched atmosphere (partial pressure of oxygen is above 0.235 ATA)

1.3 Application.

1.3.1 This standard shall apply only to the following:

- (1) New construction
- (2) New equipment added to existing facilities

1.3.2 This standard shall not require the alteration or replacement of existing construction or equipment.

1.3.3 Existing construction or equipment shall be permitted to be continued in use where its use does not constitute a distinct hazard to life as determined by the authority having jurisdiction.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 99, *Health Care Facilities Code*, 2018 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2015 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2015 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2015 edition.

2.3 Other Publications.

2.3.1 ASME Publications. ASME Technical Publishing Office, Two Park Avenue, New York, NY 10016-5990.

ASME *Boiler and Pressure Vessel Code*, 2015.

ASME PVHO-1, *Safety Standard for Pressure Vessels for Human Occupancy*, 2012.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D2863, *Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)*, 2014.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2015b.

ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 2015 e1.

2.3.3 CGA Publications. Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-2923.

CGA C-7, *Guide to Classification and Labeling of Compressed Gases*, 10th edition, 2014. (Supersedes CGA C-4)

2.3.4 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008.

2.3.5 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2018 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 99, *Health Care Facilities Code*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 Guide. A document that is advisory or informative in nature and that contains only nonmandatory provisions. A guide may contain mandatory statements such as when a guide can be used, but the document as a whole is not suitable for adoption into law.

3.2.5 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.6* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.7 Shall. Indicates a mandatory requirement.

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

3.2.9 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3* General Definitions.

3.3.1 Adiabatic Heating. The heating of a gas caused by its compression. [99, 2018 (HYP)]

3.3.2 Anoxia. A state of markedly inadequate oxygenation of the tissues and blood, of more marked degree than hypoxia.

3.3.3* Atmosphere. The pressure exerted by, and gaseous composition of, an environment. [99, 2018 (HYP)]

3.3.3.1 Ambient Atmosphere. The pressure and composition of the environment surrounding a chamber.

3.3.3.2 Atmosphere Absolute (ATA). The pressure of the earth's atmosphere, 760.0 mmHg, 101.325 kPa, or 14.7 psia. Two ATA = two atmospheres. (See also 3.3.3, *Atmosphere*.) [99, 2018 (HYP)]

3.3.3.3* Atmosphere of Increased Burning Rate. Any atmosphere containing a percentage of oxygen or oxygen and nitrous oxide greater than the quotient of 23.45 divided by the square root of the total pressure in atmospheres. [99, 2018 (HYP)]

3.3.3.4 Chamber Atmosphere. The environment inside a chamber. [99, 2018 (HYP)]

3.3.3.5 Oxygen-Enriched Atmosphere (OEA). For the purposes of this standard, an atmosphere in which the concentration of oxygen exceeds 23.5 percent by volume.