NFPA®

53

Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres

2016

NFPA®

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® DOCUMENTS

NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA DOCUMENTS

NFPA® codes, standards, recommended practices, and guides ("NFPA Standards"), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Standards") should be aware that NFPA Standards may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any Tentative Interim Amendment and any Errata then in effect.

In order to determine whether an NFPA Standard has been amended through the issuance of Tentative Interim Amendments or corrected by Errata, visit the Document Information Pages on NFPA's website. The Document Information Pages provide up-to-date, document specific information including any issued Tentative Interim Amendments and Errata.

To access the Document Information Page for a specific NFPA Standard, go to http://www.nfpa.org/docinfo to choose from the list of NFPA Standards or use the search feature on the right to select the NFPA Standard number (e.g., NFPA 101). The Document Information page includes postings of all existing Tentative Interim Amendments and Errata. It also includes the option to register for an "Alert" feature to receive an automatic email notification when new updates and other information are posted regarding the document.

ISBN: 978-145591299-5 (Print)
ISBN: 978-145591322-0 (PDF)

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Standards") should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments or corrected by Errata. An official NFPA Standard at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards ("the ANSI Patent Policy"), and hereby gives the following notice pursuant to that policy:

NOTICE: The user's attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term "adoption by reference" means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/freeaccess.

NFPA®53

Recommended Practice on

Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres

2016 Edition

This edition of NFPA 53, *Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres*, was prepared by the Committee on Oxygen-Enriched Atmospheres. It was issued by the Standards Council on November 14, 2015, with an effective date of December 4, 2015, and supersedes all previous editions.

This edition of NFPA 53 was approved as an American National Standard on December 4, 2015.

Origin and Development of NFPA 53

Development of NFPA 53 was initiated in 1965 largely as a result of interest in the area of oxygen-enriched atmospheres by the aerospace industry and medical personnel/researchers, who expressed a need for a single source of general data on the hazards of oxygen-enriched atmospheres.

The first edition was published in 1969 under NFPA procedures that did not require Association meeting action for NFPA documents. A second edition was formally adopted under NFPA procedures at the NFPA Annual Meeting in 1974. Subsequent editions were adopted in 1979, 1985, 1990, and 1994.

The 1994 edition reflected a complete review of the contents of the document and incorporated much new information gained by research at the National Aeronautics and Space Administration from 1984 to 1994.

The 1999 edition changed the document from a guide to a recommended practice. Also, some minor changes were made to the definitions of *oxygen-enriched atmosphere* and *ignition temperature*.

The 2004 edition of the recommended practice underwent editorial revisions to meet the NFPA *Manual of Style* and included only minor editorial changes.

The 2011 edition reconfirmed the provisions as they were written in the 2004 edition.

The 2016 edition adds heat of combustion and auto-ignition temperature data to the expanded table of nonmetallic materials for oxygen service. In addition, new fire experience reports have been added to Annex D.

Technical Committee on Oxygen-Enriched Atmospheres

Richard C. Barry, *Chair*
Healogics, FL [U]

Alain Colson, Air Liquide S.A., France [M]
Jolene E. Cormier, Baylor Medical Center, TX [U]
Sean Dee, Exponent, IL [SE]
Kim Phillips Dunleavy, Dunleavy Technical Services Inc., Canada [M]
Sean Faughnan, East Orange General Hospital, NJ [U]
Jack D. Fry, Los Angeles Fire Department, CA [E]
Craig H. Kampmier, Swansea Fire Department, MA [E]
Joseph Million, Praxair, NY [M]
Barry E. Newton, Wendell Hull & Associates, Inc., NM [SE]
Keisa Rosales, Jacobs Technology Inc., NM [SE]
Jerrold Sameth, Compressed Gas Association, Inc., NJ [IM]
Rep. Compressed Gas Association
Myles Tenbroeck, American Cylinder and Safety, AR [M]
Frederick Williams, U.S. Naval Research Laboratory, DC [SE]

Alternates

Walter Joslyn, CDA Technical Institute, FL [U]
(Alt. to Richard C. Barry)
Robert Nelson, Los Angeles Fire Department, CA [E]
(Alt. to Jack D. Fry)
James White, Praxair, NY [M]
(Alt. to Joseph Million)

Laura E. Montville, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the fire and explosion hazards that may exist in oxygen-enriched atmospheres. The Committee will correlate its work with the Committee on Health Care Facilities and other related NFPA committees as required.

Contents

NFPA 53

Recommended Practice on

Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres

2016 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Documents." They can also be obtained on request from NFPA or viewed at www.nfpa.org/disclaimers.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with any TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by any TIAs or Errata, please consult the National Fire Codes® Subscription Service or visit the Document Information (DocInfo) pages on the NFPA website at www.nfpa.org/docinfo. In addition to TIAs and Errata, the DocInfo pages also include the option to sign up for Alerts for each document and to be involved in the development of the next edition.

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 the recommendations sections of this document are given in Chapter 2 and those for extracts in the informational sections are given in Annex G. 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 should be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope. This document establishes recommended minimum criteria for the safe use of oxygen (liquid/gaseous) and the design of systems for use in oxygen and oxygen-enriched atmospheres (OEAs).

1.2 Purpose. The purpose of this recommended practice is to provide information for the selection of materials, components, and design criteria that can be used safely in oxygen and OEAs.

1.3 Application. This recommended practice is applicable to the selection of materials and components, and to the design of new systems associated with OEAs. Such applications include, but are not limited to, gas and compressed air supplies, spaceflight operations, industrial processes, welding applications, self-contained breathing apparatus (SCBA), self-contained underwater breathing apparatus (SCUBA), medical applications (including home assisted-breathing apparatus), underwater tunneling and caisson work, and commercial and military aviation.

1.4 Interpretations. The National Fire Protection Association does not approve, inspect, or certify any installation, procedure, equipment, or material. With respect to this recommended practice, and to fire and associated hazards in OEAs, its role is limited solely to an advisory capacity. The acceptability of a particular material, component, or system for use in an OEA is solely a matter between the user and the provider. However, to assist in the determination of such acceptability, the National Fire Protection Association has established interpretation procedures. These procedures are outlined in the NFPA Regulations Governing Committee Projects.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this recommended practice and should be considered part of the recommendations of this document.

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

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes,* 2013 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* 2013 edition.

NFPA 70®, National Electrical Code®, 2014 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2015 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids,* 2015 edition.

NFPA 99, *Health Care Facilities Code,* 2015 edition.

NFPA 99B, *Standard for Hypobaric Facilities,* 2015 edition.

NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment,* 2013 edition.

2.3 Other Publications.

2.3.1 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 620, *Design and Construction of Large, Welded, Low-Pressure Storage Tanks,* 2013.

2.3.2 ASME Publications. American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping,* 2012.

ASME B31.5, *Refrigeration Piping and Heat Transfer Components,* 2013.

ASME B31.8, *Gas Transmission and Distribution Piping Systems,* 2012.

ASME Boiler and Pressure Vessel Code, 2013.

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

CGA G-4, *Oxygen,* 2008.