NFPA® 1852

Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2008 Edition



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NFPA® 1852

Standard on

Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2008 Edition

This edition of NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)*, was prepared by the Technical Committee on Respiratory Protection Equipment and released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. It was issued by the Standards Council on December 11, 2007, with an effective date of December 31, 2007, and supersedes all previous editions.

This edition of NFPA 1852 was approved as an American National Standard on December 31, 2007.

Origin and Development of NFPA 1852

The Committee was assigned the responsibility of addressing selection, care, and maintenance issues for open-circuit self-contained breathing apparatus (SCBA). To address these issues, the Committee developed this new document, NFPA 1852, which is oriented to the users of such SCBA and their respective organizations.

This new document was developed for organizations that use SCBA for the respiratory protection of their personnel who engage in emergency operations with the goal of reducing the safety risks and potential health risks associated with poorly maintained, contaminated, or damaged SCBA.

This document was also developed to fulfill the SCBA selection, care, and maintenance portions of the overall respiratory protection program required by NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and applies to all SCBA that are certified as compliant with the current and previous editions of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*.

During the development of this document, committee member Deputy Chief Robert Kolenda of the Pittsburgh, Pennsylvania Bureau of Fire (PBF) worked tirelessly to develop meaningful requirements to assure the safety of fire and emergency services personnel who depend on SCBA for their respiratory protection and their lives. Chief Kolenda lost his son, Pittsburgh Fire Fighter Marc Kolenda, at a fire, due in part to inadequate protection provided by his SCBA.

The first edition, the 2002 edition of NFPA 1852, was acted on by the NFPA membership at its November Association Technical Meeting in Dallas, Texas, on 13 November 2001 and became effective on 31 January 2002.

In this 2008 edition, the second edition of NFPA 1852, the Committee processed a complete revision of the document including an overall revision of text for clarity, and revising text to up-to-date terminology since the last edition.

Section 1.3 was revised and restructured to include later editions of NFPA 1981 and to clarify to which documents this standard applies. Chapter 2 was revised to reference the documents referenced within the mandatory requirements and update editions approved by the Committee. Section 3.3 was reviewed and revised as necessary to update or add new definitions according to the Project's Glossary of Definitions Glossary.

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Chapter 4 was completely reviewed for upgrades and modifications to existing text as necessary. A new Section 4.2 was added to cover the special procedures and notifications for hazards involving SCBA. Section 4.4 (formerly Section 4.3), SCBA Compliance — Upgrades and Retirement, was revised and reformatted to add new requirements for SCBA purchased during the effective periods of the 2000 and 2007 editions of NFPA 1981. In Chapter 5, paragraph 5.1.1 was expanded to include selected accessories that could be added to SCBA.

Overall, Chapters 5, 6, 7, and 8 were completely reviewed for upgrades and modifications to existing text as necessary, and the Annex material was updated and expanded to provide additional advisory information regarding selection, care, and maintenance issues.

This second edition, the 2008 edition, was issued by the NFPA Standards Council with an effective date of 31 December 2007.

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Committee Scope: This Committee shall have primary responsibility for documents on respiratory equipment, including breathing air, for fire and emergency services personnel during incidents involving hazardous or oxygen deficient atmospheres.

This Committee shall also have primary responsibility for documents on the selection, care, and maintenance of respiratory protection equipment and systems by fire and emergency services organizations and personnel.

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Standard on

Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2008 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.

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

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard shall specify minimum requirements for the selection, care, and maintenance of open-circuit self-contained breathing apparatus (SCBA) and combination SCBA/supplied air respirator (SAR) that are used for respiratory protection during emergency operations in environments where the atmosphere is Immediately Dangerous to Life and Health (IDLH), or could become oxygen deficient or IDLH.

1.1.2 This standard shall specify the requirements for SCBA models as detailed in Section 1.3 of this chapter.

1.1.3 For fire departments, this standard shall specify the requirements for the SCBA selection, care, and maintenance component of the respiratory protection program required in Section 7.9 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

1.1.4 This standard shall not specify requirements for any closed-circuit SCBA.

1.1.5 This standard shall not specify requirements for other respiratory protection program components of the organization such as SCBA training, appropriate use of SCBA for operations, and breathing air quality as these program components are under the jurisdiction of other NFPA standards.

1.1.6 This standard shall not specify requirements for accessories attached to the SCBA unless specifically addressed herein.

1.1.7 Nothing herein shall restrict any jurisdiction from exceeding these minimum requirements.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to establish procedures as part of a program to provide care and maintenance for open-circuit SCBA and combination SCBA/SAR in order to reduce the safety risks and potential health risks associated with poorly maintained, contaminated, or damaged SCBA.

1.2.2 This standard shall also establish basic criteria for the evaluation and selection process associated with purchasing open-circuit SCBA to assure only SCBA that meet the requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* are acquired for use by emergency services organizations.

1.3 Application.

1.3.1 New and Existing SCBA.

1.3.1.1 For fire departments, this standard shall apply to the requirements for selection, care, and maintenance of the SCBA component of the fire department's respiratory protection program as required by Section 7.9 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

1.3.1.2 This standard shall apply to the acquisition of new open-circuit SCBA and to the preparation of new SCBA to go into the "in service" status.

1.3.1.3 This standard shall apply to the organization's existing open-circuit SCBA, other than as constrained by 1.3.1.6 and 1.3.1.7, that are covered in the care and maintenance part of the respiratory protection program for open-circuit SCBA, and shall also apply to the selection process to acquire new open-circuit SCBA to augment or replace existing SCBA.

1.3.1.4 This standard shall apply to open-circuit SCBA that were certified by an independent third-party certification organization as compliant with the 1992 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, and the 1997 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service.*

1.3.1.5 This standard shall apply to open-circuit SCBA that were certified by an independent third-party certification organization as compliant with the 2002 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire and Emergency Services*, or with the 2007 edition or later editions of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*

1.3.1.6 Only the requirements of Section 4.3 or the requirements referenced within Section 4.3 shall apply to any open-circuit SCBA that were confirmed by the SCBA manufacturer as meeting the requirements of the 1981 or 1987 editions of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, or to NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters.*

1.3.1.7 Only the requirements of Section 4.3 or the requirements referenced within Section 4.3 shall apply to any open-circuit SCBA that were never confirmed as meeting the requirements of NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, or were never certified as compliant with any edition of NFPA 1981.

1.3.2 Implementation.

1.3.2.1 When this standard is adopted by an organization or by a jurisdiction, the authority having jurisdiction shall set a date or dates for achieving compliance with the requirements of this standard.

1.3.2.2 The organization or the jurisdiction shall be permitted to establish a phase-in schedule for compliance with specific requirements of this standard.

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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 19B, *Standard on Respiratory Protective Equipment for Firefighters,* 1971 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* 2007 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus,* 2003 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters,* 1981 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters,* 1987 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters,* 1992 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service,* 1997 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services,* 2002 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* 2007 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS),* 2007 edition.

NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection,* 2008 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.134, *Respiratory Protection,* 23 April 1998.

Title 29, Code of Federal Regulations, Part 1910.156, *Fire Brigades,* 18 June 1998.

2.3.2 Other Publications.

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

2.4 References for Extracts in Mandatory Sections. (Reserved)

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 Shall. Indicates a mandatory requirement.

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

3.2.5 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Atmosphere-Supplying Respirator. A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, which includes self-contained breathing apparatus (SCBA) and supplied air respirators (SAR). *[See also 3.3.14, Self-Contained Breathing Apparatus (SCBA), and 3.3.16, Supplied Air Respirator (SAR).]*

3.3.2 Care. Procedures for cleaning, decontamination, and storage of protective clothing and equipment.

3.3.3* Combination SCBA/SAR. An atmosphere-supplying respirator that supplies a respirable atmosphere to the user from a combination of two breathing air sources both of which are independent of the ambient environment. *[See also 3.3.1, Atmosphere-Supplying Respirator; 3.3.14, Self-Contained Breathing Apparatus (SCBA); and 3.3.16, Supplied Air Respirator (SAR).]*

3.3.4 Contamination/Contaminated. The process by which protective clothing or equipment has been exposed to hazardous materials or biological agents.

3.3.5 Cross Contamination. The transfer of contamination from one item to another or to the environment.

3.3.6 Fully Charged. An SCBA cylinder filled to greater than 90 percent of the NIOSH rated service pressure.

3.3.7 In-Service. Ready for immediate use.

3.3.8 Maintenance. Procedures for inspection, repair, and removal from service of protective clothing and equipment.

3.3.9* Organization. The entity that provides the direct management and supervision for emergency services response personnel.

3.3.10 Rebuild. To clean and examine compliant product thoroughly and make needed repairs and replace components as specified by the manufacturer.

3.3.11 SAR. An abbreviation for supplied air respirator. *[See also 3.3.16, Supplied Air Respirator (SAR).]*

3.3.12 SCBA. An abbreviation for self-contained breathing apparatus. *[See also 3.3.14, Self-Contained Breathing Apparatus (SCBA).]*

3.3.13 Selection. The process of determining what protective clothing and equipment (PCE) are necessary for protection of emergency services response personnel from an anticipated specific hazard or other activity, the procurement of the appropriate PCE, and the choice of the proper PCE for a specific hazard or activity at an emergency incident.

3.3.14* Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by

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the user. *[See also 3.3.1, Atmosphere-Supplying Respirator; 3.3.3, Combination SCBA/SAR; and 3.3.16, Supplied Air Respirator (SAR).]*

3.3.15 Specified Service Life. Time, exposure event, or number of uses to which a compliant product or component is expected to remain functional.

3.3.16* Supplied Air Respirator (SAR). An atmosphere-supplying respirator, also known as an airline respirator, for which the source of breathing air is not designed to be carried by the user. *[See also 3.3.1, Atmosphere-Supplying Respirator; 3.3.3, Combination SCBA/SAR; and 3.3.14, Self-Contained Breathing Apparatus (SCBA).]*

3.3.17 Technician. An individual qualified and authorized by the compliant product manufacturer to provide specified care and maintenance to the product and perform inspection, repair, and testing beyond the level classified as "user repair."

Chapter 4 Program Component

4.1 General.

4.1.1 Emergency services organizations shall have a written respiratory protection program that addresses the respiratory protection for the members of that organization.

4.1.1.1 As part of the organization's respiratory protection program, the organization shall develop, implement, and apply a program component for the selection, care, and maintenance of open-circuit SCBA used for respiratory protection by the members of the organization.

4.1.1.2 For fire departments' respiratory protection programs specified in Section 7.9 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, the organization shall develop, implement, and apply the program component for the selection, care, and maintenance of open-circuit SCBA used by the members of the organization in the performance of their assigned functions.

4.1.2 The program component shall have the following goals:

(1) Provide SCBA that is suitable and appropriate for the intended use
(2) Maintain SCBA in a safe, usable condition to provide the intended protection to the user
(3) Remove from use any SCBA that could cause or contribute to user injury, illness, or death because of its condition
(4) Recondition, repair, or retire such SCBA

4.1.3 The SCBA selection, care, and maintenance component of the organization's respiratory protection program shall be in accordance with Section 4.3 of this chapter.

4.2 Hazards Involving SCBA.

4.2.1 As part of the respiratory protection program, the organization shall develop standard operating procedures (SOPs) for reporting hazards involving SCBA.

4.2.2 Hazards shall be considered a condition that results in exposing SCBA users to an immediately dangerous condition or a dangerous condition threatening life or bodily harm.

4.2.3 Where a specific hazard involving SCBA is identified, the organization's SOPs shall cause the SCBA manufacturer to be promptly notified in writing of the specific condition(s) or cause, and the circumstances involved with the specific condition(s) or cause.

4.2.4 Copies of the notification to the SCBA manufacturer shall also be promptly supplied to the certification organization that certified the SCBA and to National Institute for Occupational Safety and Health National Personal Protective Technology Laboratory (NIOSH NPPTL).

4.3 SCBA Selection, Care, and Maintenance Program Component.

4.3.1 The organization shall develop written SOPs that shall identify and define the various parts of the organization's respiratory protection program and the various roles and responsibilities of the organization and the members.

4.3.2 As part of the respiratory protection program, the organization shall develop SOPs for the handling and custody of SCBA that is removed from service due to the serious injury or fatality of the wearer.

4.3.3 As part of the respiratory protection program, the organization shall develop SOPs for minimizing exposure to contaminated SCBA.

4.3.3.1 The organization shall define what criteria determines when an SCBA is contaminated beyond the ability to remedy by cleaning and disinfecting in accordance with Section 6.1 of this standard.

4.3.3.2 The SOPs shall detail methods for proper disposal of such contaminated SCBA in accordance with 4.7.2.

4.3.3.3 As a minimum, SCBA that are known to be contaminated or are suspected of being contaminated shall be tagged out-of-service and shall be segregated from other equipment, personnel, and civilians.

4.3.3.4 The organization shall develop procedures to minimize the public's risk of exposure to soiled or contaminated SCBA.

4.3.4 The portion of the respiratory protection program for selection of SCBA shall include the requirements specified in Chapter 5 of this standard.

4.3.5 The portion of the respiratory protection program for care of SCBA shall include the requirements specified in Chapter 6 of this standard.

4.3.6 The portion of the respiratory protection program for maintenance of SCBA shall include the requirements specified in Chapter 7 of this standard.

4.3.6.1 As part of the respiratory protection program for maintenance, the organization shall have written SCBA testing procedures utilizing a breathing machine that meets the requirements of 7.5.5 and 7.5.6.

4.3.6.2 As part of the respiratory protection program for maintenance, the SCBA testing procedures shall include but not be limited to the following:

(1) Administration
(2) Testing protocol
(3) Training in use of the breathing machine
(4) Calibration of the breathing machine
(5) Test technician authorization
(6) Record keeping
(7) Test scheduling
(8) Evaluation of the effectiveness of the program

4.3.6.3 As part of the respiratory protection program for maintenance, the organization shall develop SOPs for the frequency of technician inspection and testing of SCBA.

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4.3.6.3.1 In all cases, the frequency of technician inspection shall not be less than specified in the SCBA manufacturer's instructions.

4.3.6.3.2 The organization shall also consider factors including but not limited to the following:

(1) Specific manufacturer's instructions related to breathing machine testing
(2) Severity of environment in which SCBA is used
(3) Number of uses for each SCBA
(4) User reports of visual damage of SCBA
(5) User complaints of improperly functioning SCBA
(6) Specific worksite issues
(7)*Specific SCBA cylinder inspection

4.3.6.4 Where the part of the respiratory protection program that addresses the maintenance of SCBA includes SCBA technicians who are members of the organization, such technicians shall meet the requirements of Section 4.9 of this chapter.

4.3.7* The organization shall develop an SOP that requires that no member of the organization performs any alterations to the SCBA's form, fit, or function that causes the certification to the National Institute for Occupational Health and Safety (NIOSH) or to NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, to be invalid.

4.3.8 The organization shall require that all members who use SCBA or are responsible for any part of the organization's respiratory protection program are informed and trained not to make any alterations or changes to any SCBA's original condition that causes the NIOSH certification of the respirators or the certification of the SCBA in accordance with NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, to be invalid.

4.4 SCBA Compliance — Upgrades and Retirement.

4.4.1 SCBA that are currently in service shall be certified as compliant with at least one of the following standards:

(1) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1992 edition
(2) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 edition
(3) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, 2002 edition
(4) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2007 edition

4.4.2* Where currently-in-service SCBA *do not meet the requirements of 4.4.1* and are covered by any of the following four categories, such SCBA shall be upgraded as specified in 4.4.3 or shall be retired as specified in 4.4.5:

(1) Currently-in-service SCBA that were *not* certified as compliant with the 1992 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, when the SCBA was manufactured
(2) Currently-in-service SCBA that were *not* certified as compliant with the 1997 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, when the SCBA was manufactured
(3) Currently-in-service SCBA that were *not* certified as compliant with the 2002 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, when the SCBA was manufactured
(4) Currently-in-service SCBA that were *not* certified as compliant with the 2007 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, when the SCBA was manufactured

4.4.2.1 The provisions of 4.4.4 shall apply to SCBA that are not covered by any of the four categories specified in 4.4.2.

4.4.3* SCBA shall be permitted to be upgraded to be compliant with the 2007 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, in accordance with the SCBA manufacturer's and certification organization's instructions.

4.4.4* Where currently-in-service SCBA do not meet the requirements of 4.4.1 and are covered by any of the following categories, such SCBA *shall be retired* as specified in 4.4.5:

(1) Currently-in-service SCBA that *only* met the requirements of NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, when the SCBA was manufactured
(2) Currently-in-service SCBA that *only* met the requirements of the 1981 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, when the SCBA was manufactured
(3) Currently-in-service SCBA that *only* met the requirements of the 1987 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, when the SCBA was manufactured
(4) Currently-in-service SCBA that were purchased prior to 29 July 1981 that *did not meet the requirements* of the 1971 edition of NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, when the SCBA was manufactured
(5) Currently-in-service SCBA that were purchased after 29 July 1981 and prior to 30 June 1987 that *did not meet the requirements* of the 1981 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, when the SCBA was manufactured
(6) Currently-in-service SCBA that were purchased after 30 June 1987 and prior to 14 August 1992 that *did not meet the requirements* of the 1987 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, when the SCBA was manufactured

4.4.5 Retired SCBA shall be disposed of as specified in 4.7.1.

4.5 Records.

4.5.1* The organization shall create a written procedure to manage the record-keeping system.

4.5.2 The record-keeping system shall accommodate the documents listed in 4.5.8 and all additional documents that are needed after considering the following factors:

(1) Need for the record, report, or document
(2) How the record, report, or document contributes to realizing the organization's goals within the selection, care, and maintenance program component
(3) Number of copies needed
(4) Person(s) responsible for producing the record, report, or document
(5) Format and substance of the record, report, or document
(6) Person(s) who receives, forwards, reviews, processes, and uses the record, report, or document
(7)*Disposition of the record, report, or document after it has been completely developed

4.5.3* The organization shall consult with legal counsel concerning specific laws that determine the length of time

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records, reports, and documents shall be retained. Legal counsel shall advise the organization about the form, written or electronic, that is permitted and under what circumstances original or copied documents are needed for various purposes.

4.5.4 The organization shall determine how required records, reports, and documents are created, processed, maintained, and stored. Regardless of the method selected, the organization shall take measures to prevent loss and damage.

4.5.5 The record-keeping system shall be managed by a person who is trained and qualified to ensure that information is obtained, collected, communicated, retrieved, used, and stored according to the plan. The record-keeping manager shall also consider how to reduce waste, redundancy, and cost in the system.

4.5.6 The manager of the record-keeping system shall educate and train personnel within the organization in completing, filing, and using various components of the record-keeping system. The manager shall be assisted by sufficient staff to fulfill the manager's duties.

4.5.7 The manager of the record-keeping system shall conduct an annual inventory and audit of records, reports, and documents. Following the inventory and audit, the manager shall recommend changes in the record-keeping system as needed.

4.5.8 The organization shall create, maintain, and disseminate the following as required:

(1) Written instructions for care, maintenance, and repair that correspond to those provided by the manufacturer
(2) Written instructions for checks while donning SCBA
(3) Written instructions for inspection, including procedures to be followed if defects are found
(4) Forms to document the findings during inspection
(5) Forms to record and to report defects found during inspections and to track the SCBA or cylinder as it is repaired
(6) Forms to document inspections, tests, and repairs by SCBA users and technicians that shall include the following:
    (a) SCBA make, model, and serial number and other information to identify components
    (b) Documentation of the date, result of the inspection or test, and all actions taken as well as who acted
(7) Written instructions for filling and for testing cylinders
(8) Written policy and procedure concerning training and authorization of SCBA technicians as well as documentation of that training and authorization
(9) Written procedures for the inspection of cylinders by technicians
(10) Written procedures for recording information about the inspection and repair of cylinders
(11) Stickers, tags, or other similarly effective means to alert users and technicians to defects, to document inspections, and to certify that tests, repairs, and other actions have been completed
(12) Written procedures for periodic tests and comprehensive inspections that comply with the requirements of this standard
(13) Documentation of the tests to verify SCBA performance
(14) Schedule for retention, disposition, and disposal of each report, record, and document
(15) Methods of identifying all SCBAs, cylinders, parts, and components so that these can be identified and tracked from initial receipt by the organization until removed from the possession and control of the organization
(16) Documentation when a defective or obsolete SCBA or component part is removed from service in accordance with the following:
    (a) Until retirement and disposal of a defective or obsolete SCBA or component as specified in 4.7.3, a tag shall be conspicuously placed on the SCBA or component.
    (b) The tag shall indicate the date and time the SCBA or component was removed from service, by whom, and for what reason.
    (c) SCBA and components that are removed from service shall be stored separately from other SCBA and components and secured, as necessary.
    (d) Access to tagged SCBA and components shall be limited, and only authorized persons shall remove tags after repair or service.
(17) Records for maintenance of each individual SCBA regulator, reducer, harness, cylinder including valve assembly, and facepiece including the following information:
    (a) Manufacturer's serial number or other unique identifier
    (b) Date of manufacture, receipt, service, inspection, test, maintenance, and repair
    (c) Inspections, service, repairs, and tests
    (d) Who performed the work
    (e) Other comments
(18) Records of training provided to each user showing date(s) and subject(s) covered
(19) Such other reports, records, and documents including forms, tags, stickers, and other means necessary to effectuate the purposes of record keeping and the intent of this standard

4.6 Manufacturer's Instructions.

4.6.1 When issuing new SCBA, the organization shall provide users with the instructions provided by the manufacturer on the care, use, and maintenance of their SCBA, including any warnings provided by the manufacturer.

4.6.2 Where the SCBA manufacturer's instructions regarding the SCBA's care, use, and maintenance differ from the requirements in this standard other than the requirements specified in 7.2.1.3 and 7.5.1, the manufacturer's instructions shall be followed.

4.7 Retirement and Disposal.

4.7.1 Retired SCBA shall be destroyed or altered in a manner assuring that they are not used for respiratory protection and shall be rendered unable to hold pressure, or the ownership of the SCBA shall be transferred to the manufacturer or the manufacturer's agent.

4.7.2 Where SCBA or SCBA components are contaminated beyond the ability to be decontaminated so the SCBA or components can be returned to service, such SCBA or component shall be disposed of.

4.7.2.1 Contaminated SCBA or components as identified according to 4.7.2 shall be segregated from other equipment and personnel and disposed of in a manner consistent with the type of contamination and any governmental regulations governing contaminated items.

4.7.2.2 Prior to disposal, contaminated SCBA or components shall be altered in a manner assuring that they cannot be used for any purpose.

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4.7.3 Defective or obsolete SCBA components or defective or obsolete SCBA that have been removed from service and cannot be repaired or upgraded shall be destroyed or altered in a manner assuring that they cannot be used in any emergency operations or other activities, including training; or the ownership of such SCBA shall be transferred to the manufacturer or the manufacturer's agent.

4.7.4 SCBA elastomeric components, including but not limited to facepieces, O-rings, and hose, shall be destroyed or altered in a manner assuring that they cannot be used for any purpose when the component reaches the SCBA manufacturer's specified component service life.

4.7.5* SCBA composite cylinders shall be removed from service and retired when they reach the end of the service life specified by the SCBA manufacturer. Such composite cylinders shall be destroyed or altered in a manner assuring that they cannot be used for respiratory protection and shall be rendered unable to hold pressure, or the ownership of the composite cylinder shall be transferred to the manufacturer or the manufacturer's agent.

4.7.6 Any SCBA cylinders that are beyond repair or not allowed to be repaired shall be destroyed or altered in a manner assuring that they are marked and identified as "Condemned" and shall be rendered unable to hold pressure. Before destroying or rendering them unable to hold pressure, permission from the owner of the cylinder shall be obtained.

4.8 Quality Assurance.

4.8.1 The organization shall establish and maintain a quality assurance plan for selection, care, and maintenance of SCBA.

4.8.2 The quality assurance plan shall be designed to realize all of the following goals:

(1) Assure effective and safe performance of SCBA provided to users
(2) Substantiate compliance with this standard
(3) Confirm the organization's policies and procedures are being followed
(4) Determine the effectiveness of those policies and procedures
(5) Improve the organization's respiratory protection program component for selection, care, and maintenance of SCBA

4.9 Technical Authorization.

4.9.1 Where the portion of the respiratory protection program component that addresses the maintenance of SCBA, as specified in 4.3.6, includes SCBA technicians that are members of the organization, such technicians shall be qualified and authorized by the SCBA manufacturer to perform specified allowable maintenance.

4.9.1.1 Allowable maintenance shall include periodic inspection, repair, and overhaul of all SCBA components and assemblies.

4.9.1.2 Technicians shall also be qualified and authorized in the use of all special tools and equipment required to test and maintain the SCBA.

4.9.2 The program component shall establish policies and procedures for qualification and selection of personnel for SCBA technician training and authorization.

4.9.3 The organization shall maintain evidence that all SCBA technicians that are used by the organization have current authorization by the SCBA manufacturer and have maintained their level of competency.

Chapter 5 Selection

5.1 Selection for Purchase.

5.1.1 Risk Assessment.

5.1.1.1 Prior to starting the procurement process of SCBA, a risk assessment shall be performed.

5.1.1.2 The risk assessment shall include, but not be limited to, the expected hazards that can be encountered by users of SCBA based on the type of duties performed, frequency of use, the organization's experiences, and the organization's geographic location and climatic conditions.

5.1.2 The organization shall review the following standards as a minimum:

(1) NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*
(2) NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, where SCBA-integrated PASS are being considered as an accessory for the SCBA

5.1.2.1 Fire department organizations shall also review NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and 29 CFR 1910.156.

5.1.2.2 Organizations in the United States shall also review 29 CFR 1910.134.

5.1.2.3 Organizations outside the United States shall also review all applicable national, state/provincial, and local regulations.

5.1.3 The organization shall compile and evaluate information on comparative product strengths and weaknesses.

5.1.4 The organization shall ensure that the SCBA interfaces properly with other personal protective items already being used by the organization.

5.1.5 The organization shall also consider the following items during the selection process:

(1) Cross contamination between users and ease of cleaning/decontamination
(2) Legibility of remote pressure indicators in reduced visibility
(3) Size
(4) Weight
(5) Rated service time
(6) Breathing resistance
(7) Environment
(8) Ease of donning and doffing
(9) Comfort
(10) Fit range and available number of facepiece sizes
(11) Number and complexity of steps involved in operation and maintenance of the SCBA
(12) Design features that provide positive feedback to the user that required steps have been completed properly
(13) Design features that prevent steps from being performed improperly

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(14) Operability by user wearing the protective clothing and gloves worn when using SCBA
(15) Facepiece vision area
(16) Cylinder fill station requirements
(17)*Method for uniquely identifying the components of the SCBA
(18)*Facepiece nose cup
(19) Vision correction needs of their personnel
(20) Characteristics of the end of service time indicators
(21) Communication capability (i.e, speech diaphragms, voice amplifiers, radio interface, and so forth)
(22) Supplied air compatibility
(23) Spare cylinders
(24) Rapid cylinder filling options
(25) Cylinder types
(26) Chemical, biological, radiological, and nuclear (CBRN) respiratory protection
(27) SCBA accessories as follows:
  (a) Telemetry and monitoring systems
  (b) Personnel location systems
  (c) SCBA-integrated PASS
  (d) Emergency egress escape systems

5.1.6 Where a field or laboratory evaluation is conducted, at least the following criteria shall be used for designing a systematic evaluation procedure:

(1) The organization shall develop an evaluation plan including, but not limited to, testing according to 7.5.2 prior to and after field evaluations.
(2) Participants for field evaluations shall be selected based on a cross-section of personnel, willingness to participate, objectivity, and level of operational activity.
(3) Participants shall perform a field evaluation on each different product model being considered from each manufacturer for a particular SCBA. Participants shall be fitted for and instructed in the use of each product model being evaluated from each manufacturer.
(4) A product evaluation form shall be developed for each model.
(5) The organization shall solicit periodic reports from participants in the field evaluation.
(6) The organization shall conclude the evaluation process and analyze the results.

5.1.7 Purchase specifications shall require evidence that the SCBA to be purchased are certified as compliant with NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services.*

5.1.7.1 Where SCBA-integrated PASS are installed as an accessory to the SCBA, the SCBA-integrated PASS shall be certified as compliant with NFPA 1982, *Standard on Personal Alert Safety Systems (PASS).*

5.1.7.2 For both NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, and NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, the edition of the respective standard(s) that is the current edition at the time of purchase shall be the edition specified.

5.1.8 Where the organization develops purchase specifications, at least the following criteria shall be considered:

(1) All requirements developed by the organization in its evaluations conducted as specified in 5.1.3 through 5.1.7
(2)*Quantitative fit testing
(3) User training
(4) Maintenance training
(5) Manufacturer assistance to develop SOPs for maintenance
(6) SCBA testing on-site prior to acceptance
(7) Maintenance schedule
(8) Complete parts list
(9) SCBA user and service manuals
(10) List of any specialized equipment or special tools needed for SCBA maintenance
(11) List of authorized service centers
(12) Warranty statement
(13) Procedures for returning items found defective upon initial receipt

5.2 Acceptance.

5.2.1 Upon receipt, organizations shall inspect and test purchased SCBA in accordance with 7.1.2, and 7.5.2 through 7.5.6, respectively.

5.2.2 Organizations shall verify that the equipment received is as specified.

5.2.3 Procedures shall be established for returning unsatisfactory products if the organization's specifications are not met.

5.2.4 Organizations shall review information supplied with the products such as instructions, warranties, and technical data.

Chapter 6 Care

6.1 Cleaning and Disinfecting.

6.1.1 The external surfaces of the SCBA shall be cleaned and disinfected according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.2 The facepiece shall be thoroughly cleaned after each use and disinfected as needed. Facepiece cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.2.1 The exhalation valve shall be cleaned and flushed.

6.1.2.2 The facepiece shall be dried, and drying shall not be done in direct sunlight or in high heat.

6.1.2.3 The exhalation valve shall be cycled to assure proper operation.

6.1.3 Where the internal components have been exposed to bodily fluids, exhaled breath, dirt, or debris, the second stage regulator shall be thoroughly cleaned and disinfected. The cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.4 SCBA straps and harness assemblies shall be cleaned and disinfected when required according to manufacturer's instructions. Straps and harness assembly cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.4.1* Under no circumstances shall a chlorine bleach ever be used to clean straps and harness assemblies.

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6.1.4.2 The straps and harness assemblies shall be dried, and drying shall not be done in direct sunlight or in high heat.

6.1.5 SCBA cylinder valve assemblies shall be cleaned and disinfected according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.5.1 The valve shall be free of debris.

6.1.5.2 The burst disc outlet shall be inspected and, if debris is present, the cylinder shall be removed from service.

6.1.6* Water or cleaning materials shall be prevented from entering the connection between the cylinder valve and the mating SCBA inlet connector.

6.1.7 Pneumatic component cleaning and disinfecting shall be performed according to the manufacturer's instructions using only those agents indicated by the manufacturer.

6.1.7.1 All pneumatic components shall be thoroughly dried after cleaning.

6.1.7.2 Drying of pneumatic components shall not be done in direct sunlight or in high heat.

6.1.8 All other SCBA components shall be thoroughly air-dried prior to storage in a compartment that does not allow for air circulation.

6.1.9 Appropriate inspections according to 7.1.2 shall be performed after cleaning.

6.2 Contamination and Decontamination.

6.2.1 Where SCBA is suspected of being contaminated, it shall be tagged out-of-service and segregated from other equipment and personnel.

6.2.2 Tags shall include details of the incident including known and suspected contaminants.

6.2.3 The SCBA manufacturer shall be contacted to determine if any additional special procedures can be used to decontaminate the SCBA.

6.2.4 In all cases, decontamination shall be conducted in accordance with the SCBA manufacturer's instructions.

6.2.5 Where it is determined, in accordance with 4.3.3.1, that the SCBA is contaminated beyond the ability to decontaminate it and return it to service, the SCBA shall be disposed of in accordance with 4.7.2.

6.3 Storage.

6.3.1 SCBA shall be stored in their original carrying or storage cases or in a wall or apparatus bracket/rack designed for quick removal and for protection of the SCBA. Brackets/racks shall protect the SCBA and shall be adjusted so they do not cause physical damage to cylinders, hoses, regulators, or straps.

6.3.2 Brackets for securing SCBA in vehicles used for transportation of emergency services personnel shall meet the requirements of 14.1.10 of NFPA 1901, *Standard for Automotive Fire Apparatus*,

6.3.3 SCBA shall be stored with the cylinder valves closed. Other valves or controls shall be positioned according to manufacturer's specifications.

6.3.4 The facepieces of all SCBA shall be positioned to avoid distortion of parts during storage.

6.3.5 All harness straps shall be adjusted to their maximum length during storage.

6.3.6 In all instances, the SCBA shall be stored in a manner to control and minimize exposure to shock, vibration, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and environmental elements.

6.3.7* All in-service SCBA cylinders shall be stored fully charged.

6.3.7.1 Cylinders shall be filled when the pressure falls to 90 percent of the manufacturer's specified pressure level.

6.3.7.2 A positive pressure shall be maintained in depleted SCBA cylinders by keeping the valve closed until they are filled to keep external contamination and condensation out of the cylinder.

6.3.7.3* Compressed breathing air stored in SCBA breathing air cylinders shall be replaced at least annually.

6.3.8 SCBA cylinders shall be stored in a manner that prevents damage to the valve and cylinder.

Chapter 7 Maintenance

7.1 User Maintenance.

7.1.1 Inspection Frequency.

7.1.1.1* Where SCBA is assigned to an individual user for a duty period, the inspection specified in 7.1.2 shall be performed by the individual user at the beginning of each duty period.

7.1.1.2 Where additional SCBA are available for use on response vehicles but not assigned to individual users, the inspection specified in 7.1.2 shall be performed on such additional SCBA at least once each duty period.

7.1.1.3 Where SCBA are not assigned to an individual user for a duty period, the inspection specified in 7.1.2 shall be performed at least once a week on all SCBA that are available for use.

7.1.1.4 In all cases, the interval between the inspections specified in 7.1.2 shall not exceed 1 week.

7.1.2 Inspection.

7.1.2.1 All of the following SCBA components shall be present:

(1) Facepiece
(2) Backframe and harness assembly
(3) Cylinder
(4) Hose
(5) End-of-service-time indicator(s) (EOSTI)
(6) Regulators
(7) Accessories

7.1.2.2 Facepiece inspection shall include the following:

(1) Material checked for deterioration, dirt, cracks, tears, holes, pliability, and tackiness
(2) Head-harness buckles, strap, and webbing checked for breaks, loss of elasticity, or wear
(3) Lens checked for holes, cracks, scratches, heat-damaged areas, and a proper seal with the facepiece material
(4) Exhalation valve, where present, checked for valve seat
(5) Springs and covers checked for proper operation and cleanliness

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(6) Regulator connection(s) checked for proper operation and damage
(7) Speaking diaphragm, where present, checked for damage

7.1.2.3 Backframe and harness assembly inspection shall include the following:

(1) Harness straps and backframe checked for cuts, tears, abrasion, indications of heat damage, and indications of chemical-related damage
(2) All buckles, fasteners, and adjustments checked for proper operation
(3) Cylinder retention system checked for damage and proper operation
(4) Cylinder checked for secure attachment to the backframe
(5) Harness straps checked for full extension

7.1.2.4 Breathing air cylinder assembly inspection shall include the following:

(1) Hydrostatic test date on the cylinder checked to be current
(2) Gauge checked for damage
(3) Cylinder body checked for cracks, dents, weakened areas, indications of heat damage, and indications of chemical damage *(See Annex B)*
(4) Composite portion of the cylinder checked for cuts, gouges, loose composite materials, and the absence of resin *(See Annex B)*
(5) Cylinder valve outlet sealing surface and threads checked for damage
(6) Valve hand wheel checked for damage, proper alignment, serviceability, and secure attachment
(7) Burst disc outlet area checked for debris
(8) Cylinder checked for full charge

7.1.2.5 Hose inspection shall include the following:

(1) Hose checked for cuts, abrasions, bubbling, cracks, heat damage, and chemical damage
(2) External fittings checked for visual signs of damage
(3) Hose checked for tight connections

7.1.2.6 EOSTI inspection shall include the following:

(1) EOSTI alarm and mounting hardware checked for damage, secure attachment, dirt, and debris
(2) EOSTI checked for proper activation in accordance with the manufacturer's instructions

7.1.2.7 Regulator inspection shall include the following:

(1) Regulator controls, where present, checked for damage and proper function
(2) Pressure relief devices checked visually for damage
(3) Housing and components checked for damage
(4) Regulator checked for any unusual sounds such as whistling, chattering, clicking, or rattling during operation
(5) Regulator and bypass checked for proper function when each is operated (Where this is accomplished by donning the facepiece and contamination between users is a possibility, the regulator, facepiece, or both shall be cleaned and disinfected.)

7.1.2.8 Pressure indicator inspection shall include the following:

(1) Pressure indicator checked for damage
(2) Cylinder pressure gauge and the remote gauge checked to read within 10 percent of each other

7.1.2.9 Where SCBA has an integrated PASS, the SCBA-integrated PASS inspection shall include the following:

(1) Wear and damage assessment
(2) Covers/compartments checked for secure attachment
(3) All operating modes checked for proper function
(4) Low battery warning signal

7.1.2.10 Where SCBA has other required components including rapid intervention company/crew universal air connection (RIC UAC), heads-up display (HUD), electronic communications enhancement, and any other required components not otherwise addressed herein, such components shall be inspected in accordance with the manufacturers' instructions and shall include at least inspection for signs of complete assembly of the component, wear, damage, secure attachment, adequate power source, and proper operation and functioning in accordance with the manufacturers' operational instructions.

7.1.2.11 As the final inspection item, the entire SCBA shall be checked for pressure retention by closing all regulator valves, opening the cylinder valve thereby pressurizing the SCBA system, and then closing the cylinder valve.

7.1.2.11.1 The SCBA shall hold system pressure in accordance with the manufacturer's specifications after the cylinder valve is closed.

7.1.2.11.2 Following the pressure check, the system pressure shall be released.

7.1.3 Repair.

7.1.3.1 Where user repair can be accomplished promptly and replacement items or remedial action are immediately available, the SCBA shall be permitted to be restored to proper condition and returned to in-service status.

7.1.3.2 Where user repair cannot be accomplished promptly or where replacement items or remedial action are not immediately available, the SCBA shall be tagged out-of-service and removed from the response vehicle or standby location until the user repair can be completed.

7.1.3.3 The organization's personnel shall follow the organization's SOPs and the manufacturer's written instructions for allowable user repairs and shall be trained on the specific repair procedures before performing them.

7.1.3.4 Users shall not perform work beyond the limits of the organization's SOPs and their training and shall not exceed what is allowed by the manufacturer's written instructions.

7.1.3.5 All repairs shall be done with the proper tools, parts, and equipment as specified by the manufacturer.

7.1.3.6 After repairs are made, the user shall conduct the appropriate inspection as specified in 7.1.2 to verify proper function of the SCBA.

7.1.4 Removal from Service.

7.1.4.1* Where a condition exists that is beyond user repair in accordance with 7.1.3, or the SCBA is suspected to be in an unsafe condition, the SCBA shall be removed from service, tagged, and referred to personnel responsible for technical maintenance.

7.1.4.2 Where any breathing air cylinder condition specified in 7.1.2.4 is identified, the cylinder shall be immediately depressurized to a slight positive pressure, tagged, and taken out

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of service. The valve shall be closed to keep external contamination and condensation out of the cylinder.

7.1.4.3 Any SCBA or SCBA components that have been exposed or are suspected of having been exposed to a CBRN agent(s) shall be removed from service, tagged, segregated from other equipment and personnel, and referred to person(s) designated in the organization's SOPs for appropriate disposition as specified in Section 4.7.

7.1.4.4 Any SCBA or SCBA components being taken out of service shall be tagged as specified in 4.5.8(16).

7.1.4.5 Where an SCBA breathing air cylinder is identified as having been filled with air that did not comply with 7.3.2, the cylinder shall be removed from service, tagged, and referred to personnel responsible for technical maintenance.

7.2 Technician Maintenance.

7.2.1 Inspection Frequency.

7.2.1.1 The technician shall perform the inspection specified in 7.1.2 upon receipt of any SCBA removed from service.

7.2.1.2 The technician shall perform the inspection specified in 7.1.2 and the testing specified in Section 7.5 prior to returning any SCBA to service.

7.2.1.3 The SCBA shall be tested on a breathing machine specified in 7.5.6 in accordance with the organization's SOPs or in accordance with the SCBA manufacturer's instructions, whichever is more frequent, but in all cases at least annually.

7.2.1.4 The frequency of technician inspection and testing of SCBA shall be conducted in accordance with the organization's SOPs developed as specified in 4.3.6.3.

7.2.1.5 The organization shall test all newly purchased SCBA as specified in Section 7.5 prior to putting the SCBA in service.

7.2.2 Inspection.

7.2.2.1 Technicians shall perform the level of inspection for which they have been trained and have been qualified to conduct by the SCBA manufacturer.

7.2.2.2 Where an SCBA is removed from service in accordance with 7.1.4, the technician shall verify the user-reported condition.

7.2.2.3 Where the user-reported condition is verified by the technician, the technician then shall determine the appropriate action to be taken to repair, return to service, or retire the SCBA or SCBA component(s).

7.2.2.4 Where the user-reported condition cannot be substantiated, the technician shall perform a complete SCBA inspection in accordance with the manufacturer's instructions.

7.2.3 Repairing and Rebuilding.

7.2.3.1 Technicians shall perform the level of repair or rebuild for which they have been qualified and are authorized to conduct by the SCBA manufacturer.

7.2.3.2 The technician shall verify that all parts and tools used in the maintenance, repair, and rebuild of SCBA are specified by the SCBA manufacturer for the specific SCBA model being repaired.

7.2.3.3* Parts and tools not specified by the manufacturer shall not be used.

7.2.3.4 The technician shall ensure that all components and tools are kept clean and free from contamination during repair and rebuild.

7.2.3.5 The technician shall ensure components are not damaged during repair and rebuild.

7.2.3.6 Product labels shall not be removed or obscured during repair or rebuild. Damaged or missing labels shall be replaced during repair or rebuild.

7.2.3.7 After repair or rebuild, the SCBA or SCBA component shall be inspected and tested in accordance with manufacturer's instructions.

7.2.3.8 Cylinder repairs shall be limited to only those conditions specified by the SCBA manufacturer.

7.2.3.9* SCBA shall be periodically rebuilt to replace all components that are subject to wear and aging at a frequency specified by the manufacturer or by the organization, whichever is more frequent. Such frequency shall be based on the conditions of use of the SCBA as indicated in 4.5.8(17)(a) through (e).

7.2.4 Removal from Service and Disposition.

7.2.4.1* An SCBA breathing air cylinder identified as having been filled with air that is found to not comply with the breathing air requirements of 7.3.2 shall be removed from service.

7.2.4.1.1 Action shall be taken based on consideration of the reason for the air sample failure.

7.2.4.1.2 Further action shall be taken to ensure that if the breathing air cylinder is placed back in service, that breathing air cylinder does not pass contaminants back to the breathing air in future fillings.

7.2.4.2* Any SCBA or SCBA component that is damaged and cannot be repaired shall be removed from service and retired as specified in Section 4.7.

7.2.4.3* Any SCBA or SCBA components that have been exposed to or are suspected of having been exposed to a CBRN agent(s), and where such exposure cannot be remedied by a decontamination process authorized by the SCBA manufacturer, shall be retired as specified in Section 4.7.

7.2.4.4 Any SCBA breathing air cylinder that is beyond repair shall be removed from service and retired as specified in Section 4.7.

7.2.4.5* Composite breathing air cylinders shall be removed from service and retired as specified in Section 4.7 when they reach the end of the SCBA manufacturer's specified service life.

7.2.4.6* Any elastomeric component, including but not limited to facepieces, O-rings, and hose, shall be removed from service and retired as specified in Section 4.7, when they reach the end of the SCBA manufacturer's specified service life.

7.3 Breathing Air Cylinder Filling.

7.3.1 Prior to filling SCBA breathing air cylinders, the cylinder inspection specified in 7.1.2.4(1) through (8) shall be performed.

7.3.2 Breathing air shall meet the requirements specified in NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection.*

7.3.3 The SCBA manufacturer's specified fill rate shall not be exceeded.

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7.3.4 SCBA breathing air cylinders shall be filled as soon as possible after use.

7.3.5* Where filling breathing air cylinders during routine maintenance, all operators and personnel shall be protected from catastrophic failure of the cylinder by the use of an SCBA fill station that meets the requirements specified in Section 25.9 of NFPA 1901, *Standard for Automotive Fire Apparatus*.

7.3.6 SCBA breathing air cylinders shall be requalified as specified by the SCBA manufacturer.

7.4 Breathing Air Cylinder Requalification.

7.4.1 SCBA breathing air cylinders shall be periodically requalified for service as required by the U.S. Department of Transportation (DOT). *(See Annex C)*

7.4.2 Where an SCBA breathing air cylinder is found to not be currently qualified for service, it shall be removed from service, tagged, and submitted for requalification testing.

7.4.3 An SCBA breathing air cylinder that fails requalification shall be dealt with in accordance with 4.7.6.

7.5 Testing.

7.5.1 The organization responsible for the maintenance of the SCBA shall perform periodic testing in accordance with the part of the SCBA program component for maintenance as specified in 4.3.6. In all cases, SCBA shall be tested at least annually on a breathing machine that meets the requirements specified in 7.5.5 and 7.5.6.

7.5.2 SCBA shall be tested for the performance specified in Table 7.5.2 after being inspected as specified in 7.1.2.

7.5.2.1 The sound level of all audible EOSTI shall be measured using a calibrated instrument following the SCBA manufacturer's instructions and specifications.

7.5.2.2 All other EOSTI shall be measured in accordance with the manufacturer's instructions and specifications at least annually.

7.5.2.3 SCBA EOSTI signaling device(s) activation and operation shall conform to the SCBA manufacturer's specifications.

7.5.3 SCBA that fail to meet any of the acceptance criteria provided in Table 7.5.2 shall be tagged out-of-service until that SCBA has been adjusted or repaired, retested, and shown to meet all the requirements of Table 7.5.2.

7.5.4 All equipment used to test SCBA shall be calibrated in accordance with the test equipment manufacturer's instructions for calibration.

7.5.4.1 Calibration shall be performed periodically in accordance with the test equipment manufacturer's instructions but shall be calibrated at least annually.

Table 7.5.2 Performance Test Requirements

Performance Element	Acceptance Criteria
Facepiece leakage	In order to proceed with the tests specified in Table 7.5.2, a pressure of at least 0.20 mb (0.1 in.) H_2O gauge below atmospheric shall remain in the facepiece at the end of a testing interval equal to 10 seconds, ±0.5 seconds.
Facepiece exhalation valve opening pressure	Facepiece exhalation valve opening pressure shall be within manufacturer's specifications.
Facepiece static pressure	Pressure shall be between 0 mb (0 in.) H_2O gauge and 3.7 mb (1½ in.) H_2O gauge above atmospheric or shall meet manufacturer's specifications, whichever are more stringent.
First stage regulator (pressure reducer) static pressure	First stage regulator (pressure reducer) static pressure shall be within manufacturer's specifications.
Minimum facepiece pressure during breathing resistance test (at 40 L/min, ±1 L/min)	Minimum facepiece pressure shall meet manufacturer's specifications.
Maximum facepiece pressure during breathing resistance test (at 85 L/min, ±1 L/min)	Maximum facepiece pressure shall be less than or equal to the manufacturer's specifications, but not more than 5.0 mb (2 in.) H_2O gauge above maximum static pressure.
Facepiece pressure during breathing resistance test (at 103 L/min, ±3 L/min)	Pressure shall be between 0 mb (0 in.) H_2O gauge and 8.7 mb (3½ in.) H_2O gauge above atmospheric or shall meet manufacturer's specifications, whichever are more stringent.
First stage pressure during breathing resistance test (at 103 L/min, ±3 L/min)	First stage pressure (pressure reducer) shall be within manufacturer's specifications.
First stage pressure during breathing resistance test (at 40 L/min, ±1.0 L/min)	First stage pressure (pressure reducer) shall be within manufacturer's specifications.
Remote pressure gauge accuracy at ¾-, $^1/_2$-, ¼- rated cylinder pressure	Remote pressure gauge accuracy shall be within ±10 percent of full scale
End-of-Service-Time Indicator (EOSTI): Activation	The EOSTI shall activate within manufacturer's specifications. Where the SCBA includes a second EOSTI, the activation pressure of the second EOSTI shall meet manufacturer's specifications.
Bypass flow rate	Where bypass valves are provided on SCBA, the flow rate through the bypass system shall be within manufacturer's specifications.

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7.5.4.2 A label shall be affixed to each piece of test equipment stating the date of the latest calibration and the date of the next scheduled calibration.

7.5.4.3 Records of calibration results shall be kept on file at the maintenance facility.

7.5.5 The breathing machine shall be capable of performing the tests listed in Table 7.5.2.

7.5.6 The breathing machine and any associated equipment shall be capable of meeting the specifications in Table 7.5.6(a) and Table 7.5.6(b).

Table 7.5.6(a) Lung Breathing Waveforms for 103 L/min Volume Work Rate

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) ±0.1 L	Volume Change (L) ±5%
0	0.00	—	–1.700	–0.012
1	0.02	Inspire	–1.688	0.012
2	0.04	Inspire	–1.662	0.025
3	0.06	Inspire	–1.626	0.036
4	0.08	Inspire	–1.581	0.045
5	0.10	Inspire	–1.529	0.052
6	0.12	Inspire	–1.471	0.058
7	0.14	Inspire	–1.409	0.062
8	0.16	Inspire	–1.345	0.064
9	0.18	Inspire	–1.277	0.068
10	0.20	Inspire	–1.207	0.070
11	0.22	Inspire	–1.134	0.073
12	0.24	Inspire	–1.059	0.075
13	0.26	Inspire	–0.984	0.076
14	0.28	Inspire	–0.906	0.077
15	0.30	Inspire	–0.828	0.079
16	0.32	Inspire	–0.748	0.080
17	0.34	Inspire	–0.667	0.081
18	0.36	Inspire	–0.586	0.081
19	0.38	Inspire	–0.504	0.082
20	0.40	Inspire	–0.421	0.083
21	0.42	Inspire	–0.337	0.084
22	0.44	Inspire	–0.254	0.084
23	0.46	Inspire	–0.169	0.085
24	0.48	Inspire	–0.085	0.085
25	0.50	Inspire	0	0.085
26	0.52	Inspire	0.085	0.085
27	0.54	Inspire	0.169	0.085
28	0.56	Inspire	0.254	0.085
29	0.58	Inspire	0.337	0.084
30	0.60	Inspire	0.421	0.084
31	0.62	Inspire	0.504	0.083
32	0.64	Inspire	0.586	0.082
33	0.66	Inspire	0.667	0.081
34	0.68	Inspire	0.748	0.081
35	0.70	Inspire	0.828	0.080
36	0.72	Inspire	0.906	0.079
37	0.74	Inspire	0.984	0.077
38	0.76	Inspire	1.059	0.076
39	0.78	Inspire	1.134	0.075
40	0.80	Inspire	1.207	0.073
41	0.82	Inspire	1.277	0.070
42	0.84	Inspire	1.345	0.068
43	0.86	Inspire	1.409	0.064
44	0.88	Inspire	1.471	0.062
45	0.90	Inspire	1.529	0.058
46	0.92	Inspire	1.581	0.052
47	0.94	Inspire	1.626	0.045
48	0.96	Inspire	1.662	0.036
49	0.98	Inspire	1.688	0.025
50	1.00	—	1.700	0.012

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Table 7.5.6(a) *Continued*

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) ±0.1 L	Volume Change (L) ±5%
51	1.02	Expire	1.688	–0.012
52	1.04	Expire	1.662	–0.025
53	1.06	Expire	1.626	–0.036
54	1.08	Expire	1.581	–0.045
55	1.10	Expire	1.529	–0.052
56	1.12	Expire	1.471	–0.058
57	1.14	Expire	1.409	–0.062
58	1.16	Expire	1.345	–0.064
59	1.18	Expire	1.277	–0.068
60	1.20	Expire	1.207	–0.070
61	1.22	Expire	1.134	–0.073
62	1.24	Expire	1.059	–0.075
63	1.26	Expire	0.984	–0.076
64	1.28	Expire	0.906	–0.077
65	1.30	Expire	0.828	–0.079
66	1.32	Expire	0.748	–0.080
67	1.34	Expire	0.667	–0.081
68	1.36	Expire	0.586	–0.081
69	1.38	Expire	0.504	–0.082
70	1.40	Expire	0.421	–0.083
71	1.42	Expire	0.337	–0.084
72	1.44	Expire	0.254	–0.084
73	1.46	Expire	0.169	–0.085
74	1.48	Expire	0.085	–0.085
75	1.50	Expire	0	–0.085
76	1.52	Expire	–0.085	–0.085
77	1.54	Expire	–0.169	–0.085
78	1.56	Expire	–0.254	–0.085
79	1.58	Expire	–0.337	–0.084
80	1.60	Expire	–0.421	–0.084
81	1.62	Expire	–0.504	–0.083
82	1.64	Expire	–0.586	–0.082
83	1.66	Expire	–0.667	–0.081
84	1.68	Expire	–0.748	–0.081
85	1.70	Expire	–0.828	–0.080
86	1.72	Expire	–0.906	–0.079
87	1.74	Expire	–0.984	–0.077
88	1.76	Expire	–1.059	–0.076
89	1.78	Expire	–1.134	–0.075
90	1.80	Expire	–1.207	–0.073
91	1.82	Expire	–1.277	–0.070
92	1.84	Expire	–1.345	–0.068
93	1.86	Expire	–1.409	–0.064
94	1.88	Expire	–1.471	–0.062
95	1.90	Expire	–1.529	–0.058
96	1.92	Expire	–1.581	–0.052
97	1.94	Expire	–1.626	–0.045
98	1.96	Expire	–1.662	–0.036
99	1.98	Expire	–1.688	–0.025

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Table 7.5.6(b) Lung Breathing Waveforms for 40 L/min Volume Work Rate

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) ±0.1 L	Volume Change (L) ±5%
0	0.000	—	–0.833	0.001
1	0.025	Inspire	–0.831	0.002
2	0.050	Inspire	–0.825	0.005
3	0.075	Inspire	–0.816	0.009
4	0.100	Inspire	–0.803	0.013
5	0.125	Inspire	–0.787	0.016
6	0.150	Inspire	–0.768	0.019
7	0.175	Inspire	–0.745	0.022
8	0.200	Inspire	–0.720	0.025
9	0.225	Inspire	–0.692	0.028
10	0.250	Inspire	–0.661	0.031
11	0.275	Inspire	–0.628	0.033
12	0.300	Inspire	–0.592	0.035
13	0.325	Inspire	–0.555	0.038
14	0.350	Inspire	–0.515	0.039
15	0.375	Inspire	–0.474	0.041
16	0.400	Inspire	–0.431	0.043
17	0.425	Inspire	–0.387	0.044
18	0.450	Inspire	–0.341	0.046
19	0.475	Inspire	–0.295	0.047
20	0.500	Inspire	–0.247	0.048
21	0.525	Inspire	–0.198	0.049
22	0.550	Inspire	–0.149	0.049
23	0.575	Inspire	–0.100	0.050
24	0.600	Inspire	–0.050	0.050
25	0.625	Inspire	0	0.050
26	0.650	Inspire	0.051	0.050
27	0.675	Inspire	0.100	0.050
28	0.700	Inspire	0.150	0.050
29	0.725	Inspire	0.199	0.049
30	0.750	Inspire	0.248	0.048
31	0.775	Inspire	0.295	0.048
32	0.800	Inspire	0.342	0.047
33	0.825	Inspire	0.388	0.046
34	0.850	Inspire	0.432	0.044
35	0.875	Inspire	0.475	0.043
36	0.900	Inspire	0.516	0.041
37	0.925	Inspire	0.555	0.039
38	0.950	Inspire	0.592	0.037
39	0.975	Inspire	0.628	0.035
40	1.000	Inspire	0.661	0.033
41	1.025	Inspire	0.691	0.031
42	1.050	Inspire	0.719	0.028
43	1.075	Inspire	0.744	0.025
44	1.100	Inspire	0.767	0.022
45	1.125	Inspire	0.786	0.019
46	1.150	Inspire	0.802	0.016
47	1.175	Inspire	0.814	0.013
48	1.200	Inspire	0.823	0.009
49	1.225	Inspire	0.829	0.005
50	1.250	—	0.833	0.004
51	1.275	Expire	0.831	–0.002
52	1.300	Expire	0.825	–0.005

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Table 7.5.6(b) *Continued*

Step Number	Time (seconds)	Inspire/ Expire	Volume (L) ±0.1 L	Volume Change (L) ±5%
53	1.325	Expire	0.816	–0.009
54	1.350	Expire	0.803	–0.013
55	1.375	Expire	0.787	–0.016
56	1.400	Expire	0.768	–0.019
57	1.425	Expire	0.745	–0.022
58	1.450	Expire	0.720	–0.025
59	1.475	Expire	0.692	–0.028
60	1.500	Expire	0.661	–0.031
61	1.525	Expire	0.628	–0.033
62	1.550	Expire	0.592	–0.035
63	1.575	Expire	0.555	–0.038
64	1.600	Expire	0.515	–0.039
65	1.625	Expire	0.474	–0.041
66	1.650	Expire	0.431	–0.043
67	1.675	Expire	0.387	–0.044
68	1.700	Expire	0.341	–0.046
69	1.725	Expire	0.295	–0.047
70	1.750	Expire	0.247	–0.048
71	1.775	Expire	0.198	–0.049
72	1.800	Expire	0.149	–0.049
73	1.825	Expire	0.100	–0.050
74	1.850	Expire	0.050	–0.050
75	1.875	Expire	0.000	–0.050
76	1.900	Expire	–0.051	–0.050
77	1.925	Expire	–0.100	–0.050
78	1.950	Expire	–0.150	–0.050
79	1.975	Expire	–0.199	–0.049
80	2.000	Expire	–0.248	–0.048
81	2.025	Expire	–0.295	–0.048
82	2.050	Expire	–0.342	–0.047
83	2.075	Expire	–0.388	–0.046
84	2.100	Expire	–0.432	–0.044
85	2.125	Expire	–0.475	–0.043
86	2.150	Expire	–0.516	–0.041
87	2.175	Expire	–0.555	–0.039
88	2.200	Expire	–0.592	–0.037
89	2.225	Expire	–0.628	–0.035
90	2.250	Expire	–0.661	–0.033
91	2.275	Expire	–0.691	–0.031
92	2.300	Expire	–0.719	–0.028
93	2.325	Expire	–0.744	–0.025
94	2.350	Expire	–0.767	–0.022
95	2.375	Expire	–0.786	–0.019
96	2.400	Expire	–0.802	–0.016
97	2.425	Expire	–0.814	–0.013
98	2.450	Expire	–0.823	–0.009
99	2.475	Expire	–0.829	–0.005

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Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.1 Emergency operations where respiratory protection is needed from IDLH atmospheres includes but is not limited to confined spaces, hazardous materials releases, CBRN (chemical, biological, radiological, nuclear) incidents, fire fighting, medical treatment, technical rescue, any operations where the atmosphere is not stable or improving and could become IDLH, and any operations where it is difficult or not possible to accurately monitor the atmosphere.

A.3.2.1 Approved. 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, 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 that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, 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, or 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 or her 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.

A.3.3.3 Combination SCBA/SAR. Combination SCBA/SAR consist of the following:

(1) An SCBA certified as compliant with NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, and having a minimum rated service time of 30 minutes
(2) A connection for the attachment of an air line that provides a continuous supply of breathing air that is independent of the SCBA breathing air supply

The definition does not include SAR that are used in conjunction with escape self-contained breathing apparatus (ESCBA) where ESCBA provide less than a minimum rated service life of 30 minutes. For the purposes of this standard, combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.3.3.9 Organization. Examples of such organizations include, but are not limited to, fire departments, police and other law enforcement agencies, rescue squads, EMS providers, and hazardous materials response teams.

A.3.3.14 Self-Contained Breathing Apparatus (SCBA). For the purposes of this standard, the terms *self-contained breathing apparatus* and *SCBA* indicate only open-circuit SCBA. Where the term *SCBA* is used without any qualifier in this standard, it indicates only SCBA and combination SCBA/SAR. Combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.3.3.16 Supplied Air Respirator (SAR). For the purposes of this standard, combination SCBA/SAR are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.4.3.6.3.2(7) A responsible member of the organization should estimate the frequency of SCBA cylinder use. It is not necessary to record or maintain records on the frequency of each SCBA cylinder use. For the purposes of determining the needed frequency of technical inspections of the SCBA cylinder, an estimate of cylinder use is acceptable.

It is also recommended that a responsible member of the organization determine the severity of the environment that the SCBA cylinders are usually exposed to. Where a more severe environment (with regards to hazards such as chemical exposure or physical damage) exists, the organization should contact the SCBA manufacturer for cylinder technical inspection frequency advice.

Where the SCBA manufacturer does not have any technical inspection frequency instructions for SCBA cylinders used with their model, the following guidelines are recommended:

(1) A routine technical inspection of SCBA cylinders should be performed every 2 or 2½ years when the cylinders are in normal service and are filled or used 5 times a week or less.
(2) A routine technical inspection of SCBA cylinders should be performed every year (annually) when the SCBA cylinders are in hazardous service, or when they are estimated to be used or filled more than 5 times a week.

The frequency guidelines are not meant to prevent a nonroutine or specially required technical inspection. Where the user has determined that a cylinder condition exists that warrants a technical inspection *(see 7.1.2.4)*, an immediate technical inspection of the cylinder is required.

A.4.3.7 The SCBA manufacturer should be contacted prior to any after-purchase modifications of any sort to an SCBA. Unapproved modifications could affect the NIOSH certification or certification to NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, and void the certifications.

A.4.4.2 The portion of the text in 4.4.2(1) that applies to the 1987 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, uses the phrase "did not meet the requirements of the 1987 edition" while the portion of the text in 4.4.2(2) that applies to the 1992 and later editions of NFPA 1981 uses the phrase "were not certified as compliant with the 1992 edition." The difference is that third-party certification first became a requirement with the 1992 edition and the terms *certified* and *compliant* are defined as relating to certification. Prior to the 1992 edition of NFPA 1981, the SCBA manufacturers confirmed their product as "meeting the requirements" of the standard.

A.4.4.3 SCBA that were compliant with the 1981 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, could have been upgraded since purchase through the SCBA manufacturer's upgrade program and now be compliant with the later edition of NFPA 1981.

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SCBA that are compliant with the 1981 edition of NFPA 1981 and have not been upgraded through the SCBA manufacturer's upgrade program since their purchase should already have been removed from service (in the United States) under OSHA regulations in 29 CFR 1910.156 that effectively removed these SCBA from service on 1 July 1983.

A.4.4.4 SCBA that were compliant with the 1971 edition of NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, cannot be upgraded and should have been removed from service and disposed of many years ago. In the United States, OSHA regulations in 29 CFR 1910.156 effectively removed these SCBA from service on 1 July 1983.

A.4.5.1 The purposes of record keeping are to document what the organization has done, to create a record that can be used for compliance with laws or standards, and to provide information for analysis, evaluation, quality control, and planning. The organization should create and maintain a system of record keeping that achieves these purposes.

Record keeping should be comprehensive and structured to meet the requirements of this standard and needs of the organization. Record keeping should create, process, maintain, and store information with a minimum of effort, time, and cost. Record keeping should provide sufficient data and findings to allow the organization to analyze and to evaluate the selection, care, and maintenance performed under this standard.

All records, reports, and documents should be accurate and clear. If the reader detects inaccuracy, then the veracity of the writer, as well as the value of the record, could be suspect. Details, without the inclusion of unnecessary information, are necessary. Duplication of information in other forms or reports should be avoided.

A.4.5.2(7) Items to be considered should include the part the record, report, or document plays in the record-keeping system and whether it will be used for checking compliance, tracking, measuring effectiveness, spotting trends, or planning.

A.4.5.3 Some records and reports can be created and stored electronically although other items that are completed by users, such as forms, notices, stickers, and tags, are only practical and effective if tangible.

A.4.7.5 No specific requalification procedures are outlined in 49 CFR for composite cylinders. Therefore, the Department of Transportation (DOT) developed special certifications known as *exemptions*. DOT-authorized composite cylinders have a maximum service life indicated in the exemption. Most exemptions specify that composite cylinders have a maximum life of 15 years. The composite cylinder is prohibited from being refilled after 15 years from the original hydrostatic test date. All U.S. retest facilities performing requalifications on composite cylinders are required by the DOT to have a current copy of the cylinder's exemption available, and have to follow its instructions and conditions. The DOT, which is the regulatory authority in the United States, specifies the cylinder requalification frequency of every 3 years for composite cylinders and the cylinder requalification frequency of every 5 years for all-metal cylinders. The organization/cylinder owner and retest facility are required by the DOT to know how often to have the requalification performed. *(See also Annex C.)*

A.5.1.5(17) SCBA maintenance and repair record keeping should include labeling and tracking SCBA major component assemblies by a unique identification method. Such identification can help to identify and document problems that are specific to a particular component assembly as well as simplify efforts to take corrective action and implement upgrades.

A.5.1.5(18) SCBA that are certified by NIOSH include a rated service time based on laboratory tests required by NIOSH. The SCBA is tested using a specified breathing machine with a breathing rate of 40 L/min. NIOSH uses this 40 L/min rate because it represents a moderate work rate that an average user can sustain for a period of time. To attain a rated service time of 30 minutes during this 40 L/min test, the typical SCBA cylinder has to contain 1200 L or more of compressed breathable air. A 45 ft^3 cylinder has a capacity of 1273.5 L, based on 28.3 L/ft^3. Because actual work performed by emergency services personnel often results in a ventilation rate that exceeds 40 L/min, these personnel frequently do not attain the rated service time of 30 minutes. During extreme exertion, for example, actual service time can be reduced by 50 percent or more.

To ensure proper utilization of equipment in actual situations, after training and instruction, it is recommended that users gain confidence by actually using the SCBA in a series of tasks representing or approximating the physical demands likely to be encountered.

In addition to the degree of user exertion, other factors that can affect the service time of the SCBA include the following:

(1) Physical condition of the user *(see also ANSI Z88.6, Respiratory Protection — Respirator Use — Physical Qualifications for Personnel)*
(2) Emotional conditions, such as fear or excitement, which can increase the user's breathing rate
(3) Degree of training or experience the user has had with such equipment
(4) Whether or not the cylinder is fully charged at the beginning of use
(5) Facepiece fit
(6) Use in a pressurized tunnel or caisson [At two atmospheres of pressure (29.4 psig), the duration is one-half the duration obtained at one atmosphere of pressure (14.7 psig); at three atmospheres of pressure (44.1 psig), the duration is one-third the duration obtained at one atmosphere of pressure.]
(7) Condition of the SCBA
(8) The SCBA effective dead air space. [Dead air space is a volume proportional to the carbon dioxide (CO_2) concentration in the inhaled breathing gas.]

During normal breathing without a facepiece, CO_2, which is produced by the body's metabolism, is released to the environment with each breath. The facepiece of an SCBA reduces this environment to a small space around the face. On exhalation, a portion of the carbon dioxide-rich exhaled breath is trapped in this space. On inhalation, fresh air from the SCBA cylinder mixes with this carbon dioxide-rich air and then enters the lungs. The concentration of carbon dioxide is dependent on facepiece configuration, flow characteristics, and ventilation rate.

The full effect of increased dead air space has not been demonstrated. However, the scientific work done in this area shows that an increase of CO_2 in the inhalation air leads to increased ventilation and, consequently, shorter service time for a given air supply. Means to reduce CO_2 in the inhalation air by using, for example, a well-fitting nose cup have been demonstrated to give longer service time. Each manufacturer should be contacted for specific data.

A.5.1.8(2) *Quantitative facepiece fit testing* measures the amount (quantity) of leakage around the facepiece-to-face

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seal. This is normally done, using specifically designed equipment, by measuring the concentration of a detector (challenge) gas or aerosol in the area surrounding a user who is wearing a facepiece and comparing this with the concentration of the challenge gas or aerosol inside the facepiece. Comparing these two concentrations results in a *protection factor* expressed as the following relationship:

Protection factor = 1 ÷ (concentration in facepiece/concentration outside facepiece)

A high protection factor indicates that a very small amount of the challenge gas or aerosol has passed to inside the facepiece, thus the facepiece provides a high degree of protection to the user being tested.

An alternative facepiece fit test method is the *qualitative fit test*. Qualitative fit testing is based on whether the wearer of a facepiece can detect the presence of the challenge gas or aerosol by sensing the odor of it. This is a highly subjective test where a particular wearer determines whether the quality of air in the facepiece is acceptable. Results of qualitative fit testing are not precise and can vary based on the wearer's senses and the concentration of the challenge gas or aerosol.

A.6.1.4.1 Exposure to chlorine bleach will damage straps and harnesses and cause holes, fraying, fiber fibrillation, and breakage of the strap or harness.

A.6.1.6 Cleaning materials or water in the connection between the cylinder valve and the SCBA inlet connector are forced into the regulator and other pneumatic assemblies and can adversely affect the SCBA's performance over time.

A.6.3.7 SCBA cylinder pressure relief devices, such as frangible discs, are designed to safely relieve the contents of a cylinder when the cylinder internal pressure exceeds 5/3 of the rated service pressure. One way a cylinder can become overpressurized is when a cylinder is exposed to high heat or fire. The frangible disc pressure relief device is designed to protect a fully charged cylinder. If the cylinder is only partially charged, the cylinder structure can catastrophically fail before the cylinder's internal pressure reaches the pressure at which the pressure relief device functions. The conclusion is that SCBA cylinders in storage should be fully charged rather than partially charged.

A.6.3.7.3 Moisture accelerates the formation of rust, and oxygen could be depleted to dangerous levels over time as oxygen combines with the iron in the steel to form iron oxide.

A.7.1.1.1 A duty period should include, but not be limited to, a single shift in a career department, a substitute person taking over a position for part or all of a shift, personnel assigned to station duty in a department where the station is not staffed on a 24-hour daily basis, and other similar situations.

A.7.1.4.1 See A.7.2.4.2.

A.7.2.3.3 Many components in an SCBA, while appearing the same as those commonly available at stores and through catalogue sales, are made of special materials or under specific controls that are necessary to meet the stringent performance requirements of NFPA and NIOSH standards. One of the best examples of this is the manufacturer's use of a particular O-ring material and hardness in conjunction with a certain lubricant. Using a different O-ring or lubricant commonly obtainable from a hardware or plumbing store instead of that supplied by the manufacturer could result in a critical failure of the apparatus under certain conditions, even though the apparatus could appear to perform perfectly well immediately after repair.

A.7.2.3.9 It is recommended that organizations request substantiation from the SCBA manufacturer for any SCBA with no prescribed overhaul period.

A.7.2.4.1 The following is a suggested procedure for handling a breathing air cylinder that has been filled with breathing air that does not meet the requirements specified in 7.3.2 or has been filled with a non-breathing air gas:

(1) Determine what gas was put into the cylinder.
(2) Determine the hazard(s) the gas poses to humans and the environment.
(3) Where the technician is not or cannot be properly protected or cannot be trained to handle the hazard(s) of the gas, or if the facility is not equipped to properly handle the gas, then the cylinder should be retired to an authorized waste disposal facility that is able to properly discard the gas and cylinder.
(4) Where the technician is properly protected and trained to handle the identified gas and its hazard(s), and the facility is equipped to properly release and dispose of the gas, then the gas is released to the atmosphere or scrubber, or disposal container, according to local, state/provincial, or federal environmental regulations.
(5) Purge the cylinder with an inert gas appropriate for the hazard(s) of the incorrect gas to remove any residual gas if the incorrect gas was a hazardous gas.
(6) Inspect the interior of the cylinder for contamination.
(7) Where cylinder contamination is found, clean the interior of the cylinder in accordance with the instructions from the SCBA manufacturer.
(8) Inspect the interior of the cylinder again to verify the cleaning process was successful in removing the contaminant(s).
(9) Once the empty cylinder passes the visual interior inspection and meets other inspections and performance requirements, the cylinder can be considered for return to service.
(10) Where the cylinder cannot be properly cleaned, or any condition prevents the cylinder from being returned to service, the cylinder should be retired.

Where the contents of a filled cylinder are unknown, then the gas should not be released and the cylinder should not be purged until the gas is identified by sampling of the cylinder contents before the cylinder is retired and sent to a waste disposal facility in accordance with local, state/provincial, or federal environmental regulations.

A.7.2.4.2 Defects that should cause an SCBA cylinder to be removed from service include, but are not limited to, cylinders under the following conditions:

(1) Not well cared for and maintained
(2) Dropped, fallen, struck, or crushed
(3) Stored improperly
(4) Degraded, deteriorated, or corroded
(5) In contact with damaging chemicals or an extremely corrosive atmosphere or environment
(6) Damaged, as evidenced by a dent, gouge, crack, scrape, cut, dig, tear, or abrasion
(7) Distorted, discolored, or showing the effects of heat exposure including one or more of the following:
    (a) Charring
    (b) Blistering
    (c) Peeling paint or coating
    (d) Melting
    (e) Loss of resin or loose fibers on composite cylinders

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(8) Partially or fully repainted or treated to hide suspected damage, or heat or fire damage
(9) Leaking
(10) Found depleted when it should have been full with no known reason for it to be in this condition

A.7.2.4.3 Many potential highly toxic or lethal agents exist for which the only known remedy is destruction and disposal. The SCBA manufacturer should affirm a decontamination procedure that achieves both of the following:

(1) Reduces the toxicity of the agent to a level not harmful to the user
(2) Does not adversely affect the performance of the SCBA or component

Decontamination procedures are not known for many toxic or lethal agents. Proper disposal of the SCBA or components exposed to such agents is a joint responsibility of the manufacturer and the user organization.

A.7.2.4.5 No specific design or requalification procedures are outlined in 49 CFR for composite cylinders. Therefore, the DOT developed special certifications known as exemptions. DOT-authorized composite cylinders have a maximum service life indicated in the exemption. Most exemptions specify that composite cylinders have a maximum life of 15 years. The composite cylinder is prohibited from being refilled after 15 years from the original hydrostatic test date. All U.S. retest facilities performing requalifications on composite cylinders are required by DOT to have a current copy of the cylinder's exemption available and to follow its instructions and conditions. DOT, which is the regulatory authority in the United States, specifies the cylinder requalification frequency for all cylinders. The organization/cylinder owner and retest facility are required by DOT to know how often to have the requalification performed. *(See also Annex C.)*

A.7.2.4.6 Some of the rubber (elastomeric) components used in the SCBA have a limited shelf/service life and can degrade below a satisfactory level if used beyond the recommended life. Such aging often appears as cracking or brittleness of the material. SCBA manufacturers often use elastomers such as silicone or ethylene propylene that do not have a limited life, but technicians should be cautious to verify that the usable date has not expired when using materials that do have a limited life.

A.7.3.5 During emergency operations and training, cylinders should be filled in accordance with the SCBA manufacturers' instructions and NIOSH-approved fill methods for the specific cylinder. Fire departments should also review the requirements in Section 7.14 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program.*

Annex B Instructions for External Examination of SCBA Breathing Air Cylinders

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

B.1 Air Cylinder Examination. Instructions for external examination of SCBA cylinders should be obtained from the SCBA manufacturer. If instructions have not been provided or cannot be obtained from the SCBA manufacturer, then the guidelines in B.2 and B.3 can be used.

B.2 Composite SCBA Breathing Air Cylinders. Composite materials often show damage in a variety of ways.

B.2.1 Fiber Damage. Look for signs of the fiber material coming loose or fraying, or for areas where the fiber strands are separating from each other or from the cylinder surface. Look for "frosty" areas; some composite materials when struck with a possibly damaging blow turn a frosty appearance in the area of the damage. Look for signs of cuts, cracks, gouges, and bulges.

B.2.2 Resin Damage. Abnormal resin conditions can also be evidence of damage. Look for signs that the resin part of the composite material is soft, absent or missing, bubbling, or has characteristics described in B.2.4. Look for scrapes or abrasions that have removed the resin coating or expose composite strands.

B.2.3 Chemical Damage. Chemicals can affect resin and composite materials. Some of the effects are not readily apparent and the best way to know what to do is to know if the cylinder has come into contact with any of the following chemical groups:

(1) Solvents such as paint thinners, kerosene, turpentine, paint solvents, paint cleaners, all paint-like products, Stoddard solvent, epoxy solvents, resin removers, organic solvents
(2) Vehicle fluids such as materials that contain benzene, glycol (anti-freeze), battery acids, window wash fluids and other alkalis, oils containing solvents, flammable materials, organic volatile materials, gasoline and oil additives, fuels such as gasohol, methanol, gasoline, diesel
(3) Bases such as materials that contain sodium hydroxide, potassium, and other hydroxides; materials containing strong soap solutions or alkalis
(4) Acids such as materials that are acids or contain any concentration of acids such as hydrochloric, sulfuric, nitric, phosphoric, acetic acid (vinegar)
(5) Corrosives such as materials that contain corrosive components or that are corrosive themselves
(6) Alcohols such as materials that are alcohol or that contain any type of alcohol

If the cylinder has come into contact with an unknown chemical or a chemical not previously listed, contact the SCBA manufacturer for guidance.

B.2.4 Paint Damage. Sometimes, when a painted or coated cylinder has come into contact with one or more of the previously listed chemicals, it is evident by what is happening to the paint. Look for paint that is soft, bubbling, blistering, discolored, lifting off, cracking, or peeling. Knowing what the paint or coating is supposed to look like will be the standard to determine if the cylinder has come into contact with an unknown chemical.

B.3 All-Metal SCBA Breathing Air Cylinders. Metal surfaces are more tolerant to physical and chemical damage than most composite surfaces. Nonetheless, observed metal conditions require that the cylinder be technically inspected.

Look for deep cuts and gouges. Look for dents; dents that are less than 50 mm (2 in.) in diameter are worse than large shallow dents, but no dent over 150 mm (6 in.) in diameter should be acceptable unless it is very shallow. Look for bulges and evidence of heat damage as indicated by charring, coating, or blistering.

Chemical damage to metal surfaces can occur. Look for discolored metal or the paint conditions as noted in B.2.4 if the metal is painted and where the metal looks like the paint has been removed or dissolved. Any discovered condition should be cause to refer the SCBA cylinder to a technical inspection.

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Annex C Requalification of SCBA Breathing Air Cylinders

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

C.1 General. Requalification of SCBA cylinders is required for interstate service in the United States, with a frequency depending on the design type of cylinder. The DOT, through the Research and Special Programs Administration (RSPA) agency, issues retester identification numbers (RIN) to retest facilities that can then legally perform cylinder requalifications. Only the DOT has the authority to issue such numbers in the United States.

C.1.1 An applicant is issued an RIN (or identification number) after meeting the agency's requirements and passing an inspection. A third-party independent inspection agency is charged with performing the application inspections and reporting the results to the RSPA. Once issued, the RIN is good for 5 years provided that the retest facility maintains equipment and personnel at the degree observed at the time of the original application inspection.

C.1.2 The SCBA cylinder requalification process includes a visual inspection, both internal and external; the hydrostatic test; marking or labeling; and maintenance of proper records of the requalification. Each retest facility has to perform all these functions during a cylinder requalification. Information about the hydrostatic retest is found in 49 CFR 173.34(e).

C.2 Exemptions. No specific requalification procedures are outlined in 49 CFR for composite cylinders. Therefore, the DOT developed special certifications known as exemptions.

C.2.1 All composite cylinders authorized for sale and use in the United States have a DOT exemption number. This is what is meant by *DOT-authorized*. Information on exemptions is found in 49 CFR 107.101.

C.2.2 DOT-authorized exempted cylinders are requalified according to specific conditions and frequency written in the exemption. All U.S. retest facilities performing requalifications on composite cylinders are required by DOT to have a current copy of the cylinder's exemption available and have to follow its instructions and conditions. Generally, composite cylinders are requalified every 3 years and all-metal cylinders are requalified every 5 years. The organization/cylinder owner and retest facility are required by DOT to know how often to have the requalification performed.

C.3 Frequency Regulatory Agency. DOT, which is the regulatory authority in the United States, specifies the cylinder requalification frequency. Any agency, cylinder manufacturer, SCBA unit manufacturer, or industry can recommend a more stringent requalification frequency or can recommend a shorter frequency for just the inspection portion of the requalification. The scuba industry, for instance, performs a voluntary annual visual inspection (internal and external) on all-metal scuba cylinders, in addition to the required requalification.

NIOSH and DOT both recommend a different inspection frequency (not requalification) than that required for all-metal SCBA cylinders manufactured by Luxfer USA prior to July 1988. These cylinders were manufactured using 6351 aluminum alloy, and there is a chance for cracking to develop in the neck region (thread region) or crown of the cylinder. Regardless of whether the inspection recommendation is followed or if the cylinder is requalified as required, if the inspection is not properly and diligently performed, the cylinder could be unsafe to fill. This applies to *any* cylinder requalification. The internal and external inspection, hydro testing, marking, and record keeping has to be properly and diligently performed.

Every organization should verify that the retest facility where their SCBA cylinders are requalified is a duly qualified DOT/RSPA retest facility, holds a valid RIN, and is diligently performing the requalification. If in doubt, contact the DOT for verification that the retest facility is authorized or find a different DOT/RSPA retest facility. If the organization suspects that the retest facility has not properly or diligently performed the requalification, the DOT Hazardous Materials Enforcement Branch should be contacted at (202) 366-4700.

DOT-authorized composite cylinders have a maximum service life indicated in the exemption. Most exemptions specify that composite cylinders have a maximum life of 15 years. The composite cylinder is prohibited from being refilled after 15 years from the original hydrostatic test date.

The service life of all-metal cylinders is determined at the time of requalification. If the cylinder passes the requalification, it can be used until the cylinder shows signs of serious external damage *(see* 7.1.2.4 *and Annex* B*)* or until its next requalification.

C.4 Requalification Process. A brief description of the requalification process follows. The cylinder is first de-valved and all internal and external surfaces made visible to the retester. The cylinder is internally and externally visually inspected according to required DOT specifications. If it passes, the hydrostatic test is performed next.

To hydro-test the cylinder, it is placed inside of a water jacket or bath (containing water) that is specially sealed. The cylinder is filled with water. The cylinder is pressurized with more water. The cylinder expands a little and displaces water in the water jacket. The amount of water displaced in the water jacket is measured by a precision method. This amount of water displaced represents how much the cylinder expanded under pressure. When the water pressure returns to normal, the amount of expansion that still exists (the water not taken back into the water jacket) is called the *permanent expansion*. This information is recorded and compared to DOT requirements to determine if the two expansions of the cylinder comply with DOT regulations.

If the cylinder passes the internal and external inspection and retest, the retester marks the all-metal cylinder by stamping into the metal or labels the composite cylinder with a label sealed in resin. The information marked or labeled includes the RIN identification and the retest date. A record is then made of the requalification with the information required by the DOT.

The retester is required to stamp out cylinder DOT markings with Xs or with the word "Condemned" if the cylinder does not pass the requalification process. Cylinders that are fully wrapped with composite materials that do not pass requalification are labeled condemned. The cylinder should be rendered unable to hold pressure with the permission of the cylinder owner. It is recommended that all organizations permit the retest facility to render condemned cylinders unable to hold pressure by drilling through the cylinder or destroying valve threads. A record is made of condemned cylinders, according to DOT requirements.

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Annex D Informational References

D.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

D.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 19B, *Standard on Respiratory Protective Equipment for Firefighters*, 1971 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2007 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1981 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1987 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters*, 1992 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2007 edition.

D.1.2 Other Publications.

D.1.2.1 ANSI Publications. American National Standards Institute Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI Z88.6 *Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, 1984.

D.1.2.2 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.156, 18 June 1998.

Title 49, Code of Federal Regulations, Parts 100–199, 1999.

D.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

D.2.1 CGA Publications. Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4100.

CGA Pamphlet C-6.2, *Guidelines for the Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders.*

D.2.2 DOT Exemptions. Associate Administrator for Hazardous Materials Safety Research and Special Projects Administration, Department of Transportation, Washington, DC 20590, Attention: DHM-31.

D.2.3 PSI Publications. Professional Scuba Inspectors, 6531 NE 198th Street, Seattle, WA 98155.

William L. High, *Inspecting Cylinders.*

SCBA Cylinder Technician Inspection, Training, and Certification.

D.3 References for Extracts in Informational Sections. (Reserved)

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- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
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- "*Notices of intent to make a motion"* are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
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(b) Section/Paragraph 3.3

2. Proposal Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

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Revise definition of effective ground-fault current path to read:

3.3.78 Effective Ground-Fault Current Path. An intentionally constructed, permanent, low impedance electrically conductive path designed and intended to carry ~~underground~~ electric fault current ~~conditions~~ from the point of a ground fault on a wiring system to the electrical supply source.

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