NFPA® 1987

Standard on Combination Unit Respirator Systems for Tactical and Technical Operations

2023 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA® 1987

Standard on

Combination Unit Respirator Systems for Tactical and Technical Operations

2023 Edition

This edition of NFPA 1987, *Standard on Combination Unit Respirator Systems for Tactical and Technical Operations*, was prepared by the Technical Committee on Tactical and Technical Operations Respiratory Protection Equipment and released by the Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. It was issued by the Standards Council on April 4, 2022, with an effective date of April 24, 2022.

This edition of NFPA 1987 was approved as an American National Standard on April 24, 2022.

Origin and Development of NFPA 1987

In August 2015, the Standards Council responded to a new project request submitted by Brian Clifford of the Federal Bureau of Investigation. The request related to the use of respiratory protection equipment for emergency operations that incorporated a combination of respiratory protective methods in one system. This system, at a minimum, would contain the capabilities of a self-contained breathing apparatus (SCBA) and at least one other respiratory protective method [air-purifying respirator (APR) or powered air-purifying respirator (PAPR)]. After review, the Standards Council determined there was a well-established technical need and a demonstrated demand for a standard addressing design, use, testing, and certification of combined unit respirators (CUR) not covered by any existing standards.

The Standards Council assigned this new project to the Technical Committee on Tactical and Technical Operations Respiratory Protection Equipment, because it already had the expertise and diversity to fulfill the request. The technical committee met for the first time to discuss this new standard in July 2016, at NFPA headquarters in Quincy, MA. The Standards Council approved the draft of NFPA 1987 to enter revision cycle in August 2019, as a Fall 2021 document.

This edition of the standard specifies the minimum requirements for the certification (Chapter 4), design (Chapter 6), performance (Chapter 7), and testing (Chapter 8) of new combination unit respirators (CUR) and for replacement parts, components, and accessories for such respirators.

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

Committee Scope: This Committee shall have primary responsibility for documents on the design, performance, testing, and certification of protective clothing and protective equipment manufactured for fire and emergency services organizations and personnel, to protect against exposures encountered during emergency incident operations. This Committee shall also have the primary responsibility for documents on the selection, care, and maintenance of such protective clothing and protective equipment by fire and emergency services organizations and personnel.

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

Committee Scope: This Committee shall have primary responsibility for documents on respiratory protection equipment and selection, care, and maintenance of respiratory protection equipment for non-firefighting emergency services operations including, but not limited to, tactical law enforcement, confined space, and hazardous materials operations, during incidents involving hazardous or oxygen-deficient atmospheres. This Committee does not cover respiratory protection equipment for firefighting operations addressed by the Technical Committee on Respiratory Protection Equipment.

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

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard shall specify the minimum requirements for the design, performance, testing, and certification of new combination unit respirator (CUR) systems and for the replacement parts, components, and accessories for such respirators.

1.1.2 Reserved.

1.1.3 This standard shall not specify requirements for respiratory protection equipment that is used for firefighting operations.

1.1.4* This standard shall not specify requirements for any accessories not certified by the National Institute for Occupational Safety and Health (NIOSH) that could be attached to a CUR.

1.1.5 This standard shall not establish criteria for CURs for water or underwater operations.

1.1.6 This standard shall not establish criteria for protection from ionizing radiation.

1.1.7 Safety.

1.1.7.1 This standard shall not be construed as addressing all of the safety concerns associated with the use of CURs.

1.1.7.2 It shall be the responsibility of the persons and organizations that use CURs to establish safety and health practices and to determine the applicability of regulatory limitations prior to use.

1.1.7.3 This standard shall not be construed as addressing all of the safety concerns, if any, associated with the use of this standard by testing facilities.

1.1.7.4 It shall be the responsibility of the persons and organizations that use this standard to conduct testing of CURs to establish safety and health practices and to determine the applicability of regulatory limitations prior to using this standard for any designing, manufacturing, or testing.

1.1.8 Nothing herein shall restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to establish minimum levels of CUR performance for respiratory protection for emergency services personnel in non-firefighting operations and in atmospheres that are categorized as follows:

(1) Entry into and escape from immediately dangerous to life or health (IDLH) atmospheres when in open-circuit SCBA mode
(2) Entry into non-IDLH and escape from IDLH and non-IDLH atmospheres when in APR mode or PAPR mode

1.2.2* Controlled laboratory tests used to determine compliance with the performance requirements of this standard shall not be deemed as establishing performance levels for all respiratory protective situations and IDLH atmospheres to which personnel can be exposed.

1.2.3 Use.

1.2.3.1 This standard shall not be interpreted or used as a detailed manufacturing or purchase specification.

1.2.3.2 This standard shall be permitted to be referenced in purchase specifications as minimum requirements.

1.2.3.3* This standard shall not address all performance or functional properties of CUR that can be of importance when references as part of purchase specifications.

1.3 Application.

1.3.1 Emergency Services Organizations.

1.3.1.1 This standard shall apply to all CURs used by emergency services organizations for respiratory protection of its personnel during rescue, hazardous materials, and terrorist incident responses, and similar operations where products of combustion, oxygen deficiency, particulates, toxic products, or other IDLH atmospheres exist or could exist at the incident scene.

1.3.1.2* If the CUR is equipped with a universal emergency breathing safety system (UEBSS), the UEBSS performance requirements set forth in this standard shall apply only to CURs

used by emergency services organizations for respiratory protection of its personnel during the applications listed in 1.3.1.1.

1.3.2 This standard shall apply to the design, manufacturing, and certification of new CURs.

1.3.3 This standard shall apply to accessories attached to a CUR that are certified by NIOSH for use with that specific CUR.

1.3.4 Reserved.

1.3.5 This standard shall not apply to closed-circuit self-contained breathing apparatus (SCBA).

1.3.6 This standard shall not apply to accessories that can be attached to CURs but which are not certified by NIOSH for use with that specific CUR.

1.3.7* Except for the cautions and limitations specified in Chapter 5, this standard shall not apply to the use of CURs.

1.4 Units.

1.4.1 In this standard, values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement.

1.4.2 Equivalent values in parentheses shall not be considered as the requirement because those values might be approximate.

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 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection*, 2019 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2018 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc. (operations) 25 West 43rd Street, 4th Floor, New York, NY 10036; (headquarters) 1899 L Street, NW, 11th Floor, Washington, DC 20036.

ANSI/ASA S3.2, *Method for Measuring the Intelligibility of Speech over Communication Systems*, 2009, reaffirmed 2014.

ANSI/ISEA Z87.1, *American National Standard Occupational and Educational Personal Eye and Face Protection Devices*, 2015

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

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2018.

ASTM D395, *Standard Test Method for Rubber Property—Compression Set*, 2018.

ASTM D412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension*, 2016.

ASTM D572, *Standard Test Method for Rubber—Deterioration by Heat and Oxygen*, 2004, reapproved 2015.

ASTM D573, *Standard Test Method for Rubber—Deterioration in Air Oven*, 2004, reapproved 2015.

ASTM D624, *Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers*, 2000, reapproved 2012.

ASTM D746, *Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact*, 2014.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, 2013.

ASTM D2240, *Standard Test Method for Rubber Property—Durometer Hardness*, 2015e1.

ASTM D2632, *Standard Test Method for Rubber Property—Resilience by Vertical Rebound*, 2015.

ASTM D3182, *Standard Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets*, 2016.

2.3.3 CGA Publications. Compressed Gas Association, 8484 Westpark Drive, Suite 220, McLean, VA 22102.

CGA G-7.1, *Commodity Specification for Air*, 2018.

CGA V-1, *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections*, 2019.

2.3.4 DoD Publications. Department of Defense, Naval Publications and Forms Center (NPFC), 5801 Tabor Avenue, Philadelphia, PA 19120.

MIL-STD-282, *Test Method Standard—Filter Units, Protective Clothing, Gas-Mask Components and Related Products: Performance Test Methods*, 2015.

2.3.5 EBU Publications. European Broadcasting Union, L'Ancienne-Route 17A, Postal Box 45 Grand-Saconnex, Geneva, Switzerland.

EBU Technical Recommendation R68, *Alignment level in digital audio production equipment and in digital audio recorders*, 2000.

2.3.6 EN Publications (CEN). European Committee for Standardization Central Secretariat, Rue de la Science 23, B-1040 Brussels, Belgium.

EN 136, *Respiratory protective devices. Full face masks. Requirements, testing, marking*, 1998.

EN 137, *Respiratory protective devices. Self-contained open-circuit compressed air breathing apparatus with full face mask. Requirements, testing, marking*, 2006.

2.3.7 IEC Publications. International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 60268, *Sound System Equipment — Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index*, 2011.

2.3.8 ISO Publications. International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, 1983.

ISO 9001, *Quality management systems — Requirements*, 2015.

ISO 16900-1, *Respiratory protective devices — Methods of test and test equipment — Part 1: Determination of inward leakage*, 2019.

ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*, 2004.

ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*, 2017.

ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*, 2015.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, 2017.

ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services*, 2012.

2.3.9 NIOSH/NPPTL Publications. National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1600 Clifton Road, Room 4505, MS E-20, Atlanta, GA 30329-4027.

NIOSH Standard Test Procedure TEB-APR-STP-0003, *Determination of Exhalation Resistance Test, Air-Purifying Respirators Standard Testing Procedure (STP),* March 15, 2019.

NIOSH Standard Test Procedure TEB-APR-STP-0004, *Determination of Exhalation Valve Leakage Test, Air-Purifying Respirators Standard Testing Procedure (STP),* March 22, 2019.

NIOSH Standard Test Procedure TEB-APR-STP-0007, *Determination of Inhalation Resistance Test, Air-Purifying Respirators Standard Testing Procedures (STP),* March 8, 2019.

NIOSH Standard Test Procedure RCT-APR-STP-0012, *Determination of Air Flow for Powered Air-Purifying Respirators Standard Testing Procedure (STP),* June 6, 2005.

NIOSH Standard Test Procedure RCT-APR-STP-0014, *Determination of Leakage of Drinking Tube and Accessories for Respirator Facepieces Standard Test Procedure (STP),* June 6, 2005.

NIOSH Standard Test Procedure RCT-APR-STP-0025, *Determination of Silica Dust Loading Test for Powered Air-Purifying Respirator Filters Standard Testing Procedure (STP),* June 14, 2005.

NIOSH Standard Test Procedure TEB-APR-STP-0051, *Determination of Particulate Filter Efficiency Level for P100 Series Filters Against Liquid Particulates for Non-Powered, Air-Purifying Respirators Standard Test Procedure (STP),* April 2, 2016.

NIOSH Standard Test Procedure RCT-APR-STP-0060, *Determination of End-of-Service-Life Indicator (ESLI) Drop Test, Air-Purifying Respirators Standard Testing Procedure (STP),* August 24, 2005.

NIOSH Standard Test Procedure RCT-APR-STP-0064, *Determination of Facepiece Carbon-Dioxide and Oxygen Concentration Levels of Tight Fitting Powered Air-Purifying Respirators with the Blower Unit Off or Non-Powered Respirators Standard Testing Procedure (STP),* September 12, 2005.

NIOSH Standard Test Procedure RCT-APR-STP-0065, *Determination of Airflow Resistance in Breath-Responsive, Powered Air-Purifying Respirators Standard Testing Procedures (STP),* September 12, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0100, *Determination of Strength of Hoses and Couplings, Type C, and CE Supplied-Air Respirators Standard Testing Procedure (STP),* June 3, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0101, *Determination of Tightness of Hoses and Couplings, Type C and CE, Supplied-Air Respirators Standard Testing Procedure (STP),* June 3, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0105A, *Determination of Airflow - Demand and Pressure Demand, Type C and CE, Supplied-Air Respirators Standard Testing Procedure (STP),* September 27, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0121, *Determination of Rated Service Time- Open-Circuit, Demand and Pressure-Demand, Self-Contained Breathing Apparatus Standard Testing Procedure (STP),* June 5, 2018.

NIOSH Standard Test Procedure RCT-ASR-STP-0126, *Determination of By-Pass Valve Flow Test - Open-Circuit, Demand and Pressure Demand, Self-Contained Breathing Apparatus Standard Testing Procedure (STP),* May 15, 2019.

NIOSH Standard Test Procedure RCT-ASRS-STP-0128, *Determination of Accuracy of Gauge, Self-Contained Breathing Apparatus Standard Testing Procedure (STP),* September 20, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0140, *Man Tests Self-Contained Breathing Apparatus Standard Testing Procedure (STP),* September 21, 2005.

NIOSH Standard Test Procedure RCT-ASR-STP-0146, *Determination of Diaphragm Over-Pressurization – Open Circuit, Self-Contained Breathing Apparatus with Belt Mounted Regulators and Breathing Tubes Standard Testing Procedure (STP),* September 12, 2005.

NIOSH Standard Test Procedure TEB-CBRN-ASR-STP-0147, *Determination of Mode Transfer Test of Combination, Open-Circuit, Self-Contained Breathing Apparatus and Supplied-Air Respirators Standard Testing Procedure (STP),* September 12, 2005.

NIOSH Standard Test Procedure TEB-CBRN-ASR-STP-0219, *Determination of Open-Circuit, Self-Contained Breathing Apparatus (SCBA) Emergency Breathing Safety Systems (EBSS) Functionality During Low-Temperature Operation Standard Testing Procedure (STP),* January 30, 2014.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0301, *Determination of CBRN Organic Vapor (Cyclohexane) Service Life Test, Air-Purifying Respirators, Standard Test Procedure (STP),* June 29, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0302, *Determination of CBRN Acid Gasses (Cyanogen Chloride) Service Life Test, Air-Purifying Respirators, Standard Test Procedure (STP),* December 12, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0303, *Determination of CBRN Acid Gases (Hydrogen Cyanide) Service Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 12, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0304, *Determination of CBRN Acid Gases (Phosgene) Service Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 12, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0305, *Determination of CBRN Acid Gases (Hydrogen Sulfide) Service-Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 13, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0306, *Determination of CBRN Acid Gases (Sulfur Dioxide) Service Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 13, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0307, *Determination of CBRN Base Gases (Ammonia) Service-Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 21, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0308, *Determination of CBRN Nitrogen Oxide Gases (Nitrogen Dioxide) Service Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 13, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0309, *Determination of CBRN Hydride Gases (Phosphine) Service Life Test, Air-Purifying Respirators Standard Test Procedure,* December 13, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0310, *Determination of CBRN Formaldehyde Service Life Test, Air-Purifying Respirators Standard Test Procedure (STP),* December 13, 2005.

NIOSH Standard Conditioning Procedure CET-APRS-STP-CBRN-0311, *Durability Conditioning Process for Environmental, Transportation and Rough Handling Use Conditions on Chemical, Biological, Radiological, and Nuclear (CBRN) Respiratory Protective Devices (RPD) Standard Conditioning Procedure (SCP),* December 8, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0314, *Determination of Lens Fogging on Full-Facepiece Chemical Biological Radiological and Nuclear (CBRN) Air-Purifying Respirators Standard Test Procedure (STP),* December 22, 2005.

NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0316, *Determination of Haze and Luminous Transmittance Properties and Abrasion Resistance Properties of the Primary Lens System Material for Full Facepiece Respiratory Protective Devices (RPD) Standard Test Procedure (STP),* October 24, 2005.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0066, *Determination of Determination of End-of-Service-Life Indicator (ESLI) Standard Testing Procedure (STP),* September 12, 2005.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0800, *Determination of Laboratory Respirator Protection Level (LRPL) Values for Combination Unit Respirators (CURs) Standard Testing Procedure (STP),* January 24, 2019.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0801, *Determination of Combination Unit Respirators (CURs) Performance During Dynamic Testing Against Chemical Agent Distilled Sulfur Mustard (HD) Vapor and Liquid, Standard Test Procedure (STP),* January 24, 2019.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0802, *Determination of Combination Unit Respirators (CURs) Performance During Dynamic Testing Against the Chemical Agent Sarin (GB) Vapor, Standard Testing Procedure,* January 24, 2019.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0819, *Determination of Combination Unit Respirators (CURs) Functionality, Including Mode Switching, During Low-Temperature Operation, Standard Test Procedure,* January 24, 2019.

NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0848, *Determination of Remote Gauge Leak Flow Test for Combination Unit Respirators (CURs), Standard Testing Procedure (STP),* January 24, 2019.

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

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations*, Sixth edition, 2002.

ANSI/UL 121201, *Non-incendive Electric Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*, 2017.

2.3.11 US Government Publications. US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 42, Code of Federal Regulations, Part 84, "Approval of Respiratory Protective Devices," 1 October 1995.

2.3.12 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2014.

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

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of

products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

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

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

3.3 General Definitions.

3.3.1 Accessory. Any item that could be attached to a certified product but that is not necessary for the certified product to meet the requirements of this standard.

3.3.2 Accreditation. Third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks, including sampling and testing, inspection, certification, and registration.

3.3.3 Air Purification Component. The air purification element of air-purifying respirators (APRs) and powered air-purifying respirators (PAPRs) that removes gases, vapors, and solid or liquid aerosols from the inspired air.

3.3.4 Air-Purifying Respirator (APR). A respirator that removes specific air contaminants by passing ambient air through one or more air purification components.

3.3.5 Atmosphere-Supplying Respirator. A respirator that supplies the user with breathing air from a source independent of the ambient atmosphere and includes a self-contained breathing apparatus (SCBA) or a supplied air respirator (SAR), or both. *[See also 3.3.61, Self-Contained Breathing Apparatus (SCBA).]*

3.3.6 Audit. Systematic, independent, documented process for obtaining records, statements of fact, or other relevant information and assessing them objectively to determine the extent to which specified requirements are fulfilled.

3.3.7 Breathing Air. See 3.3.19, Compressed Breathing Air.

3.3.8 Breathing Air Cylinder. The pressure vessel or vessels that are an integral part of the SCBA and that contain the breathing gas supply; can be configured as a single cylinder or other pressure vessel or as multiple cylinders or pressure vessels.

3.3.9 Breathing Air/Gas Container. See 3.3.8, Breathing Air Cylinder.

3.3.10 Certification. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine continued compliance of labeled and listed products with the requirements of this standard.

3.3.11 Certification Organization. An independent third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program.

3.3.12 Certified. The resultant condition of a product having undergone certification in accordance with the requirements of this standard.

3.3.13 Char. The formation of a brittle residue when material is exposed to thermal energy.

3.3.14 Closed-Circuit SCBA. A recirculation-type SCBA in which the wearer rebreathes exhaled gas after the carbon dioxide has been removed from the exhalation gas and the oxygen content within the system has been restored from sources such as compressed breathing air, chemical oxygen, liquid oxygen, or compressed gaseous oxygen.

3.3.15 Combination Unit Respirator. A respirator that employs technology of two or more different types of respiratory protective devices, comprising at least an open-circuit SCBA, and which provides the wearer a method of mode selection in an operational environment.

3.3.16 Compliance. The condition of meeting or exceeding all applicable requirements of this standard.

3.3.17 Compliant. Meeting or exceeding all applicable requirements of this standard.

3.3.18* Component. Any material, part, or subassembly used in the construction of the compliant product.

3.3.19* Compressed Breathing Air. A respirable gas mixture derived from normal atmospheric air or from manufactured synthetic air, stored in a compressed state in a storage pressure vessel or a respirator breathing air cylinder, and supplied to the user in a gaseous form.

3.3.20 CUR. See 3.3.15, Combination Unit Respirator.

3.3.21 Cylinder. See 3.3.8, Breathing Air Cylinder.

3.3.22 Drip. To run or fall in drops or blobs.

3.3.23 End-of-Service-Life Indicator (ESLI). An indicator, often a color change, that the contaminant will no longer be able to be removed by the air purification element and that the air-purification element should be replaced.

3.3.24 End-of-Service-Time Indicator (EOSTI). A warning device on an SCBA that warns the user that the end of the breathing air supply is approaching.

3.3.25 EOSTI. See 3.3.24, End-of-Service-Time Indicator (EOSTI).

3.3.26 ESLI. See 3.3.23, End-of-Service-Life Indicator (ESLI).

3.3.27 Fabric Component. Natural or synthetic material, or combination of materials, that is pliable and made by weaving, felting, forming, or knitting.

3.3.28 Facepiece. The component of a CUR that covers the wearer's nose, mouth, and eyes.

3.3.29 Failure Modes and Effects Analysis (FMEA). A risk assessment technique for systemically identifying potential failures in a system or a process.

3.3.30 Follow-Up Program. The sampling, inspections, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of labeled and listed products that are being produced by the manufacturer to the requirements of this standard.

3.3.31 Gas. Matter in a gaseous state at standard temperature and pressure.

3.3.32 HATS. See 3.3.34, Head and Torso Simulator (HATS).

3.3.33 Haze. Light that is scattered as a result of passing through a transparent object.

3.3.34 Head and Torso Simulator (HATS). A manikin with built-in ear and mouth simulators that provides a realistic reproduction of the acoustic properties of an average adult human head and torso.

3.3.35 Heads-Up Display (HUD). Visual display of information and system condition status visible to the wearer.

3.3.36 HUD. See 3.3.35, Heads-Up Display (HUD).

3.3.37 Identical CUR. CUR that are produced to the same engineering and manufacturing specifications.

3.3.38 IDLH. See 3.3.39, Immediately Dangerous to Life or Health (IDLH).

3.3.39 Immediately Dangerous to Life or Health (IDLH). An atmosphere that poses a threat of exposure to airborne contaminants where that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

3.3.40 Inspection. Examination of a product design, product, process, or installation and determination of its conformity with specific requirements or, based on professional judgment, with general requirements.

3.3.41 Manufacturer. The entity to whom the certification is issued that directs and controls any of the following: compliant product design, compliant product manufacturing, or compliant product quality assurance; also, the entity that assumes liability for the compliant product or provides the end user warranty for a compliant product.

3.3.42 Melt. A response to heat by a material, resulting in evidence of flowing or dripping.

3.3.43 Microphone Measurement Point (MMP). A point 1.5 m (59 in.) in front of and on the axis of the lip position of a typical human mouth, or an artificial mouth, and 1.5 m (59 in.) above the floor.

3.3.44 MMP. See 3.3.43, Microphone Measurement Point (MMP).

3.3.45 Mode of Operation. A respiratory mode described by the type of respiratory protective device that typically employs that technology, such as APR, PAPR, or SCBA.

3.3.46 Mouth Reference Point (MRP). A point 50 mm (1.9 in.) in front of and on the axis of the lip position of a typical human mouthor of an artificial mouth.

3.3.47 MRP. See 3.3.46, Mouth Reference Point (MRP).

3.3.48 Negative Pressure (Demand) Mode. A CUR mode of operation in which the pressure inside the facepiece, in relation to the pressure surrounding the outside of the facepiece, is negative during inhalation.

3.3.49 Open-Circuit SCBA. An SCBA in which exhalation is vented to the atmosphere and not rebreathed.

3.3.50 PAPR. See 3.3.52, Powered Air-Purifying Respirator (PAPR).

3.3.51 Pink Noise. Noise that contains constant energy per octave band.

3.3.52 Powered Air-Purifying Respirator (PAPR). An air-purifying respirator that uses a powered blower to force the ambient air through one or more air purification components to the facepiece.

3.3.53 PPE. Personal protective equipment.

3.3.54 Pressure Demand SCBA. An SCBA in which the pressure inside the facepiece, in relation to the pressure surrounding the outside of the facepiece, is positive during both inhalation and exhalation when tested by NIOSH in accordance with 42 CFR 84, Subpart H.

3.3.55* Product Label. A marking provided by the manufacturer for each compliant product, containing compliance statements, certification statements, manufacturer and model information, or similar data.

3.3.56 Rapid Intervention Crew/Company Universal Air Connection (RIC UAC). A system that allows emergency replenishment of breathing air to the SCBA of disabled or entrapped emergency services personnel.

3.3.57 Rated Service Time. The period of time, stated on a certification label, that the SCBA supplied air to the breathing machine when tested to 42 CFR 84.

3.3.58 RIC. Rapid intervention crew/company.

3.3.59 Sample. (1) Product, component, or accessory randomly selected from the manufacturer's production line, the manufacturer's inventory, or the open market. (2) Product, component, or accessory that is conditioned for testing. *(See also 3.3.65, Specimen.)*

3.3.60 SCBA. See 3.3.61, Self-Contained Breathing Apparatus (SCBA).

3.3.61* Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator the breathing air source of which is designed to be carried by the user.

3.3.62 Service Life. The period for which a compliant product should be useful before retirement.

3.3.63 Service Time. See 3.3.57, Rated Service Time.

3.3.64 Sound Pressure Level (SPL). The local pressure deviation from the ambient (i.e., average or equilibrium) atmospheric pressure caused by a sound wave.

3.3.65 Specimen. The conditioned product, component, or accessory that is tested from a sample thereof. (*See also 3.3.59, Sample).*

3.3.66 Speech Transmission Index (STI). A measure of intelligibility of speech quality on a scale of intelligibility, the values of which vary from 0 (completely unintelligible) to 1 (perfect intelligibility).

3.3.67 SPL. See 3.3.64, Sound Pressure Level (SPL).

3.3.68 STI. See 3.3.66, Speech Transmission Index (STI).

3.3.69 Switchover Element(s). A means within the CUR for selecting a mode of operation—SCBA, APR, or PAPR—that isolates one operational mode from any other.

3.3.70 Synthetic Breathing Air. Manufactured breathing air produced by blending nitrogen and oxygen. *(See also 3.3.19, Compressed Breathing Air.)*

3.3.71 Testing. Determination of one or more characteristics of an object of conformity assessment, according to a procedure, which typically applies to materials, products, or processes.

3.3.72 UAC. See 3.3.73, Universal Air Connection (UAC).

3.3.73 Universal Air Connection (UAC). The male fitting affixed to the CUR and the female fitting affixed to the filling hose that allow emergency replenishment of breathing air to a CUR breathing air cylinder. *[See also 3.3.56, Rapid Intervention Crew/Company Universal Air Connection (RIC).]*

3.3.74 Universal Emergency Breathing Safety System (UEBSS). A device on a CUR that allows users to share their available air supply in an emergency situation.

3.3.75 Variant. A grouping of subassemblies having common functional or design characteristics, the assembly of multiple variants of which results in a CUR model configuration.

Chapter 4 Certification

4.1 General.

4.1.1 The process for certification of CUR as being compliant with NFPA 1987 shall meet the requirements of Sections 4.1 through 4.8.

4.1.2 All CUR that are labeled as being compliant with this standard shall comply with both of the following:

(1) Meet or exceed all applicable requirements specified in this standard
(2) Be certified

4.1.3 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 4.2 and that is accredited for personal protective equipment (PPE) in accordance with ISO/IEC 17065.

4.1.4 Manufacturers shall not either claim compliance with a portion(s) or segment(s) of the requirements of this standard or use the name or identification of this standard, NFPA 1987, in any statements about their respective product(s) unless the product(s) is certified as compliant with this standard.

4.1.5 Listings.

4.1.5.1 All compliant CUR shall be listed by the certification organization.

4.1.5.2 All listings shall uniquely identify the certified product by, at a minimum, style or model number.

4.1.6 All compliant CUR shall have a product label that meets the requirements specified in Chapter 5.

4.1.7 The certification organization's label, symbol, or identifying mark shall be one of the following:

(1) Attached to the product label
(2) Part of the product label
(3) Immediately adjacent to the product label.

4.1.8 Reserved.

4.1.9 Reserved.

4.1.10 Reserved.

4.2 Certification Program.

4.2.1* The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified.

4.2.2 Interests.

4.2.2.1 The certification organization shall be primarily engaged in certification work.

4.2.2.2 The certification organization shall not have a monetary interest in the product's ultimate profitability.

4.2.3 Certification Organizations.

4.2.3.1 All certification organizations shall be accredited for PPE in accordance with ISO/IEC 17065.

4.2.3.2 The accreditation referenced in 4.2.3.1 shall be issued by an accreditation body operating in accordance with ISO/IEC 17011.

4.2.4 The certification organization shall refuse to certify products to this standard that do not comply with all applicable requirements of this standard.

4.2.5* The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of this standard.

4.2.5.1 The certification organization shall not offer or confer any conditional, temporary, or partial certifications.

4.2.5.2 Manufacturers shall not be authorized to use any reference to the certification organization or any label that references this standard on products that are not compliant with all applicable requirements of this standard.

4.2.6* The certification organization shall have laboratory facilities and equipment available for conducting tests to determine product compliance.

4.2.6.1 The certification organization laboratory facilities shall have both of the following:

(1) Programs in place and functioning for calibration of all instruments
(2) Procedures in use to ensure control of all testing

4.2.6.2 The certification organization laboratory facilities shall follow good practice regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

4.2.7 The certification organization shall require the manufacturer to establish and maintain a quality assurance program that meets the requirements of Section 4.5.

4.2.7.1 The certification organization shall require the manufacturer to have a product recall system as specified in Section 4.8 as part of the manufacturer's quality assurance program.

4.2.7.2 The certification organization shall audit the manufacturer's quality assurance program to ensure that the quality assurance program provides continued product compliance with this standard.

4.2.8 The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the compliant product to determine its continued certification to the 20XX edition of NFPA 1987.

4.2.9* The certification organization shall have a follow-up inspection program of the manufacturing facilities of the compliant product, with at least two random visits per 12-month period to verify the product's continued compliance.

4.2.9.1 As part of the follow-up inspection program, the certification organization shall select sample product at random from the manufacturer's production line, the manufacturer's in-house stock, or the open market.

4.2.9.2 Sample product shall be evaluated by the certification organization to verify the product's continued compliance to ensure that the materials, components, and manufacturing quality assurance systems are consistent with the materials, components, and manufacturing quality assurance that were inspected and tested by the certification organization during initial certification and recertification.

4.2.9.3 The certification organization shall be permitted to conduct specific testing to verify the product's continued compliance.

4.2.9.4 For products, components, and materials for which prior testing, judgment, and experience of the certification organization have shown results to be in jeopardy of not complying with this standard, the certification organization shall conduct more frequent testing of sample product, components, and materials acquired in accordance with 4.2.9.1 against the applicable requirements of this standard.

4.2.10 The certification organization shall have in place a series of procedures, as specified in Section 4.6, that address report(s) of situation(s) in which a compliant product is subsequently found to be hazardous.

4.2.11 Appeals.

4.2.11.1 The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions.

4.2.11.2 The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

4.2.12 Name and Label.

4.2.12.1 The certification organization shall be in a position to use legal means to protect the integrity of its name and label.

4.2.12.2 The name and label shall be registered and legally defended.

4.3* Inspections and Testing.

4.3.1 For both certification and recertification of CUR, the certification organization shall conduct both the inspection and the testing specified in this section.

4.3.2 All inspections, evaluations, conditioning, and testing for nongovernmental certification or recertification shall be conducted by a certification organization's testing laboratory that is accredited in accordance with the requirements of ISO/IEC 17025.

4.3.2.1 The nongovernmental certification organization's testing laboratory's scope of accreditation to ISO/IEC 17025 shall encompass testing of PPE.

4.3.2.2 The accreditation of a nongovernmental certification organization's testing laboratory shall be issued by an accreditation body operating in accordance with ISO/IEC 17011.

4.3.3 A certification organization shall be permitted to utilize conditioning and testing results conducted by a product or component manufacturer for certification or recertification provided the manufacturer's testing laboratory meets the requirements specified in 4.3.3.1 through 4.3.3.5.

4.3.3.1 The manufacturer's testing laboratory shall be accredited in accordance with the requirements of ISO/IEC 17025.

4.3.3.2 The manufacturer's testing laboratory's scope of accreditation to ISO/IEC 17025 shall encompass testing of PPE.

4.3.3.3 The accreditation of a manufacturer's testing laboratory shall be issued by an accreditation body operating in accordance with ISO/IEC 17011.

4.3.3.4 The certification organization shall approve the manufacturer's testing laboratory.

4.3.3.5 The certification organization shall determine the level of supervision and witnessing of the conditioning and testing for certification or recertification conducted at the manufacturer's testing laboratory.

4.3.4 Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to ensure reliability at a confidence level that products certified to this standard are compliant, unless such sampling levels are specified herein.

4.3.5 Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachments, compliance statements, certification statements, and other product information are specified for the CUR as in Section 5.1.

4.3.6 Inspection by the certification organization shall include an evaluation of any symbols and pictorial graphic representations used on product labels or in user information, as permitted in 5.1.5, to ensure that the symbols are explained in the product's user information package.

4.3.7 Inspection by the certification organization shall include a review of the user information required by Section 5.2 to ensure that the information has been developed and is available.

4.3.8 Inspection and evaluation by the certification organization for determining compliance with the design requirements specified in Chapter 6 shall be performed on whole or complete products.

4.3.9 CUR and CUR components shall be subjected to the tests specified in Table 4.3.9(a) through Table 4.3.9(d) for each series.

4.3.10 Certification and Performance.

4.3.10.1 CUR shall be initially tested for certification.

4.3.10.2 CUR shall meet the performance requirements of three separate test series as specified in the categories of Table 4.3.9(a), Table 4.3.9(b), Table 4.3.9(c), or Table 4.3.9(d), and categories as specified in Table 4.3.9(a), Table 4.3.9(b), Table 4.3.9(c), or Table 4.3.9(d).

4.3.10.3 Categories as specified in Table 4.3.9(a), Table 4.3.9(b), Table 4.3.9(c), or Table 4.3.9(d), which are designed as cumulative damage tests, shall be conducted in the order specified.

4.3.11 Certification and Performance for CUR Lens Components.

4.3.11.1 CUR lens components shall be initially tested for certification.

4.3.11.2 CUR lens components shall meet the performance requirements of one test series of Category G, as specified in Table 4.3.9(a).

4.3.11.3 CUR component testing in Category G shall be conducted on test specimens as specified in the respective test method.

4.3.12 After certification, compliant CUR and components of compliant CUR shall meet both of the following:

(1) Be tested annually within 12 months of previous tests
(2) Performance requirements of one test series as specified in the categories of Table 4.3.9(a), excluding Categories A, B and C; and Table 4.3.9(b), excluding Category A.

4.3.13 A minimum of five identical CUR that are to be certified to this standard shall be selected from the manufacturer's production.

4.3.14 The CURs shall be subjected to the tests listed sequentially in Table 4.3.9(a), Table 4.3.9(b), Table 4.3.9(c), or Table 4.3.9(d).

4.3.15 Components.

4.3.15.1 Components from CUR that are to be certified to this standard shall be subjected to the tests specified in Category G of Table 4.3.9(a).

4.3.15.2 CUR component testing in Category G shall be conducted on test specimens as specified in each respective test method.

4.3.16 The requirement specified in 4.3.12 shall be waived every fifth year when the testing required by 4.3.17 is conducted.

4.3.17 Compliant CUR shall meet the testing and performance requirements of three separate test series as specified in the categories of Table 4.3.9(a), Table 4.3.9(b), Table 4.3.9(c), or Table 4.3.9(d) every fifth year from the date of the initial certification testing specified in 4.3.10.

4.3.18 CUR Lens Component Testing and Performance.

4.3.18.1 CUR lens components shall meet the testing and performance requirements of one test series of Category G, as specified in Table 4.3.9(a), every fifth year from the date of the initial certification testing specified in 4.3.10.

Table 4.3.9(a) Series Tests

Category A (CUR #1)	Category B (CUR #2)	Category C (CUR #3)	Category D (CUR #4)	Category E (CUR #5)	Category F (CUR #6)	Category G (CUR #7)
Chemical Agent Permeation and Penetration Resistance Against Distilled Sulfur Mustard (HD), see 8.1.1	Chemical Agent Permeation and Penetration Resistance Against Sarin (GB), see 8.1.1	Field of View Performance, see 8.1.3	Nonelectronic Communications Performance, see 8.1.6	Carbon Dioxide (CO_2) Content Performance, see 8.1.9	Flame Resistance Performance, see 8.1.8	Rigid Facepiece Lens Abrasion Resistance Performance, see 8.1.4
		LRPL, see 8.1.2	Supplementary Voice Communications System Performance, see 8.1.7			Flexible Facepiece Lens Abrasion Resistance Performance, see 8.1.5
			Low-Power Capacity, see 8.1.11			
			Immersion Leakage Performance, see 8.1.10			

Table 4.3.9(b) Series Tests

Category A (CUR #1)	Category B (CUR #2)	Category C (CUR #3)	Category D (CUR #4)	Category E (CUR #5)
	CUR Airflow Performance, see 8.2.11	CUR Airflow Performance, see 8.2.11	CUR Airflow Performance, see 8.2.11	CUR Gauge Accuracy Performance, see 8.2.9
Exhalation Valve Leakage Performance, see 8.2.1	Environmental Temperature Performance, see 8.2.12	Corrosion Resistance Performance, see 8.2.14	Vibration Resistance Performance, see 8.2.13	CUR Remote Gauge Leakage Flow Performance, see 8.2.10
Service Time Performance, see 8.2.2	Universal Emergency Breathing Safety System (UEBSS) Cold Temperature Performance, see 8.2.20	Universal Emergency Breathing Safety System (UEBSS) Cold Temperature Performance, see 8.2.20		EOSTI Alarm Recognition, see 8.2.16
Integrity of Coupling Performance, see 8.2.5	Particulate Resistance Performance, see 8.2.15	Breathing Air Pressure Vessel Performance, see 8.2.19		CUR HUD Performance, see 8.2.17
CUR Standby Air Supply Airflow Performance, see 8.2.6				RIC UAC Performance, see 8.2.18
Connection to a Remote Air Source Performance, see 8.2.7				
CUR Air Flow Capabilities in Event of Second Stage Regulator Failure Performance, see 8.2.8				
Low-Temperature Man Test Performance, see 8.2.3				
Physical Exertion Man Test A Performance, see 8.2.4				
Physical Exertion Man Test B Performance, see 8.2.4				

4.3.18.2 CUR component testing in Category G shall be conducted on test specimens as specified in each respective test method.

4.3.19 The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the product or any product component prior to the product's submission for evaluation and testing by the certification organization.

4.3.19.1 The certification organization shall accept from the manufacturer for evaluation and testing for certification only product or product components that are the same in every respect to the actual final product or product component.

4.3.19.2 The certification organization shall not allow the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

Table 4.3.9(c) Series Tests

Category A (CUR #1)
PAPR Airflow Performance, see 8.3.1
Facepiece Carbon Dioxide and Oxygen Concentration Levels Performance with the PAPR Blower Off, see 8.3.4
Airflow Resistance Performance in Breathing-Responsive, Powered Air-Purifying Respirators (if equipped), see 8.3.2
PAPR Silica Dust Loading Performance, see 8.3.3

4.3.20 Adjustments or Repair or Replacement Parts.

4.3.20.1 No adjustment or repair or replacement of parts shall be permitted to any CUR being tested in accordance with this standard, except as provided in 4.3.20.2.

Table 4.3.9(d) Series Tests

Category A (CUR #1)	Category B (CUR #2)	Category C (CUR #3)
Breathing Resistance Performance, see 8.4.1 and 8.4.2	Canister Challenge and Breakthrough Concentrations Performance, see 8.4.4 to 8.4.5.10	Particulate/ Aerosol Canister Performance, see 8.4.4 and 8.4.6
Hydration Leakage Performance (if equipped), see 8.4.3		
End-of-Service-Life Indicator Drop Performance (if equipped), see 8.4.8		
End-of-Service-Life Indicator Performance for Canisters (if equipped), see 8.4.9		
Low-Temperature/Fogging Performance, see 8.4.7		

4.3.20.2 Breathing air pressure vessels shall be permitted to be filled as required.

4.3.21 Accessories.

4.3.21.1 Where CUR are provided with an attached accessory or accessories, the CUR with accessories installed shall be tested to all of the performance requirements specified in Chapter 7.

4.3.21.2 Accessories shall not cause degradation of the performance of the CUR.

4.3.21.3 The accessories themselves shall not be required to pass the performance testing unless specifically specified herein.

4.3.22 After completion of testing for a specific model CUR or its variant, only those tests on other similar CUR models or variants shall be required where, in the determination of the certification organization, the CUR's test results can be affected by any components or certified accessories that are different from those on the original CUR tested.

4.3.23 Modifications.

4.3.23.1 Any modifications made to a CUR or to any certified accessories provided for a CUR by the CUR manufacturer after certification shall require retesting and the meeting of the performance requirements of all those individual tests that the certification organization determines could be affected by such changes.

4.3.23.2 The retesting as stated in 4.3.23.1 shall be conducted before the modified CUR is certified as being compliant with this standard.

4.3.24 Data.

4.3.24.1 The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the certification of the manufacturer's compliant product.

4.3.24.2 The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

4.4 Recertification.

4.4.1 All CUR models that are labeled as being compliant with this standard shall undergo recertification on an annual basis.

4.4.2 Recertification shall include inspection and evaluation to all design requirements and testing to all performance requirements as required by 4.3.8 and 4.3.12 on all manufacturer models and components.

4.4.3 Data.

4.4.3.1 The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the recertification of manufacturer models and components.

4.4.3.2 The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

4.4.4 Follow-Up Inspection.

4.4.4.1 It is permissible for product to be manufactured for the follow-up inspection program to ensure correct configuration is available at the request of the certification organization.

4.4.4.2 Samples shall be selected at random from a product completed on the manufacturer's production line.

4.5 Manufacturers' Quality Assurance Programs.

4.5.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 4.2.7.1 and Section 4.8.

4.5.2 The operation of the quality assurance program shall evaluate and test compliant product production to the requirements of this standard to ensure that production remains in compliance.

4.5.3 The manufacturer shall be registered to ISO 9001.

4.5.3.1 Registration to the requirements of ISO 9001 shall be conducted by a registrar that is accredited for PPE.

4.5.3.2 Registrars specified in 4.5.3.1 shall be accredited for PPE in accordance with ISO/IEC 17021.

4.5.4* Any entity that does not manufacture or assemble the compliant product but meets the definition of manufacturer as specified in 3.3.41 and therefore is considered to be the manufacturer shall meet the requirements specified in Section 4.5.

4.5.5* Where the manufacturer uses subcontractors in the construction or assembly of the compliant product, both of the following shall apply:

(1) Locations and names of all subcontractor facilities shall be documented.
(2) Documentation shall be provided to the manufacturer's ISO registrar and the certification organization.

4.6 Hazards Involving Compliant Product.

4.6.1 Procedures.

4.6.1.1 The certification organization shall establish procedures to be followed where situation(s) are reported in which a compliant product is subsequently found to be hazardous.

4.6.1.2* The procedures as stated in 4.6.1.1 shall comply with the provisions of ISO Guide 27 and as modified herein.

4.6.2* Where a report of a hazard involved with a compliant product is received by the certification organization, both of the following shall apply:

(1) The certification organization shall contact NIOSH National Personal Protective Technology Laboratory (NIOSH/NPPTL)
(2) The validity of the report shall be investigated following the procedures established by NIOSH/NPPTL.

4.6.3 With respect to a compliant product, a hazard shall be a condition or create a situation that results in exposing life, limb, or property to an imminently dangerous or dangerous condition.

4.6.4 Where a specific hazard is identified, the determination of the action for the manufacturer to undertake shall take into consideration the severity of the hazard and its consequences to the safety and health of users.

4.6.5 Where it is established that a hazard is involved with a compliant product, the certification organization, in coordination with NIOSH/NPPTL, shall determine the scope of the hazard, including products, model numbers, serial numbers, factory production facilities, production runs, and quantities involved.

4.6.6 The investigation shall include, but not be limited to, the extent and scope of the problem as it might apply to other compliant product or compliant product components manufactured by other manufacturers or certified by other certification organizations.

4.6.7 The certification organization, in coordination with NIOSH/NPPTL, shall also investigate reports of a hazard where compliant product is gaining widespread use in applications not foreseen when this standard was written, such applications in turn being ones for which the product was not certified, and no specific scope of application has been provided in this standard, and no limiting scope of application was provided by the manufacturer in written material accompanying the compliant product at the point of sale.

4.6.8 The certification organization, in coordination with NIOSH/NPPTL, shall require the manufacturer of the compliant product or the manufacturer of the compliant product component, if applicable, to assist the certification organization and NIOSH/NPPTL in the investigation and to conduct its own investigation as specified in Section 4.7.

4.6.9 Where the facts indicating a need for corrective action are conclusive and the manufacturer has exhausted all appeal rights, the certification organization, in coordination with NIOSH/NPPTL, shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

4.6.10 Where the facts are conclusive and corrective action is indicated, but there is no manufacturer to be held responsible, such as where the manufacturer has gone out of business or is bankrupt, the certification organization, in coordination with NIOSH/NPPTL, shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.6.11* Where the facts are conclusive and corrective action is indicated, the certification organization, in coordination with NIOSH/NPPTL, shall take one or more of the following corrective actions:

(1) Parties authorized and responsible for issuing a safety alert shall be notified when, in the opinion of the certification organization and NIOSH/NPPTL, such a safety alert is necessary to inform the users.
(2) Parties authorized and responsible for issuing a product recall shall be notified when, in the opinion of the certification organization and NIOSH/NPPTL, such a recall is necessary to protect the users.
(3) The mark of certification shall be removed from the product.
(4) Where a hazardous condition exists and it is not practical to implement 4.6.11(1), 4.6.11(2), or 4.6.11(3), or the responsible parties refuse to take corrective action, the certification organization, in coordination with NIOSH/NPPTL, shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.6.12 The certification organization, in coordination with NIOSH/NPPTL, shall provide a report to the organization or individual identifying the reported hazardous condition and notify that organization or individual of the corrective action indicated or that no corrective action is indicated.

4.7 Manufacturers' Investigations of Complaints and Returns.

4.7.1 Manufacturers shall provide corrective action in accordance with ISO 9001 for investigating written complaints and returned products.

4.7.2 Manufacturers' records of returns and complaints related to safety issues shall be retained for at least 5 years.

4.7.3 Where the manufacturer discovers, during the review of specific returns or complaints, that a compliant product or compliant product component can constitute a potential safety risk to end users and is possibly subject to a safety alert or product recall, the manufacturer shall immediately contact NIOSH/NPPTL and the certification organization and provide all information about its review to assist NIOSH/NPPTL and the certification organization with their investigation.

4.8 Manufacturers' Safety Alert and Product Recall Systems.

4.8.1 Manufacturers shall establish a written safety alert system and a written product recall system that describe the procedures to be used in the event that they decide or are directed by the certification organization or NIOSH/NPPTL to either issue a safety alert or conduct a product recall.

4.8.2 The manufacturers' safety alert and product recall systems shall provide the following:

(1) The establishment of a coordinator and responsibilities by the manufacturer for the handling of safety alerts and product recalls
(2) A method of notifying all dealers, distributors, purchasers, users, and the National Fire Protection Association

(NFPA) about the safety alert or product recall that can be initiated within a 1-week period following the manufacturer's decision to issue a safety alert or conduct a product recall or after the manufacturer has been directed by the certification organization or NIOSH/NPPTL to issue a safety alert or conduct a product recall

(3) Techniques for communicating the nature of the safety alert or product recall and, in particular, the specific hazard or safety issue found to exist
(4) Procedures for removing product that is recalled and for documenting the effectiveness of the product recall
(5) A plan for repairing, replacing, or compensating purchasers for returned product

Chapter 5 Labeling and Information

5.1 Product Label Requirements.

5.1.1 In addition to other certification labels, each CUR shall have a CUR system product label permanently attached to the CUR system.

5.1.2 Multiple Labels.

5.1.2.1 Multiple label pieces shall be permitted in order to carry all statements and information required to be on the CUR systems product label.

5.1.2.2 All pieces of the CUR system product label shall be located adjacent to each other.

5.1.3 The certification organization's label, symbol, or identifying mark shall conform to all of the following:

(1) Be attached to other certification labels and the CUR system product label, or be part of the product labels
(2) Be placed in a conspicuous location
(3) Have letters at least 2.5 mm ($\frac{3}{32}$ in.) in height
(4) Have all labels, symbols, or identifying marks at least 6 mm ($\frac{15}{64}$ in.) in height

5.1.4 All worded portions of both required product labels shall be at least in English.

5.1.5 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

5.1.6 Product Label.

5.1.6.1 The CUR product label shall bear the following printed compliance statement:

WHEN ASSEMBLED WITH ALL REQUIRED COMPONENTS, THIS COMBINATION UNIT RESPIRATOR MEETS THE REQUIREMENTS OF NFPA 1987, STANDARD ON COMBINATION UNIT RESPIRATOR SYSTEMS FOR TACTICAL AND TECHNICAL OPERATIONS, 20XX EDITION.

DO NOT USE FOR FIREFIGHTING

DO NOT REMOVE THIS LABEL

5.1.6.2 All letters and numbers shall be at least 2 mm (0.07 in.) in height.

5.1.7 Where applicable, each APR, PAPR, and SCBA assembly shall be marked with the lot number, the serial number, or year and month of manufacture.

5.2 User Information.

5.2.1 The CUR system manufacturer shall provide with each CUR system at least the information and training materials specified within this section.

5.2.2 Upon request at the time of purchase, the CUR manufacturer shall provide to the purchaser an information sheet with each CUR that documents at least the following:

(1) Manufacturer name and address
(2) Manufacturing performance tests conducted at time of manufacture and the results
(3) Date of manufacture
(4) Model number
(5) Serial number
(6) Lot number, if applicable
(7) Hydrostatic test dates and results, if applicable

5.2.3 Information regarding CURs and their modes of operation shall be provided.

5.2.4 Information or training materials regarding preuse shall be provided at least on the following areas:

(1) Safety considerations
(2) Limitations of use
(3) Charging breathing air pressure vessels
(4) Breathing air quality in accordance with NFPA 1989
(5) Marking recommendations and restrictions
(6) Warranty information
(7) Recommended storage practices
(8) Mounting on/in vehicles or emergency apparatus

5.2.5 Cautions and Limitations.

5.2.5.1* Specific statements regarding limitations of use shall be provided under the title of "Operational Mode Information" as follows:

(1) A statement that it is the user's responsibility to monitor and understand any atmospheric hazard.
(2) A statement that APR or PAPR modes of operation are prohibited for entry into an IDLH or unknown atmosphere.
(3) A statement that the remote air source coupling is not to be used in CBRN exposures or for post-incident decontamination after CBRN incidents.
(4) A statement that the remote air source coupling is not to be used as a UEBSS.
(5) A statement of the minimum temperature for use of CUR relative to the manufacturer-specified low temperature indicated in 7.2.3.2.

5.2.5.2 CUR Manufacturer.

5.2.5.2.1 The CUR manufacturer shall provide cautions and limitations regarding the CUR's use.

5.2.5.2.2 At a minimum, the CUR manufacturer shall include the appropriate NIOSH CBRN–specific cautions and limitations for each of the operational modes supported by the CUR as defined in the following application procedures:

(1) The "Standard Application Procedure for the Approval of Powered Air-Purifying Respirators and Chemical, Biological, Radiological, and Nuclear-Powered Air-Purifying Respirators" under 42 CFR Part 84
(2) The "Standard Application Procedure for the Approval of Air-Purifying Respirators and Chemical, Biological, Radio-

logical, and Nuclear Air-Purifying Respirators" under 42 CFR Part 84
(3) The "Standard Application Procedure for the Approval of Self-Contained Breathing Apparatus and Chemical, Biological, Radiological, and Nuclear Self-Contained Breathing Apparatus" under 42 CFR Part 84

5.2.5.3 The CUR manufacturer shall also include the following:

(1) A statement that it is the user's responsibility to monitor and understand any atmospheric hazard.
(2) A statement that APR or PAPR modes of operation are prohibited for entry into an IDLH or unknown atmosphere.
(3) A statement of limitations for the use of CUR for cold temperature operations relative to manufacturer-specified low temperature indicated in 7.2.3.2 and any specific care and maintenance procedures relative to use in such conditions.

5.2.6 Inspection and Inspection Training Materials. Information or training materials regarding periodic inspections shall be provided at least as stated in 5.2.6.1 through 5.2.6.2.

5.2.6.1 Inspection Frequency.

5.2.6.1.1 Where a CUR is assigned to an individual user for a duty period, the inspection shall be performed by the individual user at the beginning of each duty period.

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

5.2.6.1.3 Where CURs are not assigned to an individual user for a duty period, the inspection shall be performed at least once a week for all CURs that are available for use.

5.2.6.1.4 In all cases, the interval between the inspections shall not exceed 1 week.

5.2.6.2 Inspection.

5.2.6.2.1 All of the following CUR components shall be present:

(1) Facepiece
(2) Backframe or harness assembly
(3) Pressure vessel
(4) Hose
(5) End-of-service-time indicator(s) (EOSTI)
(6) Regulators
(7) PAPR components, if applicable
(8) APR components, if applicable
(9) Accessories

5.2.6.2.2 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 seal with the facepiece material
(4) Exhalation valve, where present, checked for valve seat
(5) Springs and covers checked for operation and cleanliness
(6) Regulator connection(s) checked for operation and damage
(7) Nonelectronic communications system and supplementary voice communications system, where present, checked for damage
(8) Gaskets and seals, where present, checked for good condition
(9) All hardware, checked for condition of threads, couplings, and adapters
(10) HUD installation and operation, where present

5.2.6.2.3 Carrier, harness, and webbing subassembly (if included) inspection shall include the following:

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

5.2.6.2.4 Breathing air pressure vessel assembly inspection shall include the following:

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

5.2.6.2.5 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

5.2.6.2.6 PAPR assembly (if included) inspection shall include the following:

(1) Examine all hardware to ensure condition of threads, couplings, and adapters—ensure there is no visual damage or cracks
(2) No loose objects or rattling inside the PAPR assembly
(3) Ensure all gaskets and seals are present and in good condition, replace if necessary
(4) Ensure that the unit turns on/off
(5) When on, ensure the correct airflow is provided

5.2.6.2.7 EOSTI inspection shall include the following:

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

5.2.6.2.8 Regulator Inspection.

5.2.6.2.8.1 Regulator inspection shall include the following:

(1) Regulator controls, where present, checked for damage and 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 function when each is operated

5.2.6.2.8.2 Where regulator and bypass inspection is checked for function by donning the facepiece and contamination between users is a possibility, the regulator, facepiece, or both shall be cleaned and disinfected.

5.2.6.2.9 Pressure indicator inspection shall include the following:

(1) Pressure indicator checked for damage
(2) Where the CUR has a pressure vessel pressure gauge as well as a remote gauge, both checked to read within 10 percent of each other

5.2.6.2.10 Where CUR has an integrated PASS, the CUR 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

5.2.6.2.11 Other Required Components.

5.2.6.2.11.1 Where CUR has other required components, including rapid intervention crew/company 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.

5.2.6.2.11.2 Inspection of other required components shall include at least inspection for signs of complete assembly of the component, wear, damage, secure attachment, adequate power source, and proper operation and functionality.

5.2.6.2.12 System Pressure.

5.2.6.2.12.1 The CUR shall hold system pressure in accordance with the manufacturer's specifications, after the pressure vessel valve is closed.

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

5.2.7 Information or training materials regarding donning and doffing shall be provided at least on the following areas:

(1) Donning and doffing procedures
(2) Adjustment procedures
(3) Ensemble interface issues

5.2.8* Information or training materials regarding use shall be provided at least on the following areas:

(1) Pre-use checks
(2) Recharging breathing air pressure vessels
(3) Emergency procedures to be followed in the event of damage, malfunction, or failure of the breathing apparatus
(4) Emergency procedures to be followed in the event of an out-of-air situation

5.2.9* Information or training materials regarding periodic cleaning shall be provided at least on the following areas:

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

5.2.9.2 Facepiece Cleaning.

5.2.9.2.1 The facepiece shall be thoroughly cleaned after each use and disinfected as needed.

5.2.9.2.2 Facepiece cleaning and disinfecting shall be performed using only those agents indicated by the manufacturer.

5.2.9.2.3 The exhalation valve shall be cleaned and flushed.

5.2.9.2.4 Facepiece Drying.

5.2.9.2.4.1 The facepiece shall be dried.

5.2.9.2.4.2 Facepiece drying shall not be done in direct sunlight or in high heat.

5.2.9.2.5 The exhalation valve shall be cycled to ensure proper operation.

5.2.9.3 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 according to the manufacturer's instructions.

5.2.9.4 CUR Strap and Harness Cleaning and Drying.

5.2.9.4.1* CUR straps and harness assemblies shall be cleaned and disinfected when required, according to the manufacturer's instructions.

5.2.9.4.2 Under no circumstances shall a chlorine bleach ever be used to clean straps and harness assemblies made from aramid fibers.

5.2.9.4.3 The straps and harness assemblies shall be dried.

5.2.9.4.4 Drying of straps and harness assemblies shall not be done in direct sunlight or in high heat.

5.2.9.5 CUR pressure vessel valve assemblies shall be cleaned and disinfected using only those agents indicated by the manufacturer.

5.2.9.5.1 The valve shall be free of debris.

5.2.9.5.2 Disc Outlet.

5.2.9.5.2.1 The burst disc outlet shall be inspected for debris.

5.2.9.5.2.2 If debris is present, the pressure vessel shall be removed from service.

5.2.9.6* Water or cleaning materials shall be prevented from entering the connection between the pressure vessel valve and the mating CUR inlet connector.

5.2.9.7 Pneumatic component cleaning and disinfecting shall be performed using only those agents indicated by the manufacturer.

5.2.9.7.1 All pneumatic components shall be thoroughly dried after cleaning.

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

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

5.2.9.9 PAPR Assembly.

5.2.9.9.1 The PAPR assembly, if included, shall have its components or subassemblies wiped or rinsed with water or cleaning solution, in accordance with the manufacturer's instructions.

5.2.9.9.2 Unless specifically designed to be submerged, the blower assembly shall not be submerged.

5.2.9.9.3 The breathing tube connection, canister mounts, and any other sealing interface shall be cleansed of contaminants that could prevent an airtight seal.

5.2.9.10 Required inspections shall be performed after cleaning.

5.2.10 Information or training materials regarding periodic user maintenance shall be provided at least on the following areas:

(1) Information or training materials regarding low-power-source signals and power source replacement, where applicable
(2) Complete instructions for reporting to the manufacturer, certification authority, and NIOSH/NPPTL all returned equipment or complaints of damage, malfunction, or failure of the breathing apparatus that could present a hazard to the user

5.2.11 Information or training materials regarding user repair shall be provided where stated in 5.2.11.1 through 5.2.11.6.

5.2.11.1 Where user repair can be accomplished and replacement items or remedial action are immediately available, the CUR shall be permitted to be restored and returned to in-service status.

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

5.2.11.3 Organization Personnel.

5.2.11.3.1 The organization's personnel shall follow the organization's SOPs and the manufacturer's written instructions for allowable user repairs.

5.2.11.3.2 The organization's personnel shall be trained on the specific repair procedures before performing them.

5.2.11.4 Users shall not do either of the following:

(1) Perform work beyond the limits of the organization's SOPs and their training
(2) Exceed what is allowed by the manufacturer's written instructions

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

5.2.11.6 After repairs are made, the user shall conduct the required inspection as specified in 5.2.6.2 to verify proper function of the CUR.

5.2.12 Information or training materials regarding retirement shall be provided at least on replacement/retirement considerations, where applicable, for each APR, PAPR, and SCBA assembly.

5.2.13 Component Service Life.

5.2.13.1 The CUR manufacturer shall provide the manufacturer's specified component service life for composite breathing air pressure vessels and for all elastomeric components of the CUR.

5.2.13.2 The information required in 5.2.13.1 shall be included at least in the maintenance information provided to the users.

5.2.14 Contamination and Decontamination.

5.2.14.1 Tags.

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

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

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

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

5.2.14.4 Where it is determined that the CUR is contaminated beyond the ability to decontaminate it and return it to service, the CUR shall be disposed of.

5.2.15 Storage.

5.2.15.1 CUR 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 CUR.

5.2.15.2 Brackets/racks shall protect the CUR.

5.2.15.3 Brackets/racks shall be adjusted so they do not cause physical damage to pressure vessels, hoses, regulators, or straps.

5.2.15.4 Where appropriate, brackets for securing CUR in vehicles used for transportation of emergency services personnel shall meet the requirements of 14.1.10 of NFPA 1901.

5.2.15.5 CUR shall be stored with the pressure vessel valves closed.

5.2.15.6 CUR valves or controls shall be positioned according to manufacturer's specifications.

5.2.15.7 The facepieces of all CUR shall be positioned to avoid distortion of parts during storage.

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

5.2.15.9 In all instances, the CUR 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.

5.2.15.10 All in-service CUR pressure vessels shall be stored fully charged.

5.2.15.11 Pressure vessels shall be filled when the pressure falls to 90 percent of the manufacturer's specified pressure level.

5.2.15.12 A positive pressure shall be maintained in depleted CUR pressure vessels by keeping the valve closed until they are filled to keep external contamination and condensation out of the pressure vessel.

5.2.15.13 Compressed breathing air stored in CUR breathing air pressure vessels shall be replaced at least annually.

5.2.15.14 CUR pressure vessels shall be stored in a manner that prevents damage to the valve and pressure vessel.

Chapter 6 Design Requirements

6.1 CUR System Requirements.

6.1.1 CUR shall meet the applicable design requirements specified in this chapter where inspected and evaluated by the certification organization as specified in Section 4.3.

6.1.2 The CUR shall be approved as a system.

6.1.2.1 CUR modes shall not be certified individually under this certification.

6.1.2.2 The system shall consist of at least two different modes of operation.

6.1.2.2.1 One operating mode shall be an open-circuit SCBA.

6.1.2.2.2 One operating mode(s) shall be a PAPR, an APR, or both.

6.1.3 CUR shall be certified to meet system CBRN performance requirements in accordance with this document.

6.1.4 The CUR shall be designed to allow the user to switch between modes, either automatically or manually.

6.1.4.1 The switchover element(s) shall isolate one mode from the other allowing only one mode to be operational at any time.

6.1.4.2 There shall be an indication as to which mode the CUR is operating in throughout its use.

6.1.4.2.1 When the CUR is activated, the system shall provide an indication to the user which mode of operation it is in.

6.1.4.2.2 When the CUR is switched from one mode of operation to another, there shall be a distinct indication of the new mode of operation.

6.1.5 All CUR connectors that are designed to be disconnected during use shall be self-sealing when disconnected.

6.1.6 The components of each CUR shall meet the minimum construction requirements of 6.1.6.1 through 6.1.6.8.

6.1.6.1 Components shall conform to all of the following:

(1) Designed on sound engineering and scientific principles
(2) Constructed of suitable materials
(3) Show evidence of good workmanship

6.1.6.2 Components that come into contact with the wearer's skin shall be made of nonirritating materials.

6.1.6.3 Components replaced during or after use shall be constructed of materials which will not be damaged by normal handling.

6.1.6.4 Facepieces shall be constructed of materials that shall withstand repeated disinfection as recommended by the manufacturer's instructions for use of the device.

6.1.6.5 Components shall be designed, constructed, and fitted to ensure against creation of any hazard to the wearer.

6.1.6.6 Components shall be assembled to permit easy access for inspection and repair of functional parts.

6.1.6.7 Components shall be assembled to permit easy access to parts that require periodic cleaning and disinfecting.

6.1.6.8 Replacement parts shall be designed and constructed to permit easy installation and to maintain the effectiveness of the respirator.

6.1.7 Breathing hoses and other components used in conjunction with CUR shall be designed and constructed to prevent the following:

(1) Restriction of free head movement
(2) Disturbance of the fit of facepieces
(3) Interference with the wearer's activities
(4) Shutoff of airflow due to kinking, or from chin or arm pressure

6.1.8 CUR facepieces shall be equipped with adjustable and replaceable head harnesses designed and constructed to provide tension during suspension and an even distribution of pressure over the entire area in contact with the face.

6.1.9 Where inhalation or exhalation valves are provided on CUR facepieces, they shall be protected against damage and distortion.

6.1.9.1 Exhalation valves shall be protected against external influence and designed and constructed to prevent inward leakage of contaminated air.

6.1.9.2 Inhalation valves shall be designed and constructed to prevent excessive exhaled air from adversely affecting the air purifying component(s).

6.2 CUR/Open-Circuit SCBA Mode Design Requirements.

6.2.1 CUR shall be permitted to supply air to the user in a negativepressure (demand) mode only when operating in the air purifying or powered air purifying device modes.

6.2.2 A heads-up display (HUD) shall not be the sole device used to meet the requirements of 6.2.26.6.

6.2.3 The pressure gauge provided as part of the CUR manufacturer's breathing air pressure vessel and valve assembly shall be able to be read by a person other than the wearer of the CUR when the CUR is worn in accordance with the CUR manufacturer's instructions and with the breathing air pressure vessel securely retained in the CUR backframe or carrier.

6.2.3.1 The pressure gauge shall be permitted to be covered.

6.2.3.1.1 If covered, the pressure gauge shall have tool-free access in accordance with 6.2.3.

6.2.4 All CUR shall be equipped with a facepiece that covers, at a minimum, the wearer's eyes, nose, and mouth.

6.2.5 Testing.

6.2.5.1 Combination unit respirators (CUR) shall be tested for listing to ANSI/ISA-12.12.01, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*.

6.2.5.2 CURs shall meet the design (i.e., construction) requirements for at least Class I, Division 2, Groups C and D and Class II, Division 2, Groups F and G hazardous locations, and with a temperature class of T3 through T6 inclusive.

6.2.6 Nonincendive Equipment. The CUR shall be suitable for use in Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; and Class III, Divisions 1 and 2 hazardous (classified) locations as demonstrated by being certified as nonincendive equipment in accordance with ANSI/ UL 121201, *Non-Incendive Electric Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous(Classified) Locations*.

6.2.6.1 Intrinsically Safe Systems. The CUR shall be permitted to be certified for use in Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; and Class III, Divisions 1 and 2 hazardous (i.e., classified) locations as demonstrated by being certified as an intrinsically safe system in accordance with ANSI/ UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*.

6.2.7 All hardware, brackets, and snaps or other fasteners of CUR or any certified accessories shall be free of rough spots, burrs, and sharp edges.

6.2.8 All CUR shall have a voice communications capability that shall consist of a nonelectronic transmission system.

6.2.8.1 If the CUR incorporates an optional electronic supplementary voice communications system, the supplementary voice communications system design shall incorporate an indication that the system has been activated.

6.2.8.2 The optional supplementary voice communications system's power source shall, at a minimum, provide upon activation an alert signal indicating low power capacity.

6.2.8.3 The optional supplementary voice communications system shall be designed to be switched on and off manually without the performance of the CUR being affected.

6.2.8.4 Where the optional supplementary voice communications system is automatically activated, the operation of the on/off control shall override the auto activation of the supplementary voice communications system without affecting the performance of the CUR.

6.2.9 End-of-Service-Time Indicator (EOSTI) Design Requirements.

6.2.9.1 All CUR shall be equipped with a minimum of one EOSTI.

6.2.9.2 The EOSTI(s) shall be activated with no additional procedures than those required to activate the CUR breathing system.

6.2.9.3 Where the CUR is equipped with non-HUD EOSTI, the alarm signal shall remain active at least until the pressure vessel drops below 20 bar (290 psi).

6.2.9.4 Each EOSTI shall consist of at least the following:

(1) Sensing mechanism
(2) Signaling device

6.2.9.4.1 The sensing mechanism of the EOSTI(s) shall activate the signaling device(s).

6.2.9.4.2 The EOSTI(s) signaling devices shall provide notification to the CUR user of the activation of the EOSTI by stimulating one or more human senses.

6.2.9.4.3 Signaling Device.

6.2.9.4.3.1 The EOSTI(s) shall be permitted to have more than one signaling device.

6.2.9.4.3.2 Each signaling device shall be permitted to stimulate more than one human sense.

6.2.9.4.4 A failure mode and effects analysis shall be provided to the certification organization for the EOSTI(s).

6.2.9.4.4.1 The failure mode and effects analysis shall identify each potential failure mode for each component necessary for the EOSTI(s) to function.

6.2.9.4.4.2 For the failure mode and effects analysis, power sources other than the air from the CUR breathing air pressure vessel shall be considered as part of the EOSTI(s).

6.2.9.4.5 The EOSTI alarm shall activate at a minimum of 27 ±2 percent of full pressure vessel pressure.

6.2.10 Optional HUD Design Requirements.

6.2.10.1 The CUR shall be permitted to be equipped with at least one HUD.

6.2.10.2 If the CUR is equipped with a HUD, the HUD shall be activated with no additional procedures other than those required to activate the CUR breathing system.

6.2.10.3 HUD User Control.

6.2.10.3.1 The HUD shall be permitted to be capable of being user controlled following activation.

6.2.10.3.2 User control function(s) shall include, but not be limited to, deactivation of the HUD visual pressure gauge display function.

6.2.10.4 If the HUD is used as the EOSTI, the EOSTI indication shall not be capable of being disabled.

6.2.10.5 The activation/deactivation of the HUD shall be performed external to the facepiece.

6.2.10.6 The user shall be able to operate the HUD without having to use special tools.

6.2.10.7 Each time the CUR breathing system is activated with the breathing air pressure vessel pressure of 20 bar (290 psi) or greater, the HUD shall provide a visual indication of activation.

6.2.10.8 Where the HUD is provided with an external wiring disconnect, the wiring connector shall require two distinct actions for disconnection.

6.2.10.9 The HUD shall provide at least visual displays of alert signals and information.

6.2.10.10 All HUD visual displays shall be visible to the CUR wearer with the CUR and facepiece donned and regardless of the wearer's head movement.

6.2.10.11 The HUD shall not use color as the only means of differentiating between alert signal displays and informational displays.

6.2.11 Visual Alert Signals (when in the Active Mode).

6.2.11.1 The HUD shall display visual alert signals for breathing air pressure vessel content specified in 6.2.11.4.

6.2.11.2 In addition to the mandatory visual alert signals specified in 6.2.11.4, additional visual alert signals to indicate when other status or conditions have occurred shall be permitted.

6.2.11.3 Each visual alert signal shall be identifiable, by the CUR wearer, from any other visual alert signals or other informational displays provided on the HUD or on the CUR.

6.2.11.4 Visual Alert Signal.

6.2.11.4.1 The HUD shall display a visual alert signal for breathing air pressure vessel content when the breathing air in the CUR pressure vessel has been reduced to 50 percent of rated service content.

6.2.11.4.2 The visual alert signal stated in 6.2.11.4.1 shall visibly flash at a frequency of not less than one per second for a minimum of 20 consecutive seconds.

6.2.12 Visual Informational Displays (when in the Active Mode).

6.2.12.1 The HUD shall display visual informational signals for at least breathing air pressure vessel content as specified in 6.2.12.5.

6.2.12.2 In addition to the mandatory visual informational signal specified in 6.2.12.5, additional visual informational signals to indicate when other status or conditions have occurred shall be permitted.

6.2.12.3 All visual displays of information shall be permitted to flash at a frequency of not less than one per second for a minimum of 10 consecutive seconds every 60 sec.

6.2.12.4 Where the visual display is not constantly visible or is not visible for at least 10 consecutive seconds every 60 sec, the HUD shall be provided with a manual activation of the display.

6.2.12.5 The HUD shall display a visual informational signal for breathing air pressure vessel content at 100 percent, 75 percent, 50 percent, and 25 percent of the pressure vessel's total rated service content.

6.2.12.5.1 The range of pressures under the EOSTI set point shall be visually obvious.

6.2.12.5.2 Where an analog gauge is used, the pressure range below the EOSTI set point shall have a red background.

6.2.12.5.3 Where an electronic mode is used, the display of pressure below the EOSTI set point shall flash at a frequency of not less than one per second for the remaining duration of the pressure vessel.

6.2.12.6 A display only in units of pressure shall not be permitted.

6.2.13* Optional Rapid Intervention Crew/Company Universal Air Connection (RIC UAC) Design Requirements.

6.2.13.1 The CUR shall be permitted to be equipped with an RIC UAC male fitting to allow replenishment of breathing air to the CUR breathing air pressure vessel.

6.2.13.2 If the CUR is equipped with an RIC UAC, both of the following shall apply:

(1) The RIC UAC male fitting shall meet the requirements specified in 6.2.14.
(2) An RIC UAC male fitting shall be located on each CUR in a permanently fixed position.

6.2.13.3 The distance between the leading edge of the Compressed Gas Association (CGA) fitting at the outlet of the CUR pressure vessel valve and the leading edge of the RIC UAC male fitting shall be a maximum of 100 mm (4 in.).

6.2.13.4 If the CUR is equipped with an RIC UAC, a separate self-resetting relief valve shall be installed on the CUR to protect the CUR against overpressurization.

6.2.14 RIC UAC Male Fitting.

6.2.14.1 The RIC UAC male fitting shall be designed as specified in Figure 6.2.14.1.

6.2.14.2 The RIC UAC male fitting shall be capable of connecting to any RIC UAC female fitting.

6.2.14.3 The RIC UAC male fitting shall not interfere with any other operation of the CUR.

6.2.14.4 RIC UAC male fittings shall be equipped with a dust cap or sealing plug to prevent dust, dirt, and debris from entering the fitting and to serve as a leakproof seal.

6.2.15 RIC UAC Female Fitting.

6.2.15.1 The RIC UAC female fitting shall be designed as specified in Figure 6.2.15.1.

6.2.15.2 The RIC UAC female fitting shall be capable of connecting to all RIC UAC male fittings.

6.2.15.3 RIC UAC female fittings shall be equipped with a dust cap or sealing plug to prevent dust, dirt, and debris from entering the fitting and to serve as a leakproof seal.

6.2.16 RIC UAC Filling Hose Assembly.

6.2.16.1 Each CUR manufacturer shall make available an RIC UAC filling hose assembly that consists of a filling hose and an RIC UAC female fitting.

6.2.16.2 The RIC UAC filling hose assembly shall be, at a minimum, a high-pressure, 310 bar (4,500 psi) assembly designed to replenish breathing air to a CUR breathing air pressure vessel.

6.2.16.3 The filling hose shall have an RIC UAC female fitting that meets the requirements specified in 6.2.15 attached to the delivery end.

6.2.17 RIC UAC Coupling.

6.2.17.1 The complete RIC UAC male and female fittings shall constitute the RIC UAC coupling.

6.2.17.2 The RIC UAC coupling shall be capable of connection and disconnection with one hand while subjected to maximum operation pressure.

6.2.17.3 The RIC UAC coupling shall have an operating pressure of at least 310 bar (4,500 psi).

6.2.18 Power Source Design Requirements for PAPR and SCBA Operating Modes.

6.2.18.1 Where the CUR is equipped with a power source for electronics, it shall be either a single dedicated source for one device or a common power source for multiple devices.

6.2.18.2 Where all electronic devices that are part of the CUR share a common power source, at least one low power source alert signal shall be provided.

6.2.18.3 Where multiple but not all electronic devices that are part of the CUR share a common power source, a low power source alert signal shall be located on each of those electronic devices supplied by the common power source and positioned on each of those electronic devices where it will be detected upon device activation with the electronic device mounted in its permanent position on the CUR.

6.2.18.4 Where an electronic device uses a single, dedicated power source, the low power source alert signal shall be located on the electronic device and positioned where it will be detected upon device activation with the electronic device mounted in its permanent position on the CUR.

6.2.18.5 Where a HUD display of low power source alert signal(s) specified in 6.2.18.2 is visual, the low power source alert signal(s) shall be positioned within the user's field of vision with the CUR facepiece donned.

6.2.18.6 Where a power source is used for HUD to comply with the requirements of this standard, HUD shall provide an alert signal for low power source capacity when the remaining power source life will provide a minimum of 2 hours of operation of the HUD at maximum electrical draw.

6.2.18.6.1 Where the low power source alert signal is visual, it shall be independent from and physically distinguishable from the breathing air pressure vessel content visual alert signal display.

6.2.18.6.2 When the HUD is in the active mode and uses a low power source visual alert signal, the low power source visual alert signal shall be displayed at all times when the power source condition is below the level specified in 6.2.11.4, except as provided in 6.2.18.6.3.

6.2.18.6.3 Where the HUD is capable of being user controlled, the low power source capacity visual display function shall be permitted to be disabled upon indication of a low power source condition.

6.2.19 Optional Universal Emergency Breathing Safety System (UEBSS) Design Requirements.

6.2.19.1 If a CUR is equipped with a UEBSS, it shall meet the performance requirements of 7.2.20 and 8.2.20.

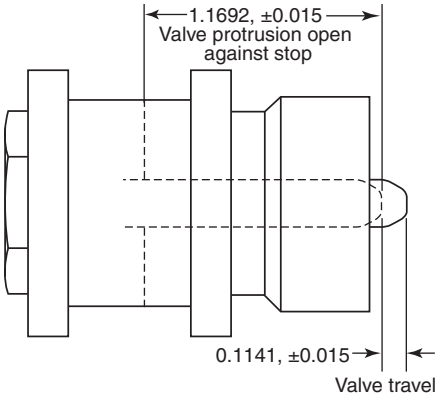
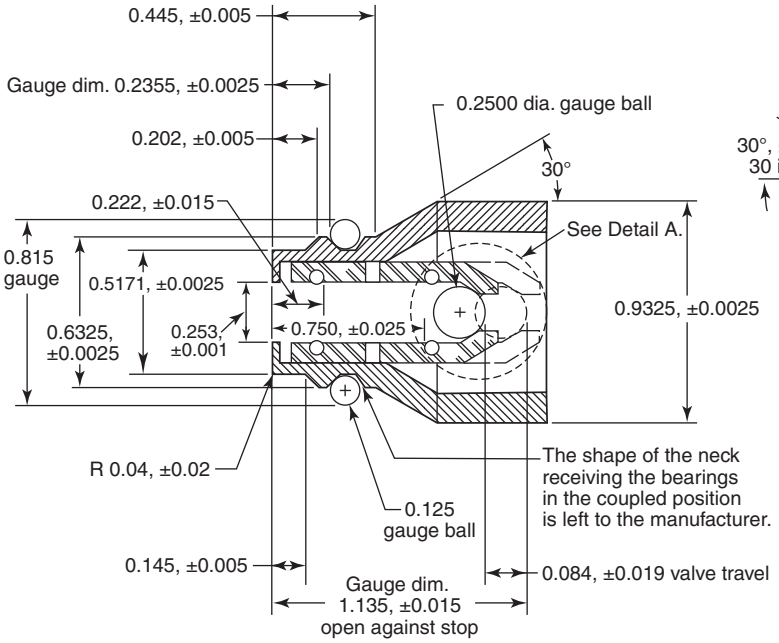


FIGURE 6.2.15.1 RIC UAC Female Fitting (all measurements in inches).



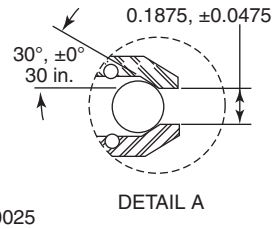


FIGURE 6.2.14.1 RIC UAC Male Fitting (all measurements in inches).

6.2.19.2 Each UEBSS shall operate off the pressure after the first-stage pressure reducer of the CUR.

6.2.19.3 The UEBSS shall have an operating pressure range between 5.5 bar (80 psi) and 10.3 bar (150 psi).

6.2.19.4 The UEBSS shall have bi-directional male and female connections with a check valve feature to prevent inward contaminants.

6.2.19.4.1 The UEBSS male fitting shall be designed as specified in Figure 6.2.19.4.1, or equivalent.

6.2.19.4.2 The UEBSS female fitting shall be designed as specified in Figure 6.2.19.4.1, or equivalent.

6.2.19.5 The UEBSS pressure hose assembly shall be a minimum of 0.51 m (20 in.) long.

6.2.19.6 The UEBSS shall be removable from storage by the wearer using a single hand in a one-directional pull.

6.2.19.7 The UEBSS shall require only one action for connection of the donor's fitting to the receiving CUR's fitting.

6.2.19.8 The UEBSS shall require two distinctive actions to disconnect the fitting between the donor CUR and the receiving CUR.

6.2.19.9 The UEBSS fitting(s) shall be equipped with a dust cap or sealing plug to prevent dust, dirt, and debris from entering the fitting(s).

6.2.19.10 The connection of two UEBSS shall be independent of the facepieces.

6.2.19.11 The UEBSS access location shall be visible to an assisting CUR user.

6.2.19.11.1 The UEBSS access location shall be marked UEBSS.

6.2.19.11.2 The letters referenced in 6.2.19.11.1 shall be at least 25 mm (1 in.) in height.

6.2.20 Optional Remote Air Source Coupling Design Requirements. If a CUR is equipped with an optional remote compressed air source coupling capability, it shall meet the performance requirements of 7.2.5 through 7.2.7 and 8.2.8 through 8.2.10.

6.2.21 Accessories Design Requirements.

6.2.21.1 Items attached to or integrated with a CUR that are not required for the CUR to meet the requirements of this standard shall be considered accessories.

6.2.21.2 All accessories attached to or integrated with a CUR shall be as follows:

(1) Certified as CUR accessories
(2) Tested, if appropriate

6.2.21.3 Any accessories attached to a CUR shall not interfere with the function of the CUR or with the function of any of the CUR's component parts.

6.2.21.4 Where a CUR is provided with accessories that are attached to or integrated with the CUR, the CUR, with accessories installed, shall meet all of the design and performance requirements of this standard.

6.2.21.5 In all cases, such accessories shall not degrade the performance of the CUR.

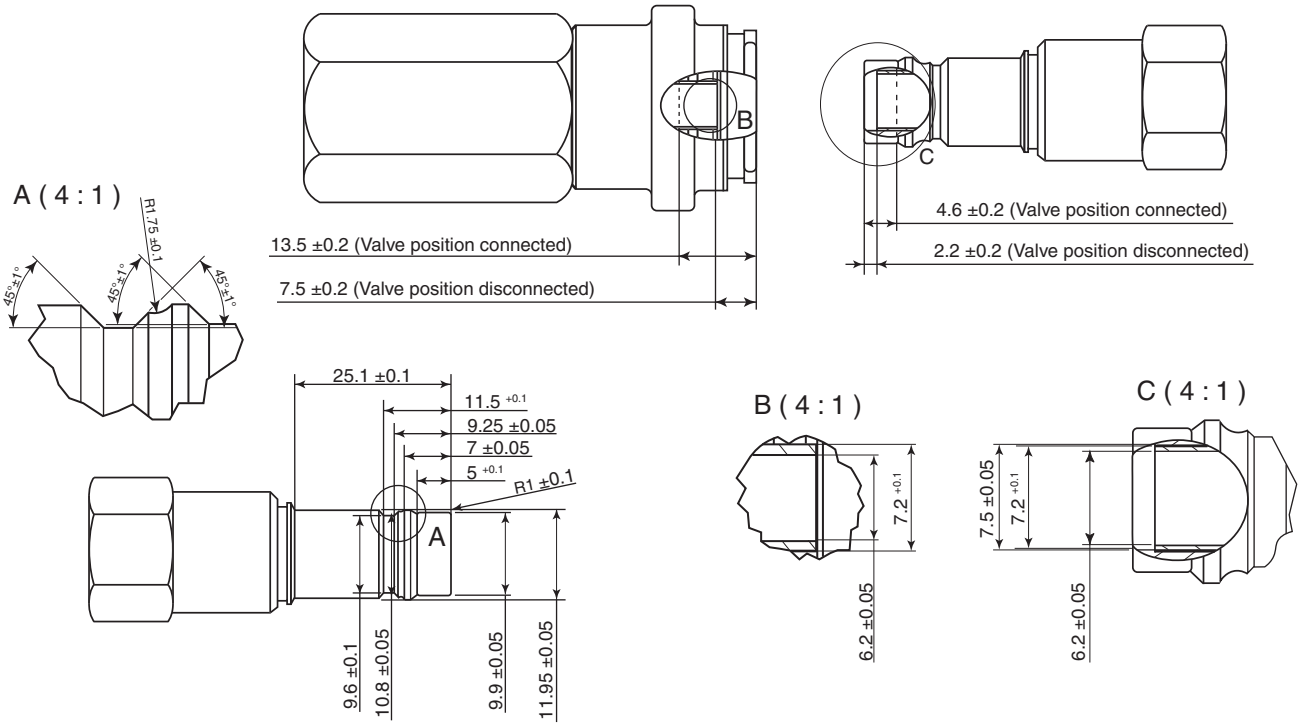


FIGURE 6.2.19.4.1 UEBSS Male and Female Fitting.

6.2.22 Self-Contained Breathing Apparatus Required Components. Each CUR shall, at a minimum, consist of the following component parts:

(1) Full facepiece
(2) Respirable breathing gas pressure vessel
(3) Supply of respirable breathing gas
(4) Gas pressure gauges
(5) EOSTI
(6) Hand-operated valves
(7) Safety relief valve or safety relief system
(8) Backframe/carrier assembly

6.2.23 Carrier/Harness Assemblies Used in CUR Installation and Construction.

6.2.23.1 Each CUR shall, where necessary, be equipped with a suitable carrier/harness assembly designed and constructed to hold the components of the CUR in position against the wearer's body.

6.2.23.2 Carrier/harness assemblies shall be designed and constructed to permit easy removal and replacement of CUR component(s) and, where applicable, provide for holding a full facepiece in the ready position when not in use.

6.2.24 Facepieces Used in CUR.

6.2.24.1 Facepieces used in CUR shall be designed and constructed to fit persons with various facial shapes and sizes, either by providing more than one facepiece size or by providing one facepiece that will fit varying facial shapes and sizes.

6.2.24.2 Facepieces shall provide for the optional use of corrective spectacles or lenses that shall not reduce the respiratory protective qualities of the CUR.

6.2.24.3 Facepieces shall be designed to prevent spectacle and lens fogging.

6.2.24.4 CUR facepiece lenses shall be designed and constructed to meet the requirements of ANSI/ISEA Z87.1 for impact and penetration resistance.

6.2.25 Compressed Breathing Gas and Gas Pressure Vessels Design Requirements.

6.2.25.1 Compressed, gaseous breathing air shall meet the applicable minimum grade requirements for Type I gaseous air set forth in CGA G-7.1.

6.2.25.2 Compressed breathing gas pressure vessels shall meet the minimum requirements of the Department of Transportation for interstate shipment of such pressure vessels when fully charged.

6.2.25.3 Pressure vessels shall be permanently marked to identify their contents (e.g., compressed breathing air).

6.2.25.4 Pressure vessels normally removed from apparatus for refilling shall be equipped with a dial-indicating gauge that shows the pressure in the pressure vessel.

6.2.25.5 Compressed breathing gas pressure vessel valves or a separate charging system or adapter provided with each apparatus shall be equipped with outlet threads specified for service by CGA V-1.

6.2.26 CUR Gauges.

6.2.26.1 Gas pressure gauges employed on compressed breathing gas pressure vessels shall be calibrated in pounds per square inch.

6.2.26.2 Gauges other than those specified in 6.2.26.1 shall be calibrated via one of the following:

(1) Pounds per square inch
(2) Fractions of total container capacity
(3) Both in pounds per square inch and fractions of total container capacity

6.2.26.3 Pressure-indicating gauges shall be reliable to within ±5 percent of full scale when tested both up and down the scale at each of five equal intervals.

6.2.26.4 The full-scale graduation of dial-indicating gauges shall not exceed 150 percent of the maximum rated pressure vessel pressures specified for the pressure vessel in applicable Department of Transportation specifications or permits.

6.2.26.5 Where gauges are connected to the apparatus through a gauge line, the apparatus shall include a flow limiting device to minimize loss of air through a broken gauge or severed gauge line.

6.2.26.5.1 The flow limiting device shall be located on the upstream side of the gauge line

6.2.26.5.2 It shall be permissible to locate the flow limiting device in the gauge line connection.

6.2.26.6 In addition to the pressure-vessel-mounted breathing air pressure gauge, all CUR shall have another breathing air pressure gauge capable of being viewed by the wearer when the CUR is worn in accordance with the CUR manufacturer's instructions.

6.2.26.6.1 The pressure gauge shall be permitted to be covered.

6.2.26.6.1.1 If covered, the pressure gauge shall have tool-free access in accordance with 6.2.26.6.

6.2.27 All CUR shall have a filter downstream of the compressed gas source to remove particles from the gas stream.

6.2.28 CUR Hand-Operated Valves Design Requirements.

6.2.28.1 The CUR operating in SCBA mode shall be equipped with a capability to provide air from the self-contained air source to the user in the event of a failure in any of the flow control or pressure reduction mechanisms.

6.2.28.2 The manufacturer shall be permitted to demonstrate compliance with 6.2.30 by means of a failure mode and effects analysis (FMEA) that yields results showing the entire system will both fail open and prevent catastrophic loss of air.

6.2.28.3 If the fulfillment of 6.2.28 incorporates a manually activated emergency flow valve, the following requirements apply:

(1) Manual emergency flow controls installed on a CUR shall be distinguishable from other components by sight and touch.
(2) Manual emergency flow controls shall not fulfill any other operational need.
(3) Manual emergency flow controls shall be capable of being operated with only one gloved hand.

(4) The material of the glove fingers shall be 2.5 mm to 4.0 mm ($^{3}/_{32}$ in. to $^{5}/_{32}$ in.) in thickness.

6.2.29 The manufacturer shall be permitted to demonstrate compliance with 6.2.28 by means of an FMEA that yields results showing the entire system will fail open or provide manual emergency flow control for air delivery and prevent catastrophic loss of air.

6.2.30 The CUR shall be designed so that any intermediate pressure overpressurization condition shall not prevent the delivery of air from any operational mode of the CUR to the user.

6.2.30.1 The CUR manufacturer shall submit a failure mode and effects analysis (FMEA) to the certification organization for verification of the requirement in 6.2.30.

6.2.30.2 The failure mode and effects analysis shall identify each potential failure mode for each component necessary for managing an intermediate pressure overpressurization.

6.3 CUR/PAPR Mode.

6.3.1 If nonpowered PAPR operation is designed to provide APR functionality, then the CUR shall not have to meet the APR requirements as specified in 6.4.1.

6.3.2 The canister shall be replaceable without the use of special tools.

6.4 CUR/Air-Purifying Respirator Mode Design Requirements.

6.4.1 The interface between the canister and the facepiece or respirator system shall use a standard Rd 40 X 1/7 thread.

6.4.2 The canister shall be replaceable without the use of special tools.

6.4.2.1 For CURs where the canister is attached directly to the facepiece (i.e., respirator-mounted), a single interface connector thread shall be located on the facepiece.

6.4.2.1.1 The interface connector on the facepiece shall be the internal thread and gasket sealing gland.

6.4.2.1.2 The canister shall use the external thread.

6.4.2.2 For CURs where the canister is not directly attached to the facepiece, an internal thread and gasket sealing gland connector complying with 6.4.1, 6.4.3, and 6.4.3.1 shall be attached to a harness system to provide strain relief between the canister and the remaining CUR system.

6.4.2.3 For CUR systems where the canister is not facepiece-mounted, multiple canister assemblies shall be permitted.

6.4.3 The dimensions for the interface connector gasket shall be as follows:

(1) Outside diameter 37.5 mm (1.48 in.) minimum
(2) Inside diameter 28.5 mm (1.12 in.) maximum
(3) Thickness 1.55 mm (.06 in.) minimum

6.4.3.1 The gasket material shall be ethylene propylene diene monomer (EPDM) or equivalent meeting the physical and chemical properties of Table 6.4.3.1(a) where tested in accordance with Table 6.4.3.1(b).

6.4.3.2 The manufacturer shall be required to provide data indicating compliance with the requirements of Table 6.4.3.1(a) and Table 6.4.3.1(b).

6.4.3.3 For gasket material other than EPDM, material samples shall be tested to the agent permeation requirements in 7.1.1.

6.4.3.4 The applicant shall provide a tolerance analysis—for negative-pressure air-purifying mode devices only—of the mechanical connector, canister thread, and gasket identified in Section 6.4, demonstrating the applicant's canister design will contact and seal on the gasket surface area as defined by the 37.5 mm (1.48 in.), minimum, outside diameter and the 28.5 mm (1.12 in.), maximum, inside diameter under all tolerance conditions.

6.4.4 The maximum weight of a respirator-mounted (i.e., chin-style) canister shall be 500 g (1.1 lb).

6.4.5 The maximum size of a respirator-mounted (chin-style) canister shall be such that the canister is able to pass through a 127 mm (5 in.) diameter opening with the threaded connector perpendicular to the 127 mm (5 in.) diameter opening.

Table 6.4.3.1(a) Rubber Gasket—Physical and Chemical Properties

Rubber Gasket Physical and Chemical Properties	Units	Unaged Minimum	Unaged Maximum	Aged Minimum	Aged Maximum
Tensile strength	Mpa (psi)	8.3 (1200)	—	6.9 (1000)	—
Ultimate elongation	Percent (%)	350	—	300	—
Tensile set at 300% elongation	Percent (%)	—	25		25
Tensile stress at 200% elongation	Mpa (psi)	3.4 (500)	—	3.4 (500)	—
Tear resistance, either Die B or Die C*	kN/m (lbf/in)	21.9 (125)	—	21.9 (125)	—
Durometer hardness (Shore "A")	—	55	75	—	—
Compression set 22 hr at 68°C (154°F)	Percent (%)	—	25	—	—
Impact resilience	Percent (%)	35	—	—	—
Agent permeation HD, Mustard and GB, Sarin†	Minutes/ Minutes	360/360	—	—	—
Low-temperature brittleness at –51°C (–59°F)	—	Pass	—	—	—

**Heat Aging*. The specimens selected for heat aging should be aged in an air oven at a temperature of 70°C ± 2°C (158°F ± 7°F) for a continuous period of 24 hr as prescribed in ASTM D573.

†*Oxygen Aging*. Specimens should be aged in an oxygen environment in accordance with ASTM D572 for 72 hr.

Table 6.4.3.1(b) Gasket Tests, Specimens, and Test Methods

Property	Unaged	Heat-Aged	Oxygen-Aged	Total	Method
Tensile strength, ultimate elongation tensile stress at 200% elongation	Cut one specimen from each of three slabs	Cut one specimen from each of three slabs	Cut one specimen from each of three slabs	9	ASTM D412
Tensile set at 300% elongation	Cut one specimen from each of three slabs	Cut one specimen from each of three slabs	Cut one specimen from each of three slabs	9	ASTM D412
Tear resistance, either Die B or Die C	Cut one specimen from each of three slabs/ buttons	Cut one specimen from each of three slabs	Cut one specimen from each of three slabs	9	ASTM D624
Low-temperature Brittleness at –51°C (–59°F)	Cut one specimen from each of five slabs	None	None	5	ASTM D746
Durometer hardness (Shore "A")	Cut one specimen from each of three slabs	None	None	3	ASTM D2240
Compression set[a]	Three test buttons	None	None	3	ASTM D395
Impact resilience[a]	Three test buttons	None	None	3	ASTM D2632
Agent permeation,[b,c] Sarin (GB) and Sulfur Mustard (HD)	Cut two specimens from each of six test slabs, six specimens per agent	None	None	12	MIL-STD-282 Method 208 Method 209

[a]The same test buttons should be used for impact resilience and compression set in that order.
[b]If gasket material is not EPDM, the applicant should submit permeation test data for gasket material along with six test slabs for the agent permeation test.
[c]Test specimens should be fabricated in accordance with ASTM D3182 from material of the same formulation that will be used during regular production of the respirator. The test specimens should have a cure equivalent to that of the regular production gaskets. The thickness of the test specimens should be the minimum gasket thickness specified by the applicants design specification. Any finish or treatment applied to the finished gasket should be applied to the test specimens.

6.4.6 The luminous transmittance value of the primary lens material shall be 88 percent or greater when tested in accordance with ASTM D1003.

6.4.7 Where CURs are equipped with a hydration facility, the CURs shall meet all requirements of the CUR standard with the hydration facility in place.

6.4.8 End-of-Service-Life (ESLI) Indicator for Canisters.

6.4.8.1 Where the CUR is operating in the APR mode and is equipped with an ESLI, the ESLI shall be tested as specified in 8.4.8.

6.4.8.2 The CUR shall be situated on the respirator so that it is visible to the wearer.

6.4.8.3 If the ESLI utilizes color change, the change shall be detectable to people with physical impairments, such as color blindness.

6.4.8.4 If the ESLI utilizes color change, reference colors for the initial color of the indicator and the final (i.e., end point) shall be placed adjacent to the indicator.

Chapter 7 Performance Requirements

7.1 CUR System Tests.

7.1.1 Chemical Agent Permeation and Penetration Resistance Against Distilled Sulfur Mustard (HD) and Sarin (GB) Performance Requirements.

7.1.1.1 HD Testing.

7.1.1.1.1 The CUR, including all components and accessories except the pressure vessel, shall be tested for permeation and penetration of distilled sulfur mustard (HD) as specified in 8.1.1.

7.1.1.1.2 The testing as stated in 7.1.1.1.1 shall not exceed either of the following:

(1) Cumulative Ct of 6.0 mg-min/m^3 for the test duration
(2) Three consecutive test values at or exceeding the peak value of 0.6 mg-min/m^3

7.1.1.2 GB Testing.

7.1.1.2.1 The CUR, including all components and accessories except the pressure vessel, shall be tested for permeation and penetration of sarin (GB) as specified in 8.1.1.

7.1.1.2.2 The testing as stated in 7.1.1.2.1 shall not exceed either of the following:

(1) Cumulative Ct of 2.1 mg-min/m^3 for the test duration
(2) Three consecutive test values at or exceeding the peak value of 0.087 mg-min/m^3.

7.1.2 Laboratory Respiratory Protection Level (LRPL).

7.1.2.1 The CUR, including all components and accessories, shall be tested as specified in 8.1.2.

7.1.2.2 The LRPL for each CUR operating in the negative-pressure mode shall be a minimum of 2,000 for 95 percent or greater of the subjects tested.

7.1.2.3 During the activation of the CUR switchover element(s), the LRPL shall be greater than 1000.

7.1.3 Field of View Performance.

7.1.3.1 The CUR shall be tested for field of view as specified in 8.1.3.

7.1.3.2 The CUR shall obtain a minimum visual field score (VFS) of 90.

7.1.4* Rigid Facepiece Lens Abrasion Resistance Performance.

7.1.4.1 Rigid CUR facepiece lenses shall be tested for abrasion resistance as specified in 8.1.4.

7.1.4.2 The haze value of the primary lens material shall be 3 percent or less.

7.1.4.3 The average value of the tested specimens shall not exhibit a delta haze greater than 14 percent.

7.1.5 Flexible Facepiece Lens Abrasion Resistance Performance.

7.1.5.1 Flexible CUR facepiece lenses shall be tested for abrasion resistance as specified in 8.1.5.

7.1.5.2 The haze value of the primary lens material shall be 3 percent or less.

7.1.5.3 The average value of the tested specimens shall not exhibit a delta haze greater than 4 percent. *(See A.7.1.4.)*

7.1.6 Nonelectronic Communications Performance Requirements.

7.1.6.1 The CUR voice communications system shall be tested for communications performance as specified in 8.1.6.

7.1.6.2 The CUR voice communications system shall have a speech transmission index (STI) average value of not less than 0.55.

7.1.7 Supplementary Voice Communications System Performance Requirements.

7.1.7.1 Where the CUR is equipped with a supplementary voice communications system as identified by the CUR manufacturer, it shall be tested for communication performance as specified in 8.1.7.

7.1.7.2 The CUR voice communications system shall have a speech transmission index (STI) average value of not less than 0.60.

7.1.8 Flame Resistance Performance.

7.1.8.1 CUR.

7.1.8.1.1 CUR operating in the SCBA mode shall be tested for flame resistance as specified in 8.1.8.

7.1.8.1.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3½ in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.1.8.2 CUR Components.

7.1.8.2.1 CUR operating in the SCBA mode and CUR accessories shall be tested for flame resistance as specified in 8.1.8.

7.1.8.2.2 No components of the CUR and no accessories shall have an afterflame of more than 5 sec.

7.1.8.3 CUR Component Separation.

7.1.8.3.1 CUR operating in the SCBA mode shall be tested for flame resistance as specified in 8.1.8.

7.1.8.3.2 No component of the CUR shall separate or fail in such a manner that would cause the CUR to be worn and used in a position not specified by the manufacturer's instructions.

7.1.8.4 CUR Facepiece.

7.1.8.4.1 The CUR facepiece shall be tested for flame resistance as specified in 8.1.8.

7.1.8.4.2 The CUR facepiece lens shall not obscure vision below the 20/100 vision criterion.

7.1.8.5 EOSTI.

7.1.8.5.1 CUR operating in the SCBA mode shall be tested for activation of the EOSTI(s) during the flame resistance testing specified in 8.1.8.

7.1.8.5.2 The EOSTI shall activate as specified in 6.2.9.

7.1.8.5.3 The EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.1.8.6 HUD.

7.1.8.6.1 Where the CUR operating in the SCBA mode is equipped with a HUD, the CUR shall be tested for functionality of the HUD breathing air pressure vessel content informational display and visual alert signals during the flame resistance testing specified in 8.1.8.

7.1.8.6.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.7.

7.1.8.6.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.1.9 Carbon Dioxide (CO_2) Content Performance.

7.1.9.1 CUR facepieces shall be tested for CO_2 content in a negative pressure mode as specified in 8.1.9.

7.1.9.2 The CO_2 content in the inhalation air shall not be greater than 2.0 percent by volume.

7.1.10 Immersion Leakage Performance Requirements.

7.1.10.1 CUR SCBA electronics shall be tested for resistance to water ingress as specified in 8.1.10.

7.1.10.2 CUR SCBA electronics shall function in accordance with the CUR manufacturer's instructions for normal use.

7.1.10.3 All power source compartments or enclosures associated with the functionality of the SCBA operating mode shall remain dry.

7.1.11 Low Power Capacity.

7.1.11.1 Where power sources are used to comply with the requirements of this standard, CUR electronic devices operating in the SCBA mode shall be tested for proper functionality during low power capacity as specified in 8.1.11.

7.1.11.2 CUR electronic devices operating in the SCBA mode shall continue to function at maximum power consumption for a minimum of 2 hours following the activation of the low-power-source alert signal.

7.2 CUR/Open-Circuit SCBA Mode Tests.

7.2.1 Reserved.

7.2.2 Service Time Performance.

7.2.2.1 Service time shall be measured with a breathing machine as specified in 8.2.2.

7.2.2.2 The CUR, when operating in the SCBA mode, shall be classified at the highest 5-minute increment achieved according to the length of time it supplies air to the breathing machine.

7.2.3 Human Subject Performance Test for Low-Temperature Operations.

7.2.3.1 Two persons shall perform the tests specified in 8.2.3, each wearing a CUR operating in the SCBA mode, in accordance with the CUR manufacturer's instructions.

7.2.3.2* The CUR worn by each test subject shall function at the temperature specified in 8.2.12.6.1.1.

7.2.3.2.1 Each wearer shall have unobscured vision to perform the work.

7.2.3.2.2 Each wearer shall not experience discomfort because of airflow restriction or other physical changes in the operation of the apparatus.

7.2.3.2.3 CUR manufacturers shall be permitted to incorporate auxiliary low-temperature parts to meet the human subject performance test for low-temperature operations requirements.

7.2.4 Human Subject Performance Tests During Physical Exertions.

7.2.4.1 Physical Exertions Performance—Test A.

7.2.4.1.1 CUR shall be tested as specified in 8.2.4.4.

7.2.4.1.2 The CUR shall function as specified by the manufacturer for the duration of the test.

7.2.4.1.3 No components shall separate from the unit during the conduct of the test.

7.2.4.1.4 Fogging of the eyepiece shall not obscure the wearer's vision.

7.2.4.1.5 The wearer shall not experience discomfort because of fit or other characteristics of the apparatus.

7.2.4.1.6 Inability of the test subject to be able to complete the man test for physical or medical reasons shall not constitute a failure.

7.2.4.1.7 Inability of the test subject to be able to complete the man test for physical or medical reasons shall necessitate a retest of all tests performed by the test subject.

7.2.4.2 Physical Exertions Performance—Test B.

7.2.4.2.1 The CUR shall be tested as specified in 8.2.5.4.

7.2.4.2.2 The CUR shall function as specified by the manufacturer for the duration of the test.

7.2.4.2.3 No components shall separate from the unit during the conduct of the test.

7.2.4.2.4 Fogging of the eyepiece shall not obscure the wearer's vision.

7.2.4.2.5 The wearer shall not experience discomfort because of fit or other characteristics of the apparatus.

7.2.4.2.6 Inability of the test subject to be able to complete the man test for physical or medical reasons shall not constitute a failure.

7.2.4.2.7 Inability of the test subject to be able to complete the man test for physical or medical reasons shall necessitate a retest of all tests performed by the test subject.

7.2.5 Integrity of Couplings Performance. Where CUR contains a coupling to a standby air supply, couplings used in conjunction with CUR shall comply with both of the following:

(1) Be tested as specified in 8.2.5
(2) Not exhibit leakage of air in excess of 50 cc per minute at each coupling

7.2.6 CUR Standby Air Supply Airflow Performance.

7.2.6.1 CUR couplings used in conjunction with CUR shall be tested as specified in 8.2.6.

7.2.6.2 The air-supply hose, detachable coupling, and pressure demand valve shall deliver respirable air at a rate not less than 115 L (4 ft^3) per minute.

7.2.6.3 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column and shall not be greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.7 CUR Connection to a Standby Air Source Performance.

7.2.7.1 CUR shall be tested as specified in 8.2.7.

7.2.7.2 The transfer from the standby air supply operating mode to the SCBA mode shall be accomplished in no more than 15 sec.

7.2.8 CUR Air Flow Capabilities in Event of Second-Stage Regulator Failure Performance.

7.2.8.1 The CUR's capability for providing flow in the event of a second-stage regulator failure shall be tested as specified in 8.2.8.

7.2.8.2 If the capability is adjustable, it shall deliver a minimum flow rate of 130 L/min (4.6 ft^3/min) in the fully open position at 20 percent to 25 percent of full service pressure.

7.2.8.3 If the capability utilizes a constant flow, it shall deliver a minimum flow rate of 85 L/min (3.0 ft^3/min) and a maximum flow rate of 130 L/min (4.6 ft^3/min) constant flow at 20 percent to 25 percent of full service pressure.

7.2.9 CUR Gauge Accuracy Performance.

7.2.9.1 The CUR shall be tested for gauge accuracy performance as specified in 8.2.9.

7.2.9.2 Gauges shall be reliable to within ±5 percent of full scale.

7.2.10 CUR Remote Gauge Line Flow Performance.

7.2.10.1 The CUR's remote gauge line flow shall be tested as specified in 8.2.10.

7.2.10.2 Flow shall not exceed 24 L/min (0.84 ft^3/min) at 152 bar (2,200 psi).

7.2.11* CUR Airflow Performance when Operating in SCBA Mode.

7.2.11.1 CUR, when operating in SCBA mode, shall be tested for airflow performance as specified in 8.2.11.

7.2.11.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column and shall not be greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.11.3 CUR, when operating in the SCBA mode, shall be tested for activation of EOSTI during the airflow performance testing specified in 8.2.12.

7.2.11.3.1 The EOSTI shall activate as specified in 6.2.9.

7.2.11.3.2 The EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.2.11.4 HUD.

7.2.11.4.1 Where the CUR is equipped with a HUD, the CUR shall be tested for functionality of the HUD breathing air pressure vessel content informational display and visual alert signals during the airflow performance testing specified in 8.2.12.

7.2.11.4.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.

7.2.11.4.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.2.12 Environmental Temperature Performance.

7.2.12.1 While operating in SCBA mode, the CUR shall be tested for environmental temperature performance as specified in 8.2.12.

7.2.12.2 Cold Environment.

7.2.12.2.1 CUR shall be tested for cold environment as specified in 8.2.12.

7.2.12.2.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.12.3 Hot Environment.

7.2.12.3.1 CUR shall be tested for hot environment as specified in 8.2.12.7.

7.2.12.3.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.12.4 Hot-to-Cold Environment.

7.2.12.4.1 CUR shall be tested for hot-to-cold environment as specified in 8.2.12.8.

7.2.12.4.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.12.5 Cold-to-Hot Environment.

7.2.12.5.1 While operating in SCBA mode, the CUR shall be tested for cold-to-hot environment as specified in 8.2.12.9.

7.2.12.5.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.13 Vibration Resistance Performance.

7.2.13.1 Facepiece Pressure.

7.2.13.1.1 CUR shall be tested for vibration resistance as specified in 8.2.13.

7.2.13.1.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.13.1.3 There shall be no movement of the CGA fittings, if applicable, causing a break of any width in the line.

7.2.13.2 EOSTI.

7.2.13.2.1 CUR shall be tested for activation of EOSTI during the vibration testing specified in 8.2.13.

7.2.13.2.2 The EOSTI shall activate as specified in 6.2.9.

7.2.13.2.3 The EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.2.13.3 HUD.

7.2.13.3.1 While operating in SCBA mode, where the CUR is equipped with a HUD, the CUR shall be tested for functionality of the HUD breathing air pressure vessel content informational display and visual alert signals during the vibration testing specified in 8.2.13.

7.2.13.3.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.

7.2.13.3.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.2.14 Corrosion Resistance Performance.

7.2.14.1 CUR Function.

7.2.14.1.1 While operating in SCBA mode, the CUR shall be tested for corrosion resistance as specified in 8.2.14.

7.2.14.1.2 Any corrosion shall not prohibit the use and function, as specified in the manufacturer's instructions, of any control or operating feature of the CUR.

7.2.14.2 Facepiece Pressure.

7.2.14.2.1 While operating in SCBA mode, the CUR shall be tested for corrosion resistance as specified in 8.2.14.

7.2.14.2.2 While operating in the SCBA mode, the CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.14.3 EOSTI.

7.2.14.3.1 While operating in SCBA mode, the CUR shall be tested for activation of EOSTI during the corrosion resistance testing specified in 8.2.15.

7.2.14.3.2 The EOSTI shall activate as specified in 6.2.9.

7.2.14.3.3 The EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.2.14.4 HUD.

7.2.14.4.1 While operating in SCBA mode, where the CUR is equipped with a HUD, the CUR shall be tested for functionality of the HUD breathing air pressure vessel content informational display and visual alert signals during the corrosion resistance testing specified in 8.2.14.

7.2.14.4.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.

7.2.14.4.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.2.15 Particulate Resistance Performance.

7.2.15.1 Facepiece Pressure.

7.2.15.1.1 While operating in SCBA mode, the CUR shall be tested for particulate resistance as specified in 8.2.16.

7.2.15.1.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.15.2 EOSTI.

7.2.15.2.1 While operating in SCBA mode, the CUR shall be tested for activation of EOSTI during the particulate resistance testing specified in 8.2.15.

7.2.15.2.2 The EOSTI shall activate as specified in 6.2.9.

7.2.15.2.3 The EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.2.15.3 HUD.

7.2.15.3.1 While operating in SCBA mode, where the CUR is equipped with a HUD, the CUR shall be tested for functionality of the HUD breathing air pressure vessel content informational display and visual alert signals during the particulate resistance testing specified in 8.2.16.

7.2.15.3.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.

7.2.15.3.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.2.16 EOSTI Audible Alarm Recognition.

7.2.16.1 Each EOSTI shall be tested for alarm recognition as specified in 8.2.16.

7.2.16.2 The EOSTI alarm signal shall be recognized in 10 sec or less.

7.2.17 Additional CUR HUD Performance. Where the CUR is equipped with a HUD, the tests in 8.2.17 shall apply.

7.2.17.1 Exposed Wiring.

7.2.17.1.1 Where a HUD incorporates exposed wiring, the wire's entry into any associated components shall be tested for connection strength as specified in 8.2.17.1.

7.2.17.1.2 The HUD shall remain functional.

7.2.17.2 Power Source.

7.2.17.2.1 Where a power source is used for a HUD to comply with the requirements of this standard, the HUD shall be tested for functionality of alert signals and visual information displays as specified in 8.2.17.2.

7.2.17.2.2 The HUD shall continue to function at maximum current draw for a minimum of 2 hours following the activation of the low-power-source alert signal.

7.2.17.2.3 The HUD shall display the alert signals specified in 6.2.10.

7.2.17.2.4 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.11.

7.2.17.3 Visibility.

7.2.17.3.1 The HUD shall be tested for wearer visibility as specified in 8.2.17.3.

7.2.17.3.2 Each informational display and visual alert signal shall be observable, distinct, and identifiable in both darkness and bright light.

7.2.17.4 Disabling Glare.

7.2.17.4.1 The HUD shall be tested for disabling glare as specified in 8.2.17.5.

7.2.17.4.2 The test subject shall be able to read at least 9 out of 10 selected letters when each visual alert signal is activated.

7.2.18 RIC UAC Performance Requirements.

7.2.18.1 Facepiece Pressure.

7.2.18.1.1 If a CUR is equipped with an RIC UAC, the CUR shall be tested for pressure vessel refill breathing performance as specified in 8.2.18.1.

7.2.18.1.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.18.2 Fill Rate.

7.2.18.2.1 If a CUR is equipped with an RIC UAC, the CUR shall be tested for RIC UAC system fill rate performance as specified in 8.2.18.2.

7.2.18.2.2 The maximum allowable fill time shall be 3.0 min.

7.2.18.3 Accessibility.

7.2.18.3.1 If a CUR is equipped with an RIC UAC, the RIC UAC system connection shall be tested for accessibility as specified in 8.2.18.3.

7.2.18.3.2 The RIC UAC shall be connected in a maximum of 15 sec.

7.2.18.3.3 The RIC UAC shall disconnect in a maximum of 15 sec.

7.2.19 Breathing Air Pressure Vessel Performance Requirements.

7.2.19.1 Where the CUR is equipped with a rigid backframe/carrier, the CUR and the pressure vessel retention device shall be tested for breathing air pressure vessel and valve assembly retention security as specified in 8.2.19.

7.2.19.2 The pressure vessel and valve assembly shall not change position by more than 25 mm (1 in.).

7.2.20 Universal Emergency Breathing Safety System Cold Temperature Performance Requirements.

7.2.20.1 Facepiece Pressure.

7.2.20.1.1 Where the CUR is equipped with a UEBSS, the donor CUR and the receiving CUR shall be tested independently for airflow performance as specified in 8.2.12.

7.2.20.1.2 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.20.2 EOSTI.

7.2.20.2.1 Each CUR shall be tested independently for activation of EOSTI during the airflow performance testing specified in 8.2.12.

7.2.20.2.2 EOSTI shall activate as specified in 6.2.9.

7.2.20.2.3 EOSTI shall continue to operate throughout the remainder of the airflow performance test.

7.2.20.3 HUD.

7.2.20.3.1 Where the CUR is equipped with a HUD, the CUR shall be tested independently for functionality of the HUD breathing air pressure vessel content informational display and HUD visual alert signals during the airflow performance testing specified in 8.2.12.

7.2.20.3.2 The HUD shall display the visual information for the breathing air pressure vessel content as specified in 6.2.10.

7.2.20.3.3 The HUD shall display the visual alert signal as specified in 6.2.11.

7.2.20.4 Donor and Receiving CUR.

7.2.20.4.1 The CUR classified as the donor shall start at full pressure vessel pressure.

7.2.20.4.2 The CUR classified as the receiving CUR shall have a pressure of 7 bar, +0.6 bar/–0 bar (100 psi, +10 psi/–0).

7.2.20.5 Cold Environment.

7.2.20.5.1 The donor and receiving CUR shall be connected through the UEBSS.

7.2.20.5.2 The donor and receiving CUR shall be tested for cold environment as specified in 8.2.20.

7.2.20.5.3 The CUR facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column or greater than 89 mm (3.5 in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

7.2.20.6 Donor CUR EOSTI.

7.2.20.6.1 The donor CUR shall be tested for activation of EOSTI during the UEBSS cold temperature performance as specified in 8.2.20.

7.2.20.6.2 The EOSTI shall activate as specified in 6.2.9.

7.2.20.6.3 The EOSTI shall continue to operate throughout the remainder of the test.

7.2.20.7 Where the CUR is equipped with a HUD, the donor CUR shall be tested for the functionality of the HUD breathing air pressure vessel content informational display and the visual alert signal during the UEBSS cold temperature performance as specified in 8.2.20.

7.3 CUR/PAPR Mode.

7.3.1 PAPR Airflow Performance.

7.3.1.1 Where the CUR incorporates a PAPR mode of operation, the PAPR airflow shall be tested as specified in 8.3.1.

7.3.1.2 The tested airflow shall be ≥115 L/min (4.0 cfm).

7.3.2 PAPR Silica Dust Loading Performance.

7.3.2.1 Where the CUR incorporates a PAPR mode of operation, the PAPR silica dust loading shall be tested as specified in 8.3.3.

7.3.2.2 The total amount of unretained test suspension in samples taken during testing shall not exceed 14.4 mg (.00003 lb).

7.3.3 Airflow Resistance Performance in Breath-Responsive, Powered Air-Purifying Respirators.

7.3.3.1 Where the CUR incorporates a breath-responsive PAPR mode of operation, the CUR shall be tested for airflow resistance performance as specified in 8.3.2.

7.3.3.2 The static pressure in the facepiece shall be ≤38 mm (1.5 in.) of water column height.

7.3.3.3 The pressure in the facepiece shall be ≥0 mm (0 in.) at inhalation airflows less than 115 L/min (4.0 cfm).

7.3.3.4 The exhalation resistance to an airflow of 85 L/min (3.0 cfm) shall not exceed the static pressure in the facepiece by more than 51 mm (2 in.) of water column height.

7.3.4 PAPR Performance with the Blower Off. Where the CUR incorporates a PAPR mode of operation, the PAPR shall be tested with the blower off to meet the requirements of Section 7.4.

7.4 CUR/APR Mode.

7.4.1 Breathing Resistance.

7.4.1.1 Where the CUR is operated in APR mode, the CUR shall be tested for inhalation breathing resistance as specified

in 8.4.1, and the maximum allowable air resistance to air flow as shown in Table 7.4.1.1.

7.4.1.2 Where the CUR is operated in APR mode, the CUR shall be tested for exhalation breathing resistance as specified in 8.4.2, and the maximum allowable air resistance to air flow shall be 20 mm (0.7 in.) H_2O.

7.4.2 Hydration Leakage.

7.4.2.1 Where the CUR contains a hydration device, the CUR shall be tested for hydration leakage as specified in 8.4.2.

7.4.2.2 The leakage between the valve and the valve seat shall not exceed 30 mL/min (0.001 ft^3/min).

7.4.3 Canister Test Challenge and Test Breakthrough Concentrations.

7.4.3.1 The CUR canisters shall be tested for canister performance as specified in 8.4.4 through 8.4.6.

7.4.3.2 The CUR canisters shall meet the gas/vapor test challenges and breakthrough concentrations shown in Table 7.4.3.2.

7.4.4 Particulate/Aerosol Canister.

7.4.4.1 The CUR canister shall be tested for particulate efficiency as specified in 8.4.6.

7.4.4.2 The CUR canister shall demonstrate a minimum efficiency level of 99.97 percent.

Table 7.4.1.1 Breathing Resistance—Canister

Inhalation	Facepiece-Mounted	Non-Facepiece-Mounted
Initial	65 mm (2.5 in.) H_2O	70 (2.7 in.) mm H_2O
Final*	80 (3.2 in.) mm H_2O	85 (3.3 in.) mm H_2O

*Measured at end of service life.

Table 7.4.3.2 Canister Test Challenge and Test Breakthrough Concentrations

	Test Concentration (ppm)	Breakthrough Concentration (ppm)
Ammonia	2,500	12.5
Cyanogen chloride	300	2
Cyclohexane	2,600	10
Formaldehyde	500	1
Hydrogen cyanide	940	4.7*
Hydrogen sulfide	1,000	5.0
Nitrogen dioxide	200	1 ppm NO_2 or 25 ppm NO†
Phosgene	250	1.25
Phosphine	300	0.3
Sulfur dioxide	1,500	5

*Sum of HCN and C_2N_2.

†Nitrogen dioxide breakthrough should be monitored for both NO_2 and NO. The breakthrough should be determined by which quantity, NO_2 or NO, reaches breakthrough first.

7.4.4.3 The CUR canister shall be classified as a P100 particulate filter.

7.4.5 Low Temperature/Fogging.

7.4.5.1 The respirator shall demonstrate an average visual acuity score (VAS) ≥75 points for all measurements of acuity as specified in 8.4.7.

7.4.5.2 The wearer shall not experience undue discomfort because of restrictions to breathing or other physical or chemical changes to the respirator.

7.4.6 ESLI Drop Test for Canisters.

7.4.6.1 Where the CUR is operating in the APR mode and is equipped with an ESLI, the ESLI shall be tested as specified in 8.4.8.

7.4.6.2 The ELSI shall withstand cleaning and a drop from a 1.83 m (6 ft) height.

7.4.6.3 Replaceable ESLI shall be able to be removed and to withstand a drop from a 1.83 m (6 ft) height.

7.4.7 ESLI Test for Canisters.

7.4.7.1 Where the CUR is operating in the APR mode and is equipped with an ESLI, the ESLI shall be tested for service life depletion as specified in 8.4.9.

7.4.7.2 The ELSI shall indicate sorbent depletion at ≤90 percent of the service life.

7.5 Optional CUR Toxic Industrial Chemical Permeation Resistance Performance.

7.5.1* Where optional toxic industrial chemical permeation resistance testing is elected by the manufacturer, CURs shall comply with both of the following:

(1) CURs shall be tested in SCBA mode for resistance to permeation as specified in Section 8.5.
(2) CURs shall meet the performance criteria in Table 7.5.1 for the chemical(s) selected by the manufacturer in both the nasal and ocular regions for one hour.

Table 7.5.1 SCBA Test Chemicals, Challenge States, and Pass/Fail Criteria

Chemical	CAS No.	Challenge State	Pass/Fail 60 min (ppm)
Acrylonitrile	107-13-1	Vapor	3
Ammonia	7664-41-7	Gas	3
Chlorine	7782-50-5	Gas	3
Methyl chloride	74-87-3	Gas	3
Diethylamine	109-89-7	Vapor	3
Ethyl acetate	141-78-6	Vapor	3
Tetrahydrofuran	109-99-9	Vapor	3
Tetrachloroethylene	127-18-4	Liquid	3
Dimethyl formamide	68-12-2	Liquid	3
Toluene	108-88-3	Liquid	3

7.5.2* Where optional toxic industrial chemical permeation resistance testing is elected by the manufacturer, CURs shall comply with both of the following:

(1) CURs shall be tested in PAPR mode for resistance to permeation as specified in Section 8.5.
(2) CURs shall meet the performance criteria in Table 7.5.2 for the chemical(s) selected by the manufacturer in both the nasal and ocular regions for one hour.

Table 7.5.2 PAPR Test Chemicals, Challenge States, and Pass/Fail Criteria

Chemical	CAS No.	Challenge State	Pass/Fail 60 min (ppm)
Acrylonitrile	107-13-1	Vapor	3
Ammonia	7664-41-7	Gas	3
Chlorine	7782-50-5	Gas	3
Methyl chloride	74-87-3	Gas	3
Diethylamine	109-89-7	Vapor	3
Ethyl acetate	141-78-6	Vapor	3
Tetrahydrofuran	109-99-9	Vapor	3
Tetrachloroethylene	127-18-4	Liquid	3
Dimethyl formamide	68-12-2	Liquid	3
Toluene	108-88-3	Liquid	3

7.5.3* Where optional toxic industrial chemical permeation resistance testing is elected by the manufacturer, CURs shall comply with both of the following:

(1) CURs shall be tested in APR mode for resistance to permeation as specified in Section 8.5.
(2) CURs shall meet the performance criteria in Table 7.5.3 for the chemical(s) selected by the manufacturer in both the nasal and ocular regions for one hour.

Table 7.5.3 APR Test Chemicals, Challenge States, and Pass/Fail Criteria

Chemical	CAS No.	Challenge State	Pass/Fail 60 min (ppm)
Acrylonitrile	107-13-1	Vapor	3
Ammonia	7664-41-7	Gas	3
Chlorine	7782-50-5	Gas	3
Methyl chloride	74-87-3	Gas	3
Diethylamine	109-89-7	Vapor	3
Ethyl acetate	141-78-6	Vapor	3
Tetrahydrofuran	109-99-9	Vapor	3
Tetrachloroethylene	127-18-4	Liquid	3
Dimethyl formamide	68-12-2	Liquid	3
Toluene	108-88-3	Liquid	3

Chapter 8 Test Methods

8.1 CUR System Requirements.

8.1.1 Chemical Agent Permeation and Penetration Resistance Against Distilled Sulfur Mustard (HD) and Sarin (GB) Performance Requirements.

8.1.1.1 Application. These tests shall apply to all CUR.

8.1.1.2 Specimens. CUR models shall be tested in each chemical agent permeation and penetration resistance against distilled sulfur mustard (HD) and sarin (GB) performance requirements performance test.

8.1.1.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.1.1.4 Procedure.

8.1.1.4.1 Specimens shall be tested as specified in sections 3, 4.1, and 5 of NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0801 and NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0802.

8.1.1.4.2 The agent shall be CASARM or non-CASARM with a purity of at least 95 percent.

8.1.1.5 Report. The chemical agent permeation and penetration resistance against distilled sulfur mustard (HD) and sarin (GB) performance requirements performance test shall be recorded and reported for each test specimen.

8.1.1.6 Interpretation. The chemical agent permeation and penetration resistance against distilled sulfur mustard (HD) and sarin (GB) performance requirements performance test shall be used to determine pass or fail performance.

8.1.2 Laboratory Respiratory Protection Level (LRPL).

8.1.2.1 Application. These tests will apply to all CUR.

8.1.2.2 Specimens. CUR models and components shall be tested in each LRPL performance test.

8.1.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.1.2.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0800.

8.1.2.5 Report. The LRPL performance test shall be recorded and reported for each test specimen.

8.1.2.6 Interpretation. The LRPL performance test shall be used to determine pass or fail performance.

8.1.3 Field of View (FoV) Performance Test.

8.1.3.1 Application. This test shall apply to all CUR.

8.1.3.2 Specimens.

8.1.3.2.1 One CUR specimen shall be tested for each size of each facepiece model.

8.1.3.2.2 For facepiece models that are offered with more than one nose cup size, each facepiece model shall be tested with each combination of nose cup installed.

8.1.3.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.1.3.4 Procedure. The field of view shall be obtained by using a medium-size respirator or equivalent that is sized to fit the head form described in Figure 14 of EN 136, or equivalent.

8.1.3.5 Report. The field of view performance shall be recorded and reported for each test specimen.

8.1.3.6 Interpretation. The field of view performance shall be used to determine pass or fail performance.

8.1.4 Rigid Facepiece Lens Abrasion Test.

8.1.4.1 Application. This test method shall apply to CUR with rigid facepiece lenses.

8.1.4.2 Samples. A minimum of four facepiece lenses shall be tested.

8.1.4.3 Specimen Preparation.

8.1.4.3.1 Seven specimens shall be chosen from a minimum of four facepiece lenses.

8.1.4.3.1.1 Four specimens shall be taken from the left viewing area.

8.1.4.3.1.2 Three specimens shall be taken from the right viewing area.

8.1.4.3.2 One of the four specimens taken from the left viewing area shall be the set-up specimen.

8.1.4.3.3 The left test specimens shall conform to all the following criteria:

(1) Specimens shall be squares measuring 50 mm × 50 mm (2 in. × 2 in.).
(2) Two edges of each square section shall be parallel within ±2 degrees of the axis of the pressure vessel or cone in the center of the specimen.
(3) At least 38 mm (1½ in.) of each 50 mm × 50 mm (2 in. × 2 in.) square shall be taken from the left side of the center line of the lens.
(4) Each 50 mm × 50 mm (2 in. × 2 in.) square shall be cut at approximately eye level.

8.1.4.3.4 The right test specimens shall conform to all the following criteria:

(1) Specimens shall be a square measuring 50 mm × 50 mm (2 in. × 2 in.).
(2) Two edges of each square section shall be parallel within ±2 degrees of the axis of the pressure vessel or cone in the center of the specimen.
(3) At least 38 mm (1½ in.) of each 50 mm × 50 mm (2 in. × 2 in.) square shall be taken from the right side of the center line of the lens.
(4) The 50 mm × 50 mm (2 in. × 2 in.) square shall be cut at approximately eye level.

8.1.4.3.5 Each of the specimens shall be cleaned in the following manner:

(1) The specimens shall be rinsed with clean tap water.
(2) The specimens shall be washed with a solution of nonionic/low-phosphate detergent and water using a clean, soft gauze pad.
(3) The specimens shall be rinsed with d-ionized water.
(4) The specimens shall be blown dry with clean compressed air or nitrogen.

8.1.4.4 Apparatus. The test apparatus shall be constructed in accordance with Figure 8.1.4.4(a) and Figure 8.1.4.4(b).

8.1.4.5 Procedure.

8.1.4.5.1 The haze of the specimen shall be measured and recorded as follows:

(1) The haze shall be measured using a haze meter in accordance with ASTM D1003.
(2) The haze shall be measured in the middle of the specimen ± 1.6 mm (± 1/16 in.).
(3) The specimen shall be repositioned to achieve the maximum haze value within the area defined in 8.1.4.5.1(1).
(4) The haze meter shall have a specified aperture of 22.4 mm (7/8 in.).
(5) The haze meter shall have a visual display showing 0.1 percent resolution.
(6) The haze meter shall be calibrated before and after each day's use following procedures specified in ASTM D1003.

8.1.4.5.2 The set-up specimen shall be placed cover side up in the test apparatus specimen holder.

8.1.4.5.3 The specimen holder shall be configured with a flat surface under the lens or with an inner radius support.

8.1.4.5.4 Pad Holder.

8.1.4.5.4.1 The pad holder shall consist of a cylinder 10 mm (3/8 in.) high and 25 mm (1 in.) in diameter with a radius of curvature equal to the radius of curvature of the outside of the lens in the viewing area, ±0.25 diopter.

8.1.4.5.4.2 The cylinder shall be affixed to the stroking arm by a #10-32 UNF threaded rod.

8.1.4.5.5 The pad shall be a Blue Streak M306M wool felt polishing pad, or equivalent, 24 mm (15/16 in.) in diameter.

8.1.4.5.6 The abrasive disc shall be made from 3M part number 7415, wood finishing pad, or equivalent.

8.1.4.5.7 A disc 24 mm (15/16 in.) in diameter shall be cut from the abrasive sheet.

8.1.4.5.8 The marked side of the disc shall be placed against the pad.

8.1.4.5.9 The orientation described in 8.1.4.5.8 shall be maintained for each abrasive disc throughout the testing.

8.1.4.5.10 The pad holder, pad, and abrasive disc shall be installed on the stroking arm.

8.1.4.5.11 The stroking arm shall be leveled to ±3 degrees by adjusting the threaded pin.

8.1.4.5.12 The pin shall be secured to prevent rotation of the pad holder.

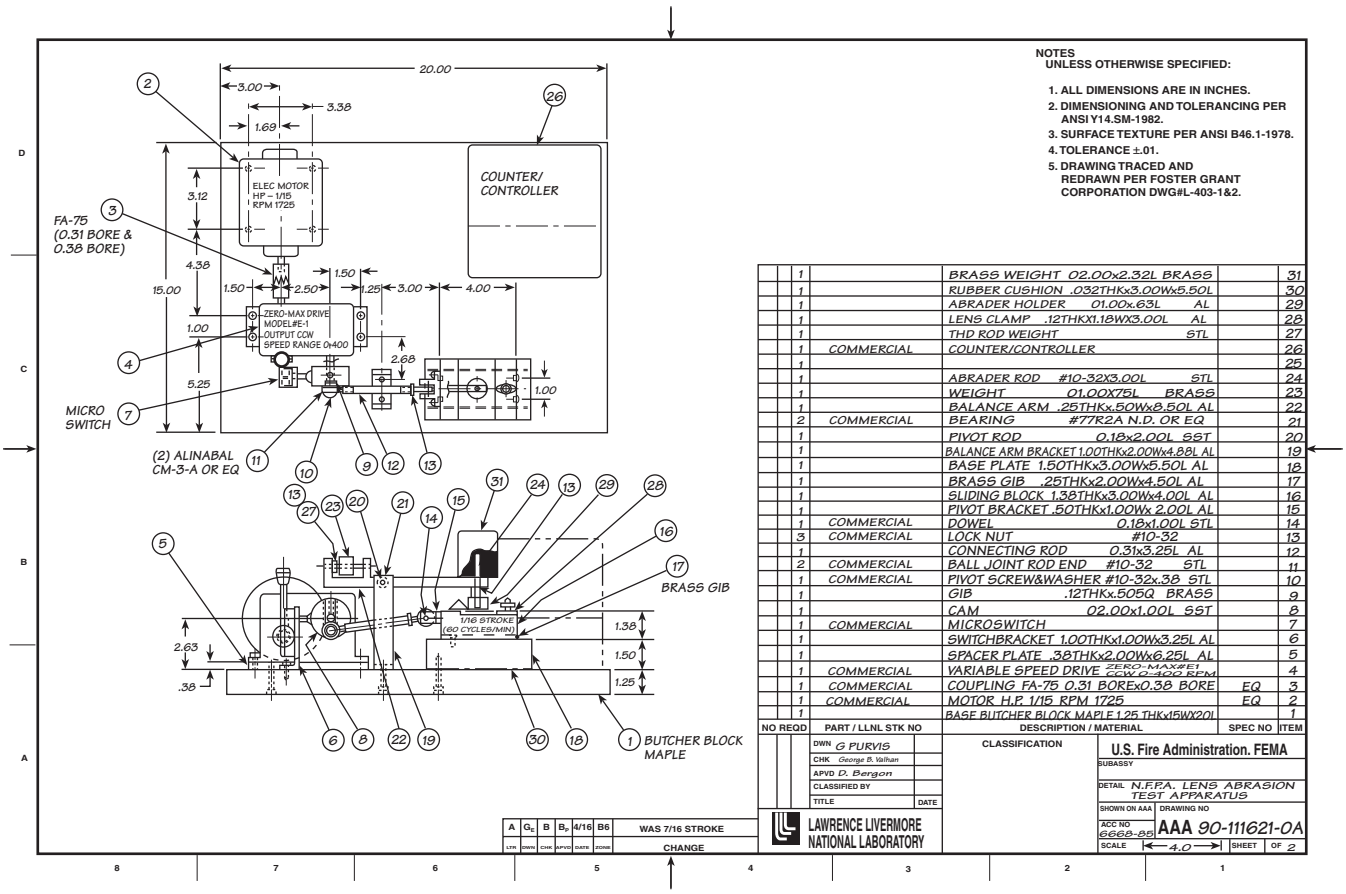


FIGURE 8.1.4.4(a) Lens Abrasion Tester.

8.1.4.5.13 The axis of curvature of the pad holder shall be coincident with the axis of curvature of the lens.

8.1.4.5.14 The stroking arm shall be counterbalanced with the pad holder, pad, and abrasive disc in place.

8.1.4.5.15 The set-up specimen shall be replaced with one of the six specimens to be tested.

8.1.4.5.16 The 1,000 g, ±5 g (2.2 lb, ±0.18 lb) test weight shall be installed on the pin above the test specimen.

8.1.4.5.17 The test shall be run for 200 cycles, ±1 cycle. One cycle shall consist of a complete revolution of the eccentric wheel.

8.1.4.5.18 The length of stroke shall be 14.5 mm ($^{9}/_{16}$ in.), producing a pattern 38 mm (1½ in.) long.

8.1.4.5.19 The frequency of the stroke shall be 60 cycles, ±1 cycle, per minute.

8.1.4.5.20 The center of the stroke shall be within ±2 mm (± $^{1}/_{16}$ in.) of the center of the specimen.

8.1.4.5.21 The specimen shall be removed and cleaned following the procedure specified in 8.1.4.3.5.

8.1.4.5.22 The abrasive disc shall be discarded.

8.1.4.5.23 The haze of the specimen shall be measured following the procedure specified in 8.1.4.5.

8.1.4.5.24 The delta haze shall be calculated by subtracting the initial haze from the final haze.

8.1.4.5.25 The testing steps specified in 8.1.4.3.5 through 8.1.4.5.24 shall be repeated five times with a new specimen and abrasive disc.

8.1.4.6 Report.

8.1.4.6.1 The six delta haze values shall be recorded, averaged, and reported.

8.1.4.6.2 The average value shall be used to determine pass or fail.

8.1.4.7 Interpretation.

8.1.4.7.1 The average delta haze shall be used to determine pass or fail performance.

8.1.4.7.2 Failure of the average value shall constitute failure for the entire sample.

8.1.5 Flexible Facepiece Lens Abrasion Test.

8.1.5.1 Application. This test method shall apply to flexible facepiece lenses.

8.1.5.2 Samples. A minimum of six specimens shall be tested.

8.1.5.3 Specimen Preparation. Six specimens shall be tested.

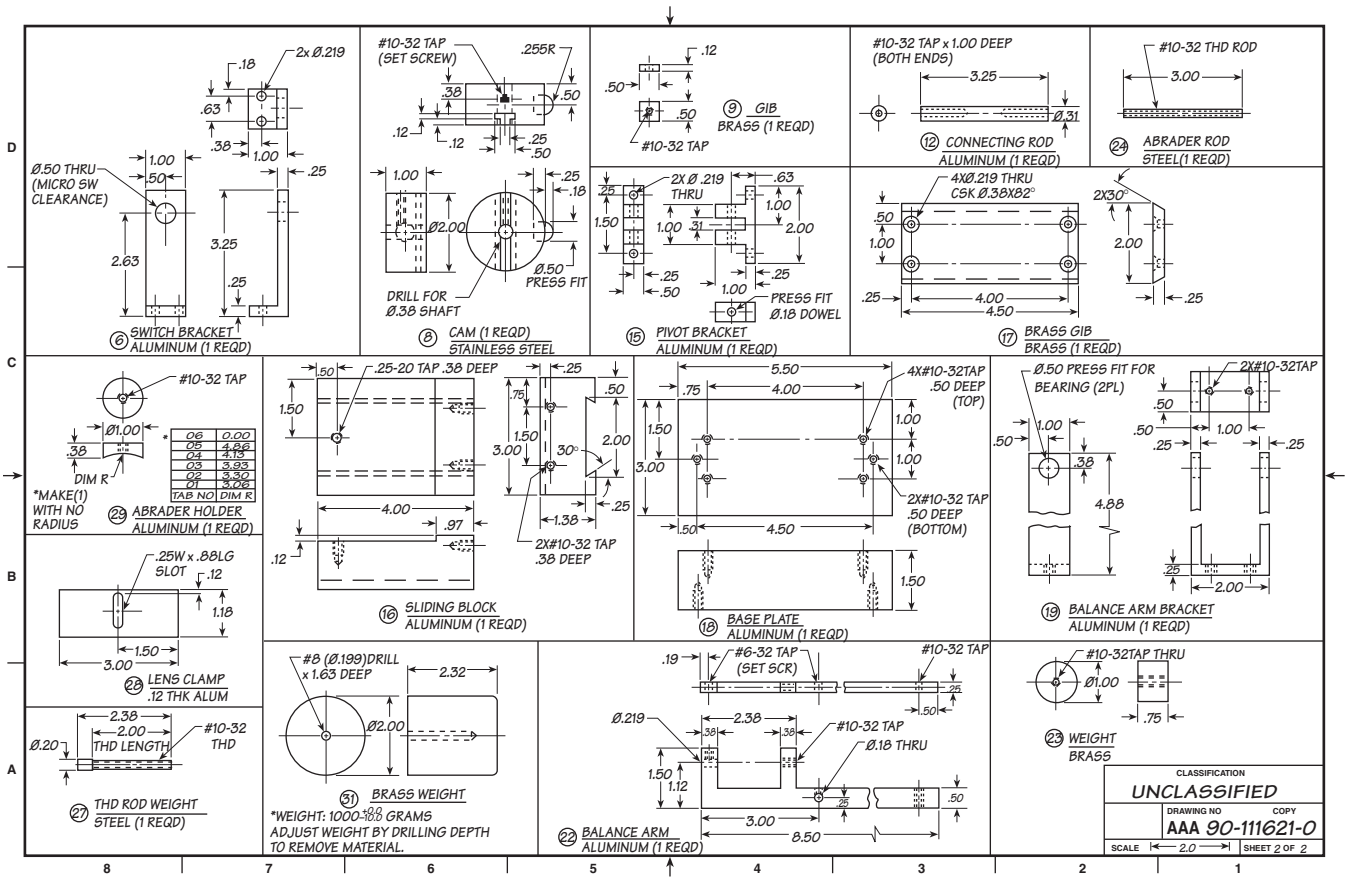


FIGURE 8.1.4.4(b) Lens Abrasion Tester (details).

8.1.5.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure CET-APRS-STP-0316.

8.1.5.5 Report. The abrasion resistance performance shall be recorded and reported for each test specimen.

8.1.5.6 Interpretation. The abrasion resistance performance shall be used to determine pass or fail performance.

8.1.6 Nonelectronic Communications Test.

8.1.6.1 Application. This test method shall apply to complete CUR facepieces and second-stage regulator(s).

8.1.6.2 Samples. Each sample to be tested shall be as specified in 4.3.9 with all voice communications systems installed, including supplementary voice communications systems, and in the "off" mode in accordance with the manufacturer's instructions.

8.1.6.3 Specimen Preparation.

8.1.6.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.6.3.2 Specimens for conditioning shall be complete medium-size CUR facepiece(s) and inner mask(s), with the second-stage regulator(s) installed in the "as worn" position as specified by the manufacturer.

8.1.6.4 Apparatus.

8.1.6.4.1 Testing shall be conducted in a chamber having the following characteristics:

(1) Minimum room dimensions of 4.6 m long × 3.1 m wide × 2.7 m high (15 ft long × 10 ft wide × 9 ft high)
(2) Hemi-anechoic construction
(3) Ambient noise level inside chamber of NC-25
(4) Walls and ceiling ≥90 percent absorptive for 100 Hz

8.1.6.4.2 All surfaces above the floor shall be acoustically treated for internal acoustic absorption, as well as for external noise mitigation.

8.1.6.4.3 A G.R.A.S. KEMAR head and torso simulator (HATS) Type 45BM shall be used for testing.

8.1.6.4.4 Tone.

8.1.6.4.4.1 The mouth simulator shall be capable of producing 112 dB/1 kHz sine tone at 25 mm (1 in.) with the mouth reference point unequalized.

8.1.6.4.4.2 The total harmonic distortion (THD) shall be ≤3 percent.

8.1.6.4.5 Frequency Response.

8.1.6.4.5.1 The mouth simulator frequency response shall be able to be equalized flat ±1 dB between 100 Hz and 10 kHz.

8.1.6.4.5.2 The response of the requirement in 8.1.6.4.5.1 shall be –15 dB or less at 100 Hz and –20 dB or less at 15 kHz.

8.1.6.4.6 A sound pressure level (SPL) meter having the following characteristics shall be used:

(1) The SPL meter shall be capable of applying an equivalent continuous sound pressure level (Leq) using an A-weighted filter.
(2) The SPL meter shall have a dynamic range from 30 dB (or less) to 130 dB (or more).
(3) The SPL meter shall display the measurement to at least one decimal place.

8.1.6.4.7 Signal/pink noise analog audio signal generators having the characteristics described in 8.1.6.4.8 and 8.1.6.4.9 shall be used.

8.1.6.4.8 One generator shall be capable of playing wave files at 48 kHz, 16-bit mono at the output level of 0 dB, FS = 18 dBu, per EBU Technical Recommendation R68.

8.1.6.4.9 The second generator shall be capable of generating pink noise and sine waves from –80 dBu to –2 dBu in one-digit steps, with a THD+N of –90 dB (0.0032 percent) at 8 dBu noise floor type 25uv.

8.1.6.4.9.1 The second generator shall have the following characteristics:

(1) Frequency range of 10 Hz to 20 kHz in one-digit steps ±0.01 percent
(2) Amplitude accuracy of within ±0.5 dB or less

8.1.6.4.10 A digital equalizer having the following characteristics shall be used:

(1) The digital equalizer shall be capable of at least two concurrently selectable equalizer sections as follows:
    (a) One 31-band graphic with an adjustment range of at least ±18 dB
    (b) A 10-band parametric with an adjustment range of at least ±18 dB
(2) The digital equalizer shall have a dynamic range of 112 dB.
(3) The digital equalizer shall be capable of equalizing the frequency response of the HATS manikin of ±1 dB flat between 100 Hz and 10 kHz, applying a 180 Hz high-pass filter with a slope of –24 dB octave, and a 10 Hz low-pass filter with a slope of –24 dB octave (–15 dB at 100 Hz, –20 dB at 15 kHz).

8.1.6.4.11 A powered speaker having the following characteristics shall be used:

(1) The sensitivity shall be ≥84 dB at 1 watt at 1 m (39.4 in.).
(2) The frequency response shall be rated at ≤80 Hz to ≥13 kHz.
(3) The amplifier shall deliver ≥10 W with a total harmonic distortion <1 percent.

8.1.6.4.12 A microphone having the following characteristics shall be used:

(1) The microphone shall be a condenser type.
(2) The microphone polar pattern shall be omnidirectional.
(3) The frequency response shall be flat ±0.5 dB from 100 Hz to 15 kHz.
(4) The residual noise shall be ≤–30 dB.
(5) The microphone shall accept signals of at least 130 dBA.

8.1.6.4.13 A speech transmission index (STI) analyzer having the following characteristics shall be used:

(1) The STI PA analyzer shall be capable of measuring and displaying a single-value STI PA result to two decimal places with a seven-octave band modulated noise test signal using the Netherlands Organization for Applied Scientific Research (TNO) verified algorithm.
(2) The STI PA analyzer shall conform to Part 16 of IEC 60268.

8.1.6.4.14 All the apparatus identified in 8.1.6.4 shall be located in the hemianechoic chamber and arranged as shown in Figure 8.1.6.4.14(a) and Figure 8.1.6.4.14(b).

8.1.6.4.15 The HATS test manikin shall be positioned in the chamber in the following manner as shown in Figure 8.1.6.4.14(a) and Figure 8.1.6.4.14(b).

8.1.6.4.16 Microphone.

8.1.6.4.16.1 The distance between the HATS test manikin and the microphone shall be 1.5 m, +25 mm/–0 mm (5 ft, +1 in./–0 in.).

8.1.6.4.16.2 The HATS test manikin and the microphone shall be facing each other.

8.1.6.4.17 The distance between the HATS test manikin mouth reference point (MRP) and the floor shall be 1.5 m, +25 mm/–0 mm (5 ft, +1 in./–0 in.).

8.1.6.4.18 The distance between the microphone and the floor shall be 1.5 m, +25 mm/–0 mm (±5 ft, +1 in./–0 in.).

8.1.6.4.19 The test chamber shall be filled with broadband pink noise with a tolerance of ±1 dB per octave band from 100 Hz to 10 kHz.

8.1.6.4.20 The pink noise speaker shall be placed directly beneath the microphone and oriented such that the central axis of the speaker cone is directly facing the microphone.

8.1.6.4.21 The speaker shall be situated on top of a block of isolating acoustic foam such that no part of the speaker box is contacting the floor or the microphone stand, to prevent conduction of sound to the microphone.

8.1.6.4.22* Speaker Distances.

8.1.6.4.22.1 The height of the speaker off the floor shall be at least 125 mm (5 in.), as measured from the bottom of the speaker box.

8.1.6.4.22.2 The distance between the speaker and the microphone shall be no less than 1 m (40 in.), as measured from the top of the speaker grille/enclosure.

8.1.6.4.23 The pink noise speaker shall be placed as indicated in Figure 8.1.6.4.23.

8.1.6.4.24 The pink noise speaker shall be fully equalized flat, from 100 Hz to 10 kHz, to within ±1dB on a relative scale in ⅓ octave bands, as measured at the microphone position.

8.1.6.4.25 The STI test signal from the manikin shall be adjusted to achieve an A-weighted sound level of 97 dB, ±0.5 dB at the MRP, 50 mm, ±3 mm (2 in., ± ⅛ in.) from the test manikin's mouth.

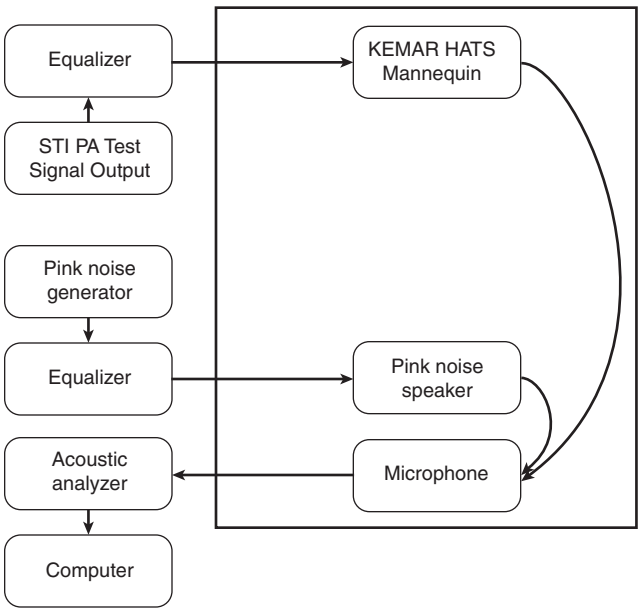


FIGURE 8.1.6.4.14(a) Hemianechoic Chamber.

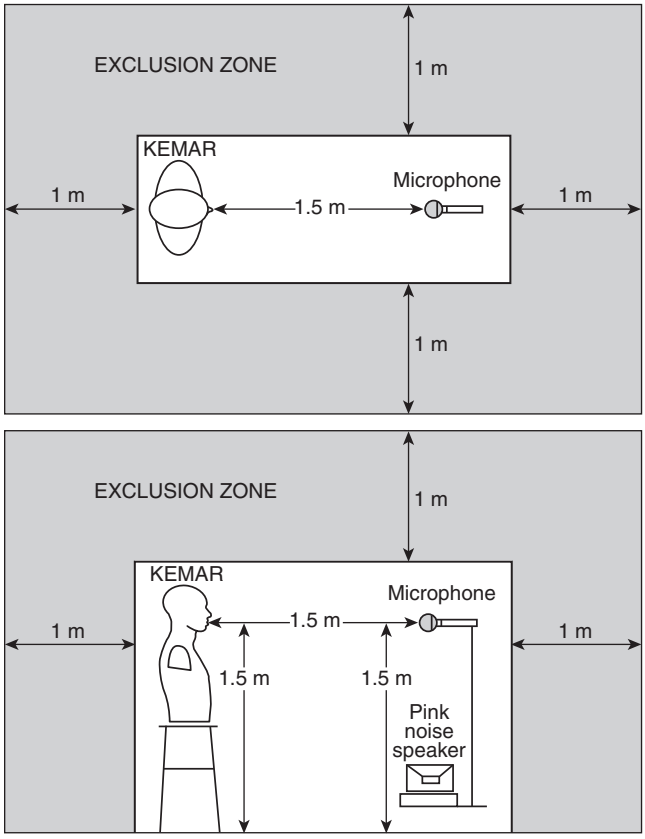


FIGURE 8.1.6.4.14(b) HATS Test Mannequin Position.

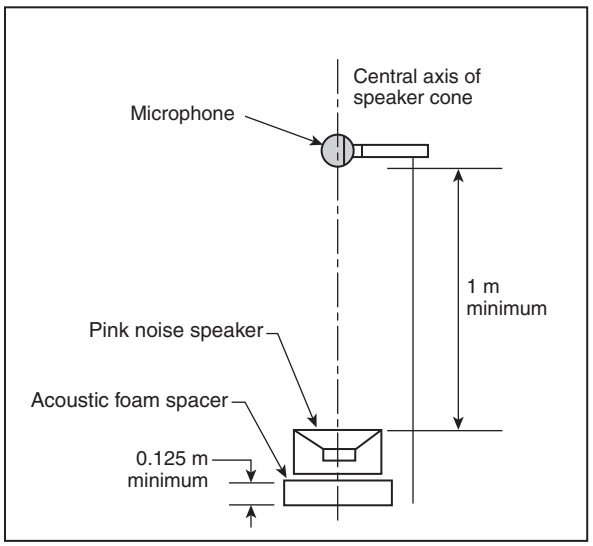


FIGURE 8.1.6.4.23 Test Chamber.

8.1.6.4.26 The microphone used for calibrating the STI signal shall be omnidirectional and oriented in a horizontal front-facing manner.

8.1.6.4.27 The STI signal shall be equalized flat to within ±1 dB on a relative scale in ⅓ octave bands as measured at the MRP of the HATS.

8.1.6.4.28 The HATS shall be calibrated as follows:

(1) Equalize flat with pink noise to 97 dBA from 100 Hz to 10 kHz to ±1 dB on a ⅓ octave scale
(2) Reduce the levels for the 125 Hz octave band (the 100, 125, and 160 ⅓ octave bands) by 10 dB
(3) Reduce the levels for the 250 Hz octave band (the 200, 250, and 315 ⅓ octave bands) by 2 dB
(4) Apply the STI PA signal and adjust the SPL to 97 dBA, ±0.5 dBA

8.1.6.4.29* The gain of the powered speaker amplifier used to generate the pink noise shall be adjusted to achieve an A-weighted sound level of 32 dB, ±0.5 dB below the signal level generated as identified in 8.1.6.4.25, measured at the microphone placed as identified in 8.1.6.4.16 and 8.1.6.4.18.

8.1.6.5 Procedure.

8.1.6.5.1 The method for measuring the STI shall be as specified in IEC 60268 with the modified apparatus as stated in 8.1.6.4.

8.1.6.5.2 The medium-size facepiece with inner mask and second-stage regulator in the normal use mode shall be fitted to the HATS test manikin in the following manner:

(1) Place the chin of the manikin in the "chin cup" of the facepiece
(2) Place the facepiece to seal against the face of the HATS test manikin
(3) Pass the head harness of the facepiece over the HATS test manikin and tighten it in a manner that maintains the symmetry of the facepiece on the HATS test manikin, using talc to minimize friction between the HATS test manikin and the strap
(4) Tighten the straps to a tension of 50 N (11.2 lbf)

8.1.6.5.3 Three medium-size facepieces shall be tested in the chamber having an ambient noise field as specified in 8.1.6.4.19 through 8.1.6.4.29.

8.1.6.5.4 Each facepiece shall be mounted as specified in 8.1.6.5.2 and then tested as follows:

(1) Three separate measurements shall be recorded for each donning of the facepiece.
(2) Five separate donnings shall be performed.
(3) A total of 45 measurements shall be taken: 3 (facepieces) × 3 (measurements) × 5 (donnings) = 45 measurements.

8.1.6.6 Report.

8.1.6.6.1 The STI PA signal SPL per octave band, the modulation transfer index per octave band, and the overall STI score at the MRP shall be recorded and reported.

8.1.6.6.2 The STI PA signal SPL per octave band, the modulation transfer index per octave band, and the overall STI score at the microphone measurement point (MMP) shall be recorded and reported.

8.1.6.6.3 The pink noise SPL per octave band at the MMP shall be recorded and reported.

8.1.6.6.4 STI Score.

8.1.6.6.4.1 The STI score for each facepiece measurement sampled as described in 8.1.6.5.4 (i.e., total of 45 scores) shall be recorded and reported.

8.1.6.6.4.2 The starting time of each facepiece donning shall be recorded.

8.1.6.6.5 Averages.

8.1.6.6.5.1 The average for each donning shall be calculated, recorded, and reported.

8.1.6.6.5.2 There shall be a total of 15 averages of three measurements (i.e., five averages for each of the three facepiece samples). *(See Figure 8.1.6.6.5.2.)*

8.1.6.7 Interpretation.

8.1.6.7.1 The averages calculated in 8.1.6.6.5 shall be used to determine pass or fail in accordance with 7.1.6.

8.1.6.7.2 If any of the 15 averages have achieved a score less than the minimum threshold specified in 7.1.6, both of the following shall apply:

(1) The facepiece shall be considered to have failed.
(2) The facepiece shall be reported as such.

8.1.6.7.3 If all 15 averages have achieved scores equal to or greater than the minimum threshold specified in 7.1.6, both of the following shall apply:

(1) The facepiece shall be considered to have passed.
(2) The facepiece shall be reported as such.

8.1.7 Supplementary Voice Communications System Performance Test.

8.1.7.1 Application. This test method shall apply to complete CUR facepiece(s) and second-stage regulator(s).

8.1.7.2 Samples. Each sample to be tested shall be as specified in 4.3.9, with voice communications systems installed and in the "on" mode in accordance with the manufacturer's instructions.

8.1.7.3 Specimen Preparation.

8.1.7.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.7.3.2 Specimens for conditioning shall be complete medium-size CUR facepiece(s) and inner mask(s) with the second-stage regulator(s) installed in the "as-worn" position as specified by the manufacturer.

8.1.7.3.3 Signal processing options that use specific features of natural speech such as, but not limited to, pitch, format analysis, and voice or nonvoiced sound to enhance the speech intelligibility or the usability of supplementary voice communications systems shall be disabled during the STI test.

8.1.7.4 Apparatus.

8.1.7.4.1 Testing shall be conducted in a chamber having the following characteristics:

(1) Minimum room dimensions of 4.6 m long × 3.1 m wide × 2.7 m high (15 ft long × 10 ft wide × 9 ft high)
(2) Hemianechoic construction
(3) Ambient noise level inside chamber of NC-25
(4) Walls and ceiling ≥90 percent absorptive for 100 Hz < f < 10000 Hz

8.1.7.4.2 All surfaces above the floor shall be acoustically treated for internal acoustic absorption, as well as for external noise mitigation.

8.1.7.4.3 A G.R.A.S. KEMAR HATS model 45BM shall be used for testing.

8.1.7.4.4 Tone.

8.1.7.4.4.1 The mouth simulator shall be capable of producing 112 dB/1 kHz sine tone at 25 mm (1 in.) with the MRP unequalized.

8.1.7.4.4.2 The THD shall be ≤3 percent.

8.1.7.4.5 Frequency Response.

8.1.7.4.5.1 The mouth simulator frequency response shall be able to be equalized flat ±1 dB between 100 Hz and 10 kHz.

8.1.7.4.5.2 The response shall be –15 dB or less at 100 Hz and –20 dB or less at 15 kHz.

8.1.7.4.6 An SPL meter having the following characteristics shall be used:

(1) The SPL meter shall be capable of applying an equivalent continuous sound pressure level (Leq) using an A-weighted filter.
(2) The SPL meter shall have a dynamic range from 30 dB (or less) to 130 dB (or more).
(3) The SPL meter shall display the measurement to at least one decimal place.

8.1.7.4.7 A signal/pink noise analog audio signal generators having the characteristics described in 8.1.7.4.8 and 8.1.7.4.9 shall be used.

8.1.7.4.8 One generator shall be capable of playing wave files at 48 kHz, 16-bit mono at the output level of 0 dB, FS = 18 dBu, according to EBU Technical Recommendation R68.

Sample Recording Sheet for STI Test

1. Tested Per Procedure:

_____ **7.1.6** Nonelectronic Communications Performance Requirements.

_____ **7.1.7** Supplementary Voice Communications System Performance Requirements.

2. Setup Information:

STIPA Signal data at Mouth Reference Point (MRP)

		Sound Pressure Levels							Modulation Transfer Index						
#	STI	125	250	500	1000	2000	4000	8000	125	250	500	1000	2000	4000	8000
1															
2															
3															
4															

1 — Initial measurement prior to fireplace testing started
2 — Final measurement after fireplace testing commenced
3 & 4 — Supplemental measurements for testing breaks greater than 1 hour during testing

STIPA Signal data at Microphone Measurement Point (MMP)

		Sound Pressure Levels							Modulation Transfer Index						
#	STI	125	250	500	1000	2000	4000	8000	125	250	500	1000	2000	4000	8000
1															
2															
3															
4															

1 — Initial measurement prior to fireplace testing started
2 — Final measurement after fireplace testing commenced
3 & 4 — Supplemental measurements for testing breaks greater than 1 hour during testing

Pink Noise data at Microphone Measurement Point (MMP)

		Sound Pressure Levels							Modulation Transfer Index						
#	STI	125	250	500	1000	2000	4000	8000	125	250	500	1000	2000	4000	8000
1															
2															
3															
4															

1 — Initial measurement prior to fireplace testing started
2 — Final measurement after fireplace testing commenced
3 & 4 — Supplemental measurements for testing breaks greater than 1 hour during testing

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FIGURE 8.1.6.6.5.2 Sample Recording Sheet for STI Test.

3. Measurement Information

- Record STI score per facepiece/donning/measurement
- Use the notes column to indicate Pass/Fail and/or observations
- Extra rows are provided if necessary

Faceplate Sample 1

	STI Scores				
Don #	Meas 1	Meas 2	Meas 3	Avg	Notes
1					
2					
3					
4					
5					

Faceplate Sample 2

	STI Scores				
Don #	Meas 1	Meas 2	Meas 3	Avg	Notes
1					
2					
3					
4					
5					

Faceplate Sample 3

	STI Scores				
Don #	Meas 1	Meas 2	Meas 3	Avg	Notes
1					
2					
3					
4					
5					

4. Pass/Fail

Indicate whether the facepiece passed or failed as whole per 8.1.6 or 8.1.7 respectively

_____ PASS

_____ FAIL

FIGURE 8.1.6.6.5.2 ***Continued***

8.1.7.4.9 A second generator shall be capable of generating pink noise and sine waves from –80 dBu to –2 dBu in one-digit steps, with a THD+N of –90 dB (0.0032 percent) at 8 dBu noise floor type 25uv.

8.1.7.4.9.1 In addition to the requirement in 8.1.7.4.9.1, a second generator shall also have the following characteristics:

(1) Frequency range of 10 Hz to 20 kHz in one-digit steps ±0.01 percent
(2) Amplitude accuracy of within ±0.5 dB or less

8.1.7.4.10 A digital equalizer having the following characteristics shall be used:

(1) A digital equalizer shall be capable of at least two concurrently selectable equalizer sections as follows:
    (a) One 31-band graphic with an adjustment range of at least ±18 dB
    (b) A 10-band parametric with an adjustment range of at least ±18 dB
(2) The digital equalizer shall have a dynamic range of ≥112 dB.
(3) The digital equalizer shall be capable of equalizing the frequency response of the HATS manikin of ±1 dB flat between 100 Hz and 10 kHz, applying a 180 Hz high-pass filter with a slope of –24 dB octave, and a 10 Hz low-pass filter with a slope of –24 dB octave (–15 dB at 100 Hz, –20 dB at 15 kHz).

8.1.7.4.11 A powered speaker having the following characteristics shall be used:

(1) The sensitivity shall be ≥84 dB at 1 W at 1 m (39.4 in.).
(2) The frequency response shall be rated at ≤80 Hz to ≤13 kHz.
(3) The amplifier shall deliver ≥10 watts with a total harmonic distortion <1 percent.

8.1.7.4.12 A microphone having the following characteristics shall be used:

(1) The microphone shall be a condenser type.
(2) The microphone polar pattern shall be omnidirectional.
(3) The frequency response shall be flat ±0.5 dB from 100 Hz to 15 kHz.
(4) The residual noise shall be ≤–30 dB.
(5) The microphone shall accept signals of at least 130 dBA.

8.1.7.4.13 An STI analyzer having the following characteristics shall be used:

(1) The STI PA analyzer shall be capable of measuring and displaying a single-value STI PA result to two decimal places with a seven-octave band modulated noise test signal using the TNO verified algorithm.
(2) The STI PA analyzer shall conform to Part 16 of IEC-60268.

8.1.7.4.14 All the apparatus identified in 8.1.7.4.11 and 8.1.7.4.12 shall be located in the hemianechoic chamber and arranged as shown in Figure 8.1.6.4.23.

8.1.7.4.15 The HATS test manikin shall be positioned in the chamber as shown in Figure 8.1.6.4.23.

8.1.7.4.16 Microphone.

8.1.7.4.16.1 The distance between the HATS test manikin and the microphone shall be 1.5 m, +25 mm/–0 mm (5 ft, +1 in./–0 in.).

8.1.7.4.16.2 The HATS test manikin and the microphone shall be facing each other.

8.1.7.4.17 The distance between the HATS test manikin MRP and the floor shall be 1.5 m, +25 mm/–0 mm (5 ft, +1 in./–0 in.).

8.1.7.4.18 The distance between the microphone and the floor shall be 1.5 m, +25 mm/–0 mm (5 ft, +1 in./–0 in.).

8.1.7.4.19 The test chamber shall be filled with broadband pink noise with a tolerance of ±1 dB per octave band from 100 Hz to 10 kHz.

8.1.7.4.20 The pink noise speaker shall be placed directly beneath the microphone and oriented such that the central axis of the speaker cone is directly facing the microphone.

8.1.7.4.21 The speaker shall be situated on top of a block of isolating acoustic foam such that no part of the speaker box is contacting the floor or the microphone stand, to prevent conduction of sound to the microphone.

8.1.7.4.21.1* Speaker Distances.

(A) The height of the speaker off the floor shall be at least 0.125 m (5 in.), as measured from the bottom of the speaker box.

(B) The distance between the speaker and microphone shall be no less than 1 m (40 in.), as measured from the top of the speaker grille/enclosure.

8.1.7.4.21.2 The pink noise speaker shall be placed as indicated in Figure 8.1.6.4.23.

8.1.7.4.21.3 The pink noise speaker shall be fully equalized flat, from 100 Hz to 10 kHz, to within ±1 dB on a relative scale in ⅓octave bands, as measured at the microphone position.

8.1.7.4.21.4 The STI test signal from the manikin shall be adjusted to achieve an A-weighted sound level of 97 dB, ±0.5 dB at the MRP, 50 mm, ±3 mm (2 in. ± ⅛ in.) from the test manikin's mouth.

8.1.7.4.21.5 The microphone used for calibrating the STI signal shall be omnidirectional and oriented in a horizontal front-facing manner.

8.1.7.4.21.6 The STI signal shall be equalized flat to within ±1 dB on a relative scale in ⅓octave bands, as measured at the MRP of the HATS.

8.1.7.4.21.7 The HATS shall be calibrated as follows:

(1) Equalize flat with pink noise to 97 dBA from 100 Hz to 10 kHz to ±1 dB on a ⅓ octave scale
(2) Reduce the levels for the 125 Hz octave band (the 100, 125, and 160 ⅓ octave bands) by 10 dB
(3) Reduce the levels for the 250 Hz octave band (the 200, 250, and 315 ⅓ octave bands) by 2 dB
(4) Apply the STI PA signal and adjust the SPL to 97 dBA, ±0.5 dBA

8.1.7.4.21.8 The gain of the powered speaker amplifier used to generate the pink noise shall be adjusted to achieve an A-weighted sound level of 9 dB, ±0.5 dB below the signal level generated as identified in 8.1.7.4.21.4, measured at the microphone placed as identified in 8.1.7.4.16 and 8.1.7.4.18.

8.1.7.5 Procedure.

8.1.7.5.1 The method for measuring the STI shall be as specified in Part 16 of IEC 60268 with the modified apparatus as stated in 8.1.7.4.

8.1.7.5.2 The medium-size facepiece with inner mask and second-stage regulator in the normal use mode shall be fitted to the HATS test mannikin in the following manner:

(1) Place the chin of the manikin in the chin cup of the facepiece
(2) Place the facepiece to seal against the face of the HATS test manikin
(3) Pass the head harness of the facepiece over the HATS test manikin and tighten it in a manner that maintains the symmetry of the facepiece on the HATS test manikin, using talc to minimize friction between the HATS test manikin and the strap
(4) Tighten the straps to a tension of 50 N (11.2 lbf)

8.1.7.5.3 Three medium-size facepieces shall be tested in the chamber having an ambient noise field as specified in 8.1.7.4.19 through 8.1.7.4.21.

8.1.7.5.4 Each facepiece shall be both of the following:

(1) Mounted as specified in 8.1.7.5.2
(2) Tested as follows:
    (a) Three separate measurements shall be recorded for each donning of the facepiece.
    (b) Five separate donnings shall be performed.
    (c) A total of 45 measurements shall be taken: 3 (facepieces) × 3 (measurements) × 5 (donnings) = 45 measurements.

8.1.7.6 Report.

8.1.7.6.1 The STI PA signal SPL per octave band, the modulation transfer index per octave band, and overall STI score at the MRP shall be recorded and reported.

8.1.7.6.2 The STI PA signal SPL per octave band, the modulation transfer index per octave band, and overall STI score at the MMP shall be recorded and reported.

8.1.7.6.3 The pink noise SPL per octave band at the MMP shall be recorded and reported.

8.1.7.6.4 STI Score.

8.1.7.6.4.1 The STI score for each facepiece measurement sampled as described in 8.1.7.5.4 (total of 45 scores) shall be recorded and reported.

8.1.7.6.4.2 The starting time of each facepiece donning shall be recorded.

8.1.7.6.5 Averages.

8.1.7.6.5.1 The average for each donning shall be calculated, recorded, and reported.

8.1.7.6.5.2 There shall be a total of 15 averages of 3 measurements (i.e., 5 averages for each of the three facepiece samples).

8.1.7.7 Interpretation.

8.1.7.7.1 The averages calculated in 8.1.7.6.5 shall be used to determine pass or fail in accordance with 7.1.7.

8.1.7.7.2 If any of the 15 averages score less than the minimum threshold specified in 7.1.7, both of the following shall apply:

(1) The facepiece shall be considered to have failed.
(2) The facepiece shall be reported as such.

8.1.7.7.3 If all 15 averages score equal to or greater than the minimum threshold specified in 7.1.7, both of the following shall apply:

(1) The facepiece shall be considered to have passed.
(2) The facepiece shall be reported as such.

8.1.8 Flame Test.

8.1.8.1 Application. This test method shall apply to complete CUR.

8.1.8.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.1.8.3 Specimen Preparation.

8.1.8.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.8.3.2 Specimens for conditioning shall be complete CUR.

8.1.8.4 Apparatus.

8.1.8.4.1 A test manikin meeting the requirements specified in Figure 8.1.8.4.1 shall be provided.

8.1.8.4.2 Both the calibration manikin and the flame test manikin shall have protective coverings.

8.1.8.4.3 The protective coverings shall be a weld blanket made of fireproof silica cloth of a minimum weight of 18 oz/yd^2 (510 g/m^2).

8.1.8.4.4 The protective coverings shall be designed and constructed to provide coverage over the surface of the manikins.

8.1.8.4.5 Where additional insulation is needed to protect the manikins electronics, an additional thermal liner underlayer shall be permitted.

8.1.8.4.6 Where the damage to any portion indicates the covering can no longer provide thermal protection for the test manikin, the complete protective covering shall be discarded.

8.1.8.4.7 A test headform meeting the requirements specified in 8.1.8.4 shall be used on the test manikin.

8.1.8.4.8 The test headform shall be both of the following:

(1) Attached to the breathing machine as specified in Figure 8.1.8.4.1
(2) Modified so that a 38 mm (1½ in.) I.D. breathing hose not longer than 7.6 m (25 ft) shall connect the breathing machine and the throat tube of the test manikin headform

8.1.8.4.9 The test headform shall be covered with a nonflammable hood for protection of the headform during testing.

8.1.8.4.10 The protective hood, when placed on the test headform, shall not affect the seal of the facepiece to the headform.

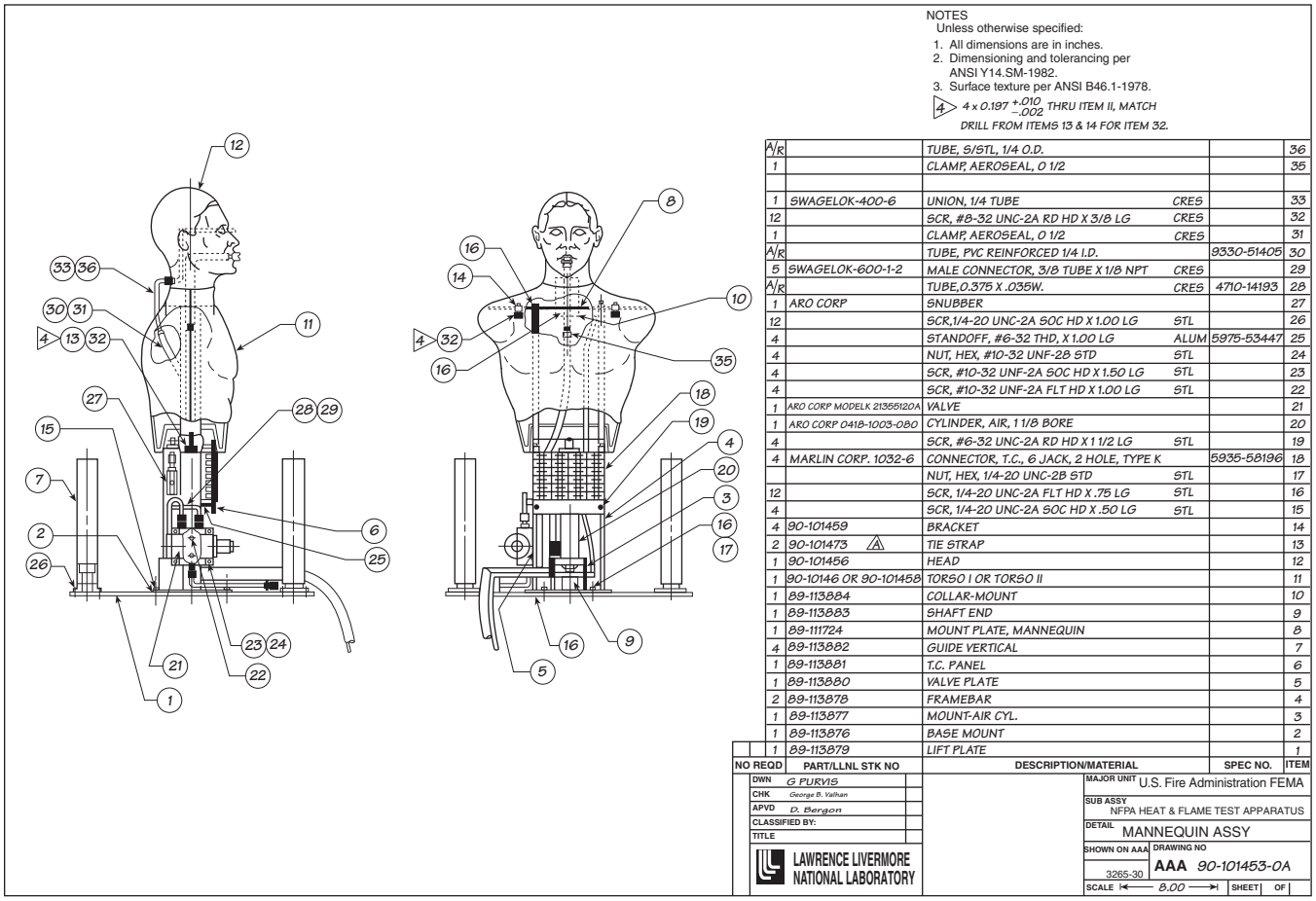


FIGURE 8.1.8.4.1 Test Manikin.

8.1.8.4.11 The protective hood shall not cover or protect any part of the facepiece or the facepiece retention system that holds the facepiece to the headform.

8.1.8.4.12 The flame test apparatus shall be as specified in Figure 8.1.8.4.12.

8.1.8.5 Procedure.

8.1.8.5.1 The CUR shall be mounted on the test manikin to simulate the correct wearing position on a person as specified by the CUR manufacturer's instructions.

8.1.8.5.2 The facepiece shall be mounted and tested on the test headform as specified in 8.1.8.4.

8.1.8.5.3 For calibration prior to the flame test, the manikin for calibration shall be the same as the test manikin specified in 8.1.8.4.

8.1.8.5.3.1 The test manikin shall be exposed to direct flame contact for 10 sec using the flame test apparatus.

8.1.8.5.3.2 All peak temperature readings shall be within a temperature range of 815°C to 1,150°C (1,500°F to 2,102°F).

8.1.8.5.3.3 The average mean of all peak temperature readings specified in 8.1.8.5.3.2 shall be no higher than 950°C (1,742°F).

8.1.8.5.3.4 The airflow performance test shall be conducted as specified in 8.2.11, with the ventilation rate specified in 8.1.8.5.3.9 and with the test temperatures specified in 8.1.8.5.3.2.

8.1.8.5.3.5 The variation in pressure extremes caused by the flame test manikin configuration shall be determined as specified in 8.1.8.5.3.6 and 8.1.8.5.3.7.

8.1.8.5.3.6 The airflow performance test as specified in 8.2.11 shall be carried out using the configuration specified in 8.1.8.4 at the same ventilation rates.

8.1.8.5.3.7 The difference in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.12.3 from the values obtained using the configuration specified in 8.2.12.

8.1.8.5.3.8 The airflow performance test shall continue through the drop test specified in 8.1.8.5.3.15.

8.1.8.5.3.9 The ventilation rate shall be set at 40 L/min, ±2 L/min (1.4 ft^3/min, ± 0.07 ft^3/min), with a respiratory frequency of 24 breaths/min, ± 1 breath/min at ambient conditions as specified in 8.1.3.2.

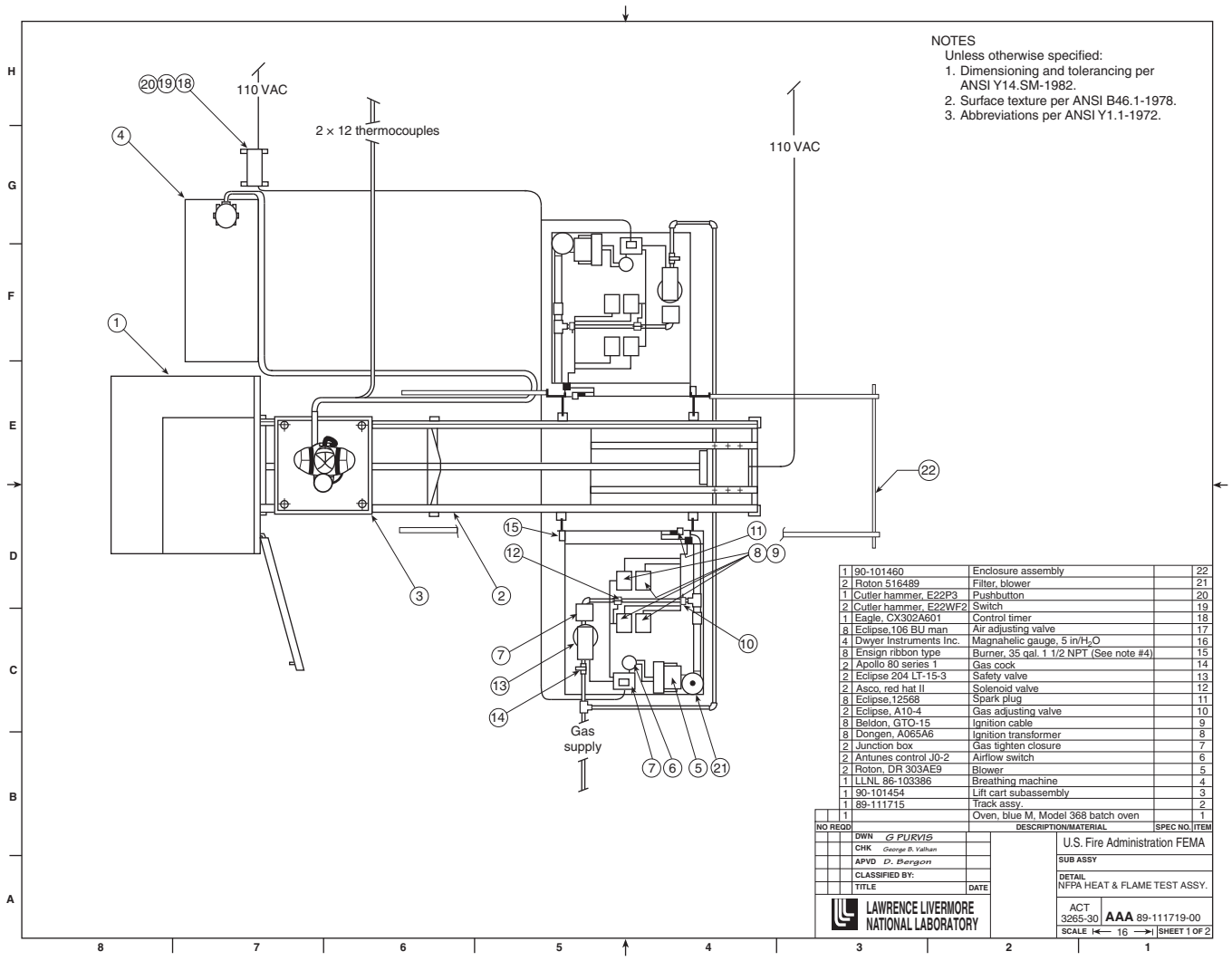


FIGURE 8.1.8.4.12 Flame Test Apparatus.

8.1.8.5.3.10 Prior to the test manikin being entered into the burner array, the ventilation rate shall be set to 103 L/min, ± 3 L/min (3.64 ft^3/min, ± 0.11 ft^3/min), as specified in 8.2.11.5.30.

8.1.8.5.3.11 The CUR mounted on the test manikin shall be moved into the center of the burner array.

8.1.8.5.3.12 The CUR shall then be exposed to direct flame contact for 5 sec, +0.25 sec/−0.0 sec.

8.1.8.5.3.13 The exposure shall begin no less than 1 min and no more than 3 min after the start of breathing.

8.1.8.5.3.14 Afterflame.

(A) The CUR shall be observed for any afterflame.

(B) The afterflame duration shall be recorded to determine pass or fail as specified in 7.1.8.2.

8.1.8.5.3.15 Within 20 sec after the direct flame exposure has been completed, the CUR mounted on the test manikin shall be raised 150 mm, +6 mm/−0 mm (6 in., + ¼ in./−0 in.) and dropped freely.

8.1.8.5.3.16 The CUR shall be observed to determine pass or fail performance as specified in 7.1.8.3.

8.1.8.5.3.17 The facepiece pressure during the entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.1.8.5.3.5 to determine pass or fail as specified in 7.1.8.

8.1.8.5.3.18 Any pressure spike caused by the impact of the drop test and measured within a duration of three cycles of the breathing machine after the apparatus drop shall be disregarded.

8.1.8.5.3.19 CUR Facepiece.

(A) The CUR facepiece shall be removed from the test headform.

(B) The CUR facepiece shall be donned by a test subject without touching the facepiece lens.

(C) If the CUR is equipped with a HUD, both of the following shall apply:

(1) The CUR facepiece and the HUD shall be removed from the test headform.
(2) The CUR facepiece and the HUD shall be donned by a test subject without touching the facepiece lens or the HUD.

8.1.8.5.3.20 The test subject shall have visual acuity of 20/20 in each eye, uncorrected or corrected with contact lenses.

8.1.8.5.3.21 If the CUR is equipped with a HUD, the test subject shall then observe the HUD display to see that visual alert signal(s) have activated.

8.1.8.5.3.22 The test subject shall identify the visual alert signals that are activated.

8.1.8.5.3.23 The CUR facepiece removed from the test headform and donned by the test subject as specified in 8.1.8.5.3.19 shall be used for determining facepiece lens vision.

8.1.8.5.3.24 The test shall be conducted using a standard 6.1 m (20 ft) eye chart with normal lighting range of 120 ft-candles to 150 ft-candles at the chart and with the test subject positioned at a distance of 6.1 m (20 ft) from the chart.

8.1.8.5.3.25 The test subject shall then read the standard eye chart through the nominal center of the lens of the facepiece to determine pass or fail performance as specified in 7.1.8.4.

8.1.8.5.3.26 The nominal center of the lens shall be the area bounded by a line 50 mm (2 in.) above, 50 mm (2 in.) below, 50 mm (2 in.) left of, and 50 mm (2 in.) right of the intersection of the basic and midsagittal planes.

8.1.8.5.4 The activation of the EOSTI shall be observed.

8.1.8.6 Report.

8.1.8.6.1 The facepiece pressure peak inhalation and peak exhalation shall be recorded and reported for each test condition.

8.1.8.6.2 Any afterflame beyond 5 sec shall be recorded and reported.

8.1.8.6.3 The facepiece lens vision shall also be recorded and reported.

8.1.8.6.4 The activation and operation of the EOSTI or the failure of the EOSTI to activate and operate shall be recorded and reported.

8.1.8.6.5 The activation and identification of HUD visual alert signals shall be recorded and reported.

8.1.8.7 Interpretation.

8.1.8.7.1 Pass or fail performance shall be based on any observed afterflame, the peak inhalation and exhalation values, and the facepiece vision value.

8.1.8.7.2 Failure to meet any of the test condition requirements shall constitute failure of the CUR.

8.1.8.7.3 Failure of any EOSTI alarm signals to activate and remain active during the test shall constitute failing performance.

8.1.8.7.4 Failure of the HUD to display the breathing air pressure vessel content or to display the visual alert signals during the test shall constitute failing performance.

8.1.9 Facepiece Carbon Dioxide Content Test.

8.1.9.1 Application. This test shall apply to all CUR facepieces.

8.1.9.2 Specimens.

8.1.9.2.1 One CUR specimen shall be tested for each size of each facepiece model.

8.1.9.2.2 For facepiece models that are offered with more than one nose cup size, each facepiece model shall be tested with each combination of nose cup installed.

8.1.9.3 Specimen Preparation. Prior to testing, specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.9.4 Procedure. Specimens shall be tested as specified in section 8.14 of EN 136.

8.1.9.5 Report. The facepiece carbon dioxide content shall be recorded and reported for each test specimen.

8.1.9.6 Interpretation.

8.1.9.6.1 The facepiece carbon dioxide content shall be used to determine pass or fail performance.

8.1.9.6.2 One or more specimens failing this test shall constitute failing performance.

8.1.10 Immersion Leakage Test.

8.1.10.1 Application. This test method shall apply to each electronic device of the CUR required to meet the mandatory design requirements of Chapter 6.

8.1.10.2 Samples.

8.1.10.2.1 The sample to be tested shall be as specified in 4.3.9.

8.1.10.2.2 Samples for conditioning shall be complete CUR.

8.1.10.3 Specimens. Prior to testing, specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.10.4 Apparatus.

8.1.10.4.1 The test water container shall be capable of covering the uppermost point of the specimen CUR with a depth of 1.5 m (4.9 ft) of water.

8.1.10.4.2 The water temperature shall be 18°C, ±10°C (64°F, ±18°F).

8.1.10.5 Procedure.

8.1.10.5.1 The CUR shall be mounted on the test manikin and tested for a seal in accordance with 8.2.11.6.5.

8.1.10.5.2 The specimen mounted to the manikin shall be as follows:

(1) Immersed in the test water container for 15 min

(2) After 15 min, the specimen shall be removed from the test water container
(3) Wiped dry
(4) Tested within 30 sec of removal from conditioning

8.1.10.5.3 The specimen's electronic components shall be operated in accordance with the manufacturer's instructions for normal use to determine functionality.

8.1.10.5.4 Reimmersion.

8.1.10.5.4.1 The specimen shall then be reimmersed in the test water container for an additional 5 min.

8.1.10.5.4.2 The power source compartment(s) shall be open.

8.1.10.5.4.3 The power source shall not be installed.

8.1.10.5.5 After the 5 min immersion, the specimen shall be as follows:

(1) Removed from the test water container
(2) Wiped dry

8.1.10.5.6 The electronic compartment(s) of the specimen shall be opened and inspected.

8.1.10.5.7 Report. The presence of water shall be recorded and reported.

8.1.10.5.8 Interpretation. The presence of water in the CUR electronic compartments shall constitute failing performance.

8.1.11 Low-Power-Capacity Test.

8.1.11.1 Application. This test shall apply to all electronic devices required for CUR by the requirements of Chapter 6.

8.1.11.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.1.11.3 Specimen Preparation. Specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.1.11.4 Apparatus. A variable power source that is capable of supplying dc voltage of at least 30 percent more than the nominal power source voltage shall be provided.

8.1.11.5 Procedure.

8.1.11.5.1 Each electronic device shall be tested with a variable power source to determine that the low-power-source alert signal will activate at the voltage level or percent capacity remaining value specified by the manufacturer, ±3 percent.

8.1.11.5.2 Each electronic device shall be tested with a variable power source to determine that the electronic device will continue to operate down to the cease-proper-operation voltage level or percent-capacity-remaining value specified by the manufacturer.

8.1.11.5.3 Where multiple electronic devices that are part of the CUR share a common power source, the minimum amount of power that causes the activation of the low-power-source alert signal shall be determined with all electronics sharing the common power source operating at their respective maximum power consumption under normal use.

8.1.11.5.4 Each electronic device power source shall be tested by discharging it at the cumulative nominal operating current for all electronic devices utilizing the power source, as specified by the manufacturer, until the voltage level or percent capacity remaining value falls to the level at which the electronic device low-power-source alert signal illuminates as specified in 7.1.11.

8.1.11.5.5 Upon reaching this voltage level or percent capacity remaining value, the current drain shall be increased to the cumulative peak current drain of all electronic devices utilizing the power source, as specified by the manufacturer.

8.1.11.5.5.1 Under the conditions stated in 8.1.11.5.5 and for a period of at least 2 hours, the power source voltage level or percent-capacity-remaining value shall remain above the voltage level or percent-capacity-remaining value that will cause the electronic device to cease proper operation.

8.1.11.6 Report.

8.1.11.6.1 The electronic device shall be observed for activation of the low-power-source alert signal.

8.1.11.6.2 The electronic device shall be observed for the display of the low-power-source alert signal down to the cease-proper-operation voltage level or percent-capacity-remaining value.

8.1.11.6.3 The power source voltage level or percent-capacity-remaining value shall be observed with respect to the cease-proper-operation voltage level or percent-capacity-remaining value.

8.1.11.6.4 The events in 8.1.11.6.1 through 8.1.11.6.3 shall be recorded and reported.

8.1.11.7 Interpretation.

8.1.11.7.1 Electronic device low-power-source alert signal function shall be evaluated to determine pass or fail performance.

8.1.11.7.2 Electronic device power source voltage level or percent-capacity-remaining value equal to or greater than the cease-proper-operation voltage level or percent-capacity-remaining value shall constitute passing performance.

8.2 CUR/Open-Circuit SCBA Mode.

8.2.1 Exhalation Valve Leakage Performance Test.

8.2.1.1 Application. This test shall apply to all CUR.

8.2.1.2 Specimens. Three CUR models shall be tested in each exhalation valve leakage test.

8.2.1.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.1.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure TEB-APR-STP-0004.

8.2.1.5 Report. The exhalation valve leakage performance shall be recorded and reported for each test specimen.

8.2.1.6 Interpretation. The exhalation valve leakage performance shall be used to determine pass or fail performance.

8.2.2 Service Time Performance Test.

8.2.2.1 Application. This test shall apply to all CUR.

8.2.2.2 Specimens. Two CUR models shall be tested in each service time test.

8.2.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.2.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASR-STP-0121.

8.2.2.5 Report. The service time performance shall be recorded and reported for each test specimen.

8.2.2.6 Interpretation. The service time performance shall be used to determine service time classification.

8.2.3 Human Subject Performance Tests for Low-Temperature Operations.

8.2.3.1 Application. This test shall apply to all CUR.

8.2.3.2 Specimens. Two CUR models shall be tested.

8.2.3.3 Specimen Preparation. Prior to testing, the apparatus shall be precooled as specified in 8.2.12.6.1.1 for 4 hours.

8.2.3.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0819.

8.2.3.5 Report. The low-temperature operation performance shall be recorded and reported for each test specimen.

8.2.3.6 Interpretation. The low-temperature operation performance shall be used to determine pass or fail performance.

8.2.4 Human Subject Performance Tests During Physical Exertion.

8.2.4.1 Application. These tests shall apply to all CUR.

8.2.4.2 Specimens. Two CUR models shall be tested in each man test.

8.2.4.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.4.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, 5.1.1, 5.1.2 (Open-Circuit), 5.1.3, 5.1.5, 5.2, and in Tables 1 and 4 in section 6.2 of the NIOSH Standard Test Procedure RCT-ASR-STP-0140.

8.2.4.5 Report. The physical exertion man test performance shall be recorded and reported for each test specimen.

8.2.4.6 Interpretation. The physical exertion man test performance shall be used to determine pass or fail performance.

8.2.5 Integrity of Couplings Performance Test.

8.2.5.1 Application. This test shall apply to all CUR where CUR is equipped with a standby air supply coupling.

8.2.5.2 Specimens. Two CUR specimens shall be tested in the integrity of couplings performance test.

8.2.5.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.5.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASR-STP-0101.

8.2.5.5 Report. The integrity of coupling performance shall be recorded and reported for each test specimen.

8.2.5.6 Interpretation. The integrity of coupling performance shall be used to determine pass or fail performance.

8.2.6 CUR with a Standby Air Supply Coupling Airflow Performance Test.

8.2.6.1 Application. This test shall apply to all CUR where CUR is equipped with a standby air supply coupling.

8.2.6.2 Specimens. Two CUR coupling specimens shall be tested installed in the CUR with the standby air supply coupling airflow performance test.

8.2.6.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.6.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASR-STP-0105A.

8.2.6.5 Report. The CUR with standby air supply coupling airflow performance test results shall be recorded and reported for each test specimen.

8.2.6.6 Interpretation. The CUR with standby air supply coupling airflow performance test results shall be used to determine pass or fail performance.

8.2.7 CUR Connection to a Standby Air Source Performance Test.

8.2.7.1 Application. This test shall apply to all CUR where CUR is equipped with a standby air supply coupling.

8.2.7.2 Specimens. Two CUR specimens shall be tested in the CUR connection to a standby air source performance test.

8.2.7.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.7.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASR-STP-0147.

8.2.7.5 Report. The transfer from the standby air source operating mode to CUR operating in the SCBA mode performance shall be recorded and reported for each test specimen.

8.2.7.6 Interpretation. The transfer from the standby air source operating mode to CUR operating in the SCBA mode performance shall be used to determine pass or fail performance.

8.2.8 CUR Airflow Capabilities in Event of Second-Stage Regulator Failure Performance Test.

8.2.8.1 Application. This test shall apply to all CUR that use a bypass valve in the event of second-stage regulator failure.

8.2.8.2 Specimens. Two CUR specimens shall be tested in the CUR airflow capabilities in the event of second-stage regulator failure performance test.

8.2.8.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.8.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASR-STP-0126.

8.2.8.5 Report. The CUR airflow capabilities in the event of second-stage regulator failure performance shall be recorded and reported for each test specimen.

8.2.8.6 Interpretation. The CUR airflow capabilities in the event of second-stage regulator failure performance shall be used to determine pass or fail. performance.

8.2.9 CUR Gauge Accuracy Performance Test.

8.2.9.1 Application. This test shall apply to all CUR.

8.2.9.2 Specimens. Three gauge specimens shall be tested in the gauge accuracy performance test.

8.2.9.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.2.9.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, 4.2, and 5 of the NIOSH Standard Test Procedure RCT-ASRS-STP-0128.

8.2.9.5 Report. The gauge accuracy performance shall be recorded and reported for each test specimen.

8.2.9.6 Interpretation. The gauge accuracy performance shall be used to determine pass or fail performance.

8.2.10 CUR Gauge Line Flow Performance Test.

8.2.10.1 Application. This test shall apply to all CUR.

8.2.10.2 Specimens. Two CUR specimens shall be tested in the CUR gauge line flow performance test.

8.2.10.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ±25 percent.

8.2.10.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure CVB-CBRN-CUR-STP-0848.

8.2.10.5 Report. The CUR gauge line flow performance shall be recorded and reported for each test specimen.

8.2.10.6 Interpretation. The CUR gauge line flow performance shall be used to determine pass or fail performance.

8.2.11 CUR/Open-Circuit SCBA Mode Tests.

8.2.11.1 Airflow Performance Test. (Reserved)

8.2.11.2 Application. This test method shall apply to complete CUR.

8.2.11.3 Samples. Each sample shall be tested as specified in 4.3.9.

8.2.11.4 Specimen Preparation.

8.2.11.4.1 Specimens for conditioning shall be complete CUR.

8.2.11.4.2 Prior to testing, specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and relative humidity (RH) of 50 percent, ±25 percent.

8.2.11.4.3* The air used in the CUR breathing air pressure vessels shall comply with the air quality requirements of NFPA 1989.

8.2.11.5 Apparatus.

8.2.11.5.1 A test headform as specified in Figure 8.2.11.5.1, or equivalent, shall be used.

8.2.11.5.2 A pressure probe shall be attached to the test headform to monitor facepiece pressure.

8.2.11.5.3 The pressure probe shall be a 6.5 mm (¼ in.) O.D. with a 1.5 mm (1⁄16 in.) wall thickness metal tube having one open end and one closed end.

8.2.11.5.4 The closed end of the pressure probe shall have four equally spaced holes as follows:

(1) Each sized 1.5 mm, ±0.1 mm (1⁄16 in., ±0.0 in.)
(2) Each positioned 6.5 mm, ±0.4 mm (¼ in., ±0.0 in.) from the end of the pressure probe

8.2.11.5.5 The closed end of the pressure probe shall extend through the test headform, exiting out the center of the left eye.

8.2.11.5.6 The pressure probe shall extend 13 mm, +1.5 mm/–0 mm (½ in., + 1⁄16 in./–0 in.) outward from the surface of the center of the left eye.

8.2.11.5.7 A length of tubing, including connections, of a 1.5 m (5 ft) length with a nominal 5 mm (3⁄16 in.) I.D. flexible smooth-bore tubing with a nominal 1.5 mm (1⁄16 in.) wall thickness shall be permitted to be connected to the open end of the pressure probe and to the inlet of the pressure transducer.

8.2.11.5.8 A differential pressure transducer or equivalent electronic sensor having the following characteristics shall be used:

(1) Range of 225 mm (8.9 in.) of water differential
(2) Linearity of ±0.5 percent full-scale (FS) best straight line
(3) Line pressure effect less than 1 percent FS zero shift/gauge pressure 1000 psi
(4) Output ±2.5 Vdc for +FS
(5) Output ripple of 10 mV peak to peak
(6) Regulation FS output change of no more than ±0.1 percent for input voltage change from 22 to 35 Vdc
(7) Operating temperature of –54°C to 121°C (–65°F to 250°F)

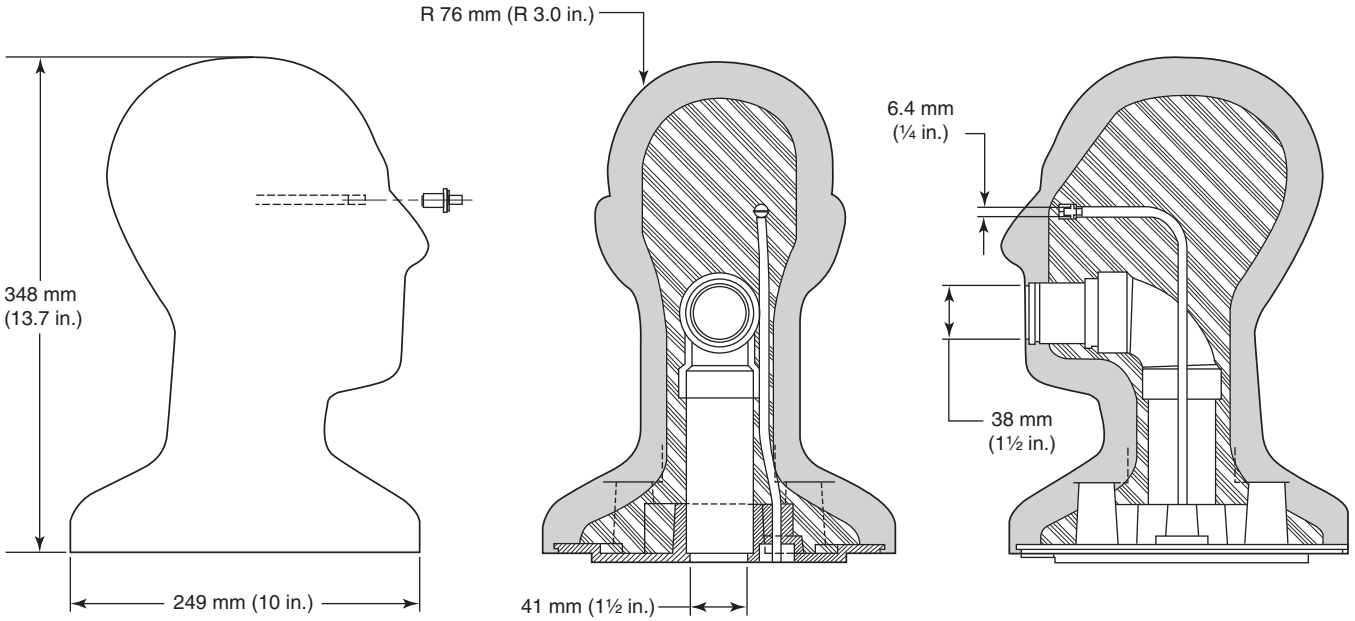


FIGURE 8.2.11.5.1 Test Headform.

(8) Compensated temperature of −18°C to 71°C (0°F to 160°F)
(9) Temperature effects within 2 percent FS/55.6°C (132°F) error band

8.2.11.5.9 The differential pressure transducer or equivalent electronic sensor shall be connected to a strip chart recorder or equivalent data acquisition system having the following characteristics:

(1) Chart width of 250 mm (9.8 in.)
(2) Pen speed of at least 750 mm/sec (29.5 in./sec)
(3) Accuracy of ±0.25 percent FS
(4) Input voltage range of 1 V FS
(5) Span set at 25 mm (1 in.) of chart per 25.4 mm (1 in.) water column

8.2.11.5.10 The test headform shall be equipped with a breathing passage.

8.2.11.5.11 The breathing passage shall lead from the mouth of the test head to the lung.

8.2.11.5.12 The sum of the volumes of the lung, when fully extended to a 3.4 L (12 ft^3) tidal volume position, and the breathing passage shall not exceed 4.0 L (0.14 ft^3).

8.2.11.5.13 The breathing passage shall be as follows:

(1) Located on the centerline of the mouth
(2) Flush with the test headform

8.2.11.5.14 The breathing passage shall extend a minimum of 200 mm (8 in.) and a maximum of 450 mm (18 in.).

8.2.11.5.15 Where flexible smooth-bore tubing is used from the metal breathing tube to the inlet connection of the breathing machine, it shall have a maximum length of 1.2 m (4 ft) and a 19 mm (¾ in.) I.D. with a nominal 3 mm (⅛ in.) wall thickness.

8.2.11.5.16 When 8.2.13 of the environmental temperature test and 8.2.20 of the UEBSS cold-temperature performance test are performed, air exhaled through the headform shall be conditioned to an average temperature of 27°C, ±6°C (80°F, ±10°F) when measured at the breathing passage outlet at the mouth of the test headform *(see Figure 8.2.11.5.16)*.

8.2.11.5.17 The breathing machine shown in Figure 8.2.11.5.17 or equivalent shall be used.

8.2.11.5.18 The breathing machine shall consist of a flexible bellows material attached at one end to a fixed plate and at the other end to a free plate constrained to two degrees of freedom.

8.2.11.5.19 The free plate shall be connected to a rotating shaft by means of a connecting rod, vibration damper, and bellows crank mechanism.

8.2.11.5.20 The bellows crank mechanism shall have a center-to-center distance of 57 mm, ± 0.254 mm (2¼ in., ± 0.01 in.).

8.2.11.5.21 The connecting rod shall have a center-to-center free plate distance of 133 mm, ± 0.254 mm (5¼ in., ± 0.01 in.).

8.2.11.5.22 The vibration damper shall be a rubber-to-metal bonded antivibration mounting with the following:

(1) Mounting flange hole spacing of 50 mm, ±5 mm (2 in., ± 3/16 in.)
(2) Overall height of 20 mm, ±2 mm (3/16 in., ± 5/64 in.)
(3) Static force/displacement curve with a slope of 11.5 N/mm, ±0.5 N/mm

8.2.11.5.23 The bellows material shall consist of neoprene-impregnated nylon fabric convoluted tubing.

8.2.11.5.24 The tubing shall have an I.D. of 200 mm, ±5 mm (8 in., ± 3/16 in.) and an O.D. of 250 mm, ±5 mm (10 in., ± 3/16 in.).

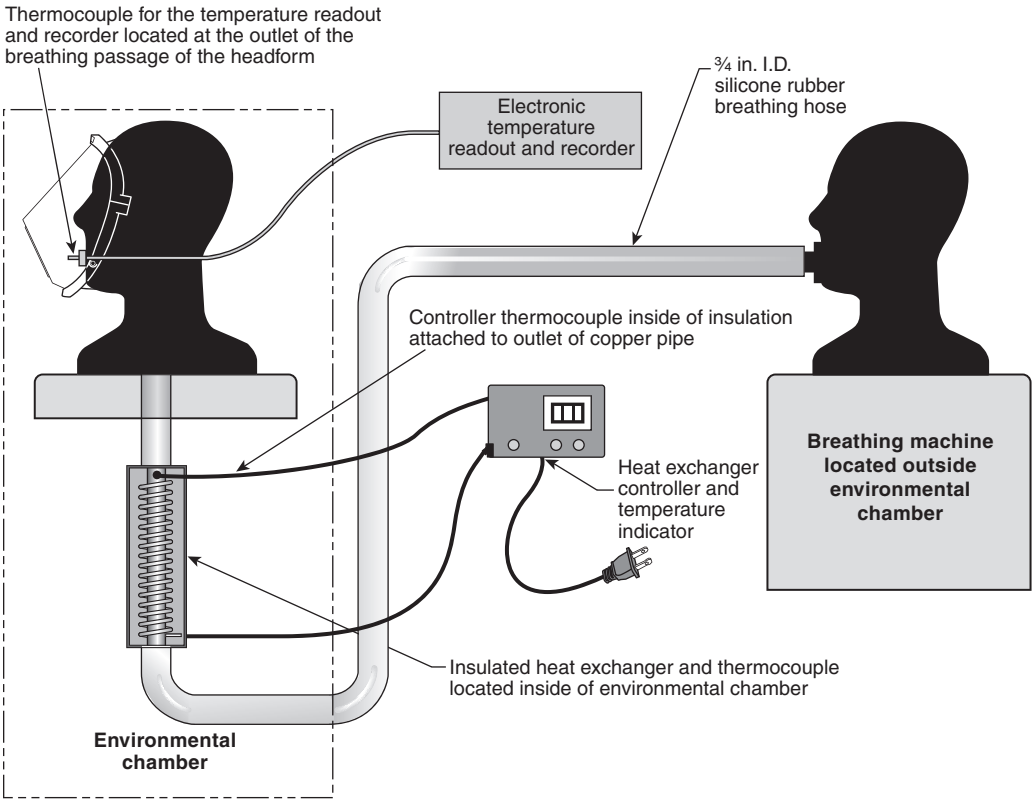


FIGURE 8.2.11.5.16 Cold-Temperature Performance Test.

8.2.11.5.25 The nominal wall thickness of the tubing shall be 1.4 mm ($\frac{1}{32}$ in.).

8.2.11.5.26 The breathing machine shall have the capability to conduct breathing resistance testing at 40 L/min, ± 1.0 L/min (1.41 CFM ± 0.03 CFM) and 103 L/min (27.2 gal/min) ± 3.0 L/min (3.63 CFM ± 0.10 CFM).

8.2.11.5.27 The tidal volume of the lung shall determine the volume of air moved during each inhalation/exhalation cycle.

8.2.11.5.28 The airflow shall be determined by the following factors:

(1) Number of inhalation/exhalation cycles per minute
(2) Tidal volume of the lung
(3) Breathing waveform

8.2.11.5.29 Inspired and expired volumes as a function of time shall be incorporated in accordance with the values given in Table 8.2.11.5.29(a) and Table 8.2.11.5.29(b), which list the volume as function of time for 103 L/min (3.64 ft^3/min) volume and 40 L/min (1.4 ft^3/min) volume work rates.

8.2.11.5.30 Switching between the two work rates shown in Table 8.2.11.5.29(a) and Table 8.2.11.5.29(b) shall be performed within 10 sec.

8.2.11.5.31 The construction of the breathing machine shall be such that the respiration rate, tidal volume, peak flow, and facepiece pressure measurement system accuracy are unaffected by temperature changes caused by the environmental airflow performance tests as specified in 8.2.12.

8.2.11.6 Procedure.

8.2.11.6.1* Test Setup.

8.2.11.6.1.1 The test setup for conducting the airflow performance test shall be calibrated at least once each day before tests are conducted.

8.2.11.6.1.2 The calibration shall be verified at least once each day after testing.

8.2.11.6.2 The calibration procedure utilized for the differential pressure transducer shall consist of confirmation of at least three different pressures between 0 mm and 125 mm (0 in. and 5 in.) water column.

8.2.11.6.3 The pressure shall be measured using an incline manometer or equivalent with a scale measuring in increments of ±0.5 mm (±0.02 in.) water column or less.

8.2.11.6.4 The SCBA being tested shall utilize a fully charged breathing air pressure vessel.

8.2.11.6.5 Facepiece.

8.2.11.6.5.1 The facepiece of the CUR being tested shall be secured to the test headform.

8.2.11.6.5.2 The facepiece seal to the headform shall ensure that an initial pressure of 25 mm, ±2.5 mm (1 in., ±0.1 in.) water column below ambient shall not decay by more than 5 mm (0.2 in.) water column in 5 sec.

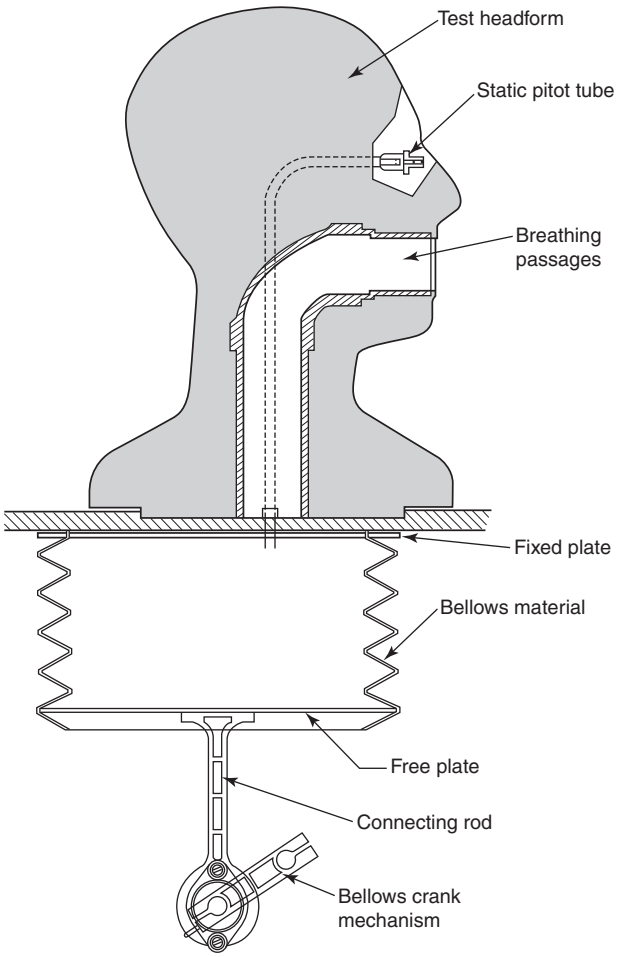


FIGURE 8.2.11.5.17 Breathing Machine.

8.2.11.6.6 The remaining components of the CUR shall be mounted to simulate the wearing position as specified by the manufacturer's instructions.

8.2.11.6.7 CUR shall be tested at an ambient temperature of 22°C ±3°C (72°F ±5°F) and RH of 50 percent ±25 percent.

8.2.11.6.8 Airflow Performance Test.

8.2.11.6.8.1 The airflow performance test shall begin after five cycles of the breathing machine.

8.2.11.6.8.2 The airflow performance test shall continue to operate through at least 20 bar (290 psi) of pressure vessel inlet pressure.

8.2.11.6.9 The breathing machine shall be set at a rate of 103 L/min (3.64 ft^3/min), ± 3 L/min (.11 ft^3/min) with a respiratory frequency of 30 breaths/min, ± 1 breath/min.

8.2.11.7 Report.

8.2.11.7.1 The facepiece peak inhalation pressure and peak exhalation pressure shall be recorded and reported for each test.

8.2.11.7.2 The activation and operation of the EOSTI or the failure of the EOSTI to activate and operate shall be recorded and reported.

Table 8.2.11.5.29(a) Lung Breathing Waveforms for 103 L/min (3.64 ft^3/min) Volume Work Rate

Step No.	Time (sec)	Inspire/ Expire	Volume (L, ±0.1 L)	Volume Change (L, ±5%)
0	0.00	—	–1.7	–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	0.07
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	0.08
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	0.08
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	0.07
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	—	1.7	0.012
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

(continues)

Table 8.2.11.5.29(a) *Continued*

Step No.	Time (sec)	Inspire/ Expire	Volume (L, ±0.1 L)	Volume Change (L, ±5%)
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	–0.07
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	–0.08
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	–0.08
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	–0.07
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

8.2.11.7.3 Where the CUR is equipped with a HUD, the activation and identification of HUD visual alert signals shall be recorded and reported.

8.2.11.8 Interpretation.

8.2.11.8.1 The peak inhalation pressure and peak exhalation pressure shall be used to determine pass or fail performance.

8.2.11.8.2 One or more specimens failing this test shall constitute failing performance.

8.2.11.8.3 Failure of any EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

Table 8.2.11.5.29(b) Lung Breathing Waveforms for 40 L/min (1.4 ft^3/min) Volume Work Rate

Step No.	Time (sec)	Inspire/ Expire	Volume (L, ±0.1 L)	Volume Change (L, ±5%)
0	0	—	–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	0.000	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
53	1.325	Expire	0.816	–0.009
54	1.350	Expire	0.803	–0.013
55	1.375	Expire	0.787	–0.016

(continues)

Table 8.2.11.5.29(b) *Continued*

Step No.	Time (sec)	Inspire/ Expire	Volume (L, ±0.1 L)	Volume Change (L, ±5%)
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

8.2.11.8.4 Where the CUR is equipped with a HUD, failure of the HUD to display the breathing air pressure vessel content or to display the visual alert signal during the test shall constitute failing performance.

8.2.12 Environmental Temperature Tests.

8.2.12.1 Application. This test method shall apply to complete CUR.

8.2.12.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.12.3 Specimen Preparation.

8.2.12.3.1 Specimens for conditioning shall be complete CUR.

8.2.12.3.2 Prior to testing, the CUR shall be placed in an ambient environment of 22°C ±3°C (72°F ±5°F) and RH of 50 percent ±25 percent for a minimum 12-hour dwell period.

8.2.12.4 Apparatus.

8.2.12.4.1 The CUR shall be placed in an environmental chamber and positioned to simulate the normal wearing position of the CUR on a person as specified by the manufacturer.

8.2.12.4.2 During the environmental exposures in 8.2.12.6 through 8.2.12.9, the CUR facepiece shall be mounted on a Scott Aviation Model No. 803608-01 or 803608-02 test headform or equivalent.

8.2.12.4.3 The thermocouple or other temperature-sensing element used shall be mounted within the chamber in a manner in which it will be exposed directly to the chamber atmosphere.

8.2.12.4.4 The test headform shall be connected to the breathing machine specified in 8.2.12.

8.2.12.4.5 The breathing machine shall be permitted to be located either inside or outside the environmental chamber.

8.2.12.5 Procedure.

8.2.12.5.1 The variation in pressure extremes caused by the environmental test configuration shall be determined as follows:

(1) The airflow performance test as specified in 8.2.11 shall be carried out using the configuration specified in 8.2.12.4 at the 103 L/min ± 3 L/min (3.63 CFM ± 0.10 CFM) ventilation rate.
(2) The difference in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.12.4 from the values obtained using the configuration specified in 8.2.11.

8.2.12.5.2 The facepiece pressure during each entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.2.12.5.1 to determine pass or fail as specified in 7.2.12.2 through 7.2.12.5.

8.2.12.5.3 These environmental temperature tests shall be permitted to be conducted in any sequence.

8.2.12.5.4 The dwell period between environmental temperature tests shall be used to refill the breathing air pressure vessel and to visually inspect the CUR for any gross damage that could cause unsafe test conditions.

8.2.12.6 Test 1.

8.2.12.6.1 The CUR shall be cold soaked to the minimum operating temperature specified by the manufacturer for a minimum of 12 hours.

8.2.12.6.1.1 The minimum operating temperature specified by the manufacturer shall be –18°C (0°F) or colder.

8.2.12.6.2 The CUR shall then be tested for airflow performance as specified in 8.2.12 at a chamber air temperature of the minimum operating temperature specified by the manufacturer.

8.2.12.7 Test 2.

8.2.12.7.1 The CUR shall be hot soaked at 71°C ±1°C (160°F ±2°F) for a minimum of 12 hours.

8.2.12.7.2 The CUR shall then be tested for airflow performance as specified in 8.2.12 at a chamber air temperature of 71°C ±5°C (160°F ±10°F).

8.2.12.8 Test 3.

8.2.12.8.1 The CUR shall be hot soaked at 71°C, ± 1°C (160°F, ± 2°F) for a minimum of 12 hours.

8.2.12.8.2 Immediately following the 12-hour hot soak, the CUR shall be transferred to a chamber with an air temperature of the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F).

8.2.12.8.2.1 The minimum operating temperature specified by the manufacturer shall be −18°C (0°F) or colder.

8.2.12.8.3 The CUR shall then be tested for airflow performance as specified in 8.2.12 at a chamber air temperature of the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F).

8.2.12.8.4 The airflow performance test shall commence within 3 min after removal of the CUR from the hot soak.

8.2.12.9 Test 4.

8.2.12.9.1 The CUR shall be cold soaked at the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F) for a minimum of 12 hours.

8.2.12.9.1.1 The minimum operating temperature specified by the manufacturer shall be −18°C (0°F or colder.

8.2.12.9.2 Immediately following the 12-hour cold soak, the CUR shall be transferred to a chamber with an air temperature of 71°C, ± 1°C (160°F, ± 2°F).

8.2.12.9.3 The CUR shall then be tested for airflow performance as specified in 8.2.12 at a chamber air temperature of 71°C, ± 5°C (160°F, ± 10°F).

8.2.12.9.4 The airflow performance test shall commence within 3 min after removal of the CUR from the cold soak.

8.2.12.10 Report.

8.2.12.10.1 The facepiece peak inhalation pressure and peak exhalation pressure shall be recorded and reported for each test condition.

8.2.12.10.2 The activation and operation of the EOSTI or the failure of the EOSTI to activate and operate shall be recorded and reported.

8.2.12.10.3 Where the CUR is equipped with a HUD, the activation and identification of HUD visual alert signals shall be recorded and reported.

8.2.12.11 Interpretation.

8.2.12.11.1 The peak inhalation and peak exhalation shall be used to determine pass or fail performance for each test procedure.

8.2.12.11.2 One or more specimens failing any test procedure shall constitute failing performance.

8.2.12.11.3 Failure of any EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

8.2.12.11.4 Where the CUR is equipped with a HUD, failure of the HUD to display the breathing air pressure vessel content or to display the visual alert signal during the test shall constitute failing performance.

8.2.13 Vibration Test.

8.2.13.1 Application. This test method shall apply to complete CUR.

8.2.13.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.13.3 Specimen Preparation.

8.2.13.3.1 Specimens for conditioning shall be complete CUR.

8.2.13.3.2 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.13.4 Apparatus.

8.2.13.4.1 CUR shall be tested on a typical package tester within the compartments specified in 8.2.13.4.2.

8.2.13.4.2 Compartments shall be set up as specified in Figure 8.2.13.4.2(a) and Figure 8.2.13.4.2(b).

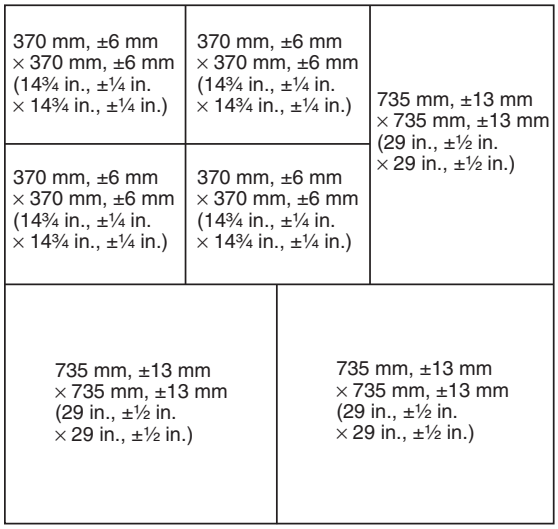


FIGURE 8.2.13.4.2(a) Vibration Table Compartments—Top View (Not to Scale).

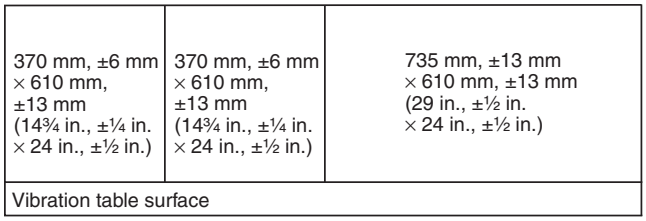


FIGURE 8.2.13.4.2(b) Vibration Table Compartments—Side View (Not to Scale).

8.2.13.4.2.1 Construction.

(A) The sides and base of the compartments shall be constructed of nominal 6 mm (¼ in.) stainless steel.

(B) The top of the compartments shall remain open.

8.2.13.4.2.2 There shall be no burrs, sharp edges, surface discontinuities, or fasteners on the internal surfaces of the holding boxes.

8.2.13.4.2.3 If the CUR does not fit the compartment as specified in Figure 8.2.13.4.2(a) and Figure 8.2.13.4.2(b), the compartment shall be designed to accommodate the size and shape of the CUR allowing a clearance of 150 mm, +150/–0 mm (6 in., +6/–0 in.) between the top to bottom length and the width of the CUR

8.2.13.4.3 The large compartments shall encase the complete CUR.

8.2.13.4.3.1 CUR regulators and hose shall remain attached to the complete CUR.

8.2.13.4.3.2 Regulators shall be allowed to be placed in the regulator holder of the CUR.

8.2.13.4.3.3 The CUR facepiece and those components that attach directly to the facepiece, excluding regulators, shall not be included in the SCBA compartment.

8.2.13.4.4 The small compartments shall encase the facepiece and those components that attach directly to the facepiece, excluding the regulator and associated hose.

8.2.13.4.5* The breathing air pressure vessel of the CUR shall be replaced by a surrogate pressure vessel.

8.2.13.4.6 The surrogate pressure vessel and pressure vessel valve shall be of identical design and construction as the breathing air pressure vessel and pressure vessel valve of the CUR to be tested.

8.2.13.4.7 Surrogate Pressure Vessel—Mass.

8.2.13.4.7.1 The mass of the breathing air of a fully pressurized breathing air pressure vessel shall be replaced in the surrogate pressure vessel with a substitute mass.

8.2.13.4.7.2 The substitute mass shall consist of a brass rod and surrounding foam constructed as shown in Figure 8.2.13.4.7.2.

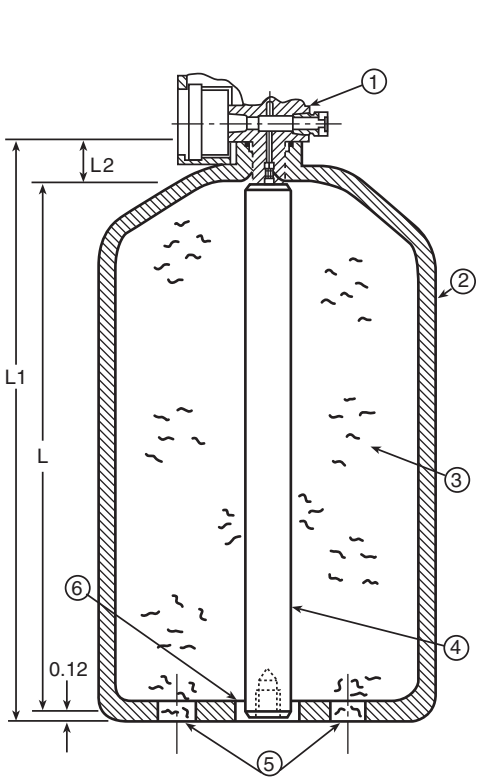
8.2.13.4.8 The surrogate pressure vessel and pressure vessel valve with the substitute mass shall have the same total mass ±5 percent as the fully pressurized breathing air pressure vessel and pressure vessel valve.

8.2.13.4.9 Surrogate Pressure Vessel—Torque.

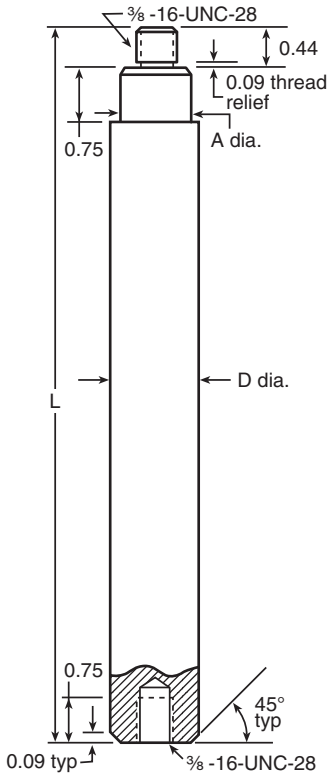
8.2.13.4.9.1 The attachment of the pressure vessel valve shall be tightened to a torque setting of 5 N-m, +0.5/–0.0 N-m (45 in. lb, +5/–0 in. lb) prior to the test.

8.2.13.4.9.2 An opposing line no wider than 3 mm (⅛ in.) shall be placed on both the male and the female CGA fitting, if applicable, prior to the start of the test, to identify the relationship between the male and the female CGA fittings when tightened at the torque setting.

Item	*Description*	*Quantity*
1	Cylinder valve assembly w/gauge and guards, etc.	1
2	SCBA air storage cylinder	1
3	Polyurethane foam	A/R
4	Ballast rod — ASTM B16/B16M brass, ½ hard	A/R
5	Fill/vent holes ¾ – ⅞ in. diameter	2
6	Ballast rod installation hole — diameter A/R	1



Complete Surrogate Cylinder



Ballast Rod Detail

Note: All dimensions are inches.

FIGURE 8.2.13.4.7.2 Surrogate Pressure Vessel.

8.2.13.5 Procedure.

8.2.13.5.1 The test items shall be placed unrestrained in the compartments specified in 8.2.13.4.2.

8.2.13.5.1.1 All CUR adjustment straps shall be fully extended.

8.2.13.5.2 No tie-downs shall be allowed to be made to the CUR.

8.2.13.5.3 The basic movement of the bed of the test table shall be a 25 mm (1 in.) orbital path, such as can be obtained on a standard package tester operating in synchronous mode at 250 rpm, ±5 rpm.

8.2.13.5.4 The test duration shall be 3 hours.

8.2.13.5.5 After being subjected to the vibration test, the male and female CGA fittings, if applicable, shall be observed for movement.

8.2.13.5.6 After being subjected to the vibration test, both of the following shall apply:

(1) The CUR shall be reattached to the breathing air pressure vessel originally provided with the CUR.
(2) The CUR and the breathing air pressure vessel shall then be tested as specified in 8.2.11.

8.2.13.6 Report.

8.2.13.6.1 The observation of movement or no movement of the male and female CGA fittings, if applicable, shall be recorded and reported.

8.2.13.6.2 The facepiece peak inhalation pressure and peak exhalation pressure shall be recorded and reported for each test condition.

8.2.13.6.3 The activation and operation of the EOSTI or the failure of the EOSTI to activate and operate shall be recorded and reported.

8.2.13.6.4 Where the CUR is equipped with a HUD, the activation and identification of HUD visual alert signals shall be recorded and reported.

8.2.13.7 Interpretation.

8.2.13.7.1 The movement of either the male or the female CGA fitting, if applicable, causing a break in the line of any width shall constitute a failure.

8.2.13.7.2 The peak inhalation and peak exhalation shall be used to determine pass or fail performance for each test procedure.

8.2.13.7.3 One or more specimens failing this test shall constitute failing performance.

8.2.13.7.4 Failure of any EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

8.2.13.7.5 Where the CUR is equipped with a HUD, failure of the HUD to display the breathing air pressure vessel content or to display the visual alert signal during the test shall constitute failing performance.

8.2.14 Accelerated Corrosion Test.

8.2.14.1 Application. This test method shall apply to complete CUR.

8.2.14.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.14.3 Specimen Preparation.

8.2.14.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.14.3.2 Specimens for conditioning shall be complete CUR.

8.2.14.4 Apparatus. A salt fog chamber that meets the requirements of section 4 of ASTM B117 shall be used for testing.

8.2.14.5 Procedure.

8.2.14.5.1 The CUR with a fully charged breathing air pressure vessel, with the breathing air pressure vessel valve fully closed, shall be placed in the test chamber attached to a manikin to simulate its typical wearing position on the operator as specified by the manufacturer.

8.2.14.5.2 CUR shall not contact each other or the sides of the test chamber.

8.2.14.5.3 The CUR shall be placed in the temperature-stabilized chamber for a minimum of 2 hours prior to introduction of the salt solution.

8.2.14.5.4 The CUR shall then be exposed to the salt fog for 48 hours, +15 min/−0 min.

8.2.14.5.5 Specimen CUR shall be subjected to a 5 percent, ±1 percent salt solution fog.

8.2.14.5.5.1 The salt solution shall be prepared by dissolving 5 parts, ±1 part by mass of sodium chloride in 95 parts of water.

8.2.14.5.5.2 The salt used shall be sodium chloride free of nickel and copper and containing on the dry basis not more than 0.1 percent of sodium iodide and not more than 0.3 percent of total impurities.

8.2.14.5.5.3 The pH of the salt solution shall be in the range of 6.5 to 7.2.

8.2.14.5.6 The compressed air supply to the nozzle or nozzles for atomizing the salt solution shall be free of oil and dirt and maintained between 69 kPa/m and 172 kPa/m (10 psi and 25 psi).

8.2.14.5.7 The exposure temperature in the chamber shall be maintained at 35°C, ±1°C (95°F, ±2°F) for the duration of the test.

8.2.14.5.8 At least two clean fog collectors shall be placed within the exposure zone so that no drops of solution from the test specimens or any other source shall be collected in them.

8.2.14.5.9 The collectors shall be placed in the proximity of the test specimens, one nearest to any nozzle and the other farthest from all nozzles.

8.2.14.5.10 The fog shall be such that for each 80 cm^2 (12.4 $in.^2$) of horizontal collecting area from 1.0 mL (.03 oz) to 2.0 mL (.06 oz) of solution per hour will be collected in each collector.

8.2.14.5.11 After completion of the salt fog exposure, the CUR shall be stored in an environment of 22°C, ±3°C (72°F,

±5°F) and RH of 50 percent, ±5 percent for a minimum of 48 hours.

8.2.14.5.12 The CUR shall then be tested as specified in 8.2.12 to determine pass or fail.

8.2.14.5.13 All controls or operating features of the CUR shall operate in accordance with the CUR manufacturer's instructions to determine pass or fail.

8.2.14.6 Report.

8.2.14.6.1 The facepiece pressure peak inhalation and peak exhalation shall be recorded and reported for each test condition.

8.2.14.6.2 The activation and operation of the EOSTI or the failure of any EOSTI to activate and operate shall be reported and recorded.

8.2.14.6.3 Where the CUR is equipped with a HUD, the activation and identification of HUD visual alert signals shall be reported and recorded.

8.2.14.7 Interpretation.

8.2.14.7.1 The peak inhalation and peak exhalation shall be used to determine pass or fail performance.

8.2.14.7.2 One or more specimens failing this test shall constitute failing performance.

8.2.14.7.3 Failure of any EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

8.2.14.7.4 Where the CUR is equipped with a HUD, failure of the HUD to display the breathing air pressure vessel content or to display the visual alert signal during the test shall constitute failing performance.

8.2.15 Particulate Test.

8.2.15.1 Application. This test method shall apply to complete CUR.

8.2.15.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.15.3 Specimen Preparation.

8.2.15.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.15.3.2 Specimens for conditioning shall be complete CUR.

8.2.15.4 Apparatus.

8.2.15.4.1 A Scott Aviation model No. 803608-01 or 803608-02 test headform or equivalent shall be joined to a manikin to simulate its typical wearing position, as specified by the manufacturer.

8.2.15.4.2 The test headform shall be connected as specified in 8.2.11 to the breathing machine specified in 8.2.11.5.17 or other respiration simulator producing a 1 min volume of 40 L (1.4 ft^3), ± 2 L (.07 ft^3) at the ambient conditions specified in 8.2.11.4.2, with a minimum tidal volume of 1.6 L (0.05 ft^3) per breath at a minimum respiration of 10 breaths/min.

8.2.15.4.3 A test facility consisting of a chamber and accessories to control dust concentration, velocity, temperature, and humidity of dust-laden air shall be used.

8.2.15.4.4 To provide adequate circulation of the dust-laden air, no more than 50 percent of the cross-sectional area and no more than 30 percent of the volume of the test chamber shall be occupied by the test item(s).

8.2.15.4.5* The chamber shall be provided with a means of maintaining and verifying the dust circulation.

8.2.15.4.6 The dust-laden air shall be introduced into the test space in such a manner as to allow the air to become laminar in flow before it strikes the test item.

8.2.15.4.7* Dust shall be silica flour.

8.2.15.4.7.1 Dust shall contain 97 percent to 99 percent by weight silicon dioxide (SiO_2).

8.2.15.4.8 The following size distribution shall apply:

(1) 100 percent shall pass through a 100 mesh screen.
(2) 98 percent, ±2 percent shall pass through a 140 mesh screen.
(3) 90 percent, ±2 percent shall pass through a 200 mesh screen.
(4) 75 percent, ±2 percent shall pass through a 325 mesh screen.

8.2.15.5 Procedure.

8.2.15.5.1 A fully charged CUR shall be secured to a test headform and manikin as specified in 8.1.4.1.

8.2.15.5.2 The manikin, including the test headform, shall be mounted upright and placed inside the test chamber.

8.2.15.5.3 The temperature of the test chamber shall be adjusted to 22°C, ±3°C (72°F, ±5°F) and the RH to less than 30 percent.

8.2.15.5.4 The air velocity shall be adjusted to 530 m/min, ±15 m/min (1,750 ft/min, ±50 ft/min).

8.2.15.5.5 The dust concentration for the blowing dust shall be maintained at 10.6 g/m^3, ±7 g/m^3 (0.3 g/ft^3, ±0.2 g/ft^3).

8.2.15.5.6 The test duration shall be 1 hour.

8.2.15.5.6.1 The breathing machine shall be operating throughout the entire test.

8.2.15.5.7 The test shall be permitted to be interrupted to allow the CUR breathing air pressure vessel to be changed.

8.2.15.5.8 Test item configuration and orientation shall be turned around its vertical axis 180 degrees midway through the test.

8.2.15.5.9 After the completion of the test, the CUR shall be removed from the test compartment.

8.2.15.5.10 The CUR shall be shaken or brushed free of dust.

8.2.15.5.10.1 Freed of dust per 8.2.15.5.10 the CUR then shall be tested as specified in 8.2.11 to determine pass or fail.

8.2.15.6 Report.

8.2.15.6.1 The facepiece pressure peak inhalation and peak exhalation shall be recorded and reported for each test condition.

8.2.15.6.2 The activation and operation of the EOSTI or the failure of any EOSTI to activate and operate shall be recorded and reported.

8.2.15.6.3 Where the CUR is equipped with a HUD, the activation and identification of HUD visual alert signals shall be recorded and reported.

8.2.15.7 Interpretation.

8.2.15.7.1 The peak inhalation and peak exhalation shall be used to determine pass or fail performance.

8.2.15.7.2 One or more specimens failing this test shall constitute failing performance.

8.2.15.7.3 Failure of any EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

8.2.15.7.4 Where the CUR is equipped with a HUD, failure of the HUD to display the breathing air pressure vessel content or display the visual alert signal during the test shall constitute failing performance.

8.2.16 EOSTI Recognition Test.

8.2.16.1 Application. This test method shall apply to complete CUR.

8.2.16.2 Sample. The sample for testing shall be selected as specified in 4.3.9.

8.2.16.3 Specimen Preparation. Prior to testing, the specimen shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.16.4 Apparatus.

8.2.16.4.1 An adapter shall be provided that allows the test subject to manually switch between a breathing air supply greater than 30 percent of the CUR breathing air pressure vessel rated service pressure and a breathing air supply pressure of 18 bar, ±1 bar (265 psi, ±15 psi).

8.2.16.4.2 The test subject shall wear a complete Class 2 nonencapsulating ensemble with gloves and footwear certified as compliant with NFPA 1994.

8.2.16.4.3 Testing shall be performed with the test subject walking at 5 km/hr, ±0.2 km/hr (3 mph, ±0.12 mph) on a treadmill at zero percent grade.

8.2.16.4.4 Testing shall be conducted in a test chamber that absorbs a minimum of 90 percent of all sound from 500 Hz to 5000 Hz.

8.2.16.4.5 The test subject shall have "audiometrically normal" hearing as defined in Section 5.3 of ANSI/ASA S3.2 in the range of 500 Hz to 3,000 Hz.

8.2.16.4.6 The test subject shall have had a physical examination conducted by a physician within the 12 months immediately preceding the date of testing.

8.2.16.4.7 The treadmill shall be positioned in the test chamber specified in 8.2.16.4.3 in a location that meets the conditions for background noise, lighting, and distraction specified in 8.2.16.4.8 and 8.2.16.4.11.

8.2.16.4.8 The test chamber shall be filled with pink noise with a tolerance of 6 dB per octave band from 400 Hz to 4,000 Hz.

8.2.16.4.8.1 The pink noise shall be adjusted to achieve an A-weighted sound level of 75 dB, ±2 dB measured at each ear of the test subject when the subject is walking on the treadmill as specified in 8.2.16.4.3.

8.2.16.4.9 The forward axis of the loudspeaker shall be located as far as possible from and pointed away from the test subject so as to create a quasi-uniform sound field at the test subject's ears.

8.2.16.4.10 More than one loudspeaker shall be permitted to be used to achieve the desired sound level.

8.2.16.4.11 The area in the test chamber where the test subject's head is positioned when the subject is standing in the walking location on the treadmill shall be artificially lighted to achieve a light level between 100 lux and 500 lux.

8.2.16.4.12 A reading stand containing printed text shall be positioned relative to the treadmill as follows:

(1) The vertical center of the text shall be in line with the center of the treadmill track within ±100 mm (±4 in.).
(2) The horizontal center of the text shall be at the same height, ±100 mm (±4 in.), as the eye level of the test subject when the subject is standing in the walking position on the treadmill.
(3) The text shall be at a distance from the test subject that permits the text to be read by the subject while the subject is walking on the treadmill.

8.2.16.5 Procedure.

8.2.16.5.1 CUR test specimens shall be tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.16.5.2 The test subject wearing the protective ensemble as specified in 8.2.16.4.2 shall don the test specimen CUR and begin walking on the treadmill in the ambient conditions specified in 8.2.16.4.3.

8.2.16.5.3 While breathing from the CUR, the test subject shall read aloud the printed text.

8.2.16.5.4 The person conducting the testing shall switch from the breathing air supply at greater than 30 percent of pressure vessel rated service pressure to 18 bar, ±1 bar (265 psi, ±15 psi) at a random point between 30 sec and 120 sec from the commencement of the test.

8.2.16.5.5 The test subject shall acknowledge recognition of the alarm signal immediately upon becoming aware of it by a gesture that has been predetermined between the test subject and the person performing the testing.

8.2.16.6 Report. The time elapsed between the switch to low supply air pressure and the acknowledgement of recognition of the EOSTI alarm signal by the test subject shall be recorded and reported.

8.2.16.7 Interpretation. Failure of either of the two test subjects to acknowledge recognition of the EOSTI alarm signal within the time period specified in 7.2.17 shall constitute failing performance.

8.2.17 Additional CUR HUD Performance Tests.

8.2.17.1 HUD Wiring Connection Strength Test.

8.2.17.1.1 Application. This test method shall apply to CUR facepieces with HUD and any associated assemblies with interconnecting wiring.

8.2.17.1.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.17.1.3 Specimen Preparation.

8.2.17.1.3.1 Specimens for conditioning shall be CUR facepieces with HUD and any associated assemblies with interconnecting wiring.

8.2.17.1.3.2 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.17.1.4 Apparatus. A mass of known weight with the means for attachment to wiring shall be provided.

8.2.17.1.5 Procedure. A force of 156 N, ±9 N (35 lbf, ±2 lbf) shall be applied gradually, in an axial direction, to the wiring of the specimen being tested.

8.2.17.1.6 Report. Observations of the HUD functionality shall be recorded and reported.

8.2.17.1.7 Interpretation. Observation of HUD functionality in accordance with 7.2.17 shall be used to determine pass or fail performance.

8.2.17.2 HUD Low Power Source Alert Signal Test.

8.2.17.2.1 Application. This test shall apply to all HUD low power source alert signals.

8.2.17.2.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.17.2.3 Specimen Preparation. Specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.17.2.4 Apparatus. A variable power source that is capable of supplying dc voltage of at least 30 percent more than the nominal power source voltage shall be provided.

8.2.17.2.5 Procedure.

8.2.17.2.5.1 Each HUD shall be tested with a variable power source to determine that the low-power-source alert signal will activate at the voltage level or percent capacity remaining value ±3 as specified by the manufacturer.

8.2.17.2.5.2 Each HUD shall be tested with a variable power source to determine that the HUD will continue to provide the visual information and alert signals down to the cease-proper-operation voltage level or percent capacity remaining value ±3 as specified by the manufacturer.

8.2.17.2.5.3 Each HUD power source shall be tested by discharging it at the nominal operating current specified by the manufacturer until the voltage falls to the level at which the HUD low-power-source alert signal activates as specified in 6.2.18.6.

8.2.17.2.5.4

(A) Upon reaching the voltage where the HUD low-power-source alert signal activates, the current drain shall be increased to the peak current drain of the power source specified by the manufacturer for all systems supplied by that power source.

(B) Under the conditions of 8.2.17.2.5.4(A) and for a period of at least 2 hours, the power source voltage shall remain above the voltage that would cause the HUD to cease proper operation.

8.2.17.2.6 Report.

8.2.17.2.6.1 The HUD shall be observed for activation of the low-power-source alert signal.

8.2.17.2.6.2 The HUD shall be observed for the display of the visual information and alert signals down to the cease-proper-operation voltage.

8.2.17.2.6.3 The power source voltage shall be observed with respect to the cease-proper-operation voltage.

8.2.17.2.6.4 The events in 8.2.17.2.6.1 through 8.2.17.2.6.3 shall be recorded and reported.

8.2.17.2.7 Interpretation.

8.2.17.2.7.1 The HUD low-power-source alert signal function shall be evaluated to determine pass or fail performance.

8.2.17.2.7.2 The HUD power source voltage greater than or equal to the cease-proper-operation voltage shall constitute pass performance.

8.2.17.3 HUD Visibility Tests.

8.2.17.3.1 Darkness Test.

8.2.17.3.1.1 Application. This test method shall apply to complete CUR.

8.2.17.3.1.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.17.3.1.3 Specimen Preparation. Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.17.3.1.4 Apparatus.

(A) The CUR breathing air pressure vessel shall be permitted to be replaced with a pressure vessel of lesser capacity.

(B) The breathing air capacity of the replacement pressure vessel shall be greater than 200 L (7.1 ft^3).

(C) Testing shall be performed in a light-controlled enclosure designated as the "testing enclosure."

(D) A diffused-light source that provides a luminance of 2 lux, ±1 lux shall be used to illuminate across the surface of the SCBA facepiece lens.

8.2.17.3.1.5 Procedure.

(A) The selected test subjects shall have visual acuity of 20/20 in each eye uncorrected or corrected with contact lenses.

(B) Selected test subjects shall be able to read lowercase letters measuring 2.5 mm (3⁄32 in.) in height at a distance of 305 mm (12 in.).

(C) The test subject shall don a complete CUR.

(D) The test subject shall enter the testing enclosure and be positioned so that the CUR facepiece is illuminated as specified in 8.2.17.3.1.4.

(E) The test subject shall wait 1 min to allow the eyes to acclimate to the illumination.

(F) The CUR shall be activated so as to activate the HUD.

(G) The pressure vessel shall be fully charged, and the HUD shall show full pressure vessel charge.

(H) The CUR pressure shall be decreased so as to activate all HUD visual displays.

8.2.17.3.1.6 Report.

(A) Each visual display of information and each visual alert signal as defined by the manufacturer's instructions shall be observed for distinctness and identifiability.

(B) The test subject's observations of distinctness and identifiability shall be recorded and reported.

8.2.17.3.1.7 Interpretation.

(A) The test subject's ability to distinguish between each visual display of information and each visual alert signal as defined by the manufacturer's instructions shall be observed.

(B) The distinguishing features shall be distinct and identifiable.

(C) Failure of the test subject to be able to observe each visual display of information and each visual alert signal as distinct, identifiable, or both shall constitute failing performance.

8.2.17.4 Light Test.

8.2.17.4.1 Application. This test method shall apply to complete CUR.

8.2.17.4.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.17.4.3 Specimen Preparation. Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.17.4.4 Apparatus.

8.2.17.4.4.1 The CUR breathing air pressure vessel shall be permitted to be replaced with a pressure vessel of lesser capacity.

8.2.17.4.4.2 The breathing air capacity of the replacement pressure vessel shall be greater than 200 L (7.1 ft^3).

8.2.17.4.4.3 Testing shall be performed in a light-controlled enclosure designated as the "testing enclosure."

8.2.17.4.4.4 A diffused light source that provides a luminance of 10,000 lux, ±1,000 lux shall be used to illuminate across the surface of the CUR facepiece lens.

8.2.17.4.5 Procedure.

8.2.17.4.5.1 The selected test subjects shall have visual acuity of 20/20 in each eye uncorrected or corrected with contact lenses.

8.2.17.4.5.2 Selected test subjects shall be able to read lowercase letters measuring 2.5 mm (3⁄32 in.) in height at a distance of 305 mm (12 in.).

8.2.17.4.5.3 The test subject shall don a complete CUR.

8.2.17.4.5.4 The test subject shall enter the testing enclosure and be positioned so that the CUR facepiece is illuminated as specified in 8.2.17.4.4.4.

8.2.17.4.5.5 The test subject shall wait 1 min to allow the eyes to acclimate to the illumination.

8.2.17.4.5.6 The CUR shall be activated so as to activate the HUD.

8.2.17.4.5.7 The pressure vessel shall be fully charged, and the HUD shall show full pressure vessel charge.

8.2.17.4.5.8 The CUR pressure shall be decreased so as to activate all HUD visual displays.

8.2.17.4.6 Report.

8.2.17.4.6.1 Each visual display of information and each visual alert signal as defined by the manufacturer's instructions shall be observed, distinct, and identifiable.

8.2.17.4.6.2 The test subject's observations shall be recorded and reported.

8.2.17.4.7 Interpretation.

8.2.17.4.7.1 The test subject's ability to distinguish among the visual displays of information and the visual alert signals as defined by the manufacturer's instructions shall be observed.

8.2.17.4.7.2 Distinguishing features from the visual displays of information and the visual alert signals shall be distinct and identifiable.

8.2.17.5 HUD Disabling Glare Test.

8.2.17.5.1 Application. This test method shall apply to complete CUR.

8.2.17.5.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.17.5.3 Specimen Preparation. Prior to testing, test specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.17.5.4 Apparatus.

8.2.17.5.4.1 Testing shall be performed in a light-controlled enclosure designated as the "testing enclosure," with a diffused light source that provides a luminance of 2 lux, +0/−1 lux measured at the surface of the reading text card.

8.2.17.5.4.2 At least eight text cards for reading shall be provided.

8.2.17.5.4.3 Each text card shall have 10 different randomly selected letters of 2.5 mm (3/32 in.) in height printed in lowercase on the card.

8.2.17.5.4.4 The CUR breathing air pressure vessel shall be permitted to be replaced with a pressure vessel of lesser capacity.

8.2.17.5.4.5 The breathing air capacity of the replacement pressure vessel shall be greater than 200 L (7.1 ft^3).

8.2.17.5.5 Procedure.

8.2.17.5.5.1 The selected test subjects shall have visual acuity of 20/20 in each eye uncorrected or corrected with contact lenses.

8.2.17.5.5.2 Selected test subjects shall be able to read lowercase letters measuring 2.5 mm (3/32 in.) in height at a distance of 305 mm (12 in.).

8.2.17.5.5.3 The test subject shall enter the testing enclosure that is illuminated as specified in 8.2.17.5.4.1.

8.2.17.5.5.4 The test subject shall wait at least 1 min to allow the eyes to acclimate to the illumination.

8.2.17.5.5.5 A text card as specified in 8.2.17.5.4.2 shall be used for each before-reading procedure and for each after-reading procedure of a single test.

8.2.17.5.5.6 Different text cards as specified in 8.2.17.5.4.2 shall be used for each test.

8.2.17.5.5.7 With the test subject's vision blocked, the text card shall be placed in a fixed position inside the testing enclosure at a distance of 305 mm, +0/–25 mm (12 in., +0/–1 in.) from the test subject's face.

8.2.17.5.5.8 For the before-reading portion of the test procedure, the test subject shall read out loud the 10 letters on the text card.

8.2.17.5.5.9 The test subject shall then don a complete CUR.

8.2.17.5.5.10 The CUR shall be activated so as to activate the HUD.

8.2.17.5.5.11 With the test subject's vision blocked, a different text card shall be placed in a fixed position inside the testing enclosure at a distance of 305 mm, +0/–25 mm (12 in., +0/–1 in.) from the test subject's CUR facepiece lens.

8.2.17.5.5.12 The CUR pressure vessel pressure shall then be decreased until the breathing air supply in the pressure vessel is exhausted.

8.2.17.5.5.13 The after-reading portion of the test procedure shall be conducted while the pressure vessel pressure is being decreased.

8.2.17.5.5.14 The test subject shall read out loud the 10 letters on the text card.

8.2.17.6 Report.

8.2.17.6.1 The test subject's visual acuity as required in 8.2.17.5.5.1 shall be recorded and reported.

8.2.17.6.2 The test subject's ability to read the lowercase letters as required in 8.2.17.5.5.2 shall be recorded and reported.

8.2.17.6.3 The test subject's reading of the 10 letters in the before-reading portion of the test as required in 8.2.17.5.5.8 shall be recorded and reported for each letter.

8.2.17.6.4 The test subject's reading of the 10 letters in the after-reading portion of the test as required in 8.2.17.5.5.13 and 8.2.17.5.5.14 shall be recorded and reported for each letter.

8.2.17.7 Interpretation.

8.2.17.7.1 The test subject's inability to read at least 9 of the 10 before-reading letters shall constitute failing performance.

8.2.17.7.2 The test subject's inability to read at least 9 of the 10 after-reading letters shall constitute failing performance.

8.2.18 RIC UAC Performance Tests.

8.2.18.1 Pressure Vessel Refill Breathing Performance Test.

8.2.18.1.1 Application. Where the CUR is equipped with an RIC UAC, this test method shall apply to complete CUR.

8.2.18.1.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.18.1.3 Specimen Preparation. Prior to testing, test specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.18.1.4 Apparatus.

8.2.18.1.4.1 The test apparatus shall be as specified in 8.2.11.5.

8.2.18.1.4.2 An RIC UAC filling hose assembly shall be provided.

8.2.18.1.4.3 The breathing air source shall provide a constant pressure equal to the rated service pressure of the CUR breathing air pressure vessel, +0/–6.8 bar (+0/–100 psi).

8.2.18.1.5 Procedure.

8.2.18.1.5.1 The CUR shall be tested for airflow performance as specified in 8.1.11 with the modification that the test will begin with the CUR breathing air pressure vessel pressurized to 25 percent of the rated pressure.

8.2.18.1.5.2 The RIC UAC filling hose shall be connected to the constant pressure source.

8.2.18.1.5.3 At 10 cycles, ±5 cycles of the breathing machine, the RIC UAC female fitting on the RIC filling hose shall be connected to the RIC UAC male fitting on the CUR.

8.2.18.1.5.4 The RIC UAC coupling shall remain connected until the air transfer is completed.

8.2.18.1.5.5 The duration of the airflow performance test shall end 4 min after the air transfer has commenced in accordance with 8.2.18.1.5.3.

8.2.18.1.6 Report. The facepiece peak inhalation and exhalation pressure shall be recorded and reported.

8.2.18.1.7 Interpretation. The peak inhalation and peak exhalation pressures shall be used to determine pass or fail performance.

8.2.18.2 RIC UAC System Fill Rate Test.

8.2.18.2.1 Application. Where the CUR is equipped with an RIC UAC, this test method shall apply to complete CUR.

8.2.18.2.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.18.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.2.18.2.4 Apparatus.

8.2.18.2.4.1 An RIC UAC filling hose assembly shall be provided.

8.2.18.2.4.2 The air source shall provide a constant pressure equal to the rated service pressure of the CUR pressure vessel, +0/−6.8 bar (+0/−100 psi).

8.2.18.2.4.3 Testing shall be performed using a timer capable of measuring elapsed time within the range of 0 to 5 min.

8.2.18.2.5 Procedure.

8.2.18.2.5.1 The pressure of the CUR breathing air pressure vessel shall be 0 bar (0 psi).

8.2.18.2.5.2 The RIC UAC filling hose shall be connected to the constant pressure air source.

8.2.18.2.5.3 With the CUR breathing air pressure vessel valve fully open, the RIC UAC filling hose shall be connected to the RIC UAC male fitting.

8.2.18.2.5.4 The test timer shall begin when the RIC UAC filling hose is connected to the CUR.

8.2.18.2.5.5 The pressure in the CUR breathing air pressure vessel shall be monitored.

8.2.18.2.5.6 When the pressure in the CUR breathing air pressure vessel reaches 75 percent of the rated service pressure of the CUR pressure vessel, the test timer shall be stopped.

8.2.18.2.6 Report. The elapsed time shall be observed, recorded, and reported.

8.2.18.2.7 Interpretation. The elapsed fill time shall be used to determine pass or fail.

8.2.18.3 Pressure Vessel Connections and Accessibility Test.

8.2.18.3.1 Application. This test method shall apply to complete CUR assemblies.

8.2.18.3.2 Samples.

8.2.18.3.2.1 Samples shall be complete CUR.

8.2.18.3.2.2 Samples shall be fitted with each of the CUR manufacturer's air pressure vessel and valve assemblies.

8.2.18.3.3 Specimen Preparation.

8.2.18.3.3.1 The CUR manufacturer's pressure vessel and valve assembly shall be fixed to the backframe/carrier according to the manufacturer's end user instructions.

8.2.18.3.3.2 Prior to testing, specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F), with RH of 50 percent, ±25 percent.

8.2.18.3.4 Procedure.

8.2.18.3.4.1 The specimen fitted with each of the CUR manufacturer's pressure vessel and valve assemblies shall be fixed to the backframe/carrier assembly in accordance with the manufacturer's end user instructions provided with the CUR.

8.2.18.3.4.2 Specimens shall be evaluated for accessibility, attachment, and detachment by a test subject with a hand that is categorized as large.

8.2.18.3.4.3 The test subject shall perform the test while wearing a glove, the fingers of which are 2.5 mm to 4.0 mm thickness ($\frac{3}{32}$ in. to $\frac{5}{32}$ in.).

8.2.18.3.4.4 Pressure Vessel and Valve Assembly Attachment and Detachment.

(A) The test subject shall fully attach the pressure vessel and valve assembly to the CUR and then fully detach the pressure vessel and valve assembly from the CUR.

(B) The time in seconds to attach and then to detach the pressure vessel and valve assembly shall be measured.

8.2.18.3.4.5 Breathing Air Fill Hose Attachment and Detachment.

(A) The test subject shall fully attach the breathing air fill hose to the RIC UAC connection and then fully detach the breathing air fill hose from the RIC UAC connection.

(B) The time in seconds to attach and then to detach the breathing air fill hose shall be measured.

8.2.18.3.5 Report.

8.2.18.3.5.1 The time to fully attach and to fully detach the pressure vessel and valve assemblies, timed in accordance with 8.2.18.3.4.4, shall be recorded and reported.

8.2.18.3.5.2 The time to fully attach and to fully detach the breathing air fill hose to and from the RIC UAC connection, timed in accordance with 8.2.18.3.4.5, shall be recorded and reported.

8.2.18.3.6 Interpretation.

8.2.18.3.6.1 One or more specimens failing the attachment and detachment times for the pressure vessel and valve assemblies shall constitute failing performance.

8.2.18.3.6.2 One or more specimens failing the attachment and detachment times for the RIC UAC connection shall constitute failing performance.

8.2.19 Breathing Air Pressure Vessel and Valve Assembly Retention Test.

8.2.19.1 Application. This test method shall apply to complete CUR assemblies.

8.2.19.2 Samples.

8.2.19.2.1 Samples shall be complete CUR.

8.2.19.2.2 Samples shall be fitted with each of the CUR manufacturer's breathing air cylinder and valve assemblies.

8.2.19.3 Specimen Preparation.

8.2.19.3.1 One CUR sample shall be tested with a pressure vessel and valve assembly as specified in 8.2.19.5.

8.2.19.3.2 Prior to testing, specimens shall be conditioned for a minimum of 4 hours at an ambient temperature of 22°C, ±3°C (72°F, ±5°F), with RH of 50 percent, ±25 percent.

8.2.19.4 Apparatus.

8.2.19.4.1 A test bench or similar fixture that can firmly fix a fully assembled CUR to the test bench or fixture and that will not allow movement of the CUR shall be used.

8.2.19.4.2 Measurements shall be taken with a calibrated measuring device having a resolution of better than ±0.25 mm (±0.010 in.).

8.2.19.4.3 Loops, straps, or pads shall be positioned on the valve to facilitate the application and measurement of an applied load to the intersection of the valve connection plane with the centerline of the breathing air pressure vessel body.

8.2.19.5 Procedure.

8.2.19.5.1 The specimen fitted with the CUR manufacturer's breathing air pressure vessel and valve assembly shall be fixed to the backframe/carrier assembly in accordance with the manufacturer's end user instructions provided with the CUR.

8.2.19.5.2 The fully assembled CUR shall be fixed to the test bench or fixture in a manner that prevents movement of the CUR but that does not interfere with the breathing air pressure vessel and valve assembly retention method.

8.2.19.5.3 The distances for each of the six directions specified in 8.2.19.5.4, the original starting positions, shall be measured and recorded.

8.2.19.5.4 A force of 200 N (45 lbf) shall be applied to the intersection point specified in 8.2.19.4.3, in the six directions shown in Figure 8.2.19.5.4.

8.2.19.5.4.1 The force shall be applied for a period of 10 sec, +5/−0 sec, allowing the measurements to be taken.

8.2.19.5.5 Following the application of force for each direction, the distance for each of the six directions shall be measured and recorded.

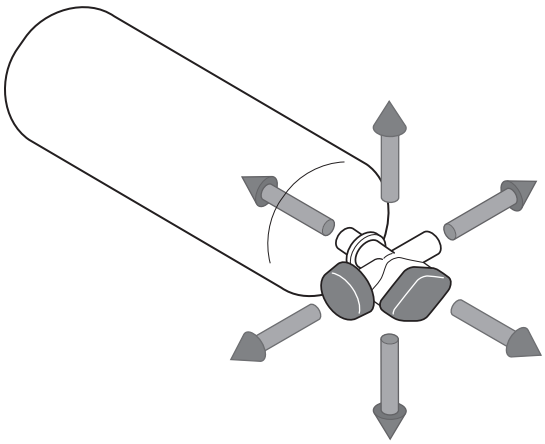


FIGURE 8.2.19.5.4 Directions of Force Applied for Retention Testing.

8.2.19.6 Report.

8.2.19.6.1 The distance moved from the original starting position for each of the six directions shall be recorded and reported.

8.2.19.6.2 No portion of the breathing air pressure vessel and valve assembly shall show movement greater than 25 mm (1 in.) from its original position prior to load application.

8.2.19.7 Interpretation. Movement of any part of the breathing air pressure vessel and valve assembly that exceeds 25 mm (1 in.) shall constitute failing performance.

8.2.20 UEBSS Cold-Temperature Performance Test.

8.2.20.1 Application. This test method shall apply to two complete CUR.

8.2.20.2 Samples. Each sample to be tested shall be as specified in 4.3.9.

8.2.20.3 Specimen Preparation.

8.2.20.3.1 Specimens for conditioning shall be two complete CUR.

8.2.20.3.2 Prior to testing, the CUR shall be placed in an ambient environment of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent for a minimum 12-hour dwell period.

8.2.20.3.3 The air used in the CUR breathing air pressure vessels shall comply with the quality requirements of NFPA 1989.

8.2.20.4 Apparatus.

8.2.20.4.1 The CUR shall be placed in an environmental chamber and positioned to simulate the normal wearing position of the CUR on a person as specified by the manufacturer.

8.2.20.4.2 During the cold temperature exposures, the CUR shall be mounted on a Scott Aviation Model No. 803608-01 or 803608-02 test headform or equivalent.

8.2.20.4.3 The thermocouple or other temperature-sensing element used shall be mounted within the chamber in a manner in which it will be exposed directly to the chamber atmosphere.

8.2.20.4.4 Two test headforms shall be connected to two breathing machines specified in 8.2.12.

8.2.20.4.5 The breathing machines shall be permitted to be located either inside or outside the environmental chamber.

8.2.20.5 Procedure.

8.2.20.5.1 The variation in pressure extremes caused by the cold-temperature performance test configuration shall be determined as specified in 8.2.20.5.1.1 and 8.2.20.5.1.2.

8.2.20.5.1.1 Receiving CUR.

(A) For the receiving CUR, the airflow performance test, as specified in 8.2.11, shall be carried out using the configuration specified in 8.2.12.4, with a breathing frequency set at 28, +1/−0 inhalation/exhalation cycles per minute and a tidal volume set at 3.4 L (.12 ft^3), ± 0.1 L (.004 ft^3).

(B) The difference in pressure between the two tests shall be calculated by subtracting the values obtained using the configu-

ration defined in 8.2.4 from the values obtained using the configuration specified in 8.2.12.

8.2.20.5.1.2 For the donor CUR, the airflow performance test, as specified in 8.2.12, shall be carried out using the configuration specified in 8.2.4, with a breathing frequency set at 29, +0/−1 inhalation/exhalation cycles per minute and a tidal volume set at 3.4 L ± 0.1 L (0.12 ft^3 ± 0.004 ft^3).

8.2.20.5.1.3 If the pressure obtained using the configuration specified in 8.2.11 is greater than the pressure obtained from the configuration defined in 8.2.12.4, the difference in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.11 from the values obtained using the configuration specified in 8.2.17.

8.2.20.5.2 For the receiving CUR, the facepiece pressure during each entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.2.20.5.1.1(A) to determine pass or fail, as specified in 7.2.12.2.2.

8.2.20.5.3 For the donor CUR, the facepiece pressure during each entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.2.20.5.1.3 to determine pass or fail as specified in 7.2.12.2.2.

8.2.20.5.4 The receiving and donor CUR shall be cold soaked at the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F) for a minimum of 12 hours.

8.2.20.5.4.1 The minimum operating temperature specified by the manufacturer shall be −18°C (0°F) or colder.

8.2.20.5.5 Receiving CUR Airflow Performance.

8.2.20.5.5.1 The receiving CUR shall then be tested for airflow performance as specified in 8.2.11 with a ventilation rate set at 103 L/min ± 3 L/min (3.64 CFM ± 0.10 CFM), at a chamber air temperature of the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F).

(A) The minimum operating temperature specified by the manufacturer shall be −18°C (0°F) or colder.

8.2.20.5.5.2 For the UEBSS cold-temperature performance test, both of the following shall apply:

(1) The airflow performance test shall begin after five cycles of the breathing machine.
(2) The airflow performance test shall continue to operate through at least 36 bar (520 psi) of the donor CUR pressure vessel inlet pressure.

8.2.20.5.6 The donor CUR shall then be tested for airflow performance as specified in 8.2.11 with a breathing frequency set at 29 + 0/−1 inhalation/exhalation cycles per minute and a tidal volume set at 3.4 L ± 0.1 L (0.12 ft^3 ± 0.03 ft^3), at a chamber air temperature of the minimum operating temperature specified by the manufacturer ± 1°C (± 2°F).

8.2.20.5.6.1 The minimum operating temperature specified by the manufacturer shall be −18°C (0°F) or colder.

8.2.20.6 Report.

8.2.20.6.1 The facepiece peak inhalation pressure and peak exhalation pressure shall be recorded and reported for each test condition.

8.2.20.6.2 The activation and operation of the donor CUR EOSTI or the failure of the donor CUR EOSTI to activate and operate shall be recorded and reported.

8.2.20.6.3 The activation and identification of the donor CUR HUD visual alert signals shall be recorded and reported.

8.2.20.7 Interpretation.

8.2.20.7.1 The peak inhalation and peak exhalation shall be used to determine pass or fail performance for each test procedure.

8.2.20.7.2 One or more specimens failing this test shall constitute failing performance.

8.2.20.7.3 Failure of the donor CUR EOSTI alarm signal to activate and remain active during the test shall constitute failing performance.

8.2.20.7.4 Failure of the donor CUR HUD to display the breathing air pressure vessel content or to display the visual alert signal during the test shall constitute failing performance.

8.3 PAPR Airflow Performance Tests.

8.3.1 Non-Breath-Responsive PAPR Airflow Performance.

8.3.1.1 Application. These tests shall apply to all CUR that incorporate a non-breath-responsive PAPR.

8.3.1.2 Specimens. Three CUR models shall be tested in each airflow performance test.

8.3.1.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.3.1.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure RCT-APR-STP-0012.

8.3.1.5 Report. The airflow performance test shall be recorded and reported for each test specimen.

8.3.1.6 Interpretation. The airflow performance test shall be used to determine pass or fail performance.

8.3.2 Airflow Resistance in Breath-Responsive, Powered Air-Purifying Respirators.

8.3.2.1 Application. These tests shall apply to all CUR that incorporate breath-responsive PAPR.

8.3.2.2 Specimens. Three CUR models shall be tested in each airflow resistance in breath-responsive, powered air-purifying respirators performance test.

8.3.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.3.2.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure RCT-APR-STP-0065.

8.3.2.5 Report. The airflow resistance in breath-responsive, powered air-purifying respirators performance test shall be recorded and reported for each test specimen.

8.3.2.6 Interpretation. The airflow resistance in breath-responsive, powered air-purifying respirators performance test shall be used to determine pass or fail performance.

8.3.3 Silica Dust Loading Test Performance.

8.3.3.1 Application. These tests shall apply to all CUR that incorporate a nonbreath responsive PAPR.

8.3.3.2 Specimens. Three CUR models shall be tested in each airflow performance test.

8.3.3.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.3.3.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure RCT-APR-STP-0025.

8.3.3.5 Report. The silica dust loading performance test shall be recorded and reported for each test specimen.

8.3.3.6 Interpretation. The silica dust loading performance test shall be used to determine pass or fail performance.

8.3.4 Facepiece Carbon Dioxide and Oxygen Concentration Levels Performance with the PAPR Blower Off.

8.3.4.1 Application. These tests shall apply to all CUR that incorporate a non-breath-responsive or breath-responsive PAPR.

8.3.4.2 Specimens. Three CUR models shall be tested in each airflow resistance in breath-responsive, powered air-purifying respirators performance test.

8.3.4.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.3.4.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5 of the NIOSH Standard Test Procedure RCT-APR-STP-0064.

8.3.4.5 Report. The facepiece CO_2 and the O_2 concentration levels shall be recorded and reported for each test specimen.

8.3.4.6 Interpretation. The facepiece CO_2 and the O_2 concentration levels shall be used to determine pass or fail performance.

8.4 CUR/APR Mode Performance Tests.

8.4.1 Inhalation Breathing Resistance Performance.

8.4.1.1 Application. These tests shall apply to all CUR.

8.4.1.2 Specimens. Three CUR models shall be tested in each inhalation breathing resistance performance test.

8.4.1.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.4.1.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5; or sections 3A, 4A.1, and 5A of the NIOSH Standard Test Procedure TEB-APR-STP-0007.

8.4.1.5 Report. The inhalation breathing resistance performance test shall be recorded and reported for each test specimen.

8.4.1.6 Interpretation. The inhalation breathing resistance performance test shall be used to determine pass or fail performance.

8.4.2 Exhalation Breathing Resistance Performance.

8.4.2.1 Application. These tests shall apply to all CUR.

8.4.2.2 Specimens. Three CUR models shall be tested in each exhalation breathing resistance performance test.

8.4.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.4.2.4 Procedure. Specimens shall be tested as specified in sections 3, 4.1, and 5; or sections 3A, 4A.1, and 5A of the NIOSH Standard Test Procedure TEB-APR-STP-0003.

8.4.2.5 Report. The exhalation breathing resistance performance test shall be recorded and reported for each test specimen.

8.4.2.6 Interpretation. The exhalation breathing resistance performance test shall be used to determine pass or fail performance.

8.4.3 Hydration Performance Test.

8.4.3.1 Application. This test shall apply to all CUR.

8.4.3.2 Specimens. Three specimens shall be tested in each hydration performance test.

8.4.3.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned for a minimum of 4 hours and then tested at an ambient temperature of 22°C ± 3°C (72°F ± 5°F) and an RH of 50 percent, ± 25 percent.

8.4.3.4 Procedure.

8.4.3.4.1 Dry drinking tube valves, valve seats, or seals shall be subjected to a suction of 75 mm (2.9 in) water column height while in a normal operating position.

8.4.3.4.2 Specimens shall be tested as specified in sections 3, 4.1, and 5 of NIOSH Standard Test Procedure RCT-APR-STP-0014.

8.4.3.5 Report. The hydration performance shall be recorded and reported for each test specimen.

8.4.3.6 Interpretation. The hydration performance shall be used to determine pass or fail performance.

8.4.4 Environmental Conditioning of Canisters.

8.4.4.1 Application. This test shall apply to all CUR.

8.4.4.2 Specimens. One hundred and twenty-five canisters in the manufacturer's recommended packaging configuration shall be subjected to the environmental conditioning of canisters.

8.4.4.3 Specimen Preparation. No preconditioning preparation shall be necessary.

8.4.4.4 Procedure. Specimens shall be conditioned as specified in sections 3, 4.1, 4.2, 5.5, and 5.6.1 through 5.6.16 of NIOSH Standard Conditioning Procedure CET-APRS-STP-CBRN-0311.

8.4.4.5 Report. No report shall be necessary.

8.4.4.6 Interpretation. The environmental conditioning of the canisters shall be performed prior to the gas and vapor testing and particulate testing in 8.4.4.

8.4.5 Canister Test Challenge and Test Breakthrough Concentrations.

8.4.5.1 Ammonia Test Challenge and Test Breakthrough Concentrations.

8.4.5.1.1 Application. These tests shall apply to all CUR.

8.4.5.1.2 Specimens. Nine canisters shall be tested in each ammonia test challenge and test breakthrough concentrations performance test.

8.4.5.1.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified in 8.4.4.

8.4.5.1.4 Procedure. Specimens shall be tested as specified in sections 3, 4.2, 5, 6.3.1, 6.3.2, 6.3.3, and 6.3.4 of the NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0307.

8.4.5.1.5 Report. The ammonia test challenge and test breakthrough concentrations performance test shall be recorded and reported for each test specimen.

8.4.5.1.6 Interpretation. The ammonia test challenge and test breakthrough concentrations performance test shall be used to determine pass or fail performance.

8.4.5.2 Cyanogen Chloride Test Challenge and Test Breakthrough Concentrations.

8.4.5.2.1 Application. These tests shall apply to all CUR.

8.4.5.2.2 Specimens. Nine canisters shall be tested in each cyanogen chloride test challenge and test breakthrough concentrations performance test.

8.4.5.2.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified in 8.4.4.

8.4.5.2.4 Procedure. Specimens shall be tested as specified in sections 3, 4.2, 5, 6.3.1, 6.3.2, 6.3.3, and 6.3.4 of the NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0302.

8.4.5.2.5 Report. The cyanogen chloride test challenge and test breakthrough concentrations performance test shall be recorded and reported for each test specimen.

8.4.5.2.6 Interpretation. The cyanogen chloride test challenge and test breakthrough concentrations performance test shall be used to determine pass or fail performance.

8.4.5.3 Cyclohexane Test Challenge and Test Breakthrough Concentrations.

8.4.5.3.1 Application. These tests shall apply to all CUR.

8.4.5.3.2 Specimens. Nine canisters shall be tested in each cyclohexane test challenge and test breakthrough concentrations performance test.

8.4.5.3.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified in 8.4.4.

8.4.5.3.4 Procedure. Specimens shall be tested as specified in sections 3, 4.2, 5, 6.3.1, 6.3.2, 6.3.3, and 6.3.4 of the NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0301.

8.4.5.3.5 Report. The cyclohexane test challenge and test breakthrough concentrations performance test shall be recorded and reported for each test specimen.

8.4.5.3.6 Interpretation. The cyclohexane test challenge and test breakthrough concentrations performance test shall be used to determine pass or fail performance.

8.4.5.4 Formaldehyde Test Challenge and Test Breakthrough Concentrations.

8.4.5.4.1 Application. These tests shall apply to all CUR.

8.4.5.4.2 Specimens. Nine canisters shall be tested in each formaldehyde test challenge and test breakthrough concentrations performance test.

8.4.5.4.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified in 8.4.4.

8.4.5.4.4 Procedure. Specimens shall be tested as specified in sections 3, 4.2, 5, 6.3.1, 6.3.2, 6.3.3, and 6.3.4 of the NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0310.

8.4.5.4.5 Report. The formaldehyde test challenge and test breakthrough concentrations performance test shall be recorded and reported for each test specimen.

8.4.5.4.6 Interpretation. The formaldehyde test challenge and test breakthrough concentrations performance test shall be used to determine pass or fail performance.

8.4.5.5 Hydrogen Cyanide Test Challenge and Test Breakthrough Concentrations.

8.4.5.5.1 Application. These tests shall apply to all CUR.

8.4.5.5.2 Specimens. Nine canisters shall be tested in each hydrogen cyanide test challenge and test breakthrough concentrations performance test.

8.4.5.5.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified in 8.4.4.

8.4.5.5.4 Procedure. Specimens shall be tested as specified in sections 3, 4.2, 5, 6.3.1, 6.3.2, 6.3.3, and 6.3.4 of the NIOSH Standard Test Procedure CET-APRS-STP-CBRN-0303.

8.4.5.5.5 Report. The hydrogen cyanide test challenge and test breakthrough concentrations performance test shall be recorded and reported for each test specimen.

8.4.5.5.6 Interpretation. The hydrogen cyanide test challenge and test breakthrough concentrations performance test shall be used to determine pass or fail performance.

8.4.5.6 Hydrogen Sulfide Test Challenge and Test Breakthrough Concentrations.

8.4.5.6.1 Application. These tests shall apply to all CUR.

8.4.5.6.2 Specimens. Nine canisters shall be tested in each hydrogen sulfide test challenge and test breakthrough concentrations performance test.

8.4.5.6.3 Specimen Preparation. Prior to testing, the specimens shall be conditioned as specified 8.4.4.