NFPA® 1999

Standard on Protective Clothing for Emergency Medical Operations

2013 Edition

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An International Codes and Standards Organization

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NFPA® 1999

Standard on

Protective Clothing for Emergency Medical Operations

2013 Edition

This edition of NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations*, was prepared by the Technical Committee on Emergency Medical Services Protective Clothing and Equipment and released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment. It was issued by the Standards Council on November 27, 2012, with an effective date of December 17, 2012, and supersedes all previous editions.

This edition of NFPA 1999 was approved as an American National Standard on December 17, 2012.

Origin and Development of NFPA 1999

This standard was developed to address protective garments, gloves, and facewear designed that protect persons providing emergency medical care against exposure to liquid-borne pathogens during emergency medical operations. NFPA 1999 defines minimum performance for protective clothing as required by the Occupational Safety and Health Administration (OSHA) Final Rule (29 CFR 1910.1030) *Protecting Health Care Workers from Occupational Exposure to Bloodborne Pathogens*. The Final Rule states:

"When there is occupational exposure, the employer shall provide at no cost to the employee, appropriate personal protective equipment, such as, but not limited to, gloves, gowns, laboratory coats, face shields or masks, and eye protection, and mouthpieces, resuscitation bags, pocket masks, or other ventilation devices. Personal protective equipment will be considered 'appropriate' only if it does not permit blood or other potential infectious materials to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used."

NFPA 1999 offers specific performance criteria that involve exposing protective clothing materials to surrogate virus challenge utilizing a specific time and pressure protocol. This procedure has been documented to discriminate between current protective clothing materials and to correlate with visual penetration results that are obtained with a human factors evaluation. Each type of clothing must resist penetration to blood-borne pathogens as determined by this test.

Additional garment requirements cover overall liquidtight integrity, material strength, physical hazard resistance, seam strength, and closure strength.

Additional requirements for gloves cover minimum performance for tensile and elongation properties in an "as received" condition as well as following heat aging and isopropyl alcohol immersion, minimum sizing, and liquidtight integrity for intended areas of penetration.

Additional requirements for facewear or face protection devices cover adequate visibility and integrity, in addition to resisting penetration of blood-borne pathogens.

The selection of test methods and performance requirements was based on surveys of emergency medical services (EMS) personnel and a technical study supported by the U.S. Fire Administration.

The Subcommittee on Hazardous Chemicals Protective Clothing began its work on the first edition of this document in 1990 and passed on its work to the Technical Committee on Fire Service Protective Clothing and Equipment in January 1991. The first edition was presented to the Association at the 1992 Annual Meeting in New Orleans, LA.

Since the first edition in 1992, the entire project for fire service protective clothing and equipment was reorganized in January 1995 by the Standards Council. The new project has a Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment and eight technical committees operating within it. The Technical Committee on Emergency Medical Services Protective Clothing and Equipment is now responsible for NFPA 1999.

In 1997, the second edition incorporated single-use and reusable items of EMS protective clothing. Prior to that edition, there was no differentiation between single-use and reusable items. Items that were reused might not have continued to provide biopenetration barrier protection. Reusable items could be advantageous and cost-effective for certain items of EMS clothing such as

garments. Durability conditioning was added to the test methods of items that would be identified as not for single use only. EMS gloves remain single-use items only. This was consistent with NFPA 1581, *Standard on Fire Department Infection Control Program*. EMS gloves were also newly required to be an FDA registered medical device.

The first edition allowed partial body garments, such as sleeve covers or apron-type gowns, and also allowed the biopenetration barrier protection to be less in area than the area covered by the garment (such as only the front of a smock or jacket having the biopenetration barrier protection). The second edition continued to permit partial body garments, but did not allow partial biopenetration barrier protection in a garment. Biopenetration barrier protection was required for the full area covered by the garment.

Test methods were completely reformatted to present consistency in test methods and to assure that all key elements of a test were given within the method.

The third edition of NFPA 1999 was reformatted into the new style for all NFPA codes and standards and, therefore, the chapter titles and numbering, as well as paragraph numbering, changed. In that edition, the Committee added new requirements for emergency medical work gloves, emergency medical footwear, and cleaning/utility gloves.

Emergency medical work gloves will provide the barrier protection from blood and liquid-borne pathogens that all EMS PPE provides, and a higher level of physical protection for incidents where rough or sharp surfaces could be contacted, such as during extrication operations. The emergency medical footwear can be configured either as a single-use, disposable bootie to pull over work shoes or as normal footwear designed for multiple uses. Both would provide the same barrier protection from blood and liquid-borne pathogens as other items of EMS PPE. The cleaning/utility gloves are single-use items to protect wearers during cleaning and decontamination of EMS equipment.

The third (2003) edition of NFPA 1999 was acted on by the NFPA membership at the November Association Technical Meeting in Atlanta, Georgia, on November 20, 2002, and became effective on February 6, 2003.

The 2008 (fourth) edition of NFPA 1999 included a number of changes that were implemented to address emerging needs for EMS providers as well as to address the special protection needs of first receivers at hospitals or other health care facilities. Specific attention was paid to types of emergency medical protective clothing items where certification activity and consequent use of certified products has been limited. Much of the work was supported by a research contract effort funded by the National Institute for Occupational Safety and Health (NIOSH) National Personal Protective Technology Laboratory (NPPTL). The NIOSH NPPTL research program involved a detailed investigation of emergency medical responder needs, identification of evaluation techniques to address these needs, testing of representative products, outreach to end-user groups to assist with discerning acceptable levels of protection, and the proposal of specific criteria. The results of this supporting work are available in the project final report, *Improved Criteria for Emergency Medical Protective Clothing, Contract No. 214-2006-M-15870 Final Report*.

The principal changes incorporated in the fourth edition of NFPA 1999 include the following:

(1) Differentiation between multiple- and single-use protective garments based on specific physical property criteria.
(2) Application of a flammability test for certain items of protective clothing to prevent the use of dangerous products in the event of accidental flame contact.
(3) New design, performance, testing, documentation, and certification requirements for [C]BRN protective ensembles to provide protection for emergency services responders and medical receivers against biological agents and radiological particulates. *The use of the [C] in the "[C]BRN" format is to indicate that chemical protection is not offered by this ensemble, while retaining the widely used "CBRN" term.* This level of protection would be needed for medical receivers and medical treatment personnel where CBRN incident victims self-present at a medical facility, or the victims have not been decontaminated or only partially decontaminated prior to transport to a medical facility. This [C]BRN protection is not addressed by the single-use garments covered in NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*. The new requirements focus on full ensembles that are subject to multiple uses prior to use during a CBRN incident.
(4) New criteria for head protection to establish protection requirements for impact hazards at emergency sites, and some guidance in the annex provided to also address prevention of trauma to emergency medical personnel traveling inside vehicles.
(5) New category of footwear to address the physical environments for first receivers at hospitals or other health care facilities.
(6) Revised criteria for footwear covers to address performance properties consistent with expected use, such as abrasion resistance of sole materials.
(7) New classification and performance requirements for eye and face protection devices. The new system segregates the different types of eye/face protection into "single-use" and "reusable" devices, and a separate category of medical face masks that are frequently used by emergency services responders during emergency medical care.
(8) Revision of requirements for cleaning glove performance to eliminate conflicting criteria.
(9) New optional high-visibility markings criteria for emergency responder protective garments; these optional criteria are consistent with ANSI 107, *Standard on High-Visibility Safety Apparel*.

In addition to the principal changes, a number of clarifications and improvements were made to ensure consistency of requirements throughout the standard.

The fourth (2008) edition was issued by the NFPA Standards Council with an effective date of December 31, 2007.

This fifth (2013) edition of NFPA 1999 is a complete revision of the document that includes editorial changes, updates to referenced publications, and new or revised definitions for *gusset*, *tongue*, *interface component*, and *manufacturer*.

The 2013 edition has removed the puncture resistance test two and the impact and compression resistance test. Revisions to the abrasion test, slip resistance test, footwear upper materials testing, cut resistance test, washing and drying procedures, and chemical permeation resistance test are also included. This edition also features a new section on work glove test areas.

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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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Additionally, this committee shall have primary responsibility for documents on the selection, care, and maintenance of emergency medical protective clothing and protective equipment by fire and emergency services organizations and personnel.

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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.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

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

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard shall specify the minimum design, performance, testing, documentation, and certification requirements for new single-use and new multiple-use emergency medical operations protective clothing, including garments, helmets, gloves, footwear, and face protection devices, used by emergency medical responders prior to arrival at medical care facilities, and used by medical first receivers at medical care facilities during emergency medical operations.

1.1.2* This standard shall also specify additional minimum design, performance, testing, documentation, and certification as requirements for multiple exposure use emergency medical protective ensembles that provide limited protection from specified [C]BRN terrorism agents.

1.1.3* This standard shall not be interpreted as specifying requirements for protection from all CBRN terrorism agents, from all radiological agents, from hazardous chemicals, from flammable or explosive atmospheres, or from thermal hazards.

1.1.4* Other than for emergency medical protective ensembles that are certified as compliant with the [C]BRN requirements of this standard, this standard shall not be interpreted as specifying requirements for respiratory protection, and protection from airborne pathogens.

1.1.5 Certification of all emergency medical ensemble elements and protective clothing items, and medical care facility ensemble elements and protective clothing items as compliant with the requirements of this standard shall not preclude certification to additional appropriate standards where the ensemble elements or protective clothing items meet all applicable requirements of each standard.

1.1.6* This standard shall not be construed as addressing all of the safety concerns associated with the use of compliant emergency medical operations protective clothing for the protection of their personnel. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of protective clothing to establish safety and health practices and determine the applicability of regulatory limitations prior to using this standard for any designing, manufacturing, and testing.

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

1.1.8* This standard shall not specify requirements for any accessories that could be attached to the certified product but are not necessary for the certified product to meet the requirements of this standard.

1.1.9 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 a minimum level of protection from contact with blood and body fluid-borne pathogens for personnel performing patient care during emergency medical operations.

1.2.2 The purpose of this standard shall also be to establish a minimum level of protection for emergency services personnel from specified [C]BRN terrorism agents in liquid splash and particulate environments during [C]BRN terrorism incidents.

1.2.3 To achieve these purposes, this standard shall establish for emergency medical responders and medical first receivers the minimum requirements for upper and lower torso, head, hands, foot, and face protection devices to minimize skin and mucous membrane contact with body fluid-borne pathogens, and from the selected [C]BRN agents where the optional [C]BRN protection is specified.

1.2.4 Controlled laboratory tests used to determine compliance with the performance requirements of this standard shall not be deemed as establishing performance levels for all situations to which personnel can be exposed.

1.2.5* This standard shall not be interpreted or used as a detailed manufacturing or purchase specification but shall be permitted to be referenced in purchase specifications as minimum requirements.

1.3 Application.

1.3.1* This standard shall apply to the design, performance, testing, and certification of new emergency medical garments; emergency medical examination gloves; emergency medical helmets; emergency medical cleaning/utility gloves; emergency medical work gloves; emergency medical facemasks; emergency medical face protection devices; emergency medical footwear and footwear covers; and medical care facility footwear, and shall apply to ensembles and ensemble elements for the additional [C]BRN protection from specified biological and radiological terrorism agents.

1.3.2 This edition of NFPA 1999 shall not apply to any emergency medical operations protective clothing manufactured to previous editions of this standard.

1.3.3 This standard shall not apply to any emergency medical operations protective clothing manufactured to the requirements of any other standard.

1.3.4* Other than the certification of emergency medical protective ensembles to the [C]BRN requirements of this standard, this standard shall not apply to respiratory protection in emergency medical operations as such requirements are specified by NIOSH in 42 CFR 84, and by OSHA in 29 CFR 1910.134 and 29 CFR 1910.1030.

1.3.5 This standard shall not apply to protection from ionizing radiation, protection from all biological terrorism agents, or protection from all weapons of mass destruction.

1.3.6* This standard shall not apply to protective clothing for chemical terrorism incidents as such requirements are specified in NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*.

1.3.7 This standard shall not apply to the use of or conditions of use for emergency medical protective clothing and ensembles by emergency medical responders and medical first receivers.

1.3.8 This standard shall not apply to any accessories that could be attached to the certified product, before or after purchase, but are not necessary for the certified product to meet the requirements of this standard.

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 as these values are 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 1500, *Standard on Fire Department Occupational Safety and Health Program,* 2013 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program,* 2010 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents,* 2012 edition.

2.3 Other Publications.

2.3.1 AATCC Publications. American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC 42, *Water Resistance: Impact Penetration Test*, 2007.

AATCC 61, *Colorfastness to Laundering, Home and Commercial: Accelerated*, 2010.

AATCC 70, *Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test,* 2010.

2.3.2 ANSI Publications. American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, 2010.

ANSI Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* 2010.

ANSI/ISEA Z89.1, *Standard for Industrial Head Protection*, 2009.

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

ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2009.

ASTM D 412a, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension,* 2006 ae2.

ASTM D 573, *Standard Test Method for Rubber-Deterioration in an Air Oven,* 2010.

ASTM D 1230, *Standard Test Method for Flammability of Apparel Textiles*, 2010.

ASTM D 1683, *Standard Test Method for Failure in Sewn Seams of Woven Apparel Fabrics,* 2011.

ASTM D 1776, *Standard Practice for Conditioning and Testing Textiles,* 2008 e1.

ASTM D 2582, *Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting,* 2009.

ASTM D 3787, *Method for Bursting Strength of Textiles — Constant-Rate-of-Traverse (CRT) Ball Burst Test*, 2011.

ASTM D 3884, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method),* 2009.

ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2010.

ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method),* 2010.

ASTM D 5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 2009.

ASTM D 5151, *Standard Test Method for Detection of Holes in Medical Gloves,* 2006.

ASTM D 5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, 2010.

ASTM D 5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, 2010.

ASTM D 5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*, 2008.

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ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, 2011.

ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, 2010.

ASTM F 1342, *Standard Test Method for Protective Clothing Material Resistance to Puncture,* 2005.

ASTM F 1359, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin,* 2007.

ASTM F 1671, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System,* 2007.

ASTM F 1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing,* 2005.

ASTM F 1862, *Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity),* 2007.

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ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2010.

ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks*, 2011.

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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. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions 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 *Manual of Style for NFPA Technical Committee Documents.*

3.3* General Definitions.

3.3.1 Accessories. An item, or items, that are attached to the certified product that are not necessary to meet the requirements of the standard.

3.3.2 Afterflame. Persistent flaming of a material after the ignition source has been removed.

3.3.3 Afterflame Time. The length of time for which a material continues to flame after the ignition source has been removed.

3.3.4 Arch. The bottom curve of the foot from the heel to the ball.

3.3.5 Barrier Layer. The layer of garment material, glove material, footwear material, or face protection device material designated as providing body fluid-borne pathogen resistance.

3.3.6 Biological Terrorism Agents. Liquid or particulate agents that can consist of biologically derived toxin or pathogen to inflict lethal or incapacitating casualties.

3.3.7 Body Fluid-Borne Pathogen. An infectious bacterium or virus carried in human, animal, or clinical body fluids organs, or tissue.

3.3.8 Body Fluids. Fluids that are produced by the body, including, but not limited to, blood, semen, mucus, feces, urine, vaginal secretions, breast milk, amniotic fluid, cerebrospinal fluid, synovial fluid, and pericardial fluid.

3.3.9 Brim. A part of the shell of the helmet that extends around the entire circumference of the helmet.

3.3.10 CBRN. An acronym for chemicals, biological agents, and radiological particulates hazards. *(See also 3.3.13, CBRN Terrorism Agents.)*

3.3.11 [C]BRN. A modification to CBRN; used in this standard to indicate the CBRN protection provided by the [C]BRN requirements does not include chemical CBRN hazards, but *only applies to biological agents and radiological particulates* CBRN hazards. *(See also 3.3.13, CBRN Terrorism Agents.)*

3.3.12* CBRN Barrier Layer. The part of a composite that is intended to provide a barrier of protection against CBRN terrorism agents.

3.3.13* CBRN Terrorism Agents. Chemicals, biological agents, and radiological particulates that could be released as an act of terrorism. [C]BRN terrorism agents include only biological agents and radiological particulates. *(See also 3.3.6, Biological Terrorism Agents and 3.3.69, Radiological Particulate Terrorism Agents.)*

3.3.14 Certification/Certified. 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 manufacturer to determine compliance with the requirements of this standard.

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

3.3.16 Combined Performance Material. A retroreflective material that is also a fluorescent material.

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

3.3.18 Compliant Product. Product that is covered by this standard and has been certified as meeting all applicable requirements of this standard that pertain to the product.

3.3.19 Component(s). Any material, part, or subassembly used in the construction of the compliant product.

3.3.20 Crown. The portion of the helmet that covers the head above the reference plane.

3.3.21 Crown Straps. The part of the helmet suspension that passes over the head.

3.3.22 Emergency Medical [C]BRN Protective Ensemble. An ensemble consisting of garment elements, glove elements, footwear elements, and a CBRN respirator that is certified to meet the requirements for protection from specific [C]BRN terrorism agents.

3.3.23* Emergency Medical Cleaning/Utility Glove. Multipurpose glove, not for emergency patient care, that provides a barrier against body fluids, cleaning fluids, and disinfectants and limited physical protection to the wearer.

3.3.24 Emergency Medical Examination Glove. An element or item of emergency medical protective ensemble or protective clothing that is designed and configured to provide barrier protection to the wearer's hand to at least the wrist. *(See 3.3.34, Emergency Medical Work Glove.)*

3.3.25* Emergency Medical Eye and Face Protection Device. An item of emergency medical protective clothing that is designed and configured to provide barrier protection to the wearer's eyes, face, or both eyes and face.

3.3.26* Emergency Medical Facemask. An item of emergency medical protective clothing that is designed and configured to provide protection to the wearer's face including the mucous membrane area of the wearer's nose and mouth.

3.3.27 Emergency Medical Footwear. An element or item of emergency medical protective ensemble or protective clothing that is designed and configured to provide barrier protection to the wearer's feet.

3.3.28 Emergency Medical Footwear Cover. An element or item of emergency medical protective ensemble or protective clothing designed and configured to be worn over standard footwear to provide barrier and physical protection to the wearer's feet.

3.3.29* Emergency Medical Garment. An element or item of emergency medical protective ensemble or protective clothing designed and configured as a single garment or an assembly of multiple garments to provide barrier protection to the wearer's upper and lower torso, excluding the hands, face, and feet.

3.3.30 Emergency Medical Helmet. An item of emergency medical protective clothing designed and configured to provide protection to the wearer's head.

3.3.31* Emergency Medical Operations. Provision of emergency patient care and transportation prior to arrival at a medical care facility by emergency medical responders, emergency patient care by medical first receivers at a medical care facility, and body recovery by emergency medical responders.

3.3.32* Emergency Medical Protective Clothing. Items of both single-use and multiple-use protective clothing that provide limited physical protection and barrier protection against body fluid-borne pathogen contact with the wearer's body during delivery of emergency patient care and other emergency medical functions. *(See 3.3.23, Emergency Medical Cleaning/Utility Glove, 3.3.24, Emergency Medical Examination Glove, 3.3.25, Emergency Medical Eye and Face Protection Device, 3.3.26, Emergency Medical Facemask, 3.3.27, Emergency Medical Footwear, 3.3.28, Emergency Medical Footwear Cover, 3.3.29, Emergency Medical Garment, 3.3.30, Emergency Medical Helmet, and 3.3.34, Emergency Medical Work Glove.)*

3.3.33 Emergency Medical Responders. Emergency services response personnel who perform emergency medical operations prior to arrival at a medical care facility.

3.3.34 Emergency Medical Work Glove. An element or item of emergency medical protective ensemble or protective clothing that is designed and configured to provide physical and barrier protection to the wearer's hand and wrist. *(See also 3.3.24, Emergency Medical Examination Glove.)*

3.3.35 Emergency Patient Care. Treatment of patients by emergency medical responders or medical first receivers including first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical procedures that occur prior to arrival at a medical care facility, or after arrival at a medical care facility.

3.3.36 Examination Glove. An abbreviated term for emergency medical examination glove. *(See also 3.3.24, Emergency Medical Examination Glove.)*

3.3.37 Face Protection Device. An abbreviated term for emergency medical face protection device. *(See also 3.3.25, Emergency Medical Eye and Face Protection Device.)*

3.3.38 Fluorescence. A process by which radiant flux of certain wavelengths is absorbed and reradiated non-thermally in other, usually longer, wavelengths.

3.3.39 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.

3.3.40 Footwear. An abbreviated term for emergency medical footwear *(See also 3.3.27, Emergency Medical Footwear.)*

3.3.41 Footwear Cover. An abbreviated term for emergency medical footwear cover. *(See also 3.3.28, Emergency Medical Footwear Cover.)*

3.3.42 Garment. An abbreviated term for emergency medical garment. *(See also 3.3.29, Emergency Medical Garment.)*

3.3.43 Garment Closure. The garment component designed and configured to allow the wearer to enter (don) and exit (doff) the garment.

3.3.44 Garment Closure Assembly. The combination of the garment closure and the seam attaching the garment closure to the garment, excluding any protective flap or cover.

3.3.45 Garment Material. All material layers used in the construction of emergency medical garments other than patches, reinforcements, and visibility markings.

3.3.46 Glove. See 3.3.23, Emergency Medical Cleaning/Utility Glove; 3.3.24, Emergency Medical Examination Glove; and 3.3.34, Emergency Medical Work Glove.

3.3.47 Glove Body. The part of the glove that extends from the tip of the fingers to the wrist crease or to a specified distance beyond the wrist crease.

3.3.48 Glove Material. All material layers used in the construction of gloves.

3.3.49* Gusset. The part of the protective footwear that is a relatively flexible material joining the footwear upper (quarter) and the tongue, which is intended to provide expansion of the footwear front to enable donning of the footwear while maintaining continuous moisture integrity of the footwear.

3.3.50 Hazardous Materials. Any solid, liquid, gas, or mixture thereof that can potentially cause harm to the human body through respiration, ingestion, skin absorption, or contact.

3.3.51 Headform. A device that simulates the configuration of the human head.

3.3.52 Helmet. See 3.3.30, Emergency Medical Helmet.

3.3.53 Helmet Shell. A helmet without the suspension system, accessories, and fittings.

3.3.54 Insole. The inner part of the protective footwear upon which the foot rests and that conforms to the bottom of the foot.

3.3.55 Interface Component(s). Any material, part, or subassembly used in the construction of the compliance product that provides limited protection to interface areas.

3.3.56 Manufacturer. The entity that directs and controls any of the following: compliant product design, compliant product

manufacturing, or compliant product quality assurance; or the entity that assumes the liability for the compliant product or provides the warranty for the compliant product.

3.3.57* Medical Care Facility Footwear. An item of emergency medical protective clothing that is designed and configured to provide protection to the wearer's feet and ankles at medical care facilities.

3.3.58 Medical First Receivers. Clinicians and other medical care staff at a medical care facility who have a role in emergency patient care including initial triage, decontamination, and treatment for patients who are delivered by emergency medical services or who self-present at a medical care facility, and those staff whose roles support these functions, e.g., security, set up, and patient tracking.

3.3.59 Medical Responders. See 3.3.33, Emergency Medical Responders.

3.3.60 Model. The collective term used to identify a group of individual elements or items of the same basic design and components from a single manufacturer produced by the same manufacturing and quality assurance procedures that are covered by the same certification.

3.3.61* Multiple Use. Items that are designed to be repeatedly worn and used for protection during emergency medical operations.

3.3.62 Nape Device. A device located below the Bitragion Inion Arc used to aid in helmet retention.

3.3.63 Outer Garment. A secondary garment worn over the ensemble garment element for the purpose of providing [C]BRN protection.

3.3.64 Outer Glove. A secondary glove worn over the glove ensemble element for the purpose of providing [C]BRN protection.

3.3.65 Package. The wrapping or enclosure directly containing a glove or face protection device.

3.3.66 Package Product Label. The product label that is printed on or attached to a package containing one or more compliant products. *(See also 3.3.68, Product Label.)*

3.3.67 Peak. An integral part of the helmet shell extending forward over the eyes only.

3.3.68* Product Label. A label or marking affixed to each compliant garment, glove, or face protection device by the manufacturer. *(See also 3.3.66, Package Product Label.)*

3.3.69* Radiological Particulate Terrorism Agents. Particles that emit ionizing radiation in excess of normal background levels, used to inflict lethal or incapacitating casualties, generally on a civilian population as a result of terrorist attack.

3.3.70 Retroreflection. The reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with this property being maintained over wide variations of the direction of the incident rays.

3.3.71 Retroreflective Markings. A material that reflects and returns a relatively high proportion of light in a direction in the direction close to the direction from which it came.

3.3.72 Safety Alert. The action by which a manufacturer identifies a specific compliant product or a compliant product component, provides notice to users of the compliant product, and informs the marketplace and distributors of potential safety concerns regarding the product or component.

3.3.73 Sample. The ensemble, element, item, component, or composite that is conditioned for testing. *(See also 3.3.77, Specimen.)*

3.3.74 Seam. Any permanent attachment of two or more materials in a line formed by joining the separate material pieces.

3.3.75 Shell. A helmet without the suspension system, accessories, and fittings.

3.3.76* Single-Use Item. Items that are designed to be used one time and then disposed of.

3.3.77 Specimen. The conditioned element, item, component, or composite that is tested. Specimens are taken from samples. *(See also 3.3.73, Sample.)*

3.3.78 Splash-Resistant Eyewear. Safety glasses, prescription eyewear with protective side shields, goggles, or chin-length face shields that, when worn properly, provide limited protection against splashes, spray, spatters, or droplets of body fluids.

3.3.79 Terrorism Agents. See 3.3.13, CBRN Terrorism Agents.

3.3.80* Tongue. The part of the protective footwear that is provided for protective footwear with a closure that extends from the vamp to the top line of the footwear between sides of the footwear upper and is exposed to the exterior environment when the footwear is correctly donned.

3.3.81 Trace Number. A code that can be used to retrieve the production history of a product (e.g., a lot or serial number).

3.3.82 Upper. That part of the protective footwear including, but not limited to, the toe, vamp, quarter, shaft, collar, and throat; but not including the sole with heel, puncture-resistant device, and insole.

3.3.83* Visibility Materials. Fluorescent and retroreflective materials used in the construction of garments to provide conspicuity for the purpose of providing both daytime and nighttime visibility of the wearer.

3.3.84 Wear Surface. A footwear term for the bottom of the sole, including the heel.

3.3.85 Work Glove. An abbreviated term for emergency medical work glove. *(See also 3.3.34, Emergency Medical Work Glove.)*

Chapter 4 Certification

4.1 General.

4.1.1 The process of certification for protective ensembles and ensemble elements as being compliant with NFPA 1999 shall meet the requirements of Section 4.1, General; Section 4.2, Certification Program; Section 4.3, Inspection and Testing; Section 4.4, Annual Verification of Product Compliance; Section 4.5, Manufacturers' Quality Assurance Program; Section 4.6, Hazards Involving Compliant Product; Section 4.7, Manufacturers' Investigation of Complaints and Returns; and Section 4.8, Manufacturers' Safety Alert and Product Recall Systems.

4.1.2 All compliant protective clothing items, protective ensembles, and ensemble elements that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

4.1.2.1 The certification organization shall permit only the certification of complete [C]BRN protective ensembles that include protective garments, protective helmets, protective gloves, protective footwear, and interface components.

4.1.2.2 The certification organization shall further require that the [C]BRN protective ensemble or ensemble element manufacturer specify the respiratory protection for the ensemble.

4.1.3 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 4.2, Certification Program, and that is accredited for personal protective equipment (PPE) in accordance with ISO 65, *General requirements for bodies operating product certification systems.* The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies.*

4.1.4 Manufacturers shall not claim compliance with portions or segments of the requirements of this standard and shall not use the NFPA name or the name or identification of this standard, NFPA 1999, in any statements about their respective product(s) unless the product(s) is certified as compliant to this standard.

4.1.5 All compliant protective ensembles and ensemble elements shall be labeled.

4.1.6 All compliant protective ensembles and ensemble elements shall be listed by the certification organization. The listing shall uniquely identify the certified product, for example, by style, model number, or part number.

4.1.7 All compliant protective ensembles and ensemble elements shall also have a product label that meets the requirements specified in Section 5.1, Product Label Requirements for Emergency Medical Protective Clothing Items.

4.1.8* The certification organization's label, symbol, or identifying mark shall be attached to the product label, shall be part of the product label, or shall be immediately adjacent to the product label.

4.1.9 The certification organization shall not issue any new certifications to the 2008 edition of this standard on or after the NFPA effective date for the 2013 edition, which is December 17, 2012.

4.1.10 The certification organization shall not permit any manufacturer to continue to label any protective clothing items that are certified as compliant with the 2008 edition of this standard on or after June 30, 2013.

4.1.11 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2008 edition of this standard from all protective ensembles and ensemble elements that are under the control of the manufacturer on June 30, 2013, and the certification organization shall verify that this action is taken.

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 The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

4.2.3 The certification organization shall be accredited for PPE in accordance with ISO 65, *General requirements for bodies operating product certification systems.* The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies.*

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 label or reference to the certification organization 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 proper tests to determine product compliance.

4.2.6.1 The certification organization laboratory facilities shall have a program in place and functioning for calibration of all instruments, and procedures shall be in use to ensure proper 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, Manufacturer's Quality Assurance Program.

4.2.7.1* The certification organization shall require the manufacturer to have a product recall system specified in Section 4.8, Manufacturers' Safety Alert and Product Recall Systems, 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 this standard.

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 and unannounced visits per 12-month period.

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

4.2.9.2 The sample product shall be evaluated by the certification organization to verify the product's continued compliance in order to assure 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 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 where prior testing, judgment, and experience of the certification organization have shown the result to be in jeopardy of not complying with this standard, the certification organization shall conduct more frequent testing of the 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, Hazards Involving Compliant Product, that address report(s) of situation(s) in which a compliant product is subsequently found to be hazardous.

4.2.11 The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

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

4.3 Inspection and Testing.

4.3.1 For both initial certification and recertification of protective ensembles and ensemble elements, the certification organization shall conduct both inspection and testing as specified in this section.

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

4.3.2.1 The certification organization's testing laboratory's scope of accreditation to ISO 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.3.2.2 The accreditation of a certification organization's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies.*

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 17025, *General requirements for the competence of testing and calibration laboratories.*

4.3.3.2 The manufacturer's testing laboratory's scope of accreditation to ISO 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.3.3.3 The accreditation of a manufacturer's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies.*

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 a reasonable and acceptable reliability at a reasonable and acceptable 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 at least as specified for the protective clothing element or item.

4.3.6 Inspection by the certification organization shall include an evaluation of any symbols and pictorial representations used on product labels or in user information, as permitted by 5.1.5, to ensure that the symbols are clearly 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 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 Testing to determine product compliance with the performance requirements specified in Chapter 7 shall be conducted by the certification organization in accordance with the specified testing requirements of Chapter 8.

4.3.9.1 Testing shall be performed on specimens representative of materials and components used in the actual construction of the protective ensemble and ensemble element.

4.3.9.2 The certification organization also shall be permitted to use sample materials cut from a representative product.

4.3.10 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.

4.3.11 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.

4.3.12 The certification organization shall not allow test specimens that have been conditioned and tested for one method to be reconditioned and tested for another test method unless specifically permitted in the test method.

4.3.13 The certification organization shall test ensemble elements with the specific ensemble(s) with which they are to be certified.

4.3.14 Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified product as being compliant with this standard.

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

4.4 Annual Verification of Product Compliance.

4.4.1 All individual elements of the protective ensemble that are labeled as being compliant with this standard shall undergo recertification on an annual basis. *(See Table 4.4.1.)* This recertification shall include the following:

(1) Inspection and evaluation to all design requirements as required by this standard on all manufacturer models and components

(2) Testing to all performance requirements as required by this standard on all manufacturer models and components within the following protocol:

(a) Where a test method incorporates testing both before and after the laundering precondition specified in 8.1.3 and the test generates quantitative results, recertification testing shall be limited to the conditioning that yielded the worst case test result during the initial certification for the model or component.

(b) Where a test method incorporates testing both before and after the laundering precondition specified in 8.1.3 and the test generates nonquantitative results, recertifications shall be limited to a single conditioning procedure in any given year. Subsequent annual recertifications shall cycle through the remaining conditioning procedures to ensure that all required conditionings are included over time.

(c) Where a test method requires the testing on three specimens, a minimum of one specimen shall be tested for annual recertification.

(d) Where a test method requires the testing of five or more specimens, a minimum of two specimens shall be tested for annual recertification.

Table 4.4.1 Initial Certification and Annual Recertification

Product	Test/Section Number	Time	Samples for Conditioning
Multiple-use emergency medical garments	Design Requirements (6.1)	Annual	Garment
	Liquidtight Integrity Test One (8.2)	Annual	Garment
	Biopenetration Test One (8.3)	Annual	Garment
	Tensile Strength Test (8.4)	Annual	Garment
	Burst Strength (8.5)	Annual	Garment
	Puncture Propagation Tear Resistance Test (8.6)	Annual	Garment
	Tear Resistance Test One (8.7)	Annual	Garment
	Seam Breaking Strength Test (8.8)	Annual	Garment
	Water Absorption Resistance Test (8.31)	Annual	Garment
	Total Heat Loss Test (8.32)	Annual	1 m^2 of composite materials
	Label Durability and Legibility Test (8.33)	Annual	Garment
	Corrosion Resistance Test (8.22)	Annual	Complete hardware items
	Retroreflectivity and Fluorescence Test (8.37)	Annual	Garment
	Flammability Test (8.39)	Annual	Garment
Single-use garments	Design Requirements (6.1)	Annual	Garment
	Liquidtight Integrity Test One (8.2)	Annual	Garment
	Biopenetration Test One (8.3)	Annual	Garment
	Tensile Strength Test (8.4)	Annual	Garment
	Burst Strength (8.5)	Annual	Initial certification: garment
	Puncture Propagation Tear Resistance Test (8.6)	Annual	Garment
	Tear Resistance Test One (8.7)	Annual	Garment
	Seam Breaking Strength Test (8.8)	Annual	Garment
	Total Heat Loss Test (8.32)	Annual	1 m^2 of composite materials
	Flammability Test (8.39)	Annual	Garment
Single-use emergency medical examination gloves	Design Requirements (6.2)	Annual	Gloves
	Liquidtight Integrity Test Two (8.9)	Annual	Gloves
	Biopenetration Test Two (8.10)	Annual	Gloves
	Ultimate Tensile Strength Test (8.11)	Annual	Gloves
	Ultimate Elongation Test (8.12)	Annual	Gloves
	Puncture Resistance Test One (8.13)	Annual	Gloves
	Dexterity Test One (8.14)	Annual	Gloves
	Protein Content Test (8.15)	Annual	Gloves

(continues)

Table 4.4.1 *Continued*

Product	Test/Section Number	Time	Samples for Conditioning
Single-use emergency medical cleaning/utility gloves	Design Requirements (6.2)	Annual	Gloves
	Liquidtight Integrity Test Two (8.9)	Annual	Gloves
	Biopenetration Test Two (8.10)	Annual	Gloves
	Chemical Permeation Resistance Test (8.24)	Annual	Glove Barrier Materials
	Ultimate Tensile Strength Test (8.11)	Annual	Gloves
	Puncture Resistance Test One (8.13)	Annual	Gloves or Glove composite swatches
	Cut Resistance Test (8.18)	Annual	Gloves or Glove composite swatches
	Abrasion Resistance Test Two (8.25)	Annual	Gloves or Glove composite swatches
	Dexterity Test Two (8.26)	Annual	Gloves
	Tactility Test (8.30)	Annual	Gloves
	Flammability Test (8.39)	Annual	Gloves or Glove composite swatches
Multiple-use emergency medical work gloves	Design Requirements (6.2)	Annual	Gloves
	Overall Liquid Integrity Test Three (8.29)	Annual	Gloves
	Biopenetration Test One (8.3)	Annual	Gloves or Glove composite swatches
	Puncture Resistance Test One (8.13)	Annual	Gloves or Glove composite swatches
	Cut Resistance Test (8.18)	Annual	Gloves or Glove composite swatches
	Abrasion Resistance Test Two (8.25)	Annual	Gloves or Glove composite swatches
	Dexterity Test Two (8.26)	Annual	Gloves
	Grip Test (8.27)	Annual	Gloves
	Glove Donning Test (8.28)	Annual	Gloves
	Tactility Test (8.30)	Annual	Gloves
	Corrosion Resistance Test (8.22)	Annual	Complete hardware items
	Flammability Test (8.39)	Annual	Gloves or Glove composite swatches
Single-use emergency medical facemasks	Design Requirements (6.3)	Annual	Facemasks
	ASTM F 2100	Annual	Per ASTM F 2100
	Liquidtight Integrity Test Three (8.17)	Annual	Facemasks
	Visual Acuity/Fogging Resistance (8.16)	Annual	Facemasks
Single-use emergency medical eye and face protection devices	Design Requirements (6.3)	Annual	Eye and face protection devices
	Biopenetration Test One (8.3)	Annual	Eye and face protection devices
	Liquidtight Integrity Test Three (8.17)	Annual	Eye and face protection devices
	Visual Acuity/Fogging Resistance (8.16)	Annual	Eye and face protection devices
	Flammability Test (8.39)	Annual	Eye and face protection devices
Single-use emergency medical garment tests	See single-use garments.	Annual	Per single-use garment above
Multiple-use emergency medical eye and face protection devices	Design Requirements (6.3)	Annual	Eye and face protection devices
	ANSI Z87.1	Annual	Per ANSI Z87.1
	Liquidtight Integrity Test Three (8.17)	Annual	Eye and face protection devices
	Visual Acuity/Fogging Resistance (8.16)	Annual	Eye and face protection devices
	Corrosion Resistance Test (8.22)	Annual	Complete hardware items
Face protection devices	Design Requirements (6.3)	Annual	Face protection devices
	ASTM F 2100	Annual	Per ASTM F 2100
	Liquidtight Integrity Test Three (8.17)	Annual	Eye and face protection devices
	Biopenetration Test One (8.3)	Annual	Eye and face protection devices
	Flammability Test (8.39)	Annual	Eye and face protection devices
	Corrosion Resistance (8.22)	Annual	Complete hardware items

Table 4.4.1 *Continued*

Product	Test/Section Number	Time	Samples for Conditioning
Single-use emergency medical footwear covers	Design Requirements (6.4)	Annual	Footwear covers
	Biopenetration Test One (8.3)	Annual	Footwear covers
	Tensile Strength Test (8.4)	Annual	Footwear covers
	Burst Strength Test (8.5)	Annual	Footwear covers
	Tear Resistance Test Two (8.38)	Annual	Footwear covers
	Seam Breaking Strength (8.8)	Annual	Footwear covers
	Abrasion Resistance Test Two (8.25)	Annual	Footwear covers or composite swatches
	Puncture Resistance Test One (8.13)	Annual	Footwear covers
	Slip Resistance Test (8.20)	Annual	Outermost layer of the footwear cover wear surface
	Flammability Test (8.39)	Annual	Footwear cover
Multiple-use emergency medical footwear	Design Requirements (6.4)	Annual	Footwear
	Cut Resistance Test (8.18)	Annual	Footwear composite swatches
	Puncture Resistance Test One (8.13)	Annual	Footwear composite swatches
	Abrasion Resistance Test One (8.19)	Annual	Footwear soles
	Slip Resistance Test (8.20)	Annual	Footwear
	Eyelet and Stud Post Attachment Test (8.21)	Annual	Footwear
	Corrosion Resistance (8.22)	Annual	Complete hardware items
	Biopenetration Test One (8.3)	Annual	Footwear or footwear composite swatches
	Overall Liquid Integrity Test Four (8.23)	Annual	Footwear
	Label Durability and Legibility Test (8.33)	Annual	Individual labels
	Flammability Test (8.39)	Annual	Footwear or footwear composite swatches
Multiple-use medical care facility footwear	Design Requirements (6.4)	Annual	Footwear
	Cut Resistance Test (8.18)	Annual	Footwear composite swatches
	Puncture Resistance Test One (8.13)	Annual	Footwear composite swatches
	Abrasion Resistance Test One (8.19)	Annual	Footwear soles
	Slip Resistance Test (8.20)	Annual	Footwear
	Eyelet and Stud Post Attachment Test (8.21)	Annual	Footwear
	Corrosion Resistance (8.22)	Annual	Complete hardware items
	Biopenetration Test One (8.3)	Annual	Footwear or footwear composite swatches
	Overall Liquid Integrity Test Four (8.23)	Annual	Footwear
	Label Durability and Legibility Test (8.33)	Annual	Individual labels
Multiple-use emergency medical helmets	Design Requirements (6.5)	Annual	Helmets
	Suspension System Retention Test (8.40)	Annual	Helmets
	Retention System Test (8.41)	Annual	Helmets
	Goggle and Headlamp Clip Attachment Test (8.42)	Annual	Helmets
	Corrosion Resistance Test (8.22)	Annual	Complete hardware items
Multiple-use emergency medical [C]BRN protective ensembles	Design Requirements (6.6)	Annual	Complete ensembles
	Particle Inward Leakage Test (8.34)	Initial certification	Complete ensembles
	Overall Ensemble Liquid Penetration Test (8.35)	Annual	Complete ensembles
	Biopenetration Resistance Test Three (8.36)	Annual	See Section 8.38.
	Multiple-Use Emergency Medical Garment Requirements	Annual	See above
	Emergency Medical Footwear Requirements	Annual	See above
	Multiple-Use Emergency Medical Work Glove Requirements	Annual	See above

4.4.2 Samples of manufacturer models and components for recertification acquired from the manufacturer or component supplier during random and unannounced visits as part of the follow-up inspection program in accordance with 4.2.9 shall be permitted to be used toward annual recertification.

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

4.5 Manufacturer's Quality Assurance Program.

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, Manufacturers' Safety Alert and Product Recall Systems.

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

4.5.3 The manufacturer shall be registered to ISO 9001, *Quality management systems — Requirements.*

4.5.3.1 Registration to the requirements of ISO 9001, *Quality management systems — Requirements,* shall be conducted by a registrar that is accredited for personal protective equipment.

4.5.3.2 Where the registrar specified in 4.5.3.1 is currently accredited for personal protective equipment in accordance with the 1996 edition of ISO Guide 62, *General requirements for bodies operating assessment and certification/registration of quality systems,* that accreditation shall be permitted until September 14, 2008.

4.5.3.3 Not later than September 14, 2008, registrars specified in 4.5.3.1 shall be accredited for personal protective equipment in accordance with the 2006 edition of ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems.*

4.5.3.4 Any new accreditations for registrars specified in 4.5.3.1 for personal protective equipment shall only be in accordance with the 2011 edition of ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems.*

4.5.4* Any entity that meets the definition of *manufacturer* specified in Section 3.3, General Definitions, and therefore is considered to be the "manufacturer" but does not manufacture or assemble the compliant product, shall meet the requirements specified in this section.

4.5.5* Where the manufacturer uses subcontractors in the construction or assembly of the compliant product, the locations and names of all subcontractor facilities shall be documented, and the documentation shall be provided to the manufacturer's ISO registrar and the certification organization.

4.6 Hazards Involving Compliant Product.

4.6.1* 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. These procedures shall comply with the provisions of ISO 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity,* and as modified herein.

4.6.2* Where a report of a hazard involved with a compliant product is received by the certification organization, the validity of the report shall be investigated.

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 appropriate action for the certification organization and 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 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 certification organization's investigation shall include, but not be limited to, the extent and scope of the problem as it might apply to other compliant products or compliant product components manufactured by other manufacturers or certified by other certification organizations.

4.6.7 The certification organization shall also investigate reports of a hazard where a compliant product is gaining widespread use in applications not foreseen when the standard was written, such applications in turn being ones for which the product was not certified, no specific scope of application has been provided in the 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 shall require the manufacturer of the compliant product, or the manufacturer of the compliant product component if applicable, to assist the certification organization in the investigation and to conduct its own investigation as specified in Section 4.7, Manufacturers' Investigation of Complaints and Returns.

4.6.9 Where the facts indicating a need for corrective action are conclusive and the certification organization's appeal procedures referenced in 4.2.11 have been followed, the certification organization 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 when the manufacturer is out of business or the manufacturer is bankrupt, the certification organization 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 shall take one or more of the following corrective actions:

(1) Notification of parties authorized and responsible for issuing a safety alert when, in the opinion of the certification organization, such a notification is necessary to inform the users.
(2) Notification of parties authorized and responsible for issuing a product recall when, in the opinion of the certification organization, such a recall is necessary to protect the users.
(3) Removal of the mark of certification 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 shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.6.12 The certification organization shall provide a report to the organization or individual identifying the reported hazardous condition and notify them of the corrective action indicated, or that no corrective action is indicated.

4.6.13* Where a change to an NFPA standard(s) is felt to be necessary, the certification organization shall also provide a copy of the report and corrective actions indicated to the NFPA, and shall also submit either a public proposal for a proposed change to the next revision of the applicable standard, or a proposed temporary interim amendment (TIA) to the current edition of the applicable standard.

4.7 Manufacturers' Investigation of Complaints and Returns.

4.7.1 Manufacturers shall provide corrective action in accordance with ISO 9001, *Quality management systems — Requirements*, 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 that is possibly subject to a safety alert or product recall, the manufacturer shall immediately contact the certification organization and provide all information about their review to assist 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 describes the procedures to be used in the event that it decides, or is directed by the certification organization, to either issue a safety alert or to conduct a product recall.

4.8.2 The manufacturers' safety alert and product recall system 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 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 to conduct a product recall, or after the manufacturer has been directed by the certification organization to issue a safety alert or conduct a product recall
(3) Techniques for communicating accurately and understandably 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 a product that is recalled and for documenting the effectiveness of the product recall
(5) A plan for either repairing, replacing, or compensating purchasers for returned product

Chapter 5 Product Labeling and Information

5.1 Product Label Requirements for Emergency Medical Protective Clothing Items.

5.1.1 General Product and Package Label Requirements.

5.1.1.1 All worded portions of the required product and package labels shall be at least in English.

5.1.1.2 All letters and numbers on product labels and product package labels shall be at least 2 mm (1/16 in.) high.

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

5.1.1.4 Configuration of the product label and attachment of the product label shall not interfere with the legibility of any printed portion of the product label.

5.1.1.5 Where applicable, multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label; however, all label pieces comprising the entire product label shall be located adjacent to each other.

5.1.1.6 Where package labels are required, the package product label shall be permanently and conspicuously located on the outside of the package or printed on the package and shall not be removed, obscured, or otherwise mutilated by the opening of the package when the package is opened as intended.

5.1.2 Single-Use Emergency Medical Garment Product Label Requirements.

5.1.2.1 Each garment shall have a product label or labels permanently and conspicuously located inside each garment when the garment is properly assembled with all layers and components in place.

5.1.2.2 The product label shall have the certification organization's label, symbol, or identifying mark and at least the following statement legibly printed on the product label:

"THIS GARMENT IS FOR SINGLE USE ONLY!

THIS GARMENT MEETS THE SINGLE-USE EMERGENCY MEDICAL GARMENT REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.2.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Garment model and style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size

5.1.3 Multiple-Use Emergency Medical Garment Product Label Requirements.

5.1.3.1 Each garment shall have a product label or labels permanently and conspicuously located inside each garment when the garment is properly assembled with all layers and components in place.

5.1.3.2 The product label shall have the certification organization's label, symbol, or identifying mark and at least the following statement legibly printed on the product label:

"THIS GARMENT MEETS THE MULTIPLE-USE EMERGENCY MEDICAL GARMENT REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.3.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Garment model or style
(5) Trace number
(6) Materials of construction
(7) Cleaning precautions
(8) Month and year of manufacture, not coded
(9) Size

5.1.3.4 Where visibility materials are used on garments and the garment meets the requirements of ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, the product label shall also meet the marking information required by ANSI/ISEA 107.

5.1.3.5 Where visibility materials are used on garments and are not intended to meet the requirements in ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, the product label shall include the following warning:

"WEARING OF THIS GARMENT ALONG ROADSIDES OR OTHER AREAS WITH VEHICULAR TRAFFIC REQUIRES ADDITIONAL HIGH VISIBILITY SAFETY APPAREL, COMPLIANT WITH AT LEAST THE CLASS 2 REQUIREMENTS OF ANSI/ISEA 107."

5.1.4 Single-Use Emergency Medical Examination Gloves Product Label Requirements.

5.1.4.1 The package containing the smallest number of glove items from which the user withdraws the product for use shall have a package product label.

5.1.4.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the package product label:

"THIS GLOVE IS FOR SINGLE USE ONLY!

THIS GLOVE MEETS THE SINGLE-USE EMERGENCY MEDICAL EXAMINATION GLOVE REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.4.3 The following information shall also be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Glove model and style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size

5.1.4.4 In addition to the required package product label, each glove shall be permitted to have a product label on the outside of the glove.

5.1.4.5 Where each glove has a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed as the product label on each glove:

"MEETS NFPA 1999, 2013 ED."

5.1.5 Single-Use Emergency Medical Cleaning/Utility Glove Product Label Requirements.

5.1.5.1 The package containing the smallest number of glove items from which the user withdraws the product for use shall be permitted to have a package product label in place of the package label.

5.1.5.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the package product label:

"THIS GLOVE IS FOR SINGLE USE ONLY!

THIS GLOVE MEETS THE SINGLE-USE EMERGENCY MEDICAL CLEANING/ UTILITY GLOVE REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.5.3 The following information shall also be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Glove model and style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size

5.1.5.4 In addition to the required package product label, each cleaning/utility glove shall be permitted to have a product label on the outside of the glove.

5.1.5.5 Where each cleaning/utility gloves has a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed as the product label on each glove:

"MEETS NFPA 1999, 2013 ED."

5.1.6 Multiple-Use Emergency Medical Work Glove Product Label Requirements.

5.1.6.1 Each work glove shall have a product label(s) permanently and conspicuously attached inside each glove.

5.1.6.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label:

"THIS GLOVE MEETS THE MULTIPLE-USE EMERGENCY MEDICAL WORK GLOVE REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.6.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Glove model and style
(5) Trace number
(6) Materials of construction
(7) Cleaning instructions
(8) Month and year of manufacture, not coded
(9) Size

5.1.7 Single-Use Emergency Medical Facemask Product Label Requirements.

5.1.7.1 The package containing the smallest number of facemask items from which the user withdraws the product for use shall have a package product label.

5.1.7.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the package product label:

"THIS FACEMASK IS FOR SINGLE USE ONLY!

THIS MASK MEETS THE SINGLE-USE EMERGENCY MEDICAL FACEMASK REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.7.3 The following information shall also be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Facemask model and style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size, where applicable

5.1.7.4 In addition to the required package product label, each mask shall be permitted to have a product label in an area of the facemask that does not affect its function.

5.1.7.5 Where each facemask has a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed as the product label on each facemask:

"MEETS NFPA 1999, 2013 ED."

5.1.7.6 Where the medical facemask is not certified by National Institute for Occupational Safety and Health (NIOSH) as a respirator to 42 CFR 84, "Approval of Respiratory Protective Devices," the package product label shall include the following additional warning:

THIS FACEMASK IS NOT A RESPIRATOR AND WILL NOT PROVIDE RESPIRATORY PROTECTION AGAINST AIRBORNE BIOLOGICAL HAZARDS.

5.1.8 Single-Use Emergency Medical Eye and Face Protection Device Product Label Requirements.

5.1.8.1 The package containing the smallest number of eye and face protection device items from which the user withdraws the product for use shall have a package product label.

5.1.8.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the package product label:

"THIS {insert name of item} IS FOR SINGLE USE ONLY!

THIS {insert name of item} MEETS THE SINGLE-USE EMERGENCY EYE AND FACE PROTECTION DEVICE REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.8.3 The following information shall also be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Eye and face protection device model or style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size, where applicable

5.1.8.4 In addition to the required package product label, each eye and face protection device shall be permitted to have a product label in a location of the eye and face protection device that does not interfere with the wearer's vision or device's function.

5.1.8.5 Where each eye and face protection device has a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed as the product label on each eye and face protection device:

"MEETS NFPA 1999, 2013 ED."

5.1.9 Multiple-Use Emergency Medical Eye and Face Protection Devices Product Label Requirements.

5.1.9.1 The package containing the smallest number of eye and face protection device items from which the user withdraws the product for use shall have a package product label.

5.1.9.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be printed on the package product label:

"THIS DEVICE MEETS THE MULTIPLE-USE EMERGENCY MEDICAL EYE AND FACE PROTECTION REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.9.3 The following information also shall be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Eye and face protection device model or style
(5) Trace number
(6) Materials of construction
(7) Cleaning precautions
(8) Month and year of manufacture, not coded
(9) Size

5.1.9.4 Each face protection device shall have a product label, in addition to the required package product label, placed

in a conspicuous location on the device that shall not interfere with the wearer's vision.

5.1.9.5 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label of each multiple-use face protection device:

"MEETS NFPA 1999, 2013 ED."

5.1.10 Single-Use Emergency Medical Footwear Cover Product Label Requirements.

5.1.10.1 The package containing the smallest number of footwear cover items from which the user withdraws the product for use shall have a package product label.

5.1.10.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the package product label:

"THIS FOOTWEAR COVER IS FOR SINGLE USE ONLY!

THIS FOOTWEAR COVER MEETS THE SINGLE-USE EMERGENCY MEDICAL FOOTWEAR COVER REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.10.3 The following information shall also be printed legibly on the package product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Footwear cover model or style
(5) Trace number
(6) Materials of construction
(7) Month and year of manufacture, not coded
(8) Size, where applicable

5.1.10.4 In addition to the required package product label, each footwear cover shall be permitted to have a product label in area of the footwear cover that does not affect the comfort of the wearer.

5.1.10.5 Where each footwear cover has a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed as the product label on each footwear cover:

"MEETS NFPA 1999, 2013 ED."

5.1.11 Multiple-Use Emergency Medical Footwear Product Label Requirements.

5.1.11.1 Each footwear item shall have a product label or labels permanently and conspicuously attached inside each footwear item when the footwear is properly donned.

5.1.11.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label:

"THIS FOOTWEAR MEETS THE MULTIPLE-USE EMERGENCY MEDICAL FOOTWEAR REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.11.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Footwear model or style
(5) Trace number
(6) Materials of construction
(7) Cleaning precautions
(8) Month and year of manufacture, not coded
(9) Size

5.1.12 Multiple-Use Medical Care Facility Footwear Product Label Requirements.

5.1.12.1 Each footwear item shall have a product label or labels permanently and conspicuously attached inside each footwear item when the footwear is properly donned.

5.1.12.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label:

"THIS FOOTWEAR MEETS THE MULTIPLE-USE MEDICAL CARE FACILITY FOOTWEAR REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

THIS FOOTWEAR HAS NOT BEEN REQUIRED TO PROVIDE RESISTANCE TO TOE IMPACT AND COMPRESSION OR SOLE PUNCTURE!

DO NOT REMOVE THIS LABEL!"

5.1.12.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture
(4) Footwear model or style
(5) Trace number
(6) Materials of construction
(7) Cleaning precautions
(8) Month and year of manufacture, not coded
(9) Size

5.1.13 Multiple-Use Emergency Medical Helmet Product Labeling Requirements.

5.1.13.1 Each helmet shall have a product label or labels permanently and conspicuously attached. At least one product label shall be conspicuously located on or inside each helmet when the helmet is properly assembled with all components in place.

5.1.13.2 The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label:

"THIS HELMET MEETS THE EMERGENCY MEDICAL HELMET REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION.

DO NOT REMOVE THIS LABEL!"

5.1.13.3 The following information shall also be printed legibly on the product label:

(1) Manufacturer's name, identification, or designation
(2) Manufacturer's address
(3) Country of manufacture

(4) Helmet model or style
(5) Trace number
(6) Helmet size or size range
(7) Nominal weight of helmet
(8) Month and year of manufacture, not coded
(9) Cleaning precautions

5.1.13.4 Where visibility materials are used on helmets and the helmet meets the requirements of ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, the product label shall also meet the marking information in ANSI/ISEA 107.

5.1.14 Multiple-Use Emergency Medical [C]BRN Protective Ensembles Product Labeling Requirements.

5.1.14.1 Where an entire ensemble is certified as compliant to the requirements for an Emergency Medical [C]BRN Protective Ensemble for protection against [C]BRN terrorism agents, each element of the entire ensemble shall have at least the additional compliance statement as specified in 5.1.14.3 on the product label in place of the appropriate compliance statement specified for the item in this section.

5.1.14.2 The appropriate term for the element type — garment, glove, footwear, or interface component — shall be inserted in the compliance statement text where indicated in this section.

5.1.14.3 Other than the term "[C]BRN Protective Ensemble," all product label letters and figures shall be at least 2.5 mm (3⁄32 in.) in height. The term "[C]BRN Protective Ensemble" letters shall be at least 10 mm (3⁄8 in.) in height.

"[C]BRN PROTECTIVE ENSEMBLE

THIS ELEMENT IS NOT PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE!

THIS EMERGENCY MEDICAL PROTECTIVE (insert appropriate element term here) ELEMENT MEETS THE REQUIREMENTS OF NFPA 1999, *STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS*, 2013 EDITION, FOR [C]BRN PROTECTION WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE.

DO NOT REMOVE THIS LABEL!"

5.1.14.4 The garment element portion of the ensemble meeting the requirements for protection against [C]BRN terrorism agents shall list those items of the certified ensemble by manufacturer name and model number on the product label.

5.2 User Information.

5.2.1 The manufacturer shall provide the following instructions and information with each product, as applicable:

(1) Pre-use information
  (a) Safety considerations
  (b) Limitations of use
  (c) Marking recommendations and restrictions
  (d) Statement that most performance properties cannot be tested by the user in the field
  (e) Warranty information
(2) Preparation for use
  (a) Sizing/adjustment
  (b) Recommended storage practices
(3) Inspection frequency and details
(4) Don/doff
  (a) Donning and doffing procedures
  (b) Sizing and adjustment procedures
  (c) Interface issues
(5) Proper use consistent with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*; NFPA 1581, *Standard on Fire Department Infection Control Program*; 29 CFR 1910.132, "General Requirements of Subpart I, Personal Protective Equipment," and 29 CFR 1910.1030, "Protecting Health Care Workers from Occupational Exposure to Blood-Borne Pathogens"
(6) Maintenance and cleaning for multiple-use products
  (a) Cleaning instructions and precautions with a statement advising users not to use products that are not thoroughly cleaned and dried
  (b) Inspection details
  (c) Maintenance criteria and methods of repair where applicable
  (d) Retirement criteria and considerations
(7) Decontamination procedures
(8) Disposal criteria and considerations

5.2.2 For protective ensembles certified to the [C]BRN requirements, the manufacturer shall provide the following additional instruction and information with each ensemble:

(1) A statement that the only the ensemble and the specific items with which the ensemble has been certified must be worn together to ensure that the [C]BRN protection is provided.
(2) A list of the specific items and interface components that must be worn as part of the [C]BRN ensemble, including each type of NIOSH CBRN APR, CBRN PAPR, or CBRN SCBA that the ensemble has been certified with.
(3) Specific limitations associated with the use of the ensemble for a response involving [C]BRN hazards, including but not limited to a statement that protection against radiological and nuclear hazards is limited to particulates only.
(4) Specific care and maintenance provisions associated with properly maintaining the unique performance properties of the ensemble, its items, or interface components.
(5) A statement that if the ensemble is used in an emergency involving [C]BRN hazards that the ensemble be retired from use and not be further used.

Chapter 6 Design Requirements

6.1 Emergency Medical Protective Garment Design Requirements.

6.1.1 Single-Use Emergency Medical Garment Design Requirements.

6.1.1.1 Garments shall be designed to cover any part of the upper and lower torso, excluding hands, face, and feet.

6.1.1.2* Garments shall be permitted to be configured as full body clothing such as jackets and pants or coveralls; and non-full body clothing such as aprons, sleeve protectors, and sleeved aprons or smocks.

6.1.1.2.1 Where garments are configured as aprons, garments shall be designed to protect the front torso of the wearer from the neck to below the knees.

6.1.1.2.2 Where garments are configured as sleeve protectors, garments shall be designed to protect the arm of the wearer from the wrist crease to a distance of no less than 405 mm (16 in.) from the wrist crease.

6.1.1.2.3 Where garments are configured as sleeved aprons, garments shall be designed to protect the front torso of the wearer from the neck to below the knees and arm of the wearer to the wrist crease.

6.1.1.3 Garments shall be permitted to include integrated booties to protect the wearer's feet in conjunction with outer footwear.

6.1.1.3.1 Where garments incorporate booties, the booties shall be designed as an extension of the garment leg and shall cover the entire foot and ankle.

6.1.1.4 Garments shall be permitted to include integrated hoods to protect portions of the wearer's head and face in conjunction with eye and face protection devices and appropriate respirators.

6.1.1.4.1 Where garments incorporate hoods, the hood shall cover at least the back and sides of the head.

6.1.1.5* All portions of the body covered by the garment item shall be provided with barrier protection.

6.1.1.6* The barrier layer used in the construction of the garment shall be a single, nonseparable layer.

6.1.1.7* All external fittings including, but not limited to, zippers, snaps, or other fasteners of specimen garments shall be examined and shall be free of rough spots, burrs, or sharp edges that could tear the garment or glove materials.

6.1.2 Multiple-Use Emergency Medical Garment Design Requirements.

6.1.2.1 Garments shall be designed to cover any part of the upper and lower torso, excluding hands, face, and feet.

6.1.2.2 Garments shall be permitted to be configured as full body clothing such as jackets and pants or coveralls; and non-full body clothing such as aprons, sleeve protectors, and sleeved aprons or smocks. *(See A.6.1.1.2.)*

6.1.2.2.1 Where garments are configured as aprons, garments shall be designed to protect the front torso of the wearer from the neck to below the knees.

6.1.2.2.2 Where garments are configured as sleeve protectors, garments shall be designed to protect the arm of the wearer from the wrist crease to a distance of no less than 405 mm (16 in.) from the wrist crease.

6.1.2.2.3 Where garments are configured as sleeved aprons, garments shall be designed to protect the front torso of the wearer from the neck to below the knees and arms of the wearer to the wrist crease.

6.1.2.3 Garments shall be permitted to include integrated booties to protect the wearer's feet in conjunction with outer footwear.

6.1.2.3.1 Where garments incorporate booties, the booties shall be designed as an extension of the garment leg and shall cover the entire foot and ankle.

6.1.2.4 Garments shall be permitted to include integrated hoods to protect portions of the wearer's head and face in conjunction with eye and face protection devices and appropriate respirators.

6.1.2.4.1 Where garments incorporate hoods, the hood shall cover at least the back and sides of the head.

6.1.2.5 All portions of the body covered by the garment item shall be provided with barrier protection. *(See A.6.1.1.5.)*

6.1.2.6 The barrier layer used in the construction of the garment shall be a single, nonseparable layer. *(See A.6.1.1.6.)*

6.1.2.7 All external fittings including, but not limited to, zippers, snaps, or other fasteners of specimen garments shall be examined and shall be free of rough spots, burrs, or sharp edges that could tear the garment or glove materials.

6.1.2.8* Where visibility materials are used on garments, and the garments are intended to be used as high-visibility safety apparel, garments shall meet the respective requirements for Performance Class 1, 2, or 3 in accordance with ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*.

6.2 Emergency Medical Glove Design Requirements.

6.2.1 Single-Use Emergency Medical Examination Glove Design Requirements.

6.2.1.1* Examination gloves shall be designed and designated to meet only the single-use requirements of this standard.

6.2.1.2 In order to label or otherwise represent examination gloves as being compliant with the requirements of this standard, the manufacturer shall provide gloves in not less than five separate and distinct sizes.

6.2.1.3 Examination gloves shall be permitted to be provided in ambidextrous sizing.

6.2.1.4 Examination glove sizing shall be consistent with EN 455-2, *Medical gloves for single use — Part 2: Requirements and testing for physical properties*.

6.2.2 Single-Use Emergency Medical Cleaning/Utility Glove Design Requirements.

6.2.2.1 In order to label or otherwise represent cleaning/utility gloves as being compliant with the requirements of this code, the manufacturer shall provide gloves in not less than four separate and distinct sizes.

6.2.2.2 Cleaning/utility glove hand circumference sizing shall be in accordance with Clause 51 of EN 420, *General requirements for gloves*. Requirements for glove length shall be disregarded.

6.2.2.3 Gloves shall have a length of at least 305 mm (12 in.).

6.2.2.4 Cleaning/utility gloves and related hardware shall be examined and shall be free of rough spots, burrs, or sharp edges that could tear garment or glove material.

6.2.3 Multiple-Use Emergency Medical Work Glove Design Requirements.

6.2.3.1 Emergency medical work gloves shall be designed and designated to meet only the multiple-use requirements of this standard.

6.2.3.2 Emergency medical work gloves shall be designed and configured to provide physical and barrier protection to the wearer's hand from the fingertips to at least the wrist crease.

6.2.3.3 The glove shall consist of a glove body and an optional interface component.

6.2.3.3.1 The glove shall extend circumferentially from the tip of the fingers to the wrist crease.

6.2.3.3.2 The portion of the glove that extends from the tip of the fingers to the wrist crease shall be considered to be the glove body and shall meet the glove body requirements in 7.2.3.

6.2.3.3.3 The optional portion of the glove that extends from the wrist crease up to the end of the entire glove shall be considered to be the glove interface component and shall meet the glove interface component requirements in 7.2.3. The glove interface component shall create a close fit at the opening to restrict the entry of foreign particles and shall allow the glove to fit closely around the wearer's wrist.

6.2.3.3.4 The location of the wrist crease shall be determined by placing the glove on a measurement board palm down and securing (locking) the fingertips down onto the board.

6.2.3.3.5 A 1 lb weight shall be attached to the end of the glove body or glove interface component. The weight shall not be attached to a knitted wristlet and shall be applied evenly across the glove.

6.2.3.3.6* Two points shall be marked on the back side of the glove. The location of the points shall be determined by measuring down the following distances according to glove size, from the finger crotch of digit two and from the finger crotch of digit three:

(1) XS: 9.46 cm (3.72 in.)
(2) S: 10.04 cm (3.95 in.)
(3) M: 10.68 cm (4.20 in.)
(4) L: 11.21 cm (4.42 in.)
(5) XL: 11.73 cm (4.62 in.)

6.2.3.3.7 A straight line shall be drawn on the back side of the glove using the two points. This line shall be drawn around the side edges of the glove.

6.2.3.3.8 The glove shall be removed from the measurement board. A line shall be drawn on the palm side of the glove by connecting the lines from the side edges of the glove.

6.2.3.3.9 The resulting straight line around the circumference of the glove shall be the location of the wrist crease.

6.2.3.4 Emergency medical work gloves shall have a wristlet or elastic that allows the glove material to fit closely around the wearer's wrist.

6.2.3.5 Hand dimensions for the selection of the proper emergency medical work glove size shall consist of measuring the hand circumference and hand length dimensions as shown in Figure 6.2.3.5.

6.2.3.5.1 Hand circumference shall be measured by placing a measuring tape on a table or other flat surface with the numerals facing downward. The subject shall place the right hand, palm down and fingers together, in the middle of the tape so that the tape can pass straight across the metacarpal knuckles. The circumference shall be measured to the nearest 3 mm (⅛ in.) as shown in Figure 6.2.3.5.

6.2.3.5.2 Finger circumference shall be measured at the proximal interphalangeal joint, the first knuckle. Finger length shall be measured from the tip of the finger to the base of the finger crease on the palm side.

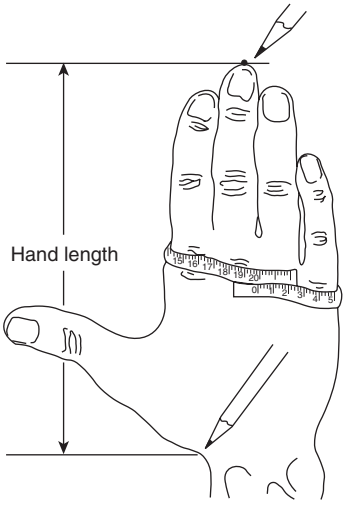


FIGURE 6.2.3.5 Method of Measuring Hand Dimensions for Selection of Proper Glove Size.

6.2.3.5.3 Hand length shall be measured by placing the subject's hand, palm down, on a piece of paper with the fingers together and the hand and arm in a straight line. The thumb shall be fully abducted, extended away from the palm as far as possible. The paper shall be marked at the tip of the third, or middle, finger. A pencil mark shall be placed in the notch at the base of the thumb where the thumb joins the wrist. The straight line distance between the two points shall be measured to the nearest 3 mm (⅛ in.) as shown in Figure 6.2.3.5.

6.2.3.6* In order to label or otherwise represent a glove as compliant with the requirements of this standard, the manufacturer shall provide gloves in not less than the five separate and distinct sizes specified in Table 6.2.3.6(a) through Table 6.2.3.6(e). The manufacturer shall provide gloves in each size that at least fit the hand dimension ranges specified in those tables.

6.2.3.7 The glove size indicated on the label shall be determined by the hand dimensions given in Table 6.2.3.6(a) through Table 6.2.3.6(e).

6.2.3.8 Any permanent attachment provided by the manufacturer to a work glove shall not interfere with the function of that work glove or with the function of any of the work glove component parts.

6.2.3.9 Where work gloves are provided by the manufacturer with permanent attachments, the work gloves shall meet all of the design and performance requirements of this standard with permanent attachments installed. In all cases, such permanent attachments shall not degrade the performance of the work gloves.

6.3 Emergency Medical Eye and Face Protection Device Design Requirements.

6.3.1 Single-Use Emergency Medical Facemask Design Requirements.

6.3.1.1 Facemasks shall incorporate a wire or other device that allows the portion of the facemask that covers the top of the nose to be shaped over the wearer's nose.

6.3.1.2 Facemasks shall include a means for securing the facemask to the wearer's head that does not require tying.

Table 6.2.3.6(a) Sizing for Extra-Small (XS) Glove

			mm	in.
Range for hand length:			16.25–17.25	6.40–6.79
Range for hand circumference:			16.25–20.25	6.40–7.97
	Mid-Size Value		Range to Be Accommodated	
	cm	in.	cm	in.
Digit 1 circumference	6.17	2.43	5.60–6.74	2.20–2.65
Digit 2 circumference	6.06	2.39	5.50–6.63	2.17–2.61
Digit 3 circumference	6.08	2.39	5.53–6.63	2.18–2.61
Digit 4 circumference	5.69	2.24	5.12–6.26	2.02–2.46
Digit 5 circumference	5.00	1.97	4.48–5.52	1.76–2.17
Digit 1 length	4.94	1.94	4.36–5.52	1.72–2.17
Digit 2 length	6.44	2.54	5.75–7.12	2.26–2.80
Digit 3 length	7.29	2.87	6.71–7.87	2.64–3.10
Digit 4 length	6.78	2.67	6.13–7.42	2.41–2.92
Digit 5 length	5.09	2.00	4.52–5.66	1.78–2.23

Table 6.2.3.6(b) Sizing for Small (S) Glove

			mm	in.
Range for hand length:			17.25–18.25	6.79–7.19
Range for hand circumference:			17.25–21.25	6.79–8.37
	Mid-Size Value		Range to Be Accommodated	
	cm	in.	cm	in.
Digit 1 circumference	6.40	2.52	5.82–6.97	2.29–2.74
Digit 2 circumference	6.29	2.48	5.73–6.85	2.26–2.70
Digit 3 circumference	6.31	2.48	5.76–6.87	2.27–2.70
Digit 4 circumference	5.92	2.33	5.35–6.49	2.11–2.56
Digit 5 circumference	5.22	2.06	4.70–5.74	1.85–2.26
Digit 1 length	5.31	2.09	4.74–5.89	1.87–2.32
Digit 2 length	6.89	2.71	6.21–7.57	2.44–2.98
Digit 3 length	7.71	3.04	7.13–8.30	2.81–3.27
Digit 4 length	7.19	2.83	6.55–7.03	2.58–3.08
Digit 5 length	5.44	2.14	4.87–6.01	1.92–2.37

Table 6.2.3.6(c) Sizing for Medium (M) Glove

			mm	in.
Range for hand length:			18.25–19.25	7.19–7.58
Range for hand circumference:			18.25–22.25	7.19–8.76
	Mid-Size Value		Range to Be Accommodated	
	cm	in.	cm	in.
Digit 1 circumference	7.01	2.76	6.36–7.65	2.50–3.01
Digit 2 circumference	6.82	2.69	6.31–7.32	2.48–2.88
Digit 3 circumference	6.83	2.69	6.26–7.40	2.46–2.91
Digit 4 circumference	6.34	2.50	5.78–6.90	2.28–2.72
Digit 5 circumference	5.63	2.22	5.09–6.17	2.00–2.43
Digit 1 length	5.63	2.22	5.00–6.26	1.97–2.46
Digit 2 length	7.11	2.80	6.50–7.72	2.56–3.04
Digit 3 length	8.07	3.18	7.55–8.58	2.97–3.38
Digit 4 length	7.61	3.00	7.14–8.08	2.81–3.18
Digit 5 length	5.78	2.28	5.16–6.41	2.03–2.52

Table 6.2.3.6(d) Sizing for Large (L) Glove

			mm	in.
Range for hand length:			19.25–20.25	7.58–7.97
Range for hand circumference:			19.25–23.25	7.58–9.15
	Mid-Size Value		Range to Be Accommodated	
	cm	in.	cm	in.
Digit 1 circumference	7.26	2.86	6.62–7.91	2.61–3.11
Digit 2 circumference	7.03	2.77	6.53–7.54	2.57–2.97
Digit 3 circumference	7.10	2.80	6.53–7.66	2.57–3.02
Digit 4 circumference	6.60	2.60	6.04–7.16	2.38–2.82
Digit 5 circumference	5.85	2.30	5.31–6.39	2.09–2.52
Digit 1 length	5.87	2.31	5.24–6.50	2.06–2.56
Digit 2 length	7.49	2.95	6.88–8.10	2.71–3.19
Digit 3 length	8.54	3.36	8.03–9.06	3.16–3.57
Digit 4 length	8.03	3.16	7.56–8.50	2.98–3.35
Digit 5 length	6.13	2.41	5.51–6.75	2.17–2.66

Table 6.2.3.6(e) Sizing for Extra-Large (XL) Glove

			mm	in.
Range for hand length:			20.25–21.25	7.97–8.37
Range for hand circumference:			20.25–24.25	7.97–9.55
	Mid-Size Value		Range to Be Accommodated	
	cm	in.	cm	in.
Digit 1 circumference	7.52	2.96	6.87–8.16	2.70–3.21
Digit 2 circumference	7.25	2.85	6.74–7.76	2.65–3.06
Digit 3 circumference	7.36	2.90	6.79–7.93	2.67–3.12
Digit 4 circumference	6.86	2.70	6.30–7.42	2.48–2.92
Digit 5 circumference	6.06	2.39	5.52–6.60	2.17–2.60
Digit 1 length	6.11	2.41	5.48–6.75	2.16–2.66
Digit 2 length	7.86	3.09	7.26–8.47	2.86–3.33
Digit 3 length	9.02	3.55	8.51–9.54	3.35–3.76
Digit 4 length	8.44	3.32	7.97–8.91	3.14–3.51
Digit 5 length	6.48	2.55	5.85–7.10	2.30–2.80

6.3.1.3 Where facemasks include plastic shields, the plastic shield shall overlap the top of the face mask by at least 19 mm (¾ in.) over the entire top between points of attachment for the plastic shield.

6.3.1.4 Where facemasks include plastic shields, the plastic shield shall have a height of at least 50 mm (2 in.) above the top of the facemask.

6.3.1.5 Where facemasks include plastic shields, the sides of the plastic shield shall extend at least 19 mm (¾ in.) beyond the points of attachment for the plastic shield.

6.3.2 Single-Use Emergency Medical Eye and Face Protection Device Design Requirements.

6.3.2.1 Eye and face protection devices shall be designed to cover part or all of the face, including the eyes.

6.3.2.2 Where the eye and face protection device is configured as a faceshield, the faceshield shall provide at least the following field of vision:

(1) Dihedral angle of at least 85 degrees
(2) Upper dihedral angle of at least 10 degrees
(3) Lower dihedral angle of at least 40 degrees

6.3.2.3 The field of vision shall be measured from the center of the surface of the eye.

6.3.2.4 The faceshield shall be positioned on an Alderson 50th percentile male headform specified in Figure 6.3.2.4.

6.3.2.5 Face protection devices and related hardware shall be examined for, and shall be free of, rough spots, burrs, or sharp edges that could tear garment or glove materials.

6.3.3 Multiple-Use Emergency Medical Eye and Face Protection Device Design Requirements.

6.3.3.1 Eye and face protection devices shall be designed to cover part or all of the face or head. Face protection devices shall be permitted to be configured as, but are not limited to, splash-resistant eyewear, goggles, faceshields, hooded visors, and combinations of these items.

6.3.3.2 Eye and face protection devices to be certified as compliant with this standard shall need not be primary eye protection but shall be permitted to be primary eye protection.

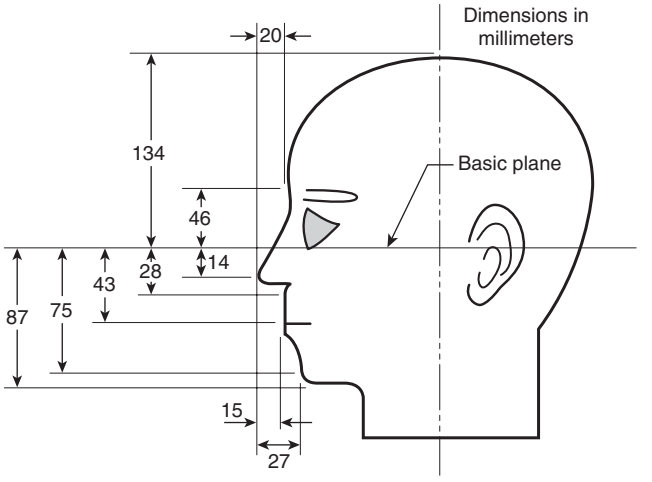


FIGURE 6.3.2.4 Alderson Headform.

6.3.3.3 Where the eye and face protection device is configured as safety glasses, the safety glasses shall meet the respective requirements for spectacles in Section 7 of, and be marked "Z87+" in accordance with, ANSI Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*.

6.3.3.4 Where the eye and face protection device is configured as goggles, the goggles shall meet the respective requirements for goggles in Section 8 of, and be marked "Z87+" in accordance with, ANSI Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*.

6.3.3.5 Where the eye and face protection device is configured as a faceshield, the faceshield shall meet the respective requirements for faceshields in Section 9 of, and be marked "Z87+" in accordance with, ANSI Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*.

6.3.3.6* Face protection devices and related hardware shall be examined for, and shall be free of, rough spots, burrs, or sharp edges that could tear garment or glove materials.

6.4 Emergency Medical Footwear Design Requirements.

6.4.1 Single-Use Emergency Medical Footwear Cover Design Requirements.

6.4.1.1 Footwear covers shall be permitted to be offered in only one size.

6.4.1.2 The footwear cover height shall be a minimum of 150 mm (6 in.).

6.4.1.2.1 An NFPA 1999-compliant footwear item in size 9, D width shall be used to determine the height of the footwear cover when placed over the footwear.

6.4.1.2.2 The footwear cover height shall be determined by measuring lowest point of the footwear cover that extends up over the ankle area of the NFPA 1999-compliant footwear.

6.4.1.3 The wear surface of the footwear cover shall extend 25 mm (1 in.) laterally in all directions from the wear surface of standard footwear when measured as specified in 6.5.3.1.

6.4.1.3.1 An NFPA 1999-compliant footwear item in size 9, D width shall be used to determine the lateral extension of the footwear cover wear surface.

6.4.1.3.2 The NFPA 1999-compliant footwear item shall be centered inside the footwear cover for determining lateral extension of the footwear cover wear surface.

6.4.1.4 The footwear cover shall have some means to allow the top of the footwear cover to fit snugly around the wearer's bottom leg.

6.4.2 Multiple-Use Emergency Medical Footwear Design Requirements.

6.4.2.1 Footwear shall be designed and designated to meet only the multiple-use requirements of this standard.

6.4.2.2 Footwear shall consist of an upper with sole and heel.

6.4.2.3 Footwear height shall be a minimum of 100 mm (4 in.) when measured according to 6.4.2.3.1 through 6.4.2.3.4.

6.4.2.3.1 The footwear height shall be determined by measuring inside the footwear from the center of the insole at the heel up to a perpendicular reference line extending across the footwear, at the lowest point of the topline, excluding the tongue and gusset.

6.4.2.3.2 Removable insole inserts shall not be removed prior to measurement.

6.4.2.3.3 Moisture protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear topline at all locations, with the exception of the area inside of and within 13 mm (0.5 in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of physical and moisture protection at all locations of the boot shall be no less than 100 mm (4 in.) when measured as described in 6.4.2.3.1.

6.4.2.3.4 Physical protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear topline at all locations, with the exception of the tongue, gusset, and the area inside of and within 13 mm (0.5 in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of physical protection at all locations of the boot, with the exception of the tongue and gusset, shall be no less than 100 mm (4 in.) when measured as described in 6.4.2.3.1.

6.4.2.4 Footwear shall be available in all of the following sizes:

(1) Men's 5–13, including half sizes, and a minimum of three widths
(2) Women's 5–10, including half sizes, and a minimum of three widths

6.4.2.4.1 Manufacturers shall be required to establish and provide, upon request, a size conversion chart for each model or style of protective footwear based on toe length, arch length, and foot width as measured on the Bannock Scientific Foot Measuring Device.

6.4.2.4.2 Full and half sizes, in each of the three required widths, shall be accomplished by individual and unique lasts to provide proper fit.

6.4.2.5 Any permanent attachment provided by the manufacturer to footwear shall not interfere with the function of that footwear or with the function of any of the footwear component parts.

6.4.2.6 Where footwear is provided by the manufacturer with permanent attachments, the footwear shall meet all of the design and performance requirements of this standard with permanent attachments installed. In all cases, such permanent attachments shall not degrade the performance of the footwear.

6.4.2.7 Footwear shall meet the performance requirements as specified in ASTM F 2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, for impact, compression, and puncture resistant footwear, with the exception that flex resistance to cracking shall not be evaluated.

6.4.3 Multiple-Use Medical Care Facility Footwear Design Requirements.

6.4.3.1 Footwear shall consist of an upper with sole and heel.

6.4.3.2 Footwear height shall be a minimum of 75 mm (3 in.) when measured according to 6.4.3.2.1 through 6.4.3.2.4.

6.4.3.2.1 The footwear height shall be determined by measuring inside the footwear from the center of the insole at the heel up to a perpendicular reference line extending across the footwear, at the lowest point of the topline, excluding the tongue and gusset.

6.4.3.2.2 Removable insole inserts shall not be removed prior to measurement.

6.4.3.2.3 Moisture protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear topline at all locations, with the exception of the area inside of and within 13 mm (0.5 in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of physical and moisture protection at all locations of the boot shall be no less than 75 mm (3 in.) when measured as described in 6.4.2.3.1.

6.4.3.2.4 Physical protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear topline at all locations, with the exception of the tongue, gusset, and the area inside of and within 13 mm (0.5 in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of physical protection at all locations of the boot, with the exception of the tongue and gusset, shall be no less than 75 mm (3 in.) when measured as described in 6.4.2.3.1.

6.4.3.3 Footwear shall be available in all of the following sizes:

(1) Men's 5–13, including half sizes, and a minimum of three widths
(2) Women's 5–10, including half sizes, and a minimum of three widths

6.4.3.3.1 Manufacturers shall be required to establish and provide, upon request, a size conversion chart for each model or style of protective footwear based on the toe length, arch length, and foot width as measured on the Bannock Scientific Foot Measuring Device.

6.4.3.3.2 Full and half sizes, in each of the three required widths, shall be accomplished by individual and unique lasts to provide proper fit.

6.5* Multiple-Use Emergency Medical Helmet Design Requirements.

6.5.1 Medical helmets shall be designed and designated to meet only the multiple-use requirements of this standard.

6.5.2 Helmets shall meet the requirements for Type 1, Class G helmets of ANSI/ISEA Z89.1, *Standard for Industrial Head Protection*.

6.5.3 Helmets shall be designed to consist of at least a shell with a brim or peak; a means of absorbing energy; a suspension system with a sweatband, chin strap, and nape device; and retroreflective markings.

6.5.3.1 The brim shall be an integral part of the helmet shell that extends outward around the entire circumference of the shell.

6.5.3.2 The peak shall be the part of the helmet shell and shall extend forward over the forehead.

6.5.3.3 Helmets shall be permitted to have goggle or headlamp clips.

6.5.4 All materials used in the helmet construction that are designed to come in contact with the wearer's head or skin shall be known to be nonirritating to normal skin.

6.5.5 The helmet complete with an energy-absorbing system; a suspension system with sweatband, chin strap, nape device, and goggle clips; and retroreflective markings shall not weigh more than 570 g (20 oz).

6.5.6 Where present, clips for headlamps or goggles shall be permanently attached with at least one clip at the rear of the helmet, and one clip on each side of the helmet. Clips shall be suitably located to retain straps and shall not be attached more than 55 mm (2$\frac{3}{16}$ in.) above the lower edge of the helmet.

6.5.7 The suspension shall contain a nape device that shall be removable and replaceable.

6.5.7.1 The suspension shall be adjustable in ⅛ hat size or smaller increments.

6.5.8 A sweatband shall be provided that shall cover at least the forehead portion of the suspension system. Sweatbands shall be either removable and replaceable, or shall be integral with the suspension.

6.5.9 The helmet shall be designed so that the distance between the top of the head and the underside of the shell cannot be adjusted to less clearance than the manufacturer's requirements for that specific helmet.

6.5.10 Chin straps shall be provided that attach to the helmet. Both chin and nape straps shall not be less than 13 mm (½ in.) in width.

6.5.11 All helmets shall have retroreflective markings on the exterior of the shell that meet the requirements of ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*. The retroreflective markings shall be placed above the goggle or headlamp clips so as not to be obscured by any clip or the strap retained by the clips. Helmets incorporating high-visibility materials in compliance with ANSI/ISEA 107 shall be labeled in accordance with 5.1.13.4.

6.5.12 Any permanent attachment provided by the manufacturer to helmets shall not interfere with the function of the helmet or with the function of any of the helmet's component parts.

6.5.13 Where helmets are provided by the manufacturer with permanent attachments, the helmet shall meet all of the design and performance requirements of this standard with permanent attachments installed. In all cases, such permanent attachments shall not degrade the performance of the helmet.

6.6 Multiple-Use Emergency Medical [C]BRN Protective Ensemble Design Requirements.

6.6.1 [C]BRN emergency medical protective ensembles, including the respirator, shall be designed to protect the wearer's upper and lower torso, head, arms, legs, hands, and feet.

6.6.2 [C]BRN emergency medical protective ensemble elements shall include emergency medical protective garments, emergency medical work gloves, emergency medical protective footwear, interface components, a protective hood where the protective hood is not already part of the garment element, and a NIOSH certified CBRN respirator specified in 6.6.4.

6.6.3* Only garment elements designated as multi-use shall be permitted to be part of the [C]BRN emergency medical protective ensemble. Single-use garments shall not be permitted.

6.6.4 The ensemble manufacturer shall specify each respirator that is part of the [C]BRN emergency medical protective ensemble. All respirators specified by the ensemble manufacturer for inclusion in the ensemble shall be certified as a CBRN APR compliant with the NIOSH *Statement of Standard for NIOSH CBRN APR Testing*, as a CBRN PAPR compliant with the NIOSH *Statement of Standard for NIOSH CBRN PAPR Testing*, or as a CBRN SCBA compliant with the NIOSH *Statement of Standard of NIOSH CBRN SCBA Testing*.

6.6.5 [C]BRN emergency medical protective ensembles shall be designed to accommodate the NIOSH approved CBRN APR, NIOSH approved CBRN PAPR, or NIOSH approved CBRN SCBA specified by the manufacturer for the specific ensemble.

6.6.6 Where booties are used as part of the ensemble, the manufacturer shall specify types of outer footwear that provide the physical and other performance requirements for footwear as specified in Section 7.4, as applicable.

6.6.7 Where outer footwear is used as part of the ensemble, the manufacturer shall specify types of inner footwear that provide the physical and other performance requirements for footwear as specified in Section 7.4, as applicable.

6.6.8 Where outer footwear is used as part of the ensemble, the manufacturer shall provide footwear covers in not less than five separate and distinct sizes.

6.6.9 Supplemental footwear including, but not limited to, booties, outer footwear, inner footwear, and footwear covers shall be provided to meet the requirements of this standard but shall not be intended to be worn continuously with the footwear element.

6.6.10 Any permanent attachment provided by the manufacturer to [C]BRN garments shall not interfere with the function of that [C]BRN garment or with the function of any of the [C]BRN garments component parts.

6.6.11 Where [C]BRN ensembles are provided by the manufacturer with permanent attachments, the [C]BRN ensemble shall meet all of the design and performance requirements of this standard with permanent attachments installed. In all cases, such permanent attachments shall not degrade the performance of the [C]BRN ensembles.

Chapter 7 Performance Requirements

7.1 Emergency Medical Garment Performance Requirements.

7.1.1* Single-Use Emergency Medical Garment Performance Requirements.

7.1.1.1 Full body or full torso garments, including, but not limited to, coveralls, coats, jackets, pants, and overalls, shall be tested for liquidtight integrity as specified in Section 8.2, Liquidtight Integrity Test One, and shall allow no water penetration.

7.1.1.2 Garment barrier layer material and barrier layer seams shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.1.1.3 Garment materials shall be tested for tensile strength as specified in Section 8.4, Tensile Strength Test, and shall have a tensile strength of not less than 50 N (11.2 lbf).

7.1.1.4 Garment materials shall be tested for bursting strength as specified in Section 8.5, Burst Strength Test, and shall have a bursting strength of not less than 66 N (14.9 lbf).

7.1.1.5 Garment materials shall be tested for puncture resistance as specified in Section 8.6, Puncture Propagation Tear Resistance Test, and shall have a puncture resistance of not less than 12 N (2.7 lbf).

7.1.1.6 Garment materials shall be tested for tear strength as specified in Section 8.38, Tear Resistance Test Two, and shall have a tear strength of not less than 17 N (3.8 lbf).

7.1.1.7 Garment material seams shall be tested for breaking strength as specified in Section 8.8, Seam Breaking Strength Test, and shall have a breaking strength of not less than 50 N (11.2 lbf).

7.1.1.8 Garment materials for full body garments including, but not limited to, coveralls and full torso and limb encapsulating garments shall be tested for total heat loss as specified in Section 8.32, Total Heat Loss Test, and shall have a total heat loss value of 450 W/m^2 or greater.

7.1.1.9 Garment materials shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.1.2 Multiple-Use Emergency Medical Garment Performance Requirements.

7.1.2.1 Garments shall be tested for liquidtight integrity as specified in Section 8.2, Liquidtight Integrity Test One, and shall allow no water penetration.

7.1.2.2 Barrier layer material and barrier layer seams shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.1.2.3 Each separable layer of garment material shall be tested for tensile strength as specified in Section 8.4, Tensile Strength Test, and shall have a tensile strength of not less than 225.5 N (50 lbf).

7.1.2.4 Each separable layer of garment material shall be tested for bursting strength as specified in Section 8.5, Burst Strength Test, and shall have a bursting strength of not less than 222.5 N (50 lbf).

7.1.2.5 Each separable layer of garment material shall be tested for puncture propagation tear resistance as specified in Section 8.6, Puncture Propagation Tear Resistance Test, and shall have a puncture resistance of not less than 25 N (5½ lbf).

7.1.2.6 Each separable layer of garment material shall be tested for tear strength as specified in Section 8.7, Tear Resistance Test One, and shall have a tear strength of not less than 36 N (8 lbf).

7.1.2.7 Seams from each separable layer of garment material shall be tested for breaking strength as specified in Section 8.8, Seam Breaking Strength Test, and shall have a breaking strength of not less than 222.5 N (50 lbf).

7.1.2.8 Garment outer shell fabric shall be tested for water absorption resistance as specified in Section 8.31, Water Absorption Resistance Test, and shall have a percent water absorption of 30 percent or less.

7.1.2.9 Garment composites shall be tested for total heat loss as specified in Section 8.32, Total Heat Loss Test, and shall have a total heat loss value of 450 W/m^2 or greater.

7.1.2.10 Product labels of garments designated for multiple use shall be tested for durability and legibility as specified in Section 8.33, Label Durability and Legibility Test, and shall remain in place and shall be legible.

7.1.2.11 All garment hardware and specimens of all garment hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional.

7.1.2.12 Where visibility materials are used on garments and the garment is intended to provide high visibility of the wearer in accordance with the requirement in 6.1.2.8, the background, retroreflective, and combined performance materials shall meet the requirements of ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*.

7.1.2.13 Where visibility materials are used on garments and the garment is intended to provide high visibility of the wearer in accordance with the requirement in 6.1.2.8, garments shall be tested for retroreflectivity and fluorescence as specified in Section 8.37, Retroreflectivity and Fluorescence Test Following Laundering.

7.1.2.14 Each separable layer of garment material shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.1.2.15 Fastener tape shall be tested for breaking strength as specified in A-A-55126B, *Commercial Item Description — Fastener Tapes, Hook and Loop, Synthetic*, and ASTM D 5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)* (G-E or G-T)2/, and shall meet or exceed the minimum breaking strength requirements established for Type 2, Class 1 and Class 4 tapes as set forth in the specification Table 1 in A-A-55126B. Tapes in a 1 in. width shall be used as the basis for performance.

7.1.2.16 Fastener tape shall be tested for shear strength as specified in A-A-55126B, *Commercial Item Description — Fastener Tapes, Hook and Loop, Synthetic*, Test Method AATCC 61, *Colorfastness to Laundering, Home and Commercial: Accelerated*, Test 3A, and ASTM D 5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, after 3 washings and shall meet or exceed the minimum shear strength requirements established for Type 2, Class 1 and Class 4 tapes as set forth in the specification Table 1 in A-A-55126B. Tapes in a 1 in. width shall be used as the basis for performance.

7.1.2.17 Fastener tape shall be tested for peel strength as specified in A-A-55126B, *Commercial Item Description — Fastener Tapes, Hook and Loop, Synthetic*, Test Method AATCC 61, *Colorfastness to Laundering, Home and Commercial: Accelerated*, Test 3A, and ASTM D 5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, after 3 washings and shall meet or exceed the minimum peel strength requirements established for Type 2, Class 1 and Class 4 tapes as set forth in the specification Table 1 in A-A-55126B. Tapes in a 1 in. width shall be used as the basis for performance.

7.1.2.18 Garment zippers shall be tested for crosswise breaking strength of chain; crosswise breaking strength of separating unit; holding strengths of stops, retainers, and separating units; operating force; and slider lock strength requirements of A-A-55634A, *Commercial Item Description — Zippers (Fasteners, Slide, Interlocking)*.

7.2 Emergency Medical Glove Performance Requirements.

7.2.1 Single-Use Emergency Medical Examination Glove Performance Requirements.

7.2.1.1 Examination gloves shall be tested for liquidtight integrity as specified in Section 8.9, Liquidtight Integrity Test Two, and shall have an acceptable quality limit of 1.5 or better.

7.2.1.2 Examination gloves shall be tested for body fluid-borne pathogen resistance as specified in Section 8.10, Biopenetration Test Two, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.2.1.3 Examination glove material shall be tested for tensile strength as specified in Section 8.11, Ultimate Tensile Strength Test, and shall have an ultimate tensile strength of not less than 14 MPa (2000 psi).

7.2.1.4 Examination glove material shall be tested for elongation as specified in Section 8.12, Ultimate Elongation Test, and shall have an ultimate elongation of not less than 500 percent.

7.2.1.5 Examination glove material shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall have a puncture resistance of not less than 4.5 N (1 lbf).

7.2.1.6 Examination gloves shall be tested for dexterity as specified in Section 8.14, Dexterity Test One, and shall have test times no greater than 106 percent of baseline test measurements.

7.2.1.7 Examination glove material shall be tested for protein levels as specified in Section 8.15, Protein Content Test, and shall have protein levels no greater than 50 μg/g.

7.2.2 Single-Use Emergency Medical Cleaning/Utility Glove Performance Requirements.

7.2.2.1 Cleaning/utility gloves shall be tested for liquidtight integrity as specified in Section 8.9, Liquidtight Integrity Test Two, and shall show no leakage.

7.2.2.2 Cleaning/utility gloves shall be tested for body fluid-borne pathogen resistance as specified in Section 8.10, Biopenetration Test Two, and shall exhibit no penetration of Phi-X174 bacteriophage.

7.2.2.3 Cleaning/utility glove materials shall be tested for permeation resistance as specified in Section 8.24, Chemical Permeation Resistance Test, and shall not have a cumulative permeation of greater than 6 $\mu g/cm^2$ for each chemical tested.

7.2.2.4 Cleaning/utility glove materials shall be tested for tensile strength as specified in Section 8.11, Ultimate Tensile Strength Test, and shall have an ultimate tensile strength of greater than 12.5 MPa (1813 psi).

7.2.2.5 Cleaning/utility glove materials shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall have a puncture resistance of greater than 10 N (2.3 lbf).

7.2.2.6 Cleaning/utility gloves shall be tested for resistance to cut as specified in Section 8.18, Cut Resistance Test, and shall have a blade travel distance not less than 20 mm (0.8 in.).

7.2.2.7 Cleaning/utility glove materials shall be tested for abrasion resistance as specified in Section 8.25, Abrasion Resistance Test Two, and shall not show wear-through after 1000 cycles.

7.2.2.8 Cleaning/utility gloves shall be tested for dexterity as specified in Section 8.26, Dexterity Test Two, and shall have an average percent of barehanded control exceeding 200 percent.

7.2.2.9 Cleaning/utility gloves shall be tested for tactility as specified in Section 8.30, Tactility Test, and shall permit pick-up of pins having a diameter of 2.5 mm (0.098 in.) or greater.

7.2.2.10 Cleaning/utility glove materials shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.2.3 Multiple-Use Emergency Medical Work Glove Performance Requirements.

7.2.3.1 Work gloves shall be tested for liquidtight integrity as specified in Section 8.29, Overall Liquid Integrity Test Three, and shall show no water penetration.

7.2.3.2 Work gloves shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage.

7.2.3.3 Work glove body materials shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall not puncture under an applied force of 22 N (5 lbf).

7.2.3.4 Work glove body and interface component materials shall be tested for resistance to cut as specified in Section 8.18, Cut Resistance Test, and shall have a blade travel distance of not less than 20 mm (0.8 in.).

7.2.3.5 Work glove body composite materials shall be tested for abrasion resistance as specified in Section 8.25, Abrasion Resistance Test Two, and shall show no wear-through.

7.2.3.6 Gloves shall be tested for hand function as specified in Section 8.26, Dexterity Test Two, and shall have an average percent of barehanded control not exceeding 170 percent.

7.2.3.7 Work gloves shall be tested for grip as specified in Section 8.27, Grip Test, and shall have a weight pulling capacity not less than 80 percent of the barehanded control values.

7.2.3.8 Work gloves shall be tested for ease of donning as specified in Section 8.28, Glove Donning Test, and shall not have a baseline donning time exceed 10 seconds, a final donning time not to exceed the baseline donning time plus 20.0 seconds, shall have no detachment of the inner liner, shall have no detachment of the moisture barrier, and shall allow full insertion of all digits.

7.2.3.9 Work gloves shall be tested for tactility as specified in Section 8.30, Tactility Test, and shall permit pick-up of pins having a diameter of 5 mm (3⁄16 in.) or less.

7.2.3.10 All metal hardware and hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion, including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation; shall have ferrous metals show no corrosion of the base metal; and shall have hardware items remain functional.

7.2.3.11 Glove body and glove interface component materials shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.2.3.12 Product labels shall be tested for durability and legibility as specified in Section 8.33, Label Durability and Legibility Test, and shall be legible.

7.3 Emergency Medical Eye and Face Protection Device Performance Requirements.

7.3.1 Single-Use Emergency Medical Facemask Performance Requirements.

7.3.1.1 Medical facemasks shall meet the requirements for high barrier performance class medical facemasks in accordance with Table 1 and Section 6 of ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks.*

7.3.1.2 Medical facemasks shall be tested for liquidtight integrity as specified in Section 8.17, Liquidtight Integrity Test Three, and shall allow no liquid penetration.

7.3.1.3 Medical facemasks that include visors that cover the eyes or affect the vision of the wearer shall be tested for visual acuity as specified in Section 8.16, Visual Acuity/Fogging Resistance Test, shall permit test subjects to read at least the 20/20 visual acuity line or better, and shall have the facemask be able to be donned and adjusted in accordance with manufacturer's instructions.

7.3.2 Single-Use Emergency Medical Eye and Face Protection Device Performance Requirements.

7.3.2.1 These requirements shall apply to eye and face protection devices that are not medical facemasks or eye and face protection devices that incorporate medical facemask–like designs, which are intended for single use only.

7.3.2.2 If the portion of the eye and face protection device covering the eyes and face is not a continuous plastic or solid film, materials used in the construction of eye and face protection devices shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.3.2.3 Eye and face protection devices shall be tested for liquidtight integrity as specified in Section 8.17, Liquidtight Integrity Test Three, and shall allow no liquid penetration.

7.3.2.4 Where present, materials used in the construction of hoods that also provide protection to the face and eyes shall meet the requirements for single-use emergency medical garments specified in 7.1.1.

7.3.2.5 Eye and face protection devices that cover the eyes or affect the vision of the wearer shall be tested for visual acuity as specified in Section 8.16, Visual Acuity/Fogging Resistance Test, and shall permit test subjects to read at least the 20/20 visual acuity line or better and shall have the eye and face protection device be able to be donned and adjusted in accordance with manufacturer's instructions.

7.3.2.6 Each textile layer used in the construction of the eye and face protection device shall be tested for flammability as

specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.3.3 Multiple-Use Emergency Medical Eye and Face Protection Device Performance Requirements.

7.3.3.1 Eye and face protection devices that involve junctures or interfaces between different items that are not continuous in their design shall be tested for liquidtight integrity as specified in Section 8.17, Liquidtight Integrity Test Three, and shall allow no liquid penetration.

7.3.3.2 Eye and face protection devices that cover the eyes or affect the vision of the wearer shall be tested for visual acuity as specified in Section 8.16, Visual Acuity/Fogging Resistance Test, and shall permit test subjects to read at least the 20/20 visual acuity line or better and shall have the eye and face protection device be able to be donned and adjusted in accordance with manufacturer's instructions.

7.3.3.3 Unless corrosion resistance is already evaluated in another requirement, all eye and face protection device hardware and specimens of all face protection device hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, and shall have metals that are inherently resistant to corrosion including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional.

7.3.4 Face Protection Devices.

7.3.4.1 Face protective devices that are medical face masks or face protection devices that incorporate medical facemask-like designs shall meet the requirements for high barrier performance class medical face masks in accordance with ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks.*

7.3.4.2 Face protection devices shall be tested for liquidtight integrity as specified in Section 8.17, Liquidtight Integrity Test Three, and shall allow no liquid penetration.

7.3.4.3 The barrier portion of face protection devices, excluding the medical face masks, shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.3.4.4 Each textile layer used in the construction of the face protection device shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have an afterflame time of 2.0 seconds or less.

7.3.4.5 For multiple-use face protection devices only, all face protection device hardware and specimens of all face protection device hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion including but not limited to stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional.

7.4 Emergency Medical Footwear Performance Requirements.

7.4.1 Single-Use Emergency Medical Footwear Cover Performance Requirements.

7.4.1.1 Footwear cover materials and seams shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage.

7.4.1.2 Footwear cover upper materials shall be tested for tensile strength as specified in Section 8.4, Tensile Strength Test, and shall have a tensile strength of not less than 50 N (11.2 lbf).

7.4.1.3 Footwear cover upper materials shall be tested for bursting strength as specified in Section 8.5, Burst Strength Test, and shall have a bursting strength of not less than 66 N (14.9 lbf).

7.4.1.4 Footwear cover materials shall be tested for tear strength as specified in Section 8.38, Tear Resistance Test Two, and shall have a tear strength of not less than 17 N (3.8 lbf).

7.4.1.5 Footwear cover material seams shall be tested for breaking strength as specified in Section 8.8, Seam Breaking Strength Test, and shall have a breaking strength of not less than 50 N (11.2 lbf).

7.4.1.6 Footwear cover wear surface materials shall be tested for abrasion resistance as specified in Section 8.25, Abrasion Resistance Test Two, and shall show no wear-through.

7.4.1.7 The footwear cover wear surface materials shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall have a puncture force greater than 8 N (1.8 lbf).

7.4.1.8 The footwear cover wear surface materials shall be tested for slip resistance as specified in Section 8.20, Slip Resistance Test, and shall have a coefficient of friction of 0/40 or greater.

7.4.1.9 Footwear cover materials shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.4.2 Multiple-Use Emergency Medical Footwear Performance Requirements.

7.4.2.1 Footwear uppers shall be tested for cut resistance as specified in Section 8.18, Cut Resistance Test, and shall have a blade travel distance not less than 20 mm (0.8 in.).

7.4.2.2 Footwear uppers shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall not puncture under an applied force of 45 N (10 lbf).

7.4.2.3 Footwear soles and heels shall be tested for abrasion resistance as specified in Section 8.19, Abrasion Resistance Test One, and the relative volume loss shall not be greater than 200 mm^3.

7.4.2.4 Footwear outer soles shall be tested for slip resistance as specified in Section 8.20, Slip Resistance Test, and shall have a coefficient of friction of 0.40 or greater.

7.4.2.5 Eyelets and stud hooks shall be tested for attachment strength as specified in Section 8.21, Eyelet and Stud Post Attachment Test, and shall have a minimum detachment strength of 295 N (66 lbf).

7.4.2.6 All footwear metal hardware and specimens of all footwear hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional.

7.4.2.7 The barrier layer material and barrier layer seams in the footwear shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage.

7.4.2.8 Footwear shall be tested for overall watertight integrity as specified in Section 8.23, Overall Liquid Integrity Test Four, and shall allow no liquid penetration, and the outer sole shall not separate.

7.4.2.9 Product labels shall be tested for durability and legibility as specified in Section 8.33, Label Durability and Legibility Test, and shall be legible.

7.4.2.10 Footwear shall be tested for flammability as specified in Section 8.39, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.4.3 Multiple-Use Medical Care Facility Footwear Performance Requirements.

7.4.3.1 Footwear uppers shall be tested for cut resistance as specified in Section 8.18, Cut Resistance Test, and shall have a blade travel distance not less than 20 mm (0.8 in.).

7.4.3.2 Footwear uppers shall be tested for puncture resistance as specified in Section 8.13, Puncture Resistance Test One, and shall not puncture under an applied force of 45 N (10 lbf).

7.4.3.3 Footwear soles and heels shall be tested for abrasion resistance as specified in Section 8.19, Abrasion Resistance Test One, and the relative volume loss shall not be greater than 200 mm^3.

7.4.3.4 Footwear outer soles shall be tested for slip resistance as specified in Section 8.20, Slip Resistance Test, and shall have a coefficient friction of 0.40 or greater.

7.4.3.5 Eyelets and stud hooks shall be tested for attachment strength as specified in Section 8.21, Eyelet and Stud Post Attachment Test, and shall have a minimum detachment strength of 295 N (66 lbf).

7.4.3.6 All footwear metal hardware and specimen footwear hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional unless specifically excluded in this test method.

7.4.3.7 The barrier layer material and barrier layer seams in the footwear shall be tested for body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage.

7.4.3.8 Footwear shall be tested for overall watertight integrity as specified in Section 8.23, Overall Liquid Integrity Test Four, and shall allow no liquid penetration, and the outer sole shall not separate.

7.4.3.9 Product labels shall be tested for durability and legibility as specified in Section 8.33, Label Durability and Legibility Test, and shall be legible.

7.5* Multiple-Use Emergency Medical Helmet Performance Requirements.

7.5.1 Helmets shall be tested for suspension system separation as specified in Section 8.40, Suspension System Retention Test, and shall have the force required to separate any individual attachment point of the suspension assembly from the helmet shell and each adjusting mechanism of the suspension system assembly not be less than 22 N (5 lbf), and the adjusting mechanism shall function properly.

7.5.2 Helmet chin straps shall be tested for retention system separation as specified in Section 8.41, Retention System Test, and the chin strap shall not exhibit any breakage and shall not stretch or slip more than 38 mm (1½ in.), and shall have all mechanisms function properly.

7.5.3 Where present, helmets with goggle or headlamp clips shall be tested for attachment strength as specified in Section 8.42, Goggle and Headlamp Clip Attachment Test, the clips shall not release from the shell, and the clips shall not deflect more than 6 mm (¼ in.) from their original position.

7.5.4 All helmet metal hardware and helmet hardware that include metal parts shall be individually tested for resistance to corrosion as specified in Section 8.22, Corrosion Resistance Test, and shall have metals that are inherently resistant to corrosion including, but not limited to, stainless steel, brass, copper, aluminum, and zinc show no more than light surface-type corrosion or oxidation, shall have ferrous metals show no corrosion of the base metal, and shall have all hardware remain functional.

7.6 Multiple-Use Emergency Medical [C]BRN Protective Ensembles Performance Requirements.

7.6.1 The entire ensemble shall be tested for overall particulate inward leakage as specified in Section 8.34, Particle Inward Leakage Test, and shall allow no visual particulate inward leakage.

7.6.2 The entire ensemble shall be tested as specified in Section 8.35, Overall Ensemble Liquid Penetration Test, and shall show no liquid penetration.

7.6.3 Each ensemble item's [C]BRN barrier layer and the barrier layer seams shall be tested for permeation resistance as specified in Section 8.36, Biopenetration Resistance Test Three, and shall exhibit no penetration of the Phi-X174 bacteriophage.

7.6.4 The garment elements of the [C]BRN Protective Ensemble shall also meet all the requirements specified in 7.1.2, Multiple-Use Emergency Medical Garment Performance Requirements.

7.6.5 The footwear elements of the [C]BRN Protective Ensemble shall also meet all the requirements specified in Section 7.4, Emergency Medical Footwear Performance Requirements.

7.6.6 The work glove elements of the [C]BRN Protective Ensemble shall also meet all the requirements specified in 7.2.3, Multiple-Use Emergency Medical Work Gloves Performance Requirements.

Chapter 8 Test Methods

8.1 Sample Preparation Procedures.

8.1.1 Application.

8.1.1.1 The sample preparation procedures contained in this section shall apply to each test method in this chapter, as specifically referenced in the sample preparation section of each test method.

8.1.1.2 Only the specific sample preparation procedure(s) procedures referenced in the sample preparation section of each test method shall be applied to that test method.

8.1.2 Room Temperature Conditioning Procedure for Garments, Gloves, and Face Protection Devices.

8.1.2.1 Samples shall be conditioned at a temperature of 21°C ± 3°C (70°F ± 5°F) and a relative humidity of 65 percent ± 5 percent, until equilibrium is reached, as determined in accordance with ASTM D 1776, *Standard Practice for Conditioning and Testing Textiles,* or for at least 24 hours.

8.1.2.2 Specimens shall be tested within 5 minutes after removal from conditioning.

8.1.3 Washing and Drying Procedure for Complete Garments, Work Gloves, and Work Glove Pouches.

8.1.3.1 When laundering complete garments, the garment shall be washed with all closures fastened.

8.1.3.2 A commercial front-loading washer/extractor shall be used.

8.1.3.3 For complete garments, a minimum of a 4.5 kg +/− 0.1 kg (10 lb +/− 0.2 lb) load shall be used. If ballast is needed to reach the minimum load size, materials similar to the test material shall be used. Two-thirds the rated capacity of the washer shall not be exceeded.

8.1.3.4 The wash cycle procedure in Table 8.1.3.4 shall be followed. Water temperature shall be within ±3°C (±5°F) of the value in the table.

Table 8.1.3.4 Wash Cycle Procedure for Whole Garments

Operation	Time (minutes)	Temperature °C	Temperature °F	Water Level
Suds Using AATCC Detergent #1993, 45.0 g	10	49	120	Low
Drain	1			
Carry-over	5	49	120	Low
Drain	1			
Rinse	2	38	100	High
Drain	1			
Rinse	2	38	100	High
Drain	1			
Rinse	2	38	100	High
Drain	1			
Extract	5			

8.1.3.5 The garment shall be dried using a tumble dryer with a stack temperature of 38°C to 49°C (100°F to 120°F) when measured on an empty load 20 minutes into the drying cycle.

8.1.3.6 The garment shall be tumbled for a minimum of 30 minutes or until samples are completely dry and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the complete garment samples shall be allowed to air dry for at least 48 hours prior to conducting the test.

8.1.3.7 Garments shall be washed and dried for a total of 25 washings and 25 drying cycles.

8.1.3.8 For work gloves and work glove pouches, a minimum of a 4.5 kg +/− 0.1 kg (10 lb +/− 0.2 lb) load shall be used. If ballast is needed to reach the minimum load size, materials similar to the test material shall be used. Two-thirds the rated capacity of the washer shall not be exceeded.

8.1.3.9 Work gloves and work glove pouches shall be dried using a tumble dryer with a stack temperature of 38°C to 49°C (100°F to 120°F) when measured on an empty load 20 minutes into the drying cycle.

8.1.3.10 Work gloves and work glove pouches shall be tumbled for 60 minutes and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the glove shall be dried on a forced air non-tumble drying mechanism operated at 10°C (+/− 2 °C) above current room temperature until completely dry.

8.1.3.11 Work gloves and work glove pouches shall be washed and dried for a total of 10 washings and 10 drying cycles.

8.1.4 Flexural Fatigue Procedure for Gloves. Sample gloves shall be subjected to one full cycle of testing for dexterity testing as specified in Section 8.14 for emergency medical examination gloves and as specified in Section 8.27 for emergency medical cleaning/utility gloves.

8.1.5 Isopropanol Immersion Procedure for Gloves.

8.1.5.1 Glove specimens shall be cut from the sample prior to conditioning. Glove specimens shall be totally immersed in 100 percent isopropanol at room temperature for a period of 2 hours.

8.1.5.2 Glove specimens shall be removed from the isopropanol, hung in a vertical position for 5 minutes, laid horizontal with AATCC textile blotting paper both under and over the sample, under a weight of 2 $\mu g/cm^2$ ± 0.2 g/cm^2 (½ psi ± 0.05 psi), for a period of 20 minutes as specified in AATCC 70, *Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test.*

8.1.5.3 Specimens shall be tested within 5 minutes following blotting.

8.1.6 Heat Aging Procedure for Gloves.

8.1.6.1 Glove samples shall be subjected to heat aging in accordance with ASTM D 573, *Standard Test Method for Rubber-Deterioration in an Air Oven,* at a temperature of 70°C ± 2°C (158°F ± 4°F) for 166 hours ± 2 hours.

8.1.6.2 The sample gloves shall be allowed to cool for 10 minutes ± 1 minute, prior to testing.

8.1.7 Abrasion Procedure for Garment Labels. Labels shall be subjected to abrasion in accordance with ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method),* with the modifications in 8.1.7.1 through 8.1.7.3.

8.1.7.1 The standard abrasive fabric and the felt-backing fabric shall be soaked for 24 hours or agitated in distilled water so that they are thoroughly wet.

8.1.7.2 The standard abrasive fabric shall be rewetted after each set of cycles by applying 20 ml (0.68 oz) of distilled water from a squeeze bottle by squirting on the center of the abrasive composite pad.

8.1.7.3 Specimens shall be subjected to 200 cycles, 3200 revolutions, of the test apparatus.

8.1.8 Wet Conditioning for Work Gloves.

8.1.8.1 Test subjects shall be selected such that their hand dimensions are as close as possible to those specified in accordance with manufacturing glove-sizing guidelines.

8.1.8.2 The wrist crease location shall be marked as described in 6.2.3.3 on each specimen around the entire glove +0/−3 mm (+0/−0.25 in.). Then, in the same manner, the water height line shall also be marked on each specimen 25 mm (1 in.) +0/−3 mm (+0/−0.25 in.) below (towards the fingers) the location of the wrist crease around the entire glove.

8.1.8.3 The test subject shall don the test specimen gloves.

8.1.8.4 The test subject shall immerse the donned specimens straight down into two containers of water at a temperature of 21°C ± 3°C (70°F ± 5°F) to the water height line for 15 seconds +1.5/−0 seconds.

8.1.8.5 The glove specimens shall be tested within 1 minute.

8.1.9* Work Glove Test Areas.

8.1.9.1 Work glove test areas shall be as described below and shown in Figure 8.1.9.1. Work glove test area abbreviations shall be as follows: P=Palm; B=Back; S=Side.

(1) A-P: Palm side of hand from finger crotch line to ⅓ of the way down (grasp area)
(2) B-P: Palm side of hand from ⅓ of the way down (grasp area) to the wrist crease
(3) C-P: Palm side of hand from the wrist crease to 50 mm (2 in.) past the wrist crease
(4) D-P: Palm side of thumb
(5) E-P: Palm side of tip of thumb
(6) F-P: Palm side of index finger
(7) G-P: Palm side of fingertip of index finger
(8) H-P: Palm side of nonindex fingers
(9) I-P: Palm side of fingertip of nonindex fingers
(10) A-PS: Sides of hand adjacent to section A-P
(11) B-PS: Outside of hand adjacent to section B-P
(12) C-PS: Sides of hand adjacent to section C-P
(13) D-PS: Outside of thumb adjacent to section D-P
(14) E-PS: Inside of thumb adjacent to section D-P
(15) F-PS: Outside of index finger adjacent to section F-P
(16) H-PS: In between fingers adjacent to sections F-P and H-P
(17) I-PS: Outside of and adjacent to the smallest finger
(18) A-B: Back side of hand from finger crotch line to ⅓ of the way down (knuckle area)
(19) B-B: Back side of hand from ⅓ of the way down (knuckle area) to the wrist crease
(20) C-B: Back side of hand from the wrist crease to 50 mm (2 in.) past the wrist crease
(21) D-B: Back side of thumb
(22) E-B: Back side of tip of thumb
(23) F-B: Back side of index finger
(24) G-B: Back side of fingertip of index finger
(25) H-B: Back side of nonindex fingers
(26) I-B: Back side of fingertip of nonindex fingers
(27) A-BS: Sides of hand adjacent to section A-B
(28) B-BS: Outside of hand adjacent to section B-B
(29) C-BS: Sides of hand adjacent to section C-B
(30) D-BS: Outside of thumb adjacent to section D-B
(31) E-BS: Inside of thumb adjacent to section D-B
(32) F-BS: Outside of index finger adjacent to section F-B
(33) H-BS: In between fingers adjacent to sections F-B and H-B
(34) I-BS: Outside of and adjacent to the smallest finger

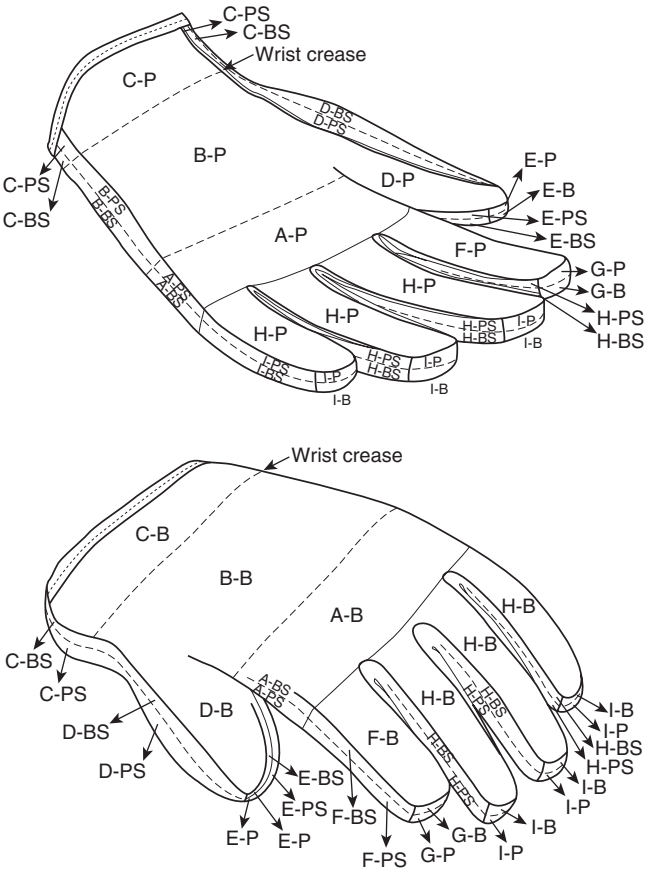


FIGURE 8.1.9.1 Work Glove Test Areas.

8.1.10 Flexural Fatigue Procedure for [C]BRN Barrier Layer. Specimens shall be subjected to flexural fatigue in accordance with ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, with the following modification. In lieu of flexing conditions A, B, C, D, or E, test specimens shall have a flex period of 3,000 cycles at 45 cycles per minute. A cycle shall be full flex and twisting action.

8.1.11 Abrasion Procedure for [C]BRN Barrier Layer. Specimens shall be abraded in accordance with ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, under the following conditions:

(1) A 2.3 kg (5 lb) tension weight shall be used.
(2) A 1.6 kg (3.5 lb) head weight shall be used.
(3) The abradants shall be each of the material layers in the composite that are adjacent to the [C]BRN barrier layer.
(4) The specimen shall be abraded for a total of 60,000 cycles.
(5) The specimen shall be abraded for half of the cycles against the outer layer of the composite with the specimen facing the outer layer in its normal "as worn" orientation.
(6) The specimen shall be then abraded for the remaining cycles against the inner layer of the composite with the specimen facing the inner layer in its normal "as worn" orientation.
(7) Where an outer layer or inner layer does not exist, the material shall be self-abraded, inner layer on inner layer, or outer layer on outer layer.

8.1.12 Cold Temperature Conditioning for Medical Facemasks and Eye and Face Protection Devices. Specimens shall be exposed to cold in an environmental chamber at a temperature of 0°C ± 2°C, for a period of not less than 4 hours.

8.2 Liquidtight Integrity Test One.

8.2.1 Application.

8.2.1.1 This test method shall apply to garments.

8.2.2 Specimens.

8.2.2.1 A minimum of one specimen shall be tested. Specimens shall consist of the entire garment with all layers assembled that are required for the garment to be compliant.

8.2.2.2 The size of the garment comprising the specimen shall be chosen to conform with the dimensions of the mannequin to ensure proper fit of the specimen on the mannequin in accordance with the manufacturer's sizing system. The size of the garments comprising the specimen shall be the same size as the mannequin in terms of chest circumference, waist circumference, and inseam height.

8.2.3 Sample Preparation.

8.2.3.1 Samples for conditioning shall be complete garments.

8.2.3.2 Single-use garment samples shall be conditioned as specified in 8.1.2.

8.2.3.3 Multiple-use garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.2.4 Apparatus. The apparatus and supplies for testing shall be those specified in ASTM F 1359, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin*, using the modifications in 8.2.4.1 and 8.2.4.2.

8.2.4.1* The surface tension of the water used in testing shall be 35 dynes/cm ± 5 dynes/cm.

8.2.4.2 The mannequin used in testing shall have straight arms and legs, with the arms positioned downward at the mannequin's side.

8.2.5 Procedure. Liquidtight integrity testing of garments shall be conducted in accordance with ASTM F 1359, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin,* with the modifications in 8.2.5.1 through 8.2.5.6.

8.2.5.1 No provision for garments with a partial barrier layer shall be allowed.

8.2.5.2* The method used for mounting of the mannequin in the spray chamber shall not interfere with the water spray.

8.2.5.3 Where non-full body garments are tested, those portions of the body not covered by the garment shall be blocked off and shall not be evaluated for watertight integrity.

8.2.5.4 The suited mannequin shall be exposed to the liquid spray for a total of 8 minutes — 2 minutes in each of the four specified mannequin orientations.

8.2.5.5 At the end of the liquid spray exposure period, excess liquid shall be removed from the surface of the specimen.

8.2.5.6 Inspection of the liquid-absorptive garment on the mannequin shall be completed within 10 minutes of the end of the liquid spray exposure period.

8.2.6* Report. A diagram shall be prepared for each test that identifies the locations of any liquid leakage as detected on the liquid-absorptive garment.

8.2.7 Interpretation. Any evidence of liquid on the liquid-absorptive garment, as determined by visual inspection, tactile inspection, or absorbent toweling, shall constitute failure of the specimen.

8.3 Biopenetration Test One.

8.3.1 Application.

8.3.1.1 This test shall be applied to the barrier layer material and barrier layer seams used in the construction of garments, work gloves, face protection devices, footwear, and footwear covers.

8.3.1.2 Modifications to this test method for testing garments shall be as specified in 8.3.7.

8.3.1.3 Modifications to this test method for testing work gloves shall be as specified in 8.3.11.

8.3.1.4 Modifications to this test method for testing face protection devices shall be as specified in 8.3.8.

8.3.1.5 Modifications to this test method for testing footwear shall be as specified in 8.3.9.

8.3.1.6 Modifications to this test method for testing footwear covers shall be as specified in 8.3.10.

8.3.2 Specimens.

8.3.2.1 A minimum of three specimens shall be tested.

8.3.2.2 Each specimen shall consist of three 75 mm (3 in.) squares for each material type.

8.3.2.3 Specimens to be tested shall be representative materials and seams used in the actual construction, or representative of actual construction.

8.3.3 Sample Preparation.

8.3.3.1 Samples of single-use garments, footwear materials, and footwear cover materials shall be conditioned as specified in 8.1.2.

8.3.3.2 Samples of multiple-use garments shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.3.3.3 Samples of single- and multiple-use face protection devices shall be conditioned as specified in 8.1.2.

8.3.4 Procedure. Liquid penetration resistance testing shall be conducted in accordance with ASTM F 1671, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System.*

8.3.5 Report. The pass/fail result for each specimen shall be recorded and reported.

8.3.6 Interpretation. A failure of any specimen constitutes failure of the material.

8.3.7 Specific Requirements for Testing Garments. Specimens for biopenetration testing shall consist of the barrier layer and barrier layer seams only.

8.3.8 Specific Requirements for Testing Face Protection Devices.

8.3.8.1 Samples for conditioning shall be whole face protection devices.

8.3.8.2 Specimens to be tested shall consist of the barrier layer and barrier layer seams.

8.3.9 Specific Requirements for Testing Footwear Materials.

8.3.9.1 Samples for conditioning shall be complete footwear or footwear composite swatches. Footwear composite swatches shall be representative of the footwear construction.

8.3.9.2 Specimens to be tested shall consist of the barrier layer and barrier layer seams.

8.3.10 Specific Requirements for Testing Footwear Covers.

8.3.10.1 Samples for conditioning shall be whole footwear covers.

8.3.10.2 Specimens shall be taken from the footwear cover that are representative of the footwear cover construction.

8.3.10.3 Where more than one material is used in the construction of the footwear cover, each material shall be tested separately.

8.3.11 Specific Requirements for Testing Work Glove Materials.

8.3.11.1 Specimens shall be representative of the glove moisture barrier and moisture barrier seams. Three specimens shall be tested.

8.3.11.2 Samples for conditioning shall be in the form of an 200 mm × 200 mm (8 in. × 8 in.) pouch. A smaller pouch size shall be permitted provided that the resulting test specimens are of sufficient size for the test. The pouch shall be made of two glove composite swatches. The two glove composites shall be permitted to be of the same materials and construction. The two glove body composites shall be permitted to be representative of either the palm or the back of the glove. The two glove composite swatches shall be constructed to simulate the actual layers of the glove, arranged in proper order. Where the moisture barrier material seam is being tested, the moisture barrier layer shall contain a seam. The seam shall run within 25 mm (1 in.) of the center and shall extend across the entire width of the specimen. Each of the two composite swatches shall be stitched on all four sides using the same thread as used in the glove construction. The two composite swatches shall then be sewn together, inner liner to inner liner, on three sides using the same thread as used in the glove construction.

8.3.11.3 Samples shall be conditioned as specified in 8.1.3.

8.3.11.4 The glove moisture barrier layers shall be removed from the multilayer composite samples after all preconditioning has been completed and shall become the glove barrier test specimen.

8.3.11.5 Specimens for testing shall be the barrier layer only.

8.3.11.6 Where the moisture barrier material is continuous through the glove body, only the barrier seams shall be tested. The test cell shall include both the moisture barrier material and the moisture barrier seam. The seam shall be located in the approximate center of the test cell.

8.4 Tensile Strength Test.

8.4.1 Application.

8.4.1.1 This test shall apply to materials used in the construction of garments and upper materials for footwear covers. Where the garment or footwear cover is constructed of several separable layers, each separable layer of garment material or footwear upper material shall be tested.

8.4.2 Specimens. Five specimens in each of the warp and fill directions shall be tested from each sample unit.

8.4.3 Sample Preparation.

8.4.3.1 Samples for conditioning shall be the entire complete garment or whole footwear cover.

8.4.3.2 Single-use garment and footwear cover samples shall be conditioned as specified in 8.1.2.

8.4.3.3 Multiple-use garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.4.4 Procedure. Specimens shall be tested in accordance with ASTM D 5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*.

8.4.5 Report.

8.4.5.1 The tensile strength of each specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf) of force.

8.4.5.2 An average tensile strength shall be calculated and reported for warp and fill directions.

8.4.6 Interpretation.

8.4.6.1 Pass/fail performance shall be based on the average tensile strength in the warp and fill directions.

8.4.6.2 A failure in any one direction shall constitute failure for the material.

8.5 Burst Strength Test.

8.5.1 Application. This test shall apply to materials used in the construction of garments. Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.5.2 Specimens. A total of 10 specimens shall be tested.

8.5.3 Sample Preparation.

8.5.3.1 Samples for conditioning shall be complete garments.

8.5.3.2 Single-use garment samples shall be conditioned as specified in 8.1.2.

8.5.3.3 Multiple-use garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.5.4 Procedure. Specimens shall be tested in accordance with ASTM D 3787, *Method for Bursting Strength of Textiles — Constant-Rate-of-Traverse (CRT) Ball Burst Test.*

8.5.5 Report. The burst strength of each specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf). The average burst strength of all specimens shall be calculated and reported.

8.5.6 Interpretation. The average burst strength shall be used to determine pass/fail performance.

8.6 Puncture Propagation Tear Resistance Test.

8.6.1 Application. This test shall apply to materials used in the construction of multiple-use garments. Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.6.2 Specimens. Five specimens in each of the warp and fill directions shall be tested from each sample unit.

8.6.3 Sample Preparation.

8.6.3.1 Samples for conditioning shall be complete garments.

8.6.3.2 Samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.6.4 Procedure. Specimens shall be tested in accordance with ASTM D 2582, *Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting*.

8.6.5 Report.

8.6.5.1 The puncture propagation tear resistance of each specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf) of force.

8.6.5.2 An average puncture propagation tear resistance shall be calculated and reported for warp and fill directions.

8.6.6 Interpretation.

8.6.6.1 Pass/fail performance shall be based on the average puncture propagation tear resistance in the warp and fill directions.

8.6.6.2 Failure in any one direction shall constitute failure for the material.

8.7 Tear Resistance Test One.

8.7.1 Application. This test shall apply to materials used in the construction of multiple use garments. Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.7.2 Specimens.

8.7.2.1 Five specimens in each of the warp and fill directions shall be tested for each material.

8.7.2.2 Specimens shall be prepared in accordance with ASTM D 5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*.

8.7.3 Sample Preparation.

8.7.3.1 Samples for conditioning shall be complete garments.

8.7.3.2 Garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.7.4 Procedure. Specimens shall be tested in accordance with ASTM D 5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*.

8.7.5 Report.

8.7.5.1 The tear strength of an individual specimen shall be the average of the five highest peak loads of resistance registered for mm (in.) of separation of the tear.

8.7.5.2 The tear strength of each specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf) of force.

8.7.5.3 An average tear strength shall be calculated and reported for warp and fill directions.

8.7.6 Interpretation.

8.7.6.1 Pass/fail performance shall be based on the average tear strength in the warp and fill directions.

8.7.6.2 Failure in any one direction shall constitute failure for the material.

8.8 Seam Breaking Strength Test.

8.8.1 Application.

8.8.1.1 This test shall be applied to seams used in the construction of garments.

8.8.1.2 Where garments consist of multiple separable layers, the test shall be applied to the seams of each separable layer.

8.8.2 Specimens.

8.8.2.1 A minimum of five seam specimens representative of the garment shall be tested for each seam type.

8.8.2.2 Straight-seam specimens shall be cut from conditioned samples.

8.8.2.3 Specimens for testing shall include at least 100 mm (4 in.) of material on either side of the seam.

8.8.3 Sample Preparation.

8.8.3.1 Samples for conditioning shall be complete garments.

8.8.3.2 Single-use garment samples shall be conditioned as specified in 8.1.2.

8.8.3.3 Multiple-use garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.8.4 Procedure. All seams shall be tested in accordance with ASTM D 1683, *Standard Test Method for Failure in Sewn Seams of Woven Apparel Fabrics*.

8.8.5 Report.

8.8.5.1 The breaking strength for each seam specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf) of force.

8.8.5.2 The average breaking strength for each seam type shall also be recorded and reported.

8.8.6 Interpretation. The average breaking strength for each seam or closure assembly type shall be used to determine pass/fail performance.

8.9 Liquidtight Integrity Test Two.

8.9.1 Application.

8.9.1.1 This test shall be applied to whole examination gloves and cleaning/utility gloves.

8.9.1.2 Modifications to this test method for testing examination gloves shall be as specified in 8.9.7.

8.9.1.3 Modifications to this test method for testing cleaning/utility gloves shall be as specified in 8.9.8.

8.9.2 Specimens. Specimens shall be whole examination gloves or cleaning/utility gloves.

8.9.3 Sample Preparation. Samples shall be conditioned as specified in 8.1.2.

8.9.4* Procedure. Liquidtight integrity testing shall be conducted in accordance with ASTM D 5151, *Standard Test Method for Detection of Holes in Medical Gloves*, with the modification that the water shall be replaced with water treated with a surfactant to achieve a surface tension of 35 dynes/cm ± 2 dynes/cm.

8.9.5 Report. The pass or fail result for each specimen shall be recorded and reported.

8.9.6 Interpretation. Passing performance shall be based on the number of passing and failing specimens.

8.9.7 Specific Requirements for Testing Examination Gloves.

8.9.7.1 The number of specimens shall be determined in accordance with ISO 2859-1, *Sampling procedures for inspection by attributes. Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

8.9.7.2 A minimum of 32 specimens shall be tested.

8.9.7.3 Passing performance shall be consistent with a set of specimens that meets an acceptable quality level of 1.5 or better, in accordance with ISO 2859-1, *Sampling procedures for inspection by attributes. Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

8.9.8 Specific Requirements for Testing Cleaning/Utility Gloves.

8.9.8.1 A total of 10 different specimens shall be tested.

8.9.8.2 The cleaning/utility glove shall be filled with the surfactant-treated water to a height 25 mm (1 in.) above the top of the thumb crotch, when the glove is oriented in the fingers down position.

8.9.8.3 If one of the 10 specimens fails, a second set of 10 specimens shall be tested and the results of the second specimen set used to determine pass/fail performance.

8.10 Biopenetration Test Two.

8.10.1 Application. This test shall be applied to whole gloves.

8.10.2 Specimens. A minimum of five whole glove specimens shall be tested.

8.10.3 Sample Preparation.

8.10.3.1 Samples for conditioning shall be whole gloves.

8.10.3.2 Specimens shall be conditioned as specified in 8.1.4.

8.10.4 Procedure.

8.10.4.1 Liquid penetration resistance testing shall be conducted in accordance with ASTM F 1671, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System.*

8.10.4.2 The modifications specified in 8.10.4.2.1 through 8.10.4.2.7 shall apply.

8.10.4.2.1 The test shall be performed by placing a sufficient volume of Phi-X174 bacteriophage suspension into a 1000 ml (34 fl oz) Erlenmeyer flask or other suitably sized vessel such that the height of bacteriophage suspension is 50 mm ± 5 mm (2 in. ± 3⁄16 in.) above the specimen glove thumb crotch.

8.10.4.2.2 The specimen shall be carefully immersed into the challenge suspension and shall be positioned such that the distance from the top of the flask to the middle finger of the glove is 180 mm (7 in.). The excess top of the specimen shall be stretched over the mouth of the flask.

8.10.4.2.3 The specimen shall be filled with a sufficient volume of nutrient broth such that the height of the nutrient broth is approximately 25 mm ± 2.5 mm (1 in. ± 3⁄32 in.) lower than the outside level of the bacteriophage suspension.

8.10.4.2.4 Five ml (0.2 fl oz) of nutrient broth shall be removed from the interior of the specimen and assayed to determine that the specimen was not contaminated.

8.10.4.2.5 The specimen cuff shall be sealed onto the flask using parafilm or tape. A sterile closure shall be placed on the top of the flask.

8.10.4.2.6 The flask shall be placed onto the platform of an orbital shaker and shaken at a speed of 100 rpm +10 min/−0 rpm. The flask shall be shaken for a period of 1 hour +5 minutes/−0 minutes.

8.10.4.2.7 At the end of 1 hour, +5 minutes/−0 minutes, the flask shall be removed from the orbital shaker and the contents from inside the specimen shall be carefully transferred to a sterile bottle and assayed for the presence of Phi-X174 bacteriophage.

8.10.5 Report. The pass/fail result for each specimen shall be recorded and reported.

8.10.6 Interpretation. A failure of any specimen constitutes failure of the material.

8.11 Ultimate Tensile Strength Test.

8.11.1 Application. This test shall be applied to glove materials.

8.11.2 Specimens.

8.11.2.1 A minimum of 10 specimens shall be tested.

8.11.2.2 Specimens shall be taken from the palm and back of individual gloves.

8.11.3 Sample Preparation.

8.11.3.1 Samples for conditioning shall be cut from whole gloves.

8.11.3.2 Specimens shall be tested for ultimate tensile strength after conditioning as specified in 8.1.2.

8.11.3.3 Specimens shall be tested for ultimate tensile strength after conditioning as specified in 8.1.6.

8.11.4 Procedure. Specimens shall be tested in accordance with Method A — Dumbbell Specimens, of ASTM D 412a, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension.* Specimens shall be cut using Die C (metric).

8.11.5 Report.

8.11.5.1 The ultimate tensile strength before and after heat aging shall be recorded and reported for each specimen to the nearest 10 kPa (2 psi).

8.11.5.2 The average ultimate tensile strength before and after heat aging shall be calculated and reported for all specimens tested.

8.11.6 Interpretation. The average ultimate tensile strength both before and after heat aging shall be individually used to determine pass/fail performance.

8.12 Ultimate Elongation Test.

8.12.1 Application. This test shall be applied to glove materials.

8.12.2 Specimens.

8.12.2.1 A minimum of 10 specimens shall be tested.

8.12.2.2 Specimens shall be taken from the palm and back of individual gloves.

8.12.3 Sample Preparation.

8.12.3.1 Samples for conditioning shall be whole gloves.

8.12.3.2 Specimens shall be tested after conditioning as specified in 8.1.5.

8.12.3.3 Specimens shall be tested after conditioning as specified in 8.1.6.

8.12.4 Procedure. Specimens shall be tested in accordance with Method A — Dumbbell Specimens, of ASTM D 412a, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension*.

8.12.5 Report.

8.12.5.1 The ultimate elongation (percentage) shall be recorded and reported for each specimen to the nearest 10 percent.

8.12.5.2 The average ultimate elongation (percentage) shall be recorded and reported for all specimens tested.

8.12.6 Interpretation. The average ultimate elongation after heat aging and the average ultimate elongation after isopropanol immersion shall be used to determine pass/fail performance.

8.13 Puncture Resistance Test One.

8.13.1 Application.

8.13.1.1 This test shall be applied to examination, cleaning, and work glove materials, footwear upper materials, and footwear cover materials.

8.13.1.2 Modifications to this test method for testing examination, cleaning, and work glove materials shall be as specified in 8.13.7 and 8.13.8.

8.13.1.3 Modifications to this test method for testing footwear upper material shall be as specified in 8.13.9.

8.13.1.4 Modifications to this test method for testing footwear cover materials shall be as specified in 8.13.10.

8.13.2 Specimens. A minimum of three specimens measuring at least 150 mm (6 in.) square shall be tested.

8.13.3 Sample Preparation.

8.13.3.1 Samples for conditioning shall be complete whole gloves, whole footwear, and whole footwear covers.

8.13.3.2 Specimens shall be tested after conditioning as specified in 8.1.2.

8.13.4 Procedure.

8.13.4.1 Specimens shall be tested in accordance with ASTM F 1342, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, using Test Method A.

8.13.4.2 The modifications specified in 8.13.4.2.1 through 8.13.4.2.3 shall apply.

8.13.4.2.1 A 0.025 mm (0.01 in.) thick, ultrahigh molecular weight high-density polyethylene shall be used as a standard reference material.

8.13.4.2.2 Puncture probes shall be qualified first before use in testing by showing an average puncture resistance of 10.3 N (2.3 lbf).

8.13.4.2.3 The compression load cell shall be capable of discerning 0.5 N (0.1 lbf) of force in the range suitable for the glove material being tested. The upper limit of the load cell shall not be more than 10 times the actual puncture resistance measured for the glove specimens.

8.13.5 Report.

8.13.5.1 The puncture force shall be recorded and reported for each specimen to the nearest 0.5 N (0.1 lbf) of force.

8.13.5.2 The average puncture force shall be calculated and reported for all specimens tested.

8.13.6 Interpretation. The average puncture force shall be used to determine pass/fail performance.

8.13.7 Specific Requirements for Testing Examination and Cleaning Glove Materials.

8.13.7.1 Specimens shall consist of each composite of the palm, palm side of the fingers, and back of the glove with layers arranged in the proper order.

8.13.7.2 Where the specimens of the palm, palm side of the fingers, and back of the glove are identical, only one representative composite shall be required to be tested.

8.13.8 Specific Requirements for Testing Work Glove Materials.

8.13.8.1 Specimens shall be representative of the glove body composite construction at the following glove areas as described in 8.1.9: A-P, B-P, D-P, E-P, F-P, G-P, H-P, and I-P. Where the specimen composites of the palm and palm side of the fingers are identical, only one representative composite shall be required to be tested. All variations in composite construction and the order of layering of composite materials shall constitute a new composite and shall be tested separately. Where a composite is identical to another composite except for additional reinforcement layer(s), the composite with no reinforcement layers shall be representative of the composite with reinforcement layer(s). Specimens shall not include seams except in the following cases:

(1) Ridged areas or similar where stitching is used to create specific performance characteristics rather than for glove assembly
(2) When there are size constraints of a material making it necessary to allow stitching in order to create the sample size required

8.13.8.2 Stitching shall be of the same type as is used in the actual glove construction.

8.13.9 Specific Requirements for Testing Footwear Upper Materials. Specimens shall consist of each composite of the footwear item used in the actual footwear construction, excluding the tongue and gusset, with layers arranged in proper order. Where a composite is identical to another composite except for additional reinforcement layer(s), the composite with no reinforcement layers shall be tested. Specimens shall not include seams.

8.13.10 Specific Requirements for Testing Footwear Cover Materials. Specimens shall be taken from the footwear wear surface and shall include all layers used in the construction of the footwear cover from wear surface exterior to interior of the footwear cover.

8.13.10.1 Specimens shall be taken from the footwear cover that are representative of the footwear cover construction.

8.13.10.2 Where more than one material is used in the construction of the footwear cover, then each material shall be tested separately.

8.14 Dexterity Test One.

8.14.1 Application. This test shall be applied to examination gloves.

8.14.2 Specimens.

8.14.2.1 A minimum of three glove pairs each for size small and for size large shall be used for testing.

8.14.2.2 Each glove pair shall be tested as a complete set of gloves in new, as-distributed condition.

8.14.3 Sample Preparation.

8.14.3.1 Samples for conditioning shall be whole glove pairs.

8.14.3.2 Glove pair specimens shall be conditioned as specified in 8.1.2.

8.14.3.3 Glove pair specimens shall not receive special softening treatments prior to tests.

8.14.4 Procedure.

8.14.4.1 Dexterity shall be evaluated using the standardized procedure known as the Crawford Small Parts Dexterity Test, Screws Technique.

8.14.4.2 Two test subjects, one for hand size small and one for hand size large, shall be selected such that their hand dimensions are consistent with those specified in 6.2.1 for emergency medical examination gloves.

8.14.4.3 Each test subject used to perform the test shall practice until the baseline times of that person's last three repetitions vary no more than 6 percent.

8.14.4.4 Each test subject shall be tested with a minimum of three pairs of gloves. A minimum of six dexterity tests with gloves shall be conducted, with at least three dexterity tests with size small gloves and three dexterity tests with size large gloves.

8.14.4.5 Dexterity test times with gloves shall be compared with baseline dexterity test times for specific test subjects. The percentage of dexterity test times with gloves to baseline dexterity test times shall be calculated as follows:

$$\text{Percent of bare-handed control} = \frac{\text{Dexterity test time with gloves}}{\text{Baseline dexterity test time}} \times 100$$

8.14.5 Report. The percent of barehanded control shall be recorded and reported for each glove pair specimen and test subject tested.

8.14.6 Interpretation. One or more glove pair specimens failing this test shall constitute failing performance.

8.15 Protein Content Test.

8.15.1 Application. This test shall be applied to glove materials.

8.15.2 Specimens.

8.15.2.1 Specimens, measuring at least 25 mm (1 in.) square, shall be taken from a minimum of three different gloves for each glove type.

8.15.2.2 A minimum of three specimens per glove shall be tested.

8.15.3 Sample Preparation.

8.15.3.1 Samples for conditioning shall be whole gloves and shall be conditioned as specified in 8.1.2.

8.15.3.2 Specimens shall be taken from conditioned samples.

8.15.4 Procedure. Specimens shall be tested in accordance with ASTM D 5712, *Standard Test Method for Analysis of Aqueous Extractable Protein in Natural Rubber and Its Products Using the Modified Lowry Method*.

8.15.5 Report.

8.15.5.1 The protein level of each specimen shall be recorded and reported to the nearest 10 µg per gram of glove material.

8.15.5.2 The average protein level shall be calculated and reported for all specimens.

8.15.6 Interpretation. Pass/fail performance shall be based on the average reported protein level for each glove type.

8.16 Visual Acuity/Fogging Resistance Test.

8.16.1 Application. This test method shall apply to the portion of medical facemasks and eye and face protection device that cover the wearer's eyes.

8.16.2 Specimens.

8.16.2.1 A minimum of three specimens shall be tested.

8.16.2.2 Specimens shall be complete medical facemasks or eye and face protection devices.

8.16.2.3 Specimens shall be selected to fit each test subject in accordance with the manufacturer's sizing guidelines.

8.16.3 Sample Preparation.

8.16.3.1 Samples for conditioning shall be complete medical facemasks or eye and face protection devices.

8.16.3.2 Samples shall be conditioned as specified in 8.1.12.

8.16.4 Procedure.

8.16.4.1 Testing shall be conducted in an atmosphere with a temperature of 21°C ± 3°C, and a relative humidity of 50 percent ± 5 percent.

8.16.4.2 Testing shall be conducted using a minimum of three different test subjects.

8.16.4.3 The test subjects shall have a minimum visual acuity of 20/20 in each eye uncorrected, or corrected with contact lenses, as determined by a visual acuity test or doctor's examination.

8.16.4.4 Prior to evaluation for visual acuity, the medical facemask or eye and face protection device shall be inspected for functionality and the ability to be donned and adjusted in accordance with the manufacturer's instructions.

8.16.4.5 To evaluate visual acuity, the medical facemask or eye and face protection device shall be donned and adjusted in accordance with the manufacturer's instructions.

8.16.4.6 The test subject shall wear the medical facemask or eye and face protection device for a period of 3 minutes ± 30 seconds, before reading the eye chart. The 3-minute period shall commence when the facemask is fully donned and adjusted by the subject.

8.16.4.7 The test shall be conducted using a standard 6.1 m (20 ft) eye chart with a normal lighting range of 100 to 150 foot-candles at the chart and with test subjects positioned at a distance of 6.1 m (20 ft) from the chart.

8.16.4.8 Test subjects shall then read the standard eye chart through the medical facemask or eye and face protection device, and the visual acuity of each subject shall be determined.

8.16.5 Report.

8.16.5.1 The visual acuity of each test subject through the medical facemask or eye and face protection device shall be recorded and reported.

8.16.5.2 The ability of the test subject to don and doff the medical facemask or eye and face protection device without difficulty or without damage to the medical facemask or eye and face protection device shall be noted.

8.16.6 Interpretation.

8.16.6.1 Failure of any one test subject to achieve the required visual acuity while wearing the medical facemask or eye and face protection device shall constitute failure of the test.

8.16.6.2 If any medical facemask or eye and face protection device cannot be properly donned or doffed, or sustains any damage during the testing, the medical facemask or eye and face protection device shall be considered to have failed the test.

8.17 Liquidtight Integrity Test Three.

8.17.1 Application.

8.17.1.1 This test shall apply to medical facemasks and eye and face protection devices.

8.17.1.2 Modifications to this test method for evaluating medical facemasks shall be as specified in 8.17.8.

8.17.1.3 Modifications to this test method for evaluating single-use eye and face protection devices shall be as specified in 8.17.9.

8.17.1.4 Modifications to this test method for evaluating single-use eye and face protection devices shall be as specified in 8.17.10.

8.17.2 Specimens.

8.17.2.1 A minimum of three specimens shall be tested for each target area.

8.17.2.2 Specimens shall be complete medical facemasks or eye and face protection devices.

8.17.3 Sample Preparation.

8.17.3.1 Samples for conditioning shall be complete medical facemasks or eye and face protection devices.

8.17.3.2 Samples shall be conditioned as specified in 8.1.2.

8.17.4 Apparatus.

8.17.4.1 The test apparatus shall be as specified in ASTM F 1862, *Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity)*.

8.17.4.2 Where needed to support the specimen, a headform shall be used.

8.17.4.3 The headform shall be permitted to be a human-shape headform, such as the Alderson headform shown in Figure 6.3.2.4.

8.17.5 Procedures. Medical facemasks and eye and face protection devices shall be tested as specified in ASTM F 1862, *Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity)*, with the modifications specified below:

(1) The medical facemask or eye and face protection device shall be positioned on an appropriate holder or headform such that the distance from the tip of pneumatic valve cannula to the target area on the face protection device is 305 mm (12 in.) and the target area of the medical facemask or eye and face protection device is perpendicular to the path of the synthetic blood.
(2) Testing shall be conducted at a blood velocity equivalent to a blood pressure of 21.3 kPa (160 mm Hg).
(3) An absorptive blotting paper or similar absorptive material shall be permitted to be placed on the interior side of the medical facemask or eye and face protection device to provide an aid in determining the occurrence of synthetic blood strikethrough.
(4) Pass/fail results shall be reported only. An acceptable quality limit shall not be applied in testing.

8.17.5.1 Straps, ear loops, and temple portions of face protection devices shall not be evaluated.

8.17.6 Report. The pass/fail result for each target for each face protection device evaluated shall be recorded and reported.

8.17.7 Interpretation. Failure of any one target area for any tested face protection device shall constitute failing performance for the face protection device.

8.17.8 Specific Requirements for Testing Medical Facemasks.

8.17.8.1 Where medical facemasks do not incorporate visors or faceshields, target areas shall include locations 13 mm (½ in.) from each side of the medical facemask and 13 mm (½ in.) from the top and bottom of the medical facemask, centered on the horizontal height or span of the medical facemask, respectively.

8.17.8.2 Where medical facemasks do incorporate visors or faceshields, target areas shall include locations 13 mm (½ in.) from each side of the medical facemask, 13 mm (½ in.) from the bottom of the medical facemask, and 13 mm (½ in.) from the bottom center of the visor or faceshield centered on the horizontal height or span of the medical facemask, respectively.

8.17.8.3 Target areas shall not coincide with attachment points for ear loops or other attachment or hardware provided on the medical facemask.

8.17.9 Specific Requirements for Testing Single-Use Eye and Face Protection Devices.

8.17.9.1 Specific target areas on each eye and face protection device to be evaluated shall include the portions of the eye and face protection device that directly cover the center of each of the wearer's eyes, two locations 13 mm (½ in.) from the edge of the protective area provided by the eye and face protection device, and at least one location at every representative seam or junction of the eye and face protection device.

8.17.9.2 Target areas shall not coincide with attachment points for ear loops or other attachment or hardware provided on the eye and face protection device.

8.17.10 Specific Requirements for Testing Multiple-Use Eye and Face Protection Devices. Specific target areas shall include at least one location at every representative juncture or interface between different items that are not continuous for the eye and face protection device.

8.18 Cut Resistance Test.

8.18.1 Application.

8.18.1.1 This test method shall apply to cleaning/utility gloves, work gloves, and footwear upper materials.

8.18.1.2 Modifications to this test method for evaluation of cleaning/utility gloves shall be as specified in 8.18.7.

8.18.1.3 Modifications to this test method for evaluation of work gloves shall be as specified in 8.18.8.

8.18.1.4 Modifications to this test method for evaluation of footwear upper materials shall be as specified in 8.18.9.

8.18.2 Specimens. A minimum of three specimens shall be tested.

8.18.3 Sample Preparation.

8.18.3.1 Samples for conditioning shall be whole gloves or footwear uppers.

8.18.3.2 Specimens shall be conditioned as specified in 8.1.2.

8.18.4 Procedure. Specimens shall be evaluated in accordance with ASTM F 1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, with the modification that specimens shall be tested to a specific load with the measurement of cut distance.

8.18.5 Report.

8.18.5.1 The cut distance shall be recorded and reported to the nearest 1 mm (1/32 in.) for each specimen.

8.18.5.2 The average cut distance in mm (in.) shall be calculated and reported for all specimens tested.

8.18.6 Interpretation. The average cut distance shall be used to determine pass/fail performance.

8.18.7 Specific Requirements for Testing Cleaning/Utility Gloves.

8.18.7.1 Specimens shall be taken from the back and palm of the glove and shall not include seams.

8.18.7.2 Cut resistance testing shall be performed under a load of 25 g (0.9 oz).

8.18.8 Specific Requirements for Testing Work Gloves.

8.18.8.1 Specimens shall be representative of the glove body composite construction at the following glove areas as described in 8.1.9 and shall not include seams: A-P, B-P, D-P, E-P, F-P, G-P, H-P, I-P, A-B, B-B, D-B, E-B, F-B, G-B, H-B, and I-B. Specimens shall be representative of each glove body composite construction. All variations in composite construction and the order of layering of composite materials shall constitute a new composite and shall be tested separately. Where a composite is identical to another composite except for additional reinforcement layer(s), the composite with no reinforcement layers shall be representative of the composite with reinforcement layer(s). Specimens shall not include seams except in the following cases:

(1) Ridged areas or similar where stitching is used to create specific performance characteristics rather than for glove assembly
(2) When there are size constraints of a material making it necessary to allow stitching in order to create the sample size required

8.18.8.2 Stitching shall be of the same type as is used in the actual glove construction.

8.18.8.3 Cut resistance testing shall be performed under a load of 150 g (5.3 oz).

8.18.9 Specific Requirements for Testing Footwear Upper Materials.

8.18.9.1 Specimens shall consist of each composite of the footwear upper used in the actual footwear construction, excluding the tongue and gusset with layers arranged in proper order. Where a composite is identical to another composite except for additional reinforcement layer(s), the composite with no reinforcement layers shall be tested. Specimens shall not include seams.

8.18.9.2 Cut resistance testing shall be performed under a load of 350 g (12.3 oz).

8.19 Abrasion Resistance Test One.

8.19.1 Application. This test method shall apply to footwear soles.

8.19.2 Sample Preparation.

8.19.2.1 Samples shall be uniform cylinders of footwear soles and heel material.

8.19.2.2 Samples shall be conditioned as specified in 8.1.2.

8.19.3 Specimens.

8.19.3.1 Specimens shall be uniform cylinders of footwear soles and heel material.

8.19.3.2 At least three specimens shall be tested.

8.19.4 Procedure. Abrasion resistance shall be performed in accordance with ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using rotating cylindrical drum device*, Method A, with a vertical force of 10 N over an abrasion distance of 40 m.

8.19.5 Report. The relative volume loss of each specimen shall be recorded and reported.

8.19.6 Interpretation. One or more footwear specimens failing this test shall constitute failing performance.

8.20 Slip Resistance Test.

8.20.1 Application. This test method shall apply to footwear.

8.20.2 Sample Preparation.

8.20.2.1 Samples shall be the whole footwear in men's size 9D, medium width.

8.20.2.2 Samples shall be conditioned as specified in ISO 13287, *Personal Protective Equipment — Footwear — Test Method for Slip Resistance*.

8.20.3 Specimens.

8.20.3.1 Specimens shall be the whole footwear in men's size 9D, medium width.

8.20.3.2 At least three specimens shall be tested.

8.20.4 Procedure. Slip resistance shall be performed in accordance with ISO 13287, *Personal Protective Equipment — Footwear — Test Method for Slip Resistance*, in the following configurations. References to any other flooring and/or contaminant within ISO 13287 shall not apply.

(1) Footwear shall be tested both in the forepart and heel positions.
(2) Footwear shall be tested in the wet condition. The wet condition shall be achieved using distilled or deionized water.

The water shall be applied to thoroughly wet the testing surface and make a pool at least as wide and long as the test portion of the footwear in the area of initial contact.

(3) Footwear shall be tested on a quarry tile surface that meets the following specifications:
   (a) The quarry tile is a flat and unglazed clay tile that is wider than the test specimen and long enough to allow a sliding distance of at least 75 mm without crossing a joint.
   (b) The quarry tile is sufficiently flat to allow it to be secured on the mounting table such that no movement occurs between the tile and mounting table during the test.
   (c) The quarry tile has a ribbed profile or directional marking on the underside to identify the direction in which the tile should be aligned (with the ribs parallel to the sliding direction).
   (d) The quarry tile conforms to the coefficient of friction values specified in Table A.8.20.4 when calibrated by the Slider 96 method.

(4) Calibration of the tiles shall be checked after every 10 tests or prior to each day of testing, whichever is the less frequent, to ensure that they are not being worn smooth or otherwise damaged.

Table 8.20.4 Calibration Values for Quarry Tile

	Dry CoF	Wet CoF
Minimum	0.57	0.43
Maximum	0.63	0.49

8.20.5 Report.

8.20.5.1 The coefficient of friction of each specimen shall be reported.

8.20.5.2 The average coefficient of friction of all specimens for each configuration shall be calculated, recorded, and reported.

8.20.6 Interpretation. The average coefficient of friction for each configuration shall be used to determine pass/fail performance.

8.21 Eyelet and Stud Post Attachment Test.

8.21.1 Application. This test method shall apply to protective footwear eyelets and stud posts.

8.21.2 Specimens.

8.21.2.1 Specimens shall total two eyelets and two stud posts on three separate footwear items.

8.21.2.2 Specimens shall be removed from the footwear and shall be 25 mm × 50 mm (1 in. × 2 in.).

8.21.3 Sample Preparation.

8.21.3.1 Samples for conditioning shall be whole footwear.

8.21.3.2 The eyelets or stud post specimens shall be conditioned as specified in 8.1.2.

8.21.4 Apparatus.

8.21.4.1 A tensile testing machine shall be used with a traverse rate of 50 mm/min (2 in./min).

8.21.4.2 Clamps measuring 25 mm × 38 mm (1 in. × 1½ in.) shall have gripping surfaces that are parallel, flat, and capable of preventing slippage of the specimen during the test.

8.21.5 Procedure.

8.21.5.1 The stud post or eyelet puller shall be inserted or attached to the upper position of the tensile machine.

8.21.5.2 The traverse rate shall be set at 50 mm/min (2 in./min). The test eyelet or stud post shall be attached using the appropriate puller fixture.

8.21.5.3 The eyelet stay shall be clamped, but clamping the base of the eyelets or stud hooks in the lower clamps shall not be permitted.

8.21.5.4 The distance between the clamps and stud hooks or eyelets shall be 2 mm to 3 mm ± 0.5 mm (1/16 in. to 1/8 in. ± 1/64 in.).

8.21.5.5 The test shall then be started.

8.21.6 Report.

8.21.6.1 The force will reach a peak, decline slightly, and then increase to complete failure; however, the value at which the force first declines shall be recorded and reported as the initial failure point, as this is the separation point of the material around the eyelet or stud post.

8.21.6.2 The average force shall be calculated and reported.

8.21.7 Interpretation. The average force shall be used to determine pass/fail.

8.22 Corrosion Resistance Test.

8.22.1 Application. This test method shall apply to hardware items on multiple-use eye and face protection devices, work gloves, footwear, and helmets.

8.22.2 Specimens. A total of five different items of each hardware type shall be tested.

8.22.3 Sample Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.22.4 Procedure.

8.22.4.1 Specimens shall be tested in accordance with ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*. Salt spray shall be 5 percent saline solution, and test exposure shall be for 20 hours, +1/–0 hour.

8.22.4.2 Immediately following the test exposure and prior to examination, specimens shall be rinsed under warm, running tap water and dried with compressed air.

8.22.4.3 Specimens shall then be examined visually with the unaided eye to determine pass/fail.

8.22.4.4 The functionality of each specimen shall be evaluated.

8.22.5 Report. The presence of corrosion and the functionality of each specimen shall be recorded and reported.

8.22.6 Interpretation. One or more hardware specimens failing this test shall constitute failing performance for the hardware type.

8.23 Overall Liquid Integrity Test Four.

8.23.1 Application. This test shall apply to protective footwear.

8.23.2 Samples.

8.23.2.1 A minimum of three footwear items shall be tested.

8.23.2.2 Samples for conditioning shall be whole footwear.

8.23.3 Specimen Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.23.4 Procedure.

8.23.4.1 Protective footwear shall be tested in accordance with FIA Standard 1209, *Whole Shoe Flex*, with the following modifications:

(1) Water shall not be used.
(2) The flex speed shall be 60 cycles/min +/− 2 cycles/min.
(3) Alternative flexing equipment shall be permitted to be used when the flexing equipment meets the following parameters:
   (a) The alternative flexing equipment shall be capable of providing the angle of flex as described in FIA 1209.
   (b) The alternative flexing equipment shall be capable of a flex speed of 60 cycles/min +/− 2 cycles/min.
   (c) The alternative flexing equipment shall provide a means of securing the footwear during flexing.

8.23.4.2 The test shall consist of 100,000 flexes.

8.23.4.3 After flexing, the footwear specimen shall be marked with a water height line on the exterior at a height of 75 mm (3 in.) below the height of the boot as defined in 6.4.2.3.1 and 6.4.3.2.1, but no lower than 75 mm (3 in.) for multiple-use emergency medical footwear or no lower than 50 mm (2 in.) for multiple-use medical care facility footwear, where measured up from the center of the insole at the heel.

8.23.4.4 The measurement shall be made on the interior and transferred to the exterior. Plain white paper toweling shall be placed inside the footwear specimen such that the paper toweling intimately contacts all areas inside the footwear specimen to at least the water height line.

8.23.4.5* The footwear specimen shall then be placed in a container that allows its immersion in tap water, treated with a dye and surfactant that achieves a surface tension of 35 dynes/cm ± 5 dynes/cm, to the water height line.

8.23.4.6 After 2 hours ± 10 minutes, the paper toweling shall be removed and examined for evidence of liquid leakage.

8.23.5 Report. The appearance of water leakage on the removed paper toweling shall be recorded and reported as failure for the tested specimen.

8.23.6 Interpretation. One or more footwear specimens failing this test shall constitute failing performance.

8.24 Chemical Permeation Resistance Test.

8.24.1 Application. This method shall apply to cleaning/utility glove materials.

8.24.2 Samples. Specimens shall be conditioned as specified in 8.1.2.

8.24.3 Specimens.

8.24.3.1 A minimum of three specimens shall be tested.

8.24.3.2 Specimens with nonuniform surfaces shall be permitted to be treated with an impermeable nonreactive sealant outside the area of the specimen exposed to the challenge chemical in order to allow sealing of the test cell to a uniform surface of the specimen.

8.24.3.3 Following any sample preparation, the specimens shall be conditioned at a temperature of 32° C +/− 1° C (90° F +/− 2° F) and at a relative humidity of 80 percent +/− 5 percent, for at least 24 hours prior to testing in accordance with 8.24.7.1.1.

8.24.4 Apparatus.

8.24.4.1 A controlled environmental chamber shall be used to maintain the test cell, air flow control system, and reagent chemicals within +/− 1.0° C (+/− 2.0° F) of the test temperature and +/− 5 percent of the test relative humidity. The controlled environment chamber shall be sized so that it can be used for conditioning test materials, test cells when not in use, challenge chemicals, and other test apparatus prior to testing, as well as holding the test cells horizontally during use while connected to the air delivery system with manifold and to the effluent sampling mechanism.

8.24.4.2* The test cell shall be a two-chambered cell for contacting the specimen with the challenge chemical on the specimen's normal outside surface and for flowing a collection medium on the specimen's normal inside surface, consisting of parts shown in Figure 8.24.4.2(a) and individual part detail shown in Figure 8.24.4.2(b) through Figure 8.24.4.2(f).

8.24.4.3* An air delivery system and manifold shall be used to provide oil-free, conditioned air to the test cell/fixtures at a rate of 2 standard liters per minute (SLPM) per test cell per fixture, with a temperature precision of +/− 0.2°C and a relative humidity precision of +/− 5 percent. The manifold is designed to deliver 0.3 L/min for the challenge side of the test cell and 1 L/min for the collection side of the test cell, and maintain at the test temperature. All parts of the air delivery system and manifold shall be chemically inert and nonabsorptive to the challenge chemical.

8.24.4.4* An analytical system shall be used to evaluate the amount of challenge chemical in the effluent air streams from the collection side of the test cell and shall be selected to provide the ability to measure the challenge chemical at 0.1 $\mu g/cm^2$ over the test exposure period. The analytical system shall be permitted to include a bubbler tube, solid sorbent, or real time chemical analyzer. Effluent sampling shall be permitted to be taken discretely or cumulatively; however, the selected analytical system shall be able to determine all of the challenge chemical permeating through the specimen in 60 minutes.

8.24.4.5 A vacuum pump capable of creating vacuum of at least 5 in. water column shall be used for testing the integrity of the assembled test cell.

8.24.4.6 A manometer or pressure gauge capable of measuring pressures or vacuums to 10 in. water column, with an accuracy of 5 percent of scale, shall be used for testing the integrity of the assembled test cell.

8.24.5 Supplies.

8.24.5.1* Replacement O-rings shall be available for use in the permeation test cell.

8.24.5.1.1* If unknown, the compatibility of the O-ring material with the challenge chemical shall be verified before use.

8.24.5.1.2 If an O-ring shows any signs of chemical degradation in the form of softening, hardening, swelling, deterioration, or loss of shape or function, an O-ring of different material shall be used that does not show chemical degradation.

8.24.5.2* An inert impermeable surrogate material shall be used as a negative control during validation tests.

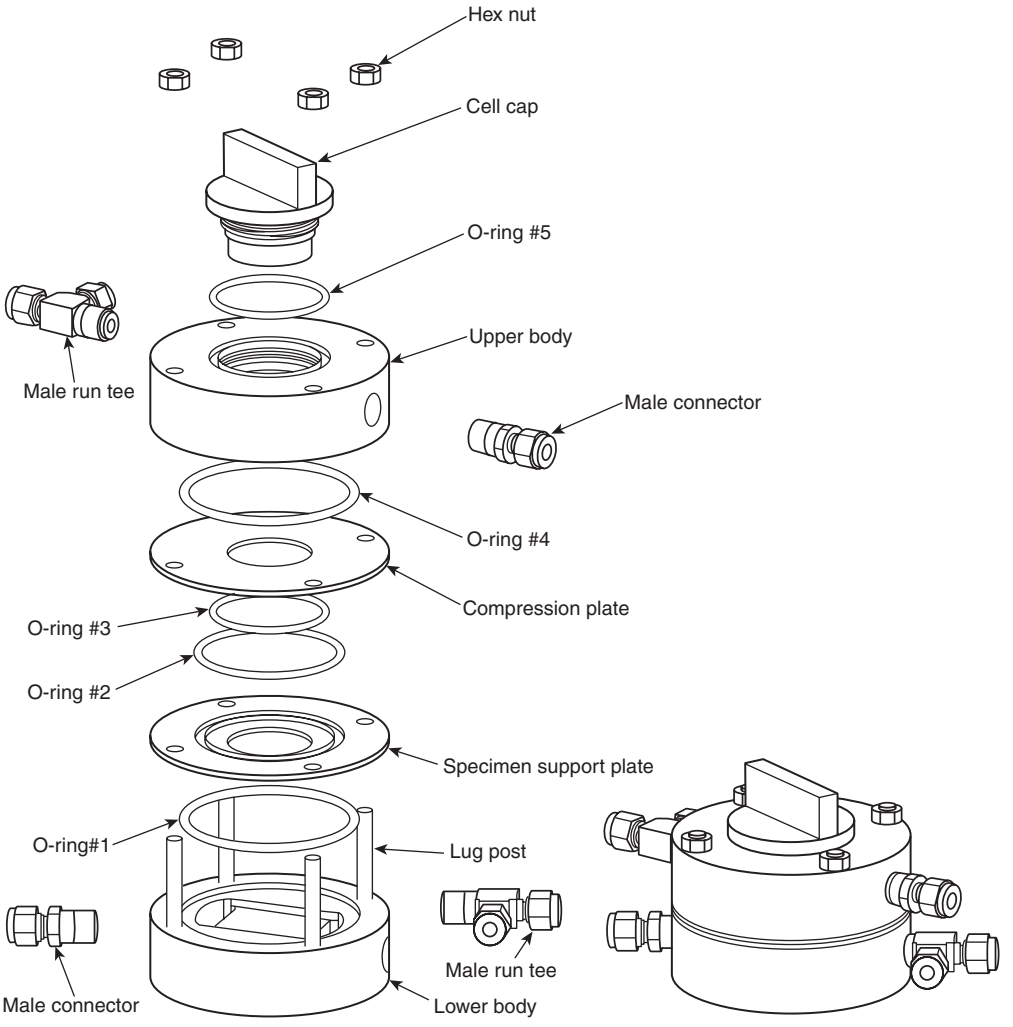


FIGURE 8.24.4.2(a) Diffusion Test Cell Assembly. (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

8.24.6 Chemicals. The following challenge chemicals shall be tested as liquids:

(1) 40 percent weight-for-weight (w/w) solution of glutaraldehyde
(2) 70 percent w/w isopropanol
(3) 5 percent solution of sodium hypochlorite
(4) 30 percent w/w hydrogen peroxide

8.24.7 Procedures.

8.24.7.1 Preconditioning.

8.24.7.1.1 The challenge chemicals, test specimen, test equipment, and test cell assembly shall be placed in the environmental chamber for a minimum of 24 hours at 32°C +/− 1°C (90°F +/− 2°F) and at a relative humidity of 80 percent +/− 5 percent, prior to testing.

8.24.7.2 Test Cell Assembly.

8.24.7.2.1 The test cell shall be assembled in the environmental chamber at 32°C +/− 1°C (90°F +/− 2°F) and at a relative humidity of 80 percent+/− 5 percent.

8.24.7.2.2 O-Ring #1 shall be placed on the lower body (collection side) of the test cell.

8.24.7.2.3 The sample support plate shall be placed on the lower body (collection side) of the test cell.

8.24.7.2.4 O-ring #2 (outer) and O-ring #3 (inner) shall be placed in the respective grooves on the sample support plate.

8.24.7.2.5 The specimen shall be removed from the conditioning location in the environmental chamber and shall be placed on top of the sample support plate.

8.24.7.2.6 With the upper body (challenge side) of the test cell upside down, O-ring #4 shall be placed in the upper body of the test cell on the specimen side and the compression plate shall be positioned over O-ring #4.

8.24.7.2.7 The upper body (challenge side) of the test cell with O-ring #4 and the compression plate shall be inverted, aligned with the lug posts, and joined with the lower body (collection side) of the test cell.

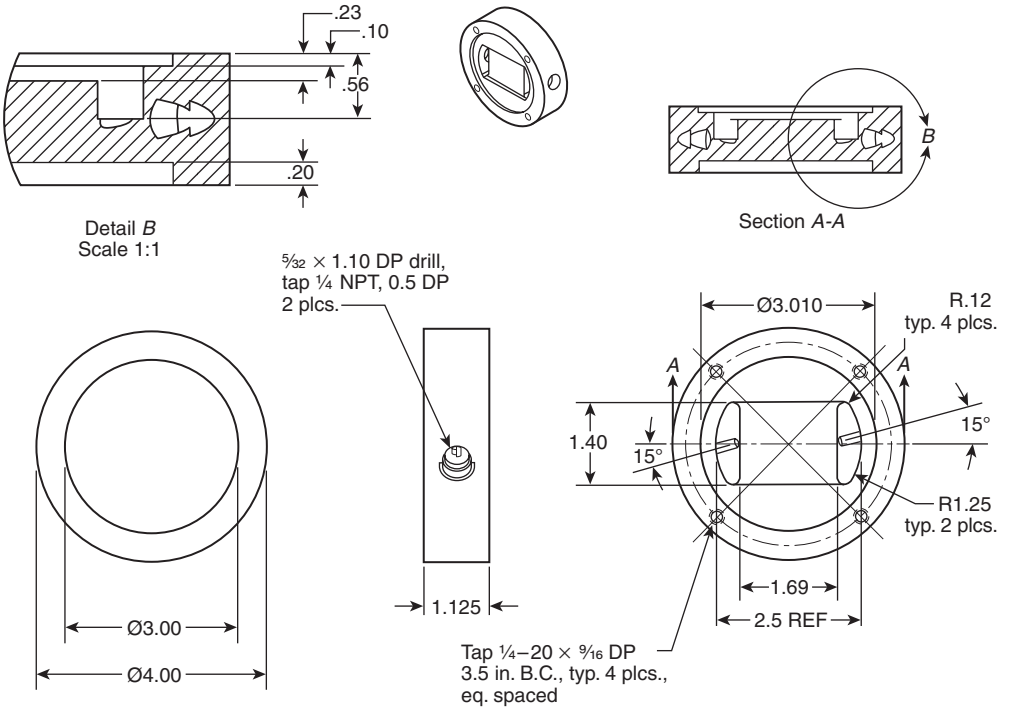


FIGURE 8.24.4.2(b) Lower Body (Collection Side). (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

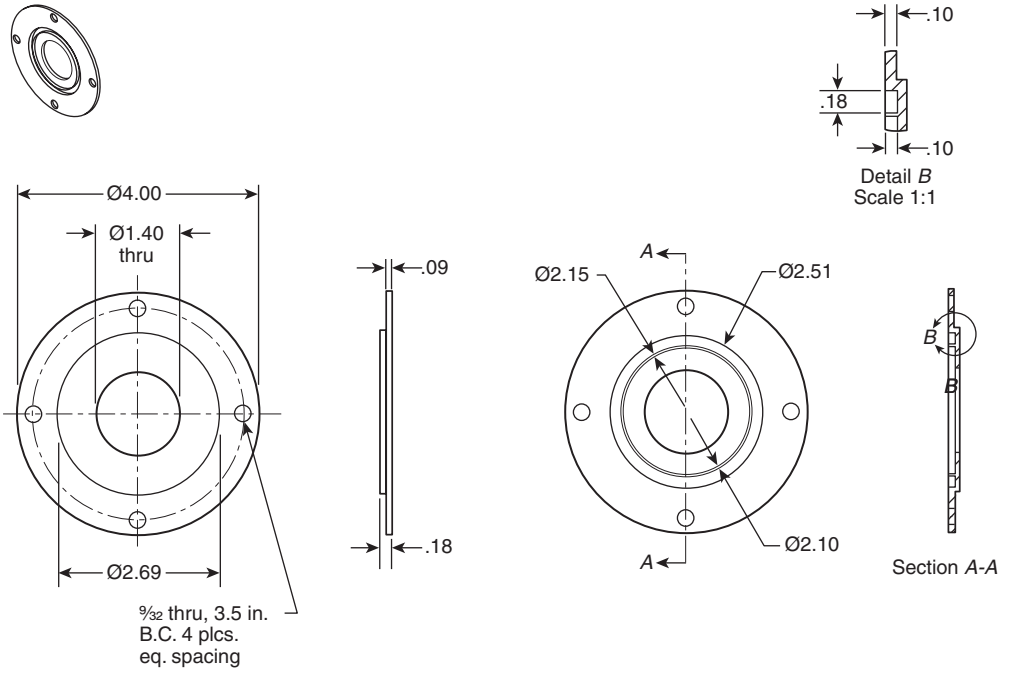


FIGURE 8.24.4.2(c) Sample Support Plate. (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

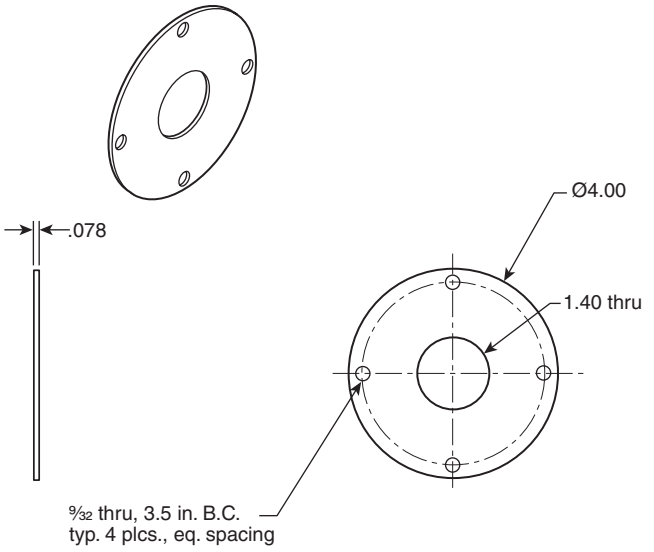


FIGURE 8.24.4.2(d) Compression Plate. (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

8.24.7.2.8 Using the four cell sealing lugs, the cell halves shall be clamped together and 51.8 cm-kg (45 in.-lb) of torque shall be applied to each lug to ensure a proper cell seal.

8.24.7.2.9 O-ring #5 shall be inserted into the groove around the agent challenge port in the upper body of the test cell, and the cell top cap shall be screwed into place.

8.24.7.2.10 The integrity of the test cell assembly shall be verified using the procedure in 8.24.7.3.

8.24.7.2.11 Each test cell shall be labeled with the challenge chemical to be used in it.

8.24.7.3 Verification of Test Cell Integrity.

8.24.7.3.1 Test cell integrity shall be performed in the environmental chamber at 32°C +/− 1°C (90°F +/− 2°F) and at a relative humidity of 80 percent +/− 5 percent.

8.24.7.3.2 Valves on the outlet ports of the upper and lower body of the test cell shall be closed.

8.24.7.3.3 Both the upper and lower body inlet ports of the test cell shall be connected to a manometer.

8.24.7.3.4 Both inlet ports shall be connected to a vacuum, and the test cell upper body and test cell lower body shall be depressurized to 75 mm (3 in.) water column pressure.

8.24.7.3.5 If the test cell pressure drops below 50 mm (2 in.) of water column within 2 minutes, the test cell shall be reassembled according to the steps in 8.24.7.2.

8.24.7.3.6 Only test cells that have passed this integrity test shall be used for testing.

8.24.7.4 Determination of Procedure for Applying Liquid Challenge Chemicals. Sufficient liquid shall be dispensed into the test cell such that a uniform, contiguous layer remains over the test exposure period.

8.24.7.5 Procedure for Liquid Chemical Challenge.

8.24.7.5.1 The test cell shall be mounted horizontally and connected to the air delivery system in the environmental chamber at 32°C +/− 1°C (90°F +/− 2°F) and at a relative humidity of 80 percent +/− 5 percent. All connections shall be secured.

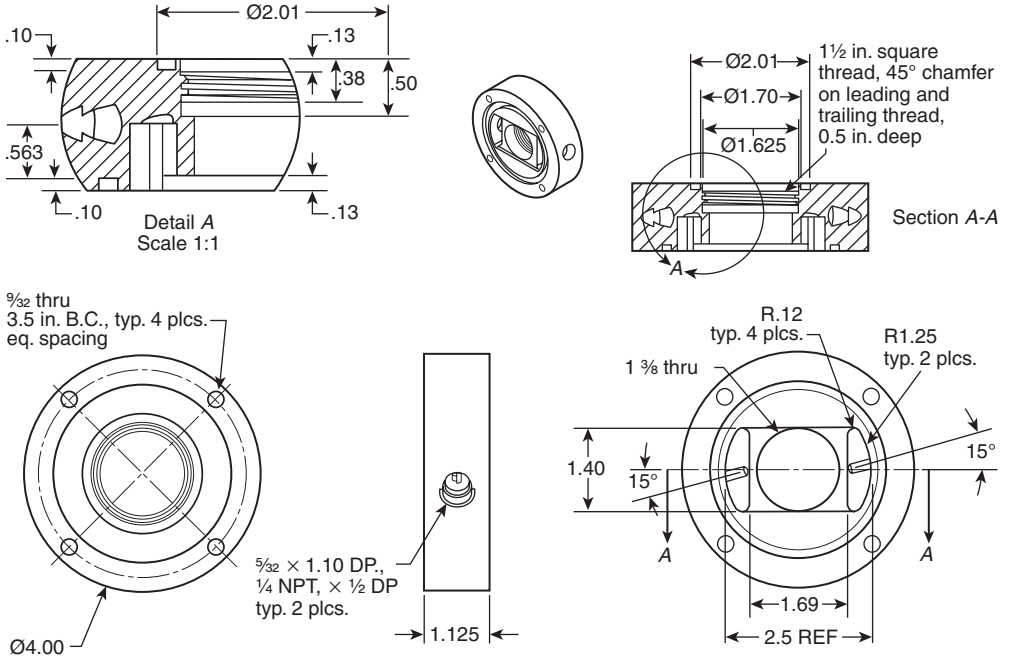


FIGURE 8.24.4.2(e) Upper Body (Challenge Side). (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

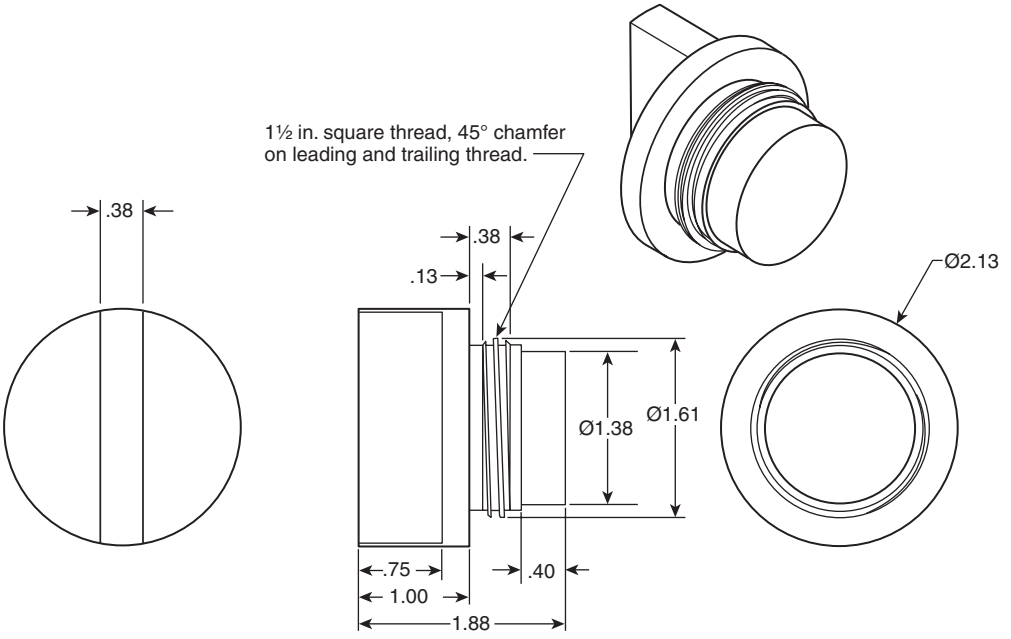


FIGURE 8.24.4.2(f) Top Cap. (Copyright © 2006, W. L. Gore & Associates, Inc. Used by permission.)

8.24.7.5.2 The calibrated analytical detection system shall be assembled and initiated according to its instructions.

8.24.7.5.2.1 If bubblers are used, each bubbler shall be filled with the proper collection solvent using a calibrated pipette or equivalent device; the collection solvent shall incorporate an internal standard so adjustments can be made for solvent evaporation/water condensation during sampling.

8.24.7.5.2.2 If solid sorbent tubes are to be used, each sorbent tube shall be cleaned by heating and purging; the absence of any residual chemical shall be verified by the appropriate analysis technique.

8.24.7.5.3 The air delivery shall be flowing filtered air at a temperature of 32°C +/–1°C (90°F +/–2°F) and at a relative humidity of 80 percent +/– 5 percent, to the collection side of the test cell at least 15 minutes prior to the application of the challenge chemical.

8.24.7.5.4 With the cell top cap removed, one-microliter droplets shall be placed through the agent challenge port of the test cell on the specimen's outer surface within 20 seconds, according to the procedure determined in 8.24.7.4.

8.24.7.5.5 After the liquid challenge chemical is placed on the specimen in the test cell, the cell top cap shall be sealed within 5 seconds.

8.24.7.5.5.1 Filtered air at a temperature of 32°C +/– 1°C (90°F +/– 2°F) and at a relative humidity of 80 percent +/– 5 percent shall be flowed only to the collection side of the test cell at a rate of 1.0 L/min +/– 0.1 L/min. No air shall be flowed across the challenge side of the test cell.

8.24.7.5.6 The challenge chemical in the effluent air stream shall be collected, measured, and analyzed using either discrete or cumulative methods for 60 minutes +1.0/– 0 minutes.

8.24.7.5.7 The collection media for the challenge chemical shall be analyzed using an appropriate analytical procedure.

8.24.7.5.8 At least one test shall be conducted with a specimen, but without the challenge chemical, as a negative control.

8.24.7.5.9* At least one test shall be conducted with an inert impermeable surrogate specimen as a negative control.

8.24.7.5.10 The results from tests accompanied by unsuccessful negative controls shall not be used, and the test shall be repeated.

8.24.7.6 Test Conclusion, Test Cell Cleaning, and Specimen Disposal.

8.24.7.6.1 At the conclusion of the test, the test cell shall be purged and the air delivery and analytical system shall be shut down.

8.24.7.6.2 Each cell shall be disassembled one at a time.

8.24.7.6.3 The tested specimen shall be inspected for degradation or other obvious abnormalities; these observations shall be recorded with the test results.

8.24.7.6.4 Disposal of tested specimens and other supplies shall be handled according to local, state, federal, or other applicable regulations.

8.24.7.6.5 Each component of the test cell shall be rinsed with acetone or other appropriate solvent to remove residual chemicals.

8.24.7.6.6 The cell shall be allowed to air dry in a clean area for 24 hours before reuse.

8.24.8 Report.

8.24.8.1 The cumulative permeation in 1 hour shall be calculated, recorded, and reported in $\mu g/cm^2$ for each specimen for each challenge chemical.

8.24.8.1.1 If no challenge chemical is detected at the end of the 60-minute test period, then the cumulative permeation shall be recorded and reported as less than the minimum detectable mass per unit area for the specific chemical being tested.

8.24.8.2 The average cumulative permeation shall be calculated and reported by averaging the results from all specimens for each challenge chemical.

8.24.8.2.1 For the calculation of average cumulative permeation, if the results of one or more of the specimens tested is less than the minimum detectable cumulative permeation, then the minimum detectable cumulative permeation shall be used as the result for those specimens.

8.24.8.2.2 For the calculation of average cumulative permeation, if the results of all the specimens tested are less than the minimum detectable cumulative permeation, then the average cumulative permeation shall be reported as the minimum detectable cumulative permeation.

8.24.8.3 Any observations of degradation or other abnormalities at the conclusion of the testing of each specimen shall be reported.

8.24.9 Interpretation. The average cumulative permeation for each challenge chemical shall be used to determine pass or fail performance.

8.25 Abrasion Resistance Test Two.

8.25.1 Application.

8.25.1.1 This test shall apply to cleaning/utility glove, work glove, and footwear cover materials.

8.25.1.2 Modifications to this test method for testing cleaning/utility glove materials shall be as specified in 8.25.7.

8.25.1.3 Modifications to this test method for testing work glove materials shall be as specified in 8.25.8.

8.25.1.4 Modifications to this test method for testing work footwear cover wear surface materials shall be as specified in 8.25.9.

8.25.2 Specimens. A minimum of five specimens shall be tested.

8.25.3 Sample Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.25.4 Procedure.

8.25.4.1 Specimens shall be tested in accordance with ASTM D 3884, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method),* using a Calibrase H-18 wheel.

8.25.4.2 At the end of each abrasion exposure, the specimen shall be examined for evidence of wear-through. Wear-through shall be defined as the occurrence of one or more holes that permits the insertion of a 6.5 mm (¼ in.) rod into the abraded area.

8.25.5 Report. The wear-through determination shall be recorded and reported for each specimen tested.

8.25.6 Interpretation. Any specimen showing wear-through shall constitute failure of this test.

8.25.7 Specific Requirements for Testing Cleaning/Utility Gloves. Testing shall be conducted under a load of 500 g, and specimens shall be examined after 1000 cycles.

8.25.8 Specific Requirements for Testing Work Gloves.

8.25.8.1 Specimens shall be taken from the palm area of the gloves representative of the glove body composite construction at the following glove areas as described in 8.1.9 and shall not include seams: A-P, B-P, D-P, E-P, F-P, G-P, H-P, I-P, A-B, B-B, D-B, E-B, F-B, G-B, H-B, and I-B. Specimens shall be representative of each glove body composite construction. Samples and specimens shall be permitted to be materials representative of those used in the construction of the glove. Specimens shall consist of a separable layer outside the barrier layer of the glove composite.

8.25.8.2 Testing shall be conducted under a load of 500 g, and specimens shall be examined after 1000 cycles.

8.25.8.3 The layer outside the barrier layer in the work glove shall be examined for wear-through.

8.25.9 Specific Requirements for Testing Footwear Cover Wear Surface Materials.

8.25.9.1 Specimens shall include all layers used in the construction of the footwear cover at the wear surface.

8.25.9.2 Testing shall be conducted under a load of 1000 g, and specimens shall be examined after 5000 cycles.

8.25.9.3 The combination of all layers shall be examined for wear-through.

8.26 Dexterity Test Two.

8.26.1 Application.

8.26.1.1 This test shall apply to cleaning/utility gloves and work gloves.

8.26.1.2 Modifications for testing work gloves shall be as specified in 8.25.8.

8.26.2 Specimens.

8.26.2.1 A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.26.2.2 Each glove pair shall be tested as a complete set of gloves in new, as-distributed, condition.

8.26.2.3 Glove pair specimens shall not receive special softening treatments prior to tests.

8.26.3 Sample Preparation.

8.26.3.1 Samples for conditioning shall be whole glove pairs.

8.26.3.2 Glove pair specimens shall be preconditioned as specified in 8.1.2.

8.26.4 Apparatus. The test apparatus shall be as specified in ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test.*

8.26.5 Procedures. Gloves shall be tested as specified in ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test.*

8.26.6 Report.

8.26.6.1 The average percent of barehanded control shall be recorded and reported for each test subject.

8.26.6.2 The average percent of barehanded control for all test subjects shall be calculated and reported.

8.26.7 Interpretation. The average percent of barehanded control shall be used to determine pass or fail performance.

8.27 Grip Test.

8.27.1 Application. This test method shall apply to work gloves.

8.27.2 Specimens.

8.27.2.1 A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.27.2.2 Each glove pair shall be tested as a complete set of gloves in new, as-distributed condition.

8.27.2.3 Glove pair specimens shall not receive special softening treatments prior to tests.

8.27.2.4 Glove pair specimens shall be tested for each material and construction combination.

8.27.3 Sample Preparation.

8.27.3.1 Samples for conditioning shall be whole gloves.

8.27.3.2 Glove pair specimens shall be preconditioned as specified in 8.1.3.

8.27.3.3 Glove pair specimens shall be tested after being conditioned for dry conditions as specified in 8.1.2.

8.27.3.4 Glove pair specimens shall be tested after being conditioned for wet conditions as specified in 8.1.8.

8.27.4 Apparatus. Grip testing shall be evaluated with the use of a 9.5 mm (⅜ in.) diameter, three-strand prestretched polyester rope attached to a calibrated force measuring device.

8.27.5 Procedure.

8.27.5.1 Two test subjects, one for hand size small as determined using the glove size dimensions in EN 420, *General requirements for gloves*, and one for hand size large as determined using the glove size dimensions in EN 420, shall be utilized for this test.

8.27.5.2 Each test subject shall make three successive attempts to exert as much horizontal pulling force as possible using the rope and force measuring device, using both hands, one in front of the other. Thumbs shall not overlap the fingers, and both feet shall be firmly planted on the ground. The average horizontal pulling force over the three attempts shall be the barehanded control value.

8.27.5.3 Wet conditioned sample gloves shall be tested on a wet rope. Gloves shall be subjected to wet conditioning as specified in 8.1.8. The rope shall be subjected to wet conditioning by immersion in room temperature water [21°C ± 3°C (75°F ± 5°F)] for 2 minutes, followed by horizontal drip-drying for 5 minutes.

8.27.5.4 Each test subject shall test a minimum of three pairs of sample gloves using the method specified in 8.27.5.2. Test subjects shall attempt one trial with each pair of gloves. A trial shall consist of three successive attempts. The average horizontal pulling force over the three attempts shall be the pulling force with gloves. The average horizontal pulling force shall be calculated, recorded, and reported for each glove pair.

8.27.5.5 The average pulling force with gloves over the three trials for each size shall be calculated, recorded, and reported. The average pulling force with gloves shall be compared with the barehanded control value.

8.27.5.6 The percentage of barehanded value shall be calculated as follows:

$$\text{Percentage of barehanded control value} = \frac{PF_g}{CV_b} \times 100$$

where:
PF_g = average pulling force with gloves
CV_b = barehanded control value

8.27.6 Report. The percent of barehanded control shall be recorded and reported for each glove pair specimen, condition, and test subject tested.

8.27.7 Interpretation. One or more glove pair specimens failing this test shall constitute failing performance.

8.28 Glove Donning Test.

8.28.1 Application. This test shall apply to work gloves.

8.28.2 Specimens. A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.28.3 Sample Preparation.

8.28.3.1 Samples for conditioning shall be whole gloves.

8.28.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.28.3.3 All glove opening configurations shall be considered for testing.

8.28.4 Procedure.

8.28.4.1 Two test subjects, one for hand size small and one for hand size large, shall be selected such that their hand dimensions are as close as possible to the middle of the range for hand length and hand circumference as specified by the manufacturer for small and large gloves.

8.28.4.2 Each donning trial shall start with the glove lying in front of the test subject and shall end when the test subject's fingers are seated in the glove sample.

8.28.4.3 The time to don one glove of the glove pair specimen shall be determined by measuring the time it takes for the test subject to don the single glove on three consecutive trials without altering the sample glove linings between donnings.

8.28.4.4 The glove shall be donned in accordance with the manufacturer's donning procedure. The glove shall then be removed by grasping the fingertip of the middle finger and pulling the hand out of the glove.

8.28.4.5 The test subject shall be permitted to don either the right-hand glove or left-hand glove according to individual preference.

8.28.4.6 The test subject shall wear the glove of the opposite handing during the test.

8.28.4.7 Where the glove cannot be donned because of detachment of the inner liner or moisture barrier, then the trial for that glove shall be stopped. If any fingers cannot be fully inserted into the glove, then the trial for that glove shall be stopped.

8.28.4.8 The baseline donning time shall be the average of the first three donning times as determined in 8.28.4.2.

8.28.4.9 The test subject shall repeat the trial specified in 8.28.4.3 for each pair of gloves.

8.28.4.10 Glove pair specimens shall then be conditioned as specified in 8.1.3.

8.28.4.11 Specimens shall be donned once after removal from the conditioning specified in 8.28.4.10 before continuing testing.

8.28.4.12 The test subject shall then don one glove of the pair specimen. The test subject shall do this for three consecutive trials, for each specimen pair of gloves, as specified in 8.28.4.3 and 8.28.4.9. The times shall be recorded.

8.28.4.13 The final donning time shall be the average of the times for the first three donnings after removal from the final drying cycle as specified in 8.28.4.8.

8.28.5 Report.

8.28.5.1 The final donning time and the baseline donning time shall be recorded and reported to the nearest 0.1 second for each trial.

8.28.5.2 The average final and average baseline donning times shall be calculated and reported for each specimen glove size.

8.28.6 Interpretation. Pass/fail determinations shall be made using the average final and average baseline donning times for each specimen glove size.

8.29 Overall Liquid Integrity Test Three.

8.29.1 Application. This test method shall apply to work gloves.

8.29.2 Specimens. A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.29.3 Sample Preparation.

8.29.3.1 Specimens shall be tested after being subjected to the procedure specified in 8.1.3.

8.29.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.29.4 Apparatus.

8.29.4.1 A water-markable glove shall cover all areas of the tester's hand. The water-markable glove shall be constructed of a fabric that is easily water-marked to determine leakage.

8.29.4.2* Water used for integrity testing shall be at a temperature of 20°C ± 3°C (68°F ± 5°F) and treated with a nonfoaming surfactant to achieve a surface tension of 35 dynes ± 2 dynes.

8.29.4.3 The following equipment shall be used for the test procedure:

(1) A clear container(s) for submerging gloved hand(s)
(2) A stopwatch

8.29.5 Procedure.

8.29.5.1 Two test subjects, one for hand size small and one for hand size large, shall be selected such that their hand dimensions are as close as possible to the middle of the range for hand length and hand circumference as specified by the manufacturer for small and large gloves.

8.29.5.2 The wrist crease location shall be marked on each test specimen glove as described in 6.2.3 after the conditioning described in 8.29.3. At the location of the wrist crease, the maximum water height line shall be drawn on each test specimen glove around the entire glove 50 mm (2 in.) +0/−3 mm (+0/−0.25 in.) towards the fingers. In the same manner, the minimum water height line shall be drawn on each test specimen glove 75 mm (3 in.) +0/−3 mm towards the fingers from the wrist crease around the entire glove +0/−3 mm (+0/−0.25 in.).

8.29.5.3 The test subject shall don the specimen(s) over the water-markable glove(s).

8.29.5.4 The test subject shall then immerse the donned glove specimens straight down into the surfactant treated water to between the minimum and maximum water height line for 5 minutes +30/−0 sec. An observer shall be present to ensure that the glove is not immersed beyond the maximum water height line.

8.29.5.5 If the test subject immerses the glove beyond the maximum water height line, the glove shall be retested after air drying and conditioning as specified in 8.1.3.

8.29.5.6 The test subject shall flex the glove specimen in a gentle, complete (but not tight) fist-clenching motion until the fingertips touch the palm every 10 seconds with each fist-clenching motion taking 10 seconds, +2/−2 seconds to complete.

8.29.6 Report. The appearance of water marks on the inner glove after testing any of the glove pairs shall be recorded and reported.

8.29.7 Interpretation. The appearance of water marks on the inner glove after testing any glove shall be considered leakage and shall constitute failing performance.

8.30 Tactility Test.

8.30.1 Application.

8.30.1.1 This test shall apply to cleaning/utility gloves and work gloves.

8.30.1.2 Modifications to this test method for testing cleaning/utility gloves shall be as specified in 8.30.7.

8.30.1.3 Modifications to this test method for testing work gloves shall be as specified in 8.30.8.

8.30.2 Specimens.

8.30.2.1 A minimum of three glove pairs each for two different sizes shall be used for testing.

8.30.2.2 Each glove pair shall be tested as a complete set of gloves in new, as-distributed condition.

8.30.2.3 Glove pair specimens shall not receive special softening treatments prior to tests.

8.30.3 Sample Preparation.

8.30.3.1 Samples for conditioning shall be whole glove pairs.

8.30.3.2 Glove pair specimens shall be conditioned as specified in 8.1.2.

8.30.4 Procedures.

8.30.4.1 A separate test subject shall be used for each size of gloves to be evaluated.

8.30.4.2 Test subjects shall be selected such that their hand dimensions conform to the offered respective sizes for each glove.

8.30.4.3 Ten metal pins having diameters of 11 mm (0.430 in.), 9.5 mm (0.370 in.), 8 mm (0.310 in.), 6.5 mm (0.260 in.), 5 mm (0.200 in.), 3.5 mm (0.138 in.), 2.5 mm (0.098 in.), 1.5 mm (0.058 in.), 0.5 mm (0.018 in.), and 0.2 mm (0.008 in.), which have a length of 50 mm ± 10 mm (2 in. ± 0.4 in.), shall be used.

8.30.4.4 With each of the metal pins lying on a flat, smooth surface at a spacing of 100 mm ± 20 mm (4 in. ± 0.8 in.), the test subject shall attempt to pick up each pin starting with the largest diameter pin. The test subject shall be provided a period of 10 seconds to complete picking up each pin and then

shall hold the pin for a minimum of 10 seconds. The test subject shall not pick up the pins by their ends.

8.30.5 Report.

8.30.5.1 The diameter of the smallest pin that can be successfully picked up shall be recorded and reported for each test subject.

8.30.5.2 The average diameter that can be successfully picked up by all test subjects shall be calculated and reported.

8.30.6 Interpretation. The average diameter of the smallest pin that can be picked up shall be used to determine pass/fail performance.

8.30.7 Specific Requirements for Testing Cleaning/Utility Gloves. The sizes selected for testing shall represent the smallest and largest sized gloves that are available for the specific style of glove being evaluated.

8.30.8 Specific Requirements for Testing Work Gloves. Size small and size large shall be evaluated.

8.31 Water Absorption Resistance Test.

8.31.1 Application. This test method shall apply to the multiple-use garment materials.

8.31.2 Sample Preparation.

8.31.2.1 Samples for conditioning shall be at least 1 m (1 yd) square of each material.

8.31.2.2 Specimens shall be conditioned as specified in 8.1.3 followed by conditioning as specified in 8.1.2.

8.31.3 Specimens.

8.31.3.1 Specimens shall be 200 mm × 200 mm (8 in. × 8 in.).

8.31.3.2 At least three (3) specimens shall be tested.

8.31.4 Apparatus. The test apparatus shall be as specified in AATCC 42, *Water Resistance: Impact Penetration Test*, with the following modifications:

(1) A metal roller 113 mm ± 6 mm (4½ in. ± ¼ in.) long and weighing 1 kg (2¼ lbs) shall be used.
(2) Embroidery hoops measuring 150 mm to 180 mm (6 in. to 7 in.) in diameter shall be used for mounting the specimen.

8.31.5 Procedure.

8.31.5.1 The conditioned specimen shall be securely mounted in the embroidery hoops with sufficient tension to ensure a uniformly smooth surface.

8.31.5.2 The direction of the flow of water down the specimen shall coincide with the warpwise direction of the specimen as placed on the stand.

8.31.5.3 The mounted specimen shall be placed on the block with the center of the specimen directly beneath the center of the nozzle and the plane of the surface of the specimen at a 45 degree angle with the horizontal.

8.31.5.4 A 500 ml volume of distilled water at a temperature of 27°C ± 1°C (80°F ± 2°F) shall be poured quickly into the funnel and allowed to spray onto the specimen.

8.31.5.5 The following operations shall then be executed as rapidly as possible:

(1) The specimen shall be removed from the hoops and placed between sheets of blotting paper on a flat horizontal surface. The metal roller shall be rolled quickly forward and back one time over the paper without application of any pressure other than the weight of the roller.
(2) A square 100 × 100 mm (4 in. × 4 in.) shall be cut out of the center of the wet portion of the specimen and weighed to the nearest 0.05 g. This weight shall be designated the "wet weight." Not more than 30 seconds shall elapse between the time the water has ceased flowing through the spray nozzle and the start of the weighing.
(3) The same 100 mm (4 in.) square shall be conditioned as specified in 8.1.2 until it has dried and reached moisture equilibrium with the surrounding standard atmosphere for textiles. Following this conditioning it shall be reweighed. This weight shall be designated the "dry weight."

8.31.5.6 The percent water absorption shall be calculated using the following equation:

$$\text{Percent water absorption} = [(\text{Wet Weight} - \text{Dry Weight})/(\text{Dry Weight})] \times 100$$

8.31.6 Report. The percent water absorption for each specimen shall be reported. The average percent water absorption for all tested specimens shall be calculated and reported.

8.31.7 Interpretation. The average percent water absorption shall be used to determine pass/fail performance.

8.32 Total Heat Loss Test.

8.32.1 Application. This test method shall apply to the protective garment composites.

8.32.2 Specimens.

8.32.2.1 Total heat loss testing shall be conducted on at least three specimens.

8.32.2.2 Specimens shall consist of all layers in the protective garment composite arranged in the order and orientation as worn.

8.32.2.3 Specimen composite shall consist of base composite layers only required to meet the specifications of this standard. Specimens shall not include layers added for reinforcement, or externally added materials for visibility or identification.

8.32.3 Sample Preparation.

8.32.3.1 Samples for conditioning shall be at least a 1 m (1 yd) square of each material.

8.32.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.32.4 Apparatus. The test apparatus shall be as specified in ASTM F 1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate.*

8.32.5* Procedure. Testing shall be conducted in accordance with Part C of ASTM F 1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, with the following modifications:

(1) The specimen shall be placed on the test plate with the side normally facing the human body toward the test plate.
(2) For multiple layers, the layers shall be arranged in the order and orientation as worn.
(3) Each layer shall be smoothed by hand to eliminate wrinkles or bubbles in each layer and, if necessary, the edges shall be secured.
(4) Once the test is started, no further adjustments to the specimen shall be made.

8.32.6 Report.

8.32.6.1 The average intrinsic thermal resistance (*Rcf*) of the sample shall be recorded and reported.

8.32.6.2 The average apparent intrinsic evaporative resistance (*ARef*) of the sample shall be recorded and reported.

8.32.6.3 The average total heat loss (*Qt*) of the sample shall be calculated and reported.

8.32.7 Interpretation. Pass/fail determination shall be based on the average reported total heat loss measurement of all specimens tested.

8.33 Label Durability and Legibility Test.

8.33.1 Application.

8.33.1.1 This test shall apply to multiple-use garments, footwear, and work glove labels.

8.33.1.2 Modifications to this test method for testing multiple-use garment labels shall be as specified in 8.33.7.

8.33.1.3 Modifications to this test method for testing footwear and work glove labels shall be as specified in 8.33.8.

8.33.2 Specimens.

8.33.2.1 A minimum of three specimens for each type of label shall be tested.

8.33.2.2 If labels have areas of "write-in" information, the specimens shall include those areas with the sample information written in.

8.33.3 Sample Preparation. Samples shall be prepared as specified in the respective section for each item.

8.33.4 Procedure. Specimens shall be examined for legibility to the unaided eye by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) in a well-illuminated area.

8.33.5 Report. The legibility for each specimen shall be recorded and reported as acceptable or unacceptable.

8.33.6 Interpretation. One or more label specimens failing this test shall constitute failing performance.

8.33.7 Specific Requirements for Testing Multiple-Use Garment Labels.

8.33.7.1 Samples for conditioning shall be complete garments.

8.33.7.2 Multiple-use garment samples shall be conditioned as specified in 8.1.3.

8.33.7.3 For multiple-use garments, additional samples of individual labels shall be conditioned only as specified in 8.1.7.

8.33.8 Specific Requirements for Testing Footwear and Work Glove Labels.

8.33.8.1 Samples for conditioning shall be individual labels.

8.33.8.2 Individual labels only shall be conditioned as specified in 8.1.7.

8.34 Particle Inward Leakage Test.

8.34.1 Application. This test shall apply to [C]BRN ensembles, including garments, hood, gloves, footwear, and respirator as appropriate to make up the entire ensemble.

8.34.2 Samples.

8.34.2.1 Samples for conditioning shall be complete ensembles and shall include the respirator where the ensemble utilizes the respirator facepiece as the ensemble visor.

8.34.2.2 Garments, gloves, and hoods shall be conditioned as specified in 8.1.3.

8.34.2.3 Where the ensemble garment does not include booties and the [C]BRN barrier material is incorporated into footwear, the footwear shall be conditioned by flexing for 100,000 cycles in accordance with Appendix B of FIA Standard 1209, *Whole Shoe Flex*.

8.34.2.4 Samples shall be conditioned as at 21°C ± 6°C and 50 percent ± 30 percent RH for at least 4 hours.

8.34.3 Specimens.

8.34.3.1 The specimen shall be a complete ensemble with gloves and footwear and shall include the respirator where applicable.

8.34.3.2 Where the ensemble utilizes the respirator facepiece as the ensemble visor, the ensemble shall be tested with each type or model of the respirator specified by the manufacturer.

8.34.3.3 A minimum of four specimens shall be tested. The specimens shall represent a minimum of two different ensemble sizes.

8.34.3.4 Where the ensemble has multiple types of external fittings, each type of external fitting shall be present on each specimen at the time of testing.

8.34.3.5 Specimens shall be provided to fit or be adjustable to fit the selected test subjects in accordance with the sizing provisions provided by the manufacturer that are specific to each element.

8.34.3.6 None of the components to be tested shall have been previously subjected to particle inward leakage testing.

8.34.4 Apparatus.

8.34.4.1 The test shall be conducted in a chamber large enough to conduct testing on at least one test subject.

8.34.4.2 The test chamber shall have a system capable of providing a stable, uniform airflow directed at the test subject.

8.34.4.3 The test chamber shall prevent significant aerosol contact with any areas of the facility not intended as exposure areas, to prevent contamination.

8.34.4.4 The test chamber shall have an aerosol generator capable of maintaining the aerosol mass concentration as specified in the procedure.

8.34.4.5 The test facility shall have separate garment storage, donning, doffing, and control room areas to prevent contamination.

8.34.4.6 The challenge aerosol shall be combination of amorphous silica, 50 percent by weight; tetraethylene glycol, 42 percent by weight; uranine, 6 percent by weight; and Tinopal™, 2 percent by weight.

8.34.4.7 All test subjects shall have a medical doctor's certificate that substantiates that they are medically and physically suitable to perform these tests without danger to themselves. The medical certificate shall have been issued within 12 months prior to testing.

8.34.4.8 Test subjects shall be familiar with the use of chemical protective ensembles and with the selected respirator.

8.34.5 Procedure.

8.34.5.1 The test chamber shall be stabilized with the following conditions:

(1) Average wind speed shall be 3 mph ± 2 mph at the fan outlet airflow station.
(2) Temperature shall be 70°F ± 5°F.
(3) Relative humidity shall be 45 percent ± 15 percent.
(4) Average aerosol concentration shall be 20 mg/m^3 + 5/ –0 mg/m^3.
(5) Aerosol aerodynamic mass median diameter shall be 2.5 µm ± 0.5 µm.

8.34.5.2 The test subject shall don black indicator garments that cover the wearer's torso, arms, hands, legs, ankles, and head excluding the face.

8.34.5.2.1 The indicator garment shall provide a dark uniform appearance under black light illumination.

8.34.5.3* Specific areas of the indicator garment shall be masked with suitable tape or masking product that will remain in place during testing and not affect the indicator garment.

8.34.5.3.1 At least 10 masked areas, with minimum dimensions of 25 mm (1 in.) by 50 mm (2 in.), shall be distributed over the indicator garment.

8.34.5.4 The test subject shall don the protective ensemble and respirator in accordance with the manufacturer's instructions in a clean area separated from the test chamber.

8.34.5.5 Once the test chamber has reached the conditions stated in 8.34.5.1, the test subject will enter the chamber and be properly positioned in the wind.

8.34.5.6 The 30-minute test period begins when the test subject is positioned in the wind.

8.34.5.7 During the 30-minute test period, the test subject shall perform the three series of stationary exercises as specified in Procedure A of ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, as modified by 8.34.5.8.

8.34.5.8* The stationary exercises specified in Procedure A of ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, shall be performed with the following modifications:

(1) Duck squat, pivot right, pivot left, stand. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.
(2) Stand erect. With arms at sides, bend body to left and return, bend body forward and return, bend body to right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.
(3) Stand erect. Extend arms overhead in the lateral direction, then bend elbows. Extend arms overhead in the frontal direction, then bend elbows. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.
(4) Stand erect. Extend arms perpendicular to the sides of torso. Twist torso left and return, twist torso right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.
(5) Stand erect. Reach arms across chest completely to opposite sides. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.
(6) Walk in place, facing wind, for 1 minute.
(7) Rest, standing facing wind, for 1 minute.
(8) Walk in place, back to wind, for 1 minute.
(9) Rest, standing back to wind, for 1 minute.
(10) Rest, standing facing wind, for 1 minute.

8.34.5.9 At the conclusion of the 30-minute test period, the test subject shall exit the test chamber and enter the doffing area.

8.34.5.10 The test subject shall then be assisted to doff the ensemble to prevent contact of the outside surface of the ensemble with the subject's skin or indicator garment.

8.34.5.11 Within 10 minutes of doffing, the masked areas will be unmasked and the test subject shall be examined under black light for evidence of particulate inward leakage.

8.34.5.11.1* The black light shall have a wavelength of 365 nm and an intensity of 1200 $\mu W/cm^2$ at 15 in.

8.34.6 Report.

8.34.6.1 A diagram shall be prepared for each test that identifies the locations of any particulate inward leakage as detected on the test subject's skin or indicator garment.

8.34.7 Interpretation.

8.34.7.1 Any evidence of particulate inward leakage on any test subject's skin or indicator garment as determined by visual inspection under a black light shall constitute failure.

8.35 Overall Ensemble Liquid Penetration Test.

8.35.1 Application. This test method shall apply to entire ensembles that are being evaluated for the [C]BRN terrorism agent protection.

8.35.2 Specimens.

8.35.2.1 A minimum of three specimens shall be tested. Specimens shall consist of entire ensembles for [C]BRN terrorism agent protection.

8.35.2.2 The size of the items comprising the specimens shall be chosen to conform with the dimensions of the mannequin for proper fit of the specimen on the mannequin in accordance with the manufacturer's sizing system. The size of the items comprising the specimen shall be the same size as the mannequin in terms of chest circumference, waist circumference, and inseam height.

8.35.3 Sample Preparation.

8.35.3.1 Samples to be conditioned shall be complete ensembles.

8.35.3.2 Specimens, except footwear, to be tested shall be conditioned as specified in 8.1.3.

8.35.3.3 Where the ensemble garment element does not include booties and the [C]BRN barrier layer is incorporated into footwear, footwear shall be conditioned by flexing for 100,000 cycles in accordance with FIA Standard 1209, *Whole Shoe Flex*, with the following modifications:

(1) Water shall not be used.
(2) The flex speed shall be 60 cycles/min +/− 2 cycles/min.

(3) Alternative flexing equipment shall be permitted to be used when the flexing equipment meets the following parameters:
   (a) The alternative flexing equipment shall be capable of providing the angle of flex as described in FIA 1209.
   (b) The alternative flexing equipment shall be capable of a flex speed of 60 cycles/min +/− 2 cycles/min.
   (c) The alternative flexing equipment shall provide a means of securing the footwear during flexing.

8.35.4 Apparatus. The apparatus and supplies for testing shall be those specified in ASTM F 1359, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin*, with the following modifications:

(1) The surface tension of the water used in testing shall be 35 dynes/cm ± 5 dynes/cm.
(2) The mannequin used in testing shall be fully upright and shall have straight arms and legs, with the arms positioned at the mannequin's side.

8.35.5 Procedure. Liquid penetration testing of ensembles shall be conducted in accordance with ASTM F 1359, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin*, with the following modifications:

(1) No provision for partial garments shall be permitted.
(2) The method used for mounting of the mannequin in the spray chamber shall not interfere with the water spray.
(3) The normal outer surface of the material shall be exposed to the liquid as oriented in the clothing item.
(4) The liquid absorptive garment shall be a hooded coverall made of fabric meeting the requirements in ASTM F 1359. The liquid absorptive garment shall not interfere with the correct wearing of the ensemble. In addition to the liquid absorptive garment, the mannequin's hands shall be covered with suitably sized, 100 percent cotton gloves and the mannequin's feet covered with suitably sized, 100 percent cotton socks.
(5) Fluorescent or visible dyes shall not be used in the water for spraying the suited mannequin.
(6) The suited mannequin shall be exposed to the liquid spray for a total of 20 minutes, 5 minutes in each of the four mannequin orientations.
(7) At the end of the liquid spray exposure period, excess liquid shall be removed from the surface of the specimen.
(8) The liquid absorptive garment, inner cotton gloves, and inner cotton socks worn on the mannequin shall be inspected to determine evidence of liquid leakage specimen within 10 minutes of the end of the liquid spray exposure period for evidence of liquid penetration.

8.35.6 Report. A diagram shall be prepared for each test that identifies the locations of any liquid leakage as detected on the liquid-absorptive garment and the interior of the garment.

8.35.7 Interpretation. Any evidence of liquid on the liquid-absorptive garment, as determined by visual, tactile, or absorbent toweling, shall constitute failure of the specimen.

8.36 Biopenetration Resistance Test Three.

8.36.1 Application.

8.36.1.1 This method shall apply to the [C]BRN barrier layer and seams used in elements and ensembles for [C]BRN terrorism agent protection.

8.36.1.2 Specific requirements for testing the garment, hood, and bootie [C]BRN barrier layer shall be as specified in 8.36.7.

8.36.1.3 Specific requirements for testing the garment, hood, and bootie [C]BRN barrier layer seams shall be as specified in 8.36.8.

8.36.1.4 Specific requirements for testing the glove [C]BRN barrier layer and seams shall be as specified in 8.36.9.

8.36.1.5 Specific requirements for testing footwear [C]BRN barrier layer shall be as specified in 8.36.10.

8.36.2 Sample Preparation. Specimens shall then be conditioned at a temperature of 21°C ± 3°C (70°F ± 5°F) and at a relative humidity of 65 percent ± 5 percent, for at least 4 hours prior to permeation testing.

8.36.3 Specimens.

8.36.3.1 A minimum of three specimens of each material shall be tested against each chemical.

8.36.3.2 The [C]BRN barrier layers shall be tested for viral penetration resistance.

8.36.3.3 The [C]BRN barrier layer plus any outer shell or other composite layers normally worn over the [C]BRN barrier layer shall be permitted to be tested for viral penetration resistance. Separable layers worn underneath the [C]BRN barrier layer shall not be tested with the [C]BRN barrier layer.

8.36.3.4 If the [C]BRN barrier layer is the outermost layer in the composite, then it shall be tested for viral penetration resistance without additional layers on top.

8.36.4 Procedure. Liquid penetration resistance testing shall be conducted in accordance with ASTM F 1671, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X174 Bacteriophage Penetration as a Test System.*

8.36.5 Report. The pass/fail result for each specimen shall be recorded and reported.

8.36.6 Interpretation. A failure of any specimen constitutes failure of the material.

8.36.7 Specific Requirements for Testing Garment, Hood, and Bootie Materials.

8.36.7.1 Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of all layers of the composite arranged in the order used in the construction of the garment, hood, or bootie.

8.36.7.2 Composite samples prepared as described in 8.36.7.1 shall be tested after being twice subjected to the conditioning as specified in 8.1.3.

8.36.7.3 The composite sample, including [C]BRN barrier layer, that was conditioned in 8.36.7.2 shall be trimmed to a sample size of 300 mm × 280 mm (12 in. × 11 in.). The trimmed composite samples shall be subject to flexing conditioning as specified in 8.1.10, with the 280 mm (11 in.) direction parallel with the compression action of the machine. The trimmed samples shall be mounted such that outer layer is visible with all layers in their normal "as worn" orientation.

8.36.7.4 Following flexing, samples of the [C]BRN barrier layer shall be removed from the flexed, trimmed composite sample and shall be cut to the dimensions shown in Figure 8.36.7.4, with the long dimension of the sample parallel to the 280 mm (11 in.) dimension.

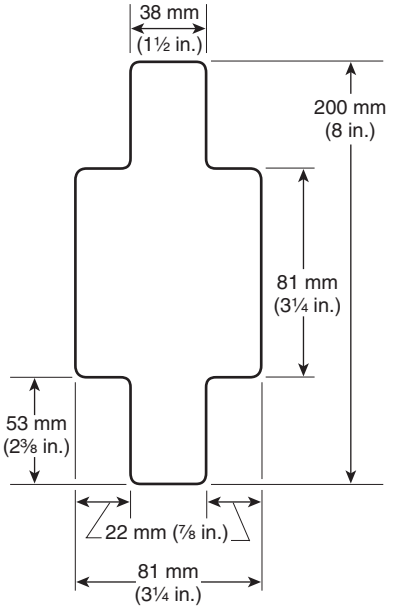


FIGURE 8.36.7.4 Specimen Configuration.

8.36.7.5 The layers in the flexed, trimmed composite sample adjacent to the [C]BRN barrier layer shall be retained for use as the abradants.

8.36.7.6 The [C]BRN barrier layer samples prepared as specified as 8.36.7.4 and the other samples retained as specified in 8.36.7.5 shall be subjected to abrasion as specified 8.1.11.

8.36.7.7 Following abrading, the viral penetration test specimen shall be taken from the center of the abraded sample so that the center of the viral penetration test and the center of the abraded sample coincide.

8.36.7.8 Use of exterior layers with the [C]BRN barrier layer specimen shall be permitted. Exterior layer specimens shall be removed from the composite samples that are conditioned as specified in 8.36.7.2.

8.36.7.9 The specimens shall be oriented in the penetration test cell with the exterior surfaces facing the challenge chemical.

8.36.7.10 Specimens shall be tested for viral penetration resistance as specified in 8.36.3.2 through 8.36.3.4.

8.36.8 Specific Requirements for Testing Garment, Hood, and Bootie Seams.

8.36.8.1 Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of all layers of the composite arranged in the order used in the construction of the garment, hood, or bootie. The [C]BRN barrier layer shall be constructed with one or more parallel seams that shall extend across the entire 380 mm (15 in.) width of the specimen. Seams shall be constructed in the [C]BRN barrier layer no closer than 75 mm (3 in.) to one another. The multilayer composite shall be stitched around the entire periphery.

8.36.8.2 Prepared composite samples prepared as described in 8.36.8.1 shall be tested after being twice subjected to the conditioning as specified in 8.1.3.

8.36.8.3 The composite sample, including the [C]BRN barrier layer seam that was conditioned in 8.36.8.2, shall be trimmed to a sample size of 300 mm × 280 mm (12 in. × 11 in.), with the seam parallel to the 300 mm (12 in.) direction. The trimmed composite samples shall be subject to flexing conditioning as specified in 8.1.10 with the 280 mm (11 in.) direction parallel with the compression action of the machine. The trimmed samples shall be mounted such that outer layer is visible with all layers in their normal "as worn" orientation.

8.36.8.4 Specimens for viral penetration testing shall be cut from [C]BRN barrier layer of the flexed, trimmed sample such that the seam bisects the specimen.

8.36.8.5 Use of exterior layers with the [C]BRN barrier layer specimen shall be permitted. Exterior layer specimens shall be removed from the composite samples that are conditioned as specified in 8.36.8.2.

8.36.8.6 The specimens shall be oriented in the penetration test cell with the exterior surfaces facing the challenge chemical.

8.36.8.7 Specimens shall be tested for viral penetration resistance as specified in 8.36.3.2 through 8.36.3.4.

8.36.9 Specific Requirements for Testing Glove Materials and Seams.

8.36.9.1 This test shall apply to all types of glove configurations.

8.36.9.2 Samples for conditioning shall be whole gloves.

8.36.9.3 Glove samples shall be subjected to conditioning as specified in 8.1.3.

8.36.9.4 Following the conditioning specified in 8.36.9.3, conditioned gloves shall be mechanically flexed in a fist-clenching motion with a minimum of 90 degree rotation of the glove fingers toward the palm, a total of 3000 times over a period not greater than 60 minutes.

8.36.9.5 Following the flexing in 8.36.9.4, specimens for viral penetration resistance testing shall be taken from [C]BRN barrier layer of the flexed glove. Where the [C]BRN layer includes seams, specimens shall include seams that bisect the specimens.

8.36.9.6 Use of exterior layers with the [C]BRN barrier layer specimen shall be permitted. Exterior layer specimens shall be removed from the composite samples that are conditioned as specified in 8.36.9.2.

8.36.9.7 Specimens shall be tested for viral penetration resistance as specified in 8.36.3.2 through 8.36.3.4.

8.36.10 Specific Requirements for Testing Footwear Materials.

8.36.10.1 This test shall not apply to footwear configurations that include booties that are subjected to the procedures in 8.36.7 and 8.36.8.

8.36.10.2 Samples for conditioning shall be whole footwear items.

8.36.10.3 Footwear samples shall be subjected to conditioning by flexing 500,000 cycles in accordance with FIA Standard 1209, *Whole Shoe Flex*, with the following modifications:

(1) Water shall not be used.
(2) The flex speed shall be 60 cycles/min +/− 2 cycles/min.
(3) Alternative flexing equipment shall be permitted to be used when the flexing equipment meets the following parameters:
   (a) The alternative flexing equipment shall be capable of providing the angle of flex as described in FIA 1209.
   (b) The alternative flexing equipment shall be capable of a flex speed of 60 cycles/min +/− 2 cycles/min.
   (c) The alternative flexing equipment shall provide a means of securing the footwear during flexing.

8.36.10.4 Following flexing, samples shall be taken in areas from the footwear upper at the footwear quarter and vamp areas, cut to the dimensions shown in Figure 8.36.7.4.

8.36.10.5 The cut samples shall then be conditioned by abrading as specified in 8.1.11 using silicon carbide, ultrafine, 600 grit sandpaper as the abradant in lieu of other specified layers.

8.36.10.6 Following abrading, the penetration test specimen shall be taken from the center of the abraded sample so that the center of the permeation test and the center of the abraded sample coincide.

8.36.10.7 Specimens shall be tested for viral penetration resistance as specified in 8.36.3.2 through 8.36.3.4.

8.37 Retroreflectivity and Fluorescence Test Following Laundering.

8.37.1 Application.

8.37.1.1 This test method shall apply to visibility materials used in the construction of multiple-use emergency protective garments.

8.37.1.2 Visibility materials shall be tested for each procedure specified in 8.37.4.

8.37.2 Specimens.

8.37.2.1 A minimum of three test specimens shall be tested as removed from conditioned garments as specified in 8.37.3.

8.37.2.2 Specimens of retroreflective material shall be 100 mm (4 in.) in length by the width of the finished trim product. Where retroreflective and nonretroreflective surface areas are combined to form a combined performance material, the specimen shall consist of the retroreflective and nonretroreflective portions of the finished combined performance material.

8.37.3 Sample Preparation. Samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.37.4 Procedures.

8.37.4.1 Measurement of Coefficient of Retroreflection.

8.37.4.1.1 The coefficient of retroreflection (R_a) shall be determined in accordance with ASTM E 809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, using the following modifications:

(1) Test distance shall equal 15.2 m (50 ft).
(2) Observation angle shall equal 0.2 degree.
(3) Entrance angle shall equal +5 degrees.
(4) Receiver shall be provided with an entrance aperture of 25 mm (1 in.) ± 5 percent in diameter that is equivalent to 0.1 degree angular aperture.
(5) Exit aperture of the source shall be circular and 25 mm (1 in.) ± 5 percent in diameter that corresponds to 0.1 degree angular aperture.
(6) Retroreflector reference angles shall equal 0 and 90 degrees.
(7) The datum mark shall be placed as specified by the trim manufacturer.

8.37.4.1.2 The coefficient of retroreflection (R_a) shall be calculated by the following equation:

$$R_a = R_I / A_r$$

where:
R_I = coefficient of luminous intensity measured as specified in 8.37.4.1.1
A_r = only the retroreflective surface area of the trim test specimen's surface area

8.37.4.1.2.1 A_r shall be calculated by subtracting the nonretroreflective surface area from the test specimen's total surface area.

8.37.4.2 Evaluation of Fluorescence.

8.37.4.2.1 The color shall be measured in accordance with the procedures defined in ASTM E 991, *Standard Practice for Color Measurement of Fluorescent Specimens*; ASTM E 1164, *Standard Practice for Obtaining Spectrophotometric Data for Object Color Evaluation*; ASTM E 2152, *Standard Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data*; and ASTM E 2153, *Standard Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color*, using the following test specifications:

(1) A polychromatic illumination of D65 shall be used.
(2) A 45/0 (or 0/45) geometry shall be used.
(3) A 2° observer shall be used.
(4) The specimen shall have a black underlay with reflectance (luminance) of less than 0.04.

8.37.4.2.2 The chromaticity shall be within one of the areas defined in Table 8.37.4.2.2, and the Cap Y luminance factor shall not be less than the corresponding minimum for the respective color.

Table 8.37.4.2.2 Color Requirements

Color	Chromaticity Coordinates		Minimum Luminance Factor, Cap Y
	X	Y	
Fluorescent yellow-green	0.387	0.610	70
	0.356	0.494	
	0.398	0.452	
	0.460	0.540	
Fluorescent orange-red	0.610	0.390	40
	0.535	0.375	
	0.570	0.340	
	0.655	0.344	
Fluorescent red	0.655	0.344	25
	0.570	0.340	
	0.595	0.315	
	0.690	0.310	

8.37.5 Report.

8.37.5.1 The coefficient of retroreflection *(R_a)* shall be recorded and reported for each specimen. The average R_a of all specimens shall be calculated and reported separately for each of the test procedures specified in 8.37.4.1.

8.37.5.2 The number of fluorescent and nonfluorescent specimens shall be recorded and reported separately for each of the test procedures specified in 8.37.4.2.

8.37.6 Interpretation.

8.37.6.1 For trim retroreflectivity, pass or fail performance shall be determined using the average coefficient of retroreflection *(R_a)* for the procedures specified in 8.37.4.1.

8.37.6.2 For trim fluorescence, specimens that do not meet the chromaticity and luminance factor requirements shall be designated as nonfluorescent.

8.38 Tear Resistance Test Two.

8.38.1 Application. This test shall apply to materials used in the construction of garments. Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.38.2 Specimens.

8.38.2.1 Five specimens in each of the warp and fill directions shall be tested for each material.

8.38.2.2 Specimens shall be prepared in accordance with ASTM D 5733, *Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure*.

8.38.3 Sample Preparation.

8.38.3.1 Samples for conditioning shall be complete garments.

8.38.3.2 Garment samples shall be conditioned as specified in 8.1.2.

8.38.4 Procedure. Specimens shall be tested in accordance with ASTM D 5733, *Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure*.

8.38.5 Report.

8.38.5.1 The tear strength of an individual specimen shall be the average of the five highest peak loads of resistance registered for mm (in.) of separation of the tear.

8.38.5.2 The tear strength of each specimen shall be recorded and reported to the nearest 0.5 N (0.1 lbf) of force.

8.38.5.3 An average tear strength shall be calculated and reported for warp and fill directions.

8.38.6 Interpretation.

8.38.6.1 Pass/fail performance shall be based on the average tear strength in the warp and fill directions.

8.38.6.2 Failure in any one direction constitutes failure for the material.

8.39 Flammability Test.

8.39.1 Application.

8.39.1.1 This test shall apply to materials used in garments, cleaning/utility gloves, work gloves, single-use eye and face protection devices, footwear covers, and multiple-use footwear.

8.39.1.2 Modifications to this test method for testing multiple-use garments shall be as specified in 8.39.7.

8.39.1.3 Modifications to this test method for testing footwear covers and single-use garments shall be as specified in 8.39.8.

8.39.1.4 Modifications to this test method for testing cleaning/utility gloves shall be as specified in 8.39.9.

8.39.1.5 Modifications to this test method for testing single-use eye and face protection devices shall be as specified in 8.39.10.

8.39.1.6 Modifications to this test method for testing work gloves shall be as specified in 8.39.11.

8.39.1.7 Modifications to this test method for testing footwear shall be as specified in 8.39.12.

8.39.2 Specimens. A minimum of five specimens shall be tested.

8.39.3 Sample Preparation. Samples shall be conditioned as specified in 8.1.2.

8.39.4 Procedure. Specimens shall be tested in accordance with ASTM D 1230, *Standard Test Method for Flammability of Apparel Textiles*, with the following modifications:

(1) Sample preparation and conditioning shall be as specified in this section.
(2) The specimens shall be positioned in the flammability tester specimen holder so that the tip of the flame contacts the bottom edge of the specimen.
(3) The time of flame application shall be 1 second.

8.39.5 Report.

8.39.5.1 The flame spread time for each specimen shall be reported to the nearest 0.1 second.

8.39.5.2 The average flame spread time for all specimens shall be reported.

8.39.5.3 Specimens that do not ignite shall be recorded as "Did not ignite" and shall not be included in the average flame spread time.

8.39.5.4 Specimens that ignite, but where the flame is extinguished before reaching the stop cord, shall be recorded as "Ignited but extinguished" and shall not be included in the average flame spread time.

8.39.6 Interpretation.

8.39.6.1 Pass/fail performance shall be based on the average flame spread time.

8.39.6.2 If no specimens have a recorded flame spread time because the specimens did not ignite or ignited but extinguished, the material performance shall be interpreted as passing.

8.39.7 Specific Requirements for Multiple-Use Garments.

8.39.7.1 Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.39.7.2 Five specimens in each of the warp and fill directions shall be tested from each sample unit.

8.39.7.3 Samples for conditioning shall be the entire complete garment.

8.39.7.4 Garment samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.39.7.5 Pass/fail performance shall be based on the average flame spread time in the warp and fill directions.

8.39.7.6 Failure in any one direction constitutes failure for the material.

8.39.8 Specific Requirements for Footwear Covers and Single-Use Garments.

8.39.8.1 Where the footwear cover or garment is constructed of several separable layers, each separable layer of garment material shall be tested.

8.39.8.2 Five specimens in each of the warp and fill directions shall be tested from each sample unit.

8.39.8.3 Samples for conditioning shall be the entire complete footwear cover or garment.

8.39.8.4 Pass/fail performance shall be based on the average flame spread time in the warp and fill directions.

8.39.8.5 Failure in any one direction constitutes failure for the material.

8.39.9 Specific Requirements for Cleaning/Utility Gloves. Samples for testing shall be taken from the palm and back portions of the gloves in the gauntlet area.

8.39.10 Specific Requirements for Single-Use Eye and Face Protection Devices.

8.39.10.1 Samples for testing shall only be taken from the textile portions of the eye and face protection device, where applicable.

8.39.10.2 If specimens do not meet the size requirements as specified in ASTM D 1230, *Standard Test Method for Flammability of Apparel Textiles*, then sections of inherently flame resistant material shall be attached to the sides of specimens to meet the specimen width of 50 mm (2 in.).

8.39.11 Specific Requirements for Work Gloves.

8.39.11.1 Samples shall be taken from each exterior surface of the work gloves.

8.39.11.2 Work glove samples shall be conditioned as specified in 8.1.3, and then conditioned as specified in 8.1.2.

8.39.12 Specific Requirements for Multiple-Use Footwear.

8.39.12.1 Specimens for testing shall be taken from each exterior surface of the footwear, including the tongue and outsole, but excluding emblems, visibility markings, gusset, zipper, laces, eyelets, and any other external hardware.

8.39.12.2 Where samples are relatively thick, specimens shall be permitted to be prepared to provide a facsimile layer representative of the material used in the construction of the footwear.

8.40 Suspension System Retention Test.

8.40.1 Application. This test shall apply to helmets.

8.40.2 Sample Preparation.

8.40.2.1 Samples shall be conditioned as specified in 8.1.2.

8.40.2.2 Samples for conditioning shall be whole helmets.

8.40.3 Specimens. A minimum of three complete helmets shall be tested.

8.40.4 Apparatus.

8.40.4.1 The suspension system retention test fixtures shall consist of rigid material of sufficient thickness and optional design to facilitate fire attachment to the helmet suspension and the tensile test machine as shown in Figure 8.40.4.1.

8.40.4.2 The calibrated tensile test machine shall be capable of measuring the force applied to the retention system within 2 percent of the specified forces.

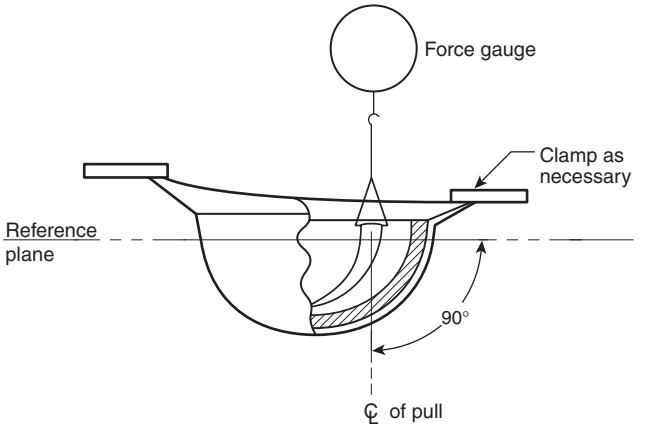


FIGURE 8.40.4.1 Suspension System Retention Test Setup.

8.40.5 Procedure.

8.40.5.1 Each helmet suspension strap shall be cut such that sufficient length of strap remains to be gripped by the movable jaw of the testing machine.

8.40.5.2 Specimens shall be positioned and secured in the tensile testing machine so that the helmet's reference plane is horizontal.

8.40.5.3 Each attachment point of the crown strap shall be tested by applying a pull force perpendicular to the reference plane to a maximum load of 23 N +1/−0 N (5 lbf +0.25/−0 lbf). The force shall be increased from 0 N to 23 N at a load rate of 25 mm/min ± 5 mm (1 in./min ± 3⁄16 in.).

8.40.5.4 After application of the force is complete, the load shall be released and the suspension system shall be inspected for any separation from the helmet shell.

8.40.5.5 Each adjusting mechanism of the helmet suspension system assembly shall be secured and unsecured, as applicable, for 20 repetitions.

8.40.6 Report.

8.40.6.1 The individual pass/fail results for each attachment point shall be recorded.

8.40.6.2 Each adjusting mechanism of the helmet suspension system shall be observed for proper functioning to determine pass or fail.

8.40.7 Interpretation.

8.40.7.1 Separation of the helmet suspension from the helmet shall constitute failing performance.

8.40.7.2 One or more helmet specimens failing this test shall constitute failing performance.

8.41 Retention System Test.

8.41.1 Application. This test shall apply to helmets.

8.41.2 Sample Preparation.

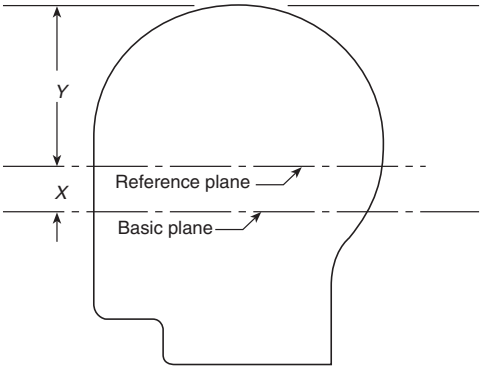
8.41.2.1 Samples for conditioning shall be whole helmets.

8.41.2.2 Samples shall be conditioned as specified in 8.1.2.

8.41.3 Specimens. A minimum of five complete helmets shall be tested.

8.41.4 Apparatus.

8.41.4.1 An ISO size J headform conforming to the nominal dimensions in Figure 8.41.4.1 shall be used.



Headform	Size (mm)	X (mm)	Y (mm)
A	500	24	90
B	540	26	96
J	570	27.5	102.5
M	600	29	107
O	620	30	110

FIGURE 8.41.4.1 Location of Reference Plane.

8.41.4.2 A mechanical chin structure shall be designed for use in.) in diameter with centers that are 75 mm (3 in.) apart. The mechanical chin structure shall conform with Figure 8.41.4.2(a), Figure 8.41.4.2(b), and Figure 8.41.4.2(c).

8.41.4.3 The calibrated tensile test machine shall be capable of measuring the force applied to the retention system within 2 percent at the specific force.

8.41.5 Procedure.

8.41.5.1 The test shall be conducted at an ambient temperature of 20°C to 28°C (68°F to 82°F), and the relative humidity shall be 30 percent to 70 percent.

8.41.5.2 Prior to testing, the test machine shall be allowed to warm up until stability is achieved.

8.41.5.3 The headform and mechanical chin structure shall be positioned so that the vertical straight line distance between the bottom of the rollers and the crown of the headform is 200 mm ± 10 mm (8 in. ± ⅜ in.). The chin strap shall be passed around the rollers, and the helmet shall be secured to the headform. The chin strap shall be adjusted and preloaded to 45 N ± 5 N (10 lbf ± 1 lbf). The distance between the top of the helmet and the rollers shall be measured and recorded to the nearest 0.5 mm (1/64 in.).

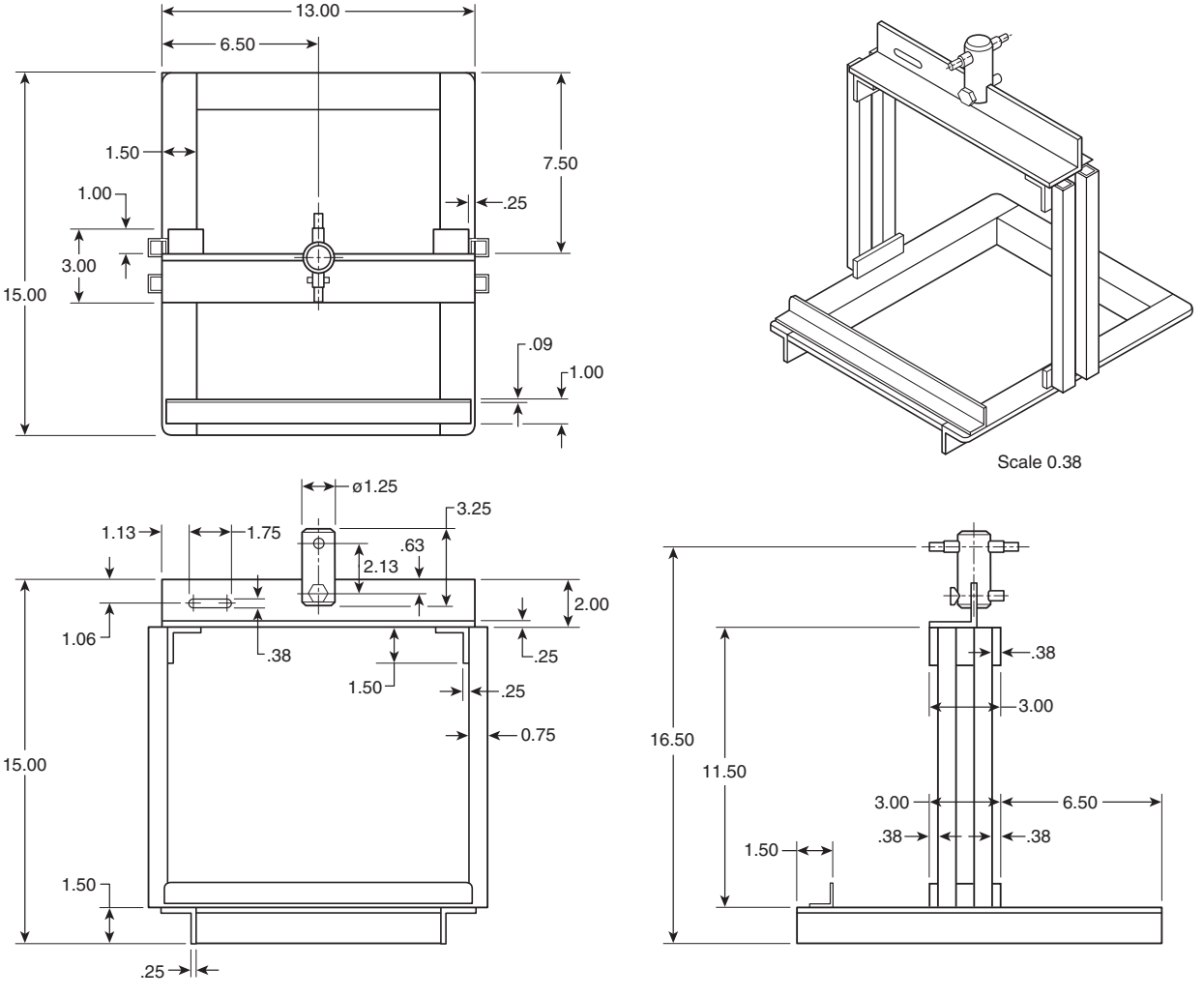


FIGURE 8.41.4.2(a) Retention Test Fixture.

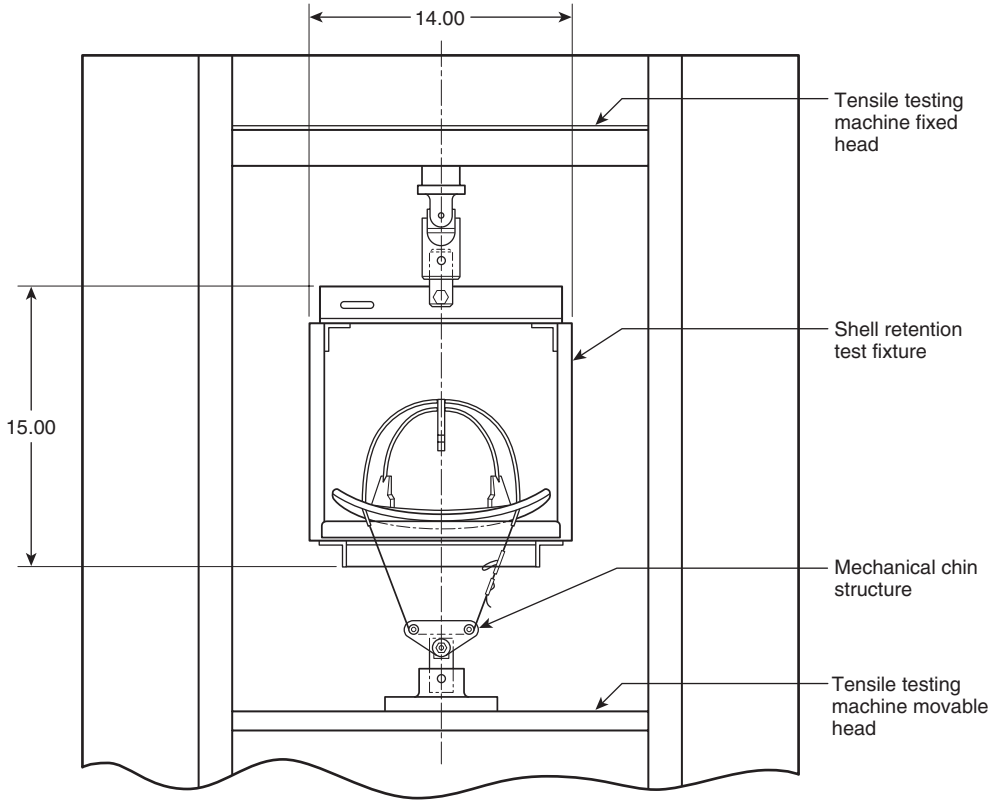


FIGURE 8.41.4.2(b) Retention Test Setup 1.

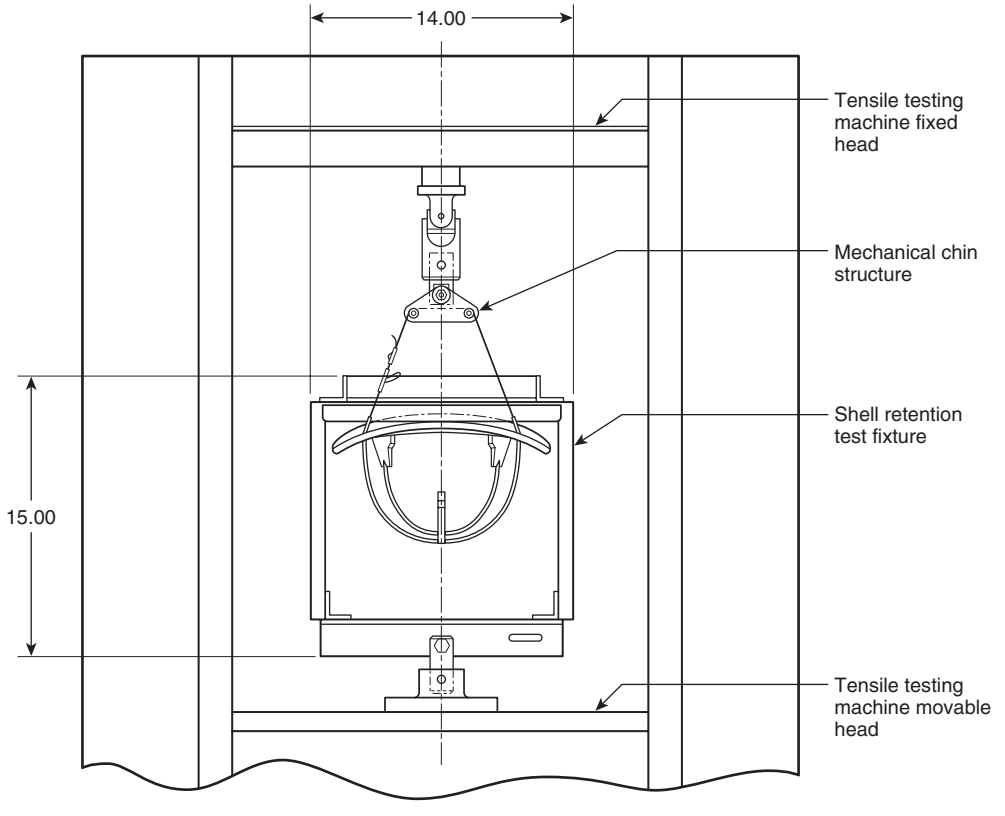


FIGURE 8.41.4.2(c) Retention Test Setup 2.

8.41.5.4 The force applied to the retention system shall be slowly increased to 225 N/sec + 5 N/sec (50 lbf/sec + 1 lbf/sec).

8.41.5.5 Where using a tensile testing machine, the load rate shall be 25 mm/min (1 in./min) to a limit of 225 N (50 lbf).

8.41.5.6 The distance between the top of the helmet and the bottom of the rollers shall be measured and recorded again after the force has been maintained at 225 N ± 5 N (50 lbf ± 1 lbf) for 60 seconds +5/−0 seconds. The difference between the second measurement and the first shall be the retention system elongation.

8.41.5.7 In addition, each adjusting mechanism of the helmet chin strap assembly shall be secured and unsecured, as applicable, for 20 repetitions.

8.41.6 Report.

8.41.6.1 The retention system elongation shall be measured, recorded, and reported for each helmet specimen.

8.41.6.2 Each mechanism shall be observed for proper functioning to determine pass or fail.

8.41.7 Interpretation. One or more helmet specimens failing this test constitutes failing performance.

8.42 Goggle and Headlamp Clip Attachment Test.

8.42.1 Application. This test method shall apply to goggle and headlamp clips on protective helmets, where present.

8.42.2 Sample Preparation.

8.42.2.1 Specimens shall be conditioned as specified in 8.1.2.

8.42.2.2 Samples for conditioning shall be complete helmets with goggle and headlamp clips in place.

8.42.3 Specimens. A minimum of three helmets with goggle and headlamp clips shall be tested for each test.

8.42.4 Apparatus. The test fixture shall consist of a 1.4 kg (3 lb) weight attached to a 1 mm (1/32 in.) diameter wire loop.

8.42.5 Procedure.

8.42.5.1 The helmet shall be turned on edge with the clip to be tested facing directly down and supported on the brim except directly beneath the clip as shown in Figure 8.42.5.1.

8.42.5.2 The wire shall be looped under the clip and, without allowing any vertical drop, the weight shall be suspended from the clip.

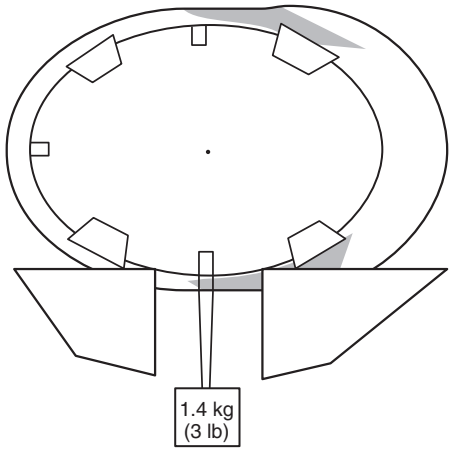


FIGURE 8.42.5.1 Test Setup (Side View of Top of Helmet).

8.42.5.3 After 5 seconds +2/−0 seconds, the clip shall be inspected to determine if it has pulled away from the helmet or deformed more than 6 mm (¼ in.) from its original position, either of which constitutes a failure.

8.42.6 Report. The individual pass/fail results for each specimen and clip shall be recorded.

8.42.7 Interpretation. One or more helmet specimens failing this test constitutes failing performance.

Annex A Explanatory Material

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

A.1.1.1 This standard addresses only emergency medical products and the design, performance, testing, and certification of specific products. For fire departments and fire department–based EMS services, the use criteria for emergency medical protective ensembles or protective clothing are covered in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1581, *Standard on Fire Department Infection Control Program*.

This document is intended to address the wide range of potential threats to emergency medical workers from the time of in-the-field incident intervention through the time of medical facility emergency room treatment. These threats range from mechanical to biological and can impact each emergency medical worker in a variety of ways. Each emergency medical worker should be trained to understand and respect the potential hazards inherent in the emergency medical field. It is essential that each worker evaluate the particular circumstances of each incident and appropriately evaluate the level of personal protection needed to protect themselves from the transmission of diseases and blood/body fluid-borne pathogens. The methods of transmission of currently known diseases are well known. Emergency medical workers are trained to understand these methodologies and protect themselves as well as the patient from incidental exposure. However, new diseases emerge every day, further necessitating the vigilance of emergency medical workers to protect themselves from unnecessary exposure.

This document provides emergency medical workers with a wide array of personal protective clothing and equipment that can be chosen to significantly reduce the possibility of exposure to body fluid-borne pathogens. In addition, the document has been expanded to include limited protection from biological, nuclear, and radiological hazards.

The hazards associated with emergency medical operations can be generally classified by the following groups:

(1) *Physical hazards.* Protection is needed against cuts, punctures, abrasive surfaces, falling objects, incidental flame contact, environmental hazards such as rain and extreme ambient temperatures.
(2) *Body fluid-borne pathogen hazards.* Protection is needed to reduce the potential for skin and particularly mucus membrane exposure to body fluid-borne pathogens.
(3) *Protection from chemical and biological agents.* Protection is needed to reduce the cross contamination of exposed victims to emergency medical workers during rescue, triage, decontamination, pre-transport emergency medical treatment, transport, and treatment at the receiving medical facility. Specialized decontamination and/or isolation can be initiated at the emergency scene and continued at the receiving medical facility.

This document is designed to offer a wide range of protective clothing and equipment options to meet the specific functional needs of emergency medical operations personnel performing a wide variety of tasks, working in a variety of environments, and with varying degrees of control over exposure and environmental threats. The frequency of exposure as well as the severity can also be addressed in the provision of protective clothing designed for single use as well as protective clothing designed for multiple use and certified as compliant with this standard.

Research and testing for the development of criteria specific to single-use garments, cleaning/utility gloves, footwear covers, eye and face protection devices, and helmets was supported by NIOSH National Personal Protective Technology Laboratory as addressed in the report, "Improvement of Criteria for EMS Personal Protective Equipment."

A.1.1.2 While separate requirements are specified for emergency medical protective elements, the [C]BRN requirements apply only to ensembles. Individual elements cannot be separately certified to the [C]BRN requirements of this standard. Only complete ensembles, in which all necessary elements are specified to achieve the stated performance requirements, can be certified to the [C]BRN criteria in this standard.

Users are cautioned that exposure of emergency medical protective [C]BRN ensembles to biological and radiological terrorism agents should require disposal immediately after the [C]BRN ensemble is doffed.

Criteria for single-exposure [C]BRN protective ensembles are addressed in the Class 4 ensemble requirements of NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents.*

A.1.1.3 Organizations responsible for CBRN first responders, chemical response functions, and other hazard protection, including radiological, cryogenic, or hazardous chemicals, should use protective ensembles and protective clothing specifically designed for those activities.

Criteria for protection from hazardous materials are provided in the following standards:

(1) NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*
(2) NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*
(3) NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents.*

A.1.1.4 Specific criteria addressing respiratory protection are not covered in this standard. However, responders and receivers that are engaged in emergency medical operations involving airborne pathogens or other respiratory hazards should wear appropriate respiratory protection. At a minimum, appropriate respiratory protection should include filtering facepieces that are certified by the National Institute for Occupational Safety and Health (NIOSH). P-100 air-purifying respirators will provide the highest level of particulate protection. In addition, responders and receivers engaged in operations involving [C]BRN hazards should, as a minimum, wear air-purifying respirators that are certified by NIOSH as CBRN air-purifying respirators (CBRN APRs) or certified by NIOSH as CBRN powered air-purifying respirators (CBRN PAPRs).

Biological agents can also be transmitted via aerosols, which are a hazard by inhalation, and in some cases, by dermal exposure. Organizations responsible for biological hazard protection should use protective clothing and respiratory protection specifically designed for those activities, including protective ensembles that are designed for [C]BRN protection covered under this standard. Criteria for protection from chemical agents, airborne and liquid-borne biological hazards, and particulate hazards are also provided in NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents.*

A.1.1.6 This standard provides a range of different types of protective clothing and equipment that can be used in the provision of emergency patient care and transportation prior to arrival at a medical care facility by emergency medical responders, emergency patient care by medical first receivers at a medical care facility, and body recovery by emergency medical responders. The selection of protective clothing and equipment for emergency medical operations should account for a hazard assessment undertaken by the department or organization that is responsible for employees that are involved in emergency medical operations. The hazard assessment should be performed in accordance with Title 29, Code of Federal Regulations, Part 1910.132, "General Requirements of Subpart I, Personal Protective Equipment," to ensure compliance with Title 29, Code of Federal Regulations, Part 1910.1030, "Protecting Health Care Workers from Occupational Exposure to Blood-Borne Pathogens," or the applicable local, state, regional, or national regulations. The hazard assessment should identify the specific risks of emergency medical responders or medical first receivers to hazards that include, but are not limited to, those listed in Table A.1.1.6(a).

Table A.1.1.6(a) List of Potential Emergency Medical and Related Hazards

Biological Hazards	**Thermal Hazards**
Blood-borne pathogens	High convective heat
Airborne pathogens	Low radiant heat
Biological toxins	High radiant heat
Biological allergens	Flame impingement
Chemical Hazards	Steam
Inhalation	Hot liquids
Skin absorption or contact	Molten metals
Chemical ingestion or injection	Hot solids
	Hot surfaces
Liquefied gas contact	**Electrical Hazards**
Chemical flashover	High voltage
Chemical explosions	Electrical arc flashover
Physical Hazards	Static charge buildup
Falling objects	**Person-Position Hazards**
Flying debris	Daytime and nighttime visibility
Projectiles or ballistic objects	
Abrasive or rough surfaces	Falling from elevated surfaces
Pointed objects	
Slippery surfaces	Drowning
Excessive vibration	**Person-Equipment Hazards**
Environmental Hazards	Material biocompatibility
High heat and humidity	Ease of contamination
Ambient cold	Thermal comfort
Wetness	Range of motion
High wind	Hand function
Insufficient or bright light	Ankle and back support
Excessive noise	Vision clarity
Radiation Hazards	Communications ease
Ionizing radiation	Fit (poor)
Nonionizing radiation	Ease of donning and doffing

It is important to recognize that the protective clothing specified in this standard does not protect against all of the hazards listed in Table A.1.1.6(a). In identifying the potential hazards, the department or organization should determine the likelihood of exposure and the consequence of exposure. The combination of these two factors should establish the risk of exposure and should permit the prioritization of protection needs.

As the requirements in this standard were designed to provide individuals with some protection against hazards associated with blood-borne pathogen exposure, it is important that the selected clothing and equipment enable the department or organization to comply with Title 29, Code of Federal Regulations, Part 1910.1030, "Protecting Health Care Workers from Occupational Exposure to Blood-Borne Pathogens." These regulations require that employers (departments and organizations) provide appropriate protective clothing and equipment to their workers. Appropriate protective clothing and equipment are defined as those items that prevent blood and other infectious liquids from passing through the clothing or equipment item to the wearer's skin or underclothing. For this reason, a principal component of most clothing and equipment requirements in this standard is a test that demonstrates the barrier performance of the item and the material in preventing liquid penetration. Additional requirements are added to demonstrate that the respective clothing or equipment item provides some degree of protection against other hazards that are relevant to the use of that item that might commonly be anticipated as part of emergency medical operations.

As part of the hazard and risk assessment conducted by the department or organization, it is important that the department or organization consider which portions of the body might become exposed. Exposures might occur to the arms and legs, as well as to the head, eyes and face, hands, feet, respiratory system, and hearing. Protective clothing and equipment should be specified for any body area that is at risk of exposure.

Table A.1.1.6(b) provides some factors for consideration of each of the protective clothing items addressed in this standard.

A.1.1.8 Fire and emergency response organizations are cautioned that accessories are not a part of the certified product but could be attached to the certified product by a means not engineered, manufactured, or authorized by the manufacturer.

Fire and emergency response organizations are cautioned that if the accessory or its means of attachment causes the structural integrity of the certified product to be compromised, the certified product might not comply with the standard for which it was designed, manufactured, and marketed. Additionally, if the accessory or its attachment means are not designed and manufactured from materials suitable for the hazardous environments of emergency incidents, the failure of the accessory or its attachment means could cause injury to the emergency responder.

Because the aftermarket for certified product accessories is so broad, fire and emergency response organizations are advised to contact both the manufacturer of the accessory and the manufacturer of the certified product and verify that the accessory and its means of attachment are suitable for use in the intended emergency response environment. Fire and emergency response organizations should seek and receive written documentation from both the accessory manufacturer and the manufacturer of the certified product to validate the following information:

(1) The accessory for a certified product, and its attachment method, will not degrade the designed protection or performance of the certified product below the requirements of the product standard to which it was designed, manufactured, tested, and certified.
(2) The accessory, when properly attached to the certified product, shall not interfere with the operation or function of the certified product, or with the operation or function of any of the certified product's component parts.

Users are also cautioned that the means of attachment of the accessory that fail to safely and securely attach the accessory to the certified product can cause the accessory to be inadvertently dislodged from the certified product and create a risk to the wearer or other personnel in the vicinity.

A.1.2.1 The federal OSHA standard, 29 CFR 1910.1030(c)(3)(i), defines personal protective equipment (PPE) as appropriate "only if it does not permit blood or other potentially infectious materials to pass through or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used." NFPA 1999 has established the minimum performance standard for PPE for use during emergency medical and medical first receiver operations.

The choice of which protective ensemble or which items of protective clothing to use will be based on an assessment of the hazards and the risk of exposure. Various conditions that exist at an emergency scene and at the medical facility receiving area(s) are uniquely different. Such conditions can be characterized by the uncontrolled environment and uncontained hazards.

A.1.2.5 This standard is not designed to be utilized as a purchase specification. It is prepared, as far as practicable, with regard to required performance, avoiding restriction of design wherever possible. Purchasers should specify organizational requirements for items such as color, markings, closures, pockets, and trim patterns, or other features related to specific items, ensembles, or ensemble elements. Tests specified in this standard should not be deemed as defining or establishing performance levels for protection from all emergency medical responder and medical first receiver environments, or in all CBRN terrorism incident environments, when the [C]BRN ensemble is specified by the purchaser.

A.1.3.1 Specific design and performance criteria are established in this standard to demonstrate limited protection against [C]BRN terrorism agents to permit first responders to escape and provide limited rescue while escaping the contaminated environment when encountering terrorism incidents. The protection criteria do not provide for reentry of first responders into the contaminated environment. Radiological and nuclear protection is limited to the hazards associated with radiological particulates. This standard does not establish specific criteria for protection from ionizing radiation. Moreover, this standard does not establish criteria for protection from chemical warfare agents or toxic industrial chemicals, protection from all biological agents, or protection from all weapons of mass destruction.

A.1.3.4 Although not covered in the standard, with the exception of [C]BRN protective ensembles, respiratory protection of emergency medical responders and first receivers is an important component of emergency medical operations. A respirator is a personal protective device that is worn on the face, covers at least the nose and mouth, and is used to reduce the wearer's risk of inhaling hazardous airborne particles (including dust particles and infectious agents), gases, or vapors.

Table A.1.1.6(b) Selection Factors for Emergency Protective Clothing and Equipment

Protected Area	Clothing or Equipment	Selection Factors
Body (arms and legs)	Single-use protective garments	Could cover body entirely or partially. (Protection is provided only to that part of the body that is covered.) Partial body clothing might not provide protection to interface areas unless the item is designed to interface effectively with the other item (e.g., sleeve protective with garment). Clothing material might or might not be breathable, which will affect wearing comfort. Single-use items tend to be less durable than multiple-use items. Might be subject to degradation in rigorous physical environments.
	Multiple-use protective garments	Factors above apply, except multiple-use items are designed to be cleaned and reused while maintaining their performance properties.
Hands	Single-use examination gloves	Gloves intended to provide protection to hand and wrist for one-time use with a maximum of dexterity and tactility. Gloves fit intimately with hand and appropriate size must be selected. Can be subject to degradation in rigorous physical environments.
	Single-use cleaning/ utility gloves	Gloves that are more robust and likely to resist physical hazards compared to examination gloves. Gloves that are more resistant to chemical solvents used in cleaning. Gloves intended for a single use only.
	Multiple-use work gloves	Gloves intended to provide barrier protection, but with sacrifice of dexterity and tactility as compared to examination and cleaning/utility gloves. Gloves can be used repeatedly if properly cared for and maintained, unless gloves cannot be properly decontaminated. Gloves are not flame or heat resistant and should not be used in thermal hazard environments.
Eyes/face	Single-use face mask	Can cover only mouth and nose (visors are optional). Visors do not provide primary eye protection and might not be effective for eye splash protection. Requirement for wearer to breathe through mask lowers blood-borne pathogen penetration resistance as compared to garments, gloves, and footwear, and other eye/face protection devices. Might be subject to degradation in rigorous physical environments. Might be used only once.
	Single-use eye and face protection device	Devices such as disposable faceshield. Periphery of device might not provide effective protection of entire face and eyes. Can be subject to degradation in rigorous physical environments. Only for a one-time use.
	Multiple-use eye and face protection device	Can include spectacles, goggles, or faceshields. Spectacles provide only limited eye protection. Goggles provide primary eye protection. Faceshields do not provide primary eye protection, but provide face and primary eye protection when combined with goggles. Can be used for multiple uses, if properly cared for and maintained, and if item can be cleaned following exposure.
	Face protective devices	Typically a combination device, or full facepiece of a respirator.
Feet and ankles	Single-use footwear covers	Disposable item that covers shoe or boot and is intended to provide barrier (splash) protection to primary footwear. Required to have slip-resistant wear surface. Can be subject to degradation in rigorous physical environments.
	Multiple-use footwear	Standard footwear with 3 in. of barrier protection. Intended to be reusable, if properly cared for and maintained, and if can be decontaminated effectively.
	Medical care facility footwear	Same as multiple-use footwear and single-use covers, but does not have requirements for impact/compression resistance for toe and puncture resistance of sole, allowing footwear to be lighter and more flexible.
Head	Helmet	Standard industrial helmet that also includes requirements for suspension and chin strap height. No specific criteria are included for side impact protection as might be needed for wearers inside vehicles.

The many types of respirators available include the following:

(1) Particulate respirators, which filter out airborne particles
(2) "Gas masks," which filter out chemicals and gases
(3) Airline respirators, which use compressed air from a remote source
(4) Self-contained breathing apparatus (SCBA), which include their own air supply

Particulate respirators can be further divided into the following categories:

(1) Disposable or filtering facepiece respirators, where the entire respirator is discarded when it becomes unsuitable for further use due to excessive resistance, sorbent exhaustion, or physical damage
(2) Reusable or elastomeric respirators, where the facepiece is cleaned and reused but the filter cartridges are discarded and replaced when they become unsuitable for further use
(3) Powered air-purifying respirators (PAPRs), where a battery-powered blower moves the air flow through the filters

An N-95 respirator is one of nine types of disposable particulate respirators. Particulate respirators are also known as air-purifying respirators (APR) because they protect by filtering particles out of the air as the wearer breathes. These respirators protect only against particles — not gases or vapors. Since airborne biological agents such as bacteria or viruses are particles, they can be filtered by particulate respirators.

Respirators that filter out at least 95 percent of airborne particles during "worse case" testing using a "most-penetrating" sized particle are given a "95" rating. Those that filter out at least 99 percent receive a "99" rating; those that filter at least 99.97 percent (essentially 100 percent) receive a "100" rating.

Respirators in this family are rated as N, R, or P for protection against oils. This rating is important in industry because some industrial oils can degrade the filter performance so it does not filter properly. Respirators are rated "N" if they are not resistant to oil; "R" if somewhat resistant to oil; and "P" if strongly resistant (oil proof). Thus, there are nine types of disposable particulate respirators:

(1) N-95, N-99, and N-100
(2) R-95, R-99, and R-100
(3) P-95, P-99, and P-100

The National Institute for Occupational Safety and Health (NIOSH) tests and approves respirators per 42 CFR 84 for occupational uses. NIOSH-approved disposable respirators are marked with the manufacturer's name, the part number (P/N), the protection provided by the filter (e.g., N-95), and "NIOSH." This information is printed on the facepiece, exhalation valve cover, or head straps. A listing of all NIOSH-approved disposable respirators is available at http://www.cdc.gov/niosh/npptl/respirators/disp_part/particlist.html. If a disposable respirator does not have these markings and does not appear on one of these lists, it has not been certified by NIOSH. NIOSH also maintains a database of all NIOSH-approved respirators regardless of respirator type, the *Certified Equipment List*, which can be accessed at http://www.cdc.gov/niosh/celintro.html. In addition, NIOSH provides a Respirator Selection Logic [http://www.cdc.gov/niosh/docs/2005-100/default.html], which provides guidance to respirator program administrators on respirator selection. More detailed respirator information has been published by NIOSH, CDC, at http://www.cdc.gov/niosh/respinfo.html.

Any of the types of particulate respirators can be worn for protection against severe acute respiratory syndrome (SARS), tuberculosis (TB), or avian influenza (bird flu) — if they are NIOSH-approved and if they have been properly fit-tested and maintained. All of the NIOSH-approved particulate respirators protect workers against SARS, TB, and avian influenza as effectively as the N-95 respirators. P-100 respirators should be worn for hazards such as hantavirus.

A respirator will work only if it is used correctly; thus, the key elements for respiratory protection are fit-testing and training of each worker in the use, maintenance, and care of the respirator. NIOSH considers each of the nine types of disposable particulate respirators to have similar fit characteristics. Therefore, when a worker is caring for or transporting infected patients, having a NIOSH-approved respirator that fits well is much more important than whether the respirator is an N-95 or one of the other eight types of disposable particulate respirators.

In patient care settings, the use of respirators by workers is regulated under the Occupational Safety and Health Administration (OSHA) standard for respiratory protection. The OSHA standard sets requirements for the fit-testing of respirators to ensure a proper seal between the respirator's sealing surface and the wearer's face. The OSHA standard also contains requirements for determining that workers can use respirators safely, for training and educating employees in the proper use of respirators, and for maintaining respirators properly. Note: Fit-testing and the other OSHA-required procedures are absolutely essential to assure that the respirator will provide the wearer with required protection. Detailed information on respiratory programs, including fit-test procedures can be found at http://www.osha-slc.gov/SLTC/etools/respiratory/index.html. Powered air-purifying respirators (PAPRs) use HEPA filters (high-efficiency particulate air filters), which are as efficient as P-100 filters and will protect against SARS, avian flu, and TB. PAPRs provide a higher level of protection than disposable respirators. Health care facilities in some SARS-affected areas have used higher levels of respiratory protection, including PAPRs, for persons present during aerosol-generating medical procedures such as bronchoscopy on SARS patients. When PAPRs are used, their reusable elements should be cleaned and disinfected after use and the filters replaced in accordance with manufacturer's recommendations. All used filters should be considered potentially contaminated with infectious material and must be safely discarded.

Design and performance requirements for medical face masks are included in this standard. These items are commonly known as surgical masks. Surgical masks are not designed for use as particulate respirators and do not provide as much protection as an N-95 respirator. Most surgical masks do not effectively filter small particles from air and do not prevent leakage around the edge of the mask when the user inhales.

When a respirator is cleared by the Food and Drug Administration (FDA) as a surgical mask and certified by NIOSH as an N-95 respirator mask, the FDA calls it a "surgical N-95 respirator." Surgical masks and surgical N-95 respirators are regulated by the FDA. The FDA evaluates the performance of these devices in areas including fluid resistance and filtration efficiency to ensure that they are at least as safe and effective as similar devices already on the market. The FDA encourages manufacturers to follow specific performance standards for their masks, and FDA also requires that these products be produced using good manufacturing practices.

Surgical masks and surgical N-95 respirators are disposable devices that cover the mouth and nose during medical procedures. They can help protect the caregiver and patient against

microorganisms, body fluids, and small particles in the air, but care should be taken for the selection and use of a surgical mask (medical facemask) versus a surgical N-95 respirator.

Types of Masks and Respirators Used in Patient Care.

(1) Surgical masks.
   (a) Include masks labeled as surgical, laser, isolation, dental, or medical procedure
   (b) Help protect against microorganisms, body fluids, and large particles in the air
   (c) Are designed to cover the mouth and nose loosely; not sized for individual fit
   (d) Help prevent exposure to the wearer's saliva and respiratory secretions
   (e) Are made of soft materials and are comfortable to wear
   (f) Are usually packaged in boxes of single-use masks

(2) Surgical N-95 respirators:
   (a) Are surgical masks designed to protect against small droplets of respiratory fluids and other airborne particles in addition to all the protection of surgical masks
   (b) Fit closely to form a tight seal over the mouth and nose
   (c) Require fit-testing and must be adjusted to your face to provide intended effectiveness
   (d) Might be uncomfortable due to tight fit
   (e) Are usually packaged as single devices or in boxes of single-use devices

Choosing Between Surgical Masks and Surgical N-95 Respirators.

CDC recommends the use of surgical masks or surgical N-95 respirators based on the ways that specific diseases are transmitted. For more information about CDC recommendations, see Infection Control in Healthcare Settings [http://www.cdc.gov/ncidod/dhqp/index.html].

A surgical mask should be chosen for the following reasons:

(1) For protection if splattered by someone's body fluids, such as blood, respiratory secretions, vomit, urine, or feces
(2) For protecting others when performing surgery, or caring for an open wound

A surgical N-95 respirator should be chosen to provide the same protections as a surgical mask as well as for the following reasons:

(1) To help prevent being exposed to very small particles (e.g., fine aerosolized droplets) such as those produced by coughing
(2) To care for persons with known or suspected pulmonary and laryngeal TB per OSHA regulations

What Should Be Known Before Using Surgical Masks and Surgical N-95 Respirators.

(1) The use of surgical masks and surgical N-95 respirators alone will not provide full protection from acquiring an infection. Other infection control practices such as hand-washing, isolating infected patients, and practicing appropriate coughing etiquette, are also important to minimize risk of infection.
(2) Surgical N-95 respirators must be fitted properly. A surgical N-95 respirator that has not been fitted properly might leave unprotected gaps between the respirator and the face. These gaps will impair the respirator's effectiveness. Facial hair or unusual facial features make it difficult to fit surgical N-95 respirators properly.
(3) Surgical masks are not fit-tested to a person's face and could leave unprotected gaps between the mask and the face.
(4) Masks lose their protective properties and must be changed when they become wet from saliva or respiratory secretions.
(5) Surgical masks and surgical N-95 respirators are not tested against specific microorganisms and should not claim to prevent specific diseases.
(6) CDC recommendations should be consulted for using surgical masks and surgical N-95 respirators in the care of patients needing isolation precautions [http://www.cdc.gov/ncidod/dhqp/gl_isolation_ptII.html].
(7) Surgical masks or surgical N-95 respirators should never be reused.
(8) Surgical masks or surgical N-95 respirators should never be washed or disinfected.
(9) Surgical masks or surgical N-95 respirators should never be shared with others.
(10) The FDA's website on PPE should be consulted [http://www.fda.gov/cdrh/ppe/about.html] for information on disposing of surgical masks and surgical N-95 respirators.

Nonmedical Respirators.

The FDA regulates as devices those respirators and other articles that are intended for use in preventing or treating infectious disease. There are a variety of respirators available for various occupational exposures that do not make medical claims and are not regulated by the FDA. Many of these respirators are intended to filter out particles of dust and mist from wood, metal, and masonry work. Nonmedical respirators are available from many sources, including hardware stores and online. Nonmedical respirators might look very similar to one another and to respirators that are regulated by the FDA. However, there are differences among these respirators and between these nonmedical respirators and respirators that have been cleared by FDA as surgical N-95 respirators.

Only respirators that have passed specific testing by NIOSH can be labeled as NIOSH approved. Each NIOSH-approved respirator contains a rating, such as N-95, which refers to its certified level of filtration efficiency. If a nonmedical respirator is not labeled as NIOSH-certified, it has not been evaluated by the government to determine whether or not it works.

Although NIOSH-approved nonmedical respirators have met filtration efficiency requirements, they are not subject to the additional requirements of FDA-cleared surgical N-95 respirators (i.e., fluid and flammability resistance).

A.1.3.6 NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, establishes two different classes of ensembles addressing the hazards present during chemical terrorism incidents. These ensembles consist of full body one- or multi-piece suit, gloves, and footwear.

The Class 2 ensemble can be designed with the CBRN SCBA worn inside or outside of the ensemble and is intended for wearer protection in an immediately dangerous to life and health (IDLH) environment. Ensembles are tested for their integrity to both vapors and liquids. Materials are tested for permeation resistance to selected chemical agent and toxic industrial chemicals at concentrations consistent with the same levels used for evaluating CBRN SCBA; materials are also tested for viral penetration resistance, and various physical properties to demonstrate adequate physical hazard resistance and durability for a single use. Ensembles are tested for functionality.

Class 3 ensembles can be designed for use with CBRN SCBA, CBRN APR, or CBRN PAPR, though CBRN APR and CBRN PAPR are consistent with the use of this ensemble. The

Class 3 ensemble is designed for protection against lower exposure levels of gases, vapors, liquids, and particulates as compared to Class 2 ensembles and are intended for exposure levels below IDLH levels. Ensembles are evaluated for vapor and liquid integrity but with less stringent criteria as compared to Class 2 ensembles. Materials are tested for permeation resistance to selected chemical agent and toxic industrial chemicals at low concentrations consistent with the same levels used for evaluating CBRN APR; materials are also tested for viral penetration resistance and various physical properties to demonstrate adequate physical hazard resistance and durability for a single use. Ensembles are tested for functionality.

In addition to NFPA 1994, CBRN protection for chemical terrorism incidents is addressed in optional performance criteria established by NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*. The levels of protection established for the CBRN option are consistent with those provided for Class 2 in NFPA 1994 to CBRN terrorism incidents; however, ensembles and materials are tested against representative CBRN agents or simulants after rigorous conditioning to help ensure that the protection will remain in place over the expected service life of the ensemble. Specific design and performance criteria are established in this standard to demonstrate limited protection against CBRN terrorism agents to permit fire fighters to escape and provide limited rescue while escaping the contaminated environment when encountering terrorism incidents. The criteria are not intended to provide for reentry of fire fighters into the contaminated environment. This standard does not establish criteria for protection from all chemical warfare agents, protection from all biological agents, protection from all weapons of mass destruction, or protection from all toxic industrial chemicals.

Similarly, NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, establishes requirements for a CBRN protective ensemble that can be used for protection during chemical terrorism incidents. The criteria and levels of protection established for the CBRN protective ensemble for technical rescue incidents are based on Class 3 in NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*. Like NFPA 1971, assessment of ensemble and material performance are made after rigorous conditioning to help ensure that the protection will remain in place over the expected service life of the ensemble. NFPA 1951 is also similar in indicating that the design and performance criteria established in this standard demonstrate limited protection again CBRN terrorism agents to permit rescuers to escape and provide limited rescue while escaping the contaminated environment when encountering terrorism incidents. NFPA 1951 also does not establish criteria for protection from all chemical warfare agents, protection from all biological agents, protection from all weapons of mass destruction, or protection from all toxic industrial chemicals.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3 Where terms are not defined in Section 3.3, General Definitions, those terms have the ordinarily accepted meanings or the meaning that the text implies.

For the purposes of this standard, the terms defined in Section 3.3, General Definitions, have the meanings stated unless modified by specific text within the mandatory requirements of this standard.

Terms used in the present tense include the past and future tense; terms used in the masculine gender include the feminine and neuter genders; terms used in the singular include the plural; and terms used in the plural include the singular.

A.3.3.12 CBRN Barrier Layer. While it is recognized that the entire composite will affect the performance of the ensemble clothing in preventing the penetration of [C]BRN agents, the identification of the [C]BRN barrier material is intended to assist with the application of specific ensemble and element tests in this standard.

A.3.3.13 CBRN Terrorism Agents. Chemical terrorism agents include solid, liquid, and gaseous chemical warfare agents and toxic industrial chemicals. Chemical warfare agents include, but are not limited to GB (Sarin), GD (Soman), HD (sulfur mustard), VX, and specific toxic industrial chemicals. Many toxic industrial chemicals, for example chlorine and ammonia, are identified as potential chemical terrorism agents because of their potential availability and degree of injury they could potentially inflict.

The [C]BRN protection specified in this standard does not offer chemical terrorism agent protection and only offers limited protection from biological terrorism agents and radiological particulates terrorism agents.

Biological terrorism agents are bacteria, viruses, or the toxins derived from biological material. The [C]BRN ensemble protects against biological particles dispersed as aerosols and liquid-borne pathogens, Airborne biological agents could be dispersed in the form of liquid aerosols or solid aerosols, that is, a powder of bacterial spores. Liquid-borne pathogens could be potentially encountered during a terrorism incident as a

result of deliberate dispersal or from body fluids released by victims of other weapons, that is, explosives or firearms.

[C]BRN ensembles protect from radiological particulates dispersed as aerosols. The protection is defined for blocking or filtering airborne particulate matter — liquid and solid aerosols — not for radiological gases or vapors. Airborne particulates have the ability to emit alpha- and beta- particles and ionizing radiation from the decay of unstable isotopes.

A.3.3.23 Emergency Medical Cleaning/Utility Glove. Emergency medical cleaning/utility gloves are not intended to be used as emergency medical examination gloves or emergency medical work gloves. Emergency medical cleaning/utility gloves are not intended and should not be used for emergency patient care because these gloves might not provide adequate hand function in terms of dexterity and tactility for some medical tasks. Emergency medical cleaning/utility gloves also do not provide the necessary levels of physical protection that are met by emergency medical work gloves, which are suitable for extrication and other emergency medical operations where significant physical hazards might be faced. However, emergency medical cleaning/utility gloves are more robust and provide greater resistance to physical hazards compared to emergency medical examination gloves and can be suitable for body recovery and other medical functions where blood and other body fluids could be encountered outside the provision of emergency patient care.

A.3.3.25 Emergency Medical Eye and Face Protection Device. These devices include spectacles, goggles, faceshields, and combination devices, but do not include emergency medical face masks, which are separately defined and to which different criteria are applied. These devices differ from emergency medical facemasks by being continuous in their barrier protection to the eyes or portions of the face that are protected. These devices further provide physical protection to the eyes and portions of the face.

A.3.3.26 Emergency Medical Facemask. Emergency medical facemasks include surgical and procedure masks, which might or might not have shields. These items of protective clothing include materials that are resistant to the penetration of blood and body fluids while allowing the wearer to breathe through the facemask material. NFPA 1999 references that emergency medical facemasks comply with the "high barrier performance" of requirements of ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks*. Nevertheless, these items do not afford the same level of barrier protection consistent with other items of emergency medical protective clothing since they are not tested for and cannot pass viral penetration resistance testing.

Emergency medical facemasks, unless certified by NIOSH under 42 CFR 84, "Approval of Respiratory Protective Devices," are not respirators and do not provide respiratory protection against airborne hazards.

A.3.3.29 Emergency Medical Garment. Emergency medical garments include, but are not limited to, full body clothing such as suits, coveralls, and patient/victim isolation bags; and non-full body clothing such as aprons and sleeve protectors.

A.3.3.31 Emergency Medical Operations. Emergency medical operations include the provision of emergency patient care by emergency medical responders and medical first receivers. For emergency medical responders, this care might be provided at the scene of accident or in the transport of patients to a medical facility. For medical first receivers, care is generally provided at a medical facility, although medical first receivers might also provide emergency patient care at various temporary emergency medical facilities. Body recovery is included as emergency medical operations because some patients could die in the course of treatment, and some events, including large-scale disasters, could require body removal, in which significant blood-borne pathogen hazards exist.

A.3.3.32 Emergency Medical Protective Clothing. Multiple items of protective clothing include single-use and multiple-use garments, single-use examination gloves, single-use cleaning/utility gloves, multiple-use work gloves, single-use footwear covers, multiple-use footwear, multiple-use medical care facility footwear, single-use facemasks, single-use and multiple-use eye and face protection devices, and multiple-use helmets.

A.3.3.49 Gusset. The gusset generally lacks some layers used in the construction of the footwear upper or might include different layers for the purpose of being flexible. The gusset is not observable from the front of the footwear when the footwear is donned or laced up.

A.3.3.57 Medical Care Facility Footwear. Medical care facility footwear is intended for use at medical care facilities where a hazard and risk hazard demonstrates that the likelihood of physical hazards warrants the use of footwear that does not provide toe impact and compression resistance or sole puncture resistance. This footwear differs from emergency medical protective footwear in that it does not require the toe impact and compression resistance and sole puncture resistance that is specified in ASTM F 2413, *Standard Specification for Performance Requirements for Foot Protection* (which replaced ANSI Z41, *Standard for Personal Protection — Protective Footwear.*). The footwear is also not required to be as high as emergency medical footwear. However, medical care facility footwear still must provide the same material barrier and integrity performance criteria as specified for emergency medical footwear.

A.3.3.61 Multiple Use. In this standard, garments, footwear, face protection devices, cleaning/utility gloves, and work gloves can be certified as multiple-use items. The continued use of these items is subject to applying the care and use instructions provided by the manufacturer. While some multiple-use items are evaluated for performance after repeated laundering, these preconditioning treatments do not indicate a specific wear life for the item. The authority having jurisdiction is responsible for determining when any particular item should be retired based on its condition and expected performance in protecting the first responder or first receiver.

A.3.3.68 Product Label. Such labels contain compliance statements, certification statements, general information, care, maintenance, or similar data. The product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark is attached to or a part of the product label.

A.3.3.69 Radiological Particulate Terrorism Agents. This standard provides only partial protection from certain radiation sources. By their nature, these ensembles provide protection from alpha particles, and the element materials and distance will significantly attenuate beta particles. These ensembles do not provide any protection from ionizing radiation, such as gamma- and x-rays, other than to keep the actual radiological particulate from direct skin contact.

A.3.3.76 Single-Use Item. What constitutes a "use" will be defined by the product manufacturer. A single use could include

unpackaging, one donning, or one wearing while responding. In the absence of any manufacturer's specific information, one "use" should be considered any wearing of the item. Inspection of any item should be conducted in accordance with the manufacturer's instructions and should assess the overall condition and suitability of an item for a specified use.

A.3.3.80 Tongue. The tongue might or might not be made of the same composite as the footwear upper. The tongue might be of a similar material composite as the footwear gusset.

A.3.3.83 Visibility Materials. Visibility materials are those materials that are intended to provide conspicuity of the wearer for the purposes of complying with ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, but do not include other materials that are used for wearer identification or marking.

A.4.1.8 From time to time the NFPA has received complaints that certain items of emergency services protective clothing or protective equipment could be carrying labels falsely identifying them as compliant with an NFPA standard. The requirement for placing the certification organization's mark on or next to the product label is to help ensure that the purchaser can readily determine compliance of the respective product through independent third-party certification.

NFPA advises those purchasing emergency medical protective ensembles or protective clothing to be aware that for emergency medical protective ensembles or protective clothing items to meet the requirements of NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations*, they must be certified by an independent third-party certification organization. In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.

NOTE: An emergency medical protective ensemble or protective clothing item that does not bear the mark of an independent third-party certification organization is not compliant with NFPA 1999, even if the product label states that the item is compliant!

For further information about certification and product labeling, Chapter 4 and Chapter 5 of NFPA 1999 should be referenced. Also, the definitions for *certification/certified*, *labeled*, and *listed* in Chapter 3 should be reviewed.

Third-party certification is an important means of ensuring the quality of emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, the NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers should also contact the certification organizations and request copies of the certification organization's "list" of certified products to the appropriate NFPA standard. This "listing" is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization and, as with NFPA 1999 emergency medical protective ensembles or protective clothing items, all items of emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

NOTE: Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is not compliant with the appropriate NFPA standard, even if the product label states that the item is compliant!

A.4.2.1 The certification organization should have sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

A.4.2.5 The contractual provisions covering a certification program should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products.

Without the clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

A.4.2.7.1 Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

A.4.2.9 Such inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it could be desirable to purchase samples in the open market for test purposes.

A.4.5.4 For example, this situation exists when the product is wholly manufactured and assembled by another entity, or entities, for a separate entity that puts their own name and label on the product, frequently called "private labeling," and markets and sells the product as their product.

A.4.5.5 Subcontractors should be considered to be, but not be limited to, a person or persons, or a company, firm, corporation, partnership, or other organization having an agreement with or under contract with the compliant product manufacturer to supply or assemble the compliant product or portions of the compliant product.

A.4.6.1 ISO 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, is a component of accreditation of certification organizations specified in 4.1.3 and 4.2.3. Those paragraphs contain mandatory reference to ISO 65, *General requirements for bodies operating product certification systems*, in which ISO 27 is referenced.

A.4.6.2 By definition, a hazard could involve a condition that can be imminently dangerous to the end user. With this thought in mind, the investigation should be started immediately and completed in as timely a manner as is appropriate considering the particulars of the hazard being investigated.

A.4.6.11 The determination of the appropriate corrective action for the certification organization to initiate should take into consideration the severity of the product hazard and its potential consequences to the safety and health of end users. The scope of testing and evaluation should consider, among other things, testing to the requirements of the standard to which the product was listed as compliant; the age, type of use, and conditions to which the compliant product has been exposed; care and maintenance that has been provided; the use of expertise on technical matters outside the certification organization's area of competence; and product hazards caused by circumstances not anticipated by the requirements of the applicable standard. As a guideline for determining between a

safety alert and a product recall, the following product hazard characteristics are provided. These characteristics are based on 42 CFR 84, Subpart E, §84.41:

(1) *Critical.* A product hazard that judgment and experience indicate is likely to result in a condition immediately hazardous to life or health (IHLH) for individuals using or depending on the compliant product. If an IHLH condition occurs, the user will sustain, or will be likely to sustain, an injury of a severity that could result in loss of life, or resultant significant bodily injury or loss of bodily function, either immediately or at some point in the future.
(2) *Major A.* A product hazard, other than Critical, that is likely to result in failure to the degree that the compliant product does not provide any protection or reduces protection, and is not detectable to the user. The term *reduces protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is likely to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
(3) *Major B.* A product hazard, other than Critical or Major A, that is likely to result in reduced protection, and is detectable to the user. The term *reduces protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is *likely* to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
(4) *Minor.* A product hazard, other than Critical, Major A, or Major B, that is not likely to materially reduce the usability of the compliant product for its intended purpose, or a product hazard that is a departure from the established applicable standard and has little bearing on the effective use or operation of the compliant product for its intended purpose.

Where the facts are conclusive, based on characteristics of the hazard classified as indicated in A.4.6.11(1)–(4), the certification organization should consider initiating the following corrective actions with the authorized and responsible parties:

(1) *Critical* product hazard characteristics: product recall
(2) *Major A* product hazard characteristics: product recall or safety alert, depending on the nature of the specific product hazard
(3) *Major B* product hazard characteristics: safety alert or no action, depending on the nature of the specific product hazard
(4) *Minor* product hazard characteristic: no action

A.4.6.13 Reports, proposals, and proposed TIAs should be addressed to the technical committee that is responsible for the applicable standard, in care of Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

A.6.1.1.2 In specifying full body emergency medical protective garments, garments should include the combination of both jacket or coat and pants in order to provide protection to the whole body. Exclusion of the protective pants permits exposure of individuals to hazards associated with emergency medical operations.

A.6.1.1.5 The requirement in 6.1.1.5 is to ensure that an entire garment will provide biopenetration protection for the wearer. In the past, certain parts of a garment, such as the front or the sleeves from wrist to elbows but not above the elbow, were permitted to provide the biopenetration protection, but the purchaser/wearer might not have been aware that the biopenetration protection was only partial.

A.6.1.1.6 The requirement in 6.1.1.6 is not intended to preclude the garment designer/manufacturer from attaching the barrier layer to other garment materials via hemming and binding means in an emergency medical garment.

It is intended that the barrier layer be composed of a single, nonseparable laminate or coated material. It is intended not to allow more than one garment material layer to be designated as and tested as the barrier layer.

The requirement in 6.1.1.6 is also intended to permit evaluation of the barrier layer's biopenetration resistance.

A.6.1.1.7 The design requirement prevents fittings being used in the construction of garments that could potentially snag or tear protective materials.

A.6.1.2.8 The authority having jurisdiction should conduct a risk assessment and make the determination for the level of visibility required in an ensemble or protective clothing for emergency medical incidents operations, based upon the anticipated use of such garments.

The Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Devices (MUTCD)*, 2009 edition, requires workers on the right-of-way of all roadways to wear high-visibility apparel that is defined as compliant to ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, performance Class 2 or Class 3. It is possible to be compliant with the MUTCD either by incorporating ANSI-compliant high-visibility fluorescent and retroflective materials into NFPA 1999-compliant apparel such as a jacket, parka, shirt, and so on, or through the use of a supplemental high-visibility garment. High-visibility component materials incorporated into primary apparel should comply with the requirements of prevailing standards applying to the chosen ensemble, such as NFPA 1999, ANSI 107, and so forth. The MUTCD also allows for the use of garments specified in ANSI/ISEA 207, *Standard for High-Visibility Public Safety Vests*, as supplemental garments for public safety workers.

Where the authority having jurisdiction anticipates the presence of hazards to personnel due to lack of visibility such as proximity to traffic, moving machinery, or heavy equipment in operation, high-visibility clothing as specified in ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*. As a compliant garment, those garments specified in ANSI/ISEA 207, *Standard of High-Visibility Public Safety Vests*, are the type of garments that should be used. A useful guide for determining appropriate application of Class 1, Class 2, and Class 3 visibility can be found in ANSI/ISEA 107, Appendix B, "Suggested Performance Class Guidelines and Scenarios." Labeling of primary or supplemental apparel complying with ANSI/ISEA 107 specifications should be in accordance with 11.2 of ANSI/ISEA 107.

Users of protective garments should be aware that visibility markings have varying durability under field use conditions. The visibility materials can be damaged, but still appear to be in good condition or can become soiled and lose retroreflective or fluorescent qualities. Such visibility markings can also lose retroreflective qualities in rain.

A.6.2.1.1 NFPA 1581, *Standard on Fire Department Infection Control Program*, requires single-use emergency medical examination gloves for emergency medical operations.

A.6.2.3.3.6 The measurements given in 6.2.3.3.6(1)–(5) are palm lengths and are calculated by subtracting the median length of digit 3 from the median hand length found for each glove size in Table 6.2.3.6(a) through Table 6.2.3.6(e).

A.6.2.3.6 The values contained in Table 6.2.3.6(a) through Table 6.2.3.6(e) are barehand dimensions, not glove pattern dimensions. Guidelines for applying these dimensions to flat glove patterns vary, depending on such factors as the type of pattern being used, the number of layers in the glove, and the type of fit desired for the glove.

The values contained in the five tables are those that apply to the five-size system intended to fit a population defined as the 5th percentile (female) through the 95th percentile (male) in the U.S. Army. These values are not valid if other than a five-size system is being used or if the demographics of the intended population vary.

Caution should be used in determining the specific value to be used in glove patterning from the given range of values for a particular dimension and glove size. The choice of the lowest, middle, or highest value is related to expectations of how the glove will fit.

A.6.3.3.6 The design requirement prevents hardware that could potentially snag or tear protective materials from being used on face protection devices.

A.6.5 Helmet design and performance criteria are provided for emergency medical helmets for use in environments where impact hazards might the present. No specific criteria have been developed to address helmets used inside emergency vehicles to help prevent injuries to emergency medical responders in the event of a vehicle crash. Alternative types of helmets might provide protection for side and top impact for use in emergency vehicles but are not addressed by this standard.

A.6.6.3 Protective ensembles offering [C]BRN protection are intended to be ensembles that are normally reusable, but offer [C]BRN protection when needed. These ensembles are not intended for reuse following exposure to [C]BRN terrorism agents, unless it can be demonstrated that the decontamination procedures adequately remove all contaminants. End users wishing to employ single-use ensembles should wear protective ensembles meeting the Class 4 requirements of NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*.

A.7.1.1 The performance criteria for single-use garments are based on the same level of material biopenetration resistance and overall garment integrity as for multiple-use garments; however, a lower level of physical property performance (tensile strength, burst strength, tear resistance, puncture propagation tear resistance, and seam strength) is defined, since it is expected that single-use garments are used for shorter periods as compared with multiple-use garments.

A.7.5 See A.6.5.

A.8.1.9 When a glove is two dimensional rather than three dimensional (the glove in Figure 8.1.9.1 is three dimensional), then the same methodology should be applied to the two-dimensional glove. For example, if there are requirements for the sides of the fingers, then the area of the glove that would cover the sides of the fingers should be considered for these requirements even though the glove does not have forchettes.

When wearing a correctly sized glove and laying the gloved hand completely flat on an even, flat surface, the portion of the glove that comes in contact with the even, flat surface should be considered the palm test areas of the glove. The layers immediately above the palm areas should be considered the areas next to the palm areas.

The finger sides should include the interior side areas of the small, ring, middle, and index fingers for a glove, that are hidden from sight, as observed both from the glove palm and glove back sides, when an individual wearing a correctly sized glove has his or her fingers completely closed.

The back area is intended to include all parts of the glove that are not defined as the palm area or the side areas. The layers immediately beneath the back areas should be considered the side areas next to the back areas.

A.8.2.4.1 A 0.04-weight-percent solution of Surfynol 104H, or equivalent, with water gives a surface tension of 40 dynes/cm.

A.8.2.5.2 Holding the mannequin's feet down on a heavy, flat metal plate with two upright threaded posts, a large slotted metal bar, and heavy-duty metal bolts is the preferred means for mounting the mannequin in the spray chamber to prevent any effects of the mannequin mounting on the garment specimen.

A.8.2.6 The authority having jurisdiction can request a diagnosis of the mechanism of failure.

A.8.9.4 A 0.04-weight-percent solution of Surfynol 104H with water gives a surface tension of 40 dynes/cm.

A.8.20.4 However, if experience shows that the friction properties of the test floor are not strongly influenced by repeated testing, then calibration intervals can be extended.

A.8.23.4.5 A 0.04-weight-percent solution of Surfynol 104H, or equivalent, with water gives a surface tension of 40 dynes/cm.

A.8.24.4.2 The specified test cell meets the test cell requirements for the Liquid Challenge/Vapor Penetration (L/V) Test Cell specified in TOP 8-2-501, *Permeation and Penetration of Air-Permeable, Semipermeable, and Impermeable Materials with Chemical Agents or Simulants*, with the following exceptions:

(1) The test cell is configured to separately permit flow across the challenge side and the collection side, and to allow the challenge side to be exposed for the placement of challenge chemical.
(2) The sample support plate shown in Figure 8.24.4.2(c) has been modified to permit the O-rings to be closer to the exposed surface area of the specimen.
(3) The cell top cap shown in Figure 8.24.4.2(f) has a smooth solid surface facing the test specimen, that is, no opening ports for cell integrity testing.
(4) Ports for testing the integrity of the assembled test cell are mounted on the inlet fittings on both the upper body and lower body of the test cell.

A.8.24.4.3 It is essential that the air delivery system provide precise flow to each test cell and achieve the specified temperature and humidity conditions. This delivery is controlled by the conditioning of the incoming air to achieve the tem-

perature and humidity conditions before reaching each test cell and is monitored by separate flow meters or controllers for each test cell.

A.8.24.4.4 The performance requirement is based on a cumulative measurement; however, discrete measurements can be used to determine this. These discrete measurements must be able to account for the total amount of the challenge chemical permeating. This means that the frequency of the discrete sampling must be almost continuous, at least sampling once per minute, preferably sampling two to four times per minute, or more. The efficacy of the selected sampling and analysis approach should be validated for each challenge chemical through the use of procedures where a known amount of the challenge chemical, representative of a cumulative permeation close to the minimum requirement, is injected into the collection medium of a trial test. The selected sampling and analytical approach should be able to demonstrate a mass recovery of 95 percent or better at test conditions to be considered a valid part of the procedures.

A.8.24.5.1 Viton® O-rings have been found to be compatible with the challenge chemicals.

A.8.24.5.1.1 One procedure to determine the compatibility of O-ring material with the challenge chemicals would be to place the O-rings in contact with the challenge chemical for a period of 4 hours. The O-rings are then removed from contact with the challenge chemical, and any physical changes or signs of degradation can be observed.

A.8.24.5.2 Aluminum foil with a thickness of 1/32 in. has been found to be acceptable.

A.8.24.7.5.9 Aluminum foil with a thickness of 1/32 in. has been found to be acceptable.

A.8.29.4.2 A 0.04-weight-percent solution of Surfynol 104H, or equivalent, with water gives a surface tension of 40 dynes/cm.

A.8.32.5 These modifications should be used instead of Note 6 in ASTM F 1868, Part C.

A.8.34.5.3 Areas of the indicator garment are masked to provide an additional means of evaluating leakage. The removal of the masked areas following testing allows for uncontaminated areas for comparison purposes. Inappropriate materials for masking can affect the indicator garment by tearing, leaving residue, skewing black light visual analysis, and so forth.

A.8.34.5.8 Procedure A of ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, is modified by excluding the crawling and kneeling activities. The Particulate Inward Leakage Test was not intended to include mechanical action or contact as part of the test method; therefore, the crawling and kneeling activities were not included and rest periods are completed in a standing position.

A.8.34.5.11.1 The Super-High-Intensity Lamp, Model SB-100P with Flood Bulb from Spectroline or equivalent has been found suitable for use to meet the black light specifications.

Annex B Informational References

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

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

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2010 edition.

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2013 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2013 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, 2005 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2012 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2012 edition.

B.1.2 Other Publications.

B.1.2.1 ANSI Publications. American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI/ISEA 107, *High-Visibility Safety Apparel and Headwear*, 2004.

ANSI/ISEA 207, *Standard for High-Visibility Public Safety Vests*, 2006.

ANSI Z41, *Standard for Personal Protection — Protective Footwear*, 1999.

B.1.2.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM F 1154, *Standard Practice for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles*, 2010

ASTM F 1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2012.

ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks*, 2004.

ASTM F 2413, *Standard Specification for Performance Requirements for Foot Protection*, 2005.

B.1.2.3 ISO Publications. International Standards Organization, 1 rue de Varembé, Case Postale 56, CH-1211 Genevé 20, Switzerland.

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

ISO 65, *General requirements for bodies operating product certification systems*, 1996.

B.1.2.4 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.132, "General Requirements of Subpart I, Personal Protective Equipment."

Title 29, Code of Federal Regulations, Part 1910.1030, "Protecting Health Care Workers from Occupational Exposure to Bloodborne Pathogens."

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

Federal Highway Administration (FHWA), *Manual on Uniform Traffic Control Devices (MUTCD)*, 2009.

NIOSH, *Certified Equipment List.*

NIOSH, "Improvement of Criteria for EMS Personal Protective Equipment."

B.1.2.5 U.S. Military Publications. U.S. Army Developmental Test Command (DTC) Attn: CSTE-DTC-TT-S, Aberdeen Proving Ground, MD 21005–5055.

Test Operations Procedure (TOP-8–2–501), *Permeation and Penetration of Air-Permeable, Semipermeable, and Impermeable Materials with Chemical Agents or Simulants*, 1997.

B.2 Informational References. AATCC 22, *Water Repellancy: Spray Test*, 2010.

AATCC 135, *Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics*, 2010.

ANSI 207, *Standard for High-Visibility Public Safety Vests*, 2006.

ASTM F 739a, *Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact*, 2007.

ISO 9001, *Quality systems — Model for quality assurance in design, development, production, installation, and servicing*, 1994.

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

Index

Sequence of Events Leading to Issuance of This NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion"* are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
- Standards Council decides, based on all evidence, whether or not to issue Document or to take other action, including hearing any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE *Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES:
1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
4. Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

Submitting Public Input / Public Comment through the Electronic Submission System (e-Submission):

As soon as the current edition is published, a Standard is open for Public Input.

Before accessing the e-Submission System, you must first sign-in at www.NFPA.org. *Note: You will be asked to sign-in or create a free online account with NFPA before using this system*:

a. Click in the gray Sign In box on the upper left side of the page. Once signed-in, you will see a red "Welcome" message in the top right corner.
b. Under the Codes and Standards heading, Click on the Document Information pages (List of Codes & Standards), and then select your document from the list or use one of the search features in the upper right gray box.

OR

a. Go directly to your specific document page by typing the convenient short link of www.nfpa.org/document#, (Example: NFPA 921 would be www.nfpa.org/921) Click in the gray Sign In box on the upper left side of the page. Once signed in, you will see a red "Welcome" message in the top right corner.

To begin your Public Input, select the link The next edition of this standard is now open for Public Input (formally "proposals") located on the Document Information tab, the Next Edition tab, or the right-hand Navigation bar. Alternatively, the Next Edition tab includes a link to Submit Public Input online

At this point, the NFPA Standards Development Site will open showing details for the document you have selected. This "Document Home" page site includes an explanatory introduction, information on the current document phase and closing date, a left-hand navigation panel that includes useful links, a document Table of Contents, and icons at the top you can click for Help when using the site. The Help icons and navigation panel will be visible except when you are actually in the process of creating a Public Input.

Once the First Draft Report becomes available there is a Public comment period during which anyone may submit a Public Comment on the First Draft. Any objections or further related changes to the content of the First Draft must be submitted at the Comment stage.

To submit a Public Comment you may access the e-Submission System utilizing the same steps as previous explained for the submission of Public Input.

For further information on submitting public input and public comments, go to: http://www.nfpa.org/publicinput

Other Resources available on the Doc Info Pages

Document information tab: Research current and previous edition information on a Standard

Next edition tab: Follow the committee's progress in the processing of a Standard in its next revision cycle.

Technical committee tab: View current committee member rosters or apply to a committee

Technical questions tab: For members and Public Sector Officials/AHJs to submit questions about codes and standards to NFPA staff. Our Technical Questions Service provides a convenient way to receive timely and consistent technical assistance when you need to know more about NFPA codes and standards relevant to your work. Responses are provided by NFPA staff on an informal basis.

Products/training tab: List of NFPA's publications and training available for purchase.

Community tab: Information and discussions about a Standard

Information on the NFPA Standards Development Process

I. Applicable Regulations. The primary rules governing the processing of NFPA standards (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing the Development of NFPA Standards (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Standards Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA Headquarters; all these documents are also available on the NFPA website at "www.nfpa.org."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the responsible Committee(s), in accordance with the Regulations, in preparation of a new or revised NFPA Standard." The Technical Committee Report is in two parts and consists of the First Draft Report and the Second Draft Report. (See *Regs* at 1.4)

III. Step 1: First Draft Report. The First Draft Report is defined as "Part one of the Technical Committee Report, which documents the Input Stage." The First Draft Report consists of the First Draft, Public Input, Committee Input, Committee and Correlating Committee Statements, Correlating Input, Correlating Notes, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.3) Any objection to an action in the First Draft Report must be raised through the filing of an appropriate Comment for consideration in the Second Draft Report or the objection will be considered resolved. [See *Regs* at 4.3.1(b)]

IV. Step 2: Second Draft Report. The Second Draft Report is defined as "Part two of the Technical Committee Report, which documents the Comment Stage." The Second Draft Report consists of the Second Draft, Public Comments with corresponding Committee Actions and Committee Statements, Correlating Notes and their respective Committee Statements, Committee Comments, Correlating Revisions, and Ballot Statements. (See *Regs* at Section 4.2.5.2 and 4.4) The First Draft Report and the Second Draft Report together constitute the Technical Committee Report. Any outstanding objection following the Second Draft Report must be raised through an appropriate Amending Motion at the Association Technical Meeting or the objection will be considered resolved. [See *Regs* at 4.4.1(b)]

V. Step 3a: Action at Association Technical Meeting. Following the publication of the Second Draft Report, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion. (See *Regs* at 4.5.2) Standards that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June Association Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.5.3.2 through 4.5.3.6 and Table1, Columns 1-3 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an Association Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.5.3.7 through 4.6.5.3) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no Notice of Intent to Make a Motion (NITMAM) is received and certified in accordance with the Technical Meeting Convention Rules, the standard is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents. (See *Regs* at 4.5.2.5)

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the Association or on matters within the purview of the authority of the Council, as established by the *Bylaws* and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (See *Regs* at 1.6). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an Association Technical Meeting within 75 days from the date of the recommendation from the Association Technical Meeting, unless this period is extended by the Council (See *Regs at* 4.7.2). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (See *Regs* at 4.5.2.5 and 4.7.4).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the Association. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in 1.7 of the *Regs*.

X. For More Information. The program for the Association Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. For copies of the First Draft Report and Second Draft Report as well as more information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org/aboutthecodes) or contact NFPA Codes & Standards Administration at (617) 984-7246.

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4 Easy Ways to Join

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