NFPA® 1999

Standard on Protective Clothing for Emergency Medical Operations

2008 Edition

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

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NFPA® 1999

Standard on

Protective Clothing for Emergency Medical Operations

2008 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 December 11, 2007, with an effective date of December 31, 2007, and supersedes all previous editions.

This edition of NFPA 1999 was approved as an American National Standard on December 31, 2007.

Origin and Development of NFPA 1999

This standard was developed to address protective garments, gloves, and facewear designed to 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 its work on 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 may 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 edition, the 2003 edition, of NFPA 1999 was acted on by the NFPA membership at the November Association Technical Meeting in Atlanta, Georgia, on 20 November 2002, and became effective on 6 February 2003.

This 2008 edition, the fourth edition of NFPA 1999, includes a number of changes that were implemented to address emerging needs for emergency medical service 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 this 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 hospital 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.

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

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

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

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

Committee Scope: This Committee shall have primary responsibility for documents on protective clothing and protective equipment, except respiratory protective equipment, that provides hand, torso, limb, and face protection for fire fighters or other emergency services responders during incidents that involve emergency medical operations. These operations include first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical procedures provided to patients prior to arrival at a hospital or other health care facility.

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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Standard on

Protective Clothing for Emergency Medical Operations

2008 Edition

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

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* The 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,* 2007 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program,* 2005 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents,* 2007 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 22, *Water Repellency: Spray Test*, 2005.

AATCC 42, *Water Resistance: Impact Penetration Test*, 2000.

AATCC 70, *Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test,* 2005.

AATCC 135, *Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics*, 2004.

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*, 2004.

ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* 2003.

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

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*, 2003.

ASTM D 412a, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers — Tension,* 1998a (2002) e1.

ASTM D 573, *Standard Test Method for Rubber-Deterioration in an Air Oven,* 2004.

ASTM D 1230, *Standard Test Method for Flammability of Apparel Textiles*, 1994 (2000).

ASTM D 1630, *Test Method for Rubber Property-Abrasion Resistance (Footwear Abrader),* 2006.

ASTM D 1683, *Standard Test Method for Failure in Sewn Seams of Woven Apparel Fabrics,* 2004.

ASTM D 1776, *Standard Practice for Conditioning and Testing Textiles,* 2004.

ASTM D 2582, *Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting,* 2003.

ASTM D 3787, *Method for Bursting Strength of Textiles-Constant-Rate-of-Traverse (CRT) Ball Burst Test*, 2001.

ASTM D 3884, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method),* 2001 e1.

ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method),* 2002.

ASTM D 4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method),* 1998 (2004).

ASTM D 5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 1995 (2001).

ASTM D 5151, *Standard Test Method for Detection of Holes in Medical Gloves,* 1999.

ASTM D 5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*, 2005.

ASTM D 5712, *Standard Test Method for Analysis of Aqueous Extractable Protein in Natural Rubber and Its Products Using the Modified Lowry Method,* 2005, e1.

ASTM D 5733, *Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure*, 1999.

ASTM E 809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors,* 2002.

ASTM E 991, *Standard Practice for Color Measurement of Fluorescent Specimens,* 1998.

ASTM E 1164, *Standard Practice for Obtaining Spectrophotometric Data for Object Color Evaluation*, 2002.

ASTM E 2152, *Standard Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data,* 2001.

ASTM E 2153, *Standard Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color,* 2001.

ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, 2004.

ASTM F 489, *Standard Test Method for Static Coefficient of Friction of Shoe Sole and Heel Materials as Measured by the James Machine*, 1996.

ASTM F 739a, *Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact.*

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

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

ASTM F 1359, *Standard Practice for Evaluating the Liquid-Tight Integrity of Chemical Protective Clothing.*

ASTM F 1359a, *Standard Test Method for Liquid Penetration Resistance Integrity of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin,* 1999.

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,* 2003.

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),* 2005.

ASTM F 1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2002.

ASTM F 2100, *Standard Specification for Performance of Materials Used in Medical Face Masks*, 2004.

ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2005.

ASTM F 2412, *Standard Test Methods for Foot Protection*, 2005.

ASTM F 2413, *Standard Specification for Performance Requirements for Foot Protection*, 2005.

2.3.4 EN Publications. European Committee for Electrotechnical Standardization, (CENELEC), 35 Rue de Stassartstraat, B-1050 Brussels, Belgium.

EN 420, *General requirements for gloves*, 2003.

EN 455-2, *Medical gloves for single use — Part 2: Requirements and testing for physical properties*, 2000.

2.3.5 FIA Publications. Footwear Industries of America, 1420 K Street, NW, Suite 600, Washington, DC 20005.

FIA Standard 1209, *Whole Shoe Flex*, 1984.

2.3.6 ISO Publications. International Organization for Standardization, 1 ch. De la Voie-Creuse, Case postale 56, CH 1211 Geneva 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 62, *General requirements for bodies operating assessment and certification/registration of quality systems.*

ISO 65, *General requirements for bodies operating product certification systems,* 1996.

ISO 2859-1, *Sampling procedures for inspection by attributes. Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection*, 1999.

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2.3.8 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 Blood-Borne Pathogens."

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Statement of Standard for NIOSH CBRN APR Testing, 2003.

Statement of Standard for NIOSH CBRN PAPR Testing, 2006.

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2.3.9 Department of Defense Publications. Standardization Documents Order Desk, Building 4D, 760 Robbins Avenue, Philadelphia, PA 19111-5094.

A-A-55126, *Commercial Item Description, Fastener Tapes, Hook and Pile, Synthetic*, 1999.

A-A-55634, *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*, 2004.

MIL-F-10884G, *Fasteners, Snap*, 16 June 1995.

2.3.10 Other Publications.

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

2.4 References for Extracts in Mandatory Sections. (Reserved)

Chapter 3 Definitions

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

Dictionary, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

3.2.3 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 shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3* General Definitions.

3.3.1 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 3.3.67, 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 25 mm (1 in.) beyond the wrist crease.

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

3.3.49 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.

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

3.3.51 Helmet. See 3.3.30, Emergency Medical Helmet.

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

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

3.3.54 Manufacturer. The person or persons, company, firm, corporation, partnership, or other organization responsible for turning the raw materials or components into a certified product for use.

3.3.55* 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.

3.3.56 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.

3.3.57 Medical Responders. See 3.3.33, Emergency Medical Responders.

3.3.58 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.

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

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

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

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

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

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

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

3.3.66 Product Label. A label or marking affixed to each compliant garment, glove, or face protection device by the manufacturer. 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. *(See also 3.3.64, Package Product Label.)*

3.3.67* 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.

3.3.68 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.

3.3.69 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.

3.3.70 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.

3.3.71 Sample. The ensemble, element, item, component, or composite that is conditioned for testing. *(See also 3.3.75, Specimen.)*

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

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

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

3.3.75 Specimen. The conditioned element, item, component, or composite that is tested. Specimens are taken from samples. *(See also 3.3.71, Sample.)*

3.3.76 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.

3.3.77 Terrorism Agents. See 3.3.13, CBRN Terrorism Agents.

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

3.3.79 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.

3.3.80* 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.

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

3.3.82 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 only permit 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 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, *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.

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 2003 edition of this standard on or after the NFPA effective date for the 2008 edition, which is 31 December 2007.

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 2003 edition of this standard on or after 30 June 2008.

4.1.11 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2003 edition of this standard from all protective ensembles and ensemble elements that are under the control of the manufacturer on 30 June 2008, 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 personal protective equipment 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, *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 assur-

ance 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 products' 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, *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, *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. 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.

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 Manufacturers' 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 14 September 2008.

4.5.3.3 Not later than 14 September 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 2006 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, and 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 one 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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, 2008 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 provided 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, sleeve aprons or smocks.

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 arm 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.

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

6.1.2.7 Fastener tape shall meet the requirements of A-A-55126, *Commercial Item Description, Fastener Tapes, Hook and Pile, Synthetic.*

6.1.2.8 Snaps shall be Style 2 and shall comply with the design and construction requirements of MIL-F-10884G, *Fasteners, Snap.* The construction of the snap shall be permitted to vary from the MIL-F-10884G drawings with regard to the attachment means and the use of logos on the caps.

6.1.2.9 Zippers shall meet the physical performance requirements of A-A-55634, *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*.

6.1.2.10 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.

6.1.2.11* 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 25 mm (1 in.) beyond the wrist crease.

6.2.3.3 Emergency medical work glove bodies shall extend circumferentially not less than 25 mm (1 in.) beyond the wrist crease where measured from the tip of the finger and shall be close-fitting at the opening to restrict the entry of foreign particles. The location of the wrist crease shall be determined as shown in Figure 6.2.3.3

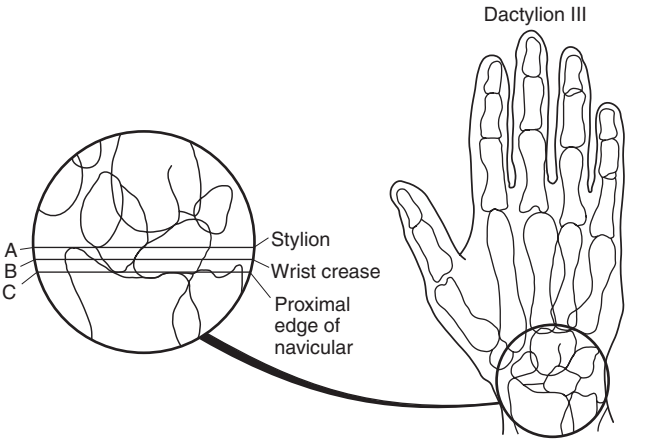


FIGURE 6.2.3.3 Anatomical Landmarks at Base of Hand.

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.

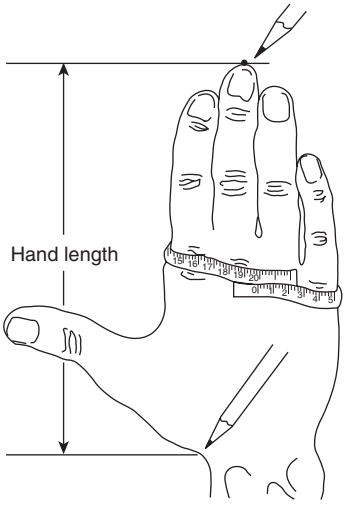


FIGURE 6.2.3.5 Method of Measuring Hand Dimensions for Selection of Proper Glove Size.

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.

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.

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

6.2.3.7 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 work glove shall not interfere with the function of that work gloves 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 a means for securing the facemask to the wearer's head that do not require tying.

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 face mask.

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, and hooded visors, and combinations of these items.

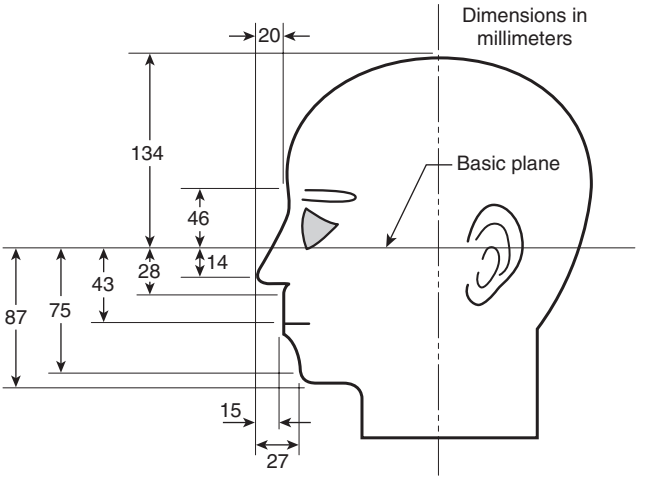


FIGURE 6.3.2.4 Alderson Headform.

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

6.3.3.3 Where the eye and face protection device is configured as safety glasses, the safety glasses shall meet the design requirements for Spectacles in Section 7 of ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* including basic impact.

6.3.3.4 Where the eye and face protection device is configured as goggles, the goggles shall meet the design requirements for Goggles in Section 8 of ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* including basic impact.

6.3.3.5 Where the eye and face protection device is configured as a faceshield, the faceshield shall meet the design requirements for Faceshields in Section 9 of ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* including basic impact.

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.) when measured as specified in 6.5.2.1 and 6.5.2.2.

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 and 6.4.2.3.2.

6.4.2.3.1 The height shall be determined by measuring inside the boot from the center of the insole at the heel up to a perpendicular reference line extending across the width of the footwear, at the highest point of footwear excluding pull-on loops.

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

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 are 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.

6.4.3 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 and 6.4.3.2.2

6.4.3.2.1 The height shall be determined by measuring inside the boot from the center of the insole at the heel up to a perpendicular reference line extending across the width of the footwear at the highest point of the footwear excluding pull-on loops.

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

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, suspension system with sweatband, chin strap, 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 energy-absorbing system, suspension system with sweatband, chin strap, nape device, 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 $\frac{1}{8}$ 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 can-

not 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 5.1.12.4.

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 are 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 are 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 are provided to meet the requirements of this standard but are not intended to be worn continuously with the wearing of the footwear element shall not be permitted.

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 8.40, 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 8.34, 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 8.41, 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 8.33, Water Absorption Resistance Test, and shall have a percent water absorption of 30% or less.

7.1.2.9 Garment composites shall be tested for total heat loss as specified in Section 8.34, 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 8.35, 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 8.24, 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 provided high visibility of the wearer in accordance with the requirement in 6.1.2.11, 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 6.1.2.11, garments shall be tested for retroreflectivity and fluorescence as specified in Section 8.39, 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 8.41, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

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 8.26, 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 cut distance resistance of greater than 25 mm (1 in.).

7.2.2.7 Cleaning/utility glove materials shall be tested for abrasion resistance as specified in Section 8.27, 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 8.28, 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 8.32, 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 8.41, Flammability Test, and shall have a flame spread time of 3.5 seconds or more.

7.2.3 Multiple-Use Emergency Medical Work Gloves Performance Requirements.

7.2.3.1 Work gloves shall be tested for liquidtight integrity as specified in Section 8.31, 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 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 45 N (10 lbf).

7.2.3.4 Work glove materials shall be tested for resistance to cut as specified in Section 8.18, Cut Resistance Test, and shall have a cut distance resistance of not less than 25 mm (1 in.).

7.2.3.5 Work glove palm composite materials shall be tested for abrasion resistance as specified in Section 8.27, Abrasion Resistance Test Two, and shall show no wear-through after 1000 cycles.

7.2.3.6 Gloves shall be tested for hand function as specified in Section 8.28, Dexterity Test Two, and shall have an average percent of barehand control not exceeding 200 percent.

7.2.3.7 Work gloves shall be tested for grip as specified in Section 8.29, Grip Test, and shall have a weight pulling capacity not less than 80 percent of the barehand control values.

7.2.3.8 Work gloves shall be tested for ease of donning as specified in Section 8.30, Glove Donning Test, and shall have a final donning time not to exceed the baseline donning time plus 20.0 seconds.

7.2.3.9 Work gloves shall be tested for tactility as specified in Section 8.32, 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 8.24, 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 materials shall be tested for flammability as specified in Section 8.41, 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 8.35, 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 face masks 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, and 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 8.41, 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 are spectacle or eye and face protection devices that incorporate designs similar to spectacles shall meet the requirements for spectacles in accordance with Section 7 of ANSI/ASSE Z87.1, *Occupational*

and Educational Personal Eye and Face Protection Devices, including requirements for basic impact resistance.

7.3.3.2 Eye and face protection devices that are goggles or eye and face protection devices that incorporate designs similar to goggles shall meet the requirements for goggles in accordance with Section 8 of ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* including requirements for basic impact resistance.

7.3.3.3 Eye and face protective devices that are faceshields or eye and face protection devices that incorporate designs similar to faceshields shall meet the requirements for faceshields in accordance with Section 9 of ANSI/ASSE Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices,* including requirements for basic impact resistance.

7.3.3.4 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.

7.3.3.5 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.

7.3.3.6 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 8.25, 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 8.41, 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 8.24, 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 8.40, 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 8.27, 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 8.21, Slip Resistance Test, and shall show a friction coefficient of greater than 0.60 under dry conditions.

7.4.1.9 Footwear cover materials shall be tested for flammability as specified in Section 8.41, 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 cut resistance distance of greater than 25 mm (1 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 have an abrasion resistance rating of greater than 65.

7.4.2.4 Footwear soles and heels shall be tested for physical penetration resistance as specified in Section 8.20, Puncture

Resistance Test Two, and shall meet the Section 5.7.4 requirements for puncture resistant footwear as specified in ASTM F 2413, *Standard Specification for Performance Requirements for Foot Protection*.

7.4.2.5 Footwear outer soles shall be tested for slip resistance as specified in Section 8.21, Slip Resistance Test, and shall show a friction coefficient of greater than 0.75 under dry conditions.

7.4.2.6 Eyelets and stud hooks shall be tested for attachment strength as specified in Section 8.22, Eyelet and Stud Post Attachment Test, and shall have a minimum detachment strength of 295 N (66 lbf).

7.4.2.7 Footwear toes shall be tested for resistance to impact and compression as specified in Section 8.23, Impact and Compression Resistance Test, and shall meet the Class 50 requirements in 5.1.4.1(3) and (4) requirements for impact resistance and 5.2.3.1(3) and (4) for compression resistance as specified in ASTM F 2413, *Standard Specification for Performance Requirements for Foot Protection*.

7.4.2.8 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 8.24, 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.

7.4.2.9 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.

7.4.2.10 Footwear shall be tested for overall watertight integrity as specified in Section 8.25, Overall Liquid Integrity Test Four, shall allow no liquid penetration, and the outer sole shall not separate.

7.4.2.11 Product labels shall be tested for durability and legibility as specified in Section 8.35, Label Durability and Legibility Test, and shall be legible.

7.4.2.12 Footwear shall be tested for flammability as specified in Section 8.41, 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 cut resistance distance of greater than 25 mm (1 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 have an abrasion resistance rating of greater than 65.

7.4.3.4 Footwear outer soles shall be tested for slip resistance as specified in Section 8.21, Slip Resistance Test, and shall show a friction coefficient of greater than 0.75 under dry conditions.

7.4.3.5 Eyelets and stud hooks shall be tested for attachment strength as specified in Section 8.22, 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 8.24, 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, and 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 8.25, 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 8.35, 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 8.42, 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 8.43, 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 8.44, Goggle and Headlamp Clip Attachment Test, and 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 8.24, 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 8.36, 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 8.37, 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 8.38, 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 Whole Garments.

8.1.3.1 The complete garment shall be washed with all closures fastened.

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

8.1.3.3 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.

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).

8.1.3.6 The garment 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 garment shall be allowed to air dry for at least 48 hours prior to conducting the test.

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 grams	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			

8.1.3.7 The garment shall be washed and dried for a total of 25 washings and 25 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 8.29 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 Samples shall be conditioned by complete immersion in water at a temperature of 21°C, ±3°C (70°F, ±5°F), for 2 minutes.

8.1.8.2 Samples shall be removed from water, hung in a vertical position for 5 minutes, and laid horizontal with AATCC textile blotting paper both under and over the sample under a weight of 0.0020 kg/cm^2, ±0.0002 kg/cm^2 (0.50 psi, ±0.05 psi), for a period of 20 minutes in accordance with paragraph 7.2 of AATCC 70, *Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test.*

8.1.9 Washing and Drying Conditioning for Work Gloves.

8.1.9.1 Specimens shall be subjected to 10 cycles of washing and drying in accordance with the procedure specified in Machine Cycle 1, Wash Temperature V, and Drying Procedure Ai, of AATCC 135, *Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics.*

8.1.9.2 A 1.8 kg, ±0.1 kg (4 lb, ±0.2 lb) load shall be used. A laundry bag shall not be used.

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 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 1359a, *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 1359a, *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 Samples for conditioning shall be complete work gloves or work glove composite swatches. Work glove composite swatches shall be representative of the glove construction.

8.3.11.2 Samples shall be conditioned as specified in 8.1.9.

8.3.11.3 Specimens shall be taken from the work gloves, including seams, representative of glove barrier construction.

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 constitutes 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 min/–0 minutes.

8.10.4.2.7 At the end of 1 hour, +5 min/–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.

8.13.1.3 Modifications to this test method for testing footwear upper material shall be as specified in 8.13.8.

8.13.1.4 Modifications to this test method for testing footwear cover materials shall be as specified in 8.13.9.

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*.

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, Cleaning, and Work 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 specimen composites 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 Footwear Upper Materials.

8.13.8.1 Specimens shall consist of each composite of the footwear item used in the actual footwear configuration with layers arranged in proper order.

8.13.8.2 Specimens shall be taken from the thinnest portion of the footwear upper.

8.13.9 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.

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

8.13.9.2 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 6.2.2.2 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:

$$\frac{\text{Percent of bare-handed control}}{\text{Baseline dexterity test time}} = \frac{\text{Dexterity test time with gloves}}{\text{Baseline dexterity test time}} \times 100$$

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 face mask 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 footcandles 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 that shall be evaluated 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 junctures or interfaces 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 50 g (1.8 oz).

8.18.8 Specific Requirements for Testing Work Gloves.

8.18.8.1 Specimens shall be taken from the back and palm of the glove and shall not include seams.

8.18.8.2 Cut resistance testing shall be performed under a load of 200 g (7 oz).

8.18.9 Specific Requirements for Testing Footwear Upper Materials.

8.18.9.1 Specimens shall consist of each composite of the footwear item used in the actual footwear configuration with layers arranged in proper order. Specimens shall be taken from the thinnest portion of the footwear upper.

8.18.9.2 Cut resistance testing shall be performed under a load of 400 g (14 oz).

8.18.10 Specific Requirements for Testing Work Gloves.

8.18.10.1 Specimens shall be taken from the back and palm of the glove and shall not include seams.

8.18.10.2 Cut resistance testing shall be performed under a load of 200 grams (7 oz).

8.19 Abrasion Resistance Test One.

8.19.1 Application. This test method shall apply to footwear soles.

8.19.2 Specimens. A minimum of three footwear soles shall be tested.

8.19.3 Sample Preparation.

8.19.3.1 Samples for conditioning shall be footwear soles.

8.19.3.2 Specimens shall be conditioned as specified in 8.1.2.

8.19.4 Procedure. Puncture resistance testing shall be performed in accordance with ASTM D 1630, *Test Method for Rubber Property-Abrasion Resistance (Footwear Abrader).*

8.19.5 Report. The abrasion resistance rating 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 Puncture Resistance Test Two.

8.20.1 Application. This test method shall apply to emergency medical footwear soles.

8.20.2 Specimens. A minimum of three footwear soles shall be tested.

8.20.3 Sample Preparation.

8.20.3.1 Samples for conditioning shall be footwear sole sections.

8.20.3.2 Specimens shall be conditioned as specified in 8.1.2.

8.20.4 Procedure. Puncture resistance testing shall be performed in accordance with Section 11 for puncture resistance of ASTM F 2412, *Standard Test Methods for Foot Protection.*

8.20.5 Report. The force required to puncture the sole reinforcement device of each specimen shall be recorded and reported.

8.20.6 Interpretation. One or more footwear specimens failing this test shall constitute failing performance.

8.21 Slip Resistance Test.

8.21.1 Application.

8.21.1.1 This test method shall apply to footwear soles and the wear surface of footwear covers.

8.21.1.2 Modifications to this test method for evaluation of footwear soles shall be as specified in 8.21.7.

8.21.1.3 Modifications to this test for this test method for evaluation of footwear cover wear surface materials shall be as specified in 8.21.8.

8.21.2 Sample Preparation. Samples for conditioning shall be footwear or whole footwear covers.

8.21.3 Specimens.

8.21.3.1 A minimum of three footwear soles or footwear cover wear surfaces shall be tested.

8.21.3.2 Specimens shall be conditioned as specified in 8.1.2.

8.21.4 Procedure. Slip resistance shall be performed in accordance with ASTM F 489, *Standard Test Method for Static Coefficient of Friction of Shoe Sole and Heel Materials as Measured by the James Machine*, in a dry condition.

8.21.5 Report. The static coefficient of friction under dry conditions of each specimen shall be recorded and reported.

8.21.6 Interpretation. One or more footwear or footwear cover specimens failing this test shall constitute failing performance.

8.21.7 Specific Requirements for Testing Footwear Soles.

8.21.7.1 Specimens shall be taken from representative outer sole and heel samples of the footwear.

8.21.7.2 Where the outer sole and heel use the same material and tread pattern, specimens shall be permitted to be taken from either outer sole or heel samples.

8.21.7.3 Specimens shall be prepared as specified in Section 7 of ASTM F 489, *Standard Test Method for Static Coefficient of Friction of Shoe Sole and Heel Materials as Measured by the James Machine.*

8.21.8 Specific Requirements for Testing Footwear Cover Wear Surface Materials.

8.21.8.1 Specimens shall include outermost layer of the footwear cover wear surface.

8.21.8.2 Specimens shall not be prepared as specified in Section 7 of ASTM F 489, *Standard Test Method for Static Coefficient of Friction of Shoe Sole and Heel Materials as Measured by the James Machine.*

8.21.8.3 Specimens shall be attached to the leather test reference shoe by wrapping the specimen tightly around the leather and taping the specimen securely to the front and rear of the shoe.

8.22 Eyelet and Stud Post Attachment Test.

8.22.1 Application. This test method shall apply to protective footwear eyelets and stud posts.

8.22.2 Specimens.

8.22.2.1 Specimens shall total two eyelets and two stud posts on three separate footwear items.

8.22.2.2 Specimens shall be removed from the footwear and shall be 25 mm × 50 mm (1 in. × 2 in.).

8.22.3 Sample Preparation.

8.22.3.1 Samples for conditioning shall be whole footwear.

8.22.3.2 The eyelets or stud post specimens shall be conditioned as specified in 8.1.2.

8.22.4 Apparatus.

8.22.4.1 A tensile testing machine shall be used with a traverse rate of 50 mm/min (2 in./min).

8.22.4.2 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.

8.22.5 Procedure.

8.22.5.1 The stud post or eyelet puller shall be inserted or attached to the upper position of the tensile machine.

8.22.5.2 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.

8.22.5.3 The eyelet stay shall be clamped, but clamping the base of the eyelets or stud hooks in the lower clamps shall not be permitted.

8.22.5.4 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.).

8.22.5.5 The test shall then be started.

8.22.6 Report.

8.22.6.1 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.

8.22.6.2 The average force shall be calculated and reported.

8.22.7 Interpretation. The average force shall be used to determine pass/fail.

8.23 Impact and Compression Resistance Test.

8.23.1 Application. This test method shall apply to the toe section of emergency medical footwear.

8.23.2 Specimens. A minimum of three footwear items shall be tested for both impact and compression.

8.23.3 Sample Preparation.

8.23.3.1 Samples for conditioning shall be complete footwear toes.

8.23.3.2 Specimens shall be conditioned as specified in 8.1.2.

8.23.4 Procedure. Footwear specimens shall be tested in accordance with Section 5 for impact resistance and Section 6 for compression resistance of ASTM F 2412, *Standard Test Methods for Foot Protection*.

8.23.5 Report. The impact and compression forces for each specimen shall be recorded and reported.

8.23.6 Interpretation. One or more footwear specimens failing this test shall constitute failing performance.

8.24 Corrosion Resistance Test.

8.24.1 Application. This test method shall apply to hardware items on multiple-use eye and face protection devices, work gloves, footwear, and helmets.

8.24.2 Specimens. A total of five different items of each hardware type shall be tested.

8.24.3 Sample Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.24.4 Procedure.

8.24.4.1 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.

8.24.4.2 Immediately following the test exposure and prior to examination, specimens shall be rinsed under warm, running tap water and dried with compressed air.

8.24.4.3 Specimens shall then be examined visually with the unaided eye to determine pass/fail.

8.24.4.4 The functionality of each specimen shall be evaluated.

8.24.5 Report. The presence of corrosion and the functionality of each specimen shall be recorded and reported.

8.24.6 Interpretation. One or more hardware specimens failing this test shall constitute failing performance for the hardware type.

8.25 Overall Liquid Integrity Test Four.

8.25.1 Application. This test shall apply to protective footwear.

8.25.2 Samples.

8.25.2.1 A minimum of three footwear items shall be tested.

8.25.2.2 Samples for conditioning shall be whole footwear.

8.25.3 Specimen Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.25.4 Procedure.

8.25.4.1 Protective footwear shall be tested in accordance with FIA Standard 1209, *Whole Shoe Flex*, with the modification to the test method that water shall not be used.

8.25.4.2 The test shall consist of 100,000 flexes.

8.25.4.3* After flexing, the specimen shall be placed in a container that allows its immersion in tap water, treated with a dye and a surfactant that achieves a surface tension of 35 dynes/cm, ±2 dynes/cm, to the level of 75 percent of the footwear height measured as specified in 6.4.3.

8.25.4.4 The paper toweling required in FIA Standard 1209, *Whole Shoe Flex*, shall be placed inside the footwear specimen such that the toweling intimately contacts all areas inside the footwear specimen to the level of 75 percent of the footwear height measured as specified in 6.4.3.

8.25.4.5 After 2 hours, ±10 minutes, the paper toweling shall be removed and examined for evidence of liquid leakage.

8.25.5 Report. The appearance of water leakage on the removed paper toweling shall be recorded and reported as failure for the tested specimen.

8.25.6 Interpretation. One or more footwear specimens failing this test shall constitute failing performance.

8.26 Chemical Permeation Resistance Test.

8.26.1 Application. This test method shall apply to cleaning/utility glove materials.

8.26.2 Specimens. A minimum of three specimens shall be tested.

8.26.3 Sample Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.26.4 Procedure.

8.26.4.1 Permeation resistance shall be measured in accordance with ASTM F 739a, *Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact*, at 25°C, ±2°C (77°F, ±3°F), using the following test parameters and modifications:

(1) A test duration of 1 hour shall be used.
(2) The test shall be done in the closed loop configuration, using distilled water as the collection medium.
(3) The selected method of detection shall have a sensitivity for measuring a cumulative permeation of 0.1 $\mu g/cm^2$ over the 1-hour test period. The actual sensitivity of the selected method of detection shall be determined.
(4) The total cumulative permeation over 1 hour shall be measured in lieu of breakthrough time and permeation rate.

8.26.4.2 Permeation resistance shall be separately evaluated against the following chemicals:

(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

8.26.5 Report.

8.26.5.1 The following information and results shall be recorded and reported:

(1) Material type or name
(2) Chemical or chemical mixture (volume composition of mixture)
(3) The measured cumulative permeation mass for each specimen in $\mu g/cm^2$ reported to the nearest 0.1 $\mu g/cm^2$
(4) Type of test cell
(5) Detection method
(6) Minimum detectable mass for detection system ($\mu g/cm^2$)
(7) Date of test
(8) Testing laboratory

8.26.5.2 If no chemical is detected at the end of the 1-hour test period, the cumulative permeation shall be reported as less than the minimum detectable mass per unit area for the specific chemical being tested.

8.26.5.3 The average cumulative permeation shall be calculated for all specimens.

8.26.5.3.1 If no chemical is detected for one or two specimens, the average cumulative permeation shall be the average of all specimens where cumulative permeation is measured.

8.26.5.3.2 If no chemical is detected in all of the specimens tested, the average cumulative permeation shall be the minimum detectable mass per unit area for the specific chemical being tested.

8.26.6 Interpretation. The average cumulative permeation shall be used in determining compliance for the particular material/chemical combination.

8.27 Abrasion Resistance Test Two.

8.27.1 Application.

8.27.1.1 This test shall apply to cleaning/utility glove, work glove, and footwear cover materials.

8.27.1.2 Modifications to this test method for testing cleaning/utility glove materials shall be as specified in 8.27.7.

8.27.1.3 Modifications to this test method for testing work glove materials shall be as specified in 8.27.8.

8.27.1.4 Modifications to this test method for testing work footwear cover wear surface materials shall be as specified in 8.27.9.

8.27.2 Specimens. A minimum of five specimens shall be tested.

8.27.3 Sample Preparation. Specimens shall be conditioned as specified in 8.1.2.

8.27.4 Procedure.

8.27.4.1 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.

8.27.4.2 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.

8.27.5 Report. The wear-through determination shall be recorded and reported for each specimen tested.

8.27.6 Interpretation. Any specimen showing wear-through shall constitute failure of this test.

8.27.7 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.

8.27.8 Specific Requirements for Testing Work Gloves.

8.27.8.1 Specimens shall include all layers used in the construction of the work gloves.

8.27.8.2 Testing shall be conducted under a load of 500 g and examined after 1000 cycles.

8.27.8.3 The layer outside the barrier layer in the work glove shall be examined for wear-through.

8.27.9 Specific Requirements for Testing Footwear Cover Wear Surface Materials.

8.27.9.1 Specimens shall include all layers used in the construction of the footwear cover at the wear surface.

8.27.9.2 Testing shall be conducted under a load of 1000 g and specimens shall be examined after 5000 cycles.

8.27.9.3 The combination of all layers shall be examined for wear-through.

8.28 Dexterity Test Two.

8.28.1 Application.

8.28.1.1 This test shall apply to cleaning/utility gloves and work gloves.

8.28.1.2 Modifications for testing work gloves shall be as specified in 8.29.8.

8.28.2 Specimens.

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

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

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

8.28.3 Sample Preparation.

8.28.3.1 Samples for conditioning shall be whole glove pairs.

8.28.3.2 Glove pair specimens shall be preconditioned as specified in 8.1.2.

8.28.4 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.*

8.28.5 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.*

8.28.6 Report.

8.28.6.1 The average percent of barehanded control shall be recorded and reported for each test subject.

8.28.6.2 The average percent of barehanded control for all test subjects shall be calculated and reported.

8.28.7 Interpretation. The average percent of barehanded control shall be used to determine pass or fail performance.

8.28.8 Specific Requirements for Testing Work Gloves. Glove pair specimens shall be conditioned as specified 8.1.9.

8.29 Grip Test.

8.29.1 Application. This test method shall apply to work gloves.

8.29.2 Specimens.

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

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

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

8.29.2.4 Glove pair specimens shall be tested for each material and construction combination.

8.29.3 Sample Preparation.

8.29.3.1 Samples for conditioning shall be whole gloves.

8.29.3.2 Glove pair specimens shall be preconditioned as specified in 8.1.9.

8.29.3.3 Glove pair specimens shall be tested after being conditioned for dry conditions as specified in 8.1.2.

8.29.3.4 Glove pair specimens shall be tested after being conditioned for wet conditions as specified in 8.1.8.

8.29.4 Apparatus. Grip testing shall be evaluated with the use of a 9.5 mm (⅜ in.) diameter, 3-strand prestretched polyester rope attached to a calibrated force measuring device.

8.29.5 Procedure.

8.29.5.1 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.

8.29.5.2 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 bare-handed control value.

8.29.5.3 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.

8.29.5.4 Each test subject shall test a minimum of three pairs of sample gloves using the method specified in 8.39.5.2. 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.

8.29.5.5 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.

8.29.5.6 The percentage of bare-handed value shall be calculated as follows:

$$\text{Percentage of bare-handed control value } \frac{PF_g}{CV_b} \times 100$$

where:
PF_g = average pulling force with gloves
CV_b = bare-handed control value

8.29.6 Report. The percent of barehanded control shall be recorded and reported for each glove pair specimen, condition, and test subject tested.

8.29.7 Interpretation. One or more glove pair specimens failing this test shall constitute failing performance.

8.30 Glove Donning Test.

8.30.1 Application. This test shall apply to work gloves.

8.30.2 Specimens. A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.30.3 Sample Preparation.

8.30.3.1 Samples for conditioning shall be whole gloves.

8.30.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.30.4 Procedure.

8.30.4.1 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.

8.30.4.2 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.

8.30.4.3 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.

8.30.4.4 The baseline donning time shall be the average of the first three donning times as determined in 8.30.4.2. The baseline donning time shall not exceed 10 seconds. The doffing time between donnings shall not exceed 10 seconds.

8.30.4.5 Glove pair specimens shall then be conditioned as specified in 8.1.9.

8.30.4.6 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 8.30.4.4. No preparation of the gloves shall be done.

8.30.5 Report.

8.30.5.1 The final donning time and the baseline donning time shall be recorded and reported to the nearest 0.1 second for each trial.

8.30.5.2 The average final and average baseline donning times shall be calculated and reported.

8.30.6 Interpretation. Pass/fail determinations shall be made using the average final and average baseline donning times.

8.31 Overall Liquid Integrity Test Three.

8.31.1 Application. This test method shall apply to work gloves.

8.31.2 Specimens. A minimum of three glove pairs each for small and large sizes shall be used for testing.

8.31.3 Sample Preparation.

8.31.3.1 Specimens shall be tested after being subjected to the procedure specified in 8.1.9.

8.31.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.31.4 Apparatus.

8.31.4.1 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.

8.31.4.2* Water used for integrity testing shall be treated with a nonfoaming surfactant to achieve a surface tension of 35 dynes, ±2 dynes.

8.31.5 Procedure.

8.31.5.1 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.

8.31.5.2 The test subject shall don the glove specimen over the water-markable glove.

8.31.5.3 The test subject shall immerse the glove specimen to within 25 mm (1 in.) of the top of the body of the glove specimen for 5 minutes in 20°C, ±3°C (68°F, ±5°F) water. The test

subject shall flex the glove specimen in a fist clenching motion every 10 seconds.

8.31.5.4 The glove specimen shall be removed from the testing person's hand and the inner glove shall be inspected for water marks.

8.31.6 Report. The appearance of water marks on the inner glove after testing any of the glove pairs shall be recorded and reported.

8.31.7 Interpretation. The appearance of water marks on the inner glove after testing any glove shall be considered leakage and shall constitute failing performance.

8.32 Tactility Test.

8.32.1 Application.

8.32.1.1 This test shall apply to cleaning/utility gloves and work gloves.

8.32.1.2 Modifications to this test method for testing cleaning/utility gloves shall be as specified in 8.33.7.

8.32.1.3 Modifications to this test method for testing work gloves shall be as specified in 8.32.8.

8.32.2 Specimens.

8.32.2.1 A minimum of three glove pairs each for two different sizes shall be used for testing.

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

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

8.32.3 Sample Preparation.

8.32.3.1 Samples for conditioning shall be whole glove pairs.

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

8.32.4 Procedures.

8.32.4.1 A separate test subject shall be used for each size of gloves to be evaluated.

8.32.4.2 Test subjects shall be selected such that their hand dimensions conform to the offered respective sizes for each glove.

8.32.4.3 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.

8.32.4.4 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.

8.32.5 Report.

8.32.5.1 The diameter of the smallest pin that can be successfully picked up shall be recorded and reported for each test subject.

8.32.5.2 The average diameter that can be successfully picked up by all test subjects shall be calculated and reported.

8.32.6 Interpretation. The average diameter of the smallest pin that can be picked up shall be used to determine pass/fail performance.

8.32.7 Specific Requirements for Testing Cleaning/Utility Gloves. The sizes selected for testing shall represent the smallest and largest sized gloves that available for the specific style of glove being evaluated.

8.32.8 Specific Requirements for Testing Work Gloves.

8.32.8.1 Size small and size large shall be evaluated.

8.32.8.2 Glove pair specimens shall be preconditioned as specified in 8.1.9 and then conditioned as specified in 8.1.2 prior to testing.

8.33 Water Absorption Resistance Test.

8.33.1 Application. This test method shall apply to the multiple-use garment materials.

8.33.2 Sample Preparation.

8.33.2.1 Samples for conditioning shall be at least 1 m (1 yd) square of each material.

8.33.2.2 Specimens shall be conditioned as specified in 8.1.3 followed by conditioning as specified in 8.1.2.

8.33.3 Specimens.

8.33.3.1 Specimens shall be 200 mm × 200 mm (8 in. × 8 in.).

8.33.3.2 At least three (3) specimens shall be tested.

8.33.4 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 to 180 mm (6 to 7 in.) in diameter shall be used for mounting the specimen.

8.33.5 Procedure.

8.33.5.1 The conditioned specimen shall be securely mounted in the embroidery hoops with sufficient tension to ensure a uniformly smooth surface.

8.33.5.2 The direction of the flow of water down the specimen shall coincide with the warpwise direction of the specimen as placed on the stand.

8.33.5.3 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.

8.33.5.4 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.

8.33.5.5 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 desig-

nated 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."

8.33.5.6 The percent water absorption shall be calculated using the following equation:

$$\text{Percent water absorption} = [(\text{Wet Weight} - \text{Dry Weight})/(\text{Dry Weight})] \times 100$$

8.33.6 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.

8.33.7 Interpretation. The average percent water absorption shall be used to determine pass/fail performance.

8.34 Total Heat Loss Test.

8.34.1 Application. This test method shall apply to the protective garment composites.

8.34.2 Specimens.

8.34.2.1 Total heat loss testing shall be conducted on at least three specimens.

8.34.2.2 Specimens shall consist of all layers in the protective garment composite arranged in the order and orientation as worn.

8.34.2.3 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.

8.34.3 Sample Preparation.

8.34.3.1 Samples for conditions shall be at least a 1 m (1 yd) square of each material.

8.34.3.2 Specimens to be tested shall be conditioned as specified in 8.1.2.

8.34.4 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*.

8.34.5 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*.

8.34.6 Report.

8.34.6.1 The average intrinsic thermal resistance (*Rcf*) of the sample shall be recorded and reported.

8.34.6.2 The average apparent intrinsic evaporative resistance (*ARef*) of the sample shall be recorded and reported.

8.34.6.3 The average total heat loss (*Qt*) of the sample shall be calculated and reported.

8.34.7 Interpretation. Pass/fail determination shall be based on the average reported total heat loss measurement of all specimens tested.

8.35 Label Durability and Legibility Test.

8.35.1 Application.

8.35.1.1 This test shall apply to multiple-use garments, footwear, and work glove labels.

8.35.1.2 Modifications to this test method for testing multiple-use garment labels shall be as specified in 8.36.7.

8.35.1.3 Modifications to this test method for testing footwear and work glove labels shall be as specified in 8.36.7.

8.35.2 Specimens.

8.35.2.1 A minimum of three specimens for each type of label shall be tested.

8.35.2.2 If labels have areas of "write-in" information, the specimens shall include those areas with the sample information written in.

8.35.3 Sample Preparation. Samples shall be prepared as specified in the respective section for each item.

8.35.4 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.

8.35.5 Report. The legibility for each specimen shall be recorded and reported as acceptable or unacceptable.

8.35.6 Interpretation. One or more label specimens failing this test shall constitute failing performance.

8.35.7 Specific Requirements for Testing Multiple-Use Garment Labels.

8.35.7.1 Samples for conditioning shall be complete garments.

8.35.7.2 Multiple-use garment samples shall be conditioned as specified in 8.1.3.

8.35.7.3 For multiple-use garments, additional samples of individual labels only shall be conditioned as specified in 8.1.7.

8.35.8 Specific Requirements for Testing Footwear and Work Glove Labels.

8.35.8.1 Samples for conditioning shall be individual labels.

8.35.8.2 Individual labels only shall be conditioned as specified in 8.1.7.

8.36 Particle Inward Leakage Test.

8.36.1 Application. This test shall apply to [C]BRN ensembles, including garments, hood, gloves, footwear, and respirator as appropriate to make up the entire ensemble.

8.36.2 Samples.

8.36.2.1 Samples for conditioning shall be complete ensembles and shall include the respirator where the ensemble utilizes the respirator facepiece as the ensemble visor.

8.36.2.2 Garments, gloves, and hoods shall be conditioned as specified in 8.1.3.

8.36.2.3 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*.

8.36.2.4 Samples shall be conditioned as at 21°C, ±6°C, and 50 percent, ±30 percent, RH for at least 4 hours.

8.36.3 Specimens.

8.36.3.1 The specimen shall be a complete ensemble with gloves and footwear and shall include the respirator where applicable.

8.36.3.2 Where the ensemble utilizes the respirator facepiece as the ensemble visor, as specified in 6.1.6, the ensemble shall be tested with each type or model of the respirator specified by the manufacturer.

8.36.3.3 A minimum of four specimens shall be tested. The specimens shall represent a minimum of two different ensemble sizes.

8.36.3.4 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.

8.36.3.5 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.

8.36.3.6 None of the components to be tested shall have been previously subjected to particle inward leakage testing.

8.36.4 Apparatus.

8.36.4.1 The test shall be conducted in a chamber large enough to conduct testing on at least one test subject.

8.36.4.2 The test chamber shall have a system capable of providing a stable, uniform airflow directed at the test subject.

8.36.4.3 The test chamber shall prevent significant aerosol contact with any areas of the facility not intended as exposure areas to prevent contamination.

8.36.4.4 The test chamber shall have an aerosol generator capable of maintaining the aerosol mass concentration as specified in the procedure.

8.36.4.5 The test facility shall have separate garment storage, donning, doffing, and control room areas to prevent contamination.

8.36.4.6 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.

8.36.4.7 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.

8.36.4.8 Test subjects shall be familiar with the use of chemical protective ensembles and with the selected respirator.

8.36.5 Procedure.

8.36.5.1 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

8.36.5.2 The test subject shall don black indicator garments which cover the wearer's torso, arms, hands, legs, ankles, and head excluding the face.

8.36.5.2.1 The indicator garment shall provide a dark uniform appearance under black light illumination.

8.36.5.3* Specific areas of the indicator garment shall be masked with suitable tape or masking product which will remain in place during testing and shall not affect the indicator garment.

8.36.5.3.1 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.

8.36.5.4 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.

8.36.5.5 Once the test chamber has reached the conditions stated in 8.37.5.1, the test subject will enter the chamber and be properly positioned in the wind.

8.36.5.6 The 30 minute test period begins when the test subject is positioned in the wind.

8.36.5.7 During the 30 minute test period, the test subject shall perform the following three series of stationary exercises. The stationary exercise shall be 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 8.36.5.8.

8.36.5.8* 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 one 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 one 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 one 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 one 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 one 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.

8.36.5.9 At the conclusion of the 30 minute test period, the test subject shall exit the test chamber and enter the doffing area.

8.36.5.10 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.

8.36.5.11 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.

8.36.5.11.1* The black light shall have a wavelength of 365 nm and an intensity of 1200 $\mu W/cm^2$ at 15 in.

8.36.6 Report.

8.36.6.1 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.

8.36.7 Interpretation.

8.36.7.1 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.

8.37 Overall Ensemble Liquid Penetration Test.

8.37.1 Application. This test method shall apply to entire ensembles that are being evaluated for the [C]BRN terrorism agent protection.

8.37.2 Specimens.

8.37.2.1 A minimum of three specimens shall be tested. Specimens shall consist of entire ensembles for [C]BRN terrorism agent protection.

8.37.2.2 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.

8.37.3 Sample Preparation.

8.37.3.1 Samples to be conditioned shall be complete ensembles.

8.37.3.2 Specimens, except footwear, to be tested shall be conditioned as specified in 8.1.3.

8.37.3.3 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 Appendix B of FIA Standard 1209, *Whole Shoe Flex*.

8.37.4 Apparatus. The apparatus and supplies for testing shall be those specified in ASTM F 1359, *Standard Practice for Evaluating the Liquid-Tight Integrity of Chemical Protective Clothing*, 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.

8.37.5 Procedure. Liquid penetration testing of ensembles shall be conducted in accordance with ASTM F 1359, *Standard Practice for Evaluating the Liquid-Tight Integrity of Chemical Protective Clothing*, 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, *Standard Practice for Evaluating the Liquid-Tight Integrity of Chemical Protective Clothing*. 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.

8.37.6 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.

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

8.38 Biopenetration Resistance Test Three.

8.38.1 Application.

8.38.1.1 This method shall apply to the [C]BRN barrier layer and seams used in elements and ensembles for [C]BRN terrorism agent protection.

8.38.1.2 Specific requirements for testing the garment, hood, and bootie [C]BRN barrier layer shall be as specified in 8.39.7.

8.38.1.3 Specific requirements for testing the garment, hood, and bootie [C]BRN barrier layer seams shall be as specified in 8.39.8.

8.38.1.4 Specific requirements for testing the glove [C]BRN barrier layer and seams shall be as specified in 8.38.9.

8.38.1.5 Specific requirements for testing footwear [C]BRN barrier layer shall be as specified in 8.39.10.

8.38.2 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.

8.38.3 Specimens.

8.38.3.1 A minimum of three specimens of each material shall be tested against each chemical.

8.38.3.2 The [C]BRN barrier layers shall be tested for viral penetration resistance.

8.38.3.3 The [C]BRN barrier layer plus any outer shell or other composite lavers normally worn over the [C]BRN barrier layer shall be permitted to be tested for viral penetration resistance. Separable lavers worn underneath the [C]BRN barrier layer shall not be tested with the [C]BRN barrier layer.

8.38.3.4 If the [C]BRN barrier layer is the outermost laver in the composite, then it shall be tested for viral penetration resistance without additional layers on top.

8.38.4 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.*

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

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

8.38.7 Specific Requirements for Testing Garment, Hood, and Bootie Materials.

8.38.7.1 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.

8.38.7.2 Composite samples prepared as described in 8.38.7.1 shall be tested after being twice subjected to the conditioning as specified in 8.1.3.

8.38.7.3 The composite sample, including [C]BRN barrier layer, that was conditioned in 8.39.7.2 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.

8.38.7.4 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 8.38.7.4 with the long dimension of the sample parallel to the 280 mm (11 in.) dimension.

8.38.7.5 The layers in the flexed, trimmed composite sample adjacent to the [C]BRN barrier layer shall be retained for use as the abradants.

8.38.7.6 The [C]BRN barrier layer samples prepared as specified as 8.39.7.4 and the other samples retained as specified in 8.39.7.5 shall be subjected to abrasion as specified 8.1.11.

8.38.7.7 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.

8.38.7.8 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 8.38.7.2.

8.38.7.9 The specimens shall be oriented in the penetration test cell with the exterior surfaces facing the challenge chemical.

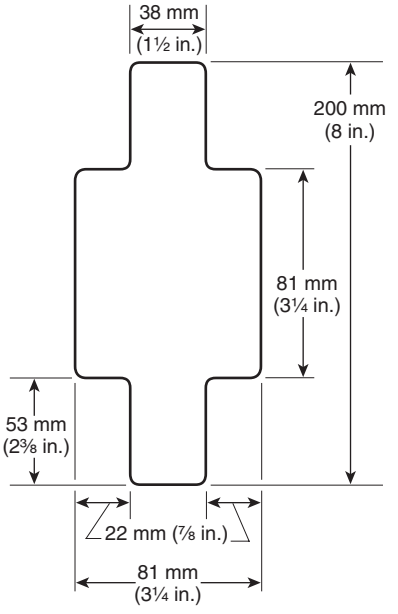


FIGURE 8.38.7.4 Specimen Configuration.

8.38.7.10 Specimens shall be tested for viral penetration resistance as specified in 8.39.2 through 8.38.6.

8.38.8 Specific Requirements for Testing Garment, Hood, and Bootie Seams.

8.38.8.1 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. Seam shall be constructed in the [C]BRN barrier layer no closer than 75 mm (3 in.) to one another. The multi-layer composite shall be stitched around the entire periphery.

8.38.8.2 Prepared composite samples prepared as described in 8.38.7.1 shall be tested after being twice subjected to the conditioning as specified in 8.1.3.

8.38.8.3 The composite sample, including [C]BRN barrier layer seam, that was conditioned in 8.38.8.2 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.

8.38.8.4 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.

8.38.8.5 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 8.38.8.2.

8.38.8.6 The specimens shall be oriented in the penetration test cell with the exterior surfaces facing the challenge chemical.

8.38.8.7 Specimens shall be tested for viral penetration resistance as specified in 8.39.2 through 8.38.6.

8.38.9 Specific Requirements for Testing Glove Materials and Seams.

8.38.9.1 This test shall apply to all types of glove configurations.

8.38.9.2 Samples for conditioning shall be whole gloves.

8.38.9.3 Glove samples shall be subjected to conditioning as specified in 8.1.3.

8.38.9.4 Following the conditioning specified in 8.38.9.3, 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.

8.38.9.5 Following the flexing in 8.39.9.4, 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.

8.38.9.6 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 8.38.9.2.

8.38.9.7 Specimens shall be tested for viral penetration resistance as specified in 8.38.2 through 8.38.6.

8.38.10 Specific Requirements for Testing Footwear Materials.

8.38.10.1 This test shall not apply to footwear configurations that include booties that are subjected to the procedures in 8.38.7 and 8.38.8.

8.38.10.2 Samples for conditioning shall be whole footwear items.

8.38.10.3 Footwear samples shall be subjected to conditioning by flexing 500,000 cycles in accordance with Appendix B of FIA Standard 1209, *Whole Shoe Flex*.

8.38.10.4 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 8.38.7.4.

8.38.10.5 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.

8.38.10.6 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.

8.38.10.7 Specimens shall be tested for viral penetration resistance as specified in 8.38.2 through 8.38.6.

8.39 Retroreflectivity and Fluorescence Test Following Laundering.

8.39.1 Application.

8.39.1.1 This test method shall apply to visibility materials used in the construction of multiuse emergency protective garments.

8.39.1.2 Visibility materials shall be tested for each procedure specified in 8.39.4.

8.39.2 Specimens.

8.39.2.1 A minimum of three test specimens shall be tested as removed from conditioned garments as specified in 8.39.3.

8.39.2.2 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.

8.39.3 Sample Preparation. Samples shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

8.39.4 Procedures.

8.39.4.1 Measurement of Coefficient of Retroreflection.

8.39.4.1.1 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.

8.39.4.1.2 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 8.39.4.1.1
A_r = only the retroreflective surface area of the trim test specimen's surface area

8.39.4.1.2.1 A_r shall be calculated by subtracting the nonretroreflective surface area from the test specimen's total surface area.

8.39.4.2 Evaluation of Fluorescence.

8.39.4.2.1 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.

8.39.4.2.2 The chromaticity shall be within one of the areas defined in Table 8.39.4.2.2, Color Requirements, and the Cap Y luminance factor shall not be less than the corresponding minimum for the respective color.

8.39.5 Report.

8.39.5.1 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 procedure specified in 8.39.4.1.

8.39.5.2 The number of fluorescent and nonfluorescent specimens shall be recorded and reported separately for each of the test procedures specified in 8.39.4.2.

8.39.6 Interpretation.

8.39.6.1 For trim retroreflectivity, pass or fail performance shall be determined using the average coefficient of retroreflection *(R_a)* for the procedures specified in 8.39.4.1.

8.39.6.2 For trim fluorescence, specimens that do not meet the chromaticity and luminance factor requirements shall be designated as nonfluorescent.

8.40 Tear Resistance Test Two.

8.40.1 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.

8.40.2 Specimens.

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

8.40.2.2 Specimens shall be prepared in accordance with ASTM D 5733, *Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure.*

8.40.3 Sample Preparation.

8.40.3.1 Samples for conditioning shall be complete garments.

8.40.3.2 Garment samples shall be conditioned as specified in 8.1.2.

8.40.4 Procedure. Specimens shall be tested in accordance with ASTM D 5733, *Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure.*

8.40.5 Report.

8.40.5.1 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.

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

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

8.40.6 Interpretation.

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

8.40.6.2 Failure in any one direction constitutes failure for the material.

8.41 Flammability Test.

8.41.1 Application.

8.41.1.1 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.

8.41.1.2 Modifications to this test method for testing multiple-use garments shall be as specified in 8.41.7

8.41.1.3 Modifications to this test method for testing footwear covers and single-use garments shall be as specified in 8.41.8.

8.41.1.4 Modifications to this test method for testing cleaning/utility gloves shall be as specified in 8.41.9.

8.41.1.5 Modifications to this test method for testing single-use eye and face protection devices shall be as specified in 8.41.10.

8.41.1.6 Modifications to this test method for testing work gloves shall be as specified in 8.41.11.

8.41.1.7 Modifications to this test method for testing footwear shall be as specified in 8.41.12.

8.41.2 Specimens. A minimum of five specimens shall be tested.

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

Table 8.39.4.2.2 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	

8.41.4 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.

8.41.5 Report.

8.41.5.1 The flame spread time for each specimen shall be reported to the nearest 0.1 second.

8.41.5.2 The average flame spread time for all specimens shall be reported.

8.41.5.3 Specimens that do not ignite shall be recorded as "Did not ignite" and shall not be included in the average flame spread time.

8.41.5.4 Specimens that ignite but where the flame extinguished before reaching the stop cord, shall be recorded as "Ignited but extinguished" and shall not be included in the average flame spread time.

8.41.6 Interpretation.

8.41.6.1 Pass/fail performance shall be based on the average flame spread time.

8.41.6.2 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.

8.41.7 Specific Requirements for Multiple Use Garments.

8.41.7.1 Where the garment is constructed of several separable layers, each separable layer of garment material shall be tested.

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

8.41.7.3 Samples for conditioning shall be the entire complete garment.

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

8.41.7.5 Pass/fail performance shall be based on the average flame spread time in the warp and fill directions.

8.41.7.6 Failure in any one direction constitutes failure for the material.

8.41.8 Specific Requirements for Footwear Covers and Single Use Garments.

8.41.8.1 Where the footwear cover or garment is constructed of several separable layers, each separable layer of garment material shall be tested.

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

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

8.41.8.4 Pass/fail performance shall be based on the average flame spread time in the warp and fill directions.

8.41.8.5 Failure in any one direction constitutes failure for the material.

8.41.9 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.

8.41.10 Specific Requirements for Single-Use Eye and Face Protection Devices.

8.41.10.1 Samples for testing shall only be taken from the textile portions of the eye and face protection device, where applicable.

8.41.10.2 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.).

8.41.11 Specific Requirements for Work Gloves.

8.41.11.1 Samples shall be taken from the exterior surface of the work gloves.

8.41.11.2 Work glove samples shall be conditioned as specified in 8.1.9, and then conditioned as specified in 8.1.2.

8.41.12 Specific Requirements for Multiple-Use Footwear.

8.41.12.1 Specimens for testing shall be taken from the exterior surface of the footwear, including the sole.

8.41.12.2 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.

8.42 Suspension System Retention Test.

8.42.1 Application. This test shall apply to helmets.

8.42.2 Sample Preparation.

8.42.2.1 Samples shall be conditioned as specified in 8.1.2.

8.42.2.2 Samples for conditioning shall be whole helmets.

8.42.3 Specimens. A minimum of three complete helmets shall be tested.

8.42.4 Apparatus.

8.42.4.1 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 8.42.4.1.

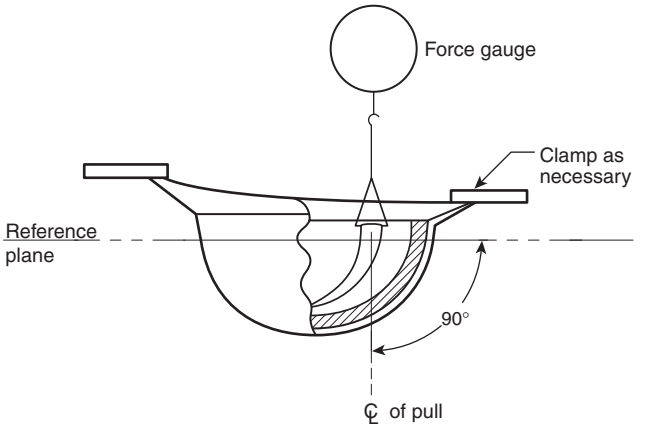


FIGURE 8.42.4.1 Suspension System Retention Test Setup.

8.42.4.2 The calibrated tensile test machine shall be capable of measuring the force applied to the retention system within 2 percent of the specified forces.

8.42.5 Procedure.

8.42.5.1 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.

8.42.5.2 Specimens shall be positioned and secured in the tensile testing machine so that the helmet's reference plane is horizontal.

8.42.5.3 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.).

8.42.5.4 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.

8.42.5.5 Each adjusting mechanism of the helmet suspension system assembly shall be secured and unsecured, as applicable, for 20 repetitions.

8.42.6 Report.

8.42.6.1 The individual pass/fail results for each attachment point shall be recorded.

8.42.6.2 Each adjusting mechanism of the helmet suspension system shall be observed for proper functioning to determine pass or fail.

8.42.7 Interpretation.

8.42.7.1 Separation of the helmet suspension from the helmet shall constitute failing performance.

8.42.7.2 One or more helmet specimens failing this test shall constitute failing performance.

8.43 Retention System Test.

8.43.1 Application. This test shall apply to helmets.

8.43.2 Sample Preparation.

8.43.2.1 Samples for conditioning shall be whole helmets.

8.43.2.2 Samples shall be conditioned as specified in 8.1.2.

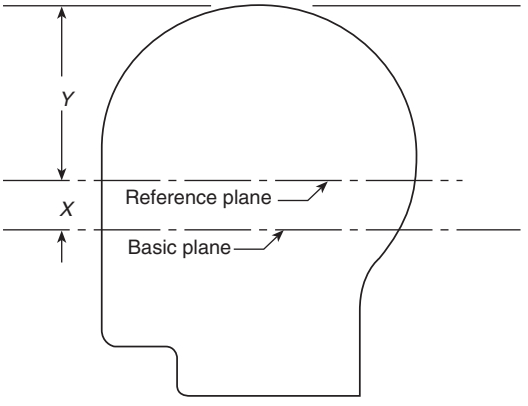
8.43.3 Specimens. A minimum of five complete helmets shall be tested.

8.43.4 Apparatus.

8.43.4.1 An ISO size J headform conforming to the nominal dimensions in Figure 8.43.4.1 shall be used.

8.43.4.2 A mechanical chin structure shall be designed for use with a calibrated tensile test machine. The mechanical chin structure shall consist of two rollers 13 mm (½ in.) in diameter with centers that are 75 mm (3 in.) apart. The mechanical chin structure shall conform with Figure 8.43.4.2(a), Figure 8.43.4.2(b) and Figure 8.43.4.2(c).

8.43.4.3 The calibrated tensile test machine shall be capable of measuring the force applied to the retention system within 2 percent at the specific force.



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 8.43.4.1 Location of Reference Plane.

8.43.5 Procedure.

8.43.5.1 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.

8.43.5.2 Prior to testing, the test machine shall be allowed to warm up until stability is achieved.

8.43.5.3 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.).

8.43.5.4 The force applied to the retention system shall be slowly increased to 225 N, + 5 N (50 lbf, + 1 lbf/sec).

8.43.5.5 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).

8.43.5.6 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.

8.43.5.7 In addition, each adjusting mechanism of the helmet chin strap assembly shall be secured and unsecured, as applicable, for 20 repetitions.

8.43.6 Report.

8.43.6.1 The retention system elongation shall be measured, recorded, and reported for each helmet specimen.

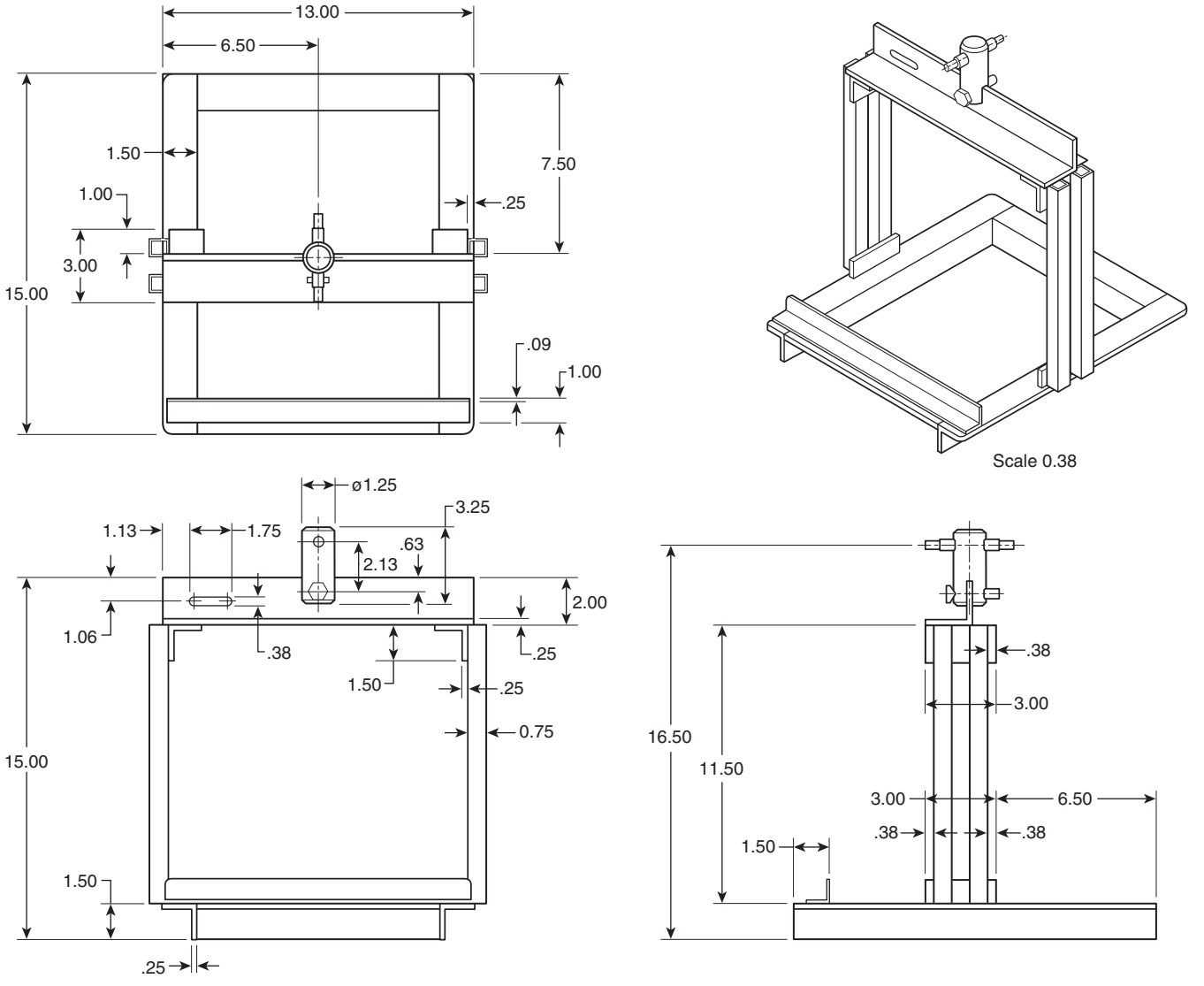


FIGURE 8.43.4.2(a) Retention Test Fixture.

8.43.6.2 Each mechanism shall be observed for proper functioning to determine pass or fail.

8.43.7 Interpretation. One or more helmet specimens failing this test constitutes failing performance.

8.44 Goggle and Headlamp Clip Attachment Test.

8.44.1 Application. This test method shall apply to goggle and headlamp clips on protective helmets, where present.

8.44.2 Sample Preparation.

8.44.2.1 Specimens shall be conditioned as specified in 8.1.2.

8.44.2.2 Samples for conditioning shall be complete helmets with goggle and headlamp clips in place.

8.44.3 Specimens. A minimum of three helmets with goggle and headlamp clips shall be tested for each test.

8.44.4 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.

8.44.5 Procedure.

8.44.5.1 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 8.44.5.1.

8.44.5.2 The wire shall be looped under the clip and, without allowing any vertical drop, the weight shall be suspended from the clip.

8.44.5.3 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.

8.44.6 Report. The individual pass/fail results for each specimen and clip shall be recorded.

8.44.7 Interpretation. One or more helmet specimens failing this test constitutes failing performance.