

# NFPA 1999

## Standard on Protective Clothing for Emergency Medical Operations

### 2003 Edition



NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101  
An International Codes and Standards Organization

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## NFPA 1999

### Standard on

## Protective Clothing for Emergency Medical Operations

### 2003 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, released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by NFPA at its November Association Technical Meeting held November 16–20, 2002, in Atlanta, GA. It was issued by the Standards Council on January 17, 2003, with an effective date of February 6, 2003, and supersedes all previous editions.

This edition of NFPA 1999 was approved as an American National Standard on January 17, 2003.

### 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.

This third edition of NFPA 1999 has been reformatted into the new style for all NFPA codes and standards and, therefore, the chapter titles and numbering, as well as paragraph numbering, have changed. In this edition, the Committee added new requirements for emergency medical work gloves, emergency medical footwear, and cleaning 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 gloves are single-use items to protect wearers during cleaning and decontamination of EMS equipment.

This third edition was acted on by the NFPA membership at the November Association Technical Meeting in Atlanta, GA, on 20 November 2002.

#### **In Memoriam, 11 September 2001**

We pay tribute to the 343 members of FDNY who gave their lives to save civilian victims on September 11, 2001, at the World Trade Center. They are true American heroes in death, but they were also American heroes in life. We will keep them in our memory and in our hearts. They are the embodiment of courage, bravery, and dedication. May they rest in peace.

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Association Inc.

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**Cy Long**, Texas Commission on Fire Protection, TX [E]

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England [SE]

**Jim Minx**, Oklahoma State Firefighters Association,  
OK [C]

Rep. Oklahoma State Firefighters Association

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VA [RT]

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**Harry Winer**, U.S. Department of the Navy, MA [RT]

**Thomas L. Wollan**, Underwriters Laboratories Inc.,  
NC [RT]

### Alternates

**Janice C. Bradley**, Industrial Safety Equipment  
Association, VA [M]

(Alt. to D. Trivette)

**Gregory S. Copeland**, Celanese AG, NC [M]

(Alt. to R. W. Blocker, Jr.)

**Patricia A. Freeman**, Globe Manufacturing Company, NH  
[M]

(Alt. to R. A. Freese)

**Patricia A. Gleason**, Safety Equipment Institute (SEI),  
VA [RT]

(Alt. to S. R. Sanders)

**Mary I. Grilliot**, Total Fire Group/Morning Pride  
Manufacturing, LLC, OH [M]

(Alt. to B. Grilliot)

**Steven B. Lumry**, Oklahoma City Fire Department,  
OK [C]

(Alt. to J. Minx)

**Daniel Ryan**, Underwriters Laboratories Inc., NC [RT]

(Alt. to T. L. Wollan)

**Frank P. Taylor**, Lion Apparel, Inc., VA [M]

(Alt. to N. J. Curtis)

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**Donna P. Brehm**, Virginia Beach Fire Department,  
VA [U]

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CA [L]

**Bryan C. Heirston**, Oklahoma City Fire Department,  
OK [L]

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NV [U]

**George M. Jackson**, U.S.D.A. Forest Service, MT [E]

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

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**Jeffrey O. Stull**, International Personnel Protection, Inc., TX [SE]

### Alternates

**Nicholas J. Curtis**, Lion Apparel, Inc., OH [M]  
(Alt. to K. E. Strumlock)  
**Stephen L. Derynck**, Underwriters Laboratories Inc., NC [RT]  
(Alt. to G. A. Skelly)

**Andy Gbur**, Intertek Testing Services NA, Inc., OH [RT]  
(Alt. to S. L. Carey)  
**Grace G. Stull**, International Personnel Protection, Inc., TX [SE]  
(Alt. to J. O. Stull)

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**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.

*These lists represent the membership at the time the Committees were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.*

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

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

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

**Chapter 1 Administration****1.1 Scope.**

**1.1.1\*** This standard shall specify the minimum documentation, design, performance, testing, and certification requirements for new single-use and new multiple-use emergency medical protective clothing, including garments, gloves, footwear, and face protection devices, used by fire and emergency services personnel during emergency medical operations.

**1.1.2\*** This standard shall not be interpreted as providing criteria for protection from radiological agents, from hazardous chemicals, from flammable or explosive atmospheres, or from thermal hazards associated with fire fighting.

**1.1.3\*** This standard shall not be interpreted as providing criteria for protection from blood and body fluid-borne pathogens that are airborne.

**1.1.4** This standard shall not be interpreted as providing criteria for respiratory protection.

**1.1.5** This standard shall not be interpreted as providing criteria for protection from chemical and biological terrorism agents.

**1.1.6** Certification of emergency medical garments, emergency medical examination gloves, emergency medical work gloves, emergency medical footwear, emergency medical footwear covers, or emergency medical face protection devices, or cleaning gloves to the requirements of this standard shall not preclude certification to additional appropriate standards where the garments, gloves, footwear, or face protection devices meet all applicable requirements of each standard.

**1.1.7** This standard shall not be construed as addressing all of the safety concerns, if any, associated with its use. It shall be the responsibility of the persons and organizations that use this standard to establish safety and health practices and determine the applicability of regulatory limitations prior to use of this standard.

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

**1.2 Purpose.**

**1.2.1\*** The purpose of this standard shall be to establish 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** To achieve this purpose, this standard shall establish minimum requirements for garments, gloves, footwear, and face protection devices to minimize skin and mucous membrane contact with blood and body fluid-borne pathogens for fire and emergency services personnel.

**1.2.3** 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.

**1.2.4** 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, manufacturing, and certification of new emergency medical garments, emergency medical examination gloves, emergency medical work gloves, emergency medical footwear and footwear covers, emergency medical face protection devices, and cleaning gloves.

**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** This standard shall not apply to respiratory protection for emergency medical operations as such requirements are specified by NIOSH in 42 CFR 84 and OSHA in 29 CFR 1910.134 and 29 CFR 1910.1030.

**1.3.5** This standard shall not apply to protective clothing for chemical and biological terrorism incidents as such requirements are specified in NFPA 1994, *Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents*.

**1.3.6** This standard shall not apply to the use of emergency medical protective clothing; such use requirements are specified in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1581, *Standard on Fire Department Infection Control Program*.

**1.3.7** The requirements of this standard shall not apply to accessories that could be attached to any emergency medical protective clothing unless specifically addressed herein.

**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 might be approximate.

**Chapter 2 Referenced Publications**

**2.1 General.** The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

**2.2 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2002 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2000 edition.

NFPA 1994, *Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents*, 2001 edition.

NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations*, 1997 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*, 1996.

AATCC 70, *Test Method for Water Repellency: Tumble Jar Dynamic Absorption Test*, 1988.

**2.3.2 ANSI Publication.** American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

ANSI Z41, *Standard for Personal Protection — Protective Footwear*, 1999.

**2.3.3 ASTM Publications.** American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 1997.

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

ASTM D 573, *Standard Test Method for Rubber-Deterioration in an Air Oven*, 1999.

ASTM D 751, *Standard Test Methods for Coated Fabrics*, 2000.

ASTM D 1630, *Test Method for Rubber Property-Abrasion Resistance (Footwear Abrader)*, 2000.

ASTM D 2582, *Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheet*, 2000.

ASTM D 3884, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)*, 1992.

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

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

ASTM D 5598, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*, 1996.

ASTM D 5712, *Standard Test Method for Analysis of Aqueous Extractable Protein in Natural Rubber and Its Products Using the Modified Lowry Method*, 1999.

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

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*, 1999.

ASTM F 1342, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 1996.

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*, 1997.

ASTM F 1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 1997.

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)*, 2000.

ASTM F 1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 1998.

ASTM F 2010, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2000.

**2.3.4 EN Publications.** European Standard, BSI, Linford Wood, Milton Keynes MK14 6LE, U.K.

EN 420, *General requirements for gloves*, 1994.

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

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

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

**2.3.6 GSA Publication.** General Services Administration, Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, DC 20407.

Federal Test Method Standard 191A, *Textile Test Methods*, 20 July 1978.

**2.3.7 ISO Publications.** International Standards Organization, 1 rue de Varembe, Case Postale 56, CH-1211 Genève 20, Switzerland.

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

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

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.

ISO 9001, *Quality management systems — requirements*, 2000.

ISO 9001, *Quality systems — model for quality assurance in design, development, production, installation, and servicing*, 1994.

ISO 9002, *Quality systems — model for quality assurance in production, installation, and servicing*, 1994.

ISO 17025, *General requirements for the competence of testing and calibration laboratories*, 1999.

**2.3.8 Psychological Corporation Publication.** Psychological Corporation, 555 Academic Court, San Antonio, TX 78204.

*Crawford Small Parts Dexterity Test*, 1981.

**2.3.9 U.S. Government Publications.** Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title 21, Code of Federal Regulations, Part 880, “Medical Devices; Patient Examination Glove; Revocation of Exemptions from the Premarket Notification Procedures and the Current Good Manufacturing Practice Regulations; Final Rule,” 13 January 1989.

Title 29, Code of Federal Regulations, Part 1910.13, “General Requirements of Subpart I, Personal Protective Equipment,” 27 August 1971.

Title 29, Code of Federal Regulations, Part 1910.1030, “Protecting Health Care Workers from Occupational Exposure to Blood-Borne Pathogens,” 6 March 1992.

### 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 included, common usage of the terms shall apply.

#### 3.2 NFPA Official Definitions.

**3.2.1\* Approved.** Acceptable to the authority having jurisdiction.

**3.2.2\* Authority Having Jurisdiction (AHJ).** The organization, office, or individual responsible 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 Arch.** The bottom curve of the foot from the heel to the ball.

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

**3.3.4 Biological Terrorism Agents.** Biological materials that are capable of causing an acute disease or long-term damage to the human body.

**3.3.5 Blood and Body Fluid-Borne Pathogen.** An infectious bacteria or virus carried in human, animal, or clinical body fluids, organs, or tissues.

**3.3.6 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.

**3.3.7 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.

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

**3.3.9\* Cleaning Glove.** Multipurpose glove, not intended for emergency patient care, that provides a barrier against body fluids, cleaning fluids, and disinfectants and limited physical protection to the wearer during cleaning or care of emergency medical clothing and equipment.

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

**3.3.11 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.

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

**3.3.13 Emergency Medical Examination Glove.** An item of emergency medical protective clothing that is designed and configured to provide barrier protection to the wearer’s hand to at least the wrist. (*See also Emergency Medical Work Glove.*)

**3.3.14 Emergency Medical Face Protection Device.** An item of emergency medical protective clothing that is designed and configured to provide barrier protection to the wearer’s face or head.

**3.3.15 Emergency Medical Footwear.** An item of emergency medical protective clothing that is designed and configured to provide barrier protection to the wearer’s feet.



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

**3.3.17\* Emergency Medical Garment.** An item of emergency medical 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.

**3.3.18 Emergency Medical Operations.** Delivery of emergency patient care and transportation prior to arrival at a hospital or other health care facility.

**3.3.19 Emergency Medical Protective Clothing.** Multiple items of protective clothing, including garments, examination gloves, work gloves, cleaning gloves, footwear and footwear covers, and face protection devices designed and configured to provide limited physical protection and barrier protection against blood and body fluid-borne pathogens contact with the wearer's body during delivery of emergency patient care and other emergency medical functions. (See also *Cleaning Glove*, *Emergency Medical Examination Glove*, *Emergency Medical Face Protection Device*, *Emergency Medical Footwear*, *Emergency Medical Footwear Cover*, *Emergency Medical Garment*, and *Emergency Medical Work Glove*.)

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

**3.3.21 Emergency Patient Care.** The provision of treatment to patients, including first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical procedures that occur prior to arrival at a hospital or other health care facility.

**3.3.22 Examination Glove.** An abbreviated term for emergency medical examination glove. (See *definition for Emergency Medical Examination Glove*.)

**3.3.23 Face Protection Device.** An abbreviated term for emergency medical face protection device. (See *definition for Emergency Medical Face Protection Device*.)

**3.3.24 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.

**3.3.25 Footwear.** An abbreviated term for emergency medical footwear (See *definition for Emergency Medical Footwear*.)

**3.3.26 Footwear Cover.** An abbreviated term for emergency medical footwear cover. (See *definition for Emergency Medical Footwear Cover*.)

**3.3.27 Garment.** An abbreviated term for emergency medical garment. (See *definition for Emergency Medical Garment*.)

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

**3.3.29 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.

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

**3.3.31 Glove.** See *Cleaning Glove*, *Emergency Medical Examination Glove*, and *Emergency Medical Work Glove*.

**3.3.32 Glove Body.** The part of the glove that extends from the tip of the fingers to 25 mm (1 in.) beyond the wrist crease.

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

**3.3.34 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.

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

**3.3.36 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.

**3.3.37 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.

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

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

**3.3.40 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 *Labeled and Package Product Label*.)

**3.3.41 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.

**3.3.42 Sample.** An amount of the material, product, or assembly to be tested that is representative of the item as a whole. (See also *Specimen*.)

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

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

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

**3.3.46 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.

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

**3.3.48 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.

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

**3.3.50 Work Glove.** An abbreviated term for emergency medical work glove. (*See definition for Emergency Medical Work Glove.*)

## Chapter 4 Certification

### 4.1 General.

**4.1.1** The process of certification for emergency medical operations protective clothing 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, Recertification; Section 4.5, ISO Registration for Manufacturers; 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 emergency medical operations protective clothing items that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

**4.1.3** 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*.

**4.1.4** Manufacturers shall not claim compliance with a portion(s) or segment(s) of the requirements of this standard and shall not use 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 emergency medical operations protective clothing items shall be labeled and listed.

**4.1.6** All compliant emergency medical operations protective clothing items shall also have a product label that meets the requirements specified in Chapter 5.

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

**4.1.8** The certification organization shall not certify any emergency medical operations protective clothing to the 1997 edition of this standard on or after 1 September 2003.

**4.1.9** The certification organization shall not permit any manufacturer to label any emergency medical operations protective clothing as compliant with the 1997 edition of this standard on or after 1 September 2003.

**4.1.10** The certification organization shall require manufacturers to remove all certification labels and product labels in-

dicating compliance with the 1997 edition of this standard from all emergency medical operations protective clothing that are under the control of the manufacturer on 1 September 2003. The certification organization shall verify 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*.

**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's 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's 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, ISO Registration for Manufacturers.

**4.2.7.1\*** The certification organization shall require the manufacturer to have a product recall system 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 com-

pliant 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 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** Sample product shall be inspected and tested by the certification organization to verify the product's continued compliance.

**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 clothing, 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 the certification organization or a facility accredited by the certification organization for inspections, evaluations, conditioning, and testing in accordance with all requirements pertaining to testing laboratories in ISO 17025, *General requirements for the competence of testing and calibration laboratories*.

**4.3.3** All inspections, evaluations, conditioning, or testing conducted by a product manufacturer shall not be used in the certification or recertification process unless the facility for inspections, evaluations, conditioning, or testing has been accredited by the certification organization in accordance with all requirements pertaining to testing laboratories in ISO 17025, *General requirements for the competence of testing and calibration laboratories*.

**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. This information shall be included in the manufacturer's technical data package.

**4.3.5** Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachment, compliance statements, certification statements, and other product information are at least as specified for the respective protective clothing item in 5.1.1 through 5.1.7.

**4.3.6** Inspection by the certification organization shall include an evaluation of any graphic representations used on product labels as permitted by in 5.1.1 through 5.1.7 to ensure that the symbols are consistent with the worded statements, readily understood, and clearly communicate the intended message.

**4.3.7** Inspection by the certification organization shall include a review of the user information required by Section 5.2, User Information, 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 conducted by the certification organization in accordance with the testing requirements of Chapter 8, for determining product compliance with the applicable performance requirements specified in Chapter 7, shall be performed on samples representative of materials and components used in the actual construction of the emergency medical protective clothing. The certification organization also shall be permitted to use sample materials cut from a representative product.

**4.3.10** Where certification testing includes a protective clothing item with one or more accessories, the item with each accessory shall be certified as complying with 6.1.7 and 6.1.8, 6.2.4 and 6.2.5, 6.3.5 and 6.3.6, or 6.6.4 and 6.6.5, as applicable.

**4.3.11** 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.

**4.3.12** 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.

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

**4.3.14** 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.

**4.3.15** 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.

**4.3.16** 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 the AHJ.

### **4.4 Recertification.**

**4.4.1** All individual items of emergency medical protective clothing that are labeled as being compliant with this standard shall undergo recertification on an annual basis. This recertification shall include inspection and evaluation to all design requirements and testing to all performance requirements as required by this standard on all manufacturer models and components.

**4.4.1.1** Any change that affects the item's performance under the design or performance requirements of this standard shall constitute a different model.



**4.4.1.2** For the purpose of this standard, models shall include each unique pattern, style, or design of an individual item.

**4.4.2** Samples of manufacturer models and components for recertification shall be acquired from the manufacturer or component supplier during random and unannounced visits as part of the follow-up inspection program.

**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 the AHJ.

#### **4.5 ISO Registration for Manufacturers.**

**4.5.1** The manufacturer shall be registered to ISO 9001, *Quality management systems — requirements*, 2000 edition.

**4.5.1.1** Where the manufacturer is already registered to the 1994 edition of ISO 9001, *Quality systems — model for quality assurance in design, development, production, installation, and servicing*, the manufacturer shall be permitted to be registered to the 1994 edition of ISO 9001 until 15 December 2003.

**4.5.1.2** Where the manufacturer is already registered to the 1994 edition of ISO 9002, *Quality systems — model for quality assurance in production, installation, and servicing*, the manufacturer shall be permitted to be registered to the 1994 edition of ISO 9002 until 15 December 2003.

**4.5.1.3** Manufacturers who are currently registered to either the 1994 edition of ISO 9001, *Quality systems — model for quality assurance in design, development, production, installation, and servicing*, or the 1994 edition of ISO 9002, *Quality systems — model for quality assurance in production, installation, and servicing*, shall be permitted to be registered to the 2000 edition of ISO 9001, specified in 4.5.1, at any time prior to 15 December 2003.

**4.5.1.4** Effective not later than 15 December 2003, all manufacturers of compliant emergency medical protective clothing shall be registered to the 2000 edition of ISO 9001, *Quality management systems — requirements*.

**4.5.2** The manufacturer shall provide and operate a quality assurance program.

**4.5.3** The manufacturer's quality assurance program shall include a safety alert and product recall systems that shall meet the requirements specified in Section 4.8, Manufacturers' Safety Alert and Product Recall Systems.

#### **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 condition 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 product 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 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 government 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

**4.6.11.1** Where a hazardous condition exists and it is not practical to implement 4.6.11(1), (2), or (3) or the responsible parties refuse to take corrective action, the certification organization shall notify relevant government 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, if 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 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 its 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 conduct a product recall.

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

- (1) 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 1 week 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 product that is recalled and documenting the effectiveness of the product recall
- (5) A plan for either repairing, replacing, or compensating purchasers for returned product

## **Chapter 5 Labeling and Information**

### **5.1 Product Label Requirements.**

#### **5.1.1 Emergency Medical Garments Product Label Requirements.**

**5.1.1.1** 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.

**5.1.1.2** 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.

**5.1.1.3** All worded portions of the required product label shall be at least in English.

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

**5.1.1.5** The product label of each garment that has been designated by the manufacturer as a single-use garment, in accordance with 6.1.1, shall have the following statement printed in letters that are at least 2 mm ( $\frac{1}{16}$  in.) high:

**“THIS GARMENT IS FOR SINGLE USE ONLY.”**

**5.1.1.6** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**“THIS (insert name of garment type) MEETS THE EMERGENCY MEDICAL GARMENT REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. DO NOT REMOVE THIS LABEL.”**

**5.1.1.7** The following information shall also be printed legibly on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

- (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

#### **5.1.2 Emergency Medical Examination Gloves Product Label Requirements.**

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

**5.1.2.2** The package product label shall be permanently and conspicuously located on the outside of the package or printed on the package. This label shall not be removed, obscured, or otherwise mutilated by the opening of the package when the package is opened as intended.

**5.1.2.3** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label in letters at least 3 mm ( $\frac{3}{16}$  in.) high.

**“THIS GLOVE MEETS THE EMERGENCY MEDICAL EXAMINATION GLOVE REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. THIS GLOVE IS FOR SINGLE USE ONLY.”**



**5.1.2.4** The following information shall also be printed legibly on the package product label. This portion of the package label shall not be removed, obscured, or otherwise mutilated by the opening of the package when the package is opened as intended. All letters and numbers shall be at least 3 mm ( $\frac{1}{8}$  in.) high.

- (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

**5.1.2.5** All portions of the required product labels and package product labels shall be printed at least in English.

**5.1.2.6** Symbols and other pictorial graphic representations shall be permitted to be used to supplement the worded statements on the product labels and package product labels.

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

**5.1.2.8** 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. All letters and numbers shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**"MEETS NFPA 1999 (2003 ED.)."**

### **5.1.3 Emergency Medical Face Protection Devices Label Requirements.**

**5.1.3.1\*** The package containing the smallest number of face protection device items from which the user withdraws the product for use shall have a package product label.

**5.1.3.2** 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.

**5.1.3.3** The package product label of face protection devices that have been designated by the manufacturer as single-use devices, in accordance with 6.3.1, shall have the following statement printed in letters that are at least 3 mm ( $\frac{1}{8}$  in.) high:

**"THIS FACE PROTECTION DEVICE IS FOR  
SINGLE USE ONLY."**

**5.1.3.4** The certification organization's label, symbol, or identifying mark and at least the following statement shall be printed on the package product label. All letters shall be at least 3 mm ( $\frac{1}{8}$  in.) high:

**"THIS DEVICE MEETS THE EMERGENCY MEDICAL  
FACE PROTECTION REQUIREMENTS OF NFPA 1999,  
STANDARD ON PROTECTIVE CLOTHING FOR  
EMERGENCY MEDICAL OPERATIONS, 2003 EDITION."**

**5.1.3.5** The following information also shall be printed legibly on the package product label. This portion of the package labels shall not be removed, obscured, or otherwise mutilated by the opening of the package when the package is opened as intended. All letters and numbers shall be at least 3 mm ( $\frac{1}{8}$  in.) high.

- (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

**5.1.3.6** All portions of the required product labels and package product labels shall be printed at least in English.

**5.1.3.7** Symbols and other pictorial graphic representations shall be permitted to be used to supplement the worded statements on the product labels and package product labels.

**5.1.3.8** Where face protection devices are intended for multiple use, 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.

**5.1.3.9** 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. All letters and numbers shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**"MEETS NFPA 1999 (2003 ED.)."**

**5.1.3.10** Face protection devices that are intended for single use shall be permitted to 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.

**5.1.3.11** Where single-use face protection devices bear a product label, the certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label of the face protection device. All letters and numbers shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**"MEETS NFPA 1999 (2003 ED.)."**

### **5.1.4 Emergency Medical Footwear Label Requirements.**

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

**5.1.4.2** 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.

**5.1.4.3** All worded portions of the required product label shall be printed at least in English.

**5.1.4.4** Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s). Such graphic representations shall be consistent and clearly communicate the intended message.

**5.1.4.5** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**“THIS FOOTWEAR MEETS THE EMERGENCY MEDICAL FOOTWEAR REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. DO NOT REMOVE THIS LABEL.”**

**5.1.4.6** The following information shall also be printed legibly on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

- (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

**5.1.5 Emergency Medical Footwear Cover Label Requirements.**

**5.1.5.1** Each footwear cover shall have a product label or labels permanently and conspicuously attached to the footwear cover.

**5.1.5.2** 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.

**5.1.5.3** All worded portions of the required product label shall be printed at least in English.

**5.1.5.4** Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s). Such graphic representations shall be consistent and clearly communicate the intended message.

**5.1.5.5** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**“THIS FOOTWEAR COVER MEETS THE EMERGENCY MEDICAL FOOTWEAR COVER REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. THIS FOOTWEAR COVER IS FOR SINGLE USE ONLY. DO NOT REMOVE THIS LABEL.”**

**5.1.5.6** The following information shall also be printed legibly on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

- (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

**5.1.6 Cleaning Glove Label Requirements.**

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

**5.1.6.2** 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.

**5.1.6.3** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label. All letters shall be at least 3 mm ( $\frac{1}{8}$  in.) high.

**“THIS CLEANING GLOVE MEETS THE CLEANING GLOVE REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. THIS GLOVE IS FOR SINGLE USE ONLY. DO NOT REMOVE THIS LABEL.”**

**5.1.6.4** The following information shall also be printed legibly on the package product label. This portion of the package label shall not be removed, obscured, or otherwise mutilated by the opening of the package when the package is opened as intended. All letters and numbers shall be at least 3 mm ( $\frac{1}{16}$  in.) high.

- (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

**5.1.6.5** All worded portions of the required product label shall be printed at least in English.

**5.1.6.6** Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s). Such graphic representations shall be consistent and clearly communicate the intended message.

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

**5.1.6.8** Where each cleaning 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. All letters and numbers shall be at least 3 mm ( $\frac{1}{8}$  in.) high.

**“MEETS NFPA 1999 (2003 ED.).”**

**5.1.7 Emergency Medical Work Glove Label Requirements.**

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

**5.1.7.2** Multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label; however, all pieces comprising the product label shall be located adjacent to each other.

**5.1.7.3** All worded portions of the required product label shall be printed at least in English.

**5.1.7.4** Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s). Such graphic representations shall be consistent and clearly communicate the intended message.

**5.1.7.5** The certification organization's label, symbol, or identifying mark and at least the following statement shall be legibly printed on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

**“THIS GLOVE MEETS THE EMERGENCY MEDICAL WORK GLOVE REQUIREMENTS OF NFPA 1999, STANDARD ON PROTECTIVE CLOTHING FOR EMERGENCY MEDICAL OPERATIONS, 2003 EDITION. DO NOT REMOVE THIS LABEL.”**

**5.1.7.6** The following information shall also be printed legibly on the product label. All letters shall be at least 2 mm ( $\frac{1}{16}$  in.) high.

- (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

## **5.2 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) A 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

## **Chapter 6 Design Requirements**

### **6.1 Emergency Medical Garment Design Requirements.**

**6.1.1** The manufacturer shall designate whether the garment is designed to meet the single-use requirements or the multiple-use requirements of this standard.

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

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

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

**6.1.5\*** The barrier layer shall be a single, nonseparable layer.

**6.1.6\*** 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.

**6.1.7** Any accessories attached to any garment shall not interfere with the function of that garment or with the function of any of the garment's component parts.

**6.1.8** Where garments are provided with accessories, the garment shall meet all of the design and performance requirements of this standard with accessories installed. In all cases, such accessories shall not degrade the performance of the garment.

### **6.2 Emergency Medical Examination Glove Design Requirements.**

**6.2.1\*** Gloves shall be designated as single-use only.

**6.2.2\*** All compliant gloves shall be Class 1 Medical Devices and shall meet the requirements of 21 CFR 880, “Medical Devices; Patient Examination Glove.”

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

**6.2.3.1** Gloves shall be permitted to be provided in ambidextrous sizing.

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

**6.2.4** Any accessories attached to any glove shall not interfere with the function of that glove or with the function of any of the glove's component parts.

**6.2.5** Where gloves are provided with an accessory or accessories, the glove shall meet all of the design and performance requirements of this standard with accessories installed. In all cases, such accessories shall not degrade the performance of the glove.

### **6.3 Emergency Medical Face Protection Device Design Requirements.**

**6.3.1** The manufacturer shall designate whether the face protection device is designated to meet the single-use requirements or the multiple-use requirements of this standard.

**6.3.2** 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, hooded visors, and masks.

**6.3.3** Face protection devices that are compliant with this standard are not intended to be primary eye protection but shall be permitted to be primary eye protection.

**6.3.4\*** Specimen face protection devices and related hardware of specimen face protection devices shall be examined and shall be free of rough spots, burrs, or sharp edges that could tear garment or glove materials.

**6.3.5** Any accessories attached to any face protection device shall not interfere with the function of that face protection device or with the function of any of the face protection device's component parts.

**6.3.6** Where face protection devices are provided with an accessory or accessories, the face protection device shall meet all of the design and performance requirements of this standard with accessories installed. In all cases, such accessories shall not degrade the performance of the face protection device.

#### **6.4 Emergency Medical Footwear Design Requirements.**

**6.4.1** Footwear shall consist of an upper with sole and heel.

**6.4.2** Footwear height shall be a minimum of 100 mm (4 in.) when measured according to 6.4.2.1 and 6.4.2.2.

**6.4.2.1** 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 footwear excluding pull-on loops.

**6.4.2.2** Removable insole inserts shall be removed prior to measurement.

#### **6.4.3 Sizing.**

**6.4.3.1** 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

**6.4.3.2** 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.

**6.4.3.3** 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 Emergency Medical Footwear Cover Design Requirements.**

**6.5.1** Footwear covers shall be designated as single-use only.

**6.5.2** The footwear cover height shall be a minimum of 200 mm (8 in.).

**6.5.3** The footwear cover height shall be determined by measuring inside the cover from the center of the heel area up to a perpendicular reference line extending across the width of the footwear cover. Footwear cover height shall be a minimum of 100 mm (4 in.) when measured according to 6.4.2.1 and 6.4.2.2.

#### **6.6 Cleaning Glove Design Requirements.**

**6.6.1** Gloves shall be designated as single-use only.

**6.6.2** Glove sizing shall be in accordance with EN 420, *General requirements for gloves*. Gloves shall have a length of at least 305 mm (12 in.).

**6.6.3** Specimen gloves and related hardware of sample gloves shall be examined and shall be free of rough spots, burrs, or sharp edges that could tear garment or glove material.

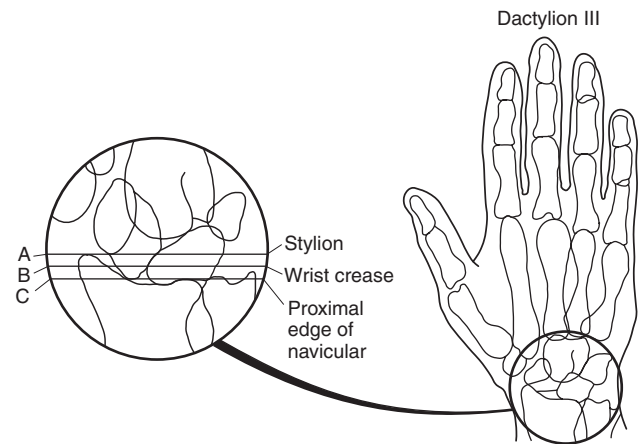
**6.6.4** Any accessories attached to any glove shall not interfere with the function of that glove or with the function of any of the glove's component parts.

**6.6.5** Where gloves are provided with an accessory or accessories, the glove shall meet all of the design and performance requirements of this standard with accessories installed. In all cases, such accessories shall not degrade the performance of the glove.

#### **6.7 Emergency Medical Work Glove Design Requirements.**

**6.7.1** The emergency medical work glove 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.

**6.7.2** The glove body 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 6.7.2.



**FIGURE 6.7.2 Anatomical Landmarks at Base of Hand.**

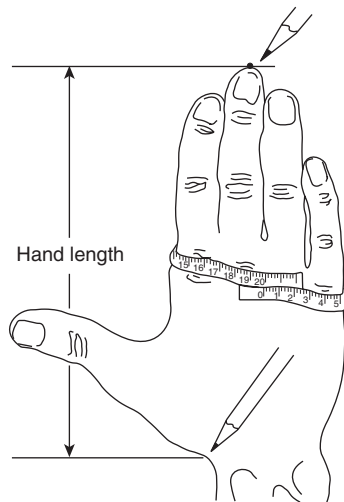
**6.7.3** Gloves shall have a wristlet or elastic that allows the glove material to fit closely around the wearer's wrist.

#### **6.7.4 Glove Sizing.**

**6.7.4.1** Hand dimensions for the selection of the proper glove size shall consist of measuring the following two dimensions, as shown in Figure 6.7.4.1:

- (1) Hand circumference
- (2) Hand length





**FIGURE 6.7.4.1 Method of Measuring Hand Dimensions for Selection of Proper Glove Size.**

**6.7.4.1.1** 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 3.18 mm ( $\frac{1}{8}$  in.) as shown in Figure 6.7.4.1.

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

**6.7.4.1.3** 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 3.18 mm ( $\frac{1}{8}$  in.) as shown in Figure 6.7.4.1.

**6.7.4.2\*** 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 6.7.4.2(a) through Table 6.7.4.2(e). The manufacturer shall provide gloves in each size that at least fit the hand dimension ranges specified in those tables.

**6.7.4.3** The glove size indicated on the label shall be determined by the hand dimensions given in Table 6.7.4.2(a) through Table 6.7.4.2(e).

**Table 6.7.4.2(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
Hand circumference	18.25	7.19	16.34–20.16	6.43–7.94
Hand length	16.75	6.59	16.27–17.23	6.41–6.78

**Table 6.7.4.2(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
Hand circumference	19.25	7.58	17.34–21.16	6.83–8.33
Hand length	17.75	6.99	17.27–18.23	6.80–7.18

**Table 6.7.4.2(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
Hand circumference	20.25	7.97	18.34–22.16	7.22–8.72
Hand length	18.75	7.38	18.27–19.23	7.19–7.57

**Table 6.7.4.2(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
Hand circumference	21.25	8.37	19.34–23.16	7.61–9.12
Hand length	19.75	7.78	19.27–20.23	7.59–7.96

**Table 6.7.4.2(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
Hand circumference	22.25	8.76	20.34–24.16	8.01–9.51
Hand length	20.75	8.17	20.27–21.23	7.98–8.36

## Chapter 7 Performance Requirements

### 7.1 Emergency Medical Garment Performance Requirements.

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

**7.1.3** 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 135 N (30 lbf).

**7.1.4** 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 345 kPa (50 psi).

**7.1.5** Each separable layer of garment material 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 25 N (5½ lbf).

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

**7.1.7** Seams from each separable layer of garment material shall be tested for breaking strength as specified in Section 8.8, Seam/Closure Breaking Strength Test, and shall have a breaking strength of not less than 67 N/50 mm (15 lbf/2 in.).

**7.1.8** Garment closure assemblies shall be tested for breaking strength as specified in Section 8.8, Seam/Closure Breaking Strength Test, and shall have a breaking strength of not less than 67 N/50 mm (15 lbf/2 in.).

**7.1.9** Outer garment materials shall be tested for water repellency as specified in Section 8.34, Water Repellency Test, and shall have a spray rating of 70 or greater.

**7.1.10** Garment composites shall be tested for total heat loss as specified in Section 8.35, Total Heat Loss Test, and shall have a total heat loss value of 450 W/m<sup>2</sup> or greater.

**7.1.11** Product labels of garments designated for multiple use shall be tested for durability and legibility as specified in Section 8.36, Label Durability and Legibility Test, and shall remain in place and shall be legible.

## **7.2 Emergency Medical Examination Glove Performance Requirements.**

**7.2.1** 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.

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

**7.2.3** 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).

**7.2.4** 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.

**7.2.5** 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).

**7.2.6** 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.

**7.2.7** 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.

## **7.3 Emergency Medical Face Protection Device Performance Requirements.**

**7.3.1** Face protection devices shall be tested for visual acuity as specified in Section 8.16, Visual Acuity Test, and the test subjects shall be able to read at least the 20/20 visual acuity line or better. The face protection device shall also remain functional and shall be able to be donned and adjusted in accordance with the manufacturer's instructions.

**7.3.2** 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.

**7.3.3** Face protection devices shall be tested for blood and body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall exhibit no penetration of the Phi-X174 bacteriophage.

## **7.4 Emergency Medical Footwear Performance Requirements.**

**7.4.1** 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** 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** 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.

**7.4.4** Footwear soles and heels shall be tested for physical penetration resistance as specified in Section 8.20, Puncture Resistance Test Two, and shall have a puncture force of greater than 223 N (50 lbf).

**7.4.5** Footwear outer soles shall be tested for flex fatigue resistance as specified in Section 8.21, Flex Fatigue Test, and the outer sole shall not separate.

**7.4.6** Footwear outer soles shall be tested for slip resistance as specified in Section 8.22, Slip Resistance Test, and shall show a friction coefficient of greater than 0.75 under dry conditions.

**7.4.7** Eyelets and stud hooks shall be tested for attachment strength as specified in Section 8.23, Eyelet and Stud Post Attachment Test, and shall have a minimum detachment strength of 295 N (66 lbf).

**7.4.8** Footwear toes shall be tested for resistance to impact and compression as specified in Section 8.24, Impact and Compression Resistance Test, shall have an impact requirement of 40 J (30 ft-lb), and shall have a compression requirement of 4450 N (1000 lbf) with a minimum clearance of 13 mm (½ in.).

**7.4.9** All footwear metal hardware and specimens of footwear hardware that include metal parts including but not limited to toecap, ladder shank, puncture-resistant device, and components shall be tested for corrosion resistance as specified by Section 8.25, Corrosion Resistance Test.

**7.4.9.1** Metals inherently resistant to corrosion, including, but not limited to, stainless steel, brass, copper, aluminum, and zinc, shall show no more than light surface-type corrosion or oxidation.

**7.4.9.2** Ferrous metals shall show no corrosion of the base metal.

**7.4.9.3** All hardware, unless specifically excluded in the test method, shall remain functional.

**7.4.10** The barrier layer material and barrier layer seams in the footwear shall be tested for blood and body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage for at least 1 hour.

**7.4.11** Footwear shall be tested for overall watertight integrity as specified in Section 8.26, Overall Liquid Integrity Test Four, and shall allow no liquid penetration.

**7.4.12** Product labels shall be tested for durability and legibility as specified in Section 8.36, Label Durability and Legibility Test, and shall be legible.

## **7.5 Emergency Medical Footwear Cover Performance Requirements.**

**7.5.1** Footwear cover material 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.).

**7.5.2** Footwear cover material 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 4.5 N (1 lbf).

**7.5.3** The footwear cover wear surface shall be tested for abrasion resistance as specified in Section 8.19, Abrasion Resistance Test One, and shall have an abrasion resistance rating of greater than 65.

**7.5.4** The footwear cover wear surface shall be tested for physical penetration resistance as specified in Section 8.20, Puncture Resistance Test Two, and shall have a puncture force greater than 45 N (10 lbf).

**7.5.5** The footwear cover wear surface shall be tested for slip resistance as specified in Section 8.22, Slip Resistance Test, and shall show a friction coefficient of greater than 0.75 under dry conditions.

**7.5.6** Footwear cover material and seams shall be tested for blood and body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage for at least 1 hour.

**7.5.7** Footwear covers shall be tested for overall watertight integrity as specified in Section 8.9, Liquidtight Integrity Test Two, and shall allow no liquid penetration.

#### **7.6 Cleaning Glove Performance Requirements.**

**7.6.1** 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.

**7.6.2** Gloves shall be tested for blood and body fluid-borne pathogen resistance as specified in Section 8.10, Biopenetration Test Two, and shall exhibit no penetration of Phi-X174 bacteriophage.

**7.6.3** 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 15 MPa (2175 psi).

**7.6.4** Glove materials shall be tested for ultimate elongation as specified in Section 8.12, Ultimate Elongation Test, and shall have an ultimate elongation of greater than 400 percent.

**7.6.5** 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 20 N (4½ lbf).

**7.6.6** 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.).

**7.6.7** Gloves shall be tested for dexterity as specified in Section 8.14, Dexterity Test One, and shall not have test times greater than 120 percent of baseline test measurements.

**7.6.8** Glove materials 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.

**7.6.9** Glove materials shall be tested for permeation resistance as specified in Section 8.27, Chemical Permeation Resistance Test, and shall not exhibit breakthrough detection times of 1 hour or less.

**7.6.10** Glove materials shall be tested for abrasion resistance as specified in Section 8.28, Abrasion Resistance Test Two, and shall show wear-through after 1000 cycles.

#### **7.7 Emergency Medical Work Gloves Performance Requirements.**

**7.7.1** Gloves shall be tested for liquidtight integrity as specified in Section 8.32, Overall Liquid Integrity Test Three, and shall show no water penetration.

**7.7.2** Gloves shall be tested for blood and body fluid-borne pathogen resistance as specified in Section 8.3, Biopenetration Test One, and shall show no penetration of the Phi-X174 bacteriophage for at least 1 hour.

**7.7.3** 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).

**7.7.4** 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.).

**7.7.5** Glove materials shall be tested for abrasion resistance as specified in Section 8.28, Abrasion Resistance Test Two, and shall show no wear-through.

**7.7.6** Gloves shall be tested for hand function as specified in Section 8.29, Dexterity Test Two, and shall have an average percent of barehand control not exceeding 200 percent.

**7.7.7** Gloves shall be tested for grip as specified in Section 8.30, Grip Test, and shall have a weight pulling capacity not less than 80 percent of the barehand control values.

**7.7.8** Gloves shall be tested for ease of donning as specified in Section 8.31, Liner Retention Test, and shall have a final donning time not to exceed the baseline donning time plus 20.0 seconds.

**7.7.9** Gloves shall be tested for tactility as specified in Section 8.33, Tactility Test, and shall permit pick up of pins having a diameter of 5 mm (¾ in.) or greater.

**7.7.10** All glove metal hardware and glove hardware that includes metal parts shall be tested for corrosion resistance as specified in Section 8.25, Corrosion Resistance Test.

**7.7.10.1** Metals inherently resistant to corrosion, including, but not limited to, stainless steel, brass, copper, aluminum, and zinc, shall show no more than light surface-type corrosion or oxidation.

**7.7.10.2** Ferrous metals shall show no corrosion of the base metal.

**7.7.10.3** All hardware, unless specifically excluded in the test method, shall remain functional.

**7.7.11** Product labels shall be tested for durability and legibility as specified in Section 8.36, Label Durability and Legibility Test, and shall be legible.

## **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 Section 4 of Federal Test Method Standard 191A, *Textile Test Methods*, or for at least 24 hours, whichever time period is shortest.

**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.

**Table 8.1.3.4 Wash Cycle Procedure for Whole Garments**

Operation	Time (minutes)	Temperature		Water Level
		°C	(°F)	
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			

**8.1.3.5** 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.

**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.

**8.1.5 Isopropanol Immersion Procedure for Gloves.**

**8.1.5.1** Sample gloves shall be totally immersed in 100 percent isopropanol at room temperature for a period of 2 hours.

**8.1.5.2** Sample gloves 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 0.002 kg/cm<sup>2</sup>, ±0.0002 kg/cm<sup>2</sup> (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 then shall be cut from the sample after conditioning.

**8.1.5.4** 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, 32,000 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<sup>2</sup>, ±0.0002 kg/cm<sup>2</sup> (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*.

**8.2 Liquidtight Integrity Test One.**

**8.2.1 Application.**

**8.2.1.1** This test method shall apply to garments.

**8.2.1.2** Sample garments that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures specified in 8.2.3.

**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 40 dynes/cm,  $\pm 2$  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** Sample garments that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.3.3.

**8.3.1.3** Sample face protection devices that are designated as single-use or multiple-use in accordance with 6.3.1 shall be subjected to the sample preparation procedures specified for single- and multiple-use face protection devices in 8.3.3.

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

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

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

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

**8.3.1.8** 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 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.

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.

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

8.4.1.2 Specimen garments and components that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.4.3.

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.

8.4.3.2 Single-use garment 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 Section 11 through Section 15, Breaking Strength, Procedure A — Grab Test Method, of ASTM D 751, *Standard Test Methods for Coated Fabrics*.

### 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.

8.5.1.1 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.

8.5.1.2 Sample garments and components that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.5.3.

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 Section 18 through Section 21, Bursting Strength, of ASTM D 751, *Standard Test Methods for Coated Fabrics*.

8.5.5 **Report.** The burst strength of each specimen shall be recorded and reported to the nearest 7.0 kPa (1 psi). 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.

8.6.1.1 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.

8.6.1.2 Sample garments and components that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.6.3.

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

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

8.6.4 **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.**

##### **8.7.1 Application.**

**8.7.1.1** 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.

**8.7.1.2** Sample garments and components that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.7.3.

##### **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 5598, *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** Single-use garment samples shall be conditioned as specified in 8.1.2.

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

**8.7.4 Procedure.** Specimens shall be tested in accordance with ASTM D 5733, *Standard Test Method for the Tearing of Nonwoven Fabrics by the Trapezoidal 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/Closure Breaking Strength Test.**

##### **8.8.1 Application.**

**8.8.1.1** This test shall be applied to seams and closure assemblies 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 and closure assemblies.

**8.8.1.3** Sample garments and components that are designated as single-use or multiple-use in accordance with 6.1.1 shall be subjected to different sample preparation procedures as specified in 8.8.3.

**8.8.1.4** Modifications to this test method for testing seams shall be as specified in 8.8.7.

**8.8.1.5** Modifications to this test method for testing closure assemblies shall be as specified in 8.8.8.

##### **8.8.2 Specimens.**

**8.8.2.1** A minimum of five seams and five closure assembly specimens representative of the garment shall be tested for each seam and closure assembly type.

**8.8.2.2** Straight-seam specimens and closure assembly specimens shall be cut from conditioned samples.

##### **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 and closure assemblies shall be tested in accordance with Section 71 through Section 76, Seam Strength, of ASTM D 751, *Standard Test Methods for Coated Fabrics*.

##### **8.8.5 Report.**

**8.8.5.1** The breaking strength for each seam or closure assembly 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 or closure assembly 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.

**8.8.7 Specific Procedures for Testing Seams.** Specimens for testing shall include at least 100 mm (4 in.) of material on either side of the seam.

**8.8.8 Specific Procedures for Testing Closure Assemblies.** Specimens for testing shall include at least 100 mm (4 in.) of material on either side of the closure.

#### **8.9 Liquidtight Integrity Test Two.**

##### **8.9.1 Application.**

**8.9.1.1** This test shall be applied to whole gloves and footwear covers.

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

**8.9.1.3** Modifications to this test method for testing footwear covers shall be as specified in 8.9.8.



**8.9.2 Specimens.** 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*. A minimum of 32 specimens shall be tested.

**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 40 dynes/cm,  $\pm 2$  dynes/cm.

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

**8.9.6 Interpretation.** 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*.

**8.9.7 Specific Requirements for Testing Gloves.** Whole gloves shall be tested.

**8.9.8 Specific Requirements for Testing Footwear Covers.**

**8.9.8.1** Whole footwear covers shall be tested.

**8.9.8.2** The footwear cover shall be filled with the surfactant-treated water to a height 25 mm (1 in.) below the top line of the footwear cover.

**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,  $\pm 5$  mm (2 in.,  $\pm 3/16$  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,  $\pm 2.5$  mm (1 in.,  $\pm 3/32$  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,  $\pm 10/-0$  rpm. The flask shall be shaken for a period of 1 hour,  $\pm 5/-0$  minutes.

**8.10.4.2.7** At the end of 1 hour,  $\pm 5/-0$  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 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*.

**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.

**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.

**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 and cleaning 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 6.2.3.2 for emergency medical examination gloves, 6.6.2 for cleaning gloves, and shall be as close as possible to the middle of the range for hand length and hand circumference as specified by the manufacturer for work gloves.

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

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

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

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

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

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

## **8.15 Protein Content Test.**

**8.15.1 Application.** This test shall be applied to glove materials.

### **8.15.2 Specimens.**

**8.15.2.1** Specimens, measuring at least 25 mm (1.0 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 Test.**

**8.16.1 Application.** This test method shall apply to the portion of the face protection device that covers the wearer's eyes.

### **8.16.2 Specimens.**

**8.16.2.1** A minimum of three specimens shall be tested. Specimens shall be complete face protection devices.

**8.16.2.2** 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 face protection devices.

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

### **8.16.4 Procedure.**

**8.16.4.1** Testing shall be conducted using a minimum of three different test subjects.

**8.16.4.2** 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.

**8.16.4.3** Prior to evaluation for visual acuity, the face protection device shall be inspected for functionality and the ability to be donned and adjusted in accordance with the manufacturer's instructions.

**8.16.4.4** To evaluate visual acuity, the face protection device shall be donned and adjusted in accordance with the manufacturer's instructions.

**8.16.4.5** The test shall be conducted using a standard 6.1-m (20-ft) eye chart with a normal lighting range of 100 to 150 foot-candles at the chart and with test subjects positioned at a distance of 6.1 m (20 ft) from the chart.

**8.16.4.6** Test subjects shall then read the standard eye chart through the face protection device and the visual acuity of each subject shall be determined.

**8.16.5 Report.** The visual acuity of each test subject through the face protection device shall be recorded and reported.

**8.16.6 Interpretation.** Failure of any one test subject to achieve the required visual acuity while wearing the face protection device shall constitute failure of the test.

## **8.17 Liquidtight Integrity Test Three.**

**8.17.1 Application.** This test shall apply to face protection devices.

### **8.17.2 Specimens.**

**8.17.2.1** A minimum of five specimens shall be tested.

**8.17.2.2** Specimens shall be complete face protection devices.

### **8.17.3 Sample Preparation.**

**8.17.3.1** Samples for conditioning shall be complete face protection devices.

**8.17.3.2** Samples shall be conditioned as specified in 8.1.2.

**8.17.4 Apparatus.** 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)*.

### 8.17.5 Procedures.

**8.17.5.1** 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 in 8.17.5.1.1 through 8.17.5.1.4.

**8.17.5.1.1** The face protection device shall be positioned on an appropriate holder or headform such that the distance from the tip of pneumatic valve canula to the target area on the face protection device is 305 mm (12 in.).

**8.17.5.1.2** Testing shall be conducted at a blood velocity equivalent to a blood pressure of 21.3 kPa (160 mm Hg).

**8.17.5.1.3** Only five specimens shall be tested.

**8.17.5.1.4** Pass/fail results shall be reported only. An acceptable quality limit shall not be applied in testing.

**8.17.5.2** Specific target areas on each face protection device that shall be evaluated include the following:

- (1) The portions of the face protection device that directly cover the center of each of the wearer's eyes
- (2) Two locations 13 mm (½ in.) from the edge of the protective area provided by the face protection device
- (3) At least one location at every representative seam or junction of the face protection device

**8.17.5.3** 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.

### 8.18 Cut Resistance Test.

#### 8.18.1 Application.

**8.18.1.1** This test method shall apply to work gloves, cleaning gloves, footwear upper materials, and footwear covers.

**8.18.1.2** Modifications to this test method for evaluation of work gloves shall be as specified in 8.18.10.

**8.18.1.3** Modifications to this test method for evaluation of cleaning gloves shall be as specified in 8.18.9.

**8.18.1.4** Modifications to this test method for evaluation of footwear upper materials shall be as specified in 8.18.7.

**8.18.1.5** Modifications to this test method for evaluation of footwear covers shall be as specified in 8.18.8.

**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, footwear uppers, or whole footwear covers.

**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 (0.05 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 Footwear Upper Materials.

**8.18.7.1** 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.

**8.18.7.2** Cut resistance testing shall be performed under a load of 400 grams (14 oz).

### 8.18.8 Specific Requirements for Testing Footwear Covers.

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

**8.18.8.2** Where different materials are used in the construction of the footwear cover, then each material shall be tested separately.

**8.18.8.3** Cut resistance testing shall be performed under a load of 25 grams (1 oz).

### 8.18.9 Specific Requirements for Testing Cleaning Gloves.

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

**8.18.9.2** Cut resistance testing shall be performed under a load of 60 grams (2 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 and the wear surface of footwear covers.

**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 (or footwear cover) specimens failing this test shall constitute failing performance.



## 8.20 Puncture Resistance Test Two.

**8.20.1 Application.** This test method shall apply to footwear soles and the wear surface of footwear covers.

**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 or whole footwear covers.

**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 5 of ANSI Z41, *Standard for Personal Protection — Protective Footwear*.

**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 or footwear cover specimens failing this test shall constitute failing performance.

## 8.21 Flex Fatigue Test.

**8.21.1 Application.** This test shall apply to footwear.

**8.21.2 Sample Preparation.** Samples for conditioning shall be whole footwear.

### 8.21.3 Specimens.

**8.21.3.1** A minimum of three footwear items shall be tested.

**8.21.3.2** Specimens shall be conditioned as specified in 8.1.2.

### 8.21.4 Procedure.

**8.21.4.1** Protective footwear shall be tested in accordance with FIA Standard 1209, *Whole Shoe Flex*.

**8.21.4.2** No water shall be used in this testing.

**8.21.4.3** The test shall consist of 100,000 flexes.

**8.21.4.4** Following the testing, the specimen shall be examined for sole separation.

**8.21.5 Report.** The separation of soles from any specimen shall be reported as failure for the tested specimen.

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

## 8.22 Slip Resistance Test.

**8.22.1 Application.** This test method shall apply to footwear soles and the wear surface of footwear covers.

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

### 8.22.3 Specimens.

**8.22.3.1** A minimum of three complete footwear items or footwear covers shall be tested.

**8.22.3.2** Specimens shall be conditioned as specified in 8.1.2.

**8.22.4 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.

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

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

## 8.23 Eyelet and Stud Post Attachment Test.

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

### 8.23.2 Specimens.

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

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

### 8.23.3 Sample Preparation.

**8.23.3.1** Samples for conditioning shall be whole footwear.

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

### 8.23.4 Apparatus.

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

**8.23.4.2** 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.

### 8.23.5 Procedure.

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

**8.23.5.2** 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.

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

**8.23.5.4** The distance between the clamps and stud hooks or eyelets shall be 2 mm to 3 mm, ±0.5 mm (⅛ in. to ⅜ in., ±¼ in.).

**8.23.5.5** The test shall then be started.

### 8.23.6 Report.

**8.23.6.1** 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.

**8.23.6.2** The average force shall be calculated and reported.

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

## 8.24 Impact and Compression Resistance Test.

**8.24.1 Application.** This test method shall apply to the toe section of the footwear.

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

### 8.24.3 Sample Preparation.

**8.24.3.1** Samples for conditioning shall be complete footwear toes.

**8.24.3.2** Specimens shall be conditioned as specified in 8.1.2.

**8.24.4 Procedure.** Footwear specimens shall be tested in accordance with Section 1.4 of ANSI Z41, *Standard for Personal Protection — Protective Footwear*.

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

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

### 8.25 Corrosion Resistance Test.

**8.25.1 Application.** This test method shall apply to hardware items on footwear, on work gloves, and on face protection devices.

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

**8.25.3 Sample Preparation.** Specimens shall be conditioned as specified in 8.1.2.

#### 8.25.4 Procedure.

**8.25.4.1** Specimens shall be tested in accordance with ASTM 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.

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

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

**8.25.4.4** The functionality of each specimen shall be evaluated.

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

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

### 8.26 Overall Liquid Integrity Test Four.

**8.26.1 Application.** This test shall apply to protective footwear.

#### 8.26.2 Samples.

**8.26.2.1** A minimum of three footwear items shall be tested.

**8.26.2.2** Samples for conditioning shall be whole footwear.

**8.26.3 Specimen Preparation.** Specimens shall be conditioned as specified in 8.1.2.

#### 8.26.4 Procedure.

**8.26.4.1** Protective footwear shall be tested in accordance with FIA Standard 1209, *Whole Shoe Flex*.

**8.26.4.2** The test shall consist of 100,000 flexes.

**8.26.4.3\*** 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 40 dynes/cm,  $\pm 2$  dynes/cm, to the level of 75 percent of the footwear height measured as specified in 6.4.2.1 and 6.4.2.2.

**8.26.4.4** 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 6.4.2.1 and 6.4.2.2.

**8.26.4.5** After 2 hours,  $\pm 10$  minutes, the paper toweling shall be removed and examined for evidence of liquid leakage.

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

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

### 8.27 Chemical Permeation Resistance Test.

**8.27.1 Application.** This test method shall apply to cleaning glove materials.

**8.27.2 Specimens.** A minimum of three 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** 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,  $\pm 2^\circ\text{C}$  (77°F,  $\pm 3^\circ\text{F}$ ) for a test duration of at least 3 hours.

**8.27.4.2** The minimum detectable permeation rate for the permeation test apparatus shall be measured for each chemical tested.

**8.27.4.3** The minimum detectable permeation rate shall be less than or equal to 0.10  $\mu\text{g}/\text{cm}^2/\text{min}$  for all permeation resistance tests.

**8.27.4.4** Where closed loop systems are used, the testing laboratory shall assume 1 hour accumulated permeation.

**8.27.4.5** 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) 3 percent w/w hydrogen peroxide

#### 8.27.5 Report.

**8.27.5.1** 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) Permeation normalized breakthrough detection time (minutes) calculated at a system detectable permeation rate of 0.10  $\mu\text{g}/\text{cm}^2/\text{min}$
- (4) Maximum permeation rate ( $\mu\text{g}/\text{cm}^2/\text{min}$ ) observed
- (5) Minimum detectable rate for test apparatus ( $\mu\text{g}/\text{cm}^2/\text{min}$ )
- (6) Detection method
- (7) Date of test
- (8) Testing laboratory

**8.27.5.2** All four measured normalized breakthrough detection times shall be recorded and reported.

**8.27.5.3** All four observed permeation rates shall be recorded and reported.

**8.27.6 Interpretation.**

**8.27.6.1** The shortest normalized breakthrough detection time shall be used in determining compliance for the particular material/chemical combination.

**8.27.6.2** Any normalized breakthrough detection time less than 60 minutes shall constitute failing performance.

**8.28 Abrasion Resistance Test Two.**

**8.28.1 Application.**

**8.28.1.1** This test shall apply to cleaning glove and emergency medical work glove materials.

**8.28.1.2** Modifications to this test method for testing cleaning glove materials shall be as specified in 8.28.7.

**8.28.1.3** Modifications to this test method for testing emergency medical work glove materials shall be as specified in 8.28.8.

**8.28.2 Specimens.** A minimum of five specimens shall be tested.

**8.28.3 Sample Preparation.** Specimens shall be conditioned as specified in 8.1.2.

**8.28.4 Procedure.**

**8.28.4.1** 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.

**8.28.4.2** At the end of each abrasion exposure, the specimen shall be examined for evidence of wear-through.

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

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

**8.28.7 Specific Requirements for Testing Cleaning Gloves.** Specimens shall be examined after 1000 cycles.

**8.28.8 Specific Requirements for Testing Emergency Medical Work Gloves.** Specimens shall be examined after 2500 cycles.

**8.29 Dexterity Test Two.**

**8.29.1 Application.** This test 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.

**8.29.3 Sample Preparation.**

**8.29.3.1** Samples for conditioning shall be whole glove pairs.

**8.29.3.2** Glove pair specimens shall be preconditioned as specified in 8.1.3.

**8.29.4 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*.

**8.29.5 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*.

**8.29.6 Report.**

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

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

**8.29.7 Interpretation.** The average percent of barehanded control shall be used to determine pass/fail performance.

**8.30 Grip Test.**

**8.30.1 Application.** This test method shall apply to work gloves.

**8.30.2 Specimens.**

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

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

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

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

**8.30.3 Sample Preparation.**

**8.30.3.1** Samples for conditioning shall be whole gloves.

**8.30.3.2** Glove pair specimens shall be preconditioned as specified in 8.1.3.

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

**8.30.3.4** Glove pair specimens shall be tested after being conditioned for wet conditions as specified in 8.1.7.

**8.30.4 Apparatus.** Grip testing shall be evaluated with the use of a 9.5-mm ( $\frac{3}{8}$ -in.) diameter, 3-strand prestretched polyester rope attached to a calibrated force measuring device.

**8.30.5 Procedure.**

**8.30.5.1** 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.

**8.30.5.2** Each test subject shall make three successive attempts to lift as much weight using the halyard as possible, using both hands and keeping both feet firmly planted on the ground. The average weight hoisted over the three trials shall be the barehanded weight lift capability.

**8.30.5.3** Dry-conditioned sample gloves shall be tested on a dry rope and then on a wet rope.

**8.30.5.4** Wet-conditioned sample gloves shall be tested on a dry rope and then on a wet rope.

**8.30.5.5** Each test subject shall be tested with a minimum of three pairs of gloves. Test subjects shall attempt one trial with

each pair of gloves for a minimum of six grip tests for each set of conditions, with at least three grip tests with small sized-gloves and three grip tests with large-sized gloves.

**8.30.5.6** Weight pulling capacity with gloves shall be compared with barehanded weight lift capability. The percentage of weight pulling capacity with gloves to barehanded weight lift capability shall be calculated as follows:

$$\text{Percent of barehanded control} = \frac{\text{Weight pulling capacity (with gloves)}}{\text{Barehanded weight lift capability}} \times 100$$

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

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

### **8.31 Liner Retention Test.**

**8.31.1 Application.** This test 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** Samples for conditioning shall be whole gloves.

**8.31.3.2** Specimens to be tested shall be conditioned as specified in 8.1.3.

#### **8.31.4 Procedure.**

**8.31.4.1** 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.

**8.31.4.2** 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.

**8.31.4.3** 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.

**8.31.4.4** The baseline donning time shall be the average of the first three donning times as determined in 8.31.4.2. The baseline donning time shall not exceed 10 seconds. The doffing time between donnings shall not exceed 10 seconds.

**8.31.4.5** Glove pair specimens shall then be conditioned as specified in 8.1.3.

**8.31.4.6** 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 8.31.4.4. No preparation of the gloves shall be done.

#### **8.31.5 Report.**

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

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

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

### **8.32 Overall Liquid Integrity Test Three.**

**8.32.1 Application.** This test method shall apply to work gloves.

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

#### **8.32.3 Sample Preparation.**

**8.32.3.1** Specimens shall be tested after being subjected to the procedure specified in 8.1.3.

**8.32.3.2** Specimens to be tested shall be conditioned as specified in 8.1.2.

#### **8.32.4 Apparatus.**

**8.32.4.1** 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.

**8.32.4.2\*** Water used for integrity testing shall be treated with a nonfoaming surfactant to achieve a surface tension of 40 dynes,  $\pm 2$  dynes.

#### **8.32.5 Procedure.**

**8.32.5.1** 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.

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

**8.32.5.3** 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,  $\pm 3^\circ\text{C}$  (68°F,  $\pm 5^\circ\text{F}$ ) water. The test subject shall flex the glove specimen in a fist clenching motion every 10 seconds.

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

**8.32.6 Report.** The appearance of water marks on the inner glove after testing any of the three gloves shall be recorded and reported.

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

### **8.33 Tactility Test.**

**8.33.1 Application.** This test shall apply to emergency medical work gloves.

#### **8.33.2 Specimens.**

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

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

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



### 8.33.3 Sample Preparation.

**8.33.3.1** Samples for conditioning shall be whole glove pairs.

**8.33.3.2** Glove pair specimens shall be preconditioned as specified in 8.1.3.

### 8.33.4 Procedures.

**8.33.4.1** A separate test subject shall be used for each pair of gloves to be evaluated.

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

**8.33.4.3** 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,  $\pm 10$  mm (2 in.,  $\pm 0.4$  in.), shall be used.

**8.33.4.4** With each of the metal pins lying on a flat, smooth surface at a spacing of 100 mm,  $\pm 20$  mm (4 in.,  $\pm 0.8$  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.

### 8.33.5 Report.

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

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

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

### 8.34 Water Repellency Test.

**8.34.1 Application.** This test shall apply to garment outer shell materials.

### 8.34.2 Sample Preparation.

**8.34.2.1** Samples for conditioning shall be the entire garment.

**8.34.2.2** Samples for single-use garments shall be conditioned as specified in 8.1.2.

**8.34.2.3** Samples for multiple-use garments shall be conditioned as specified in 8.1.3 and then conditioned as specified in 8.1.2.

### 8.34.3 Specimens.

**8.34.3.1** A minimum of three specimens shall be tested.

**8.34.3.2** Specimens shall consist of three 175-mm (7-in.) squares of the outermost separable layer of the garment composite.

### 8.34.4 Procedure.

**8.34.4.1** Liquid penetration resistance testing shall be conducted in accordance with AATCC 22, *Water Repellency: Spray Test*.

**8.34.4.2** The normal outer surface of the material shall be exposed to the water as oriented in the clothing item.

**8.34.5 Report.** The spray rating for each specimen shall be recorded and reported.

**8.34.6 Interpretation.** The lowest spray rating for the material shall be used to determine pass/fail performance.

### 8.35 Total Heat Loss Test.

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

### 8.35.2 Specimens.

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

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

### 8.35.3 Sample Preparation.

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

**8.35.3.2** Specimens to be tested shall be conditioned as specified in 8.1.2.

**8.35.4 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*.

**8.35.5 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*.

### 8.35.6 Report.

**8.35.6.1** The average intrinsic thermal resistance ( $R_{cl}$ ) of the sample shall be recorded and reported.

**8.35.6.2** The average apparent intrinsic evaporative resistance ( $AR_{cl}$ ) of the sample shall be recorded and reported.

**8.35.6.3** The average total heat loss ( $Q_t$ ) of the sample shall be calculated and reported.

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

### 8.36 Label Durability and Legibility Test.

#### 8.36.1 Application.

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

**8.36.1.2** Modifications to this test method for testing multiple-use garment labels shall be as specified in 8.36.6.

**8.36.1.3** Modifications to this test method for testing footwear and work glove labels shall be as specified in 8.36.6.

#### 8.36.2 Specimens.

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

**8.36.2.2** If labels have areas of “write-in” information, the specimens shall include those areas with the sample information written in.

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

**8.36.4 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.

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

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

**8.36.7 Specific Requirements for Testing Multiple-Use Garment Labels.**

**8.36.7.1** Samples for conditioning shall be complete garments.

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

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

**8.36.8 Specific Requirements for Testing Footwear and Work Glove Labels.**

**8.36.8.1** Samples for conditioning shall be individual labels.

**8.36.8.2** Individual labels only shall be conditioned as specified in 8.1.7.

## Annex A Explanatory Material

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

**A.1.1.1** This standard only addresses emergency medical products and the design, performance, testing, and certification of specific products. The use criteria for emergency medical protective clothing are covered in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, and NFPA 1581, *Standard on Fire Department Infection Control Program*.

**A.1.1.2** Organizations responsible for fire-fighting operations, chemical response functions, and other hazard protection, including radiological, cryogenic, or hazardous chemical, should use protective clothing and equipment specifically designed for those activities. Criteria for protection from hazardous materials are provided in the following standards:

- (1) NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*
- (2) NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*

**A.1.1.3** Biological agents can also be transmitted via aerosols. Organizations responsible for biological hazard protection should use protective clothing and equipment specifically designed for those activities. Criteria for protection from airborne and liquid-borne biological hazards are provided in NFPA 1994, *Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents*.

**A.1.2.1** The federal OSHA standard, 29 CFR 1910.1030 (c)(3)(i), defines personal protective equipment as appropriate “only if it does not permit blood or other potentially infectious materials to pass through or reach the employee’s work

clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used.” NFPA 1999 has established the minimum performance standard for personal protective equipment for use during emergency medical operations.

The choice of which items of personal protective clothing to use will be based on an assessment of the risk of exposure at the emergency scene. Various conditions that exist at the scene of an emergency are uniquely different from those of a hospital-based practice. Such conditions are characterized by the uncontrolled environment of an emergency scene.

**A.3.2.1 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

**A.3.2.2 Authority Having Jurisdiction (AHJ).** The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**A.3.2.4 Listed.** The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

**A.3.3** Where terms are not defined in Section 3.3, General Definitions, those terms have the ordinarily accepted meanings or the meaning that the text implies.

For the purposes of this standard, the terms defined in Section 3.3, General Definitions, have the meanings stated unless modified by specific text within the mandatory requirements of this standard.

Terms used in the present tense include the past and future tense, terms used in the masculine gender include the feminine and neuter genders, terms used in the singular include the plural, and terms used in the plural include the singular.

**A.3.3.9 Cleaning Glove.** Cleaning gloves are *not* emergency medical examination gloves or emergency medical work gloves. Cleaning gloves are not intended and should not be

used for emergency patient care or hand protection during any functions at emergency medical operations.

**A.3.3.17 Emergency Medical Garment.** Emergency medical garments include, but are not limited to, full body clothing such as suits, coveralls, and patient/victim isolation bags; and non-full body clothing such as aprons and sleeve protectors.

**A.3.3.44 Single-Use Item.** What constitutes a “use” will be defined by the product manufacturer. A single use could include unpackaging, or one donning, or one wearing while responding. In the absence of any manufacturer’s specific information, one “use” should be considered any wearing of the item. Inspection of any item should be conducted in accordance with the manufacturer’s instructions and should assess the overall condition and suitability of an item for a specified use.

**A.4.1.7** From time to time the NFPA has received complaints that certain items of fire and emergency services protective clothing or protective equipment could be carrying labels falsely identifying them as compliant with an NFPA standard. The requirement for placing the certification organization’s mark on or next to the product label is to help ensure that the purchaser can readily determine compliance of the respective product through independent third-party certification.

NFPA advises those purchasing emergency medical protective clothing to be aware that for emergency medical protective clothing items to meet the requirements of NFPA 1999, *Standard on Protective Clothing for Emergency Medical Operations*, they must be certified by an independent third-party certification organization. *In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.*

**An emergency medical protective clothing item that does not bear the mark of an independent third-party certification organization is NOT COMPLIANT with NFPA 1999, even if the product label states that the item is compliant!**

For further information about certification and product labeling, Chapter 4 and Chapter 5 of NFPA 1999 should be referenced. Also, the definitions for “certification/certified,” “labeled,” and “listed” in Chapter 3 should be reviewed.

Third-party certification is an important means of ensuring the quality of fire and emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, the NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers should also contact the certification organizations and request copies of the certification organization’s “list” of certified products to the appropriate NFPA standard. This “listing” is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization and, as with NFPA 1999 emergency medical protective clothing items, all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

**Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is NOT COMPLIANT with the appropriate NFPA standard, even if the product label states that the item is compliant!**

**A.4.2.1** The certification organization should have sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

**A.4.2.5** The contractual provisions covering a certification program should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products.

Without the clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

**A.4.2.7.1** Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

**A.4.2.9** Such inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it could be desirable to purchase samples in the open market for test purposes.

**A.4.6.1** ISO 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, is a component of accreditation of certification organizations specified in 4.1.3 and 4.2.3. Those paragraphs contain mandatory reference to ISO 65, *General requirements for bodies operating product certification systems*, in which ISO 27 is referenced.

**A.4.6.2** By definition, a hazard could involve a condition that can be imminently dangerous to the end user. With this thought in mind, the investigation should be started immediately and completed in as timely a manner as is appropriate considering the particulars of the hazard being investigated.

**A.4.6.11** The determination of the appropriate corrective action for the certification organization to initiate should take into consideration the severity of the product hazard and its potential consequences to the safety and health of end users. The scope of testing and evaluation should consider, among other things, testing to the requirements of the standard to which the product was listed as compliant; the age, type of use, and conditions to which the compliant product has been exposed; care and maintenance that has been provided; the use of expertise on technical matters outside the certification organization’s area of competence; and product hazards caused by circumstances not anticipated by the requirements of the applicable standard. As a guideline for determining between a safety alert and a product recall, the following product hazard characteristics are provided. These characteristics are based on 42 CFR 84, Subpart E, §84.41:

(1) *Critical.* A product hazard that judgment and experience indicate is likely to result in a condition immediately hazardous to life or health (IHLH) for individuals using or depending on the compliant product.

If an IHLH condition occurs, the user will sustain, or will be *likely* to sustain, an injury of a severity that could result in loss of life, or resultant significant bodily injury or loss of bodily function, either immediately or at some point in the future.



- (2) *Major A*. A product hazard, other than *Critical*, that is likely to result in failure to the degree that the compliant product does not provide any protection or reduces protection, and is not detectable to the user.

The term *reduces protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is *likely* to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.

- (3) *Major B*. A product hazard, other than *Critical* or *Major A*, that is likely to result in reduced protection, and is detectable to the user.

The term *reduces protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is *likely* to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.

- (4) *Minor*. A product hazard, other than *Critical*, *Major A*, or *Major B*, that is not likely to materially reduce the usability of the compliant product for its intended purpose, or a product hazard that is a departure from the established applicable standard and has little bearing on the effective use or operation of the compliant product for its intended purpose.

Where the facts are conclusive, based on characteristics of the hazard classified as indicated in A.4.6.11 (1)–(4), the certification organization should consider initiating the following corrective actions with the authorized and responsible parties:

- (1) *Critical* product hazard characteristics: product recall.
- (2) *Major A* product hazard characteristics: product recall or safety alert, depending on the nature of the specific product hazard.
- (3) *Major B* product hazard characteristics: safety alert or no action, depending on the nature of the specific product hazard.
- (4) *Minor* product hazard characteristic: no action.

**A.4.6.13** Reports, proposals, and proposed TIAs should be addressed to the technical committee that is responsible for the applicable standard, in care of Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02269-9101.

**A.5.1.3.1** Purchasers should use the technical data package to compare garment performance data when purchasing emergency medical garments. The purchaser should determine the relative ranking of performance data to aid this selection process.

**A.5.2.1** It is preferred that every compliant emergency medical examination glove be labeled individually. This might not be practical for single-use emergency medical examination gloves.

**A.6.1.4** The requirement in 6.1.4 is to ensure that an entire garment will provide biopenetration protection for the wearer. In the past, certain parts of a garment, such as the front or the sleeves from wrist to elbows but not above the elbow, were permitted to provide the biopenetration protection, but the purchaser/wearer might not have been aware that the biopenetration protection was only partial.

**A.6.1.5** The requirement in 6.1.5 is not intended to preclude the garment designer/manufacturer from attaching the barrier layer to other garment materials via hemming and binding means in an emergency medical garment.

It is intended that the barrier layer be composed of a single, nonseparable laminate or coated material. It is intended not to allow more than one garment material layer to be designated as and tested as the barrier layer.

The requirement in 6.1.5 is also intended to permit evaluation of the barrier layer's biopenetration resistance.

**A.6.1.6** The design requirement prevents fittings being used in the construction of garments that could potentially snag or tear protective materials.

**A.6.2.1** NFPA 1581, *Standard on Fire Department Infection Control Program*, requires single-use emergency medical examination gloves for emergency medical operations.

**A.6.2.2** The requirement in 6.2.2 for registration provides further benefit to emergency medical personnel. The requirement that emergency medical examination gloves be registered as Class 2 medical devices should not be construed as an interpretation of U.S. Food and Drug Administration (FDA) requirements in 21 CFR 880, *Medical Devices; Patient Examination Glove; Revocation of Exemptions from the Premarket Notification Procedures and the Current Good Manufacturing Practice Regulations; Final Rule*. While FDA registration is not a certification of the product, it is a process by which the manufacturer must provide substantiation for any and all claims made regarding the performance of the product (e.g., viral barrier performance, material biocompatibility, levels of quality assurance, and sterility) in product packaging and marketing literature. The FDA either affirms or denies these claims. If claims are affirmed, the manufacturer is permitted to market their product in the United States. Therefore, the requirement helps to ensure that the fire service and emergency medical personnel are provided with accurate information about the products they purchase.

**A.6.3.4** The design requirement prevents hardware that could potentially snag or tear protective materials from being used on face protection devices.

**A.6.7.4.2** The values contained in the five tables are bare-hand dimensions, not glove pattern dimensions. Guidelines for applying these dimensions to flat glove patterns vary, depending on such factors as the type of pattern being used, the number of layers in the glove, and the type of fit desired for the glove.

The values contained in the five tables are those that apply to the five-size system intended to fit a population defined as the 5th percentile (female) through the 95th percentile (male) in the U.S. Army. These values are not valid if other than a five-size system is being used or if the demographics of the intended population vary.

Caution should be used in determining the specific value to be used in glove patterning from the given range of values for a particular dimension and glove size. The choice of the lowest, middle, or highest value is related to expectations of how the glove will fit.

**A.8.2.4.1** A 0.04-weight-percent solution of Surfynol 104H, or equivalent, with water gives a surface tension of 40 dynes/cm.

**A.8.2.5.2** Holding the mannequin's feet down on a heavy, flat metal plate with two upright threaded posts, a large slotted metal bar, and heavy-duty metal bolts is the preferred means for mounting the mannequin in the spray chamber to prevent any effects of the mannequin mounting on the garment specimen.