

NFPA®

2112

Standard on
Flame-Resistant Clothing for
Protection of Industrial Personnel
Against Short-Duration Thermal
Exposures from Fire

2023



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NFPA® 2112

Standard on

Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

2023 Edition

This edition of NFPA 2112, *Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire*, was prepared by the Technical Committee on Flash Fire Protective Garments. It was issued by the Standards Council on June 16, 2022, with an effective date of July 6, 2022, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See “Codes & Standards” at www.nfpa.org for more information.

This edition of NFPA 2112 was approved as an American National Standard on July 6, 2022.

Origin and Development of NFPA 2112

The NFPA Standards Council established the Technical Committee on Flash Fire Protective Garments in 1998. Between February and August of 1999, the technical committee developed two draft standards: NFPA 2112 and NFPA 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire*, which were then released for public proposals and comments. NFPA 2112 specifies the minimum design, performance, certification requirements, and test methods for flame-resistant garments for use in areas at risk from flash fires. The first editions of NFPA 2112 and NFPA 2113 were approved by the NFPA membership at the May 2001 NFPA World Fire Safety Congress and were issued by the Standards Council in July 2001.

The 2007 edition revised the scope to clarify that the standard applies to the performance of fabrics and components of garments and not the garment itself. The scope was also modified to indicate that NFPA 2112 does not apply to single-use or limited-use garments. The committee pursued the development of separate documents to address the design, testing, certification, selection, and use of those garments. This revision also incorporated updates to reference test methods and the method for calculating total heat flux.

The 2012 edition updated the term *thermal protective performance* to *heat transfer performance* and incorporated ASTM F2700, *Standard Test Method for Unsteady-State Heat Transfer Evaluation of Flame Resistant Materials for Clothing with Continuous Heating*, as the test method. The test method previously shown in the standard was removed, because it duplicated the ASTM F2700 method. A definition for *cold weather insulation material* and testing requirements were added to ensure that garments incorporating such insulation material are properly tested and certified. The 2012 edition clarified certain aspects of the laundering requirements to prevent the presence of residual detergent during testing.

For the 2018 edition, the technical committee refined the term *flash fire* to *short duration thermal exposure from fire*, which is a more descriptive term for the hazard that the standards address. Revisions were made to change the terms. The term *inherent flame resistance* also was added to the standard from NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*.

New garments were added to the standard, including shrouds/hoods/balaclavas as one item, and gloves. Shrouds/hoods/balaclavas were defined to cover those items intended to protect the head and/or neck. Gloves were defined as garments designed to protect the hands and wrist. The technical committee decided to include only performance and construction requirements for these garments without an ASTM F1930, *Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin*, style test. These requirements

include, but are not limited to, construction, thermal shrinkage, heat transfer protective performance, flame resistance, thread, hardware, and interlinings.

TIA 12-2 was issued to address cold weather insulation and interlining for the 2012 edition. Prior to the issuance of the TIA, testing for afterflame, fire resistance, and thermal shrinkage had been performed on materials in a configuration not representative of that seen in application. Typically, these materials serve as internal insulation when used in garments in the field, and therefore not directly exposed to fire. However, during testing, the materials had been directly exposed to fire, which resulted in restricted use of cold weather gear without adding additional safety to the garments.

The TIA incorporated modifications to the testing requirements for cold weather and interlining materials for the 2012 edition to allow the use of these materials in NFPA 2112 gear. For the 2018 edition, the technical committee incorporated these allowances for the performance and testing requirements.

New requirements were added for emblems that are represented as flame resistant. Separate testing requirements were added to confirm that the fire-resistant emblems provide the desired performance. Reflective striping also now needs to be tested for flame resistance.

Finally, due to a concern about variability in the ASTM F1930 testing standard, the technical committee added two requirements to the testing apparatus to address variability. First, the lab must verify the response from the sensors to a heat flux before being mounted on the manikin. Second, the TC has added a requirement for two standard reference garments which are constructed of known materials with known results. Before a lab can certify results for the manikin test, the lab must test the reference garments and attain results within a predisposed range.

For the 2023 edition, the technical committee has added a new definition and requirements for venting material. Certification requirements have been added to the standard to properly document testing laboratories where fabric components are tested. Additionally, new annual recertification requirements have been added for samples of products compliant with this standard.

Test methods have been updated by the committee to include specific requirements for testing specimens from whole knitted gloves, as well as new requirements on the standard garment design and updated procedures for the manikin test.

TIA 18-1 was issued for the 2018 edition to address the COVID-19 pandemic and the need for industrial workers to wear cloth face coverings in the performance of their duties as dictated by federal, state, or local authorities. The inclusion of flame-resistant cloth face coverings was intended to aid in worker safety under the circumstances of the global pandemic in the personal protection against airborne pathogens. For the 2023 edition, the technical committee has incorporated these updates but changed the term “cloth face covering” to “barrier face covering” to align with the definition provided in ASTM F3502.

New requirements also have been added to ensure barrier face coverings are certified, labeled, and listed in the same manner as other clothing items covered in the standard.

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

Committee Scope: This Committee shall have primary responsibility for documents on the manufacture, selection, care, and use of garments and equipment used for protection of industrial personnel where there is potential for flash fire. Industrial personnel include workers who are potentially or may accidentally be exposed to hydrocarbon or combustible dust flash fires, and not electrical flashes. These documents do not cover firefighters and other emergency services personnel.



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NFPA 2112

Standard on

Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

2023 Edition

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

Chapter 1 Administration

1.1 Scope. The standard shall specify the minimum design, performance, testing, and certification requirements and test methods for flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings for use in areas at risk from short-duration thermal exposure from fire.

1.2 Purpose.

1.2.1* This standard shall provide minimum requirements for the design, construction, evaluation, and certification of flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings for use by industrial personnel, with the

intent of not contributing to the burn injury of the wearer, providing a degree of protection to the wearer, and reducing the severity of burn injuries resulting during egress from or accidental exposure to short-duration thermal exposure from fire.

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

1.2.3* This standard shall not be intended to be utilized as a detailed manufacturing or purchasing specification but shall be intended 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 flame-resistant garments, shrouds/hoods/balaclavas, and gloves and the design and manufacturing of new barrier face coverings.

1.3.2* This standard shall not apply to protective clothing for wildland firefighting, technical rescue, structural firefighting, proximity firefighting, or any other firefighting operations or hazardous materials emergencies. This standard shall not apply to single-use or limited-use garments. This standard shall not apply to protection from electrical flashes, radiological agents, biological agents, or hazardous materials.

1.3.3 Certification of flame-resistant garments to the requirements, shrouds/hoods/balaclavas, or gloves of this standard shall not preclude certification to additional appropriate standards where the garment, shrouds/hoods/balaclavas, or gloves meet all the applicable requirements of each standard.

1.3.4 The requirements of this standard shall not apply to accessories that might be attached to flame-resistant garments, shrouds/hoods/balaclavas, gloves, or barrier face coverings unless specifically addressed herein.

1.3.5 The minimum requirements identified in this standard are not intended to meet all the protection needs of a user in areas at risk from short-duration thermal exposure from fire. Users shall refer to NFPA 2113 for conducting the appropriate hazard assessment to identify the in-use area’s minimum protection requirements.

1.4 Retroactivity. This standard shall apply only to garments, shrouds/hoods/balaclavas, gloves, or barrier face coverings manufactured on or after the effective date of the standard.

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

1.6 Units. 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. 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, Quincy, MA 02169-7471.

NFPA 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire*, 2020 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 TM158, *Dimensional Changes on Drycleaning, in Perchloroethylene: Machine*, 2016.

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

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2016.

ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin*, 2018.

ASTM F2700, *Standard Test Method for Unsteady-State Heat Transfer Evaluation of Flame-Resistant Materials for Clothing with Continuous Heating*, 2008, reapproved 2020.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing, and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, 2019.

ASTM F3502, *Standard Specification for Barrier Face Coverings*, 2021.

2.3.3 ISO Publications. International Organization for Standardization, ISO Central Secretariat, BIBC II Chemin de Blandinnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

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

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

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

2.3.4 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 270, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber*, 2018 edition.

NFPA 921, *Guide for Fire and Explosion Investigations*, 2021 edition.

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

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Fire Fighting*, 2022 edition.

NFPA 1983, *Standard on Life Safety Rope and Equipment for Emergency Services*, 2017 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

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

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

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

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

3.3 General Definitions.

3.3.1 Accreditation/Accredited. A system whereby a certification organization determines that a laboratory has demonstrated the ability to conduct tests in an accurate and precise manner consistent with the requirements of this standard, accepts the laboratory's test data, and continues to monitor laboratory practices to ensure accurate and precise testing consistent with the requirements of this standard.

3.3.2 Agents.

3.3.2.1 Biological Agents. Biological materials that are capable of causing an acute disease or long-term damage to the human body. [1991, 2016]

3.3.2.2 Radiological Agents. Radiation associated with x-rays, alpha, beta, and gamma emissions from radioactive isotopes, or other materials in excess of normal background radiation levels.

3.3.3* Barrier Face Covering. A product worn on the face, specifically covering at least the wearer's nose and mouth, with the primary purpose of providing source control and a degree of particulate filtration to reduce the amount of inhaled particulate matter.

3.3.4 Body.

3.3.4.1 Lower Body. The area of the body below the waist including the legs but excluding the ankles and feet.

3.3.4.2 Upper Body. The area of body above the waist and extending to the shoulders, including the arms and wrists but excluding the hands.

3.3.5 Breakopen. When testing thermal protective materials, a material's response during thermal exposure evidenced by the formation of a hole through the test specimen that can result in passage of heat and/or flame.

3.3.6 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 methods the manufacturer uses to determine continued compliance with the requirements of this standard. [1971, 2018]

3.3.7 Certification Organization. An independent, third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program. [1971, 2018]

3.3.8* Cold Weather Insulation Material. Fabric that consists of one or more nonseparable layers that is used for protection in a low-temperature environment.

3.3.9 Compliance/Compliant. Meeting or exceeding all applicable requirements of this standard. [1971, 2018]

3.3.10 Component(s). Any material, part, or subassembly used in the construction of the compliant product. [1971, 2018]

3.3.11 Drip. A flow of liquid that lacks sufficient quantity or pressure to form a continuous stream and runs or falls in drops.

3.3.12* Emblem(s). Shields, heraldry, or printing that designates a governmental entity or a specific organization; rank, title, position, or other professional status that is painted, screened, embroidered, sewn, glued, bonded, or otherwise attached in a permanent manner.

3.3.13* Fabric. The one or more layers of textile material(s) used in the primary construction of protective garments.

3.3.13.1 Textile Fabric. A planar structure consisting of yarns or fibers. [1977, 2022]

3.3.14* Fire. A rapid oxidation process, which is an exothermic chemical reaction, resulting in the evolution of light and heat in varying intensities. [921, 2021]

3.3.15* Flame Resistance. The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or nonflaming source of ignition, with or without subsequent removal of the ignition source. Flame resistance can be an inherent property of a material, or it can be imparted by specific treatment. [1971, 2018] (See 3.3.15.1, *Inherent Flame Resistance*.)

3.3.15.1 Inherent Flame Resistance. Flame resistance that is derived from the essential characteristic of the fiber or polymer. [1971, 2018]

3.3.16 Flash Fire. A type of short-duration fire that spreads by means of a flame front rapidly through a diffuse fuel, such as dust, gas, or the vapors of an ignitable liquid, without the production of damaging pressure.

3.3.17 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. [1977, 2022]

3.3.18 Functional. The ability of an item to continue to be utilized for its intended purpose.

3.3.19 Garments. Clothing including, but not limited to, coveralls, trousers, shirts, and outerwear.

3.3.19.1 Limited-Use Garment. A garment whose service life is limited by the manufacturer to a specified number of wear cycles and does not meet the testing requirements of this standard.

3.3.19.2* Single-Use Garment. A garment that is designed to be used one time and then disposed of.

3.3.20 Glove. An item designed to provide protection to the wearer's hand and wrist.

3.3.21 Hardware. Nonfabric components of the protective garment including, but not limited to, those made of metal or plastic.

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

3.3.23 Hazardous Materials Emergencies. Incidents involving the release or potential release of hazardous materials. [1971, 2018]

3.3.24 Industrial Personnel. Workers who might be at risk of burn injuries resulting during egress from or accidental exposure to short-duration thermal exposure from fire.

3.3.25* Interlining. Any textile that is incorporated into any garment as a layer between outer and inner layers that covers only a small portion of the overall garment.

3.3.26 Lining. Any material that is attached and used to cover or partially cover the inside surface of a flame-resistant garment.

3.3.27 Melt. A response to heat by a material resulting in evidence of flowing or dripping. [1983, 2017]

3.3.28 Model. The collective term used to identify a group of 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. [1971, 2018]

3.3.29* Product. The compliant flame-resistant garment, shrouds/hoods/balaclavas, or gloves.

3.3.30* Product Label. A label or marking affixed to a product by the manufacturer containing compliant statements, certification statements, manufacturer or model information, or similar dates. [1971, 2018]

3.3.31 Reflective Striping. Material added to the exterior of the garment to enhance nighttime or daytime visibility.

3.3.32 Reinforcement. An additional layer of a textile material applied to a specific area of the protective garment to make that portion of the protective garment more resistant to wear.

3.3.33 Sample. An amount of the material, product, or assembly to be tested that is representative of the item as a whole. [270, 2018]

3.3.34 Seam. Any permanent attachment of two or more protective garment fabrics in a line formed by joining the separate material pieces.

3.3.34.1 Sewn Seam. A series of stitches joining two or more separate plies of material(s) of planar structure, such as textiles.

3.3.35 Separate. A material response evidenced by splitting or delaminating. [1971, 2018]

3.3.36* Short-Duration Thermal Exposure from Fire. A period of egress from or accidental exposure to thermal events, including but not limited to, vapor cloud fires, jet flames, liquid fires (pool fires or running liquid fires), solids fires (fires of solid materials or dust fires), or warehouse fires.

3.3.37* Shroud/Hood/Balaclava. An item of clothing designed to provide protection to the wearer's head or neck, or both, less the face opening.

3.3.38 Specimen. The item that undergoes testing; in some cases, the specimen is also the sample. [1971, 2018]

3.3.39 Transfer Film. A type of emblem characterized as a thin nontextile polymeric material thermally bonded to the exterior surface of a garment, excluding reflective striping.

3.3.40 Trouser. A garment that is designed to provide minimum protection to the lower torso and legs, excluding the ankles and feet.

3.3.41 Venting Material. A fabric material used in a flame-resistant garment to aid in the transfer of air through the garment for the primary purpose of increasing the wearer's comfort.

Chapter 4 Certification

4.1 General.

4.1.1 All flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

4.1.2 All test data used to determine compliance of flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings with this standard shall be provided by an accredited testing laboratory.

4.1.3 All flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings shall be labeled and listed.

4.1.3.1 Fabric components that are tested in accordance with Section 8.5 shall be listed.

4.1.3.2* The location of the testing laboratory where testing of fabric components is conducted shall be included in the listing, including, at a minimum, the following information:

- (1) Accredited laboratory name, identification, or designation
- (2) Accredited laboratory address

4.1.4 All flame-resistant garments, shrouds/hoods/balaclavas, gloves, and barrier face coverings shall have a product label that meets the requirements of Section 5.1.

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

4.1.6 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 in any statements about their respective product(s) unless the product(s) is certified as compliant to this standard.

4.1.7 The certification organization shall not certify any flame-resistant garments, shrouds/hoods/balaclavas, or gloves to the 2018 edition of this standard on or after the issue date of this standard.

4.1.8 The certification organization shall not permit any manufacturer to label any flame-resistant garments, shrouds/hoods/balaclavas, or gloves as compliant with the 2018 edition of this standard on or after the issue date of this standard, plus 18 months.

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

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 There shall be no 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 manufactured in compliance with all applicable requirements of this standard.

4.2.6 The certification organization shall have a program to accredit laboratories to perform the tests required by this standard.

4.2.6.1 The accredited laboratory shall conduct the required tests and maintain documentation of test results.

4.2.6.2 The accredited laboratory shall have laboratory facilities and equipment available for conducting required tests.

4.2.7 A program for calibration of all instruments shall be in place and operating procedures shall be in use to ensure proper control of all testing.

4.2.8 In the absence of an accredited laboratory, the certification organization shall be permitted to have its own laboratory facilities and equipment available for conducting required tests.

4.2.9* The certification organization shall require the manufacturer to establish and maintain a program of production inspection and testing that meets the requirements of Section 4.4.

4.2.9.1 The certification organization shall ensure that the audit assurance program provides continued product compliance with this standard.

4.2.9.2 The certification organization shall permit the manufacturer to be registered to ISO 9001, *Quality management systems — Requirements*, in lieu of meeting the requirements of Section 4.4.

4.2.10 The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the certified product to determine its continued certification to this standard.

4.2.11* The certification organization shall have a follow-up inspection program of the manufacturing facilities of the certified product, with a minimum of one visit per 12-month period.

4.2.12 As part of the follow-up inspection program, the certification organization shall review the manufacturer's records and sample product to ensure the following:

(1) Garments, shrouds/hoods/balaclavas, and gloves conform to the requirements of this standard.

- (2) The manufacturer has documentation that the fabric and components used in the garment, shroud/hood/balaclava, and glove were tested by an accredited laboratory and comply with this standard.
- (3) A manufacturing quality assurance plan meeting the requirements of this standard is in place.

4.2.13 The certification organization shall also have a follow-up inspection program of the accredited testing laboratory(ies).

4.2.13.1 The certification organization shall conduct a minimum of one visit per 12-month period.

4.2.13.2 The certification organization shall review the accredited laboratory's records and facilities to ensure required documentation is maintained and to ensure conformance with testing requirements.

4.2.14 The certification organization shall have a program for investigating field reports alleging malperformance or failure of listed products.

4.2.15* The certification organization shall require the manufacturer to have a product recall system as part of the manufacturer's quality assurance program.

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

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

4.3 Inspection and Testing.

4.3.1 For the certification of flame-resistant garments, shrouds/hoods/balaclavas, and gloves, the certification organization shall conduct inspections of the manufacturing facility and the accredited laboratory, as specified in 4.3.2 through 4.3.9.

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 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 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 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 as specified for the specific item in Section 5.1.

4.3.5 Inspection by the certification organization shall include a review of any graphic representations used on product labels, as permitted in 5.1.6 to ensure that the systems are consistent

with the worded statements, are readily understood, and clearly communicate the intended message.

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

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

4.3.8 Testing conducted by the accredited laboratory in accordance with the testing requirements of Chapter 8, for determining product compliance with the applicable requirements specified in Chapter 7, shall be performed on samples representative of materials and components used in the actual construction of the flame-resistant garment, shroud/hood/balaclava, and glove or sample materials cut from a representative product.

4.3.9 Recertification.

4.3.9.1 Any change in the design, construction, or material of a compliant product shall require new inspection and testing to verify compliance with all applicable requirements of this standard that the certification organization determines can be affected by such change.

4.3.9.1.1 Recertification shall be conducted before labeling the modified products as being compliant with this standard.

4.3.9.2 Samples of products compliant to this standard shall undergo recertification on an annual basis that includes the following:

- (1) Inspection and evaluation to all design requirements as required by this standard on all manufacturer models and components
- (2) Testing to all performance requirements as required by this standard on all manufacturer models and components with the following protocol:
 - (a) Where a test method incorporates testing both before and after laundering conditioning as specified in 8.1.3 and the test generates quantitative results, recertification testing shall be limited to the conditioning that yielded the worst-case test result during the initial certification for the model or component.
 - (b) Where a test method incorporates testing both before and after laundering conditioning as specified in 8.1.3 and the test generates nonquantitative results (e.g., pass/fail for melt or drip), recertification shall be limited to a single conditioning procedure in any given year and subsequent annual recertification testing shall cycle through the remaining conditioning procedures to ensure all required conditionings are included over time.
 - (c) Where a test method requires the testing of three specimens, a minimum of one specimen shall be tested.
 - (d) Where a test method requires the testing of more than three specimens, a minimum of two specimens shall be tested.
 - (e) Manikin testing as specified in 7.1.5 shall be performed on a minimum of one specimen within a 5-year period.

4.3.10 Product Modifications.

4.3.10.1 The certification organization shall not permit 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 accredited laboratory.

4.3.10.2 The accredited laboratory 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.

4.3.10.3 The accredited laboratory shall not permit the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

4.4 Manufacturer's Quality Assurance Program.

4.4.1 General.

4.4.1.1 The manufacturer shall provide and maintain a quality assurance program that includes a documented inspection and product recall system.

4.4.1.2 The manufacturer shall have an inspection system to substantiate conformance to this standard.

4.4.1.3* The manufacturer shall be permitted to be registered to ISO 9001, *Quality management systems — Requirements*, in lieu of meeting the requirements of 4.4.2 through 4.4.8.

4.4.2 Instructions.

4.4.2.1 The manufacturer shall maintain written inspection and testing instructions.

4.4.2.2 The instructions shall prescribe inspection and test of materials, work in process, and completed articles.

4.4.2.3 Criteria for acceptance and rejection of materials, processes, and final product shall be part of the instructions.

4.4.3 Records.

4.4.3.1 The manufacturer shall maintain records of all “pass” and “fail” tests.

4.4.3.2 Records shall indicate the disposition of the failed materials or products.

4.4.4 Inspection System. The manufacturer's inspection system shall provide for procedures that assure the latest applicable drawings, specifications, and instructions are used for fabrication, inspection, and testing.

4.4.5 Calibration Program.

4.4.5.1 The manufacturer shall maintain, as part of the quality assurance program, a calibration program of all instruments used to ensure proper control of testing.

4.4.5.2 The calibration program shall be documented as to the date of calibration and performance verification.

4.4.6 Inspection Status. The manufacturer shall maintain a system for identifying the inspection status of component materials, work in process, and finished goods.