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Chemical-Resistant Apparel Information

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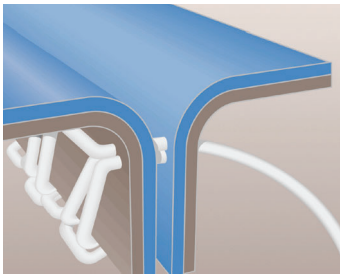
Choosing a Garment

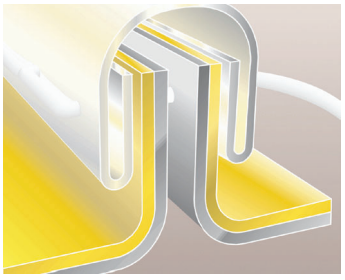
Seam Construction

Seams are a critical component of the overall barrier protection provided by a chemical protective garment. It is vital to select the appropriate seam configuration for your application needs and to know that the garment will be constructed with strong, tight seams. One loose thread or gap and the barrier between you and your environment unravels — leaving you vulnerable.



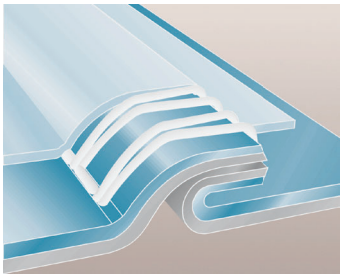
Serged or Sewn*

A seam produced when multiple threads are interlocked around the raw edges of two pieces of material for a strong, stress-resistant seam.



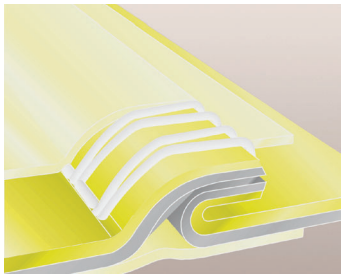
Bound*

Tightly sewn with a reinforced outer binding to increase seam strength and barrier. For potential misting exposure of non-hazardous liquids or particle penetration through the seam.



Taped

Both sewn and taped to provide strong chemical resistance against heavy liquid splashes and tough seam stress. A sewn seam is covered with a strip of compatible material by heat-sealing.



Double Taped

Sewn, then taped on the inside and the outside of the seam for a very strong chemical-and stress-resistant seam.

*Serged and/or bound seams are degraded by some hazardous liquid chemicals, such as strong acids, and should not be worn when these chemicals are present.

Garment style

There are many garment styles available — from hoods and shoe covers to aprons, coveralls and fully encapsulated suits. Fully encapsulated suits are available with front or rear entry, with a flat back for airline accommodation or an expanded back for SCBA accommodation.

Hoods

In addition to a standard hood design, many garments offer a respirator fit hood. These hoods are designed with a longer zipper for complete coverage of the neck area.

Standard **Respirator Fit**

Flame-Resistant Apparel Information

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The Need for Flame-Resistant Protective Apparel

Every day, workers in the electrical maintenance, utilities, oil, gas, petrochemical and steel industries work in environments that may expose them to hazards that could cause severe or fatal burn injuries. Garments made with non flame-resistant fabrics of untreated natural fibers or synthetic fibers can ignite and will continue to burn (until extinguished or until all flammable material is consumed) even after the ignition source has been removed. Synthetic fibers will melt and drip causing severe contact burns to the skin. The most severe burns are often the result of ignited garments and not the initial exposure.

Flame-resistant garments are intended to resist ignition, prevent the spread of flames, and to self-extinguish almost immediately upon removal of the ignition source. The use of flame-resistant garments will provide thermal protection at the exposure area and can dramatically reduce the severity of injuries, thus increasing the chance for survival.

A wide variety of flame-resistant fabrics are available on the market today. Important considerations in any flame-resistant protective apparel program are testing and standards requirements. Following are common performance standards and test methods related to flame-resistant protective apparel. Please consult reference documents for complete information.

Standards for Electrical Safety in the Workplace

NFPA 70E: Standard for Electrical Safety in the Workplace 2018 Edition is a recognized consensus standard that addresses electrical safety work practices for employee workplaces. Employers are required to perform an Arc Flash Hazard Analysis in order to protect personnel from the possibility of being injured by an arc flash. The analysis shall determine the arc flash boundary, the incident energy at the working distance, and the personal protective equipment that people within the flash boundary shall use. Where it is determined that work will be performed within the arc flash boundary by NFPA 70E 130.5, one of the following methods shall be used for selection of protective clothing and other PPE:

1. **Incident Energy Analysis**

   The incident energy analysis shall determine, and the employer shall document, the incident energy exposure of the worker (in calories per square centimeters). Arc-rated clothing and other PPE shall be used by the employee based on the incident energy exposure associated with the specific task. For information on selection of arc-rated clothing and other PPE, reference NFPA 70E Table H.3(b) Annex H.

2. **NFPA 70E Arc Flash PPE Categories Method**

   The requirements of NFPA 70E Tables 130.7 (C)(15) and 130.7 (C)(16) shall apply when the arc flash PPE category method is used for the selection of arc flash PPE.

3. **NFPA 70E Informative Annex H Guidance on Selection of Protective Clothing and Other Personal Protective Equipment - H.2 Simplified Two-Category Clothing Approach for use with Table 130.7(C)(15)(A)(a), Table 130.7(C)(15)(A)(b), Table 130.7(C)(15)(B) and Table 130.7(C)(16)**

   The use of Table H.2 in NFPA 70E Annex H is suggested for a simplified approach to provide minimum PPE for electrical workers within facilities with large and diverse electrical systems. In addition to the arc-rated clothing systems listed in Table H.2, other PPE appropriate for the arc flash PPE category could be required.

Standards for Workers Exposed to Flash Fire Hazards

NFPA 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire 2012 Edition specifies the minimum performance requirements and test methods for flame-resistant fabrics and components and the design and certification requirements for garments for use in areas at risk from flash fires. NFPA 2113 Standard on Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protections of Industrial Personnel Against Flash Fire 2015 Edition specifies the minimum selection, care, use and maintenance requirements for flame-resistant garments for use by industrial personnel in areas at risk from flash fires or short duration flame exposure that are compliant with NFPA 2112 Third-party certification of garments. Visit NFPA.org for additional information on these standards.

- Flame resistance testing shall be performed in accordance with ASTM D 6413. Fabric samples are tested in this manner both before and after 100 wash/dry cycles or 100 dry cleaning cycles
- Heat Transfer Performance (HTP) must be tested both in contact with the sensor and separated by a ¼" spacer from the sensor with a minimum HTP rating of 3.0 for "contact" and 6.0 for "spaced"
- Coveralls made to a standard pattern from candidate fabrics are tested for overall flash fire exposure in accordance with ASTM F1930. The average total predicted body burn must not exceed 50%

Other Standards for Flame-Resistant Apparel — ASTM International — astm.org

- D6413 Standard Test Method for Flame Resistance of Textiles (Vertical Method)
- F1506 Standard Performance Specification for Flame-Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards
- F1891 Standard Specification for Arc and Flame Resistant Rainwear
- F1930 Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Flash Fire Simulations Using an Instrumented Mannequin
- F1958/F1958M Standard Test Method for Determining the Ignitability of Non-Flame-Resistant Materials for Clothing by Electric Arc Exposure Method Using Mannequins
- F1959/F1959M Standard Test Method for Determining the Arc Rating of Materials for Clothing
- F2733 Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards
- ASTM 2178 Standard Test Method for Determining the Arc Rating and Standard Specification for Face Protective Products

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Types and Performance Classes of Garments under ANSI/ISEA 107-2015

The ANSI/ISEA 107-2015 Standard, the industry recognized yet voluntary consensus on high visibility safety apparel recommendations, continues to classify garments by 3 performance classes and has added garment types. In addition, the requirements of American National Standard for Public Safety Vests, ANSI/ISEA 207, have been consolidated into ANSI/ISEA 107-2015. Performance classes define the amount of background material, retroreflective or combined-performance materials on a garment and other considerations that make a person more easily seen in low visibility situations. Refer to ansi.org for complete information.

Types/Class	Intended Use	Work Examples	Performance Class
Type O Class 1	Off-Road / Non-Roadway	Oil & Gas extraction, Refinery and Mining	Class 1 provides the minimum amount of high visibility materials required to differentiate the wearer visually.
Type R Class 2	Roadway and Temporary Traffic Control	Roadway Construction Airport Workers Municipalities	Class 2 provides for the use of additional amounts of high visibility materials to identify the wearer more effectively.
Type R Class 3		Flaggers Nighttime Workers Municipalities	Class 3 offers greater visibility to the wearer in complex backgrounds and a full range of body movements. A sleeveless garment or vest alone is not considered Class 3.
Type P Class 2	Emergency and Incident Responders and Law Enforcement Personnel	Police Sheriff Fire EMS	Class 2 provides for the use of additional amounts of high visibility materials to identify the wearer more effectively.
Type P Class 3			Class 3 offers greater visibility to the wearer in complex backgrounds and a full range of body movements. A sleeveless garment or vest alone is not considered Class 3.
Supplemental Class E	Pants, Overalls, Shorts, Rain Pants and Gaiters		When a Supplemental Class E item is worn with Performance Class 2 or 3, the overall classification for the ensemble is Performance Class 3.

This summary does not represent official, legal, or complete interpretations of the standard. If specific questions arise, the standards should be referred to and relied upon.