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# DEMYSTIFYING FR CLAIMS:

**AN ERGODYNE WHITE PAPER**

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Each year, hundreds of burn injuries and deaths are recorded from workers encountering open flame and high heat or exposure to flash fires and electrical arc flashes without proper personal protective equipment (PPE). In 2010, the U.S. Department of Labor Bureau of Labor Statistics reported approximately 200 worker fatalities due to fire and explosions. During the same year, nearly 15,000 workers sustained lost-time industries because of heat burns.

If the on the job risk can't be eliminated, it is mission critical that the supplied or chosen work wear and PPE can withstand the heat and protect against the real risk of arc flash or flash fire hazards in the electrical/utilities or petrochemical industries.

## **WATCH WHAT YOU WEAR**

Dozens of individual workers each year are accidentally exposed to flash fires causing severe burn injuries, in some cases caused by the continued burning of their clothing. One of the real dangers of wearing ordinary non-flame resistant clothing is that regular fabrics can easily catch on fire and continue to burn even after the initial exposure to petrochemical flash fire or electrical arc.

Employers are required by OSHA regulations to assess the risks in their workplace and select appropriate PPE, including clothing, that protects against identified hazards. Selection of clothing that conforms to recognized industry specifications is one way of ensuring that these regulations are followed. At the same time, it is important to be cognizant of the specific claims being made by manufacturers of protective clothing and ensure that the claims are based on appropriate standards and can be verified by test or other documentation.

## **MIND THE STANDARDS**

Every day, as many as 5 to 10 arc explosions occur from electric equipment. To mitigate these risks, regulatory bodies have created a number of standard test methods and specifications that discriminate amongst the different fabrics that are protective against flame and heat exposure, as well as specific types of industrial exposures. Different standards are set in the industry to address a variety of applications where flame and heat resistant protective clothing may be needed. Three examples of these standards include:

- **ASTM F2302, Standard Performance Specification for Labeling Protective Clothing as Heat and Flame Resistant**, provides criteria for clothing materials in terms of flame resistance and heat/thermal shrinkage resistance. The standard specifies that material afterflame times cannot exceed 2 seconds; char lengths cannot be more than 6 inches; and materials cannot both melt and drip. In addition, clothing materials cannot ignite, melt, drip, separate or shrink more than 10% when tested for heat and thermal shrinkage. For clothing that is reusable, these properties must be demonstrated both before and after at least 10 cycles of laundering, as prescribed by the manufacturer.

- ASTM F1506, Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards**, defines a series of requirements for clothing intended for used by workers in the electrical utilities industries. This standard includes the same requirements for flame resistance as applied in ASTM F 2302, but requires testing before and after 25 laundering cycles. In addition, there are tests for fabric physical strength, colorfastness and laundering shrinkage. One of the most important requirements is the arc-resistance test, for which the value must be provided on the garment label (either ATPV or EBT). The test, described in ASTM F 1959, Standard Test Method for Determining the Arc Rating of Materials for Clothing, provides an arc rating, which is a measure of the insulation time provided by the clothing in preventing a second-degree burn injury under very specific exposure conditions. The arc rating can either be reported as arc thermal protective value (ATPV) or estimated break-open threshold (EBT). ATPV is the energy level on a fabric or material that results in sufficient heat transfer through the fabric or material to cause the onset of a second-degree burn. EBT is used when the material breaks open and represents the energy that causes fabric break-open.
- NFPA 70E, Standard for Electrical Safety in the Workplace**, is primarily an electrical safety standard aimed at companies that operate in the electrical utility industry and is primarily directed towards end users. A portion of the standard addresses safety-related work practices including gloves, sleeves footwear, head protection, face and eye protection as well as protective apparel. A key part of the standard establishes hazard-risk categories (HRCs) which define the level of arc rating needed by clothing to perform specific hazardous tasks where the potential for an arc flash exists. The standard identifies a specific HRC for each type of work normally performed by electrical workers. The table below summarizes this rating system:

<b>HRC</b>	<b>TYPICAL CLOTHING DESCRIPTION</b>	<b>MINIMUM ARC RATING (ATPV OR EBT) OF PPE IN CAL/CM<sup>2</sup></b>
<b>0</b>	Nonmelting, flammable materials (i.e., untreated cotton, wool, rayon, or silk or blends of these materials)	<b>N/A</b>
<b>1</b>	Arc-rated FR shirt and FR pants or FR coverall	<b>4</b>
<b>2</b>	Arc-rated FR shirt and FR pants or FR coverall	<b>8</b>
<b>3</b>	Arc-rated FR shirt and pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum	<b>25</b>
<b>4</b>	Arc-rated FR shirt and pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum	<b>40</b>

OSHA recognizes that the provision of clothing that complies with industry consensus standards is one way of demonstrating that appropriate PPE has been provided by employers to their employees.

## READ THE LABELS

Unfortunately, despite the existence and promotion for using standards to qualify clothing in the workplace, often there is still incorrect information provided to end users. Some tests are used to represent products as flame resistant or protective in ways that are outside the scope of their intended use and may, in some cases, be a complete misrepresentation of the product's protective capabilities. Two common examples include:

- Some manufacturers infer that clothing meeting the Consumer Product Safety Commission requirements in Title 16, CFR 1610 (Standard for Flammability of Clothing Textiles) is protective against flame exposure. This regulation applies to ALL clothing sold in the United States and simply helps organize textiles into classes based on how quickly they burn. Textiles that have a flame spread between 3.5 - 7 seconds are considered normal flammability and are acceptable for use in clothing. Standards noted above only allow for a 2 second maximum afterflame. And when every second means precious escape time for a worker, which standard do you want your FR workwear to pass? Limits are set to exclude unreasonably dangerous fabrics from being used in the general U.S. clothing industry.
- Other manufacturers may cite an incorrect standard, such as NFPA 701 (Standard Methods of Fire Tests for Flame Propagation of Textiles and Films) or NFPA 702 (Standard on Flammability of Wearing Apparel), to base claims of their product's flame resistance characteristics. NFPA 701 clearly is intended to address home and industrial furnishings such as draperies and wall coverings. NFPA 702 was withdrawn in 1986 and was never intended to cover protective clothing applications. It also has several other standards that provide requirements for specific types of flame and heat resistant clothing.

It is always best to check with the manufacturer to see what claims are being made and, if there is a question, to ask for documentation that demonstrates the claim of a particular product meeting a standard or specification. The product label should clearly state all standard compliances.

## REMEMBER THIS

When exposed to flame or high heat, ordinary clothing can quickly ignite, burn or degrade causing serious burn injury and potentially, death. For those applications where exposure may occur, it is critical that workers are provided with and correctly wear proper PPE. The standards clearly state the varying levels of protection:

- **ASTM F2302: Standard Performance Specification for Labeling Protective Clothing as Heat and Flame Resistant** – meets standards after 10 laundering cycles.

- **ASTM F1506: Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards** – meets standards after 25 laundering cycles
- **NFPA 70E: Standard for Electrical Safety in the Workplace** – establishes important Hazard Risk Categories (HRCs) for choosing proper PPE

Education and compliance are critical to outsmarting the daily risks faced in these flame-friendly environments.

## RESOURCES

U.S. Department of Labor, Bureau of Labor Statistics: <http://www.bls.gov/iif/data.htm>

CapSchell statistics on electrical arc incidents, accidents, and injuries:  
<http://www.capschell.com/FARProject1999.htm>

Jeffrey O. Stull and Salvatore A. Chines, “Fibers and Textiles,” Section 6, Chapter 5, in *Fire Protection Handbook*, 20th Edition, Volume 1, National Fire Protection Association, Quincy, MA 2008.

### Copies of Regulations and Standards

**29 CFR 1910.132:**

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10118](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10118)

**28 CFR 1910.269:**

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=9868](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9868)

**ASTM D 6413:** <http://www.astm.org/Standards/D6413.htm>

**ASTM F 1506:** <http://www.astm.org/Standards/F1506.htm>

**ASTM F 2302:** <http://www.astm.org/Standards/F2302.htm>

**ASTM F 2894:** <http://www.astm.org/Standards/F2894.htm>

**NFPA 70E:** <http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70E>