



FLAME RESISTANT (FR) CLOTHING BASICS

FLAME RESISTANCE DEFINED

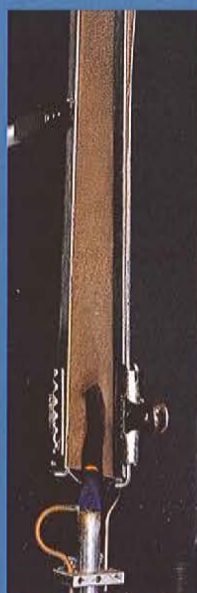
Flame resistance is the characteristic of a fabric that causes it to self-extinguish when the source of ignition is removed. The most commonly used test method is ASTM D6413* *Standard Test Method for Flame Resistance of Textiles* (Vertical Test). The vertical flame test is a test method with no pass/fail requirements. Industry established standards range from 4" to 6" (100 mm to 150 mm) maximum char lengths. It is very important for flame resistant fabrics to self-extinguish. Fabrics that self-extinguish after the source of ignition is removed can dramatically reduce body burn percentage and increase the chance for survival. However, char length measurements by themselves have no correlation to the protection afforded by a flame resistant fabric. True protection to thermal events is better measured by testing the thermal resistance of fabrics against exposures to simulated hazards, such as the flash fire manikin test (see pages 16-18) or the arc thermal performance test (see pages 10-15).

"Although passing the vertical flammability requirements is an essential criterion for protective clothing fabrics, it is only one of a battery of tests that fully describes the protective characteristics."

ASTM D6413



Vertical flame test on non-flame resistant fabric.



Vertical flame test on INDURA® Ultra Soft® fabric.

*Please review ASTM D6413 for a complete description of test procedures.

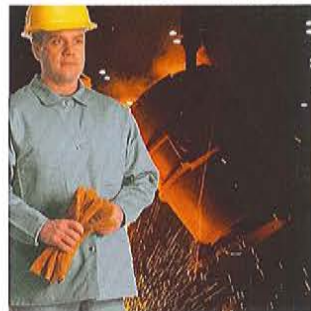
PRIMARY VS. SECONDARY PROTECTIVE CLOTHING

EXAMPLES OF PRIMARY PROTECTIVE CLOTHING



Primary Protective Clothing is defined as clothing that is designed to be worn for work activities where significant exposure to molten substance splash, radiant heat, and flame is likely to occur. An example of primary protective clothing is firefighter turnout gear and aluminized suits. INDURA® Ultra Soft® and INDURA® are **not** designed for use as primary protective clothing.

EXAMPLES OF SECONDARY PROTECTIVE CLOTHING



Secondary Protective Clothing is designed for continuous wear in designated locations where intermittent exposure to molten substance splash, radiant heat, and flame is possible (as defined by ASTM Standard F1002). INDURA® Ultra Soft® and INDURA® flame resistant fabrics are designed for use as secondary protective clothing.

FLAME RESISTANT (FR) CLOTHING BASICS



THE NEED FOR FR CLOTHING

Everyday, workers in the electrical maintenance, utility, oil, gas, petrochemical and steel industries work in environments that may expose them to hazards that could cause severe or fatal burn injuries. In the event of a momentary electric arc flash, flash fire or molten metal splash exposure, everyday non-flame resistant work clothes can ignite and will continue to burn even after the source of ignition has been removed. Untreated natural fabrics will continue to burn until the fabric is totally consumed and non-flame resistant synthetic fabrics will burn with melting and dripping causing severe contact burns to the skin.

Government reports note that the majority of severe and fatal burn injuries are due to the individual's clothing igniting and continuing to burn, not by the exposure itself.

The use of flame resistant clothing will provide thermal protection at the exposure area. The level of protection typically rests in the fabric weight and composition. After the source of the ignition is removed, flame resistant garments will self-extinguish, limiting the body burn percentage.

KEYS TO EVALUATING AND COMPARING FR FABRICS

The first step is to search out and evaluate information that was generated using the following three criteria. By doing this you can evaluate different types of FR fabrics on a level playing field and ensure that you're comparing "apples to apples."

#1) Identify your potential hazard. Exposures such as electric arc flash and flash fire are unique hazards with vastly different characteristics and the test results do not directly correlate to one another. The results from flash fire testing should not be substituted for electric arc flash testing when evaluating products. Be wary of fiber and/or fabric producers that attempt to draw comparisons between these two hazards.

#2) Identify industry consensus standards for the exposure. Industry standards have been developed for electric arc flash and flash fire testing. For electric arc flash, ASTM has developed F1959, which produces an ATPV (Arc Thermal Performance Value). NFPA 2112 was created for employees that work in environments where a potential flash fire hazard exists.

#3) Make sure the testing is conducted at independent laboratories. This will help ensure that unbiased and scientifically valid data is being produced. While it is often helpful and interesting to witness testing conducted by a company that has a vested interest in the FR business, there is no substitute for information generated at an independent laboratory.

NON-FLAME RESISTANT CLOTHING VS. INDURA® Ultra Soft® 10 SECONDS AFTER A 3 SECOND FLASH FIRE EXPOSURE.



NON-FLAME RESISTANT CLOTHING

INDURA® Ultra Soft®

POTENTIAL HAZARD

EXAMPLES:

- Electric Arc Flash
- Flash Fire
- Molten Metal Splash

INDEPENDENT LABORATORY

EXAMPLES:

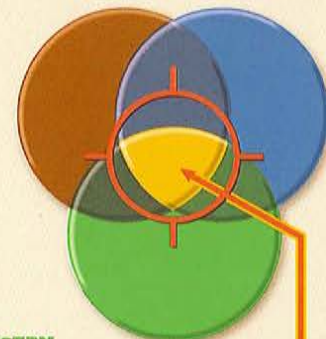
- Kinectrics (Electric Arc)
- University of Alberta (Flash Fire)

INDUSTRY CONSENSUS STANDARD

EXAMPLES:

- ASTM F1959, NFPA 70E (Electric Arc)
- NFPA 2112, ASTM, F1930 (Flash Fire)

RELEVANT & NON-BIASED INFORMATION TO COMPARE PROTECTIVE PERFORMANCE



SPECIFY FR FABRICS BY BRAND NAME

It is important to recognize that industry consensus standards only provide minimum performance criteria for flame resistant fabrics. While these standards typically provide a fair basis for comparing protective properties, they do not adequately address other important performance characteristics that are critical to achieve long-term success in an FR clothing program. Many unproven and/or generic FR fabrics promote the fact that they "meet the standards"; however they often experience quality problems including, but not limited to, inconsistent FR durability to laundering, poor shrinkage control, stiff feel, excessive color fading and UV degradation. Investigating a fabric's performance in the real-world and evaluating the experience and expertise of the company producing the product has become a necessary step in a global marketplace. Like many products in the safety category, the majority of companies specify FR fabrics by brand name to ensure compliance and a long-term successful FR program.