DuPont Personal Protection

THERMAL TECHNICAL BULLETIN

FACTS ABOUT INHERENT FLAME-RESISTANT PROTECTIVE CLOTHING

"Flame resistant" clothing will not support combustion after the heat source is removed. There are two main types of flame resistant fabric used to manufacture flame resistant clothing: fabric made from inherently flame resistant fibers or chemically treated fabrics.

The word "inherent" is defined as being involved in the "constitution or essential character" of something (Ref: Merriam-Webster Dictionary). The word "inherent," as it relates to flame resistant clothing, means that the flame resistant properties have always been a part of the fibers used in the fabric — from the first moment these fibers were made. Because flame-resistance is an intrinsic part of inherently flame resistant fibers, it is permanent, and cannot be washed out or worn out of the fiber no matter how the garment is used or laundered. The terms "treated" and "topically treated" refer to a manufacturing step whereby a special mixture of chemicals is added to a naturally flammable fabric, such as cotton or cotton/nylon blends, to make the final fabric flame-resistant (FR). Unlike fabrics made with inherently FR fibers, chemically treated FR fabrics may have their flame resistant properties diminished or removed completely depending on how these fabrics are laundered and/or which chemicals they are exposed to in the work environment.

Understanding the basic differences between "inherent" and "treated" FR technologies is very important for those responsible for evaluating, selecting, and wearing FR garments. DuPont™ Nomex® IIIA and the new DuPont™ Protera™ fabrics are "inherently" FR and provide excellent protection from fire and arc flash hazards.

Fabrics and garments made from Nomex® IIIA have been third party certified to meet the requirements of NFPA 2112, and deliver superior protection across a range of possible fire exposure conditions. Nomex® IIIA fabrics and garments are very durable with a long wear life and have a history of proven performance. The DuPont™ Protera™ fabric has been specifically engineered to protect against electric arc hazards, meeting NFPA 70E Category 2 requirements. Like Nomex® IIIA, the flame resistant properties of Protera™ fabric come from the inherently FR fibers and cannot be washed out or worn away. Unlike FR-treated cotton fabrics, which have special chemicals added to the base fabric to achieve flame-resistance, the inherent flame-resistance found in Nomex® IIIA and Protera™ fabrics will not diminish regardless of the laundry process.

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Frequently Asked Questions

1) Why is "inherent" protection important to me?

The flame-resistant (FR) properties of inherent fabrics cannot be washed out or worn away, period. This means the flame-resistant properties of garments made of inherent fibers cannot be compromised. It is crucial for the wearer to know the flame-resistant protection is always there.

2) What does 'inherent for the life of the garment' mean?

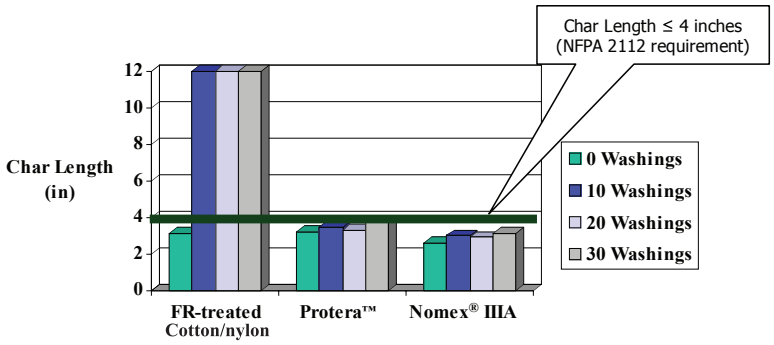
Only garments using fabrics made of inherently flame-resistant fibers are truly "inherent".

3) How can FR properties be removed from a garment?

For FR-treated fabric, such as FR cotton/nylon blends, one way to remove its flame resistant properties is to use regular chlorine bleach while washing the garment. Test results shown in the chart below demonstrate this.

Char damage length is one of the key criteria used to qualify fabrics as being "flame resistant". NFPA 2112 sets a requirement of less than or equal to 4 inches of char damage length. As can be seen in the chart, while the FR cotton/nylon fabric passed this requirement when new (0 washes), by 10 washes with regular detergent and chlorine bleach, its char length had increased to 12 inches (the entire length of the sample burned). While use of chlorine bleach may not be recommended per some fabric manufacturers' laundry instructions, this can happen in the real world. It does not take many washes with chlorine bleach to damage the flame resistance properties of a FR cotton or cotton/nylon fabric. And unfortunately, the wearer would not be able to tell it was no longer flame resistant simply by looking at the garment. With inherent fabrics, the flame resistant properties can not be removed.

Note that for DuPont™ Nomex® IIIA and Protera™ fabrics laundered and tested in the same way, even at 30 washes with detergent and chlorine bleach, both fabrics meet the NFPA 2112 requirements for char damage length.



Notes: **Fabrics were all home-laundered using household detergent and chlorine bleach, following the recommended instructions on the label.**

Char length is the length that is damaged when 12 inch long fabric samples are tested using ASTM D6413 method.

Fabric softeners and/or dryer sheets should not be used in laundering FR garments as they may contaminate the garment with chemicals that could be flammable

4) What will happen if I home launder FR-treated cotton/nylon, Nomex® IIIA or Protera™ garments?

If home laundering instructions for Nomex® IIIA, Protera™ and FR-treated cotton/nylon garments are followed precisely, nothing negative should happen to any of these garments. However, there have been specific instances when FR-treated cotton/nylon garments were laundered using hydrogen peroxide (a type of oxygen bleach) during the wash cycle and the flame resistant properties of the FR cotton/nylon fabrics were compromised. This was reported by Westex in their "Update to Industrial Laundry Care Advisory" dated October 2, 2003.

5) Other than chlorine bleach, what else could damage the flame resistant properties of FR treated garments?

- The combination of hydrogen peroxide (a type of oxygen bleach) with 'hard' water during laundering could compromise the FR properties of garments made with FR-treated fabrics.

- Exposure to oxidizing (e.g., chlorine-containing) chemicals in the workplace may, over time, compromise the flame-resistant properties of garments made with FR-treated fabrics.

6) How will I know if the FR-treated garment's FR properties have been compromised?

Without performing destructive testing, such as vertical flammability testing, you would not know. This is dangerous, since the wearer cannot see the difference between a FR-treated garment that is still effective and one that has lost its flame-resistant properties.

7) When should I 'retire' my FR garments from service?

Any garment with visible holes, rips, and/or tears or contamination from flammable materials should be properly repaired, cleaned, or removed from service. But it is difficult to judge the remaining level of flame-resistance in a FR-treated garment because there are no visible cues. The flame-resistant performance can only be determined through a destructive test. Since the FR properties of a truly inherent FR fabric, like Nomex® IIIA and Protera™ do not change with use or laundering, the FR properties for Nomex® IIIA and Protera™ will be there no matter the garment age or how it was laundered.

A garment made with FR-treated fabric, such as FR cotton/nylon blends, may need to be retired from service because its FR chemical treatment was compromised, long before the fabric shows any visible wear. However, the wearer would not know this since the garment would show no indication of this compromise.

8) If inherent FR garments and FR-treated garments perform differently, how can they both be certified to the same standard?

The two main garment performance standards for FR clothing, NFPA 2112 and ASTM F1506 (used for NFPA 70E), only specify minimum performance levels for fabrics and garments. These standards do not address all factors related to durability of the flame resistant properties. It is the end-user's responsibility to determine if these minimum standards provide an appropriate performance level for their particular application.

9) If Nomex® IIIA and Protera™ fabrics are inherently FR, why do the DuPont laundry instructions advise me not to use chlorine bleach?

Repeated use of chlorine bleach in the laundry can affect fabric color and can weaken fabric strength, which may shorten the useful wear life of the garment. Exposure to chlorine bleach will not affect the flame-resistant properties of inherently FR fabrics like Nomex® IIIA and Protera™.

10) How does Protera™ compare to FR-treated Cotton or Cotton/Nylon Blends?

Protera™ fabrics and garments provide inherent protection against electric arc hazards. This means that the thermal protection cannot be washed out or worn away as compared with chemically treated FR products such as UltraSoft®. Garments made from Protera™ fabric are lighter weight than FR cotton/nylon blend garments, such as UltraSoft® (6.5 oz/yd^2 vs. 7.0 oz/yd^2), and they will retain their professional appearance throughout extended use and repeated launderings. Protera™ garments will demonstrate a better lifecycle value than less durable FR-treated cotton and FR-treated cotton/nylon blend garments.

DuPont Personal Protection

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