

THE TRUTH ABOUT FLAME RESISTANT FABRIC TERMS:

What's Really Behind the
“Inherent” vs. “Treated” Debate



The Truth About Flame Resistant Fabric Terms: Inherent vs. Treated

In the protective clothing industry, there has been substantial debate about the merits of two types of flame resistant (FR) fabrics — “inherent” and “treated.” These two terms are commonly used to describe different approaches to producing the FR properties of a fiber. Unfortunately, much of what has been written about the distinctions between “inherent” and “treated” fabrics has been inaccurate, incomplete or misleading.



This paper seeks to set the record straight by exploring:

- The unscientific origin of the terms — “inherent” and “treated”
- The evolving meaning of these terms over time
- Why “proven” vs. “unproven” is a more useful basis for comparison

Because it's the FR fabric which largely determines the level of protection offered by a protective garment (arc ratings and flash fire performance test results are based on fabric brand and weight), it is critical for safety managers to not only understand the real differences among fabrics, but also how these distinctions impact performance. After all, safety decisions should be made on facts — not stories and marketing terms.

The Role of Marketing in FR Fabric Terminology

First and foremost, it is important to understand that “inherent” and “treated” are marketing terms with no origin in textile science and with little or no consistency of application fiber to fiber, fabric to fabric, or year to year. Sales literature frequently implies that one method is better than the other, and the marketing spin has been that the FR properties of “treated” fabrics wash or wear out, while those of “inherent” fabrics do not. Like virtually everything else in life, neither method is perfect and each has its pros and cons, but repetition over time has created impressions in the marketplace that are simply not borne out by the facts.

The “inherent” fibers tend to be synthetics, and most begin as naturally occurring flammable substances (petrochemicals), not fibers. Humans must intervene, using chemistry, to engineer the fiber and embed the flame resistant properties within it.

Similarly, most “treated” products begin as naturally occurring flammable substances (usually cotton or other cellulose), so nature has already taken care of the fiber portion, and humans get involved to engineer the FR.

The word “inherent” was not originally a textile or FR term. Its definition varies slightly from source to source, but the common thrust is “by its very nature, built-in, implicit.” On the other hand, “treated” is usually defined as chemical engineering to impart properties not previously present. Nature provides very few FR fibers, the most well known of which is asbestos, which is obviously not in common use in protective apparel in North America today. Conversely, all flame resistant fibers in common use today for industrial protective apparel are engineered by humans — using chemistry — to be flame resistant.

What is important is not how the engineering was accomplished, but that it was accomplished correctly and consistently, so that a garment maintains its flame resistance weeks, months and years later — regardless of how many times it is laundered.

What should be critically important to the ultimate end user is that the garments are flame resistant for the life of the garment. The FR protection shouldn’t wash out, wear out, or fall off, and it should be there every time the garment is taken out of a locker or drawer and worn to work.

So what does “inherent” mean as applied to the FR fabric market? Regardless of actual definition, the value cited by virtually everyone is that “inherent” FR garments won’t wash out, that they are FR for life. However, “inherency” is not the only path to engineering life-of-the-garment flame resistance.

What does “treated” mean as applied to the FR clothing market? To many, it means a fabric whose FR properties are topical and/or temporary. This may be true with some generic, unbranded 88% cotton/12% Nylon fabrics (sometimes referred to as “88/12 FR”). It can also be said of generic 100% cotton FR fabrics that have hit the market in the past five years. However, when it comes to the fabric brands that have the largest share in this category, Westex UltraSoft® and Indura®, the engineering technology results in a fabric that is guaranteed to be flame resistant for the life of the garment. This guarantee has been proven in many independent labs and through tens of millions of garments, in service worldwide for more than 25 years. The FR portion of the fabric is a long-chain polymer engineered in situ and locked in the core of the cotton fiber, and the FR mechanism is solid-phase. These fabrics char instead of burning, just like most well-known “inherent” fabrics.



How New Fabric Blends Complicate Naming

Most popular FR fabrics today are blends of different fibers, and this has created another whole level of misuse and misunderstanding. Independent of the issues discussed above around definitions and individual fiber technologies, what other fiber classes should be allowed, and what blend levels should be necessary to call a fabric “inherent”? One or more major manufacturers are currently marketing each of the following examples as “inherent”:



- Should we call a blend of “inherent” and “treated” fibers “inherent”? If so, at what ratio of “inherent” to “treated”? Is 1 percent inherent enough, and, if not, what level is sufficient?
- What about a fabric that is about 15-20% “inherent” (by the original definition), about 40-50% of a fiber that used to be called “treated,” but which has recently been relabeled inherent, and about 30-40% non-FR natural fibers?
- What should we call a fabric which in which half the blend is an FR fiber that was called “treated” for 20 years, but recently was relabeled as “inherent”? (Keeping in mind that the other half of the fabric isn’t “inherent,” isn’t “treated,” and isn’t even flame resistant?) If it is half non-FR, how can it possibly be characterized as “inherent”?



The Real Distinction: Proven vs. Unproven

At the end of the day, the only real measure of a flame resistant fabric is whether its performance and protection are proven. This requires safety managers to look beyond marketing claims; some are made with little or no substantiation, while others are based on tests or standards that fall far short of real-world service life and laundering conditions. “Proven,” however, means different things to different people, and at present, there is no specific definition of how it applies to FR garments.

Here is what proven should mean:

It starts with repeated independent laboratory evaluation. However, it is critically important to understand that this is a starting point, NOT an end point. Performance in the real world, over time, is absolutely essential to vetting the full range of FR fabric/garment performance.

There are a number of reasons for this:

- Standards are generally written to be inclusive, not exclusive, and as such, provide de minimus parameters which most fabrics easily pass.
- Test samples are self-submitted and, once certified, never checked again, much less by random, third party acquisition from commercially available stock. And as a result, what is later manufactured in full commercial scale too often bears little or no resemblance to what was originally submitted for certification. As a result, testing done on market-sourced fabrics frequently records failure (usually FR or shrinkage, sometimes both) at far fewer laundering cycles than standards predict.
- The laundering tests in particular are minimal — they involve lower (and often MUCH lower) laundering cycles than service life, and are conducted under perfect conditions: water temperature, chemistry, detergent types and loads,

garment loads, wash and dry times and temps, etc. But how representative is this of real-life laundering conditions? It's not, and as a result, some fabrics that perform acceptably when new suffer major degradation of properties (especially shrinkage and FR) far more rapidly than standards predict. This holds true whether the test garments are pulled from actual use, or sourced new, but laundered under conditions more representative of the real world.

Given these facts, it's easy to see why proven performance, over time, in actual use is a vitally important factor when evaluating and specifying FR fabrics. So what should constitute proven performance? People ultimately vote with their wallets; that is, things that do not perform or are a poor value will not often be repurchased. On the other hand, when many different large users across different industries have purchased, worn and washed the garment for 2–4 years until replacement becomes necessary, and then re-purchased the same product, a pattern of reliability begins to be established. Two full replacement cycles (requires selection of the same item for the third cycle) is the threshold, and the larger and more global the customer base who make these decisions, the more reliable the market proof. Unlike the stock market, past performance of FR fabrics IS an excellent predictor of future results.

Ensuring FR Protection, Comfort and Value

The fabric properties most important to wearers of flame resistant apparel are protection, comfort, and overall value. Durability of these properties is critical; what ultimately matters most is that the apparel is flame resistant for the life of the garment and market proven. The “inherent” vs. “treated” worldview is simply inaccurate and/or actively misleading — both on the fiber level and as applied to fabric blends. This has been reaffirmed recently as the market has been flooded by new, unproven FR fabrics being marketed as “inherent” and “treated” (many of which are actually “inherent-treated” blends). These fabrics may look good in the lab or a trade show booth, but simply do not perform in the real world.

The truth is that there are large differences among otherwise compliant FR fabrics, including those that — at first glance — appear quite similar. Because the fabric brand is the largest factor in determining these core values, effective protective clothing programs begin with the same first step: Specifying FR fabric by name.

There have been too many failures, including FR durability, excessive shrinkage, poor comfort, and more. The critical differentiator should be “proven” vs. “unproven,” because lives are on the line.

About the Author

Scott Margolin is International Technical Director for Westex. Prior to joining Westex in 2000, Scott M. Margolin was a firefighter for six years and then spent 10 years at a major multinational chemical company, working in two of its flame resistant fiber businesses, including four years leading the flash fire segment. He has conducted more than 3,200 flash fires and 1,100 arc flashes in labs in the United States, Canada, and Europe; among this research is groundbreaking work creating arcs in real equipment and utilizing high-speed, super-slow-motion cameras to analyze arc flash and PPE performance. He has presented these topics at seminars around the world, including North and South America, Europe, Russia, and Australia. He is a member of numerous NFPA and ASTM committees, including 2112, F-18, and F-23.



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2845 West 48th Place

Chicago, IL 60632

773.523.7000

866.493.7839

WESTEX.COM