

# Protect Workers from Arc Flash & Related Hazards

Inside you will read about:

- What is Arc Flash?
- FR Clothing Options That Are Lightweight and Comfortable
- Is It Safe to Wear Base Layers Underneath FR Clothing?
- Multi-Hazard Protection Makes a Difference
- High-Performance FR: Changing the Industrial Market

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# What is Arc Flash?

## Everything You Want to Know About Arc Flashes

An electric arc is a complex phenomenon gaining increased understanding and attention in the electrical safety world. Arcs are basically ionized gases caused when electricity travels through air. "Arc flashes" arc blasts, and "electric arc" are really all different names for the same basic phenomenon.

### Arc Flash Overview

There are three primary issues in electrical arcs from an electrician's point of view:

1. Thermal
2. Pressure wave
3. Current flow

Electricity begins to travel through air because of a breakdown of insulation from air or another insulator. This causes air to ionize, spinning off the outer shell electrons from air. This ionization has two effects: blast and radiation release. The blast is a function of fault current, container size and other parameters, including magnetic forces. The pressure wave is not as well-documented as the thermal effects, but it does occur. Standards do not tell us what the cutoff is for arc blast, but good understanding is key.

If you have greater than a 40 cal/cm<sup>2</sup> exposure, you should seek engineering guidance to see if it is safe to de-energize or work live. Remember, de-energizing can cause an arc if equipment fails or is not designed to be safely de-energized in the manner you are using. The thermal portion of the arc is very well-understood, and standards like NFPA 70E, NESC and CAN/UL S801 have reasonable guidelines for determining arc flash energies and some guidelines on clothing worn.

In the most prevalent writings on the matter, it is common to read about two types of arcs, most predominantly considered in calculations and standards. However, there are actually four types of arcs, two of which are

rarely considered in arc hazard assessments and only briefly addressed in the arc flash calculations.

### The Four Types of Electric Arcs

1. **Open-air arc** - The primary, most commonly understood arc used in arc testing
2. **Arc-in-a-box** - Used in one form for arc testing in the EU
3. **Ejected arc** - When arc plasma hits the worker
4. **A tracking arc** - Most common at higher voltages, arc plasma conducts on skin or through clothing

Only the first two are considered in the calculations and standards. The open-air arc is well-understood.

In lab testing, we control movement of the arc for the sake of replication but, in reality, from 480V higher, the open-air arc can quickly turn into an ejected arc or a tracking arc. The tracking arc is most common at very high voltages or during an electrical contact.

### Arc Flash Video

This is a slow-motion video (1:36) showing the difference between an electric arc with and without the use of a safety shield on a hotstick. Check out our other [arc flash videos](#).

*[Editor's note: This article originally appeared on an [e-Hazard blog](#). Used with permission. See [www.e-hazard.com](http://www.e-hazard.com) for details.]*



## FR AR Protective Clothing Trends

Advancements in the industrial market for Personal Protective Equipment (PPE) continue to offer improvements aimed at increasing wearer compliance. Proper and consistent use is best motivated by fit, comfort, and style.

Particularly within the flame resistant (FR) and arc rated (AR) apparel categories, there is a trend supporting benefits related to better fit, comfort features, and enhanced performance. Workwear can boast modern performance technologies in much the same way as well known brands in the sporting goods industry. Trend-right design styles are saturating product assortments, further inspiring wearer satisfaction. Protective clothing is no longer seen as a garment exclusively dedicated to the job. More and more, lifestyles demand that workers are wearing their FR clothing in their personal activities, interchangeable as casual wear.

Innovative textile compositions continue to offer a wide variety of choices. Inherent FR fabrics are made with fibers chemically structured to be flame resistant. These include aramids, modacrylics, and carbon fibers. Treated FR fabrics have flame retardants engineered into a fabric type that would otherwise be flammable.

Moisture-wicking technology is also now widely available in FR fabrics. It was originally created to enhance an athlete's performance in extreme climates, keeping them cool and dry. The application is a perfect fit in the industrial market, especially for those workers facing the harshest of environments, and a remedy for the discomfort of being weighed down with layers of excessive moisture.

Beyond the required efficacy of resisting ignition, FR garments are continuously improving other functionalities. Mobility features are added which aim to increase range of motion and alleviate restriction. Garment construction allows unconstrained movement, adding stretch knit panel insets perfectly positioned for reaching

and bending. Strategically placed elastic bands provide fit flexibility and prevent stress at seams caused by poor fit.

FR fleece garments continue to grow in popularity and serve as outerwear in accommodating climates. High quality trim, including FR buttons, snaps, and non-conductive zippers are customized for a durable look with sportswear appeal.

Protective apparel that satisfies multiple hazard protection standards is growing in popularity. While a variety of industries confront both flash



fire and arc flash (most notably petrochemical and utilities), there is a need for protective clothing that protects against both of these two hazards. There are also occupations that involve more than one hazard, and workers benefit from not having to repeatedly change clothes with each hazard they may encounter.

Garments that protect against both flash fire and arc flash must meet both the requirements of NFPA 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire and NFPA 70E, the Standard for Electrical Safety in the Workplace.

Meeting both requirements, these FR AR garments will then be Flame Resistant with an Arc Rating. In short, all AR clothing is flame resistant (FR), but not all FR clothing is Arc Rated, unless further tested through 70E for an arc rating.

Through innovative textile technologies, advanced functionality, and multi-hazard options, FR and AR protective clothing are taking a giant leap toward improving safety.

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## FR Clothing Options That Are Lightweight and Comfortable

FR clothing is an essential part of an employee's uniform. But, employees will sometimes resist wearing it. They don't like having to wear thick, heavy layers over their clothing. That's understandable. But these days, FR clothing comes in a variety of styles and options.

Manufacturers are introducing products that are lightweight and comfortable. You can't even tell the difference in some of these clothes! Not everyone is familiar with the options out there. Are you? If you've ever had to purchase FR clothing, then you might be.

But why is FR clothing so important anyway? **Let's review.**

### Hazards in the Workplace

FR clothing protects workers from fire-related hazards. It's a special kind of PPE that is crucial for many employees. Maintenance workers and electricians wear FR clothing on a regular basis. But others can be exposed to fire hazards, too. So, many companies require all of their workers to wear



Photo credit: Shutterstock

A lightweight option doesn't necessarily mean short sleeves. In fact, short sleeves should only be worn as a base layer. If a worker is at risk, he needs to protect himself entirely. Not just his torso. Long sleeves are critical.



Photo courtesy of RMI

it. Check out our blog on the [FR Clothing Requirements for Oil and Gas](#) to learn more.

### Fire-Related Hazards

Employees should wear FR clothing whenever they perform hot work activities. Welding, cutting, and grinding are examples of hot work. These kinds of tasks can generate sparks and slag. These applications can create fires when in close proximity to combustible materials.

### Electrical Arc Hazards

Electricians can receive significant burns from electrical arc flash hazards. When there is potential for an arc flash, employees must wear what's known as arc-rated clothing.

### High Risk Operations

Certain jobs and industries have a higher risk of fire hazards than others. Employees who work in these environments should wear FR clothing. For instance, oil and gas companies typically require FR clothing for all of their employees. The same goes for workers who deal with combustible dust, explosives, and other high-risk operations.

### FR and AR Clothing

There are two kinds of FR clothing you may need to purchase: flame-resistant clothing and arc-rated clothing.

### FR Clothing

FR clothing is the basic minimum. It's made from materials that will



self-extinguish when ignited. These garments can be constructed from inherently resistant fabrics. Or, they can be made from other materials and chemically treated to resist flames. Treated garments are referred to as flame-retardant. Inherently designed fabrics are considered the “true” flame-resistant garment.

Inherent fabrics are designed and engineered to last. They retain their FR properties for life. The garment will continue to protect employees, no matter how many times it’s washed and laundered.



Photo credit: Shutterstock

AR and FR are two very similar garments. The difference is in the fabric and the levels of protection. All arc-rated garments are flame-resistant. But not all flame-resistant garments are arc-rated.

### AR Clothing

AR clothing protects against electrical arc flash hazards. An arc flash is a sudden, violent release of thermal heat and energy. Arc flash occurs when there is an unexpected fault in electrical equipment. Electrical workers need to wear AR clothing for protection from these hazards.

### Why Comfort is Important

Are you going to purchase FR clothing anytime soon? If so, remember to evaluate how comfortable the clothing is. Employees aren’t going to be happy about something that is heavy, bulky, or too restrictive.

You need your workers to comply with your policies and wear their PPE.

But, put yourself in their shoes for a moment. Would you want to work in something all day that’s hot and uncomfortable? Probably not.

So, take the time to assess your options. Look for something that provides a sufficient level of protection. Choose a garment that is reasonable for someone to wear for an extended period of time. Check out our post, “[How to Choose the Best FR Coveralls](#)” to learn more about what to look for in quality FR clothing options. **WMHS**

*[Editor’s note: This article first appeared in Rocky Mountain Industrial Supply’s (RMI) Jan 23, 2018, [Industrial Supply Blog](#). For more from RMI, go to: <http://www.rmiwyoming.com>.]*

Treated fabrics work different. The garments get coated with a chemical that makes them flame-resistant. Over time, the protection level will degrade. The garment is only good for a certain number of washes.

Both kinds of fabrics are widely accepted. Remember, FR clothing is designed to self-extinguish. It will catch fire but won’t continue to burn. The purpose of these garments is to minimize the extent of burn injuries.



## Is It Safe to Wear Base Layers Underneath FR Clothing?

If you work in the oil and gas industry, you realize how important it is for workers to wear the right personal protective equipment (PPE). The hazards are just too risky to take any chances. Not only do workers face the risk of falls, crush hazards and injury from chemical exposure — they face the daily threat of fires and explosions. The good news? Workers can protect themselves from those fire-related hazards by wearing the right clothing.

### Flame-resistant (FR) clothing isn't always the most comfortable thing to wear.

Workers often complain of how heavy and bulky their garments are, how restrictive and how hot they can become. Until recently, they were correct. Comfortable or not, they need to wear the gear that keeps them safe. Protective FR clothing can mean the difference between life and death. It's always easier to get workers to wear the right gear when it's comfortable though, right?

Fortunately, there have been modern advancements in technology over the last several years. We no longer have to choose between comfort and protection when outfitting workers with their FR gear. The FR clothing on the market today is [lightweight, comfortable and safe!](#)

### Comfortable, modern clothing is finally available for your employees!

One common thing you'll see workers do to increase their comfort level is to wear layers. This is when you'll see them wear a garment on top of their FR clothing. But more often than not, employees will wear base layers underneath their FR clothing. Sometimes, base layers are worn to keep warm, stay cool or reduce moisture. But, how do you know if those layers are safe to wear?

Not all base layers are safe to wear in hot zones. Some materials can burn and melt to the skin. That's why it's so important to make sure each layer of clothing meets certain protective requirements.

Make sure your employees are using base layers that are flame-resistant.

They'll be much better off. FR base layers are the last line of defense against injury. If a fire or thermal event is strong enough, it could burn through the FR clothing, and affect the garments underneath.

### Base Layers to Avoid

It's not uncommon to hear of workers wearing popular athletic wear made of synthetic fabric under their protective garments, and this is extremely dangerous. Workers should avoid wearing synthetic garments. This type of clothing will ignite and can continue to burn against the skin. Synthetic garments can also melt to the skin, creating additional injury concerns. Here are some examples of synthetic garments to avoid:

- Polyester
- Nylon



Photo credit: Shutterstock

In 2010, OSHA sent out an official memo that explains the enforcement policy in oil and gas. It requires companies to provide oilfield workers with FR clothing. Workers need to wear that clothing in certain situations. The requirement covers most drilling, servicing, and other production-related processes.

- Rayon
- Spandex
- Cotton synthetic hybrid

Unfortunately, these are the most common types of base layers that people will wear. It's up to you to educate them on the dangers of synthetic clothing. Most people don't realize that what they're doing is wrong. They just want to be comfortable.

### Reasons for Wearing FR Base Layers

Comfort is the main reason why employees choose to wear layers. Some FR clothing is rough and scratchy. Having something soft and lightweight feels much better against their skin.

They also might be in a position where they don't always need their FR clothing. For instance, a worker might be required to wear it in one area, but not in another. If he moves around a lot throughout the day, he probably only wears the FR when he needs to. These workers often just wear a t-shirt or base layer. They'll throw on a long-sleeve jacket or coat only when they need FR protection. In this instance, the protective barrier has been compromised.

### Weather and the environment are some other popular reasons for choosing base layers

#### Cold Weather FR Apparel

Of course, it's natural to want to bundle up when it's cold outside. Workers may simply want an extra layer for warmth. You might find that some of them are wearing regular clothes from home, such as long-underwear, turtlenecks, and even sweaters. It's completely reasonable for workers to want to stay warm and comfortable while they work. But, those

When FR clothing is required, it must fully cover and protect the employee. Short sleeve tee shirts don't provide adequate coverage. You do have options, though. Workers may wear a shirt and pant combination. Or, they can choose a one-piece coverall. They can wear jackets, sweatshirts or long underwear, as long as it's rated flame-resistant.

layers need to be flame-resistant. That's why it's up to the employers to provide safe and effective alternatives.

Today, many of the garments that workers wish to wear are [available in FR clothing](#) options. You can find FR base layers that are safe to wear, and that [help keep them warm](#). For anyone who works outdoors during the winter, that can be a game-changer. They'll be much more comfortable. This keeps them focused on the task at hand, greatly reducing distraction and potential for injury.

Workers may also want to wear layers overtop their FR clothing. Did you know that there are [FR jackets](#) they can wear? They should still have FR clothing on underneath, but the jackets protect them from the elements — and keep the wind, rain, and snow off of them.

#### Warm Weather FR Apparel

You may not think of adding layers when it's warm outside. But it's actually a great way to manage a person's body temperature.

[Moisture-wicking garments](#) help keep a person cool. They remove perspiration away from the skin. This allows workers to dry more quickly. And, it helps to avoid the sudden "chilled effect" that people sometimes get after heavy perspiration.

Have you ever experienced that? Think back to a time when you were in a hot environment and you worked up a sweat. Then, you head off to a cool area to take a break and get a chill when the cooler air reaches your skin and damp clothing. That's when some people experience a sudden, drastic drop in body temperature. It's because they are wearing fabrics like cotton, which have the opposite effect that moisture-wicking garments do.

Cotton absorbs the moisture from your skin. It gets trapped between the clothing and your body. It doesn't allow you to regulate your body temperature in a controlled and safe way.

Moisture-wicking garments solve that issue. So, if you have employees in a hot work environment, they may want to consider adding a [breathable FR base layer](#) to their daily wear. They'll be more comfortable, even though they're wearing extra clothes.



Photo courtesy of RMI



When FR clothing is required, it must fully cover and protect the employee. Short sleeve tee shirts don't provide adequate coverage. You do have options, though. Workers may wear a shirt and pant combination. Or, they can choose a one-piece coverall. They can wear jackets, sweatshirts or long underwear as long as it's rated flame-resistant.

Talk to your employees. Find out what they prefer. Remember, you want them to be comfortable.

### Don't Forget These Minimum Requirements for Oil and Gas Work

The Occupational Safety and Health Administration (OSHA) specifies when FR clothing is required. **The rules are pretty clear for those who work in the oil and gas industry.** Plenty of other industries use FR clothing, too.

Specifically, OSHA requires FR clothing:

- When active gas or hydrocarbon zones are reached
- When there is a history of fluid or gas kicks from underground zones
- If a potential for flash fire exists during stages such as:
  - Snubbing tubing
  - Open-hole work
  - Plugging an abandoned well
  - Cementing
  - Stimulation
  - Working with wellhead or wellbore under pressure
  - Gauging
  - Tank heating
  - Using an open flame

A full list can be found in the [OSHA memo](#).

### Key Points to Remember

Many employees like to wear base layers. Base layers are not required.

But if worn, they must be made from flame resistant materials. [NFPA 70e](#) discusses this topic further. The requirement for FR base layers also falls under OSHA's general duty clause. It's always good practice to refer back to these safety requirements anytime you're in doubt.

Make sure your workers understand what their options are. Many of them aren't aware of how dangerous it can be to just wear regular clothing. Explain the risks clearly and often. Make it clear that any additional layers must also be made of flame-resistant materials.



Even though base layers aren't required, you may want to consider providing them from the start. Employers are responsible for putting workers in the proper PPE. So, if you think they're going to wear something from home, you might as well provide it instead. That way, you know they're wearing the right thing. It'll give you and your employees some peace of mind. **WMHS**

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## Multi-Hazard Protection Makes a Difference

By: Mark Saner, FR Technical Manager, Workrite Uniform Company

Every day, people go to work and perform tasks they've done hundreds of times before without incident. Then one day there's an accident—an accident that causes severe injury or even death. Whether it's due to human error or equipment failure, this scenario is far too common.

According to the Bureau of Labor Statistics, 5,190 fatal work injuries were reported in the United States in 2016. Millions of other workers suffered nonfatal injuries—nearly one third of which were serious. In many cases, these devastating injuries could have been prevented by establishing a strong safety culture and following safe work practices, including wearing the necessary personal protective equipment (PPE).

However, ensuring employees have—and wear—the proper PPE is sometimes easier said than done. Not only does PPE need to effectively address the hazards found in your workplace; it also needs to be comfortable and practical enough that it will be worn consistently and correctly. This is where multi-hazard protection can make a huge difference.

### Why Multi-Hazard Protection

In 2016, four employees were injured in an explosion at a Massachusetts-based chemical plant. The explosion involved trimethylaluminum, a flammable chemical that can also cause severe irritation and burns if it comes into contact with the skin or eyes. The company received numerous OSHA citations, including one for failing to provide and require the necessary PPE. In the case of this chemical plant—as with many other environments where dangerous, flammable chemicals are present—the necessary PPE would likely include protection against both chemical and thermal hazards.

With these combined hazards to consider, the first solution that comes to mind in terms of selecting protective clothing might be to find separate items to address each hazard. And, in some work environments, that might be the most effective approach. But when it is possible to adequately protect against multiple hazards with a single garment, there are a few significant advantages.

First, the fewer items that are needed for protection, the easier it is to remember to wear them all. For example, if you are wearing flame-resistant (FR) clothing, but also need to put on a layer of protection against chemicals before performing certain tasks, you could easily forget that essential second layer. But if you have one protective garment

### KNOW THE STANDARDS, REDUCE THE RISKS

Essentially, OSHA and NFPA requirements should be followed to develop and implement an effective electrical safety program—which can ultimately save lives.

There are many OSHA standards that relate to arc flash hazards.

The NFPA 70E national consensus standard is a comprehensive standard that contains detailed information on how to protect workers from arc flashes. Employers must consider and adopt NFPA 70E when employees work on an electrical system.

NFPA 70E is not an OSHA requirement; however, OSHA requires employers to protect employees from electrical hazards, including arc flash. OSHA issues citations based on the requirements of NFPA 70E through existing Agency regulations.

#### The most common OSHA standards cited for arc flash include:

- 29 CFR 1910.132(d)(1): Requires employers to perform a PPE hazard assessment to determine necessary PPE.
- 29 CFR 1910.332(b)(1): Practices addressed in this standard. Employees must be trained in and familiar with the safety-related work practices required by 1910.331 through 1910.335 that pertain to their respective job assignments.
- 29 CFR 1910.333(b)(2)(iv)(B): A qualified person must use test equipment to test the circuit elements and



that is designed for all-day use and addresses each of the hazards you might encounter, you only need to remember to put it on at the beginning of the day.

Multi-hazard protection is also significantly more convenient than wearing multiple garments. The more PPE you have to put on and take off throughout the day, the more hassles you face and the more time you waste. If wearing multiple protective garments is too great of an inconvenience, it can be tempting to skip wearing one (or even all) of them. Skipping PPE even one time can have serious consequences, and multi-hazard protection helps prevent this temptation. In addition, with a single multi-hazard protective garment, you can use the time you would have spent changing into and out of protective clothing on more productive activities.

Finally, multi-hazard protection is often more comfortable than the alternative. Wearing multiple layers of protective apparel can restrict movement; cause uncomfortable bulkiness; and/or make the wearer too hot. Plus, not all PPE is designed with comfort in mind. Think of the chemical-barrier aprons that are often worn over other workwear. The workwear underneath may be comfortable enough, but in addition to the inherent discomforts of wearing multiple garments, the apron adds a stiff and heavy second layer. It's easy to see how, once again, it could become tempting to skip some or all of the necessary PPE. Workwear that is built for multi-hazard protection is often also designed with comfort in mind, helping to encourage wearer compliance.

### Types of Multi-Hazard Protection

Depending on the hazards present in your workplace, different types of multi-hazard protection may be beneficial. When selecting PPE, be sure to thoroughly assess the hazards in your environment and ensure that the products you select will address those hazards effectively.

As previously mentioned, thermal hazards, such as arc flash or flash fire, are often present in environments where there is also a risk of chemical splash. This combination of hazards is often a concern for those working in laboratories, food processing, machinery and transportation, agriculture, or anywhere else flammable substances or liquid chemicals are present.

Thanks to recent innovations in multi-hazard protection, coveralls and lab coats that combine FR properties with chemical-splash protection (CP) are now available. Not only do these FR/CP products meet the requirements of key industry standards and regulations (such as NFPA 2112, NFPA 45 and OSHA 1910.1450), but they are also comfortable and designed to be worn as all-day attire—helping increase the likelihood that they will be worn consistently and properly.

electrical parts of equipment to which employees will be exposed and must verify that the circuit elements and equipment parts are de-energized.

- 29 CFR 1910.335(a)(1)(i): Employees working in areas where there are potential electrical hazards must be provided with, and must use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.
- 29 CFR 1910.335(a)(1)(iv): Requires employees to wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.
- 29 CFR 1910.335(a)(1)(v): Employees must wear protective equipment for the eyes or face wherever there is the danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.
- 29 CFR 1910.335(a)(2): Employees must use insulated tools or handling equipment if the tools or handling equipment might make contact with such conductors or circuit parts.
- 29 CFR 1910.269(l)(6)(iii): Requires employers to ensure that each employee working at electric power generation, transmission, and distribution facilities who is exposed to the hazards of flames or electric arcs does not wear clothing that could increase the extent of injury to such a hazard.
- 29 CFR 1926.28(a): The employer must require that employees wear appropriate PPE during construction work.

The best way to eliminate the risk of electrical shock or arc flash is to de-energize (turn off) the equipment. However, this is not always possible. Therefore, it is important to understand arc flash and its potential hazards; be able to calculate risk; know the importance of labeling; and implement the proper use of PPE. **WMHS**



Photo courtesy of Workrite Uniform Company

Another common combination involves poor visibility and thermal hazards. This results in a need for both FR and high-visibility protection. Even when it's worn over FR clothing, non-FR, high-visibility workwear can ignite, burn and even melt when exposed to heat and flame, thus endangering the wearer.

However, going without high-visibility clothing can be just as dangerous. Fortunately, FR clothing manufacturers have developed numerous high-visibility FR products that meet the requirements of the ANSI/ISEA 107-2015 Standard for High-Visibility Safety Apparel and Accessories, as well as standards and regulations related to FR protection.

Manufacturers have also developed multi-hazard protective workwear for environments that face the risk of both flash fire and arc flash. Available in a wide selection of styles, these products meet the requirements of both NFPA 2112 and NFPA 70E.

For many workplaces, multi-hazard protection can make a significant difference in safety. And these innovations are only the beginning. **WMHS**

#### **About the author:**

*Mark Saner has served as the FR Technical Manager for Workrite Uniform Company, a brand of VF Corporation (NYSE: VFC), since 2006. He brings 40 years of experience in the fire and safety industries to his work, including 29 years in technical support, safety standards and product development for Akron Brass Manufacturing Company. Mark participates as a voting member within a number of national and international safety organizations to help develop, revise, influence and further improve standards for worker safety.*

*For questions related to safety requirements, product performance and industry standards, contact Mark at 1-800-521-1888 or visit [www.workrite.com](http://www.workrite.com).*

When selecting PPE, be sure to thoroughly assess the hazards in the environment and ensure that the products selected will address those hazards effectively.



# High-Performance FR: Changing the Industrial Market

By: Brad Sipe, Director Business Development, Lakeland Industries



Photo courtesy of Lakeland Industries

There is a movement within the industrial market for flame-retardant (FR) apparel to be more stylish, functional and performance-driven. Workers are transitioning from work to date night, working out or doing chores around the house in their FR—and they are demanding performance. There are more moisture-wicking options for FR fabrics than there are in the consumer market; the problem is, most American workers don't understand the technology.

## What are High-Performance Fabrics?

"High performance" is a term used to describe moisture-wicking technology. These specialized fabrics have been around for over 20 years. They were created to boost an athlete's performance in extreme outdoor situations—keeping them drier

and cooler in hot conditions, and warmer and drier in cold weather. The challenge for many is understanding the science behind the fabric. The world's top athletes wear high-performance fabrics to optimize their performance and have a better concentration on the task in front of them

Moisture wicking's history began with a synthetic fiber (like polyester) with a chemical finish applied to allow moisture to spread. Eventually, the finish would wash out and the fabric lost its wicking abilities. The tag on garments reveal the blend of fibers. A blend of 100% of any fiber, along with claims of moisture wicking, identifies the presence of a chemical finish. Check to see if the manufacture guarantees wicking for the life of the garment: Chances are, they don't.

Today, the next generation of high-performance fabrics have a combination of hydrophobic (water-hating) and hydrophilic (water-loving) fibers. Examples of hydrophobic fibers include modacrylic, aramids and

para-aramids, while hydrophilic fibers include rayon and lyocell. The combination of these two fibers blended together ensures permanent moisture wicking for the life of the garment. The big question then becomes: What is the optimal blend of these two fibers that creates a soft hand, while performing the best?

Data has proven that the optimal blend is when both numbers are closer together, such as a 60/40 blend. This allows for better face (skin side) pick up and transport. If you don't have enough hydrophilic fiber, the fabric won't absorb well; if you don't have enough hydrophobic, the fabric will not push the moisture to the front properly. It is the balance of the blend that creates a high-performance product.



Photo courtesy of Lakeland Industries

Performance fabrics allow for garments to be lighter-weight and for layering to become the norm. Look for a complete layering system, to allow for maximum protection, comfort and performance.

### ARC Rating



Select a garment with the appropriate ARC Rating from your hazard risk analysis.

### Air Permeability



Breathability of the fabric, or air permeability, is important to keep you cool on the job.

### Vertical Moisture Wicking



Vertical moisture wicking measures how well a garment pulls moisture off of your skin into the fabric.

### Transport of Moisture



Transport of moisture refers to a garment's ability to move moisture through the fabric to the outside surface.

### Spread of Moisture



Spread of moisture measures how quickly moisture spreads on the surface. The faster it spreads dictates how quickly you will feel dry.

### Water Vapor Transmission Rate



Water vapor transmission rate measures how quickly moisture dissipates through a garment.

## How to Choose the Right Fabric

When choosing a high-performance, FR fabric based on a number alone, be wary of marketers. Ask for the data, it is available. There are different blends of high-performance fabrics, and they all perform differently. Smart shoppers look at the tags to determine the blend of fabrics and learn what high performance is.

The same high-performance fabrics worn the world's top athletes are available in this market! There must be a blend of hydrophobic and hydrophilic to have permanent moisture wicking. Most consumer performance products are 100% polyester with a finish. Look at the tags, as they reveal everything.

These performance fabrics allow for garments to be lighter-weight and for layering to become the norm. Look for a complete layering system, to allow for maximum protection, comfort and performance. The system must wick moisture throughout each garment, or it will not work.

The last characteristic for a successful FR program is style and fit. Not all fabric is styled alike, and not every manufacturer cuts a garment the same way. Specify the fabric first, then the manufacturer of that fabric. Chances are, your FR program will be less expensive, and your garments will last longer. Your employees—your industrial athletes—will be more comfortable, better protected and more focused on the task in front of them. **WMHS**



Photo courtesy of Lakeland Industries

Today, the next generation of high-performance fabrics have a combination of hydrophobic (water-hating) and hydrophilic (water-loving) fibers.

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