COMPLIANCE BRIEF

PROTECTING YOUR WORKERS FROM FLAMES AND ARC FLASHES



Did you know that flame-resistant (FR) clothing is a special kind of personal protective equipment (PPE) your workers must wear to protect themselves from certain hazards such as electrical arc flashes and flash fires? **Certain fabrics, like acetate, nylon, polyester, rayon, or other synthetic materials, may melt and burn, causing them to stick to your worker's skin during an arc flash or blast, flash fires, or during a fire event while handling flammable liquids.**

Remember that FR clothing isn't fireproof. It's fire-resistant until it isn't. It won't melt or stick to workers' skin like non-FR clothing. Under the right heat and conditions, FR clothing will eventually burn. FR clothing has an arc rating that is measured by the amount of heat the FR fabric blocks. The FR rating is the number of calories the garment is expected to absorb.

A calorie is a unit of measure of the heat energy from a flash fire or an arc flash or blast. The higher the calorie number, the greater the protection of the FR clothing. Workers' FR clothing must have a higher rating than the calorie rating of heat generated.



Arc Ratings

The Arc Rating is measured in calories/cm² and determines how many calories of energy the garment can withstand from an arc flash. Arc Rating is defined as the amount of energy a material can withstand before a 50% likelihood of the onset of second-degree burn through the fabric.

Category	Required Minimum Arc Rating cal/cm²
1	4
2	8

WHY DO EMPLOYERS NEED TO PROVIDE FR CLOTHING?

Flame-resistant (FR) and arc-rated (AR) clothing are used by workers in general industry and construction where exposure to flash fires exist. OSHA's 29 CFR 1910 general industry standards apply to work that isn't construction, maritime, or agriculture work. Things like making repairs, alterations, painting, and decorating fall under OSHA's 29 CFR 1926 construction standards.

The OSHA PPE rules for construction, 1926.28, and for general industry, 1910.132, state employers are responsible for requiring employees to wear appropriate PPE in all operations where there is an exposure to hazardous conditions, or there is a need for such equipment to reduce those hazards. This would include providing FR and AR apparel to workers exposed to flash fires.

You're required to provide workers with a hazard-free work environment. When you cannot eliminate a hazard, such as a flash fire, by engineering or administrative methods, PPE must be provided, used, and maintained in a sanitary and reliable condition.

WHAT IS AN ARC FLASH?

Electrical equipment failures cause arc flashes (like a short circuit) or human error (such as holding a metal object too close to energized equipment). If two energized points are not contacting each other solidly, the current can jump from one point to the other. This is called an electric arc or arc flash.

A mixture of flammable or combustible air is ignited during a flash fire, causing a rapidly expanding fire. Unlike a flash fire, an electric arc can begin and end in less than a second. Workers see a flash and hear an extremely loud boom, and it is over.



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WHY IS AN ARC FLASH HAZARDOUS TO YOUR WORKERS?

The arc immediately turns the electrical conductors into molten metal droplets that fly away from the source at near the speed of sound during an arc blast. These projectiles can travel quite a distance, starting clothing and other materials on fire that isn't FR-rated.

A person can be severely injured or killed by the arc's huge amount of heat. The temperature of the arc can range from 15,000 to 35,000 degrees F. (Heat in excess of 122 degrees F can cause third-degree burns, which do not heal.) Imagine what this heat can do to the human body.

THE TEMPERATURE OF THE ARC CAN RANGE FROM 15,000 TO 35,000 ° F

WHAT IS AN ARC BLAST?

An arc blast is the pressure wave created after an arc flash. Extremely high-energy arc blasts can damage equipment, causing the fragmented metal to fly in all directions. Even low-energy blasts can cause violent atmospheric explosions that contain explosive gases, vapors, or combustible dust.

Workers' clothing can catch fire, too, if they're not wearing FR clothing. Materials stored nearby can also start on fire. Violent blast waves can throw employees working nearby away from the arc. This wave is so strong it can even break eardrums and cause concussions and broken bones.



WHY DO YOU NEED TO PAY FOR FR CLOTHING?

The payment provisions in OSHA's general rule on PPE start with the requirement that employers must pay for the PPE that employees use to comply with OSHA standards. If a particular item is not PPE, or if OSHA standards do not require it, you don't need to pay for it.

If you've determined your workers must wear FR clothing, you must pay for it. OSHA's general PPE rule includes some payment exceptions based on the type of PPE.

The first exception addresses non-specialty prescription safety eyewear and non-specialty safety-toe protective footwear. The second exception relates to metatarsal protection. A third exception is for logging boots. And the fourth exception relates to everyday clothing.



WHAT ARE FLAMMABLE LIQUIDS?

A flammable liquid is a liquid that ignites easily and burns quickly. Once ignited, flammable liquids burn intensely, are explosive under specific conditions, and can spread rapidly. Gasoline, acetone, lacquer, or thinner are examples of flammable liquids.

The flash point is the temperature at which a liquid produces enough vapors to be ignited. More than any other factor, the flash point determines the flammability hazard of a liquid – the lower the flash point, the more flammable the material.

Employers with workers using flammable liquids should also determine if protective apparel such as FR clothing is necessary while performing their PPE assessment.

DO WORKERS IN THE OIL AND GAS INDUSTRY NEED TO WEAR FR CLOTHING?

Workers in the oil and gas industry do need to wear FR clothing when exposed to arc flashes, blasts, and flash fires. Static electricity is created when flammable liquids flow through pipelines or between containers. A flash fire or explosion can occur in the presence of an ignition source.



Oil and gas pipelines are subject to arc flash and blast potential.

WHAT OSHA STANDARDS REQUIRE EMPLOYERS TO PROVIDE FR CLOTHING?

OSHA 1910.269, ***Electric power generation, transmission, and distribution*** (269 standard), requires that employees exposed to hazards from flames or electric arcs in the power generation, transmission, and distribution industry must not wear clothing that could ignite and continue to burn or that could melt onto their skin when exposed to flames or heat energy.

OSHA's general industry welding standard 1910.252, ***Welding, Cutting and Brazing***, requires employers to provide workers protective clothing, such as FR clothing, when exposed to flash fires during welding operations. Similarly, employers in the construction industry would provide workers similar FR-rated protective clothing per 1926.28 – after determining workers' exposure to flash fire during welding activities.

OSHA also recognizes ***National Fire Protection Association (NFPA) standards such as NFPA 2112, National Fire Protection Association Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire***. If your workers are exposed to arc flash hazards, they'll need both FR and Arc-rated (AR) clothing. For flame-resistant clothing only, FR-rated clothing would be sufficient.

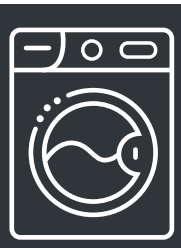
NFPA 70E, ***Standard for Electrical Safety Requirements for Employee Workplaces***, is a voluntary consensus standard employers commonly reference for protection from arc flash hazards. OSHA doesn't adopt NFPA 70E or NFPA 2112. Remember that AR clothing is also FR-rated but not vice versa. FR-rated clothing isn't usually AR-rated.

WHAT TRAINING TIPS CAN EMPLOYERS FOLLOW FOR WORKERS WEARING FR CLOTHING?

You should provide instructions about safely wearing and removing FR clothing employees use in the workplace. Workers must understand and follow these instructions to maximize the protection of their protective apparel.

Instruct your employees to follow laundry care instructions provided by the manufacturer to avoid damaging the fabric's protective properties. For example, certain detergents and softeners can clog the fabric, reducing its fire-resistant capacity.

In summary, perform a workplace assessment to determine if your employees have exposure to arc flash and flash fire hazards. If they do, provide them with properly rated protective clothing that will protect them from injury during a flash fire or arc blast event.



Certain detergents and softeners can clog the fabric, reducing its fire-resistant capacity.



RAY CHISHTI, EDITOR, J. J. KELLER & ASSOCIATES, INC.

Ray Chishti joined J. J. Keller in 2017 as a Workplace Safety Editor. He has 15 years of EH&S experience in a variety of industries, including EPC projects, construction, railway, fossil fuel power plants, gas distribution and transmission, electrical transmission, and retail. His experience includes working knowledge in OSHA safety, environmental, HR, workers' compensation, and DOT topics. As a safety professional, his previous roles included auditing and leadership positions with new construction, existing facilities, and large EPC projects valued between one million and two billion dollars. His experience includes positions within law enforcement as a police officer and fraud specialist.

His degrees include a Bachelor of Arts (BA) in Law Enforcement, a Master of Business Administration (MBA), and a Juris Doctor (JD) – with a certificate in Occupational Safety and Health. Ray also participated as an intern in his law school's Innocence Project – part of the Innocence Network, which has been credited with the release of over 350 wrongfully convicted prisoners, mainly through the use of DNA testing. His training in environmental, health, safety, and DOT topics includes certifications as a construction and general industry OSHA Outreach Instructor, in root cause analysis (Sologic), basic first aid, CPR, and AED use.



Protect Your Workers From Arc Flashes and Flash Fires With J. J. Keller® SAFEGEAR® FR Apparel

We've teamed up with recognized apparel brand DRIFIRE® FR to bring you a wide selection of Category 1 and 2 flame-resistant (FR)/ arc-rated (AR) clothing, from base layers to coveralls and jeans. With advanced, proprietary fabrics designed for breathability and comfort, your workers will find it easy to wear it all day long!

Visit JJKeller.com/SAFEGEAR | Call 800-327-6868

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