

How to Properly Care for Flame-Resistant Garments

BY HUGH HOAGLAND



Here's a comprehensive look at different welding workwear, ranging from leather to carbonized material blends, and what it takes to make them last longer

Following manufacturer's laundering instructions for special safety-oriented workwear, such as this Walls® FR™ welding shirt and denim jeans, is required to maintain protective qualities. (Photo © Walls FR Workwear.)

Welding clothing has come a long way in the past 40 years.

Previously, welders wore the same protective clothing as other trades workers. The mind set was, "If leather is good enough for the blacksmith, it's good enough for the welder."

Thankfully, those days are gone.

Importance of Wearing the Appropriate Attire

Steel mills rarely use leather protection anymore unless it is in conjunction with other clothing materials. For secondary protection, new materials are coming to light all the time. Aluminized fabric is com-

mon, and many new materials are now used in the welding trade, each requiring special care. It is essential to follow the manufacturer's care instructions precisely, which vary from garment to garment.

Another big change for welders is recognition of the hazards of electric arc ignition of clothing in the National Fire Protection Association's standard NFPA 70E, which means that it's been discovered that there is danger to the wearer, regardless of who is performing the task. This indicates the need for personal protective equipment (PPE) on the job, because welders have been killed operating disconnects and plugging in welding equipment. NFPA 70E requires flame-resistant clothing at a weight of HRC 2

(8 cal/cm²) for such tasks.

Fortunately, this common welding clothing weight increases workers' safety. The welding arc is of much lower intensity and is more predictable than the arc from the electrical feed. So welders who weren't previously required to wear flame-resistant (FR) clothing now have to do so while operating disconnects or plugging in welding equipment.

Though some companies are finding engineering methods to reduce potential arc flash energy from connecting welding plugs and operation of disconnects, no arc flash specialist worth his or her salt recommends anything less than daily FR wear. This kind of protective clothing prevents ignition, and in the vast majority of

HUGH HOAGLAND (hugh@arcwear.com) tests electric arc clothing and personal protective equipment in his companies ArcWear.com and e-Hazard.com, Louisville, Ky., along with providing training and hazard assessment services. For more information on Walls FR Protective Workwear, Cleburne, Tex., visit www.walls.com or call Sandy Finkelstein at (800) 433-1765.

the cases, eliminates fatalities and often severe injuries.

Therefore, it's vitally important to take proper care of these potentially lifesaving garments in order to maintain their protective qualities.

Mark Saner, technical manager for Workrite Uniform Co., said, "Proper care of FR garments is an important part of any FR clothing program. Workrite's broad range of customers successfully use both home and commercial laundering to clean their FR clothing."

Another national FR expert, vice president and general manager of Walls FR Workwear, Sandy Finkelstein, notes that the most critical thing for properly cleaning protective clothing is to precisely follow the laundering instructions on the garment. "At Walls, we have done a great deal of research on FR fabric care, and we strive to make sure protective garment instructions are clear and easy to follow," said Finkelstein.

Rules to Follow for Various Types of Materials

To maintain safety garment integrity, the following general laundering guidelines are recommended, but the best plan is to always follow the manufacturer's garment care information carefully.

Aluminized Clothing

The heat reflective ability of aluminized clothing can be reduced when the garment is stained or soiled, but can usually be cleaned with a light detergent. (Aluminized PPE is used for high splatter welding, but other materials are becoming more common in the workplace.) Lou Ott of Gentex, a large supplier of aluminized materials, suggests the following to ensure protective qualities of reflective clothing:

- Do not store the garment wet or with any chemical contaminants.
- Store clothing on hangers, with ample hanging space to prevent the fabrics from creasing or cracking. If folded, the folds should be loose on aluminized garments. Do not sit on a folded garment.
- Sponge off dirt and soot by using mild soap and water. Dry aluminum surfaces with a clean dry cloth. Rub gently to avoid removing the aluminum.
- Grease stains can normally be removed with dry cleaning solvents. (Note: Isopropanol or perchloroethylene will react with the metal in proximity suits, and may etch the aluminum surface.) After using solvents, clean the clothing with water and wipe dry. Allow the garment to hang in a ventilated location at room temperature until dry.
- Do not machine wash.

Tips for Cleaning Protective Garments at Home

Sandy Finkelstein of Walls FR offers the following "Dos and Don'ts for Protective Garment Home Laundering," which concur with the most common recommendations in the industry:

Don't

- Use fabric softener on FR garments in the washer. (Acts as a fuel.)
- Use fabric softener sheets in the clothes dryer. (Acts as a fuel.)
- Use bleach on FR garments. (Can destroy fabric integrity.)
- Wear garments that are grossly contaminated by oils, paints, solvents, or chemicals that leave a combustible residue on the fabric.
- Apply insect repellents containing DEET to garments. (Acts as a fuel.)
- Apply any chemicals directly to the FR garment, including spray starch.

Do

- Wash FR clothing separate from the home laundry to avoid transferring contaminants or non-FR fibers to the FR garment. This form of hydrocarbon loading may decrease protective value of the garment. (No documented government study is currently available, but one company's internal anecdotal research is commonly cited that states protection is reduced by about 3% when FR garments are laundered with non-FR cotton clothing.)
- Use warm water and any liquid or dry detergent that does not contain bleach.
- Dry the garment on medium or low heat.
- Launder the garments when they become visibly contaminated with any grease, oil, hydraulic fluid, petroleum product, paint, or chemical.
- Follow manufacturer's washing instructions printed on the garment's label.

- Hang the garment to dry in a well-shaded area with good air circulation; use fans if necessary.
- Do not use cleaners containing ammonia, chlorine, or abrasive agents.

Wool and Wool Blends

Wool and wool blends are the most common materials used in the aluminum industry. A. J. Charnaud, Inc.'s ALU-SAFE®, Oasis™ from TenCate (formerly Southern Mills), and PR97™ from Melba Industries are types of fabrics for protection from aluminum. These materials are secondary protection for potential splash or are worn under primary garments, and may be used for welding especially when welders are working in the vicinity of molten aluminum. The garments made from these fabrics are much more comfortable than those of old but do require special care. Unlike most protective garments, it is acceptable to launder wool garments with soap and dry them at lower temperatures.

Leather

While use of leather is still common (in whole or in part), leather has issues regarding comfort and weight. Using leather in high wear areas can make sense, but the individual welder may find better materials depending on the work situation and practices. From an arc- or flame-resist-

ance perspective, the leather should be kept free of oils.

Undergarments

Certain types of undergarments can make a slag incident very dangerous. Newer "wicking" materials melt and are not usually recommended. In fact, they are banned if made of polyester, nylon, acetate, polypropylene, polyethylene, or other melting fibers, unless these materials are arc or flash fire-rated under the American Society for Testing and Materials (ASTM) International's ASTM F1506, *Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards*, or NFPA 2112, *Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire*.

Flame-Resistant Cotton

While flame-resistant cotton has long been a staple of welding clothing, old-fashioned and lower cost cotton today may actually be dangerous. Though they may pass a flame low level flame test, if they do not meet ASTM F1506 or NFPA 2112, they are not guaranteed for the life of the garment and the FR may wash out in as little as 25 washings.

Special care by the end user needs to

be exercised when using FR cottons. Most "welding greens" (a common term for FR treated cottons used in welding, often green dyed to avoid worker pilfering) claim flame resistance for 25 washes, but this is a very low level flame resistance. If they meet the previously mentioned standards, they should last for more than 25 washings, but it's far safer and better to choose something with compliance to 100 washings. Note: "Welding greens" may be appropriate for welding, but not for electric arc and may not comply with NFPA 70E. Check the garment label for an arc rating, which is a good indication they have been properly tested.

FR Cotton/Nylon

Flame-resistant cotton/nylon is commonly referred to as ⁸⁸/₁₂ blends. Three materials on the market today meet the 100 wash test requirement for flame resistance: Walls FR Itex BanWear; Indura UltraSoft® by Workrite Uniform (and others); and ammonia-free FR material from Milliken Amplitude, also available from Workrite. BanWear and Indura UltraSoft are providers in the steel and many other industries for arc-rated materials that are commonly used for welding clothing, in conjunction with sleeves made of other materials. These blends also need special care.

Initially they cost about 20% more than other materials, but many of these blends have twice the wear life, which is a real savings to the end user.

Carbonized Material Blends

CarbonX®, Carbtex, and other carbonized material blends have the advantage of being flame resistant, arc rated, and a great shedder of most molten metals. Some of these materials are more commonly used in undergarments, but one General Motors job site replaced regular FR cotton coverall sleeves with Carbtex ones sewn on in the place of the cotton. This eliminated the need for wearing extra sleeves over the regular garment. The Carbtex sleeves won an R&D 100 Award and increased worker comfort and compliance, because donning the new coverall means the protective sleeves are always on the worker without the added weight of an oversleeve.

Kevlar® and Twaron® are commonly used in blends for welding clothing but not normally alone, because metal sticks to aramids alone. For welding, most companies avoid Nomex®, Conex, PBI, and other aramid materials, even though they are very flame resistant. Some blends, however, do have unique properties, so consider ones like Lenzing/Twaron, CarbonX/Twaron, Lenzing/Kevlar, Cot-

ton/Kevlar, CarbonX/Kevlar, and Carbtex/Kevlar, commonly used in welding materials under name brands like Tuffweld®, CarbonX, and Carbtex. These materials need little special care. Simply follow the ASTM standards mentioned in the next section or the manufacturer's instructions for laundering and care.

Washing Outfits Correctly

ASTM has long had a standard for industrial laundering of FR garments (initially proposed by the Industrial Laundering Association), and a new universal standard for home laundering is in the final stages. Many users choose an industrial launderer for convenience, ease of use, and peace of mind, but this isn't always necessary. Flame-resistant or arc-rated garments are normally guaranteed for the life of the garment, and home laundering has been shown to be effective in maintaining the integrity of the garment's flame and arc resistance.

The proposed *Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal and Arc Resistant Clothing* will give guidance for home laundering and common advice most workers need to know when home laundering. This standard is facing a final vote in ASTM F23, which is the ruling committee for the industrial laundering standard ASTM F1449 - 08, *Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing*.

Employers should consider the National Institute for Occupational Safety and Health (NIOSH) recommendations on clothing soiled with hazardous chemicals at work. Hazardous chemical clothing is usually laundered by the employer; or, if washed at home, is recommended to be laundered separately from the family wash. Some companies choose industrial or on-site laundering to limit liability, and some chemicals are too hazardous to ever take home. The industrial hygiene or safety department makes this determination in most companies. But home laundering is more common than industrial so proper evaluation of the work site soils is critical as well as employee training.

The proposed ASTM *Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal and Arc Resistant Clothing* will likely be approved in the next round of ASTM meetings, but until this is available, most companies use manufacturer's recommendations.

Final Point

Following these instructions should give America's welders the arc and flame resistance they need for safety and extend the life of their garments.◆