FR and AR Clothing Standards: A Guide for Employers

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Flame resistant and arc-rated clothing is required by OSHA in a wide range of industrial environments — electrical work, oil and gas, utilities, chemical processing, and others. But the standards governing this clothing are often misunderstood, and the terminology is used inconsistently enough to cause real compliance problems.

FR and AR are not the same thing. NFPA 70E and NFPA 2112 are not interchangeable. A cal/cm² rating and a hazard risk category are related but distinct. Getting these right matters — not just for compliance, but for the protection of workers who depend on the clothing to perform under extreme conditions.

This guide covers the key standards, the difference between FR and AR clothing, PPE categories under NFPA 70E, how to select the right clothing for your workforce, and what to look for when specifying and purchasing FR/AR garments.

FR vs. AR: Understanding the Distinction

The terms flame resistant and arc-rated are frequently used as if they mean the same thing. They don't — and the difference has direct implications for compliance and worker safety.

Flame Resistant (FR) clothing is designed to self-extinguish when exposed to flame or thermal energy. It will not melt, drip, or continue to burn after the ignition source is removed. This is the baseline property that all protective thermal clothing must have. FR clothing is governed primarily by NFPA 2112 (for flash fire environments) and ASTM F1506 (for arc flash garments).

Arc-Rated (AR) clothing is a subset of FR clothing. All AR clothing is FR, but not all FR clothing is AR. What makes AR clothing distinct is that it has been tested specifically for arc flash incident energy and carries a documented arc rating — expressed in calories per square centimeter (cal/cm²). That rating is the maximum incident energy the garment can absorb while still protecting the wearer from second-degree burns.

	FR (Flame Resistant)	AR (Arc Rated)
What it means	Self-extinguishes; will not melt or drip	FR + tested for arc flash energy; carries a cal/cm² rating
Governing standard	NFPA 2112, ASTM F1506	NFPA 70E, ASTM F1506
Protects against	Flash fire, thermal exposure	Arc flash incident energy
Has cal/cm² arc rating?	Not necessarily	Yes — required
Use case	Oil & gas, petrochemical, wildland fire	Electrical work, utilities, industrial maintenance

Employer compliance note

NFPA 70E requires arc-rated clothing for workers exposed to arc flash hazards — not just flame-resistant clothing. Specifying FR clothing without an arc rating does not satisfy NFPA 70E requirements for electrical work. Verify the label: compliant AR garments will show an arc rating in cal/cm² and reference ASTM F1506.

The Standards That Matter

NFPA 70E — Standard for Electrical Safety in the Workplace

NFPA 70E is the primary standard governing electrical safety in the workplace, including arc flash PPE requirements. It is updated on a three-year cycle and is the standard most commonly referenced in OSHA enforcement for electrical hazard protection.

Under NFPA 70E, employers are required to conduct an arc flash risk assessment, establish arc flash boundaries, and specify PPE — including arc-rated clothing — based on the incident energy levels present at each piece of equipment. The standard establishes four PPE categories, each with a minimum arc rating in cal/cm².

The 2018 revision of NFPA 70E replaced the older Hazard Risk Category (HRC) system with PPE Categories. The categories are numbered the same (1 through 4), but the revised framework places greater emphasis on the incident energy analysis method over table-based selection. Both methods remain permissible, but incident energy analysis is considered more precise.

NFPA 2112 — Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

NFPA 2112 governs flame-resistant clothing used in flash fire environments — primarily oil and gas, petrochemical, refining, and chemical processing. Flash fire is a different hazard from arc flash: it involves a rapid, engulfing flame wave rather than an explosive electrical discharge.

Garments certified to NFPA 2112 must pass a test using an instrumented mannequin exposed to a defined flash fire exposure. The standard specifies maximum predicted body burn percentages and requires that the garment not break open, melt, or drip. NFPA 2112 compliance does not mean the garment carries an arc rating — these are separate certifications for separate hazards.

ASTM F1506 — Performance Specification for Flame Resistant and Arc-Rated Textile Materials

ASTM F1506 is the performance specification that arc-rated garments must meet under NFPA 70E. It covers fabric flammability, arc rating, and labeling requirements. Any garment used to satisfy NFPA 70E arc flash PPE requirements must be labeled in accordance with ASTM F1506, including the arc rating (ATPV or EBT) in cal/cm².

Understanding Arc Ratings: ATPV and EBT

Arc-rated garments carry one of two values to express their protective performance: ATPV (Arc Thermal Performance Value) or EBT (Energy Breakopen Threshold). Both are expressed in

cal/cm² and represent the maximum incident energy the garment can handle while still providing protection from second-degree burns.

ATPV is the incident energy level at which there is a 50% probability that the wearer would sustain a second-degree burn through the garment. Lower ATPV values mean less protection.

EBT is the incident energy level at which there is a 50% probability that the fabric will break open — creating a hole — before the wearer would sustain a second-degree burn. EBT is used when breakopen occurs at a lower energy level than the burn threshold.

In practice, the arc rating on the garment label is whichever of these two values is lower. When selecting PPE to meet a specific PPE category minimum, the arc rating — whether ATPV or EBT — must meet or exceed the category requirement.

NFPA 70E PPE Categories

NFPA 70E's table-based method organizes arc flash PPE requirements into four categories based on the type of electrical equipment and the task being performed. Each category specifies a minimum arc rating for clothing and identifies the additional PPE required.

Category	Min. Arc Rating	Example Tasks	Minimum Clothing
CAT 1	4 cal/cm² min	Inspecting energized equipment, reading meters	FR shirt and pants or FR coverall
CAT 2	8 cal/cm² min	Working on exposed conductors, panelboard work	FR shirt and pants, arc-rated face shield
CAT 3	25 cal/cm² min	Work on switchgear, some MCC tasks	CAT 2 PPE + arc flash suit
CAT 4	40 cal/cm² min	High-energy switchgear, transformer work	CAT 2 PPE + higher-rated arc flash suit

> **Important: layering counts**
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> Arc ratings are additive when garments are layered correctly. An FR base layer worn under an arc-rated shirt increases the total system arc rating. However, only clothing tested and labeled as arc-rated counts toward meeting PPE category minimums — standard clothing worn underneath does not add to the system rating and can actually increase burn risk if it melts.

Inherent FR vs. Treated FR Fabrics

FR clothing falls into two construction categories: inherent FR and treated FR. Understanding the difference matters for purchasing decisions, wash care compliance, and long-term performance.

Inherent FR

Inherent FR fabrics are flame resistant because of the chemistry of the fiber itself — not because of a chemical treatment applied afterward. Common inherent FR fibers include Nomex, Kevlar, and modacrylic blends. The FR property cannot be washed out or worn away because it is part of the fiber structure.

Inherent FR garments typically have a higher initial cost but offer consistent, lifelong protection as long as the garment is structurally intact. They are common in high-risk environments where reliability over time is the priority.

Treated FR

Treated FR fabrics start as standard fibers — typically cotton — and are treated with flame-resistant chemistry during manufacturing. The FR properties are durable but can be compromised by incorrect laundering. Specifically, bleach, non-FR detergents with optical brighteners, and heavy fabric softeners can degrade the treatment over time.

Treated FR garments generally have a lower initial cost and are widely used across construction, utilities, and oil and gas. Proper care is essential to maintaining certification throughout the garment's service life.

- Never launder FR clothing with bleach — it degrades both treated and some inherent FR fibers.
- Avoid fabric softener — it coats fibers and can reduce the effectiveness of FR treatments.
- Use detergents without optical brighteners (UV-reactive whitening agents) — these can affect the surface chemistry of treated FR fabrics.
- Follow the garment's specific care label. Many FR manufacturers provide detailed laundering instructions tied to maintaining certification.

Contamination voids protection

FR clothing contaminated with flammable substances — fuel, oil, solvents — must be removed and laundered before re-use. A contaminated FR garment can burn and cause severe injury even if the fabric itself is certified. Employers should include contamination protocols in their FR clothing program.

Building an FR Clothing Program: What Employers Need to Do

OSHA 29 CFR 1910.269 (electric power generation and transmission) and 29 CFR 1910.132 (personal protective equipment — general industry) both create obligations around FR/AR clothing. NFPA 70E provides the technical framework most commonly used to meet those obligations for electrical work. For oil and gas, API RP 2218 and NFPA 2112 set the expectations.

A compliant FR clothing program typically requires:

- A documented hazard analysis identifying arc flash and/or flash fire exposures by work area and task.
- Specification of FR/AR clothing that meets or exceeds the arc rating or thermal protection requirements for each identified hazard.

- A written PPE program covering selection, issuance, inspection, care, and replacement of FR garments.
- Worker training on the purpose of FR clothing, its limitations, proper wear, and care requirements.
- A process for removing and replacing damaged, contaminated, or worn garments that no longer meet performance requirements.

Reading the Garment Label

Compliant FR and AR garments carry specific label information required by ASTM F1506 and the relevant NFPA standard. Before purchasing or issuing FR clothing, confirm the label includes:

- Arc rating in cal/cm² (ATPV or EBT) for AR-rated garments
- Reference to ASTM F1506 or NFPA 2112 compliance
- Fiber content and fabric weight
- Care instructions specific to maintaining FR properties
- Manufacturer name and country of origin

A garment described as “flame resistant” or “FR” without a cal/cm² arc rating does not meet NFPA 70E PPE category requirements for arc flash protection. When in doubt, ask for the test documentation.

FR and AR Clothing Brands We Carry

Work ’n More stocks FR and AR-rated clothing from brands trusted in electrical, industrial, and oil and gas environments.

- **Carhartt** FR line covers shirts, pants, coveralls, and outerwear in both inherent and treated constructions. Widely used in construction, utilities, and industrial maintenance.
- **Portwest** Broad FR/AR range including NFPA 2112 and NFPA 70E compliant garments. Strong value for employers outfitting larger crews across multiple exposure categories.
- **Bulwark** Broad FR/AR range including NFPA 2112 and NFPA 70E compliant garments. Strong value for employers outfitting larger crews across multiple exposure categories.
- **Radians** FR clothing with hi-vis options for workers who need both arc flash or flash fire protection and ANSI 107 compliant visibility. Common in utilities and road construction.

Work ’n More also supports employer purchasing programs for FR clothing — standardized SKUs, bulk ordering, and allowance program management across multiple locations. Contact us to discuss a program for your organization.