

Hybrid PPE Solutions

By Jim Pollard

Confusing is how most consumers would describe the flood of new products entering the personal protective equipment (PPE) market. Though the options available may be overwhelming, we must appreciate the many advances in arc rated FR PPE. Not only has the available PPE technology grown by leaps and bounds but our understanding of Workplace Electrical Safety in Canada has also grown. Our renewed education and increased awareness of electrical hazard identification have uncovered some significant gaps in our current level of protection.

The need to upgrade existing flame resistant (FR) coveralls to arc rated compliant solutions has been identified by many employers with both hydrocarbon and electrical hazards present in their work environments. For decades now the most popular FR fabric has provided adequate protection from the risk of flash fires, but falls short on the required thermal protection from an electric arc flash. Approximately 70% of the electrical work tasks being performed by workers today have been quantified as requiring a minimum arc rating of 8 cal/cm^2 (or HRC2 & HRC2* if using the CSA Z462 Table Method of arc flash hazard analysis) protection or equivalent, leaving many workers under protected. In the more established FR markets here in Canada, many workers are currently wearing a meta-aramid based inherently flame resistant solution offering an arc rating less than 6 cal/cm^2 ATPV (Arc Thermal Performance Value) protection. Wearing this type of protection has become a rule of thumb in industries such as oil & gas and petrochemicals. CSA Z462-08 states that HRC2 & HRC2* require protection with a minimum arc rating of 8 cal/cm^2 . The need to upgrade insufficient arc rated



fabrics is most prevalent when a wide variety of workers are performing job tasks that put them at risk to an arc flash exposure – operators, technicians and maintenance. Many of these workers are considered part of the “general population” and are often overlooked when companies roll out an electrical specific PPE program for the electrical communities only.

A variety of hybrid solutions are now available which offer great protection for both flash fires and arc flash. All of the acceptable fabrics demonstrate both low percentage body area burn results

(as per ASTM F1930 (NFPA 2112)) and sufficient arc ratings (using ASTM F1959 (CSA Z462)) above 8 cal/cm^2 . The latest technologies available on the market are constructed with inherently flame resistant (IFR) fabrics. These hybrid solutions offer both pros and cons. The PPE that you select should be designed for your specific application(s). One important variable for you to consider is how often the PPE is used: More frequent users will benefit from the lighter weights, ease of care and life cycle value of IFR options, while less frequent users would benefit

from the lower initial cost of flame retardant treated (FRT) fabrics. If you compare the garments constructed of IFR technologies and the FRT fabrics, you should consider the following characteristics:

- Weight (measured in ounces per square yard)
- Comfort (measured best through a wear trial by your workers)
- Launderability (FR treated fabric is sensitive to most chemicals)
- Durability (tensile strength, tear resistance)
- Breathability (affects the worker's ability to control body heat)
- Wickability (moisture transfer)
- Life cycle value (the overall cost of your electrical safety PPE program)

Once you have narrowed down your selection to only a few eligible fabrics consider performing the following exercises before making your final decision:

- 1) Protection and weight are two fundamental characteristics of arc rated fabrics, and the most commonly discussed. Workers typically perceive the weight of their garment as having the greatest influence when describing personal comfort. Selecting PPE by weight and protection can often be a confusing task. Instead of comparing these characteristics independently of each other, divide the arc rating (cal/cm^2) by the weight (oz/yd^2). The higher the result the better; each unit of weight offers a level of protection. This exercise is known as the protection by weight ratio.
- 2) A typical procurement method such as requesting three or more bids and making your decision based on the initial cost is misleading. The overall cost of your electrical specific PPE program is best determined by the cost per day. The upfront cost of IFR fabrics compared to FRT fabrics will differ substantially. IFR fabrics can provide up to 300% longer wear life when compared to FRT fabric alternatives. Therefore making your decision based only on the initial cost is difficult. The true cost of your PPE can be determined by dividing the up front cost by the expected wear life, or by the number of expected industrial laundering

cycles. The lower per day cost the better, and ultimately your best capital investment.

With increased awareness of electrical hazards such as arc flash, industry in Canada is now beginning to grasp the term "electrical specific PPE". Beyond the fabric deficiencies of some antiquated FR technologies is the realization of specific design features that are important for protection from electrical hazards. Many garments currently being used by workers today have design features that are inconsistent with the electrical safety standards and the arc flash and shock hazards, including conductive material such as metal snaps and metal zippers either exposed or easily exposed, pass through pockets, non-FR stitching, non-FR identification tags, non-FR heraldry including logos and name patches. Safer alternatives exist that can be used in the garment's construction to prevent the potential of any part of the worker's PPE further contributing to a skin burn injury or electric shock. Replace the brass zippers with high temperature plastic, or use FR hook & loop closures rather than metal snaps. FR thread should be used to embroider your corporate logo or worker's name. Electrical specific PPE has been designed to protect workers from electrical hazards such as arc flash and shock, not simply carried over from a previous FR garment now being marketed towards electrical safety. Just because a garment carries a label with an arc rating does not mean that the garment is appropriate for arc flash protection if it has design deficiencies.

There is a new standard for finished good manufacturers (ASTM F2621) to demonstrate the effectiveness of their products "as sold". At present, this standard is not a requirement by CSA Z462 or NFPA 70E, so it will be the responsibility of the consumer to demand the garment manufacturer to complete this testing.

When selecting a new hybrid coverall, or any arc flash PPE, never sacrifice weight or comfort for protection without first investigating all of the available fabric options that meet the criteria required to protect your workers. One of the common mistakes being made while selecting arc flash PPE is adding an

unknown "safety buffer" which often results in a fabric that is heavier than required. While the intention is good, if you have completed an incident energy analysis (e.g. arc flash hazard analysis), this data will enable you to make a more educated selection based on skin burn probabilities. When the fabric is tested to determine the arc rating, probabilities are established from 5% up to 90% of your worker receiving enough heat transfer to create the onset of a 2nd degree skin burn injury (based on the Stoll Curve). Existing standards dictate that the garment manufacturer must label the 50% probability point, which then becomes the arc rating. An alternative selection method exists that allows you to select PPE with a lower 2nd degree skin burn injury probability based on actual laboratory testing documentation (ASTM F1959). The Oberon Company's BIRG (burn injury reduction guide) is one example of using the data collected from the laboratory to help consumers select PPE based on a 5% probability, versus a flip of a coin chance of your worker receiving a 2nd degree skin burn injury. If you are basing your PPE selection on Hazard/Risk Categories (CSA Z462-08, Clause 4.3.3.3.3 Table Method of arc flash hazard analysis), then you can select a fabric offering the minimum arc rating required at the 5% probability point. This is an educated "safety buffer".

The PPE that you decide to provide for your workers should cover all of the applicable hazards as identified in your work environment. The last step to electrical specific PPE compliance is to contact your industry resources and select electrical specific PPE systems as per CSA Z462 methods. Reach out to your local distributor and ask them to demonstrate the latest available technologies. Initiate a wear trial to engage the workers and solicit their feedback. Search out samples and new options as more and more are just around the corner. ⚠

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