

New options for arc flash PPE for thermal imaging

Application Note

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At Shermco Industries, Inc. we have several certified infrared thermographers, all of whom hate wearing the personal protective equipment (PPE) required by the NFPA 70E, “Standard for Electrical Safety in the Workplace.” This is understandable. Most of the complaints are centered around the lack of visibility and restriction of movement created by the PPE.

Often we hear technicians saying things like, “We aren’t doing anything that could create an arc flash” or “I can’t do my job wearing all of this equipment”. To some degree, these are valid concerns. Mobility and vision are limited by arc flash PPE, however, newer-generation PPE has made improvements in both areas.

Changes to arc flash PPE

Figures 1 and 2 shows slide from a presentation at the 2006 IEEE/IAS/Electrical Safety Workshop by Dr. Tom Neal¹.

Figures 1 and 2 show how newer PPE systems have reduced fabric weight and improved light transmission through face shields. While PPE is expensive, these kind of benefits make keeping your PPE up-to-date worthwhile.

Arc flash analysis

In the NFPA 70E, Article 110.8(B)(1) states, “(b) Arc Flash Hazard Analysis. An arc flash hazard analysis shall determine the Flash Protection Boundary and the personal protective equipment that people within the Arc Flash Protection Boundary shall use.” Article 130 expands on this further. Essentially, the standard says that if there’s an arc flash possibility, you need to do an arc flash analysis. That applies to anyone working within the Flash Protection Boundary.

Workers outside the Flash Protection Boundary are not required to wear arc flash-level protection. Article 130 requires technicians to select PPE based on the incident energy associated with the specific task and the calories/cm² exposure.

Typical system weights for a range of arc ratings

Sytem Rating cal/cm ²	1st Generation FR Fabric Systems	3rd Generation FR Fabric Systems
8	10 oz/yd ²	6.5 oz/yd ²
15 to 20	13 oz/yd ²	8.8 oz/yd ²
25 to 31	17 oz/yd ²	9.7 oz/yd ²
40 to 50	24 oz/yd ²	12 oz/yd ²
65 to 76	34 oz/yd ²	15 oz/yd ²
100	41 oz/yd ²	18 oz/yd ²

Figure 1. Differences in the weight of arc flash protective clothing
“Arc Flash Improvement Update and Worker Heat Stress Analysis for Arc Flash PPE.”

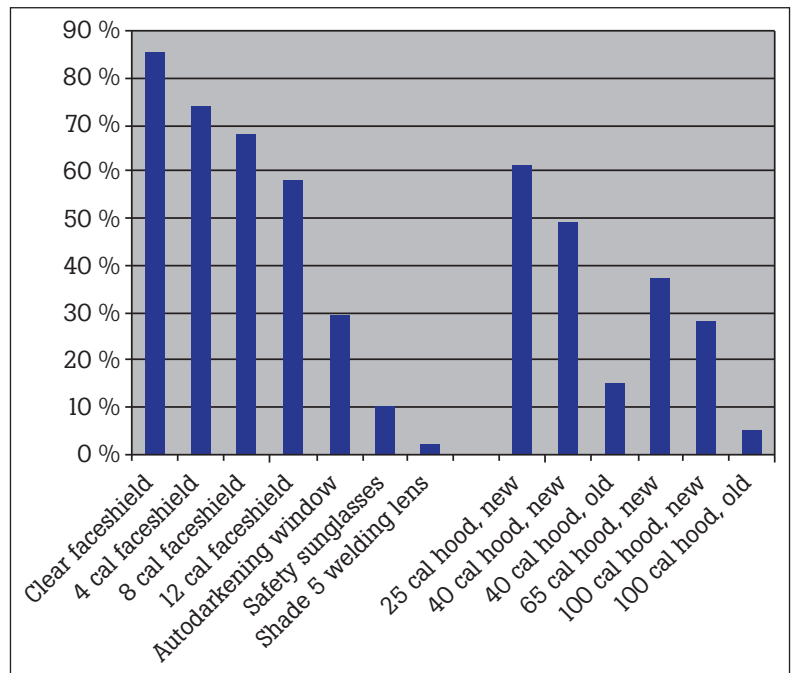


Figure 2. Improvements in light transmission through arc-rated face shields
“Arc Flash Improvement Update and Worker Heat Stress Analysis for Arc Flash PPE.”

These articles were discussed at the previous 70E cycle and the consensus among committee members at that time was that an arc flash doesn't care what task the person is doing. If there is an accident, the worker will be exposed to a certain level of incident energy and he has to be prepared for that level of exposure.

The Flash Protection Boundary is an "all-or-nothing" deal—you are inside the boundary or you are not. If you are outside the boundary, then you don't need arc flash PPE—however, at a minimum a long-sleeve cotton shirt and pants and safety glasses or goggles are required. If you are inside the boundary, then you need full arc-flash protection.

Distance is our friend

Do these PPE requirements create issues and problems for thermographers? Certainly, but there are options. I like to say that "distance is our friend." Incident energy decreases by the inverse square of the distance. That may sound complicated, but what it means is that just a few inches additional

distance between you and a potential arc source drops the heat from an arc rapidly. **Often, just six to twelve inches can be the difference between a serious burn and almost no burn.** Put as much distance as possible between you and the equipment being scanned. Staying out of the Flash Protection Boundary is ideal, but not always possible.

Viewing ports are another option, especially when distances are too close to adequately protect a worker or requires a high level of protection. Crystal viewing ports work best for infrared imaging, but can cloud over if not properly installed or maintained. The 2009 edition of the NFPA helps resolve some of the PPE issues (sidebar).

Inconvenient? Uncomfortable? Impossible? Yes, yes and no. What is really inconvenient and uncomfortable is spending a few weeks in a burn unit at a hospital, wondering if you will be able to work again, or if you will ever look the same. Arc flash is a real, life-changing event. Just talk to a few people who have been through it like I have. The arc-flash PPE doesn't sound nearly so bad once you do.

New 2009 edition of the NFPA 70E specifically addresses thermography



Figure 3. Arc-related break open of fabric
"Two Similar Incidents; Two Different Outcomes."

During the 2009 cycle NFPA 70E committee meetings, the committee took special note of a number of PPE proposals. The committee voted to include in Table 130.7(C)(9) tasks specifically related to infrared thermography.

The 70E Committee reasoned, based on the proposals submitted, that if a thermographer does not remove the panel covers, does not break the plane of the enclosure (either with the body or equipment), and is completely non-intrusive, then the Hazard/Risk Category could be reduced by one number.

The assumption was that the thermographer would stand as far back as possible, thereby reducing the incident energy and the overall risk of an incident occurring. However, the worker would have to recognize that if an arc-flash occurred while he/she was wearing the reduced

level of protection, the chances of an injury could be greater, as the heat from the arc could be greater than the PPE protection. Even though this could happen anytime an overcurrent protective device malfunctions, the worker has to consider this additional risk as part of the required Hazard/Risk Analysis.

Figure 3 shows the after-effects of arc-rated clothing that has suffered "break open". Break open occurs when the arc rating of clothing is exceeded and the fabric chars and crumbles apart. Note that the seam is all that is left of the leg of the coveralls. This is due to the fabric being three or four layers thick at the seam. These workers suffered serious injuries from the arc-flash burns. All they were doing was installing covers on low-voltage breaker cubicle doors².

About the author

Jim White is the Training Director for Shermco Industries, <http://www.shermco.com/> in Irving, Texas and a level IV NETA technician. Jim represents NETA on NFPA 70E and B committees, as well as the Arc Flash Hazard Work Group, and is Chairman of the 2008 IEEE Electrical Safety Workshop.

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1. Neal, Thomas Dr., "Arc Flash Improvement Update and Worker Heat Stress Analysis for Arc Flash PPE", 2006 IEEE/IAS/Electrical Safety Workshop.
2. Doan, Dan and Floyd, Lanny, "Two Similar Incidents; Two Different Outcomes", 2006 IEEE/IAS/Electrical Safety Workshop.

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