

APPLICATION NOTE

Arc flash safety and thermal imaging

By Jim White, Shermco Industries, Inc.

National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace has come a long way with regard to Personal Protective Equipment (PPE) for thermographers (people using infrared cameras).

For the last several NFPA 70E cycles, thermographers and their employers have proposed changing the requirement for arc-rated clothing and PPE while performing an infrared scan. There's good reason for complaints (see Figure 1).

Figure 1 shows HRC4 PPE and equipment. In a paper presented to the 2008 IEEE/IAS/Electrical Safety Workshop,¹ Vladimir Ostrovsky noted that such equipment (specifically the hood) reduces oxygen to the wearer, increasing feelings of claustrophobia and difficulty in "catching your breath." While air circulating accessories can reduce this discomfort, thermographers still struggle to take effective thermal images through the limited light transmission provided by the hood's viewing window and to use their infrared camera while wearing the heavy gloves.

During the 2009, 2012 and 2015 NFPA 70E edition reviews, several proposals were made by people and companies that perform thermal imaging and the 70E Committee reconsidered their approach to the problem. Among the questions considered:

- What are the actual risks involved with thermography?

- Would the thermographer remove the covers on the energized equipment or would someone else perform that task?
- Would the thermographer break the plane of the enclosure?
- Was there any chance of contact or components/parts falling into the energized equipment?
- How close would the thermographer be to the potential arc source?
- Is the person doing the thermal scan a qualified electrical worker, according to OSHA and the NFPA 70E?

In the 2015 of NFPA 70E, the committee decided that if the person removing the covers wore full arc-rated clothing and PPE, the thermographer could elect to not wear arc-rated clothing and PPE if they did not:

- Cross the restricted approach boundary,
- Break the plane of the enclosure; or
- Interact with the equipment in any way.

One of the primary questions the committee had to deal with is whether thermographers are qualified. We decided that OSHA and NFPA 70E requires anyone exposed to



Figure 1. PPE Category 4 arc-rated clothing and PPE before and after an arc flash.

Top THREE

Questions to ask when deciding whether or not to wear PPE

1. What would your life be like after a serious arc-flash incident?
2. How would your family and friends be affected if you were injured? How would your life change if you were disfigured or disabled?
3. How certain can you be that there are no defects in the equipment about to be scanned?

the risks be qualified. Therefore, the 70E Committee concluded it was acceptable to provide electrically-qualified persons with the flexibility to perform their job tasks in a safe manner. Since we cannot be at every job site, that decision has to be made by the qualified person performing the work.

It's decision time

It is important to note that the NFPA 70E represents minimum safe work practices, not best safe work practices. Any qualified person about to perform a task that exposes them to electrical hazards must perform a full risk assessment, including a shock risk assessment and an arc flash risk assessment. This may seem to be confusing and contradictory at first glance. On the one hand, NFPA 70E does not mandate arc-rated PPE and clothing when performing an infrared scan. On the other hand, the technician may recognize that in his or her particular case, PPE may be required, even though it is not mandated by NFPA 70E.

It is the opinion of the 70E committee that as long as the equipment is energized, the risk of arc flash remains. In Table 130.7(C)(15)(A)(a), we state that arc-rated PPE is required or not required, depending on the tasks and conditions. Arc-rated PPE may be required for personal safety, but not mandated by NFPA 70E. As stated previously, 70E represents the minimum acceptable requirements and it is likely that those requirements will need to be exceeded. This is an example of why the user of NFPA 70E must be familiar with all of Chapter 1 if they are performing tasks on electrical equipment.

There are no free rides; looking at a table in NFPA 70E and ignoring the risks involved in a task will only ensure expedited entry to a burn unit. This is not where anyone wants to end up. This is absolutely one area where being lazy can impact the thermographer for the rest of his life.

Secondly, the person removing the covers must wear full arc-rated clothing and PPE. Once the covers are off, the area secured and inspected for possible hazards, then the thermographer can enter and perform the scan, wearing appropriate PPE for that level risk.

A look at Table 130.7(C)(15)(A)(a) shows how the 70E committee arranged the tasks so that "Removal of bolted covers (to expose bare energized electrical conductors and circuit parts)" is before the task of "Perform infrared thermography and other non-contact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers."

It is clear from the table that the two tasks are separate and must be evaluated separately. See Figure 2, which is a partial table 130.7(C)(15)(A)(a).

Table 130.7(C)(15)(A)(a)		
Task	Equipment condition*	Arc flash PPE required
Removal of battery intercell connector covers	All of the following: <ul style="list-style-type: none"> The equipment is properly installed The equipment is properly maintained Covers for all other equipment are in place and secured There is no evidence of impending failure 	No
	One or more of the following: <ul style="list-style-type: none"> The equipment is not properly installed The equipment is not properly maintained Equipment doors are open or not secured Equipment covers are off or not secured There is evidence of impending failure 	Yes
Opening hinged door(s) or cover(s) (to expose bare energized electrical conductors and circuit parts)	Any	Yes
Perform infrared thermography and other noncontact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers.	Any	No

Figure 2. NFPA 70E Table 130.7(C)(15)(A)(a), Partial
Courtesy of National Fire Protection Association

Also, be aware that even where the task of infrared thermography in Table 130.7 (C)(15)(A)(a) states "No PPE Required" in any condition, technicians cannot knowingly put themselves at risk, which is why the risk assessment is so critical.

Summary

Whether to wear arc-rated clothing and PPE for infrared thermography may in some cases now be a personal decision. Be aware that OSHA directs employers to supply required PPE and for employees to wear the supplied PPE, if hazards exist. A risk assessment can indicate whether such PPE is needed and the assessment needs to be properly documented.

Consider these questions when deciding whether or not to wear PPE:

- What would your life be like after a serious arc-flash incident?
- How would your family and friends be affected? How would your life change if you were disfigured or disabled?
- How certain can you be that there are no defects in the equipment about to be scanned?

It is the sincere wish of the NFPA 70E Committee (including myself) that no one be in a position to answer these questions due to an electrical mishap. If it is truly not practical to wear the needed PPE, or if there is simply no available clearance, viewing windows should be considered.

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¹Advancements in Electrical PPE for the Worker (ESW2008-08), V. Ostrovsky, IEEE Electrical Safety Workshop, 2008