“PPE... what you need... when you need it.”

By Mark Ackerson, Senior Electrical Safety Training Specialist at AVO Training Institute

In our quest to provide the safest work environment for our employees, our goal should always be eliminating all hazards. What if you have a hazard that cannot be eliminated? Electrical workers face this challenge every day due to the nature of our jobs. Even the use of our most important tool, the volt meter, requires us to be exposed to electrical hazards. Just because it is the nature of our jobs, it does not mean we need to be risk takers. Through the use of Personal Protective Equipment (PPE), we can lower this risk to an acceptable level. However, PPE requires human interaction to provide that safety, as PPE is only effective if tested properly, worn correctly, and used consistently.

OSHA is quite clear in 29 CFR 1910.132(d) (1) “The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE).” This includes all electrical hazards!

OSHA also states that employers that they must provide PPE to provide protection for each part of the body that may be exposed to a hazard. The trouble is OSHA gives little guidance as to what type or level of PPE is required to provide adequate protection. This is where NFPA 70E- Electrical Safety in the Workplace® comes in. This document, along with a proper electrical hazard assessment, will enable the ability to determine the correct level of required PPE. OSHA gives us the “What”, NFPA 70E® gives us the “How”.

NFPA 70E® breaks Protective Clothing and PPE down into 5 Hazard/Risk Categories: 0-4. With five different PPE levels, this Category rating can be somewhat overwhelming, however what is offered in Annex “H” of the NFPA 70E® document is something called the “Simplified Two Category Arc Rated Method”. This two-tier method is one that most employers have chosen due to lower cost and ease of management. This method basically involves issuing Category 2 daily work clothing in the form of a long sleeve shirt and pants or coveralls with an arc rating (AR) of 8 cal/cm² (a calorie or “cal” is a unit of thermal energy measurement /per centimeter squared). If the risk assessment requires PPE greater than 8 cal/cm² then a Category 4- 40 cal/cm² arc flash suit is worn over the daily wear to provide protection. If the risk assessment finds the hazard exceeds Category 4, then other work methods must be used to lower the arc rating, as PPE alone no longer provides effective protection.

One common misconception is that by simply layering clothing, one can provide adequate protection by just adding the calorie rating together. This is not true. In fact, in some cases it has been shown to have the opposite affect and actually lowers the rating. (Annex “M” in NFPA 70E® gives more guidance on that subject.)

There are several companies that provide managed clothing programs that include leasing and laundering of the clothing. This service is offered because although AR clothing may look fine, AR clothing is made of very specific materials and could have its AR properties rendered ineffective by improper laundering. As the employer, you are responsible to provide effective PPE, and by allowing employees to launder their own PPE you cannot guarantee the AR clothing will function properly.
In addition to daily wear, let’s look at additional PPE required for each part of the body and review some best practices / lessons learned for other electrical PPE.

Safety glasses should be worn at all levels of electrical work. They should be nonconductive if working within the restricted approach boundary (refer to NFPA 70E® for Shock Boundary information) of any exposed energized electrical conductors or circuit parts.

Ear protection is required at all PPE category levels, and is specific to ear canal inserts. Muff type ear protection does not meet the standard as they can be stripped off due to an arc blast.

Nonconductive head protection is required wherever there is a danger of head injury due to electrical shock, burns, or from flying object as a result of an electrical explosion. In general, most hard hats are rated for 2200 volts (class G) but some have a rating of 20,000 volts (class E). Hard hats that have any type of ventilation penetration generally are not voltage rated and should not be used by electrical workers.

Along with head protection, face, chin and neck protection is also required starting at category 1. Category 1 requires protection in the form of an Arc Rated face shield. This face shield is a wraparound type that also provides protection to the forehead, chin, ears and neck. Welders face shields look very similar to these but the difference is AR rated face shields are designed to provide protection from thermal energy in the form of an arc flash/blast and not just heat, hence the AR rating and not an FR rating that welder’s PPE carries. This distinction holds true for all electrical safety PPE: it must be AR rated. When we move up to Category 2 it is now required to provide additional protection under the AR rated face shield in the form of a balaclava or “head sock” as they are called providing a greater level of protection against thermal energy. Alternatively, AR flash suit hoods may be used at this level. When we exceed Category 2, our only option is the use of the AR flash suit hood rated for whatever the hazard category is. It is important to note that these face shields and hoods are to provide protection from thermal energy only, not impact. Safety glasses are required to be worn under hoods or shields.

Hand protection requirements for protection from arc flash/blast up to Category 2 only requires heavy-duty leather gloves. Categories 3 & 4 require AR rated gloves. Because we must also provide shock protection for the hands we would typically be wearing voltage rated gloves with leather protectors at this point. The exception given is if one is wearing voltage rated gloves with leather protectors, additional leather or AR gloves are not required.

With regard to voltage rated gloves, they come in different voltage ratings and the most commonly issued is “00” gloves, which are rated for 500V AC/ 750V DC. One may be tempted to get a voltage class larger than required as an added measure of protection; however, this can be a mistake as the gloves lose dexterity as the class increase. Getting used to wearing gloves for electrical tasks is enough of a challenge, the easier we make this transition, the more likely electrical workers will embrace this change.
Sizing gloves is done by measuring the palm of the hand at the widest point and rounding up to the next full or half inch to determine your glove size. This measurement, however, is kind of like buying shoes, you need to try them on to get what feels right. In addition to voltage rated gloves, leather protectors are also required. They also come in sizes that correspond to the class and size of the gloves. They are not just normal leather gloves and should not be used as daily work gloves, as they are made so the seams do not damage the rubber gloves. To protect gloves from physical or UV damage, a glove bag should also be provided. No hand lotions, (they deteriorate the rubber) or baby power (contains aluminum powder) are to be used when wearing voltage rated gloves. There is an approved glove powder that can be used that is available from the glove manufactures.

Some additional glove requirements involve testing. Gloves, like any other piece of PPE, should always be inspected before daily use. This should also include an inflation test of the rubber glove to assure that there are no holes or cracks in the glove. Voltage rated gloves also require a certified test lab do a voltage test on gloves every 6 months. Testing is much more cost effective that replacing them with new gloves every 6 months unless you only have a few pair. A good best practice is to buy a second set of gloves in another color to swap with the first set being sent in for testing after the first 6 months. The different color is a visual check that everyone’s gloves are in the correct test cycle. If properly maintained, gloves should last several years. Most glove testing companies will also help to manage your glove program by providing shipping labels and automatic emails when your glove tests are due.

Last, but not least, are shoes. In general, the only requirement from an electrical standpoint is they must be leather. Steel toes are fine as long as the steel is not exposed. There are shoes with an electrical hazard or EH rating but an informational note in NFPA 70E® reminds us they are for secondary protection only and only then under dry conditions. They have no retesting requirements and therefor may or may not provide protection when needed.

It is important to remember that some of the PPE provides protection for several hazards at the same time. Regardless, just because we control one hazard does not mean that all PPE can be removed. Appropriate PPE must be worn until all hazards have been controlled.

By conducting our electrical hazard risk assessments on all electrical equipment we will be able to define the correct PPE levels without being excessive, leading to better acceptance by electrical workers.

BIO:

Mark Ackerson is a Senior Electrical Safety Training Specialist at AVO Training Institute. He has over 35 years’ experience as a Licensed Master Electrician and Contractor and as well as being a Health & Safety instructor with 30 years’ experience in the fire service. He may be reached at info@avotrainging.com and for AVO Training Institute course schedules please visit avotraining.com.