How to Protect Workers from Arc Flash Hazards

Following NFPA 70E requirements is the key to controlling arc flash dangers.

Workplace equipment used to generate, distribute or use electricity (we'll use the term 'electrical equipment') poses 2 kinds of hazards: shock and arc flash. Arc flash occurs when electricity jumps through the air from one piece of energized electrical equipment to another or to the ground. Workers don't need to be in direct contact with electrical equipment to get injured by an arc flash; they simply need to be within a few feet of the equipment. Arc flash can cause fires and explosions. Workers near an arc flash can suffer severe burns. While electrocution produces more fatalities, arc flash is responsible for more worker hospitalizations. Even so, OHS laws say relatively little about arc flash. Accordingly, arc flash safety requirements derive from voluntary standards like the *Canadian Electrical Code*, Part 1 and NFPA 70E.

The Canadian Electrical Code

The Canadian Standards Association (CSA) doesn't have a specific standard on arc flash hazards. But the CSA's *Canadian Electrical Code*, Part 1 (Code), which is now in its twenty fifth version, having been last revised in 2021, requires certain electrical equipment to be marked to warn people of potential electrical shock and arc flash hazards [Rule 2-306].

The Code's appendix also refers employers to a U.S. National Fire Protection Association (NFPA) Standard'NFPA 70E. Note that the Code focuses on worker safety while installing and maintaining electrical equipment, not on their safety while working near such equipment.

While most jurisdictions have adopted all or parts of the Code, many incorporate earlier versions. So, it's expected that they'll eventually adopt the 25th or a later version at some point.

NFPA 70E

NFPA 70E, which is a more comprehensive electrical safety standard with detailed arc flash requirements, has become something of an industry standard in Canada and the U.S. NFPA 70E requires performance of an arc flash hazard analysis when workers work on or near 'exposed energized' electrical equipment'that is, equipment that's not enclosed, shielded, covered or otherwise protected, such as switchboards, panel boards, industrial control boards and motor control centers. Because of the complexity of some of the required calculations, you may need to have an electrical engineer conduct the analysis. The arc flash hazard analysis should:

Identify potential arc flash hazards. Determine if the potential for arc flash exists in electrical equipment workers may work on or near while the equipment is exposed and energized. This process involves the collection of a lot of data from your workplace. One-line electrical drawings can be very useful in this process, says Klingler.

Reduce or eliminate potential arc flash hazards. If practicable, eliminate or at least reduce arc flash hazards. This may require only relatively simple measures, such as changing fuses or breaker settings or enclosing the equipment.

Determine the 'flash protection boundary,' that is, the

minimum safe working distance from exposed, energized electrical equipment. Determining the minimum safe working distances for shock hazards is easy: the higher the equipment's voltage, the further away workers must stay. But determining the flash protection boundary for arc flash hazards involves fairly sophisticated calculations factoring both voltage and current figures. OHS managers may need to have an electrician perform the calculations for them.

An alternative to calculating the flash protection boundary for every potential arc flash hazard in your workplace, is to use the NFPA 70E default flash protection boundary: 4 feet for equipment with a voltage less than 600 volts. There are downsides to using the default boundary, though. The boundary is generally conservative. It errs on the side of safety and precludes workers from working close to equipment even when it would be safe to do so. Conversely, the default boundary might not provide adequate protection at large workplaces that have high energy equipment.

Determine the appropriate PPE. Because it's not always practicable to work outside the flash protection boundary, you'll also need to determine the appropriate PPE required for workers working within the boundary. It's preferable to make mechanical changes first, such as changing fuses or breaker settings, to protect workers and rely on PPE only as a last resort.

NFPA 70E defines appropriate PPE as that which is necessary to prevent the onset of a second-degree burn. To calculate what level of protection that involves, you must calculate the heat in calories per centimeter squared that a worker would likely be exposed to from an arc flash at a certain distance from the electrical equipment. Again, this calculation is complicated and best left to electrical engineers.

As it does with the flash protection boundaries, NFPA 70E provides default PPE requirements that are generally

conservative and may require workers to wear PPE even when it’s not actually necessary. And the required PPE can be expensive, restrictive and very hot. So, relying on the default requirements may end up costing you more in PPE than you would have to spend to have an electrical engineer or qualified consultant calculate the requirements suitable for your actual workplace.

Once the analysis is done, you should inform workers of its results and provide appropriate arc flash hazard training. The NFPA 70E now requires labelling of specific electrical equipment to warn workers of the potential of an arc flash hazard; these labels may be very brief and generic. If an arc flash analysis has been conducted, the pertinent information from the analysis should be on the label, including at a minimum:

- The maximum voltage of the equipment;
- The flash protection boundary for that equipment; and
- The required PPE to be used by those within that boundary.

Takeaway

If your goal is electrical safety rather than mere compliance, you must be prepared to go beyond what your province’s OHS regulations require and take measures to assess and manage arc flash hazards. Although it’s not the only option, NFPA 70E represents the most comprehensive and accepted standard on arc flash safety. So, it’s no wonder that so many companies in Canada and the U.S. have chosen to implement its requirements.