Arc Flash and Energized Equipment Requirements

Exposure to energized electrical equipment and conductors (“electrical equipment”) accounts for roughly 1 in 10 workplace injuries and 3 of 100 work fatalities. Those figures are substantially higher in the construction industry. Electrical equipment poses 2 kinds of hazards: shock and arc flash. Canadian OHS laws tend to concentrate more on the former. Here is a look at the requirements for arc flash. (Click here for the energized limits of approach rules of your jurisdiction.)

Arc Flash Hazards

An arc flash occurs when electrical energy passes through air from a high voltage down to a low voltage (usually ground) conductor, resulting in extreme heat and a blinding flash of light that potentially detonates a fire or explosion. It only takes a few milliseconds to happen, typically as a result of deteriorating insulation in aging equipment, poor installations, dust and debris in the electrical components, and improper or accidental connection of tools.

In addition to panel design, grounding and installation standards, OHS laws require employers to isolate and control hazardous energy sources before service, repair and maintenance work is done on electrical equipment. These so-called lockout rules primarily protect the workers working on

the equipment. However, arc flash can injure more than just the workers in direct contact with electrical equipment; it can also put those who are simply near the equipment in peril.

Limits of Approach

Where work is conducted on or near energized electrical equipment, the preferred means of preventing arc flash is to ensure it's totally deenergized. If that's not practicable, there should be physical or mechanical barriers to prevent access. Most jurisdictions also establish limits of approach, i.e., minimum distances that workers and their vehicles, tools and other equipment must remain from energized electrical lines, equipment and conductors. The distance of approach limits vary depending on:

- The voltage of the equipment'the higher the voltage, the greater the required distance of separation; and
- Which workers are exposed' The general rule is that workers deemed to be "qualified persons" can get closer than workers that aren't qualified persons; and
- The type of work performed. Normal limits of approach don't generally apply to tree trimming, power line work and other operations where getting close to energized electrical equipment can't be avoided.

As usual, PPE is the protect of last resort. PPE for work on or near exposed parts of energized electrical equipment include rubber gloves, mats and shields and insulated footwear to prevent shock and burns.

Voluntary Standards

The OHS laws are general and don't go into much technical detail about arc flash'in fact, they don't even use the term at all. To fill in these critical details, employers must look to non-government voluntary standards, in this case:

- Canadian Electrical Code (CEC) Rule 2-306;
- National Fire Protection Association (NFPA) Standard NFPA 70E, which is more comprehensive than the CEC but comes from the US; and
- Canadian Standards Association (CSA) Z462, which follows

The CEC standard is intended for those who design, install, and inspect electrical installations and is somewhat limited in scope. NFPA 70E is more comprehensive and was the primary standard in Canada even for a long time though it comes from the US. CSA Z462, which was published in 2009, follows the NFPA 70E framework but converts it into a Canadian standard.

What CSA Z462 Requires

CSA Z462 requires employers to implement an electrical safety program to ensure an “electrically safe work condition” that includes the following elements:

1. Arc Flash Risk Assessment

Before workers work on or near exposed energized electrical equipment, a qualified person must perform a hazard assessment to determine if an arc flash hazard exists and, if so, what safety measures must be implemented. There must be a parallel assessment for shock hazards. The assessment must be reviewed at least every 5 years and updated when changes are made to the system.

2. Arc Flash Boundary

As part of the assessment, the qualified person must determine the arc flash boundary, i.e., the distance at which the incident energy equals 5 Joules/cm2(1.2 calories/cm2). The arc flash boundary is designed to prevent second degree burns and can be longer or shorter than the limited approach (shock) boundary.

3. Required PPE

The qualified person must determine what PPE and clothing should be required by personnel within the arc flash boundary using one of the following methods:

Option 1: Incident energy analysis method: The preferred method is to select PPE and arc-rated clothing based on the incident energy exposure associated with a specific task. Incident energy varies with distance from the arc source. A working distance of 18 inches is typically used for equipment rated at 600 volts and below. Additional PPE must be used for any parts of the body that are closer than the working distance.

Option 2: Table method: The other method is to select PPE and protective clothing based on the task to be performed using the default working distance of 18 inches. The Standard includes tables listing the Hazard/Risk Category (HRC) of particular tasks.

4. Equipment Labelling

There must be a label on the exposed, energized electrical equipment warning of the danger of arc flash that lists:

- The nominal system voltage;
- The arc flash boundary;
- The required PPE within the arc flash boundary, i.e., **either** the available incident energy with corresponding working distance, **or** PPE category from the tables; and
- The date the information was determined.

Conclusion

Unlike some CSA and other voluntary standards, neither CSA Z462 nor NFPA 70E are incorporated by reference into the OHS laws. But OHS coordinators need to keep in mind that simply

following OHS requirements is the minimum necessary and that implementing more extensive measures provided by voluntary standards may be called for to provide a greater level of safety. This is particularly likely to be the situation when dealing with electrical safety.