WHAT IS AN ARC FLASH?

An arc flash is the explosive release of energy that occurs when there is a phase-to-phase or phase to ground arc fault. The arc fault may be the result of unsafe work procedures such as a dropped tool or accidental contact by a human. Additionally, an arc fault may be caused by corrosion, insulation failure, conductive dust, and contact by animals.

During an arc flash, the rapid heating of air molecules and the vaporization of conductive metals generate an intense pressure blast. This blast pressure can propel shrapnel, tools and workers through the air. The heat wave generated by an arc flash may be severe enough to melt metal and severely burn a worker that is standing in the vicinity of the flash.

Workers that are exposed to an arc flash sustain injuries typical to an explosion such as, burns, loss of sight, loss of hearing, broken bones, head injuries and shrapnel injuries.

A pictorial example of an arc flash is shown in figures 1 through 4.

Figure 1

Figure 2

Figure 3

Figure 4

APPLICABLE CODES AND STANDARDS

NFPA 70E – Safety related work practices and application tables

This standard outlines safety programs, calculations for the degree of hazard, personal protective equipment, worker training and warning labels for equipment.

IEEE 1584 - ARC FLASH HAZARD ANALYSIS /CALCULATIONS

This article deals with calculating the size of the potential fault. These calculations provide a basis for the level of personal protective equipment (PPE) that is required when examining or servicing equipment.

ARC FLASH AND ENCLOSURES

Article 110.16 of the National Electric Code (NEC) states that switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that require examination or maintenance while energized, must be clearly field marked so that qualified persons examining or servicing the equipment know the potential hazards that exist. A couple of common field marking labels are found below in figures 5 and 6.

Since the NEC requires field marking of enclosures where arc flash hazards exist, UL does not require an arc flash hazard marking for enclosures by the integrator or manufacturer of the equipment. It is the responsibility of the end user to determine the arc hazard that exists in respect to the power supply to the equipment and the specific components used in that equipment.

Once the arc flash hazard analysis has been completed for a specific piece of equipment, a flash protection boundary is established. This boundary is not based on a protective rating of the enclosure but rather the level of energy that an arc flash could produce. Any person that comes within this protection boundary must use personal protective equipment according to the level of fault that has been calculated. In general, NFPA 70E states that for low voltage applications (below 600V), a 4-foot protection boundary must be observed.

Figure 5 – Generic Field Label

Figure 6 – Equipment Specific Field Label

ARC FLASH AND BUSBAR SYSTEMS

When designing a custom busbar power distribution system, it is important to ensure that the phases, neutral and ground busbars are properly spaced and are braced to support a specific electrical short. Standardizing on a pre-tested busbar system can eliminate costly engineering and design work by providing safe and acceptable configurations for the set of pre-tested components.

CONCLUSIONS

Arc flash hazard should be taken seriously. End users should perform detailed hazard analysis, and proper safety measures must be taken to prevent injuries.

IEEE 1584 and NFPA 70E should be the guideline for flash hazard analysis and safety initiatives.

Enclosures must be field labeled to warn of potential arc flash hazards.

Empty enclosures do not require arc flash ratings or testing.

Pre-Tested Busbar systems should meet or exceed spacing and short-circuit bracing standards.