

Introduction

One of the most pressing issues today in the design and maintenance of electrical distribution systems is electrical safety. The relatively large number of electrical accidents, injuries, and fatalities from working on equipment, has spurred the industry to focus attention in this area. This has in turn lead to research in electrical hazards and the development of electrical safety standards and requirements.

Standards and Requirements

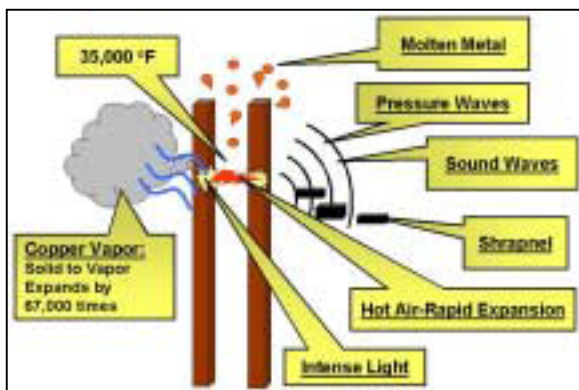
The premiere electrical safety standard is NFPA 70E-2000 – “Standard for Electrical Safety Requirements for Employee Workplaces”. NFPA 70E was developed, at the request of OSHA, by industry experts from various fields in electrical safety, follows an industry consensus process and is based upon extensive testing.

The basic rule for the industry and law per OSHA and NFPA 70E is “don’t work equipment hot”. Therefore, equipment should be put in an electrically safe work condition prior to maintenance. However, to accomplish this task, the absence of voltage must be verified. During this process, the worker could be exposed to electrical hazards. Because of this and other factors, two exceptions are permitted.

The first exception to the rule is where it is infeasible due to equipment design or operational limitations (such as voltage testing). The second exception would be where deenergizing would introduce increased or additional hazards. In both conditions, the user must perform an arc flash hazard analysis on the equipment to be serviced.

Electrical Hazards

In order to complete an arc flash hazard analysis, one must first understand the electrical hazards from an arcing fault. When an arcing fault is initiated, such as a screwdriver creating a path from phase to ground, a tremendous amount of energy is released (see figure below).



The first hazard is the heat created by the electrical arc, which can reach 35,000° F. This high temperature results in materials, such as copper, to vaporize and expand. The rapid expansion of copper (67,000 times) and air creates additional hazards including molten metal, pressure and sound waves, shrapnel, and intense light.

Arc Flash Hazard Analysis

The arc flash hazard analysis must determine the flash protection boundary (FPB) and the level of personal protective equipment (PPE) required for the worker. The level of PPE is typically based upon the incident energy available and workers are required to wear PPE within the FPB.

PPE will help to protect the worker from the thermal effects of electrical arc flash hazards; however, it may not protect against shrapnel and pressure waves. Also, the incident energy calculation and resulting PPE level is based upon a specific working distance from the potential arc fault source; typically 18” is selected. The incident energy within this 18” will be higher and thus protection may not be assured or additional personal protective equipment may be necessary.

Arc Flash Hazard Calculations

The new IEEE Std. 1584-2002 – “Guide for Performing Arc Flash Hazard Calculations” provides users the newest methods of arc flash hazard analysis. In addition, IEEE Std. 1584-2002 applies to a wider range of available fault currents (from 700A to 106kA) compared to current issue of NFPA 70E (from 16 to 50kA). Bussmann® was an active participant in the development of IEEE Std. 1584, NFPA 70E, and arc flash hazard testing.

To simplify the process, Bussmann® has created an arc flash calculator, based on IEEE Std. 1584, that can determine the incident energy, required protection level of PPE, and flash protection boundary. It is important to note that before the arc flash calculator can be utilized effectively, the user must have a thorough understanding of electrical hazards, NFPA 70E, IEEE Std. 1584, and the notes associated with the calculator. The arc flash calculator is available on the Bussmann® website at:

<http://www.cooperbussmann.com/7/Arc-FlashCalculatorNotes.html>

Limiting Arc Flash Hazards

Two of the most important factors in limiting arc flash hazard are the clearing time and amount of current let-through by the overcurrent protective device. Therefore, devices, which are current limiting, can present a significant advantage in reducing the effects of arc flash hazards. By reducing the arc flash hazards, current-limiting devices can play a key role in increasing worker safety and equipment protection.

Conclusions

To protect electrical workers and equipment, electrical safety standards and procedures must be followed and work on live equipment limited as much as possible. Where this is not possible, an arc flash hazard analysis must be completed. Bussmann® provides a simplified method with their on-line Arc Flash Calculator. One method to reduce electrical arc flash hazards is the use of current-limiting devices. This analysis must be then implemented to ensure the safety of electrical workers.