Seven Steps to Implementing an Arc Flash Safety Program

Step #1: Define the boundaries of the arc flash study

First, determine those areas where a danger exists. OSHA and other applicable safety standards require workers to protect themselves when working on energized electrical equipment at 208 volts and above. “Working” includes such activities as opening and closing circuit breakers, operating disconnect switches, testing, and other operating activities, as well as maintenance activities. If the station single line diagrams are not current then this is a good time to start bringing them up to date. Using the single lines and a walkthrough of the electrical system, identify those areas where workers need to be protected from arc flash hazards.

Step #2: Gather the information

This is typically where the most effort is needed, depending on how current your coordination studies and single line diagrams are. The data that is needed to perform the study is the same as a good coordination study i.e. a good model of the electrical system including normal and abnormal operating configurations, source capacities, electrical impedances, and types of protective devices and their tripping characteristics.

Note that, unlike a bolted fault study to determine equipment withstand capabilities, an arc flash study is much more sensitive to system impedances. A reduced short circuit current can result in delayed tripping times. An arc flash is a function I^2t. A lower current can result in a higher arc flash danger due to slower fault clearing. Items such as cable sizes, configurations and lengths should be as accurate as possible.

Step #3: Perform the arc flash hazard analysis

For systems below 15 kV IEEE Standard 1584 provides the generally accepted methodology for calculating arc flash hazards. Most of the available computer programs have incorporated these equations into their software and have very good modules that will calculate the incident energy, arc flash hazard risk category, arc flash boundaries, PPE required, and will also generate the label to be placed on the equipment.

For voltages above 15 kV the programs will fall back on theoretical Lee Equations. Depending on system configuration and the likelihood that the fault will become a three phase fault, this calculation method can yield overly conservative results, especially for high voltage systems. The high voltage situations need to be evaluated and, if applicable, another program for single phase faults can be used.

After the incident energy levels are determined is a good time to look for opportunities to reduce the hazard by re-coordinating the relaying system with arc flash in mind. Often, by tightening up on the coordination or by looking at other ways to reduce the arc flash hazard (a topic for another newsletter), you can reduce the level of PPE required. A reduced level of PPE is much less cumbersome and less expensive.

Step #4: Decide on a safety policy

This step is often overlooked until the results of the study are in and you are faced with the question of how to implement your arc flash safety program. You will find that a number of questions will come up when looking at the study results, the PPE required, and when it is necessary to use the PPE. Management needs to sit down with operations and maintenance personnel to examine different

scenarios that occur in normal and abnormal operation, and maintenance activities and under what conditions the workers will be required to wear the PPE. For instance, will the workers be required to wear PPE when taking readings and operating meter selector switches inside the Arc Flash Protection Boundary? What will be the policy for non-qualified workers in the vicinity of energized equipment being worked on? Many questions like this will need to be answered when training the workers on arc flash safety.

Step #5: Select a PPE provider and the appropriate PPE

In addition to purchasing the needed PPE from a reliable vendor, decisions will need to be made on how to maintain and clean the protective clothing and who is responsible for doing this. These tasks can usually be contracted out to a vendor that specializes in this work, often the same vendor that initially sells you the equipment. In any event, your PPE provider will be your best guide to the options and services that are available.

Step #6: Label the equipment

NFPA 70E labeling requirements include placing a label on the equipment informing the worker of the flash protection boundary, incident energy, working distance, required PPE level, and the shock hazard voltage and boundaries. Labels must be made up from the results of the flash hazard analysis and attached to the electrical equipment. Switchgear room floor plans showing applicable boundaries, while not required, can help personnel understand what PPE are required and where.

Step #7: Train the workers

The final step is to train the workers on what the arc flash hazard is, why it is important, how and when to use the Personal Protective Equipment required, and what the company arc flash safety policy contains. At least two training programs should be given, one for supervisory personnel and one for the front line workers. When the training programs are conducted a number of questions and suggestions will be raised for issues that had not been previously considered. Remain flexible. This is a good opportunity to incorporate the comments and suggestions into the final safety policy.