Arc Flash Safety Starts With Electrical Distribution Maintenance

Joseph Weigel, Product Manager, Square D Services, Schneider Electric

Knowing where to start when it comes to electrical distribution system maintenance can be the most challenging part of electrical distribution system maintenance

An electrical worker preparing to don Oberon Company ARC65 FR-rated personal protective equipment (PPE). (Photo Copyright 2005 Oberon Company)

The electricity that flows through the electrical distribution system of any industrial facility is the lifeblood of the entire operation. Production processes, environmental controls and security, lighting and safety systems all require a clean, reliable, and continuously available flow of power.

It is well understood that overcurrent protective devices, such as circuit breakers and fuses, have a critical role in protecting the system, and the connected load equipment, from overload conditions, as well as potentially damaging electrical faults. These devices also play a very important role in reducing the level of arc

flash hazard if an arcing fault occurs when someone is working on or near the equipment. The incident energy (or thermal energy) that is released in an arcing fault is extremely dangerous to anyone in close proximity to it, such as an electrical worker who may be working on or near energized equipment.

In most industrial plants, regular maintenance of the electrical system and connected load equipment has historically not been a high priority. One characteristic of improperly maintained electrical distribution equipment is that large switching devices (such as power circuit breakers or fused switch assemblies) can remain closed even under conditions where they should open. This means there is usually no immediate indication of the failure, such as an interruption of the flow of power or other event that would bring attention to it. In fact, it could be months, or even years, before a problem is noted– typically when an overcurrent protective device is called upon to do its job, but cannot.

Avoiding such a situation requires proper maintenance completed at frequent intervals. This is the most important step to maintain electrical distribution system reliability and, more importantly, increase safety for personnel, including workers who could be in the immediate vicinity of an arcing fault.

There are multiple resources available for recommendations on maintenance of electrical equipment, including the original equipment manufacturers' operation and maintenance manuals, and counsel from the service branches of those manufacturers and service companies that specialize in electrical equipment maintenance. Yet another is the 2006 edition of the National Fire Protection Association's [1] NFPA 70B consensus standard, "Recommended Practice for Electrical Equipment Maintenance [2]."

Standards

Overcurrent protective devices play a crucial role during an incident like an arcing fault. Since the length of time that an arc is permitted to continue proportionally affects the amount of thermal energy released, the upstream overcurrent protective device must be in proper operating condition to respond correctly to clear the fault based on the actual fault conditions, characteristics, and settings of the device. When these devices are not maintained on a regular basis, their clearing time may increase, allowing more energy to be released in an event. If maintenance is deferred long enough, it may result in a worst-case condition that may render the device completely inoperable, meaning it will not open to clear a fault of any magnitude.

Many overcurrent protective devices in this condition are locked internally, and cannot even be opened mechanically. A study done by a major electrical equipment manufacturer several years ago determined that power circuit breakers that were not maintained for a period of five years would experience a substantial failure rate.

The National Fire Protection Association's NFPA 70E 2004 "Standard for Electrical Safety in the Workplace [3]" requires industrial facilities to perform an arc flash hazard analysis as one of the critical compliance steps outlined in the electrical

safety standards.

These arc flash hazard analyses are complex engineering studies that ultimately determine the amount of incident energy that would be released by each piece of electrical equipment that is studied if an arc flash event were to occur. This information is needed in order to properly calculate the hazard-risk category of personal protective equipment (PPE) that a worker would be required to wear if that worker were to work on or near energized equipment.

NFPA 70E has recognized for several years that elevated arc flash hazard levels will occur if electrical protective devices are not maintained regularly. The 2004 edition of NFPA 70E1 refers to NFPA 70B in a fine print note for maintenance requirements, in chapter 2, article 200. NFPA 70B, which has been available since the early 1970s, contains recommendations and details for electrical equipment maintenance intervals based on equipment type and environmental and duty conditions.

Annex H of NFPA 70B provides recommended maintenance intervals for most types of electrical distribution equipment used in industrial facilities. Intervals depend on the type of equipment; for example, it states that low-voltage switchgear should be inspected every three to six months, and undergo an overhaul, and maintenance, every three to six years.

Getting Started

Because NFPA 70B is a recommended practice, there is no mechanism for enforcement by OSHA; consequently, there have been concerns for years that NFPA 70B was not being observed adequately. The fact remains that proper maintenance of electrical equipment is well recognized as a risk factor for any company that understands the risk of electrical accidents and wishes to avoid those risks wherever possible.

Knowing where to start when it comes to electrical distribution system maintenance can typically be the most challenging part of electrical distribution system maintenance. The best rule of thumb is to make contact with the services branch of an established electrical equipment manufacturer, which can provide detailed arc flash analyses, recommendations on equipment replacements or upgrades, and even help develop and complete all relevant maintenance work and documentation.

Joseph Weigel is a product manager for Square D Services marketing. He is a veteran of more than 30 years in the electrical industry in the United States and China, and is a member of the National Fire Protection Association and IEEE/Power Engineering Society *[4].*

[1]Chapter 2 of NFPA 70E 2004 is titled “Safety-Related Maintenance Requirements.” It states “Chapter 2 covers practical safety-related maintenance requirements for electrical equipment and installations in workplaces as included in 90.1. These requirements identify only that maintenance (is) directly associated with employee safety. Chapter 2 does not prescribe specific maintenance methods or testing procedures. It is left up to the employer to choose these from the methods

available.”

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