Removing the Confusion Over Electrical Standards - 11/19/2002

Not sure whether to follow OSHA or National Electrical Code requirements for electrical safety at your construction site? Here is guidance to help you understand the differences in four controversial areas.

by Thomas and Michael Kovacic

Electrical safety on construction sites continues to be a major issue. While progress has been made over the years, electrical accidents continue to rank high on the list of construction accidents. In some areas of the country, they are the second leading cause of death or serious injury.

One reason that electrical accidents occur is because of confusion between National Fire Protection Association (NFPA) and OSHA requirements. Four areas in particular continue to spark controversy or are approached differently by different regulatory standards. There are ways to bring harmony to these four issues by providing recommendations to deal with the differences.

GFCIs and Portable Generators

Ground-fault circuit-interrupters (GFCIs) continue to be a very cost-effective form of protection for cord- and plug-connected equipment on construction sites. With the introduction of the 2002 edition of NFPA's National Electrical Code (NEC), however, differences have appeared between NEC and OSHA.

Since 1971, there has been an exception to the GFCI requirement by NEC for outlets on portable generators. In the 1999 NEC, it was Exception No. 1 to 305-6(a). In the OSHA regulation, it is found in 1926.404(b)(1)(ii). It reads:

"Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5 kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground-fault circuit interrupters."

This exception has been removed from the 2002 edition of the NEC. The reasoning is that Article 250 requires that 120-volt generators have one wire of the generator winding connected to the generator frame (grounded). The generator described in 1926.404(b)(1)(ii) is commonly referred to as an "isolated winding" generator. The NEC, and specifically Article 250, does not permit such a generator.

What does this mean for you? OSHA will continue to allow the use of an "isolated winding" generator without the use of a GFCI, as long as the generator meets all of the stated requirements. Some states with a state OSHA plan may not, and there are reports that many local authorities are enforcing the 2002 NEC requirements.

What should you do? The main concern should be the safety of all employees. GFCIs are inexpensive and provide a higher level of protection than an "isolated winding" generator. Do not get involved in these enforcement issues; simply follow NEC requirements.

Additionally, many new generators have a GFCI receptacle installed by the manufacturer. These generators and the GFCI outlets are not suitable for use in wet locations. Thus, they require additional protection when used outdoors.

Personnel are required to use a GFCI whenever cord- and plug-connected tools are used for construction or maintenance purposes. The GFCI must be installed as close to the source of power as is practical. When using portable-type GFCIs, do not use extension cord sets between the GFCI and the source of power.

Open Wiring on Insulators

Open wiring on insulators for temporary lighting and, in some cases, receptacle outlets, has been a common wiring method used on construction sites. Prior to the 1996 NEC, Section 305-4(b) and (c) allowed such wiring for feeders and/or branch circuits not exceeding 150 volts to ground. Beginning with the 1996 NEC, this wiring method is prohibited. It is only permitted for emergencies and tests. In the 2002 NEC edition, this section has been relocated to Section 527.4(B) and (C).

What does this mean for you? As with GFCIs, OSHA will continue to enforce its regulations. 1910.305(a)(2)(iii)(A) & (B) and 1926.405(a)(2)(ii)(A) & (B) permit open wiring on insulators provided the installation meets all of the requirements. Many inspection authorities were never comfortable with open wiring on insulators because of the possible exposure to physical damage. Thus, many will enforce NEC requirements regardless of what OSHA will accept.
What should you do? After years of electrical safety inspections, we tend to agree with those who do not like this method of temporary wiring. In the early days, there were limited cord assemblies available, and the quality was poor. Today, numerous manufacturers have cord assemblies with molded-on lamp holders with proper lamp guards at a reasonable cost. They are easy and time-efficient to install and can be reused job after job. Avoid the unnecessary hassle of enforcement differences between local and federal authorities.

Under some circumstances, cable assemblies such as nonmetallic-sheath cable may be used. Such cable assemblies must be suitable for the environment. For example, nonmetallic-sheath cable cannot be used in wet locations. Some cable assemblies may not be listed for exposure to sunlight.

Relocatable Power Taps

Relocatable power taps (RPTs), previously called temporary power taps, continue to be found on construction sites. Although convenient and inexpensive, they are not intended for use at construction sites and similar locations, nor can they be used outdoors. These limitations can be found in the UL Directory titled General Information for Electrical Equipment - 2002 edition (frequently referred to as the UL White Book).

Although these devices appear to be adequate, when UL or any other nationally recognized testing laboratory (NRTL) evaluates a product, the application conditions described in the product standard will establish the criteria for the evaluation process. If a product is not intended for certain uses, the standard will not include criteria that may be important for safe use in that application.

There is also confusion in the marketing of these devices. Many otherwise quality products have been found in the marketplace with packaging that indicates they are suitable for use at construction sites, outdoor locations or for use with heavy construction-type equipment. All this is in conflict with the UL White Book information. Under Section 110.3(b) and OSHA's 1926.403(b)(2), the product must be used in accordance with its intended use as described by an NRTL.

What does this mean for you? There is mixed input from the field on the consistency of enforcement regarding this issue. The OSHA compliance officer must take into account numerous factors that will have a bearing on whether a citation is issued. Many local authorities are not even going into these areas simply because of the time limitation on them to get their inspection completed.

What should you do? Many times RPTs are used because they are convenient and inexpensive. Don't adopt this attitude. Use the correct product for the job. In most instances, use an extension cord set with multiple outlets. Such extension cord sets are available and listed for the application. In some cases, they can be field-fabricated using all listed components applied correctly.

RPTs can be used in construction trailers and similar office-type structures. The best rule to keep in mind when applying an RPT is that they are intended for use where there is a high concentration of low-powered loads. If this simple rule is followed, an unsafe application will be avoided.

Arc-Blast and Arc-Flash Hazards

One of the most important issues discussed is the application of NFPA 70E to construction site activity and, particularly, the flash hazard issue. This issue has not been well-addressed in the construction industry even though there is a significant risk.

Electrical accident fatality data indicates that a high number of fatalities occur each year among electricians due to an arc blast or arc flash. The data indicates that 80 percent of the fatalities among qualified persons is due to a burn-related incident.

The possibility of an arc flash and the extreme amount of heat that it produces is not new information. In 1990, OSHA promulgated its electrical safety-related work practices regulations. OSHA did not specifically mention arc-flash hazard. Its approach was to be somewhat performance-oriented and let the employer assume the responsibility of determining what hazards were present and how they would be addressed.

This approach did not work as well as some may have anticipated, and another important document had to assume the responsibility of being more specific. This document is NFPA 70E - Standard for Electrical Safety for Employee Workplaces, 2000 Edition. Section 2-1.3.3 in Part II states that a flash hazard analysis must be performed before an employee can approach any exposed electrical conductor or circuit part that has not been placed in an electrically safe work condition.

In the last few years, considerable progress has been made in industrial facilities after the owners take occupancy. It is during the construction phase that there is little or no attention to this hazard. In many of our code classes for construction electricians, the majority states that this is the first time they have heard about this issue.
What does this mean for you? It is not unusual during construction to be working on electrical equipment that is energized and has the cover and enclosure doors open. As the need for power increases and more system stability is demanded, the impedance of transformers is becoming quite low. It also is not unusual to find services for commercial and industrial buildings with the available fault current as high as 65,000 amperes. Even some residential services can be a problem.

If an accident should occur and an arc is initiated in such a system, the heat from the arc could be as high as 40 calories per cm². This is more than three times the heat needed to ignite typical work clothing an electrician may wear. The catastrophic forces associated with arc blast/arc flash can destroy the electrical equipment and fatally burn anyone within an 8-foot radius.

What should you do? If you have not done it already, acquire a copy of the 2002 edition of NFPA 70E. Become familiar with how a fault current study is done and how to perform a flash hazard analysis. This will add cost to the job, but it will be far less expensive than having an unexpected fatality.

Everyone on the construction site could be exposed to such hazards. Once the flash hazard analysis is completed, proper clothing will be required for construction electricians when working on energized equipment while enclosure covers have been opened or removed. When such work is being performed, a flash protection boundary must be established, and all unqualified and unprotected workers will have to remain outside said boundary.

Construction site safety managers should become familiar with these requirements and verify that all trades are properly trained to avoid a flash hazard.

It is interesting that the 2002 NEC also is beginning to address the importance of a flash hazard. Section 110.116 requires that electrical equipment be field-marked to warn qualified persons of potential electric arc-flash hazards. A generic sign that meets the NEC and local AHJ requirements normally will be adequate initially. It is recommended, however, that a more complete marking be provided after occupancy.

Conclusion

Although there are additional electrical safety issues associated with construction work, these four need to attract the most attention. The first three are reasonably easy to address and have been discussed for years. Flash hazard, however, is a newer issue in the construction industry. It is a major issue that has not been well-addressed and needs to be given serious consideration.

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