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Electrical safety needs vigilance

Understanding the risks involved with electricity and electical equipment, using the resources available and implementing proper procedures and work practices can go a long way toward making your facility safe and bringing everyone home at the end of the day.

By **BRENT KOOIMAN***

ELECTRICITY is all around us. Almost everything we see either operates on or was manufactured using electricity. However, electricity is also a dangerous and deadly resource if handled incorrectly, causing 4,000 non-disabling and 3,600 disabling injuries annually in the U.S. There are about five electrocutions every week, meaning that one person who went to work this morning will not come home tonight. Electricity is a good and helpful resource but also has significant risk for injuries and fires if it is not respected.

Types of injuries

Electrical injuries are classified into four categories. The first three categories are tied to direct contact with electricity, while the fourth includes all injuries that are indirectly associated with electricity.

The first two categories of electrical injuries are the ones most people think of: electrocution and injury or death due to electric shock. An electrical shock is received when electrical current passes through the body when someone completes a circuit by coming into contact with a live electrical wire and ground or two live wires at different voltage levels.

A dangerous misconception is that it takes a lot of current or a high voltage to cause injury. This is simply not the case. The severity of a shock depends on three main factors: path, amount of current and duration.

If the path is across the chest, then the shock is much more likely to cause serious problems or death. The greater the amount of current present increases the likelihood of serious injury. Only 10 mA of electric current can "freeze" muscles and result in paralysis, while 75 mA can disrupt the rhythm of the heart, and a defibrillator will be needed to prevent death. Now, consider that most of the electric outlets in our homes and offices are 15-20 amps.

The third and most common shock-related injury is an electrical burn, which is very serious. The severity of the damage may not be realized at first because, unlike common burns, electricity burns from the inside out.

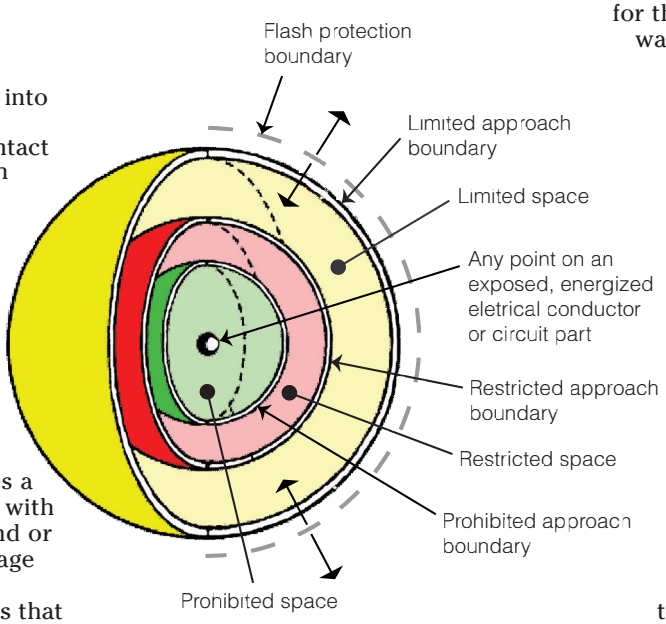
The fourth category, indirect injuries, includes falls and other accidents caused by the body's reaction when it experiences a shock or flash.

A common cause of indirect injuries is falling from a ladder or other elevated position after an electric shock, causing sprains, broken bones, head injuries and death. Special consideration should be taken into account when performing electrical work in elevated or otherwise precarious situations.

Approach boundaries to live parts for shock protection

Nominal system voltage range, phase to phase	-Limited approach boundary- Exposed movable conductor	Exposed fixed circuit part	Restricted approach boundary	Prohibited approach boundary
0-50	Not specified	Not specified	Not specified	Not specified
51-300	10 ft.	3 ft. 6 in.	Avoid contact	Avoid contact
301-750	10 ft.	3 ft. 6 in.	1 ft.	1 in.
751-15kV	10 ft.	5 ft.	2 ft. 2 in.	7 in.

All dimensions are distance from live part to employee.



Minimizing hazards

The Occupational Safety & Health Administration (OSHA) requires every employer to provide electrical equipment that is free from recognized hazards that are likely to cause death or serious injury to employees. Listed or labeled equipment must be installed according to the instructions and for the specific use for which it was designed.

OSHA also requires proper labeling of equipment, disconnects and starters. This requirement is essential for a complete and effective lock-out/tag-out program.

The National Fire Protection Assn. (NFPA) 70E Electrical Safety in the Workplace standard is available to help you meet these requirements. Although OSHA doesn't specifically call out the enforcement of NFPA 70E, it did co-develop the standard and considers it to be an effective "how-to" manual for electrical safety compliance. Using NFPA 70E as a guide will get you a long way toward providing a safe workplace and reducing the risk of employee injury.

What is NFPA 70E?

NFPA 70E is split into four chapters. The first two chapters (which we will discuss here) deal with safe work practices and maintenance

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requirements. Chapter 3, Safety Requirements for Special Equipment, is fairly specialized, and Chapter 4, Installation Safety Requirements, is basically a summary of the National Electrical code installation requirements.

Chapter 1, Safety Related Work Practices, discusses personnel training requirements, including hazards of electrical energy, safe work procedures and what to do in an emergency. It also defines a "qualified person" who may work on live electrical equipment.

This person must be able to distinguish exposed live parts from other parts of the electrical equipment, determine the voltage level of the associated equipment, determine the approach distances corresponding to these voltage levels and have the decision-making process to determine the degree of the hazard, the proper personal protection equipment (PPE) and the planning necessary to perform the task safely.

NFPA 70E does not provide a qualification program; it simply explains what the outline of one should be.

Chapter 1 also includes the requirements for an electrical safety program and work practices. Safe electrical work practices include lock-out/tag-out programs, using qualified personnel, shock hazard analysis, arc flash hazard analysis and energized work permits. NFPA 70E provides guidelines for performing this risk analysis as well as samples of the work permits. Consult a professional to help you determine shock and arc flash hazards, as this is a key part of keeping your facility safe.

Chapter 2, Safety Related Maintenance Requirements, describes important steps to help maintain your facility as safely as possible. It requires proper clearances and working space around the equipment so work can be safety performed. Examples of this are shown in the Figure and Table.

Proper guarding and protective equipment must be in place to keep unauthorized personnel away from live parts and also to protect authorized personnel when they are working on the system. Safety equipment must also be available and maintained in proper working condition.

Chapter 2 stresses the importance of ensuring that the single line of the facility is maintained so the electrical power can be properly disconnected and locked out. Grounding and bonding are also very important parts of a safety program, ensuring that the over-current devices operate properly.

All components must be properly identified for safe working conditions, and all conductors must be free from damage.

These are just some of the requirements laid out in Chapter 2. The full text should be consulted to ensure complete fulfillment of your safety-related maintenance requirements.

Understanding the risks involved, using the resources available and implementing the proper procedures and work practices can go a long way toward making your facility safe and bringing everyone home at the end of the day.

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