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ELECTRICAL SAFETY

How Do You Know Your Workers Are Qualified?

by Kenneth Cybart

OSHA has long required employers to evaluate the workplace for electrical hazards. Most companies are familiar with possible shock hazards and know that OSHA requires all qualified workers be properly trained to work on or near electrical equipment. However, many safety managers are unaware that OSHA also requires so-called unqualified personnel to be trained to recognize and avoid electrical hazards. These workers—including maintenance personnel, painters, cleanup crews, etc.—are not expected to work on electrical equipment, but they must receive sufficient training to ensure their safety and the safety of others in the facility.

The same requirements also apply to the use of outside contractors to work on electrical systems. Although contractors may state that their personnel are qualified to work on electrical systems, they may not be qualified from OSHA's standpoint. Simply being an electrician is not enough. The person must receive the proper training, ideally from a professional instructor.

Companies ignore these requirements at their own peril. Failure to comply with OSHA requirements puts workers at risk and can result in fines and exposure to multimillion-dollar lawsuits. Worse yet, they risk the health and safety of their employees by exposing them to hazards they are not prepared to handle.

Who's Qualified; Who Isn't

NFPA 70E defines a qualified person as one who has skills and knowledge related to the construction and operation of the electrical equipment and installation and has received safety training on the hazards involved. The key points of this definition are how knowledgeable workers are about the equipment and whether they have received safety training. In addition to helping to prevent accidents, both items are critical to designate a person as qualified and to avoid problems if OSHA performs an inspection.

NFPA 70E defines an unqualified person as simply "a person who is not a qualified person." There are two kinds of unqualified persons:

- An unqualified electrician who does not know the equipment or has not received safety training on the potential hazards involved.
- A non-electrician, such as a general maintenance worker or painter, who is not expected to work on live electrical equipment.

While these definitions may be clear, they provide only a bare minimum of guidance. Companies can get into trouble if they interpret the definitions to mean that they need to train only electricians who work on live circuits. A reading of NFPA 70E Article 110 sheds more light on who needs to be trained and to what level. This section covers the general requirements for electrical safety in a plant, and it applies to all workers—both qualified and unqualified.

Article 110 outlines electrical safety-related work practices and procedures for people working on or near exposed, energized electrical equipment. The article states that it is the employer's responsibility to issue safety-related work practices and train employees to implement them.

Paragraph 100.6 specifies that employees who face the risk of electrical hazard must be trained. It makes no distinction between qualified and unqualified workers but requires that these employees be trained to understand the specific hazards associated with electrical energy. This means they must be trained in safety-related work practices and requirements necessary to protect themselves from the electrical hazards associated with their jobs or tasks.

Workers must be trained to identify and understand the relationship between electrical hazards and possible injury. Further, people working on or near exposed, energized electrical conductors or circuit parts must be trained in methods to release victims from contact with exposed electrical circuits and in methods of first aid.

Paragraph 110.6 (D) then makes it clear that these requirements apply to both qualified and unqualified workers by outlining the training required for each. Obviously, the training for qualified workers is more comprehensive than that for unqualified workers. But the message is clear: Companies cannot neglect electrical safety training for unqualified workers simply because they are not expected to work on live, exposed circuits.

OSHA Requirements

OSHA Standard 29 CFR 1910.332 clarifies the training requirements for all workers, stating that they apply to workers who face a risk of electric shock that is not reduced to a safe level. OSHA requires the following workers to be trained in electrical safety

because they face a higher-than-normal risk of electrical accident:

- Blue collar supervisors
- Electrical and electronic engineers
- Electrical and electronic equipment assemblers
- Electrical and electronic technicians
- Electricians
- Industrial machine operators
- Material handling equipment operators
- Mechanics and repairers
- Painters
- Riggers and roustabouts
- Stationary engineers
- Welders

Standard 29 CFR 1910 calls for the following minimal training for qualified workers:

- Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment
- Skills and techniques necessary to determine the nominal voltage of exposed live parts
- Clearance distances and corresponding voltages to which they will be exposed.

Training can be in the classroom or on-the-job, with the degree of training being determined by the risk to the employee.

The OSHA standard requires that unqualified persons be trained in and familiar with electrically related safety practices that are necessary for their safety. Finally, OSHA adds the following blanket statement: "Any other employees who may reasonably be expected to face comparable risk of injury due to electric shock or other electrical hazards must also be trained." This makes it clear that virtually all employees who work anywhere near electrical equipment must be trained.

Training for Qualified Workers

NFPA 70E outlines comprehensive electrical safety training required for qualified workers. It specifies that they must be trained and knowledgeable about the construction and operation of electrical equipment and be trained to recognize and avoid electrical hazards that might be present.

As expected, the standard requires qualified workers to be familiar with the use of special precautionary techniques and personal protective equipment (PPE). They also must be knowledgeable about arc flash, insulating and shielding materials, and insulating tools and equipment. Interestingly, workers undergoing on-the-job training are considered to be qualified if they are under the direct supervision of a qualified person.

The standard outlines additional training required for people working within the Limited Approach Boundary of 3.5 feet of exposed, live parts operating at 50 V or more. These skills include:

- Distinguishing exposed, energized parts from other parts of electrical equipment
- Determining the nominal voltage of exposed live parts
- Approach distances and corresponding voltages
- Decision-making process necessary to determine the degree and extent of the hazard and the PPE and job planning necessary to perform the task safely

The standard is less specific about the training required for unqualified workers, stating simply that they must be trained in and be familiar with any electrical safety-related practices necessary for their safety. This guidance is admittedly vague because the standard cannot anticipate the electrical hazards to which every worker might be exposed in each plant. Thus, training must be tailored to the specific needs of each facility. This is where professional training consultants can help. They can conduct a survey of the facility and determine the appropriate level of training for unqualified workers.

Getting Help with Training

In 2005, OSHA assessed employers more than $34 million in fines, 34 percent of which were due to electrical hazards. With the stakes so high, it is imperative that companies assess their electrical infrastructure and work practices. Quality training is an essential part of an assessment, and unless the instructor has the special expertise required, the company risks falling short of OSHA requirements.

Because of the complexities involved, most companies hire a training firm that provides employee safety training and continuing audits. At a minimum, the training firm should meet the following requirements:

- Employs instructors trained by OSHA and NFPA, ensuring that course content is up-to-date, practical, and focused on the things OSHA cares about most
- Uses instructors who can draw upon real-world experiences to show trainees how to identify and assess electrical hazards
- Offers a broad selection of courses (both on-site and online) that go beyond theory to what experience proves are best practices
- Can offer courses on-site or at a nearby location to minimize employee travel and time away from work
- Provides employees with certification of training completed

APPROACH BOUNDARIES TO LIVE PARTS FOR SHOCK PROTECTION

Nominal System Voltage Range	Limited		Restricted	Prohibited
	Exposed Movable Conductor	Exposed Fixed Circuit Part		
< 50 V	Not specified	Not specified	Not specified	Not specified
50-300 V	10 ft.	3.5 ft.	Avoid contact	Avoid contact
301-750 V	10 ft.	3.5 ft.	1 ft.	1 in.
751 V-15 kV	10 ft.	5 ft.	2 ft 2 in.	7 in.
15.1-36 kV	10 ft.	6 ft.	2 ft. 7 in.	10 in.
36.1-46 kV	10 ft.	8 ft.	2 ft. 9 in.	1 ft. 5 in.
46.1-72.5 kV	10 ft.	8 ft.	3 ft. 2 in.	2 ft. 1 in.
72.6-121 kV	10 ft. 8 in.	8 ft.	3 ft. 3 in.	2 ft. 8 in.
138-145 kV	11 ft.	10 ft.	3 ft. 7 in.	3 ft. 1 in.
161-169 kV	11 ft. 8 in.	11 ft. 8 in.	4 ft.	3.5 ft
230-242 kV	13 ft.	13 ft.	5 ft. 3 in.	4 ft. 9 in.
345-362 kV	15 ft. 4 in.	15 ft. 4 in.	8.5 ft.	8 ft
500-550 kV	19 ft.	19 ft.	11ft. 3 in.	10 ft. 9 in.
765-800 kV	23 ft. 9 in.	23 ft. 9 in.	14 ft. 11 in.	14 ft. 5 in.

Training topics should include:

- Standards that govern electrical work and their requirements, including NFPA 70E and others
- Electrical safety work practices, including lockout/tagout procedures per 29 CFR 1910
- The difference between qualified and unqualified workers and work limitations for unqualified workers
- Comprehensive examples of acceptable and unacceptable work practices, including those in wet or damp locations
- Use of key interlocking systems
- Identification of type and level of hazards, including electrical shock and arc flash hazards
- Identifying energized components and conductors
- Determining nominal circuit and equipment voltages
- The use of voltage sensors and meters
- Interpreting hazard warning labels
- Safe approach distances to exposed electrical conductors
- Rules for authorized "Hot Work" and use of Live Work Permits and Job Briefings
- The consequences of poor electrical safety practices to people and equipment
- PPE requirements, including selection, proper use, and maintenance
- Required and recommended maintenance and safety inspections
- Grounds and grounding
- Applicability of OSHA or other local rules and penalties for noncompliance

All training should include appropriate job aids. Furthermore, it should be integrated with the employer's standard operating procedures and enforcement policies.

Approach Boundaries

NFPA 70E, Paragraph 130.2 specifies that companies should perform a shock hazard analysis to determine the voltage to which personnel will be exposed, boundary requirements, and the PPE needed to minimize the potential for shock. Shock protection boundaries are defined as Limited, Restricted, and Prohibited. Both qualified and unqualified workers must be trained to know safe approach distances and avoid areas they are not qualified to enter.

The table on page 2 lists the allowable approach boundaries for workers exposed to live parts.

The Restricted Approach Boundary listed in the table represents the closest that qualified workers should approach exposed live parts operating at 50 V or more unless:

- They are insulated or guarded from the live parts
- The live parts are insulated from workers and from conductive objects at a different potential
- They are insulated from any other conductive object

Unqualified workers are expressly prohibited from entering areas accessible only to qualified workers unless the equipment is in an electrically safe condition. When unqualified workers must work close to the Limited Approach Boundary, they must be advised of the electrical hazard and warned to stay outside the boundary. If unqualified workers must cross the Limited Approach Boundary, they must be escorted by a qualified worker. ■

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