

Reduce the Risk of Electrical Accidents by Utilizing Only Trained and Qualified Electrical Workers

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INTRODUCTION:

This article not only defines and identifies who a *Qualified Person* is; it also identifies the training requirements for the skills and knowledge required for a person to be considered qualified. There is a misunderstanding in industry of what constitutes a *Qualified Person* and what training is required; this will be clarified. Maintenance of electrical protective devices, particularly circuit breakers and relays, is vital not only for electrical systems and equipment reliability, but also for the safety of employees working on, near, or with these systems and equipment, therefore it must be performed by a *Qualified Person*. This article provides an insight into the training requirements and how this can reduce the risk of employee injuries and fatalities.

The Occupational Safety and Health (OSHA) regulations, along with the National Fire Protection Association (NFPA) in NFPA 70E[®] *Standard for Electrical Safety in the Workplace*, as well as other standards, requires employers to protect their employees from electrical hazards in the workplace. There must be a strong emphasis on “*qualified persons only*” performing work on or near, or interacting with, electrical systems and equipment, especially if there are exposed energized or deenergized electric circuits, conductors, or parts of the equipment. An understanding of the potential hazards of electricity, which include electrical shock, arc flash, and arc blast, must be addressed as a major part of training and qualifying employees. Here we will focus on an overview of the requirements for:

- Qualified Persons
- Conducting a Needs Assessment
- Conducting a Job/Task Analysis
- Conducting the Electrical Hazard Risk Assessments
- Selecting Personal Protective Equipment (PPE),
- Developing safe work practice programs and procedures
- Providing the required training for qualified persons

All of this is necessary in order to properly train and qualify employees, based on their respective job and tasks, and to protect them while they are working on, near, or interacting with electrical systems and equipment, or where any electrical hazard exists or may exist.

QUALIFIED PERSON REQUIREMENTS:

There is a serious misconception throughout industry that a licensed Journeyman or Master Electrician constitutes a *Qualified Person*. This is not necessarily true. A Journeyman or Master license is obtained through a required number of years working under the guidance of a licensed electrician (depending on federal, state, county, or municipality requirements) and passing a National Electrical Code (NEC[®]) exam. As an example; a licensed Master Electrician may have 10 years of hands-on field experience and qualifications in wiring residential buildings but he/she would not be experienced or qualified to work in a manufacturing or processing facility and therefore could not be hired as a *Qualified Person*. The following definitions will help make this clear.

The NFPA 70E defines a *Qualified Person* as: *One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved.* OSHA 29 CFR 1910.399 provides a similar definition of a *Qualified Person* that states: *One who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved.* OSHA provides additional information on what constitutes a *Qualified Person* in the following notes to the definition:

Note 1 to the definition of “qualified person:” *Whether an employee is considered to be a “qualified person” will depend upon various circumstances in the workplace. For example, it is possible and, in fact, likely*

for an individual to be considered “qualified” with regard to certain equipment in the workplace, but “unqualified” as to other equipment. (See 1910.332(b)(3) for training requirements that specifically apply to qualified persons.)

Note 2 to the definition of “qualified person:” An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

Since one of the three qualification requirements is being trained in the hazards of the equipment, it must be addressed specifically. OSHA and NFPA 70E have provided strict requirements for safety training that go hand-in-hand with the qualification of an employee. The following information is provided in order to clarify the OSHA mandates for training employees in the electrical field:

OSHA 29 CFR 1910.332 Training, requires a *Qualified Person* to be trained in *the safety-related work practices that are required by 1910.331 through 1910.335 that pertain to their respective job assignments*. OSHA goes on to require: *Qualified Persons (i.e. those permitted to work on or near exposed energized parts) shall, at a minimum, be trained in and familiar with the following:*

- *The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.*
- *The skills and techniques necessary to determine the nominal voltage of exposed live parts, and*
- *The clearance distances specified in 1910.333(c) and the corresponding voltages to which the qualified person will be exposed.*

Employees are also required to be trained in any other safety practices including applicable emergency procedures that are related to their work and are necessary for their safety.

Note 1: *For the purposes of 1910.331 through 1910.335, a person must have the training required by paragraph (b)(3) of this section in order to be considered a qualified person.*

Note 2: *Qualified persons whose work on energized equipment involves either direct contact or contact by means of tools or materials must also have the training needed to meet 1910.333(C)(2).*

OSHA 1910.332 also states the following concerning the training required for qualified employees: *The training requirements contained in this section [1910.332] apply to employees who face a risk of electric shock...*

Note: *Employees in occupations listed in Table S-4 face such a risk and are required to be trained. Other employees who also may reasonably be expected to face comparable risk of injury due to electric shock or other electrical hazards must also be trained.*

**Table S-4
Typical Occupational Categories of Employees Facing
A Higher Than Normal Risk of Electrical Accident**

Occupation
Blue collar supervisors. ⁽¹⁾
Electrical and electronic engineers. ⁽¹⁾
Electrical and electronic equipment assemblers. ⁽¹⁾
Electrical and electronic technicians. ⁽¹⁾
Electricians
Industrial machine operators. ⁽¹⁾
Material handling equipment operators. ⁽¹⁾
Mechanics and repairers. ⁽¹⁾
Painters. ⁽¹⁾
Riggers and roustabouts. ⁽¹⁾
Stationary engineers. ⁽¹⁾
Welders.

Footnote⁽¹⁾ Workers in these groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.

In addition to the requirements noted above, qualified employees also are required to be trained in:

- The proper use of:
 - Special precautionary techniques
 - Insulating and shielding materials
 - Insulated tools and test equipment
 - Job planning
- Decision-making process necessary to be able to do the following:
 - Perform the job safety planning
 - Identify electrical hazards
 - Assess the associated risk
 - Select the appropriate risk control methods from the hierarchy of controls, which include:
 - Elimination
 - Substitution
 - Engineering controls
 - Awareness
 - Administrative controls
 - PPE

A person is required to receive, as a minimum, this training in order to be considered a qualified person. The employer is required, through regular supervision and annual inspections, to verify that employees are complying with the safety-related work practices. Additional training or retraining may also be required if:

- The supervision or annual inspection indicate non-compliance with work practices
- New technology
- New types of equipment
- Changes in procedures
- Employee is required to use work practices that they normally do not use

Tasks that are performed less often than once per year may require retraining before the performance of the work practices involved. This retraining may be as simple as a detailed job briefing prior to the commencement of the work or it may require more in-depth classroom instruction along with on-the-job training. All training is required to establish employee proficiency in the work practices and procedures. In fact OSHA and NFPA 70E requires the employee to demonstrate proficiency in the work practices involved before the employer can certify that the employee has been trained. The only way the employee can demonstrate proficiency is through a written exam and to actually do the work after receiving or as part of the training. Hands-on training would be valuable in accomplishing this requirement. The required training must be classroom, on-the-job type, or a combination of the two. The type of training provided can be determined by the risk to the employee. Retraining is required to be performed at intervals not to exceed 3 years, due to the 3-year revision cycle of NFPA 70E. All training and retraining must be documented.

In addition to the requirements stated above, employees must also be trained to understand the specific hazards associated with electrical energy, the safety-related work practices, and procedural requirements. These training requirements are necessary to help protect employees from the electrical hazards associated with their respective job or task assignments, as well as to identify and understand the relationship between electrical hazards and possible injury. Training in emergency procedures is also required when employees are working on or near, or interacting with electrical equipment, especially when there are exposed energized electrical conductors or circuit parts.

Qualified Persons are intended to be only those who are well acquainted with and thoroughly conversant in the electric equipment and the electrical hazards involved with the work being performed. OSHA and NFPA are consistent in their requirements for training and qualifying employees to perform work on electrical equipment and systems. As can be seen by the above statements, proper training is a vital part of the worker's safety and proficiency, as well as the reduction of risk to the employee.

The requirements for qualifying employees must be established before the needs assessment and job/task analysis can be properly conducted. This section has provided information that establishes the foundation for

training and qualifying maintenance employees and should be considered when conducting the needs assessment and job/task analysis.

NEEDS ASSESSMENT

The needs assessment should be performed before any significant *Qualified Person* training can be developed and implemented. This assessment involves relevant company personnel who are aware of the job requirements and all applicable codes, standards, and regulations. Information that is collected during the needs assessment will provide insights into any past or present performance problems that should also be addressed in the training program. This process can also be used to determine whether or not training is the solution to any problems that may exist. Other factors that may affect performance should also be recognized and considered. These other factors could include the quality of procedures, human factors, management style, and work environment. Any one or all of these factors may affect job performance, as well as the need for training or retraining, in order to establish employee proficiency.

JOB/TASK ANALYSIS

A review of the information collected during the needs assessment will help to write the initial job description. The job description should contain the following components:

- Job Title
- Qualification requirements for the job
- General description of job requirements
- Description of the job position within the organization, including lines of supervision and assistance available to the employee.
- Description of job environment
- Listing of tools and equipment used in the job
- Listing of resource documents and references used in the job
- Inventory of tasks

The most difficult part of the job description to develop is the task inventory, which is a list of all tasks that make up the job. A task is defined as an observable, measurable unit of work which has a definite beginning and end. A task can be performed in a relatively short period of time (i.e., minutes, hours, or days), and is independent of other actions. Each task is then made up of elements or steps, each of which must also be identified.

Once the Needs Assessment and the Job/Task Analysis are completed, the hazards associated with each task must be identified by performing the electrical hazard risk assessments, which includes the shock and arc flash risk assessments, which are required by NFPA 70E. Proper training and qualification cannot be developed and conducted until these three functions are completed.

ELECTRICAL HAZARD RISK ASSESSMENTS

The results of the electrical hazard risk assessments constitute one of the most important factors in determining hazard mitigation techniques, risk management responsibilities, the selection of personal protective equipment, developing a training program for qualified persons, and developing an effective electrical safety program. The risk assessments are used to identify the three hazards of electricity; shock, arc flash, and arc blast, along with potential employee exposure.

The base requirement for conducting the hazard assessments is provided by OSHA 1910.132(d)(1) which states: *The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE).* NFPA 70E identifies what is needed for conducting the electrical hazard risk assessments for electrical equipment. The Shock Risk Assessment (130.4) is performed to determine the voltage exposure, shock protection boundaries, and the required PPE necessary to protect employees and minimize the possibility of electrical shock. The Arc Flash Risk Assessment (130.5) is performed to help protect employees by determining if an arc flash hazard exists. If it is determined that an arc flash hazard does exist then safe work practices must be determined, the arc flash boundary must be established and required arc-rated PPE must be identified in order to protect employees.

OSHA 1910.132(d)(2) additionally requires employers to certify that they performed a hazard assessment. The signed certification must include the date of the hazard assessment and the identification of the workplace (area or location) evaluated.

The electrical hazard risk assessments will also identify the requirements for an Energized Electrical Work Permit. Where employees are exposed to energized conductors or circuit parts, which have not been placed in an electrically safe work condition, the hazards must be identified on the Energized Electrical Work Permit along with the required PPE and work procedures. This permit must be written, signed, and authorized by management, and it must be used in order to help protect employees who are or may be exposed to any electrical hazards that are present in the workplace. Essentially the electrical hazard risk assessments help to ensure that the training and PPE selected is appropriate for the hazards present in the workplace.

PERSONAL PROTECTIVE EQUIPMENT

Again referring to OSHA 1910, Subpart I, Personal Protective Equipment, 1910.132(d)(1) requires employers to perform a hazard assessment of the workplace to determine if personal protective equipment is necessary. This assessment is an important part of the process to help ensure that the PPE selected is appropriate for the hazards that are or may be present in the workplace.

Training on the selected PPE is also a requirement as stated in OSHA 1910.132(f)(1): *The employer shall provide training to each employee who is required by this section to use PPE. Each such employee shall be trained to know at least the following:*

- *When PPE is necessary*
- *What PPE is necessary*
- *How to properly don, doff, adjust, and wear PPE*
- *The limitations of the PPE*
- *The proper care, maintenance, useful life and disposal of the PPE*

Paragraph (f)(2) goes on to state that: *Each affected employee shall demonstrate an understanding of the training specified in paragraph (f)(1) of this section, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.*

Paragraph (f)(3) further states that: *When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by paragraph (f)(2) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:*

- *Changes in the workplace render previous training obsolete; or*
- *Changes in the types of PPE to be used render previous training obsolete; or*
- *Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.*

Paragraph (f)(4) of 1910.132 states: *The employer shall verify that each affected employee has received and understood the required training through a written certification that contains the name of each employee trained, the date(s) of training, and that identifies the subject of the certification.*

As noted above, NFPA 70E, 130.4 addresses the requirements for performing the Shock Risk Assessment to determine the potential voltage exposure, shock protection boundaries (i.e. Limited and Restricted Approach Boundaries), and the required rubber insulating PPE (i.e. gloves, blankets, sleeves, etc.).

Also noted above, NFPA 70E, 130.5 provides the requirements for performing the Arc Flash Risk Assessment to determine if and arc flash hazard exists. If an arc flash hazard does exist, safe work practices must be established, the arc flash boundary must be established, and the requirements for arc-rated clothing and PPE, for employees working within the arc flash boundary, must be determined. When work is to be performed within the arc flash boundary, the arc flash incident energy analysis (used to determine the incident energy levels) or the Arc Flash Hazard Identification and PPE Category Tables may be used to determine the proper arc-rated clothing or PPE that the employee would be required to use.

Other personal protective equipment, that is often overlooked, but is equally important, is the requirement to use insulated hand tools. OSHA 1910.335(a)(2) requires that: *When working near exposed energized conductors or circuit parts, each employee shall use insulated tools or handling equipment if the tools or handling equipment might make contact with such conductors or parts.* A common misconception is that when using insulated tools, rubber-insulating gloves are not needed. This is a false concept. The primary purpose of rubber gloves is shock protection and the primary purpose of insulated tools is to prevent an electrical arc flash by going phase-to-ground or phase-to-phase with the tool. Rubber-insulating gloves and insulated hand tools must be used together in order to help avoid the electrical hazards.

A good summary statement for PPE comes from OSHA 1910.335(a)(2)(ii) which states: *Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the live parts.*

ELECTRICAL SAFETY PROGRAM

OSHA 1910.333(a) states that: *Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.*

Paragraph (2) of 1910.333(a) goes on to say that: *If the exposed live parts are not deenergized, other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts.* Paragraph (b)(1) also states that: *Conductors and parts of electric equipment that have been deenergized but have not been locked out or tagged...shall be treated as energized parts, and paragraph (c) of this section applies to work on or near them.*

Paragraph (c)(1) for energized work states that this *applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.*

Paragraph (c)(2) further states that: *Only qualified persons may work on electric circuit parts or equipment that have not been deenergized... Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.* Paragraph (3) goes on to state that: *If work is to be performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before work is started.*

The OSHA Instruction STD 01-16-007, Directorate of Compliance Programs, Electrical Safety-Related Work Practices--Inspection Procedures and Interpretation Guidelines, states: *Under 1910.333(a)(2) if the employer does not deenergize, then suitable safe work practices for the conditions under which the work is to be performed shall be included in the written procedures and strictly enforced.*

NFPA 70E requires the employer to implement an Electrical Safety Program appropriate for the voltage, energy, and circuit conditions, as found in Section 110.1. This program is required to contain the following elements:

- Condition of Maintenance
- Awareness and Self-Discipline
- Electrical Safety Program Principles
- Electrical Safety Program Controls
- Electrical Safety Program Procedures
- Risk Assessment Procedure
- Job Briefing
- Electrical Safety Auditing

CONCLUSION

As can be seen by the above quotes from NFPA 70E and OSHA, an employee, in order to be considered a qualified person, must receive extensive training. In order to determine the required training a Needs Assessment along with a Job/Task and Hazard Analysis, which must include the Shock Risk Assessment and the Arc Flash Risk Assessment, must be performed. The goal of any training program is to develop and maintain an effective and safe work force.

Electrical power systems today are often very complex. Protective devices, controls, instrumentation, and interlock systems demand that technicians be trained and qualified at a high technical skill level. Safety and operating procedures utilized in working on these systems can be equally as complex, requiring technicians to be expertly trained in all safety practices and procedures.

OSHA regulations, along with NFPA 70E, require employers to document that employees have demonstrated proficiency in electrical tasks. Employers must “certify” (document) that their employees are trained and qualified and that this certification is maintained for the duration of the employee’s employment. OSHA’s intent here is to ensure that the training is well documented; a notation in the employees training record would suffice for in-company training. If the employee attends training outside of his/her company, a Certificate of Completion would serve as acceptable documentation that the training was successfully completed. A copy of the certificate should be maintained in the employees training record.

Utilizing only Qualified Persons to perform electrical work can greatly reduce the risk to the safety of the employee, as well as increasing reliability of the electrical system and equipment.

REFERENCES:

- [1] NFPA 70, National Electrical Code, 2014 Edition
- [2] OSHA 29 CFR 1910.399, Definitions
- [3] OSHA 29 CFR 1910.331-.335, Electrical Safety-Related Work Practices, Aug. 6, 1990
- [4] NFPA 70E, Standard for Electrical Safety in the Workplace, 2015 Edition
- [5] OSHA 29 CFR 1910.269, Electric Power Generation, Transmission, and Distribution, April 11, 2014
- [6] OSHA 29 CFR 1910, Subpart I, Personal Protective Equipment, 1910.132, General Requirements
- [7] OSHA Instructions STD 01-16-007, Directorate of Compliance Programs, July 1, 1991

VITA

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