

Gearing up for the Revised 2012 NFPA 70E Electrical Safety/Arc Flash Requirements

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Introduction

Worker injuries resulting from inadequate electrical safety controls can be debilitating and even fatal. It is the OEHS professional's responsibility to recognize electrical hazards and suggest methods of control.

NFPA 70E (Standard for Electrical Safety in the Workplace) is a global consensus that has provided guidance on worker safety from shock and arc flash hazards since 1976. In late 2011 NFPA released the 2012 Edition of NFPA 70E. The 2012 standard includes revisions to hazard risk category tables, new PPE requirements, frequency requirements for electrical safety program auditing and qualified person training, and revisions to electrical safety program implementation.

Background

To understand the application of NFPA 70E to workplace conditions it is first important to understand the difference between electrical installations and work practices:

- Electrical Installations: Covers electrical engineering controls to prevent inadvertent shock to the worker.
- Work Practices: Covers means to protect worker during energized work including personal protective equipment, approach boundaries, tools, and awareness means.

NFPA 70E applies to work practices where it is necessary to perform work on energized conductors. Both OSHA and NFPA have stringent criteria to allow energized work practices. These criteria are as follows:

- Because of infeasibility due to testing of electrical circuits that can only be performed with the circuit energized.
- Increased or additional hazards include interruption of life-support equipment, deactivation of emergency alarms, shutdown of hazardous location ventilation systems, or removal of illumination for an area.

- Employer can demonstrate the de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.
- Less than 50 Volts: Not required to be de-energized

NFPA 70E-2012 Edition Revisions to PPE Requirements

The following summarized revisions to personal protective equipment requirements for arc flash and shock protection:

- *Hand Protection.* Protector gloves are worn over voltage rated gloves for flash protection & protect the v-rated gloves against punctures & snags. The 2012 NFPA 70E clarifies that protector gloves shall be worn over rubber insulating gloves for protection against arc flash and shock protection. In addition Heavy duty leather gloves are to be constructed entirely of leather which a minimum thickness of 0.03” with non-flammable, non-melting fabrics. Arc Thermal Protection Values (ATPV) also needs to protect the worker to incident energies greater than 10 cal/cm².
- *Eye and Face Protection.* Employees must wear protective equipment for the eyes & face whenever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosions. A new requirement in 2012 will require the use of Arc rated balaclava (head sock) be used with an arc rated face shield when the back of the head is within the arc flash boundary. Also previous editions of NFPA 70E required the use of the head sock in Hazard Risk Category (HRC) of 2*. The HRC 2* was eliminated in 2012 as HRC 2 will require the use of the head sock. An Arc rated hood is permitted in lieu of head sock.
- *Arc Rated Clothing.* Arc Rated Clothing (ARC) is the characteristic of protective clothing not supporting combustion in air. ARC should be appropriate to hazard meaning that it should protect the arms and torso of the worker against the anticipated incident energy. This term has been previously referred to as Flame Resistant in previous versions of NFPA 70E. In 2012 the term Flame Resistant has been replaced with the term Arc Rated.
- *Hearing Protection.* A new requirement in 2012 requires the use of hearing protection whenever working within the arc flash boundary.
- *PPE Selection in General.* As with previous editions of NFPA 70E there are two ways to select proper PPE for a given tasks. These include the use of NFPA 70E Tables, or the preferred method of performing an arc flash hazard analysis. Starting in 2012 PPE tables are separated into AC vs. DC systems as follows:
 - AC Systems: NFPA 70E, Table 130.7(C)(15)(a), page 33-37
 - DC Systems: NFPA 70E, Table 130.7(C)(15)(b), page 38
 As with previous editions, selection of PPE (utilizing tables) involves knowledge of the following:
 - Type of Equipment
 - Voltage Range (Nominal Voltage)
 - Task
 Once these have been identified, a hazard risk category is assigned. As each hazard risk category (0-4) increases, it corresponds to increasing levels of PPE. Likewise the arc rating of arc rated clothing also increases.

NFPA 70E-2012 Edition Revisions to Approach & Flash Boundaries

The following summarizes revisions to approach boundary requirements for arc flash and shock protection:

- *Arc Flash Analysis.* NFPA 70E has always required an Arc Flash Analysis. This is the distance from electrical equipment at which the incident energy equals 5 J/cm² (1.2 cal/cm²)
- *Arc Flash Default Boundaries.* Previous editions of NFPA 70E allowed a 4 foot default boundary of systems meeting certain criteria including threshold clearing times. The 2012 edition of NFPA 70E now lists default boundaries at the beginning of each PPE table. In addition the 2012 NFPA 70E has separated AC and DC systems as follows:
 - AC Systems: NFPA 70E, Table 130.7(C)(15)(a), page 33-37
 - DC Systems: NFPA 70E, Table 130.7(C)(15)(b), page 38
- *Shock Protection Boundaries.* Approach Boundaries as outlined in Table 130.4(C)(a) is the linear distance about energized parts restricted to qualified persons performing such work. Note that Table 130.4(C)(a) applies to approach distances on AC systems. The 2012 NFPA 70E has added Table 130.4(C)(b) which applies to approach distances for DC systems. There are three approach distance boundaries which are outlined as follows:
 - Limited approach boundary: Outermost boundary that can be crossed by qualified person. One common confusing aspect of the limited approach boundary is that it divided into exposed movable conductor limited approach boundary and exposed fixed circuit part. These two approach boundaries are not used interchangeable and are defined as follows:
 - Exposed Movable Conductor:
 - Typically an overhead conductor
 - Distances greater than for fixed conductor
 - Worker requires a bucket truck or other means, such as a movable platform, to work on conductor
 - Exposed Fixed Circuit Path:
 - Exposed fixed circuit path
 - Distances less than for movable conductor
 - Example would be an open section of a panelboard where a worker or object could come into contact with the exposed part
 - Restricted Approach Boundary: Safest distance before qualified worker is required to use shock protection equipment and techniques. Unqualified persons may not cross the boundary under any circumstances.
 - Prohibited Approach Boundary: Crossing this boundary is the same as coming into contact with a live part.

NFPA 70E-2012 Edition Revisions to equipment labeling

Equipment must be labeled to warn of potential shock and arc flash hazard. Markings shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of electrical equipment. In other words labeling must be visible before the qualified person access potentially energized equipment. The 2012 NFPA 70E requires the following information be available on an equipment label:

- At least one of the following:
 - Available incident energy and the corresponding working distance
 - Minimum arc rating of clothing
 - Required level of PPE
 - Highest Hazard/Risk Category (HRC) for the equipment
- Nominal system voltage
- Arch Flash Boundary

NFPA 70E-2012 Edition Revisions to electrical safety program implementation

An electrical safety program shall be established which addresses the hazards and appropriate control measures for these hazards. The program should also address the procedures for electrical safety program implementation. NFPA 70E has always required the generation and implementation of an electrical safety program. Starting in 2012 there are many revisions electrical safety program requirements.

- *Work Permit System.* A work permit system requires the following:
 - Description of equipment to be worked on and location
 - Justification of why work must be performed in energized condition
 - Description of safe work practices to be employed
 - Results of shock hazard analysis
 - Determination of shock protection boundaries
 - PPE
 - Means employed to restrict access of unqualified persons to persons working in area
 - Job Briefing
 - Approvals
 - 2012 NFPA 70E revisions include the following:
 - Results of Flash Hazard Analysis
 - Flash Protection Boundaries
- *Auditing.* Auditing Ensures that principles and procedures are followed. 2012 revisions to NFPA 70E include the following:
 - Electrical safety program must be audited every three years. This is a definite change from previous editions that did not require an audit frequency.
 - Field work must be audited. This means that there is now a requirement to audit qualified persons. In addition, NFPA 70E requires that qualified persons be retrained if an annual field audits shows that they are not complying with safe work practices.

- *Host Employer/Contractor Relationship.* The 2009 edition of NFPA 70E outlined requirements for contractors performing energized work within a host employer's facility. The 2012 version of NFPA 70E expands on this relationship. Responsibilities of contractor and host employers are summarized as follows:
 - Contract Employer
 - Communicate hazards to his employees as communicated by the host employer in addition to the requirement of NFPA 70E
 - Require that employees follow safe work practices as require by host employer and NFPA 70E
 - Inform host employer of:
 - Unusual hazards presented during work
 - Unanticipated hazards
 - Corrective actions taken as a result of any violations reported by the host employer
 - Host Employer
 - Communicate any known hazards with contract employer
 - Report any observed contractor employer violations of NFPA 70E to contract employer
 - There shall be a documented meeting between the host employer and the contract employer.

NFPA 70E-2012 Edition Revisions to training requirements

Requirements/revisions to the 2012 Edition of NFPA 70E related to re-training requirements are summarized as follows:

- Annual inspections indicate employee is not complying with safety work practices
- New equipment or technology
- Work practices as not part of one's regular job duties
- Every 3-years

Bibliography

National Fire Protection Association (NFPA). 2012. *Standard for Electrical Safety in the Workplace* (NFPA 70E), Quincy, MA: National Fire Protection Association (NFPA 2012)