Electrical Safety Compliance: NFPA 70E

From Graybar and Schneider Electric
Risks associated with shock and electrocution from inadvertent contact with energized parts have long been recognized as a threat to electrical workers. It has only been in recent years that awareness of the dangers of arc flash events have been incorporated into electrical safety standards.

Over the last ten years, more than 30,000 workers have been injured in workplace electrical accidents.*

Regulatory agencies soon recognized the severity and urgency of the situation. The Occupational Safety and Health Administration (OSHA) developed laws to protect electrical workers. These laws, in essence, mandate that work on electrical equipment must be performed in a manner that does not expose the worker to undue risk of injury.

The National Fire Protection Association (NFPA) 70E: Standard for Electrical Safety in the Workplace® is the document most often referenced for electrical safety. OSHA enforces electrical workplace safety standards outlined in NFPA 70E. Enforcement may take place following an electrical accident or during their normal on-site inspection process.

Graybar along with Schneider Electric™ Services advocates compliance to NFPA 70E: Standard for Electrical Safety in the Workplace not only for worker safety, but also equipment productivity. An arc flash accident can render equipment unusable and place the facility in a costly downtime mode, which could last hours or days.

While not the leading cause of on-the-job injuries and accidents, electrical accidents are disproportionately fatal and costly.*

*Electrical Safety Foundation International (ESFI)

NFPA 70E requires the development and enforcement of an Electrical Safe Work Practices (ESWP) policy. It also defines the requirements for safe work practices and requires audits and revisions to keep the safety policy up to date.

While basic compliance to NFPA 70E requirements is established with a five-step process, a sixth step assists the facility owner with fine tuning the electrical power system, both for safety and operability.

### Did you know?

NFPA 70E 2015, Section 110.3(A) states that hiring contractors to perform electrical work does not absolve the owner of the facility (host employer) from assuring compliance to safe work practices.

The facility owner is ultimately responsible for safety at their site and must document and communicate known hazards covered by NFPA 70E to the contracted worker(s).

In addition, the owner must report any contract employee's safety violations to the contract employer.
Develop and Audit an Electrical Safe Work Practices (ESWP) Policy.

This is a written document created by the employer that covers all areas of the company’s electrical safety practices. It includes such things as lockout/tagout procedures, method of qualifying the workers, selection and application of PPE, methods of establishing a safe work area, arc flash and shock protection calculations, equipment labeling, and worker audit procedures.

An audit of the safety policy must be performed on a three-year cycle to assure continued compliance of the policies and procedures to the standard. When the auditing determines that the principles and procedures of the electrical safety program are not being followed, appropriate revisions to the training program and/or revisions to the procedures shall be made. In addition, workers must be evaluated for compliance to the standards and the policy, and any deviations must be documented.

The safety policy is a living document that must be audited and corrected over time.

Conduct an Arc Flash Risk Assessment to Determine the Present Degree of Arc Flash Hazards.

This is an electrical system engineering study that is overseen by professional engineers familiar with the power distribution and control equipment and the calculation methods required. The methodology for conducting an arc flash analysis is outlined in IEEE 1584™ Guide for Performing Arc-Flash Hazard Calculations.

NFPA 70E-2015, Section 130.5 states an arc flash hazard analysis shall determine the arc flash boundary, the incident energy at the working distance, and the personal protective equipment that people shall use within the arc flash boundary.

An arc flash hazard analysis must be updated when a major renovation or modification takes place. At a minimum, it should be reviewed every five years because changes in the electrical distribution system could affect the results of the arc flash hazard analysis.
Understanding How to Apply Warning Labels to Equipment

NFPA 70E-2015, Section 130.5(D) requires that equipment that is likely to be examined, adjusted, serviced, or maintained while energized shall be field-marked with a label containing all of the following information:

1. At least one of the following:
   • Available incident energy or required PPE Category, but not both
   • Minimum arc rating of clothing
   • Site specific level of PPE

2. Nominal system voltage

3. Arc flash boundary

In addition, the calculation method and data to support the information for the label shall be documented.

Understanding the Different Types of Arc Flash Labels

Arc-flash labels shall always be applied to equipment per the company’s ESWP policy. Custom labels or site-specific PPE labels that comply with the ESWP policy are allowed by NFPA 70E. Graybar recommends three predefined label formats which address the majority of arc flash labeling scenarios.

Graybar and Schneider Electric recommend simplified arc flash labels because they:

• Reduce the opportunity for PPE selection errors due to the two-tiered system for “energized work”
• Standardize PPE purchases and reduce supply chain complexity
• Eliminate time and costs associated with label changes due to small incident energy changes

1. Simplified Labeling is based upon a two-tiered PPE system, reporting the maximum arc flash boundary for each case:
   • Level 1: \( \leq 8 \text{ cal/cm}^2 \) OR
   • Level 2: \( > 8 \text{cal/cm}^2 \) and \( \leq 40 \text{ cal/cm}^2 \)

Using this labeling method results in fewer arc flash boundaries to observe. Therefore, the PPE that employers must provide for workers is simplified and standardized. In some cases, this method requires more PPE than necessary as it assumes a minimum work wear rated to 8 cal/cm2. However, showing the maximum IE and arc flash boundary may indicate that minor system changes do not invalidate the labels of the PPE category. This results in simpler label Installation and records management.

2. Actual Incident Energy (IE) Levels (Individual) labels reflect the precise IE and arc flash boundary with the equipment name.
   • Having unique labels for each location complicates the installation process.
   • Requires workers to interpret discrete IE values to select proper PPE.
   • Reflect many different arc flash boundaries within the same power system.
   • Any changes in the power system can easily invalidate the label values.

3. Site-Specific (Standard) labels group pieces of equipment within a given range, based upon IE levels. The same label is used for all equipment within a given range and align with ESWP policies that indicate site-specific PPE levels.
   • An update to 2004-2012 Schneider Electric legacy labels.
   • Easier to install than actual IE arc flash boundary labels.
Employees working in areas where there are potential electrical hazards shall be provided with personal protective equipment (PPE) that is appropriate for the specific parts of the body to be protected. This can include arc-resistant shirt, pants or coveralls, or a multi-layer flash suit. Additional PPE requirements consist of flash hoods, voltage rated gloves, EH-rated safety shoes, safety glasses, and hard hats. Employees working within the arc flash boundary are also required to wear hearing protection.

Properly-rated equipment is needed to test voltages. Insulated tools are required for workers who are to perform testing and troubleshooting on energized equipment.

NFPA 70E defines a qualified person as “one who has demonstrated skill 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.” This training requirement means that the employee must have received safety training specific to the hazards of arc flash, arc blast, shock, and electrocution. Electrical workers are not considered to be qualified by OSHA until they have received this specific training.

Further, the employer must verify, through regular supervision or through inspection conducted on at least an annual basis, that each worker is complying with the safety-related work practices required by NFPA 70E.
The "active" components in electrical distribution systems consist of fuses, circuit breakers, and protective relays that help protect the system in the event of an electrical fault. These over-current protective devices have a critical role in controlling the arc flash energy. Therefore, it is crucial to keep these devices in proper operating condition with a regular maintenance program. Without proper over-current protection, sustained arcing can subject electrical workers to much higher levels of energy. On the other hand, modern, properly adjusted over-current protective devices that have been well maintained are able to detect an arcing fault condition and clear the fault quickly. Unless adequate maintenance is performed, the electrical system study and the arc flash analysis will not be a correct representation of the potential performance of the power system. Therefore, in addition to compliance with NFPA 70E, Graybar and Schneider Electric recommend that facilities adopt NFPA 70B: Recommended Practice for Electrical Equipment Maintenance. Our qualified field services personnel perform on-site preventive and predictive maintenance services for any manufacturer’s electrical equipment. Upon completion, a detailed report is provided that identifies potential issues along with corrective recommendations.

Equipment must be in an electrically-safe condition during maintenance, testing, and repair.
This often overlooked step is one of the most crucial in optimizing the safety and performance of the power system. The arc flash study performed in step two essentially establishes the arc flash energy levels and the required PPE for the power system in the existing condition. However, the calculated arc flash energies may be high enough to hinder some normal tasks from being performed within the arc flash boundary of the equipment. For example, an incident energy of 35 cal/cm² may be calculated for a 600 volt motor control center. To protect the worker from the arc flash levels, PPE such as heavy arc-rated clothing and flash hood will be needed. Yet, workers may view the required arc flash PPE to actually be a hindrance to the job. The difficulty in movement under heavy clothing and the reduction in eye sight under the heavy flash hood make it difficult, if not impossible, to perform proper testing and troubleshooting.

The goal of arc flash mitigation is to reduce the arc flash energy, and thus the PPE, to a level that permits normal tasks to be performed on equipment. Arc flash mitigation has been a rapidly developing area of research and development. We are constantly working on new mitigation strategies to promote electrical workplace safety.
Arc Flash Mitigation Solutions

Graybar and Schneider Electric Services provide a variety of arc flash mitigation solutions for any brand of electrical equipment.

Solution Group 1

Lowers arc flash energy by reducing the arcing time.

Over-Current Protective Device (OCPD) Coordination Study

An OCPD coordination study optimizes circuit breaker and relay settings and can be specified as a component of the arc flash study. The speed of operation of the OCPD determines the duration of an arc flash event.

Specialized Relaying Such as Light Sensing Technology

Strategically-placed light sensors in switchgear compartments makes it possible to sense the arc within a millisecond. Modern relays can sense this condition and trip the appropriate circuit breaker. Other relaying technologies are zone selective interlocking and differential protection.

Virtual Main Relay

Low-voltage switchgear and switchboards can be subjected to dangerous levels of arc flash incident energy when fed directly from a power transformer. Upgrading switchgear with a virtual main relay adds over-current sensing to the low-voltage side of the service transformer and is designed to trip an existing upstream fault-breaking device.

Solution Group 2

Removes worker from location or places a barrier between worker and exposed energized parts.

Infrared (IR) Windows

IR windows allow you to obtain condition and status information of electrical equipment without the need to remove equipment panels. The complete unit is permanently fitted into electrical equipment and enables infrared inspections to be performed without downtime.

Remote Racking System (RRS)

A RRS allows medium-voltage circuit breaker racking operations to be performed via a control panel located away from the cell, removing the operator from manual contact with the circuit breaker. In addition, a RRS may reduce the PPE Hazard Risk category because the worker is removed from the flash protection boundary.

Wireless Temperature Monitoring System (WTMS)

A WTMS allows for easy field installation of wireless sensors into low- and medium-voltage equipment. Sensors can be placed in locations usually not accessible with an infrared camera. They can be installed on equipment with high arc flash ratings, allowing equipment condition to be monitored without a risk of danger to personnel or equipment.
Electrical Safety is Serious Business

Did you know?

- Nearly 3 deaths per week
- 4,000 injuries per year
- A severe injury every 30 minutes

**OSHA's top 10 cited violations include:**
- Hazard communication
- Lockout/tagout
- Electrical wiring
- Electrical systems design

6 steps to NFPA 70E 2015 compliance

1. An electrical safe work practices policy – sect. 110.3 (H)
2. Arc flash risk assessment – sect. 110.1 (G)
3. Ensure adequate supplies, PPE and proper tools – sect. 130.4
4. Conduct regularly scheduled safety and training audits for all electrical workers – sect. 205.1
5. Maintain all electrical system components – sect. 205.3
6. Graybar and Schneider Electrical recommend a crucial step 6: Employ arc flash mitigation strategies – Annex O
We work to your advantage.

Graybar, a FORTUNE 500 corporation and one of the largest employee-owned companies in North America, is a leader in the distribution of high quality electrical, communications and networking products, and specializes in related supply chain management and logistics services.

Graybar has the power and stability of a big company and the integrity and drive of an employee-owned business. Graybar is ISO 9001:2008 Registered.

Discover how Graybar can work to your advantage.

FEATURED MANUFACTURER

Call your local sales representative at 1-800-GRAYBAR to schedule an arc flash assessment.

We work with Schneider Electric, a recognized leader in promoting electrical workplace safety and helping companies comply with the requirements of NFPA 70E.