

Arc Flash & Electrical Safety Training

Modular Training in Support of Safe Operations and Maintenance of Electrical Distribution Systems as Required by NFPA 70E 2024



Electrical Safety Training for Electrical Workers and Everyone Else

With NFPA 70E 2024, the employer, contractor, and employee all have responsibilities related to creating and maintaining a safe electrical work environment. Arc flash and electrical safety training is relevant to anyone that performs or supervises electrical work or is responsible for electrical work or safety at a facility.



Fox River Systems offers modular training conducted in 2-, 4-, 6-, and 8-hour sessions that are targeted to the roles, responsibilities, and level of detail needed to learn how to be safe. The full 8-hour class is comprised of 4 modules designed for electrical workers; however, the course is delivered in a way that builds from the basics that everyone needs to know to the more technical details that the electrical worker needs to know. The course employs lecture, demonstrations, and hands-on lab exercises and simulations to engage students.

Fox River Systems provides services in support of creating and maintaining a safe workplace.

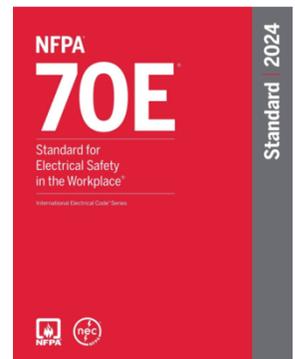
Fundamentally, everyone wants to work in a safe environment, but improper work practices, missing or inconsistently followed policies and procedures, and safety issues associated with electrical distribution equipment itself are frequently invisible or not understood by management and electrical workers.

To reduce the potential for injuries and the number of deaths, the Occupational Safety and Health Administration (OSHA) has taken the lead in creating and enforcing regulations designed to promote workplace safety. The OSHA standards for electrical installation are found in Subpart S of 29-CFR, Part 1910, and draw heavily on work done by the National Fire Protection Association (NFPA) which established industry consensus standards, collectively referred to as NFPA-70E (the “Standard for Electrical Safety in the Workplace”). The combination of OSHA’s 29-CFR, NFPA-70E, and the National Electric Code (NEC) are reasonably necessary to provide protection against the significant risks of injury or death to employees from the electrical hazards in the workplace.

A starting point for establishing a safe work environment for personnel is to understand answers to questions about your facilities that will help you assess which aspects of an Electrical Safety/Arc Flash Loss Prevention program are needed by your organization to address workplace safety and regulatory compliance.

Our approach helps you understand:

- How your facility can be compliant with OSHA regulations
- Where your Electrical Safety Program is deficient
- How to select and maintain Personal Protective Equipment (PPE)
- Training required for personnel to understand the risks and safe work practices associated with electrical work
- How arc flash studies & labeling improve compliance with wearing proper PPE
- The disciplines to put in place to improve workplace safety and protect assets



With an understanding of the answers to these questions and others, we can work with you consultatively to determine the best course of action to take.

Electrical Safety Training—Syllabus

Module 1: What Everyone Needs to Know About Electrical Hazards/Risks, Safety, and Regulations

Why do we need electrical safety and who is it for?

- Electrical statistics & facts on electrical incidents
- Relationship between OSHA & NFPA 70E; OSHA citations □ Who is NFPA?
- NFPA 70E Standard for Electrical Safety in the Workplace
- Intent of NFPA 70E
- What's covered and what's not

What are the Electrical Hazards?

- Hazard: Electric Shock
- Effects of electric current on the human body
- Mitigating exposure to electric shock
- Hazard: Arc Flash, Arc Flash Hazard
- Terms: Incident Energy, Arc Thermal Performance Value (ATPV)
- Arc flash and arc blast—dangers & causes

General Requirements for Electrical Safety-Related Work Practices (Article 110)

- Elements of risk assessment
- Hierarchy of risk control methods
- Job safety planning and job briefing
- Electrical Safety Training

NFPA 70E Arc Flash Hazard Analysis & Shock Protection

- Equipment labeling & example labels
- Personal Protective Equipment (PPE)
- Shock protection approach boundaries
- Flash protection boundary
- Mitigating exposure to arc flash
- Definition: “working on” energized electrical conductors

Training Requirements

- Host employer responsibilities
- Relationship with contractors
- Contract employer responsibilities
- Definition: Qualified Persons
- Training requirements for qualified persons & unqualified persons

Electrical Safety Program

- Elements of an electrical safety program
- Shared Responsibility – examples from 70E

Summary Review

Module 2: What Electrical Workers and Direct Supervisors of Electrical Workers Need to Know

Electrical Safety Program Elements

Hazard/Risk Evaluation Procedure

- The Safety Program: Job Briefing
- Audit of Employee Safety-Related Work Practices

Establishing an Electrically Safe Work Condition

- Steps to a safe work condition
- Forms of control
- Simple and complex lockout/tagout procedures
- Equipment requirements
- Lockout devices and tagout devices
- Electrical circuit interlocks
- Temporary grounding equipment

Elements of Control

Energized Electrical Work Permits

- Justification for work
- When this is necessary & exemptions
- Safe work practices
- Restricted Access
- Job briefing
- Approval signatures

Approach Boundaries & Shock Risk Assessment

- Worker/PPE requirements
- Establishing approach boundaries
- Limited approach boundary
- Approach boundaries and unqualified persons

Arc Flash Protection Boundary

- The Arc Flash Hazard
- Approach boundary vs. Flash protection boundary □
Estimating likelihood of arc flash incidence □
Flash hazard analysis: □ Arc flash PPE and arc flash boundary □ Arc flash assessment:
- Arc flash PPE method
- The incident energy analysis method
- Data collection phase
- Pros & cons for each method of arc flash boundary and PPE determination
- Preparations for an incident energy analysis
- Data collection & modeling electrical systems
- Resulting fault analysis calculations by bus

Summary Review

Module 3: Additional Info for Electrical Workers

Personal Protective Equipment and Clothing

- Care of Personal Protective
- Arc Rated Clothing Care
- PPE for Every Part
- Selecting PPE:
 - PPE Hazard/Risk Categories
 - Engineering Calculations of Incident Energy and Arc Flash Boundary
 - PPE Clothing/Equipment Matrix
 - PPE Characteristics
 - Arc Thermal Performance Value
- PPE layering, coverage, and fit
- Clothing that is not permitted
- PPE markings
- Clothing care and inspection
- Electrical measurement instrument ratings

Maintenance and Testing of Protective Equipment

- Insulated Tools
- Voltage rated plastic guard equipment
- Other insulating equipment
- Barriers and Barricades
- Alerting Techniques, signs, and labels
- Protective equipment testing
- Intervals of testing

PPE Selection

- What to do when no hazard labels are on equipment
- Interpreting equipment labels to select PPE
- Arc flash PPE strategy to maximize use and minimize cost
 - Base clothing layers
 - Use of Category 2 and Category 4 arc flash PPE

Recognizing Other Potential/Future Problems

- Observation and documentation of potential problems:
- Enclosure mechanical integrity
- Broken/failed equipment
- Mismatched fuse types
- Burned or discolored wire insulation

70E Chapter 3: Special Equipment Requirements

- Electrolytic Cells
- Batteries and Battery Rooms
- Lasers
- Power Electronic Equipment
- R&D Laboratories

Summary Review

Module 4: Electrical Measurement Safety

Test Instruments and Accessories Are Part of PPE

- How to check if your test equipment conforms to industry standards
- How transients can trigger an arc flash
- IEC 6010 Measurement Category locations/ratings
- Identifying CAT ratings and markings on meters
- How Measurement Category & voltage ratings are used to confirm an instrument is appropriate for use
- What to do if you can't find a rating

Meter Design Features and Category Ratings

- Independent testing and certification of ratings
- Common user errors with measurement tools
 - Measuring ohms or continuity on a live circuit
 - Connecting a meter to a voltage source when meter is set for inline amps measurement
 - Using a meter above rated voltage
- Some meters provide protection features
- Meter fuses: Importance of using the correct fuse
- Safety inspection—validation of meter fuses on most meters

Meter Probes/Leads and Category Ratings

- Perform an inspection of test leads
- Using quality test leads is important
- Minimize exposed probe-tip metal for safety
- Test lead safety checklist

Electrical Current Measurements

- Why amps inputs should employ high energy fuses
- Use of clamp meter vs. inline amps measurement
- AC and AC/DC current clamp accessories
- Current Transformer (CT) style clamps for AC current measurement
- AC/DC Current Clamps that use V inputs of Digital Multi-Meter
- 4-20mA process signals

Measuring for Absence of Voltage

- Tools and methods for verifying absence of voltage
- Tools that shouldn't be used to verify voltage absence

Other Tools/Technology That Can Enhance Safety

- Remote/wireless measurement tools
- Infrared windows
- Non-contact voltage and current measurement

Summary Review

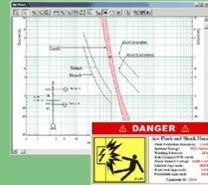
Fox River Systems recognizes that organizations have unique needs and unique capabilities related to instituting policies and practices aimed at ensuring electrical safety in the workplace. Fox River Systems offers modular services that complement your in-house capabilities to provide a cost-effective solution for putting your electrical safety and loss prevention program in place. Contact us to learn more about any of the following service offerings:

Arc Flash Loss Prevention Program



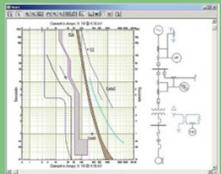
Arc Flash Loss Prevention Program services help an organization's management and maintenance teams understand the risks, regulations, and current work practices associated with electrical safety in the workplace and then provides the supporting framework and guidance to address the combined people, process, and technology issues needed to implement and sustain electrical safety in the workplace.

Arc Flash Analysis/ Power Study



Arc Flash Analysis provides insight about the risks and hazard levels associated with the electrical distribution system of a facility including incident energy levels that personnel may be exposed to while working on energized equipment. This is the basis for determining required Personal Protective Equipment (PPE) and for creation of hazard labels for electrical equipment. A short-circuit study identifies required short-circuit current ratings.

Coordination Study



A Coordination Study is primarily completed when new electrical distribution equipment is being specified and installed. The study seeks to identify proper over-current protective devices and breaker trip unit settings to isolate faults to the nearest upstream protective device. Achieving selective coordination minimizes outages of equipment not directly related to a fault.

Electrical Hazard Labeling



Creation and application of labels to alert workers about the shock and arc flash hazards associated with electrical distribution equipment. We also advise clients regarding the information printed on the labels to both comply with NFPA-70E and to improve worker understanding of the hazards and compliance with wearing the correct Personal Protective Equipment (PPE) while working on or near energized conductors.

Infrared Thermal Scanning of Electrical Systems



Infrared thermal inspections are performed in conjunction with qualified electricians across all electrical distribution equipment to identify anomalies and fire hazards such as high-resistance connections, micro-arcing, and overloads. These problems increase the risk of equipment outages as well as arc flash, arc blast, and fire—leading causes for loss of life and property.

Arc Flash Training



NFPA-70E Electrical Safety Training informs your personnel about the electrical hazards, safe work practices, Personal Protective Equipment requirements, and measurement meter safety necessary to comply with NFPA-70E. The training is modular and tailored to the roles of personnel that work on, supervise work, or have management responsibility for personnel working on electrical distribution systems.

For more information or ordering assistance, please contact:



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