

Answers from



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Arc flash

Q. What are some of the causes of an electrical arc flash?

Accidents, such as dropped tools, accidental contact with electrical systems and the build up of conductive dust, dirt, corrosion and particles.

Electrical Equipment and Insulation Failure

Improperly designed or utilized equipment

Improper work procedures

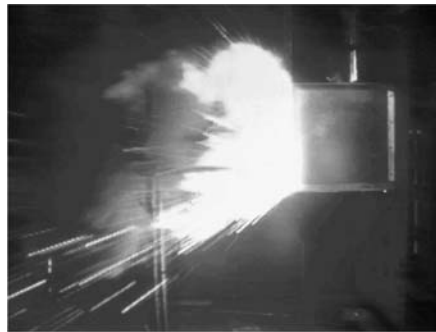
An arc is produced by flow of electrical current through ionized air after an initial flashover or short circuit.

Q. What are the hazards from an arc flash?

Arcing faults release dangerous levels of radiant heat energy, capable of causing severe burns. Fatal burns can occur up to five feet from the arc, with severe burns up to ten feet away. Arcs produce some of the highest temperatures known to occur on earth; up to 35,000 degrees Fahrenheit. *This is 4 times the surface temperature of the sun.*

Clothing can be ignited several feet away. Blast shrapnel can be distributed over a wide area.

Arcs spray droplets of molten metal with the explosion distributing the molten metal produced by the arc over a large area.



The vaporization of metal and heating of the air produces blast pressure waves that have thrown workers across rooms and knocked them off ladders.

Hearing loss from sound blast

Q. What is the impact of an arc flash?

Treatment can require years of skin grafting and rehabilitation

Victim may never return to work or regain quality of life.

Victim may DIE.

Cost of treatment can exceed \$1,000,000/case.

Potential Litigation fees

Potential Loss of Process

Potential Fines:
Escalation of Insurance.

Q. What is the potential exposure to an arc flash?

Bureau of Labor Statistics data for 1994 show 11,153 cases of reported days away from work due to electrical burns, electrocution/electrical shock injuries, fires and explosions.

The Census of Fatal Injuries noted 548 employees died from the causes of electrical current exposure, fires and explosions out of 6,588 work related fatalities nationwide.

In the US Chemical Industry, 56% of the fatalities that occurred over a 5-year period were attributable to burns, fires and explosions, with many of the ignition sources being related to electrical activity.

Q. What is the electrical industry doing to address the arc flash issue?

Historically, the National Electrical Code (NEC) and other safety codes have been primarily concerned with protection from fire, electrocution, and shock hazard. Arc flash hazards were not addressed.

This is changing. The 2002 NEC contains requirements for warning

Landmark agreement forged between OSHA, IBEW and NECA contractors to use NFPA-70E to protect electricians in Columbus, Ohio could set trend for the Nation.

labels and the National Fire Protection Association (NFPA) 70E and Institute of Electrical and Electronics Engineers (IEEE) 1584, provide guidance on implementing appropriate safety procedures.

NEC Article 110.16 requires “field marking” of potential arc flash hazard for panels likely to be serviced or examined in energized condition. This article also contains a Fine Print Note (FPN) regarding proper signage and an FPN referencing NFPA 70E. These FPNs are not technically part of the NEC.

OSHA has NOT specifically addressed Arc Flash, however existing and new provisions impact how it is addressed:

OSHA 1910.132(d), and 1926.28(a). The employer is responsible to assess the hazards in the work place, select, have, and use the correct Personal Protective Equipment (PPE) and document the assessment.

OSHA has tasked the NFPA with addressing both shock and arc flash hazards in detail for OSHA adoption (discussions PCIC 2003).

Q. What Does NFPA-70E do to address arc flash hazards?

It defines a series of **boundaries** related to electrical safety when working on energized equipment:

- Flash Protection Boundary*
- Limited Approach Boundary*
- Restricted Approach Boundary*
- Prohibited Approach Boundary*

Determining Flash Protection Boundaries may be based on **voltage, available short-circuit current and predicted fault duration.**

Q. Are there differences between NFPA 70E and IEEE 1584 calculations?

Both calculation methods attempt to compute the expected arc flash energy that would be created by an arcing fault. This is a worst-case calculation based on expected fault current, arc length and fault duration.

Differences do exist between the two calculation methods. It is suggested that you review both methods to help determine the approach that is appropriate for your facility.

NFPA-70E 2004 Equipment Requirements (Proposed)

Category	Energy Level	Typical Personal Protective Equipment required (NFPA-70E)
0	≤2 cal/cm ²	Non-melting flammable materials
1	4 cal/cm ²	Fire Resistant (FR) shirt and FR pants
2	8 cal/cm ²	FR shirt, FR pants, cotton underwear
3	25 cal/cm ²	Two layers FR clothing, cotton underwear
4	40 cal/cm ²	FR shirt, FR pants, multilayer flash suit, cotton underwear

Other:
 Face Protection Face Shield and/or safety glasses
 Hand Protection Leather over rubber for arc flash protection
 Leather work boots above 4 cal/cm²

NFPA 70E provides THREE acceptable methods of determining flash protection Boundary:

1. Simplified Table 220.2(B)(2) ©,220.6(B) (9)
2. Analysis based on NFPA 70E Annex B
3. Analysis based on IEEE-1584 Standards

Q. Are there advantages of doing detailed arc flash calculations with EasyPower® software?

Recently, the PCIC safety Committee recommended that Arc Flash Calculations be completed in conjunction with Short Circuit Calculations and

Advantages of Detailed Calculations:

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| <p>1. More realistic risk assessment</p> <p>2. Helps insure worker safety.</p> <p>3. Increases compliance by workers compared to overly conservative blanket Rules.</p> | <p>4. Self-documenting---helps assure compliance with safety standards.</p> <p>5. Can result in worker productivity savings of thousands of dollars on an annual basis</p> |
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Protective Device Coordination to help ensure that the most accurate results were achieved.

Arc Flash Hazard boundaries are based on **voltage**, available **Short-circuit current** and **predicted fault duration**. All this information is calculated automatically in EasyPower ShortCircuit, PowerProtector, and ArcFlash, which work in concert to give you instant results on any system, helping you save you time, obtain accurate results, provide for improved safety and more reliable power systems.

With the click of a mouse you can:

- Verify protective device & arc hazard ratings. Calculate momentary interrupting and relay currents.
- Establish settings for all types of protective devices.
- Coordinate your entire power distribution system to minimize downtime.
- Provide the information you need to help insure compliance with NFPA and OSHA requirements.

Q. How Does a Company Go About Reducing Risk and Exposure to Arc Flash Hazards?

Acknowledge there is a hazard.

Assess the magnitude of the hazard.

Develop an Arc Flash Hazard Program.

Per NFPA 70E, Flash Hazard Analysis must be documented by employer prior to any work.

Addressing the hazard:

Avoid working on or near **exposed** energized equipment.

Calculate Arc Flash Hazard Levels and Evaluate the Potential Strategies to Deal with Arc Flash Hazards

Where exposure cannot be avoided, implement safety procedures to minimize dangers.

Develop a Personal Protective Equipment Plan.

Develop a proper Arc Flash Hazard Labeling Plan.

Develop, document and

implement safety procedures.

Provide training for workers on safety procedures and protective gear.

Develop and implement record keeping processes.

Determine methods for maintaining personal protective equipment.

Establish methodology for updating Arc Flash Hazard programs as new information becomes available.

Establish ongoing programs to help ensure workers within danger zones are appropriately protected with suitable PPE.

Work pro-actively with your electrical engineering and contracting teams to assess Arc Flash Hazard issues during the design process, since the power system design can have a significant impact on the AFH levels. *This can be simply achieved by updating the EasyPower model in a matter of minutes to evaluate the impacts of various design options and system changes.*

Q. I'd like to get my arc flash program underway. Where do I begin?

Here are the steps that we suggest... (And yes, ESA is available to help all the way.)

1. Evaluate the magnitude of the Hazards.
2. Assess internal as well as contracted resources available to address the issues and assure support with resources where deemed appropriate.
3. Perform Arc Flash Hazard Training with information on the latest standards & practices.
4. Provide your design team with EasyPower[®] Software to get an accurate analysis.
5. Perform application training to implement the EasyPower ArcFlash Solution.
6. Review safety program and integrate Arc Flash.
7. Arrange on-site or on-line, engineering support to assist in performance of AFH studies.
8. Select Personal Protective Equipment Vendor.
9. Acquire additional equipment and information that you need, (printers, training videos, etc.)
10. Implement your Arc Flash Hazard safety program.
11. Continue ongoing program tracking, documentation, improvements, and updates.



How to meet and beat the challenge of the new arc flash regulations.

Call 503 655-5059

Meeting the challenge of the new arc flash safety requirements requires resources familiar with the standards, expert assistance in power engineering and partners experienced in today's operational realities.

ESA is uniquely qualified to help you develop, structure and implement a complete, cost effective arc flash solution for your plant or facility.

Our engineering teams can help you craft arc flash hazard solutions that provide the required worker safety and regulatory compliance while you're coping with fewer resources and constrained budgets

NEW

ArcFlash, the latest addition to the array of capabilities in EasyPower insures compliance with OSHA, NFPA-70E, and IEEE-1584 safety standards. It

includes everything you need to develop a complete plan--right down to the ability to output warning labels.

Extensive research into the issues involved led us to develop enhanced arc flash algorithms that integrate seamlessly with our EasyPower power system software.

Let us help you identify and implement cost effective solutions that prevent costly over-protection and worker productivity losses.

Call ESA today for an expert response to arc flash safety requirements.

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