# ESOURCE NEWSLETTER

## WHAT IS ARC FLASH?

Arc flash (often called a flashover) is a type of electrical explosion or discharge that results from a connection through air to ground or another voltage phase in an electrical system. For example, when a wire makes contact with an earthed system. Temperatures at the source of an arc flash can reach 20,000 °C — around four times the surface of the sun.
Injuries can include external burns (i.e. severe burns to the skin), internal burns and intoxication from inhaling hot gasses and vaporized metal, hearing damage, eye damage and blindness from the ultraviolet light of the flash as well as many other devastating injuries.

When there is a rapid expansion of air and vaporized material from arc flash, an arc blast may occur. The explosive force from an arc blast can exceed 100 kiloPascal (kPa), causing the propulsion of molten metal, equipment parts and debris speeds of up to 300 meters per second.

## WHAT CAUSES ARC FLASH?

Arc flash may be caused by unintentional contact between an energised conductor, such as a bus bar or wire, with another conductor or an earthed surface. Equipment failure can also cause an incident.
Many believe the risk of arc flash occurs when working at high voltage but there is evidence to suggest low voltage may be even riskier. Studies show hazard severity is, on average, higher at low voltage than high voltage.
The potential to cause harm will vary with the current that can flow in an arc, the amount of time the arcing fault is sustained, the length of the gaps between the conductive parts, which are bridged by the arc, electrodes, the confinement around the arc, the chemical compositions of the conductors and the materials around the arc, and the distance of the worker from the arc.

**Common causes of arc flash include:**

- Equipment failure
- Dropping un-insulated tools or metal parts
- Using incorrectly specified instruments
- Live work on damaged equipment such as cables
- Loose connections and exposed live parts
- Lack of awareness and training

## HOW TO PREVENT ARC FLASH

Other than isolating the power supply, completely eliminating the arc flash hazard is very difficult, but there are measures you can take to reduce the possibility and severity of hazards.
Management of Health and Safety at Work Regulations 1999 specifies an obligation on behalf of the Employer to assess the level of risk involved in the workplace and the effectiveness of the precautions to be taken. For electrical work, this should include arc flash hazards.
The likelihood of an electric arc (or worse) occurring is low but the potential severity is high. Control measures can be adopted to reduce both the hazard and likelihood of taking place, therefore reducing the risk.

**For example, you can:**

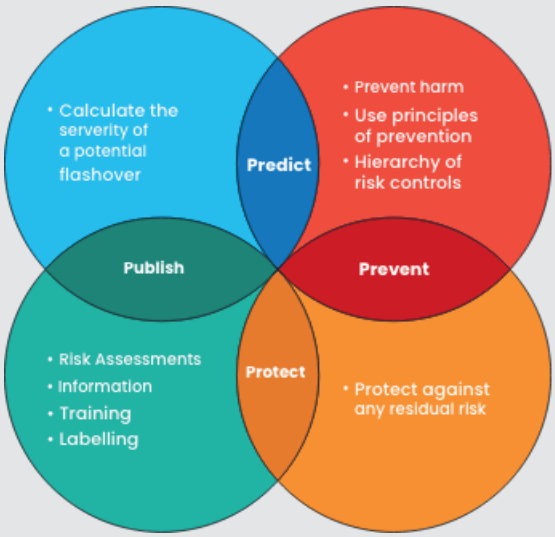
- De-energize electrical equipment
- Wear suitable Personal Protective Equipment (PPE)
- Keep at a safe distance
- Reduce the energy output from an incident
- Carry out a risk assessment
- Train on-site workers to control risks and interrupt faults

An effective way to help prevent arc faults is to use our 4P Model for arc flash hazard management: Predict, Prevent, Protect, Publish. Identify and calculate the potential risks. Use principles of prevention to control risks. Reduce the risk of injury with proper protection. Collect information for future workers to reassess changes such as environmental conditions and equipment state.

For businesses, a great place to get started is by booking a free arc flash pre-assessment. One of the best ways to combat the risk of arc flash is to get in an electrical safety professional. We've conducted arc flash safety management for a wide range of clients including National Grid, Northern Powergrid and Honda Racing so you're in safe hands.
If you have on-site workers and you're looking to manage hazards yourself, there is also the option to undergo training.

## WHO NEEDS ARC FLASH TRAINING?

Human error can play a large part in injury or death due to arc flash, so effective training is essential to reduce the risk. Electrical personnel are susceptible to incidents at both high and low voltage. This typically includes personnel carrying out maintenance and testing activities on electrical equipment such as Electricians and Electrical Engineers.




## SOME PROFESSIONS WHERE ARC FLASH TRAINING IS IMPORTANT TO INCLUDE:

**Electrical Engineers**

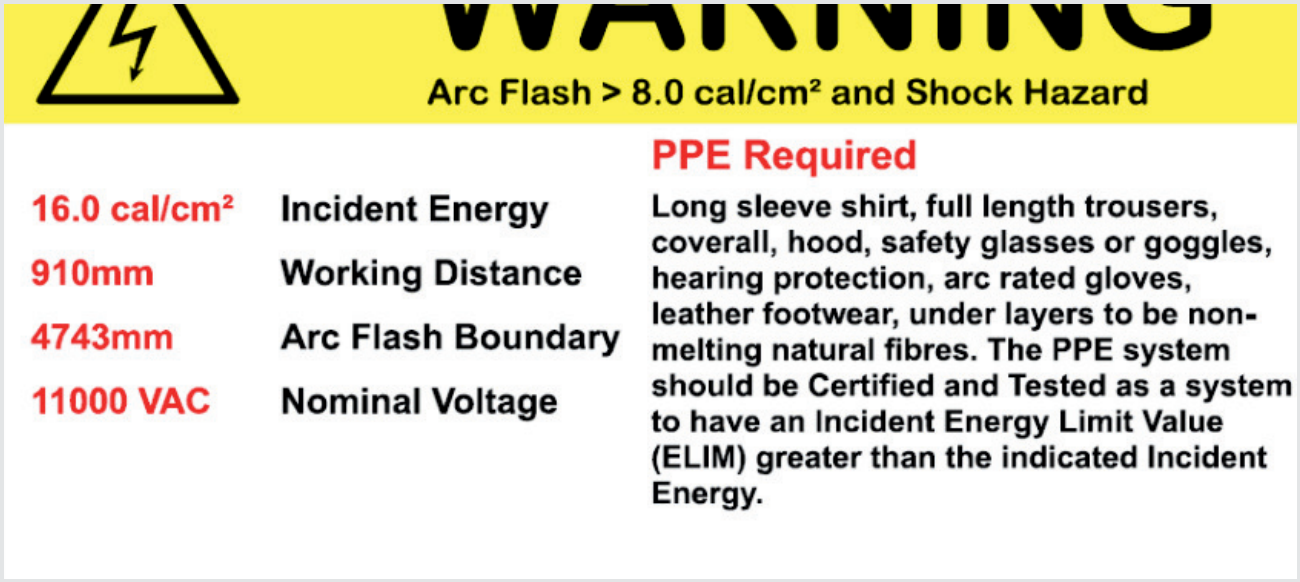
**Civils - Excavations**

**Working Near Electrical Equipment**

**Electricians**

**Electrical Supervision**

Qualified persons should know how to limit fault currents with appropriate devices, reduce arcing time, and calculate safe arc flash boundaries. If you are familiar with applicable legislation, recognising when you could be exposed, and knowing the level of hazard present, you have a great foundation to keep safe. We highly recommend learning how to carry out task-based arc flash risk assessments with this City & Guilds Assured Programme.




## Arc Flash Boundary Distances

According to NFPA 70E, three boundaries exist, these are Limited Approach Boundary, Restricted Approach Boundary and Arc Flash Boundary. Dependant on the remit of any arc flash study carried out, labels fitted to switchgear may make reference to one, or all of the above boundaries.

This article looks at the arc flash boundary, however, before moving on it is work discussing the limited and restricted approach boundaries that in fact relate to electric shock protection, rather than arc flash control.

Limited Approach Boundary- approach by Unqualified Persons. In Europe we would know this as an ordinary person, that being a person who is neither electrically skilled nor instructed and is the minimum distance that a non-competent person can approach parts that are energized and dangerous. Typically, switch panels contain live parts within enclosure and it is only when such enclosures are open and live parts are accessible does an issue exist.

Restricted Approach Boundary- approach by a Qualified Person. In Europe we would know this person as an electrically skilled or instructed person, in other words a competent person, again stating the minimum distance that should be maintained from exposed live parts in order to prevent electric shock.

The table below has been adapted from NFPA 70E, Table 130.4(E)(a)

## Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Alternating Current Systems.

Nominal System Voltage Range, Phase to Phase Limited Approach Boundary Restricted Approach Boundary Includes Inadvertent Movement Adder
Exposed Moveable Conductor Exposed Fixed Circuit Part
Volts (V) Metres (m) Metres (m) Metres (m)
Less than 50 Not specified Not specified Not specified
50 – 150 3.0 1.0 Avoid contact
151 – 750 3.0 1.0 0.3
751 – 15,000 3.0 1.5 0.7
15,100 – 36,000 3.0 1.8 0.8

**Note:** the above distances may be different to those stated in company operational safety rules, DNO standards or transmission standards.
Consider the arc flash warning label above which contains important information. It details the incident energy at the panel and the working distance, the arc flash boundary and the nominal voltage of that equipment. It also contains details relating to protective equipment to be worn when working on or near that equipment whilst it is live.

Incident energy value, which could be stated in a number of units, is often quoted as Calories per centimeter squared. This is the calculated energy that would be released on that equipment should an arc fault occur. It is important in that any personal protective equipment worn by operators of the equipment should be able to protect against the incident energy level that is present. It is worth noting that equipment that is well maintained and in good condition should be capable of being operated in its normal way. It should also be noted that if the supply of electricity has been removed from that equipment, the arc flash risk is removed.

The working distance is the minimum distance that should be maintained between accessible live parts and persons, their tools and other materials.

The nominal voltage is the phase to phase (line to line) voltage that should be expected at that point of supply.

The arc flash boundary is the minimum distance between an energised part and persons, without further protection measures such as barriers and enclosures, to protect against the thermal effects should an arc flash occur. At this limit the incident energy reduces to, or below 1.2 Cal/cm2, the threshold of where survivable second-degree burns occurs. Many companies mandate that this is the closest that persons can get to switchgear without the need to wear arc rated specific personal protective gear, whilst others will mandate this is the minimum distance whilst operating that switchgear, or whilst approaching that switchgear with doors open, or covers removed.

The arc flash boundary can vary, based on several factors, and is not simply a product of the operating voltage and the type of equipment or switchgear. It is often the case that incident energy values are higher on Low Voltage systems when compared with their High Voltage counterparts, and in some instances, more modern equipment and switchgear can have larger arc flash boundaries than more aged, but well-maintained equivalents.

When determining the risks that are present it is important to undertake a switchgear arc flash risk assessment, considering the incident energy value present, the arc flash boundary, the work that will be undertake and who will complete such work. Your arc flash study should contain guidance on how to carry this out, and your study provider should be able to provide instruction and training on how to do this.

**Just as a reminder,** the arc flash boundary is the limit at which, if an arc flash was to occur, a person would most likely sustain second degree burns which are survivable, without the need for further protective measures. In many cases, switchgear will be enclosed and will incorporate other control and mitigation levels to protect those in normal proximity to switchgear and equipment that is in normal service. Personal Protective Equipment, including arc rated PPE should only be considered as the primary risk mitigation method when all other options have been eliminated.

## Welcome Our Newest Associate Members!

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**Contact:** Derek Rizor
**Direct:** (269) 370-1139
**Email:** drizor@biddergy.com
**Company Description:** Online Auction services for Municipalities and Businesses.

**Hoosier Edison Line Company**
**Company Address:** 4301 N 800 W Sharpsville, IN 46068
**Contact:** Christopher Brown
**Direct:** (765) 438-6432
**Email:** drizor@biddergy.com
**Company Description:** OH & UG Line construction and maintenance.

**Voltage Tools and Testing**
**Company Address:** 1632 Michigan Ave Battle Creek, MI 49014
**Contact:** Don Perkins
**Direct:** (574)727-1955
**Email:** dperkins@voltagetools.us
**Company Description:** Rubber goods and PPE Testing facility.


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