



Insight & Expertise

# A Guide to Arc Flash

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## What is Arc Flash?

An arc flash is the rapid release of electrical energy through the air between two conductors.

It can occur when an uncharacteristic flow of electricity, known as an arcing fault, creates an exceptionally high current through copper or other conductive material. The resulting short circuit creates an explosion and releases a plasma fireball that can reach significant temperatures causing catastrophic damage and potentially fatal injuries.



## How does it apply to me?

**Arc flashes from electrical switchgear are a potential hazard to personnel who operate and maintain electrical system equipment in an energised state.**

Employers must undertake adequate consideration of arc flash risks as part of their responsibilities under health and safety legislation. Relevant regulations include the Management of Health & Safety at Work Regulations (1999) and the Electricity at Work Regulations 1989. More recently, BS7671 - Wiring Regulations (18th Edition) makes reference to the use of arc fault detection devices in order to mitigate the risk of fire. Published guidance that makes specific reference in the need to undertake Arc Flash hazard studies comes from the NFPA70E - Standard for Electrical safety in the Workplace.

It is a common misconception that arc flash risks are mainly associated with high voltage installations. In fact, high arc energy levels are more often found in low voltage switchgear of the types used in many manufacturing environments. Low voltage is defined in BS7671 as being referenced to systems with a nominal voltage of 1000V or less and hence is directly applicable to the typical 400/230V distribution commonly encountered in commercial and manufacturing industries.



## What causes Arc Flash?

An arc flash event can be initiated by a failure within electrical switchgear such as a breakdown of insulation or by the introduction of a conducting object that accidentally creates a short circuit.

In industrial environments, some of the most common causes of arc flash are;

- > Ageing electrical systems
- > Inadequate maintenance and trip testing of electrical systems
- > Lack of awareness by technicians/operators
- > Poor maintenance techniques
- > Incorrect design/specification
- Unauthorised modifications and repairs

The severity of an arc flash incident is influenced by the overall short circuit current available at any point of the site electrical system and determines the amount of energy available. The time to clear any fault that occurs is determined by the protection and the settings used on circuit breakers and other safety equipment and will determine how long the fault condition will last.



## What should I be doing?

### **Employers and Operators must undertake adequate consideration of arc flash hazards as part of their responsibilities under health and safety legislation**

Relevant regulations include the Management of Health & Safety at Work Regulations (1999), Electricity at Work Regulations 1989 and the NFPA70E Standard for Electrical safety in the Workplace.

Our approach to the management of arc flash hazards has three related elements;

#### **Analyse the Hazards**

Calculating the potential severity of an arc flash event requires knowledge of system fault currents and protection clearance times. Specialist software is typically used to analyse fault levels and detailed arc incident level calculations are performed in accordance with IEEE 1584 - Guide for performing Arc Flash Calculations. Arc Flash Hazard analysis is a time consuming exercise and requires specialist knowledge to implement effectively. For this reason many organisations choose to make use of external specialists for this work.

#### **Design & Implement Appropriate Mitigation Measures**

Since arc flash current is always less than short circuit current, an efficient protection assessment should be performed to select appropriate settings for overcurrent protection devices such as fuses and circuit breakers. The challenge here is to reduce potential arc flash energy without sacrificing selectivity, so the portion of a power system that is disconnected in response to an event is minimised.

## What should I be doing? cont...

### **Design & Implement Appropriate Mitigation Measures cont...**

A number of newer technologies offer alternative forms of protection.

- > Arc fault detection relays are triggered by light from the flash, current and sometimes sound.
- > The automated introduction of an alternate current path in order to transfer the arcing fault and capture it
- > The use of remote switching equipment to remove personnel from high risk areas
- > The use of arc resistant designed switch gear to contain and then channel arc flash incident energy away from the operator.

### **Manage Residual Risk**

Once appropriate mitigation strategies are in place, an equipment operator must understand the residual risks and take appropriate steps to manage them. These steps include;

- > Clear labelling of equipment showing the PPE categories and their boundaries.
- > Appropriate training for personnel involved with the operation and maintenance of switchgear.
- > Compliance with appropriate operation and maintenance procedures.
- > Use of personal protective equipment (PPE) appropriate to the level of residual risk.

Awareness training in Arc Flash benefits staff by giving them an insight into the hazards associated with this topic and should be aimed at operating, maintenance and project related staff.

## Can I do this myself?

Calculating arc flash risk is a specialist task. The potential severity of an arc flash event depends on the configuration of the entire electrical system at a site, along with knowledge of system fault currents and protection clearance times. Specialist software is usually required to make the necessary calculations.

In any system, the likelihood of an incident depends on the condition of the equipment and the way it is operated. Clearly a modern switchboard maintained in a clean dry switch room will present less of a risk than an older unit located in an exposed atmosphere. This leads on to the concept of a risk assessment, an area of study which is coming more to the fore in terms of both HV and LV equipment.



## Where Covol can help

### **We can provide the necessary support with the implementation of your risk reduction strategy.**

We have extensive experience in the provision of arc flash hazard analysis and the implementation of mitigation measures in various environments around the world including petrochemical sites, oil platforms, manufacturing facilities and wind energy installations.

- > Construction and verification of Electrical distribution system models that include protection characteristics and Arc Flash calculations with incident energies and boundaries
- > Arc flash mitigation studies  
Implementation of remediation projects including design and installation.
- > Equipment labelling
- > Site surveys, protective device determination and audits of electrical management systems
- > Risk assessment of switchgear
- > Creation and adaptation of maintenance and operating procedures
- > Training
- > 5-yearly revalidation of electrical systems

If our help in supporting you with Arc Flash services is something that you would like to know a bit more about then please contact us.



# Ready to engineer change and progress in your business?

Get in touch to speak to our experts

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