



# WORKPLACE SAFETY

A W A R E N E S S C O U N C I L

## Understanding “Arc Flash”

Simply put, an arc flash is a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The results are often violent and when a human is in close proximity to the arc flash, serious injury and even death can occur.

Arc flash can be caused by many things including:

- Dust
- Dropping tools
- Accidental touching
- Condensation
- Material failure
- Corrosion
- Faulty Installation

Three factors determine the severity of an arc flash injury:

- Proximity of the worker to the hazard
- Temperature
- Time for circuit to break

Because of the violent nature of an arc flash exposure when an employee is injured, the injury is serious – even resulting in death. It’s not uncommon for an injured employee to never regain their past quality of life. Extended medical care is often required, sometimes costing in excess of \$1,000,000.

### **Typical Results from an Arc Flash**

- Burns (Non FR clothing can burn onto skin)
- Fire (could spread rapidly through building)
- Flying objects (often molten metal)
- Blast pressure (upwards of 2,000 lbs. / sq.ft)
- Sound Blast (noise can reach 140 dB – loud as a gun)
- Heat (upwards of 35,000 degrees F)

---

This material was produced under grant number SH-16615-07-60-F-12 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

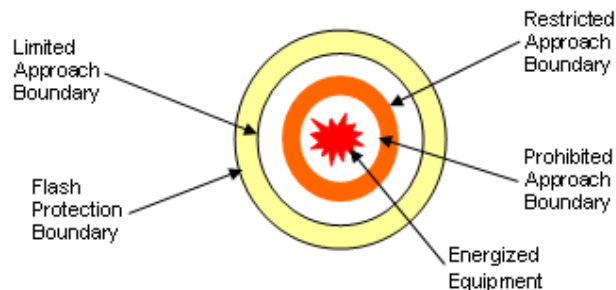


# WORKPLACE SAFETY

A W A R E N E S S C O U N C I L

## Approach / Protection Boundaries

The National Fire Protection Association (NFPA) has developed specific approach boundaries designed to protect employees while working on or near energized equipment. These boundaries are:



- Flash Protection Boundary (outer boundary)
- Limited Approach
- Restricted Approach
- Prohibited Approach (inner boundary)

**Flash Protection Boundary (outer boundary):** The flash boundary is the farthest established boundary from the energy source. If an arc flash occurred, this boundary is where an employee would be exposed to a curable second degree burn (1.2 calories/cm<sup>2</sup>). The issue here is the heat generated from a flash that results in burns.

**Limited Approach:** An approach limit at a distance from an exposed live part where a shock hazard exists.

**Restricted Approach:** An approach limit at a distance from an exposed live part which there is an increased risk of shock.

**Prohibited Approach (inner boundary):** A distance from an exposed part which is considered the same as making contact with the live part.

This distance is not common between equipment. Some equipment will have a greater flash protection boundary while other equipment will have a lesser boundary.

## Ways to Protect the Workers

There exists a number of ways to protect workers from the threat of electrical hazards. Some of the methods are for the protection of qualified employees doing work on electrical circuit and other methods are geared towards non-qualified employees who work nearby energized equipment.

---

This material was produced under grant number SH-16615-07-60-F-12 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.



# WORKPLACE SAFETY

A W A R E N E S S C O U N C I L

Here are a few of the protective methods:

- De-energize the circuit
- Work Practices
- Insulation
- Guarding
- Barricades
- Ground Fault Circuit Interrupters (GFCI)
- Grounding (secondary protection)

### **If You Must Work on Energized Circuits**

If it has been determined that deenergizing a circuit is not feasible and the employee must work “hot”, the employer shall develop and enforce safety-related work practices to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts.

The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

These safety related work practices could include:

- Energized Electrical Work Permit
- Personal Protective Equipment
- Insulated Tools
- Written Safety Program
- Job Briefing

**Fast Fact:** The most effective and fool-proof way to eliminate the risk of electrical shock or arc flash is to simply deenergize the equipment.

### **Understanding the Arc Flash Warning Labels**

Each piece of equipment operating at 50 volts or more and not put into a deenergized state must be evaluated for arc flash and shock protection. This evaluation will determine the actual boundaries (i.e. prohibited, limited, restricted etc) and will inform the employee of what PPE must be worn.

Once the evaluation is complete an Arc Flash Hazard warning label must be affixed to the equipment and readily accessible to employees who may work on the energized equipment.

---

This material was produced under grant number SH-16615-07-60-F-12 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

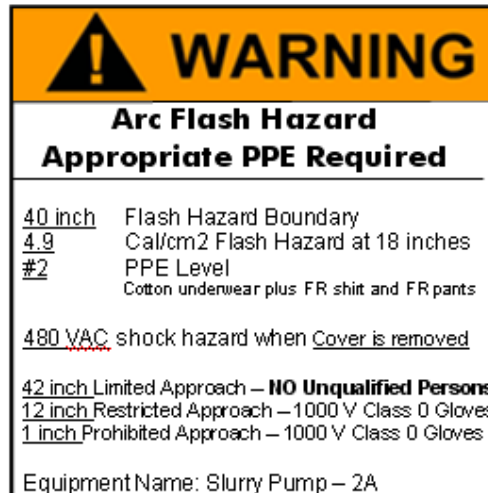


# WORKPLACE SAFETY

A W A R E N E S S C O U N C I L



Minimum arc flash label example



Detailed (preferred) arc flash label example

## The Employees Obligation

Employees must follow the requirements of the Arc Flash Hazard label by wearing the proper personal protective equipment (PPE), use of insulated tools and other safety related precautions. This includes not working on or near the circuit unless you are a “qualified” worker.

Qualified person: One who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved.

Additional requirements for qualified persons. Qualified persons (i.e. those permitted to work on or near exposed energized parts) shall, at a minimum, be trained in and familiar with the following:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts, and
- The clearance distances specified in 1910.333(c) and the corresponding voltages to which the qualified person will be exposed.