

## Electrical Safety

More than 3,600 disabling electrical contact injuries occur in the workplace and more than 2,000 workers are sent to burn centers with electric burns every year in the U.S. Every day one person dies from electrical incidents.

This fact sheet provides *awareness level* information of electrical hazards and their safety program controls. For those doing electrical work, hiring or overseeing electrical contractors, developing or purchasing research or facility electrical equipment, or attaching to or working on facility / utility electrical systems, please see the [UC Berkeley Electrical Safety Program](#) for guidance, safe work practices, equipment development guidance, procurement procedures, and code compliance requirements.

### Why should you be concerned about electrical hazards?

Electricity has long been recognized as a serious workplace hazard, exposing personnel to possible electrical shock, electrocution, burns, fires and explosions. Deaths and injuries include exposures to a range of voltages. Low voltage does not imply low hazard.

### Effects of Electric Current in the Human Body

Electrical current is measured in *amps* depending upon how much available current is present. The higher the current the higher the number of amps available to 'shock' the body. The table below shows the general relationship between the level of current exposure to a person and the reaction they may experience when current flows from one of their hands to a foot for just 1 second. (Note: One *milli-amp* is 1/1000th of an amp.)

Reaction of the human body to electrical current	
Effect of AC current (95% of Young Adults Average weight 115-150 lbs)	
<b>Perception Threshold</b> - tingling sensation	0.7-1 mA
<b>Slight Shock (not painful)</b> - no loss of muscle control	1.2-1.8 mA
<b>Shock (painful)</b> - no loss of muscle control	6-9 mA
<b>Shock (severe)</b> - muscle control loss, breathing difficulty, onset of <i>let go</i> threshold	15-23 mA
<b>Possible ventricular fibrillation</b> - 3 send shock	0.1 A
<b>Possible ventricular fibrillation</b> - 1 send shock	0.2 A
<b>Heart muscle activity ceases</b>	0.5 A
<b>Tissue and organ burn</b>	1.5 A

Source: Electrical Safety in the Workplace by Ray and Jane Jones

# FACT SHEET

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### How do safety and health programs control electrical hazards?

Everyone at UC Berkeley has the right to work in a safe environment. Safety and health add value to your department's business, your research, your safety and your direct report's / coworker's safe workplace. Through cooperative efforts of training on and application of the [UC Berkeley Energy Isolation – Lock out Tag out Program](#) and the [UC Berkeley Electrical Safety Program](#), all personnel can learn to identify and eliminate or control electrical hazards and achieve an injury free safe workplace.

### Electrical Hazards and Controls

Hazard	Effect	Control
<b>Electrical burns</b>	Electric current flows through tissues or bone, generating heat that causes tissue damage	<ul style="list-style-type: none"> <li>• <a href="#">LOTO</a></li> <li>• <a href="#">Energized Work Permit</a></li> <li>• Risk assessment</li> <li>• <a href="#">PPE</a></li> <li>• <a href="#">Inspections</a></li> </ul>
<b>Thermal burns</b>	Injury to the different layers of the skin	<ul style="list-style-type: none"> <li>• <a href="#">PPE</a></li> <li>• Administrative controls</li> <li>• Fire Life safety program</li> </ul>
<b>ARC flash high-energy arcs and low energy arcs</b>	Burns caused by arc flash are typically severe, 2nd-degree (partial thickness) or 3rd-degree (full thickness) burns. Clothing may catch on fire, and this will contribute to the area of the burn, further increasing the already high risk of mortality.	<ul style="list-style-type: none"> <li>• PPE for Arc flash</li> </ul> <p>In new construction and renovation that alters electrical panels, distribution or switching equipment or other electrical infrastructure, Arc Flash studies are required. See <a href="#">Division 26 00 00 Electrical</a> in the <a href="#">Campus Design Standards</a> for detailed requirements.</p>
<b>Static electricity</b>	Build up, explosion	Grounding

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## Protection against Electrical Hazards

### Insulation

Insulators such as glass, mica, rubber, or plastic used to coat metals and other conductors help stop or reduce the flow of electrical current. This helps prevent shock, fires, and short circuits.

### Guarding

Inspect and enclose electric equipment to ensure that workers do not come in contact with any exposed electrical parts. OSHA requires that all high voltage tools and equipment is placed in an enclosed location, out of reach of other employees. Signs must alert about the electrical danger and forbid entry to unauthorized personnel.



### Grounding

*Grounding* a tool, a piece of equipment, or a specific part of an electrical system means intentionally creating a low-resistance path that connects to the earth to prevent the buildup of voltages, including a static charge. Grounding is often a permanent part of any functioning electrical circuit. Grounding may also be added **temporarily** to electrical circuits or equipment by maintenance or research personnel to ensure safety and that the equipment they are working on cannot build-up an electrical charge greater than *ground*.

### Electrical Protective Devices

Circuit protection devices, such as fuses and circuit breakers, automatically stop the flow of an electric current if a short circuit occurs. Fuses and circuit breakers protect the equipment by opening or breaking the circuit when too much current flows through them. OSHA requires construction sites and high-risk areas to use ground fault circuit interrupters.

### Safe Work Practices

Employees can prevent electrical accidents by following OSHA safety instructions applicable to their workplaces. These may include de-energizing equipment before inspection or repair, keeping electrical tools in good working condition with timely maintenance, exercising caution when working near electrical lines, and always using appropriate protective equipment. Employees should receive appropriate training when working with electrical hazards. OSHA describes electrical safety-related work practice requirements in subpart S of 29 CFR part 1910.

- [Facilities Services Shutdown Process](#)
- [LOTO](#)
- [Energized Work Permit](#)

## References

CA Code of Regulations, Division 1, Chapter 4, Subchapter 5. Electrical Safety Orders

[Group 1. Low-Voltage Electrical Safety Orders \(Sections 2299 - 2599\) Article 3. Work Procedures](#)

[Group 2. High-Voltage Electrical Safety Orders \(Sections 2700 - 2989\)](#)

*The above Fact Sheet content was originally excerpted and adapted for UC Berkeley use from the Fed-OSHA website on July 9, 2010. Please see Fed-OSHA's [Controlling Electrical Hazards](#) for additional information and the complete publication.*