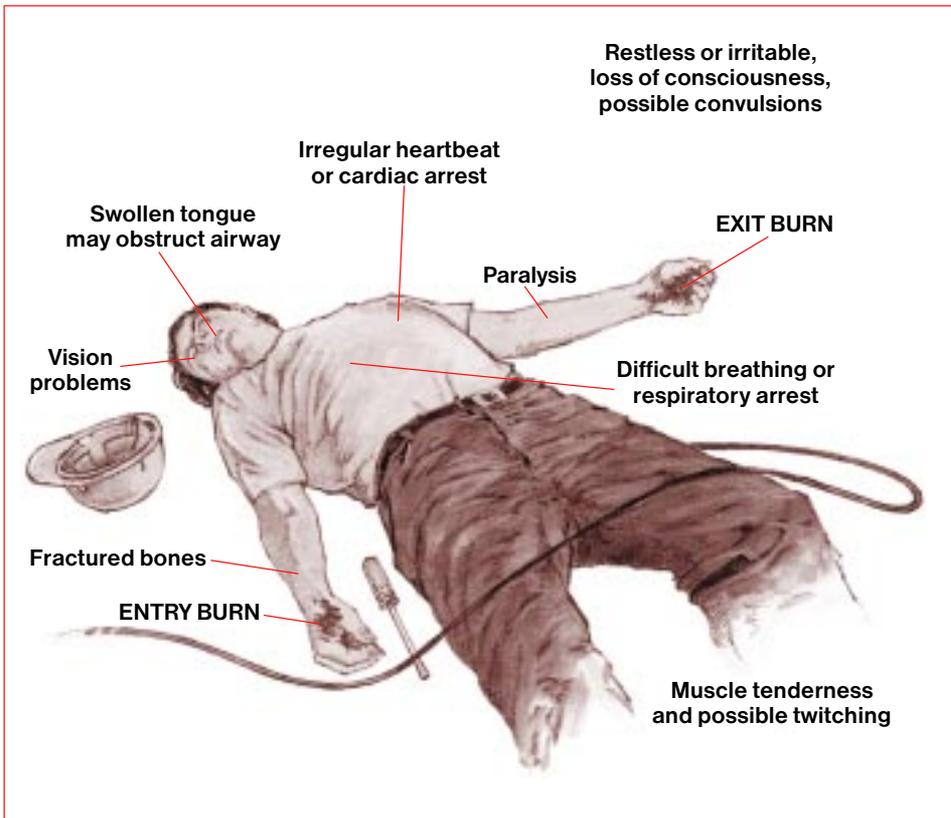


# Types of electrical injuries

*Electrical injury* is a term for all injuries caused by contact with electrical energy. Electrical contact can cause a wide variety of injuries involving most organ systems. Most electrical injuries are classified as one of the following:

- Burns
- Electric shock injuries
- Eye injuries

As well as these injuries directly related to the electrical accident, the worker may be thrown or may fall if working at a height. As a result, the worker may also have fractures, spinal injuries, or internal injuries.



*A worker with an electrical injury may have any of a number of signs and symptoms.*

## Burns

Burns are the most common electrical injury. An injured worker may have one or more types of burns:

**Flash burns** are caused by heat released when an arc is formed between the electrical source and a ground or between two electrical conductors. In this case, the arc does not pass through the body. However, electric arcs can produce intense heat (several thousands of degrees)—more than enough to melt steel. This heat can cause first-degree through third-degree burns to any part of the worker exposed to the heat. Electric arcs can also generate intense ultraviolet radiation and cause serious eye injury, even at a distance.

**Arcing burns** occur when the current jumps from the current source to the worker or from one part of a body surface to another.

**Flame burns** caused by the ignition of clothing are common, particularly with high-voltage exposure.

**Contact burns** occur when the skin touches hot surfaces of overheated electrical conductors or other equipment.

**Electrical burns** are the result of electrical current flowing through tissues or bone. The burn is often only visible at entrance and exit wounds, with the major damage inside the body. Extensive damage to nerves, blood vessels, muscles, and organs may take place as the current passes through the body and generates intense heat (up to 3,000°C).

## Electric shock

Electric shock is caused by electric current passing through the body. Electric shock symptoms can range from a barely perceptible tingle to immediate heart stoppage. As well as the electric burn injuries discussed on page 50, there may be internal bleeding, unconsciousness, respiratory paralysis, and cardiac disorders.

The electric current can cause involuntary muscle contractions. These may prevent the injured worker from letting go of the live conductor. Sometimes involuntary movements lead to bruises or bone fractures—or even death from collisions or falls.

In some cases, electric shock can cause injuries that are not evident and symptoms may be delayed. For this reason, all electric shock victims should be taken to hospital for observation.

The damage that electricity does to the body is determined by three major factors:

- The rate of current flow (measured in amperes, and determined by voltage and resistance)
- The path of the current through the body
- The length of time the current is flowing through the body

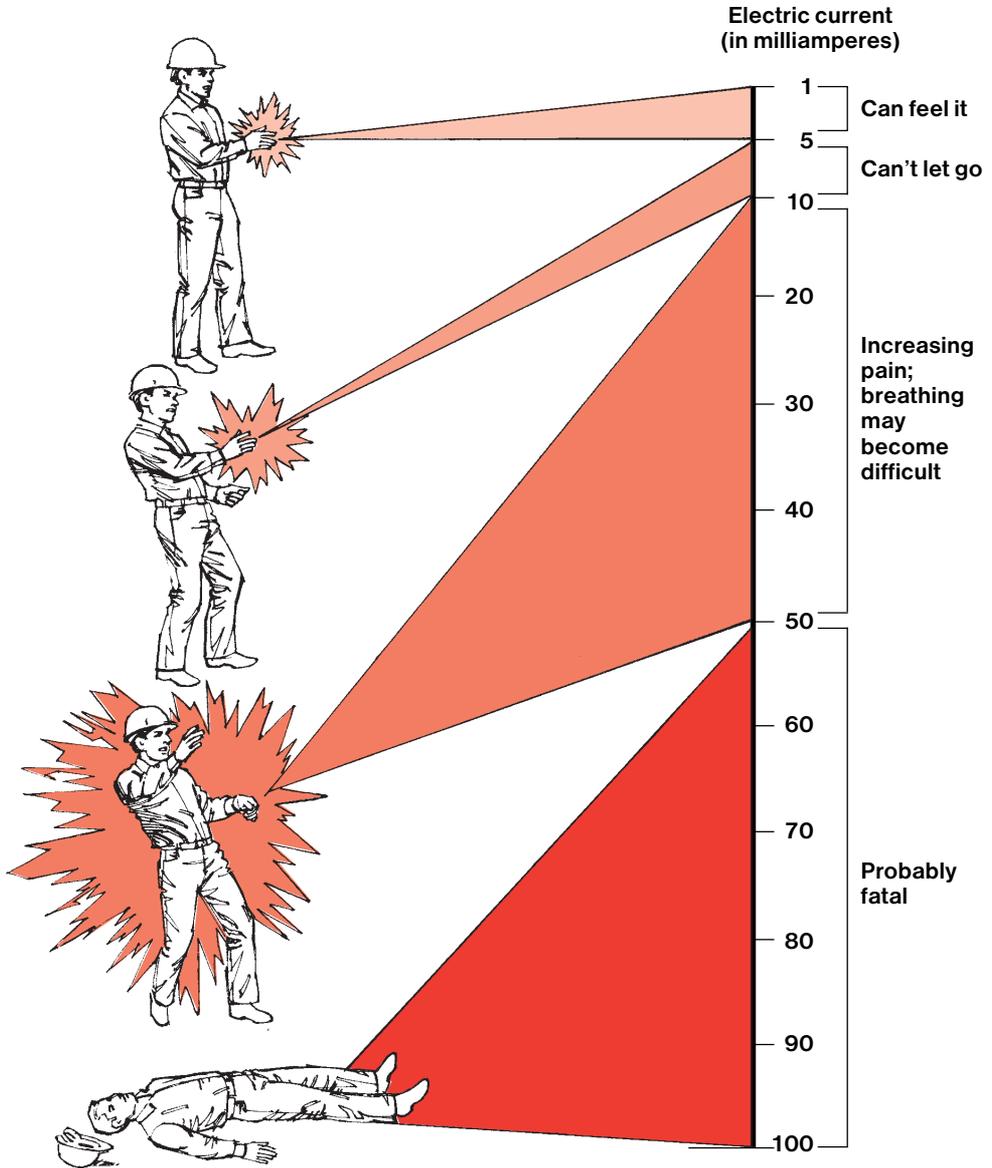
Other factors that may affect severity of injuries from electric shock are:

- The frequency of current (for example, 60 cycles)
- The type of current (AC or DC)
- The phase of the heart cycle when the shock occurs
- The general health of the person receiving the shock

It is not possible to say exactly what injuries will occur from any given amperage. The table on page 52 shows the general relationship between the degree of injury and the amount of current flowing through a person in a hand-to-foot path for a just few seconds. Current that is strong enough to run a 5 or 10 watt light bulb can kill you. Low voltages can be extremely dangerous.

As shown on page 52, a difference of less than 50 mA (milliamperes) exists between a current that is barely perceptible and one that can kill. The degree of injury is proportional to the length of time the body is in the electrical circuit. The longer you're exposed to the current, the more serious the shock. **Low voltage does not mean low hazard!**

## Range of body tolerance



A 100 watt light bulb uses 1000 mA (milliamperes) of current. It takes only 5 mA to trip a ground fault circuit interrupter (GFCI). A small amount of current running through the body for a few seconds can give the effects shown in the table.

## Eye injuries

Like any other part of the body, the eyes can be burned. Regular safety glasses may not protect against flash burns from electric arcs. Direct or reflected light from an electric arc may cause a surface burn to the cornea. Although flash burns are very uncomfortable, most of those caused by shorter flashes are not serious and usually heal in 12 to 24 hours. With longer flashes of a couple of seconds, permanent retinal damage may occur from the ultraviolet light.

If there is a fire, the eyelids are frequently burned. The treatment of burned eyelids requires specialized medical care. The eyes should not be examined as this may injure the burned tissue. Both eyes should be covered with sterile dressings.

## First aid

Electric shock and electrical burns are serious injuries and should receive immediate medical attention. Contact the first aid attendant, if available, or get other medical help. Arrange for transport to hospital immediately.

Make sure you keep yourself and the injured worker out of further danger:

- With **low voltage**, carefully remove the source of contact from the injured worker without endangering yourself. Turn off the power or use insulated material to remove the source of contact (low-voltage only).
- With **high voltage**, stay back at least 10 metres (33 ft.) until the owner of the power system says it is safe to approach. Do not become a second victim. If the voltage is over 60 kV (60,000 V), you may need to keep as far away as 32 metres (105 ft.). See page 31 for more information on rescue work around power lines.

First aid for electrical injuries includes the following:

1. Remove the worker from the heat and put out the fire on any clothing by smothering the flames with a blanket or dousing the worker with water. Make sure that fabric is no longer smouldering. Cooling more than 20% of the body at one time can cause hypothermia. Wet dressings and any clean source of water may be used for cooling. *Never* apply ice.

2. Initiate priority action following the ABC approach:
  - A. Airway: Establish and maintain an open airway.
  - B. Breathing: Check and maintain breathing. If the injured worker is not breathing, start assisted ventilation (using mouth-to-mouth or a pocket mask).
  - C. Circulation: Monitor the worker's circulation constantly. Initiate cardiopulmonary resuscitation (CPR) if necessary, and carry on until more advanced life support is obtained. Electrical workers should be familiar with CPR.
3. Keep the injured worker warm and at rest.
4. If the injured worker is conscious, offer reassurance.
5. If the injured worker vomits, turn the worker onto one side to keep the airway clear.
6. Transport the injured worker to medical aid. While waiting for transport or en route to medical aid, administer first aid for burns (see box below).
7. Do not leave injured workers unattended. Maintain a constant watch on their airway, breathing, and circulation while they are transported to medical aid.

### **First aid for burns**

First aid for burns can be administered while the injured worker is waiting for transport or being transported to medical aid:

- Remove rings, wrist watches, and footwear, if possible.
- Elevate burned extremities, if possible, to decrease fluid loss. Do not splint burned limbs unless there is an obvious fracture or dislocation. Avoid handling the affected body parts unnecessarily.
- Apply wet dressings on burns to less than 20% of the body surface. Any burns in excess of 20% can be covered with dry dressings or clean sheets. Do not apply tight, encircling dressings.
- Do not break blisters.
- Do not apply creams, ointments, or other medications to the burned area.
- Do not examine burned eyelids. Cover them with sterile dressings until they can receive specialized treatment.