



Safety for Electricians





Section One

Electrical Hazards

Objective

1. Identify electrical hazards and their effects.
 - a. Understand the effects of electrical shock on the human body.
 - b. Verify that circuits are de-energized.
 - c. Identify causes of electrical incidents.
 - d. Explain the hierarchy of risk controls.



Performance Task

There are no Performance Tasks associated with this section.



1.0.0 – 1.1.0 Electrical Hazards

- The most life-threatening hazards on a construction site are falls, being crushed by falling materials or equipment, electric shock, and being struck by flying objects or moving equipment. Most accidents are preventable if safety precautions are followed.
- Effects of electrical contact include heart fibrillation, cardiac arrest, and burns.



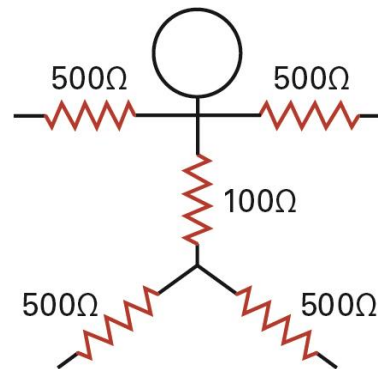
1.1.0 What's wrong with this picture?



Figure Credit: Mike Powers

1.1.1 Body Resistance

- Shock occurs when the body becomes part of an electric circuit.
- The effects of electric shock depend on the amount of current, its path through the body, and the length of exposure.
- Shocks often result in internal burns or bleeding, and other injuries including burns and falls.



- HAND TO HAND 1000 OHMS
- 120 VOLT
- FORMULA: $I = E/R$
- $120/1000 = 0.120$ AMP
OR 120 MILLIAMPS
- $50/1000 = 0.050$ AMP
OR 50 MILLIAMPS

1.1.2 – 1.1.3 Reducing Your Risk

- Limited approach boundaries have been established to provide minimum safe clearance distances to live parts.
- Only trained and qualified individuals may cross a limited approach boundary.
- Always follow company safety policies as well as OSHA and NFPA standards.



1.2.0 Verifying that Circuits are De-Energized

- Step 1** Ensure that the circuit is properly tagged and locked out (*CFR 1910.333/1926.417*).
- Step 2** Verify the test instrument operation on a known source using the appropriately rated tester.
- Step 3** Using the test instrument, check the circuit to be de-energized. The voltage should be zero.
- Step 4** Verify the test instrument operation, once again on a known power source.



1.3.0 Causes of Electrical Incidents (1 of 3)

OSHA lists the following activities as some of the most frequent causes of electrical injuries:

- Failure to place the circuit or equipment in an electrically safe work condition
- Contact with power lines by ladders, powered construction equipment, earth-moving equipment, and construction tools such as long-handled cement finishing floats
- Lack of ground-fault protection on outlet receptacles, powered hand tools, extension cords, and installed electrical equipment



1.3.0 Causes of Electrical Incidents (2 of 3)

OSHA lists the following activities as some of the most frequent causes of electrical injuries (continued):

- Damaged equipment such as cut, nicked, or pinched power cords and cables, worn insulation on power cords or cables, missing ground prongs, and damaged tool casings
- Path to ground missing or discontinuous due to loose or broken ground wires, improperly grounded equipment, improper grounds, or extremely dry conditions around existing grounds



1.3.0 Causes of Electrical Incidents (3 of 3)

OSHA lists the following activities as some of the most frequent causes of electrical injuries (continued):

- Equipment not being used in the prescribed manner, such as fabricating extension cords from multi-receptacle boxes, fabricating extension cords from nonmetallic (NM) cable, using power tools with damaged or modified cords, and using oversized fuses or circuit breakers



1.4.0 – 1.4.6 Hierarchy of Risk Controls

- Elimination example – appropriate lockout/tagout procedures
- Substitution example – reducing energy by replacing a 120V control circuit with 24V control circuitry
- Engineering Controls example – barricades
- Awareness example – electrical hazard warning labels
- Administrative Controls example – safety policies and procedures
- Personal Protective Equipment example – shock and arc flash PPE



Wrap Up – Trade Terms

Double-insulated/ungrounded tools: Electrical tools that are constructed so that the case is insulated from electrical energy. The case is made of a nonconductive material.

Fibrillation: Very rapid irregular contractions of the muscle fibers of the heart that result in the muscle being unable to contract and pump blood properly.

Ground fault circuit interrupter (GFCI): A protective device that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value. This value is less than that required to operate the overcurrent protective device of the supply circuit.



Next...

Section 2.0.0
Using PPE to Reduce the Risk of
Injury



*Read Sections 2.0.0 through 2.2.8 and
complete the Section Review questions.*