

# Electrical safety

by Warren K. Brown

## Before you begin

- To understand electrical safety and the sequence of topics, review the material as well as the resources.
- Make a list of examples of electrical hazards from your home, office and the workplace.
- Display a few items such as a portable ground fault circuit interrupter (GFCI), an extension cord, a lockout lock and toolbox-safety talks.



## Introduction

Electricity is at home, at work and in our recreational areas. It provides the energy that makes many of our tasks much easier and life more pleasant. It powers machinery, provides heating and cooling, energizes lights, pumps our water and runs home and office equipment. When used correctly, electricity essentially goes unnoticed. But, if something goes wrong, there may be injuries, death, fires and costly equipment and building damage. We will discuss:

- Basic electricity concerns;
- How we can get into trouble with electricity;
- How to avoid electrical hazards.

## Discussion

Each year, there are more than 30,000 non-fatal electrical injuries, and more than 411 people die from electrocution. Electrical problems cause approximately 25 percent of fires. People could have avoided most of these incidents.

To organize the efforts of bringing electricity into society, code organizations began writing codes to avoid undesirable consequences. Underwriters Laboratories and the National Fire Protection Association (NFPA) are examples of these code organizations. In addition, they make the use of electricity safer.

## Definitions

To understand electricity, it is important to know some basic definitions.

- **Current** - Measured in amperes, it is the movement of an electrical charge.
- **Resistance** - Measured in ohms, it is the opposition to current flow.
- **Voltage** - Measured in volts, it is the measure of electrical force.
- **Conductors** - They are materials with little resistance to electrical current flow.
- **Insulators** - They are materials with high resistance to electrical current flow.
- **Grounding** - It is a conductive pathway that permits electrical current flow to the earth. This is part of the electrical safety protective system.
- **Shocking current** - It is an electrical current that passes through a body part. The shock's severity depends on the voltage, amperage and resistance. The greater the current, the greater the shock.
- **Arc flash/blast** - This is the resulting flash and pressure wave when an electrical fault occurs. The temperature may approach 35,000 degrees Fahrenheit and molten components may cause serious injuries.

When the human body becomes part of an electrical path or circuit, injuries may occur. These include shock, burns, nerve/organ damage, loss of vision and death. In addition, other secondary results such as falls may happen.

An electrical shock's severity depends on the quantity of the current, the electricity's path through the body and the length of time the current passes through the body.

Electricity that is out of control may result in fire, explosions and equipment damage. The distance from an arc/blast along with enclosure and personal protective equipment determine how it will affect the body.

#### Group action

- Ask the participants to identify root causes of electrical incidents. They may include unsafe equipment installations, environmentally induced concerns and work practices.
- Ask the participants to identify key electrical safety considerations related to the equipment their facility uses. Their answers should include those listed below.

#### Insulation

Insulation protects workers from direct contact with energized equipment. Check the wiring for intact insulation. Make sure the wiring methods protect the insulating properties from damage. For example, you can use conduit for protection or it could be the wiring that is behind the dry-wall in your house.

#### Short circuits

Short circuits in equipment may result in electrically energized equipment. The worker who touches this equipment may become part of the path to ground and may suffer an injury or death. If there is damage to an electrical device, have a qualified electrician check it to ensure there are no electrical faults.

#### Grounding

Grounding is an important safety issue. It ensures exposed metal equipment connects to a low resistance electrical path to ground. If the insulation fails, the fault protection will operate to protect the worker from an electrical shock.

You must appropriately enclose exposed current-carrying devices to prevent inadvertent contact and protect from an arc flash/blast. Such a blast could result in bodily injury or equipment damage.

#### List

Ask the participants to develop a list of do's and don'ts for electrical safety. Write their responses on a flip chart or a white board. To compare here are examples.

#### Do's

- The cord plugs should match the receptacle.
- Trained and qualified electricians should do any electrical repairs.

#### Don'ts

- Don't use cords in water; hot or exposed mechanical environments could damage the insulation.

Ask the group members to identify the types of emergencies that could occur as a result of an electrical incident and the actions they should take. Here are examples.

- If there is a fire, call trained firefighters before you attempt to extinguish it. Only attempt to extinguish a fire if you have fire-extinguisher training.
- If a person is hurt from electrical contact, summon medical help first. Then, perform the levels of first aid your training allows you to do.

#### Group action

To look for electrical hazards, ask employees to do a walk-around inspection of their work areas. Schedule time for a group discussion of their findings and the solutions they proposed for each identified concern. Conduct a follow-up inspection to verify there is corrective action.

### References

#### Publications

- *National Safety Council (NSC) Accident Prevention manual*
- National Fire Protection Association National Electrical Code (NFPA 70)
- Occupational Safety and Health Administration 29CFR 1910 Subpart S
- *ASSE Safety Professionals Handbook – Technical Applications*

#### Slide presentation

OSHA's Electrical Safety PowerPoint presentation: [http://www.osha.gov/dte/outreach/construction\\_generalindustry/general\\_industry/electrical.zip](http://www.osha.gov/dte/outreach/construction_generalindustry/general_industry/electrical.zip)

#### Web site

National Institute of Occupational Safety and Health (NIOSH) Electrical safety: <http://www.cdc.gov/niosh/topics/electrical>

**Warren K. Brown** is a certified safety professional, an associate in risk management and a certified safety and health manager. He is retired from General Motors, Delphi and DMAX Ltd. He also taught safety at Dayton's Sinclair Community College. A General Motors Safety Fellow and Safety Professional of the Year for Ohio and Region 7 of the American Society of Safety Engineers (ASSE), Brown was ASSE's president from 2008 to 2009.

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