



Avoiding Electrocution Hazards

The OSHA 10-Hour Construction Industry Course

Required Online Topic Time: 60m



Learning Objectives



Duration

60 minutes

Terminal Learning Objective

Given current OSHA and industry information regarding construction worksite illnesses, injuries and/or fatalities, the student will be able to recognize electrocution hazards in construction.

Enabling Learning Objectives

- Identify major electrocution hazards
- Describe types of electrocution hazards
- Protect him/herself from electrocution hazards
- Recognize employer requirements to protect workers from electrocution hazards



Introduction

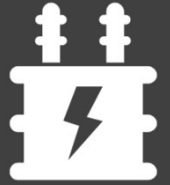


Electricity is essential to modern life, both at home and on the job. Some people work with electricity directly while others work with it indirectly.

Because electricity is such a familiar part of our daily life, we may overlook the hazards electricity poses and fail to take the necessary precautions to protect ourselves, our coworkers, and our clients.



Major Electrical Hazards



Electrocution results when a person is exposed to a lethal amount of electrical energy.



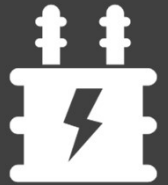
An electrical hazard is defined as a serious workplace hazard that exposes workers to any of the following (**BE SAFE**):

- Burns
- Electrocution
- Shock
- Arc flash
- Fire
- Explosions

To make sure that workplace environments are safe, OSHA *inspects workplaces* and *issues fines* for violations to safety standards. In 2017, there were over **4,600 electrical-related violations** cited by OSHA in the workplace.

Major Electrical Hazards

continued...



Knowledge Key

There are several types of electrical hazards, all of which can cause injury or death. For this reason, you need to be aware of the dangers involved with working around electricity. The acronym BE SAFE can help you remember the types of hazards electricity can pose to you, the worker. B stands for burns, E stands for electrocution, S stands for shock, A stands for arc flash, F stands for fire, and E stands for explosion.

Types of Electrical Hazards



- **Contact with Power Lines:**

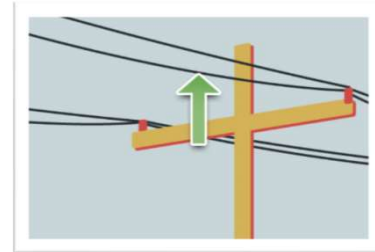
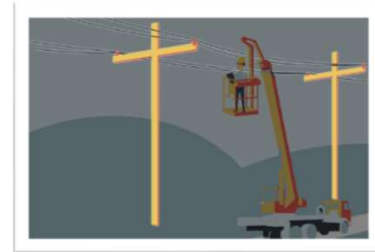
- **Overhead** and **buried** power lines are especially hazardous because they carry **extremely high voltage**.
- Cranes, ladders, and man-baskets **under** or **near** power lines pose electrocution risks.
- If you touch a power line, covered or bare, **death is probable**.

- **Contact with Energized Sources:**

- The main hazards involved with energized sources are electrical **shock** and **burns**.
- Electrical burns require **immediate medical attention**.
- If the power supply to electrical equipment is not grounded or if the path has been broken, electrical current may travel **through a worker's body**, causing electrical **burns** or **death**.

- **Extension and Flexible Cord Hazards:**

- Even when extension cords are used and maintained correctly, they are **prone to damage** because they are **exposed**, **flexible**, and **unsecured**.
- Flexible power cords can be damaged by **sharp** or **abrasive materials** and **aging**.
- Damaged cords can **expose** the conductors inside the cords, **increasing the danger** of shocks, burns, or fire.



Types of Electrical Hazards

continued...



Knowledge Key

Overhead and buried power lines are especially hazardous because they carry extremely high voltage. Workers typically come into contact with overhead power lines when working on cranes, ladders, or man-baskets. Touching overhead power lines, whether covered or bare, almost always results in death.

Contact with energized sources causes the body to become part of the electrical circuit, resulting in shock and burns. The severity of the shock depends on a number of factors, such as the pathway through the body, the amount of current, the length of time of exposure, and whether the skin is wet or dry. Even when the power system is properly guarded, electrical equipment can instantly change from safe to hazardous because of extreme conditions and rough treatment.

Even when extension cords are used and maintained correctly, they are prone to damage because they are exposed, flexible, and unsecured. Prevent these types of hazards by not putting excess tension on the cords and preventing damage from window and door edges, sharps and so on. Replace aging cords.

Protection from Power Lines



Always maintain a **safe distance** from overhead and buried power lines.

Be sure the utility company has confirmed the voltage and therefore the **safe working distance** from the power lines.

Use **nonconductive** ladders and be sure to **retract** them before moving.

Ensure that no materials are stored under power lines and use caution tape and signs to **cord off areas** under power lines.

Locate and **know** what the local underground line locator service has marked before digging. Be aware that more than one underground cable may be buried in area of locator markings.

If provided, use installed rider posts under power lines to avoid working too close to the power lines.



Protection from Power Lines

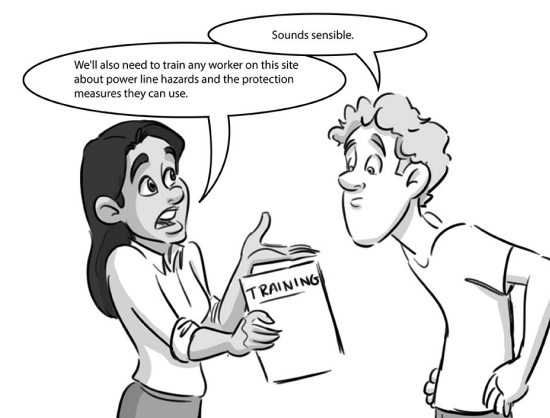
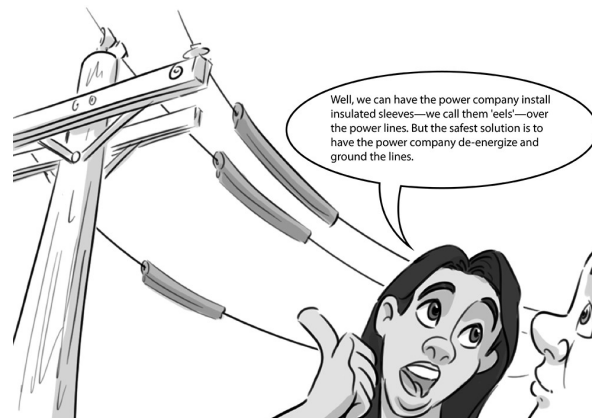
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While PPE, such as rubber insulating gloves, hoods, sleeves, matting, protective helmets and so on, could help, it is better to **avoid** the possibility of workers getting shocked at all.

Your employer must **contact the power company** if you will be working near power lines. The power company can install **insulated sleeves**, called “eels,” over the power lines or can **de-energize** and **ground** the lines.

Employers are also responsible for **training workers** who will be working around power line hazards on the **hazards** and available **protection methods**.



Protection from Power Lines

continued...



Knowledge Key

Since coming into contact with power lines is almost always fatal, you must exercise extreme caution when working around them, following all recommendations when working with cranes, ladders, material storage, mobile heavy equipment, and when doing excavations.

In order to keep you safe around overhead power lines, your employer should make sure the work is performed at a safe distance from power lines, have the power company de-energize and ground the power lines, or install insulated sleeves over the power lines.

Ground Fault Circuit Interrupters (GFCI)



A **ground-fault** occurs when there is a break in the low-resistance grounding path from a tool or electrical system. The electrical current may then take an alternative path to the ground through the user, resulting in **serious injuries** or **death**.

A **Ground Fault Circuit Interrupter (GFCI)** is designed to:

- *Protect people from severe and sometimes fatal electrocution by monitoring for electrical leakage to ground*
- *Detect when the current leakage is greater than 5 mA*
- *Interrupt the flow of electric current by tripping quickly enough to prevent electrocution from leakage*

In a case where electrical current leakage from the circuit occurs, the GFCI would:

1. *Sense the current leakage*
2. *Trip the circuit*
3. *Cut off the electricity*



Ground Fault Circuit Interrupters (GFCI) continued...



A **receptacle GFCI** is often found on construction worksites, outdoor areas and other locations where damp conditions do or could exist. They should be tested **after installation** and **once a month**.

The **GFCI circuit breaker** controls an entire circuit and is installed as a replacement for a circuit breaker on the main circuit board. One GFCI circuit breaker can protect the **entire circuit**.

Your employer is obligated to use GFCIs on construction sites for receptacle outlets in use and not part of the permanent wiring of the building or structure unless an assured equipment grounding conductor program (AEGCP) is being used.

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Ground Fault Circuit Interrupters (GFCI)

continued...



Knowledge Key

A GFCI protects workers by detecting ground faults and interrupting the flow of electric current, which limits the duration of an electrical shock. There are three types of GFCIs: receptacle, temporary or portable, and circuit. Each of these needs to be tested per the guidelines for each type.

If your employer does not provide a grounding conductor program, they must provide GFCIs for receptacle outlets in use and part of the permanent building or structure. GFCIs can be provided for receptacles on the ends of extension cords or by circuit breakers which protect the entire circuit.

Tools/Extension Cords/Equipment



You must **inspect extension cords** before you use them to **check for cuts or abrasions**. Electric hand tools that are old, damaged, or misused may have damaged insulation inside.

For some equipment, such as temporary and portable construction lights, you **shouldn't** use a regular power cord. Because these lights require a **higher amount of power**, you must use cords rated for hard or extra-hard usage with these lights.

Your **employer** needs to make sure that all power tools and equipment are maintained in a safe condition to:

- *Ground power supply systems, electrical circuits, and electrical equipment.*
- *Frequently inspect electrical systems to ensure path to ground is continuous.*
- *Ensure workers understand to inspect electrical equipment prior to use.*
- *Ensure ground prongs are not removed from tools or extension cords.*
- *Ground exposed metal parts of equipment.*



Tools/Extension Cords/Equipment

continued...



When using power tools and equipment, follow these tool safety tips:

- Never carry a tool by the cord or yank the cord to disconnect it
- Disconnect tools when they are not in use and when changing accessories, such as blades and bits
- Use gloves and appropriate footwear around tools and equipment
- Store power tools in a dry place when you aren't using them, and don't use them in damp or wet environments
- Keep any working areas well-lit
- Remove any damaged tools from use
- Use double-insulated tools if you cannot avoid working in damp or wet conditions, but be aware that these tools are not immune to water hazards

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Tools/Extension Cords/Equipment continued...



Knowledge Key

You must inspect your tools and extension cords before each use and replace any that are damaged. Certain types of equipment need hard service extension cords. Ensure that the cord you use is rated for the type of equipment you use.

Workers using power tools and equipment should follow tool safety tips to avoid misusing equipment. This includes ensuring cords are not damaged during use; replacing equipment with damaged cords; keeping cords away from heat, oil, sharp edges and water; using double-insulated tools; and using the appropriate PPE. While you should check all of your own equipment before use, it is your employer's responsibility to make sure that the equipment is grounded and in good working order.

Lockout/Tagout



Many accidents occur because workers fail to lockout/tagout equipment properly.

Lockout/tagout (LOTO) is a safety procedure that:

- *Protects workers from injury while working on or near electrical circuits and equipment.*
- *Locks the device or power source and prevents anyone from turning on the hazardous power sources while someone is performing maintenance or servicing work.*
- *Requires workers to place a tag on the locked device indicating that it should not be turned on.*
- *Prevents contact with operating equipment parts such as blades, gears, shafts, etc.*
- *Prevents the unexpected release of hazardous gases, fluids, or solid matter in areas where workers are present.*

Electrical circuits **must be** locked-out/tagged-out **before** electricians work on any equipment. If a switch is not in the “on” position, **ALWAYS** ask a supervisor if it is safe to turn the switch on. **Never** attempt to flip a tripped switch **especially if it is tagged**. Leave this task for trained electricians.



Lockout/Tagout continued...



Knowledge Key

LOTO is a safety procedure that visually communicates to others that work is being done on electrical circuits and equipment. Its use ensures that dangerous equipment is shut off and not able to be started up again prior to the completion of maintenance or repair work. To protect against electrocution, you should follow LOTO procedures. Only qualified individuals may work on electric circuit parts or equipment that have not been energized.

Additional Employer Responsibilities



Your employer has certain responsibilities:

- Equipment with exposed parts operating at 50 volts or more must be **guarded** by being placed where they are accessible **only to those qualified** to work with or on the equipment.
- Electrical parts must always be **covered** and **protected**.
- Metal covers should be **grounded**.
- Outlet boxes must have a cover, faceplate, or fixture canopy.
- Any outlet boxes or covers should not pinch or restrict the cords in any way, as that can cause damage to the insulation.
- Employees must have **training** before working with or near electrical equipment.

Additional Employer Responsibilities

continued...



If your employer chooses not to use ground-fault circuit interrupters (GFCIs) to protect workers from ground-faults, then they must implement an **Assured Equipment Grounding Conductor Program**, or **AEGCP**.

Your employer must assign one or more competent persons to implement the program.

Additionally, OSHA requires any AEGCP to include two tests to be done on all electrical equipment: a **continuity** test and a **terminal connection** test.

- *The continuity test should be performed on all cord sets, receptacles that aren't part of a building or structure's permanent wiring, and cord- and plug-connected equipment required to be grounded. The point of this test is to make sure that the equipment grounding conductor is electrically continuous.*
- *The terminal connection test makes sure that the equipment grounding conductor is connected to the correct terminal at receptacles and cord plugs.*

Additional Employer Responsibilities continued...



Knowledge Key

Although you must make sure that you are being safe in the workplace, your employer has some overarching responsibilities to keep you safe from electrical hazards while on the job. These include ensuring that electrical parts and conductors are isolated and protected, any electrical equipment with exposed parts operating at 50 volts or more are adequately guarded so that only qualified workers may access them, and training be provided to any workers who deal with electric equipment. Additionally, if your employer chooses not to use GFCIs on your worksite, they must ensure that an assured equipment grounding conductor program is in place and that proper recordkeeping takes place.

Practice Questions



1. Faulty electrical outlets and old wiring, problems with extension and appliance cords, receptacles and switches are common causes of what?

- a. Fire
- b. Arc Flash
- c. Explosion

2. Which of the following answer options can damage flexible and extension cords? **Select all that apply.**

- a. Door or window edges
- b. Staples
- c. Fastenings
- d. Aging
- e. Abrasion from adjacent materials

3. What can your employer do to protect you from overhead power lines? **Select all that apply.**

- a. Maintain a safe distance from lines when working
- b. Having the power company de-energize and ground the power lines
- c. Wearing PPE is the only way to prevent being electrocuted
- d. Have the power company install insulated sleeves (also known as “eels”) over power lines

Practice Questions continued...



4. When are employers required to provide GFCIs on construction sites?

- a. Anytime an AEGCP is not implemented
- b. Every time a tool is being used
- c. GFCIs are always optional for employers
- d. GFCIs must be used with an AEGCP

5. When must you inspect your tools and extension cords?

- a. Before each use
- b. At the end of each work day
- c. Before the beginning of a work week
- d. Whenever the tool or cord isn't operating properly

6. Which of the following answer options are ways you can avoid power tool and equipment hazards in your workplace? **Select all that apply.**

- a. Replace equipment that has damaged cords
- b. Keep cords away from heat, oil, sharp edges, and water
- c. Make sure you use the tools as much as possible
- d. Use the appropriate PPE
- e. Use double-insulated tools
- f. Make sure cords aren't damaged during use

Practice Questions continued...



7. A 39-year-old journeyman electrician with 16 years experience on-the-job was removing metal fish tape from a hole at the base of a metal light pole. It was raining during the course of the work. The fish tape became energized, electrocuting him. What could have been done to prevent this accident? **Select all that apply.**

- a. This type of work shouldn't have been conducted in the rain.
- b. Ensure all circuits are de-energized before beginning work.
- c. Deactivated controls during the course of work on energized or de-energized equipment or tag circuits.
- d. The employee should have been trained to recognize and avoid unsafe conditions associated with his work.

8. When must an Assured Equipment Grounding Conductor Program (AEGCP) be in place?

- a. At every worksite
- b. Only when GFCIs are in place
- c. Only when working around power lines
- d. When an employer does not use GFCIs

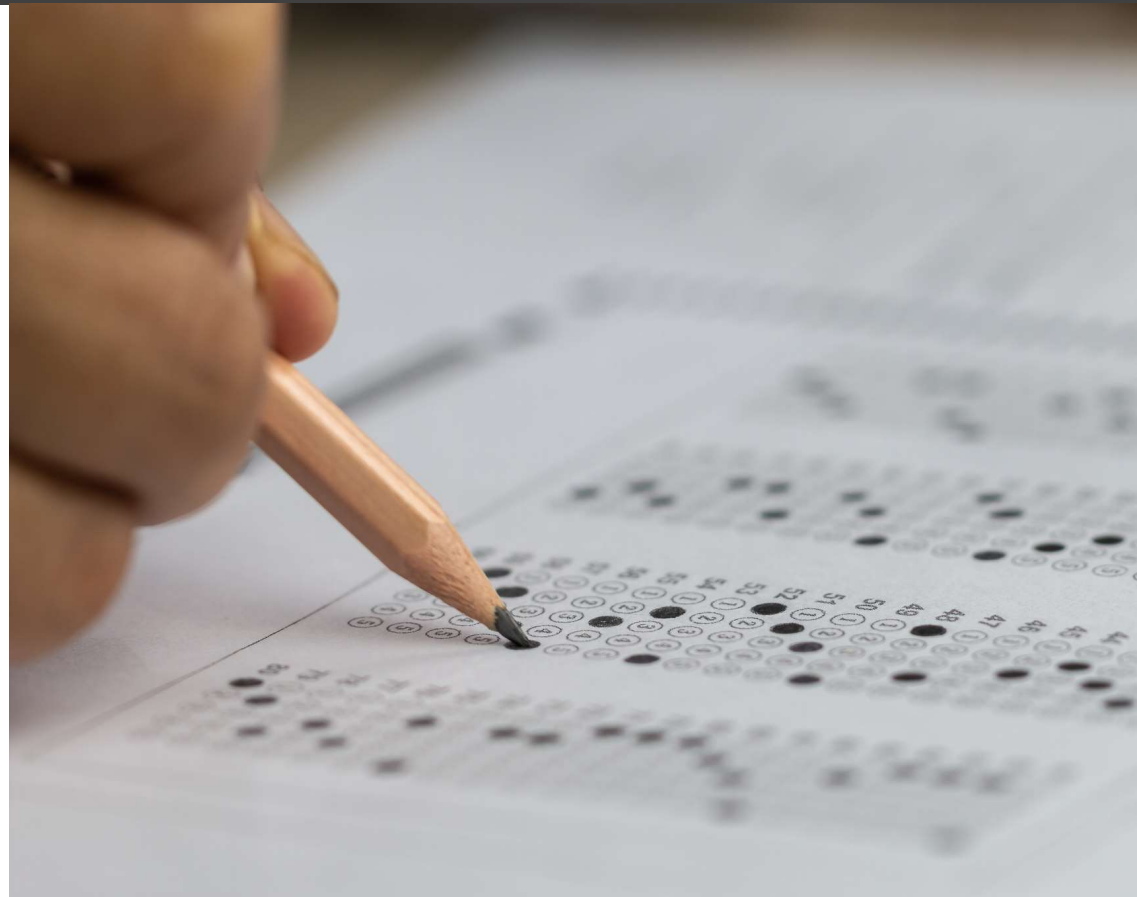
9. What is the purpose of guarding electrical equipment with exposed parts operating at 50 volts or more?

- a. To fulfill lockout/tagout requirements
- b. So that only authorized workers can access the equipment
- c. To allow easy access to the equipment
- d. So that the general public is kept away from construction equipment

Practice Questions Answer Key



1. A
2. A, B, C, D, E
3. A, B, D
4. A
5. A
6. A, B, D, E, F
7. B, C, D
8. D
9. B



Conclusion



Great Job!

You have completed the Avoiding Electrocution Hazards – Construction topic.

