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# MODULE 2—ELECTROCUTIONS


**At the end of this module, you will be able to...**

- Cite facts relating to electrocutions on the job.
- Define the important words that relate to working with electricity.
- Recognize and use the OSHA regulations that relate to working with electricity.
- Identify practices at your work that protect you from electrical injuries.
- Perform a worksite analysis to find hazards that could cause an electrical injury.
- Describe behaviors at your worksite that could cause an electrical injury.



### Activity: Can You Find The Electricity-Related Hazards?

**Directions:** Look at the photo below as well as the slide your facilitator shows you. Can you find the hazards that relate to electricity? Write them in the space below.



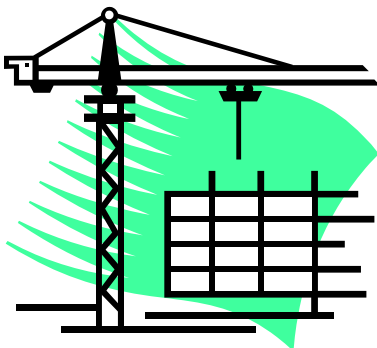
## Facts About Electricity

### *Did You Know?*



- About 700 workers get hurt by electricity every year.
- About 350 people die each year in electrical incidents.

- The construction industry has more electrocutions than any other industry.
- Electrical safety is important for all construction workers. It's not just for electricians.
- When an electrocution occurs, there are often no emergency response plans.

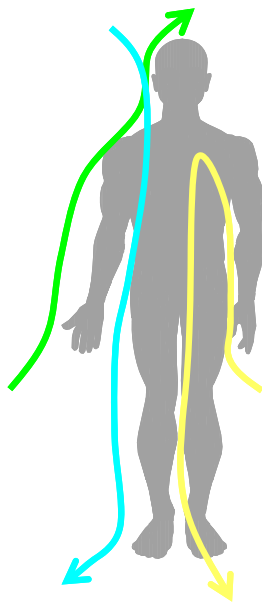


- About 30% of electrical deaths involve cranes and overhead power lines.
- Overhead power lines are not insulated. They can carry tens of thousands of volts. This makes them very dangerous to employees working near them.

**Note:** To remind you of the required clearances for operating equipment around high wires, there is a clearance chart on Page 10 of your Pocket Reference Guide.

## Estimated Effects of AC Currents

U.S. Standard 60 Hz	
1 milliamp (mA)	Barely perceptible
16 mA	Maximum current an average person can grasp and “let go”
20-30 mA	Paralysis of respiratory muscles
100 mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
15/20/30 Amps	Common U.S. household breakers



### PATH

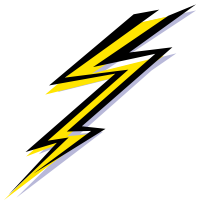
Harm is related to the path by which current passes through the body.

Chart and diagram courtesy of Associated General Contractors of America

**Note:** To help you remember the effects of AC currents on the body, this chart is reprinted on Page 11 of your Pocket Reference Guide.

## Words You Need to Know

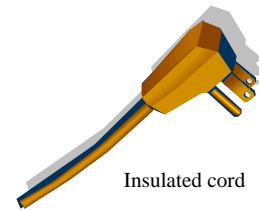
In this module, we will use some words relating to electricity. Let's review them.



**Ground Fault**—a small leak of electricity

**Grounding**—A process that prevents electricity from building up. It does this by creating a low-resistance path to earth or some other ground plane.

**Insulation**—Materials that don't conduct electricity. They are used to cover an object that does conduct electricity. This allows the object to be handled without danger of electric shock.

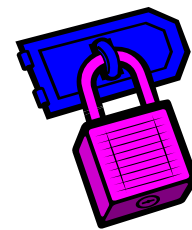


GFCI

**Ground Fault Circuit Interrupter (GFCI)**—A device used to prevent electric shock. It cuts power off if there is a leak of electricity. It is designed to protect people.

**Circuit Breaker**—Overcurrent protection that is designed to protect equipment and wiring.

**Lockout/Tagout**—Practices that protect employees who work around electricity. First, the machine or equipment must be disconnected from the electrical source. Next the source must be locked. Finally, someone must verify that proper procedures were followed.



## OSHA and Electricity

There are many OSHA standards that address working safely around electricity. Some are in OSHA 29 CFR 1910, General Industry Standards. Others are in OSHA 29 CFR 1926, Construction Standards. To read more about any of these regulations, see the OSHA website at [www.osha.gov](http://www.osha.gov). You can access the OSHA website using the hyperlink on your Tools and Resources CD-ROM.

### **OSHA 29 CFR 1910.147, Lockout/Tagout**

This standard describes how to service electrical equipment in a safe manner. It tells employees how to control electrical energy when they are working on equipment.

### **OSHA 29 CFR 1926, Subpart I**

This subpart addresses safe use of hand and power tools.

1926.302	Addresses standards for power-operated hand tools
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### **OSHA 29 CFR 1926, Subpart K**

This subpart addresses electrical safety.

1926.403	Gives the general requirements for electrical equipment
1926.404	Addresses wiring design and protection
1926.405	Provides standards for wiring methods, components and equipment for general use
1926.416	Gives general requirements for worker safety around electricity

### **OSHA 29 CFR 1926, Subpart N**

This subpart addresses safe operation of cranes and derricks.

1926.550(a)(15)	Gives standards for operating cranes and derricks around electrical lines
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## Activity: OSHA Quiz

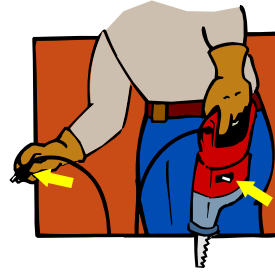
**Directions:** Test how well you know the OSHA regulations. Following are five statements. Decide whether each statement is true or false, then check the appropriate box. Use the extra space to take notes during the quiz discussion.

- |    | TRUE                     | FALSE                    |   |
|----|--------------------------|--------------------------|---|
| 1. | <input type="checkbox"/> | <input type="checkbox"/> | It is acceptable <u>not</u> to comply with the manufacturer's instructions when installing electrical equipment as long as a qualified person does the work.  |
| 2. | <input type="checkbox"/> | <input type="checkbox"/> | Live parts of electrical equipment operating at 50 volts or more must be guarded.   |
| 3. | <input type="checkbox"/> | <input type="checkbox"/> | A temporary worksite has a 120-volt single phase 15-ampere receptacle outlet that's not a permanent part of the building under construction. Because it is temporary, it is not necessary to use a ground-fault circuit interrupter in that outlet. |
| 4. | <input type="checkbox"/> | <input type="checkbox"/> | If a switch is installed in a wet location, it doesn't need a weather-proof enclosure as long as people using the switch wear insulated gloves.   |
| 5. | <input type="checkbox"/> | <input type="checkbox"/> | It is acceptable to use a flexible cord as a substitute for the fixed wiring of a structure.  |

## Activity: Best Practices and Injury Prevention Strategies

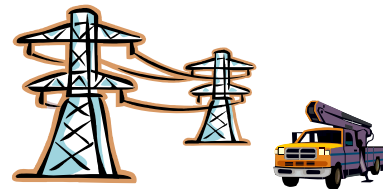
**Directions:** As important as it is to know the OSHA standards, it’s even more important to know how to use the standards at your worksite. Identify some of the best safety practices that you use on the job in each of the following areas.

***Use of Power Tools***—List the safety practices you use on the job relating to the use, care and maintenance of power tools.



***Working With Electricity***—List the safety practices you use on the job when you work around electricity.

***Operating Equipment Around High Electric Wires***—List the safety practices you use on the job when you operate equipment around high electric wires.



**Note:** To remind you of what to do in the event of an electric shock, Page 12 of your Pocket Reference Guide contains emergency response procedures for electric shock.



## Checklist for the Worksite Analysis—Electricity

Every day, when you begin work at your construction site, you should check for hazards that could cause an electrocution. Following is a list you can use when you do this check.

ITEM	OK?	CORRECTIVE ACTIONS
<b>General Electrical Safety</b>		
<ul style="list-style-type: none"> <li>Do you assume power sources are energized unless you know for certain they are not?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you use equipment only for its designed purpose?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid making extension cords with ROMEX<sup>®</sup> wire?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid using equipment outdoors that is labeled for use indoors?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid attaching ungrounded, two-prong adapter plugs into three-prong cords or tools?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid using circuit breakers or fuses with the wrong rating (example: using a 30-amp breaker in a system with a 15- or 20- amp outlet)?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you have an emergency response plan for electrical injuries?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you practice your emergency response plan for electrical injuries?</li> </ul>	_____	_____

## Checklist for the Worksite Analysis—Electricity

ITEM	OK?	CORRECTIVE ACTIONS
<b>Power Tool Safety</b>		
<ul style="list-style-type: none"> <li>● Do you avoid carrying power tools by their cords?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you avoid yanking cords to disconnect them from outlets?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you keep cords away from heat, oil and sharp edges?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you keep cords away from cutting surfaces of power saws or drills?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you disconnect tools when not in use?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you disconnect tools before servicing or when changing blades or bits?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you avoid holding your finger on the “ON” switch when carrying a plugged-in tool?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you use gloves and safety footwear when using electrical tools?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you avoid using tools in damp or wet locations unless tools are specifically approved for such use?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you operate tools in a well-lit area?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you tag damaged tools with “Do Not Use”?</li> </ul>	_____	_____

## Checklist for the Worksite Analysis—Electricity

ITEM	OK?	CORRECTIVE ACTIONS
<b>Extension and Flexible Cord Safety</b>		
<ul style="list-style-type: none"> <li>Do you use factory assembled cord sets?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you use only extension cords that are three-wire type?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you use only extension cords that are marked with a designation code for hard or extra-hard usage?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid yanking cords to disconnect them from outlets?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you have a system for auditing cords to ensure they are the proper kind?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid straining flexible cords?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid dragging flexible cords along window and other sharp edges?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid dragging flexible cords through staples and other sharp objects found at construction sites?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>Do you avoid removing ground plugs?</li> </ul>	_____	_____

## Checklist for the Worksite Analysis—Electricity

ITEM	OK?	CORRECTIVE ACTIONS
<b>Ground Fault Protection</b>		
• Are all your power supply systems grounded?	_____	_____
• Are all your electrical circuits grounded?	_____	_____
• Is all your electrical equipment grounded?	_____	_____
• Do you use ground-fault circuit interrupters (GFCIs) on all 120-volt, single-phase, 15- and 20-ampere receptacles?	_____	_____
• Do you follow manufacturers' testing procedures to ensure GFCI is working properly?	_____	_____
• Do you use double-insulated equipment?	_____	_____
• Do you use tools according to their instructions?	_____	_____
• Do you avoid using tools with frayed cords?	_____	_____
• Do you avoid using tools with missing ground prongs?	_____	_____
• Do you avoid using tools with cracked tool casings?	_____	_____
• Do you ground all exposed metal parts of equipment?	_____	_____
• Are all of your electrical systems grounded?	_____	_____

## Checklist for the Worksite Analysis—Electricity

ITEM	OK?	CORRECTIVE ACTIONS
<b>Working Around Power Lines</b>		
• Do you look for overhead power lines when you enter a construction site?	_____	_____
• Do you contact utilities for buried power line locations?	_____	_____
• Are power lines de-energized, guarded or insulated?	_____	_____
• Do you post warning signs when power lines can't be de-energized?	_____	_____
• If power lines are not de-energized, do you allow enough clearance?	_____	_____
• Do you identify safe routes where cranes and other equipment must travel?	_____	_____
• Do you operate cranes at slower-than-normal speeds when near power lines?	_____	_____
• Do you designate a signal person to indicate when clearance is safe?	_____	_____
• Do you avoid touching or handling the crane or its load until a signal person says it is safe to do so?	_____	_____
• Do you use boom guards?	_____	_____
• Do you use insulating links?	_____	_____
• When handling equipment or materials with a crane boom, do you use equipment that has an electrical ground connected directly to the upper structure of the boom?	_____	_____

## Checklist for the Worksite Analysis—Electricity

ITEM	OK?	CORRECTIVE ACTIONS
<b>Working Around Power Lines—continued</b>		
<ul style="list-style-type: none"> <li>● Do you ground the metal frames and tracks of electrically operated cranes?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you ground the frames of non-electrically driven elevator cards to which electric conductors are attached?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Do you ground hand-operated metal shifting ropes or cables of electric elevators?</li> </ul>	_____	_____
<ul style="list-style-type: none"> <li>● Are ladders made of non-conductive wood or fiberglass?</li> </ul>	_____	_____

**OSHA Resources for this checklist are:**

- 29 CFR 1910.147
- 29 CFR 1926 Subpart I
- 29 CFR 1926 Subpart K
- 29 CFR 1926 Subpart N

**Note:** To help you perform a worksite analysis when you are working at a job site, this checklist is reprinted on Pages 13-18 of your Pocket Reference Guide.

## Activity: Can You Find The Electricity-Related Hazards?

**Directions:** Look at the slides your facilitator shows you. Can you find the hazards that relate to electricity? Write them in the space below.

### Case #1



### Case #2



### Case #3



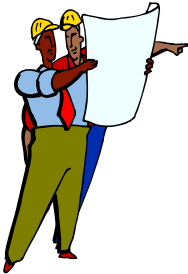
### Case #4



## Activity: Concerns at Your Worksite

**Directions:** Think about the sites where you usually work. Now answer the following questions as they relate to working safely around electricity.

1. Describe some areas where it is tempting to take shortcuts or cut corners when you are working around electricity. How does this create hazards?



2. Describe behavior that you have seen that that you think could cause an electrocution.

