

CONSTRUCTION

HANDS-ON WORKSTATIONS

ZONE



Electrician





Electrician

This Construction Zone workstation will teach you the basic fundamentals of electricity, as you acquire skills by performing hands-on activities. No prior knowledge of the trade is required, as the Construction Zone curriculum will introduce you to professional tools and provide step by step instructions to use them in skills practice.

You will learn the basic concepts behind electricity and how it is controlled and routed once inside a building. Electricity can be dangerous, so you'll be given important tips on how to work with electricity safely and how to be safe around live wires.

Before working on the activities, you will learn:

- What electricians do
- What job opportunities for electricians exist
- The fundamentals of electricity
- Some basic principles behind wiring a building

WORKSTATION OVERVIEW

You will complete the following tasks:

- Calculate the total current load in a circuit
- Test the various components of a circuit breaker box
- Install electrical boxes
- Use an electric drill to drill holes in studs
- Strip and run electrical cable
- Install and wire electrical fixtures and devices
- Ground an electrical circuit
- Connect wiring to a circuit breaker
- Test a completed circuit
- Complete a work order

ELECTRICIAN SKILLS OBJECTIVES

Activity Day 1

- Describe the two stages electricians wire a building in
- List the tasks associated with each stage
- Define the term National Electrical Code
- Define the term regulated trade
- Define the terms journeyman electrician and master electrician
- State the function of a work order

Activity Day 2

- Draw and label a diagram of an atom
- Define the terms current, voltage, power and resistance, and describe the water analogy associated with each
- Define the terms conductor and insulator
- Define the term circuit and describe how current flows in a circuit
- Define the term ground and describe the purpose of a ground wire
- Explain the conditions necessary for electric shock to happen
- Define the term transformer
- Describe the function of hot, neutral and ground wires
- Explain why the size of wire is important
- Define the term cable

Activity Day 3

- Define the term circuit breaker box and explain its function
- Identify three different types of screwdrivers
- Use a screwdriver to safely remove the circuit breaker box face plate
- Define the term circuit breaker and explain its function
- Identify the entrance cable at your workstation
- List and define the three types of bus bars in the circuit breaker box
- Safely use a 12 volt test lamp inside the circuit breaker box

Activity Day 4

- Name two types of electrical boxes
- Locate a receptacle outlet and a light switch in accordance with the NEC
- Identify the different parts of tape measure
- List three safety considerations when using a hammer
- Define the term awl
- Using an electrician's hand tools, safely install four electrical boxes
- List three safety considerations when using an electric drill
- Safely drill holes in studs for a cable run

Activity Day 5

- Define the term cable run
- Accurately measure for cable lengths
- Identify the parts of a cable/wire stripper
- Safely use a cable/wire stripper to cut and strip cable
- Locate the cable clamps and knockouts in an electrical box
- Run cable to and from electrical boxes

Activity Day 6

- Safely use the cable/wire strippers to strip #14 wire
- Identify the different parts of a pair of needle nose pliers
- List the safety considerations when using needle nose pliers
- Be able to distinguish clockwise rotation from counter-clockwise
- Make wire end loops
- Describe the two types of terminals on a receptacle
- Locate the important components of a receptacle
- Using an electrician's hand tools, safely wire and install a receptacle
- Draw cable connections on a work order

Activity Day 7

- Identify the parts of a pair of lineman's pliers
- List the safety considerations when using lineman's pliers
- Safely use needle nose pliers and lineman's pliers to splice wire
- Define the term wire nut
- Make wire connections in a junction box
- Make wire connections for a light fixture and install the fixture and light bulb.
- Describe the two types of terminals on a light switch
- Locate the important components of a light switch
- Using an electrician's hand tools, safely wire and install a light switch
- Draw cable connections on a work order

Activity Day 8

- Using an electrician's hand tools, safely make wire connections for a circuit breaker and circuit breaker box
- Draw cable connections on a work order
- Make jumper wires
- Use a test lamp to test the receptacle outlet
- Install cover plates

Activity Day 9

- Use basic math skills to calculate material and labor charges

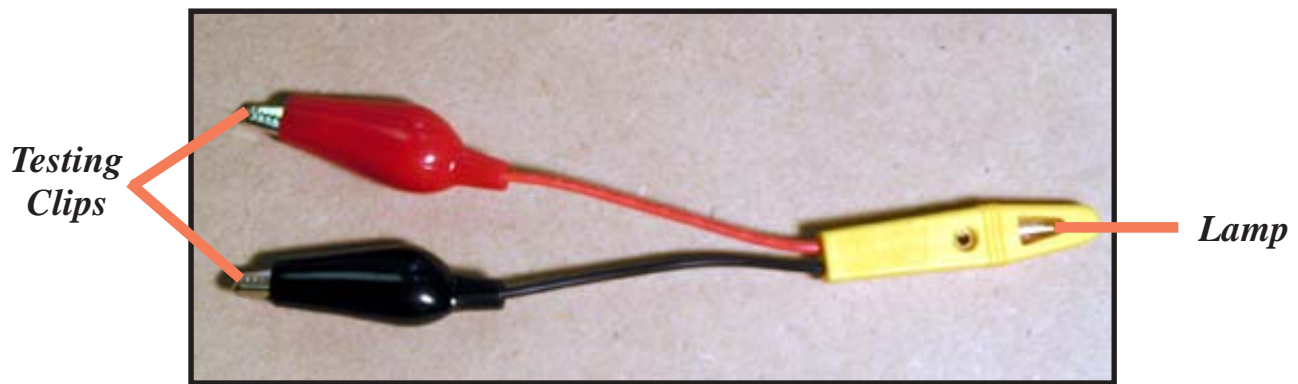
Activity Day 10

- Safely use a screwdriver to disconnect the cover plates and electrical devices in the circuit
- Disconnect all wires from one another and from electrical boxes
- Safely use a screwdriver to loosen cable clamps
- Pull out all cable runs in the circuit
- Use needlenose pliers to cut wire



Using the Test Lamp

A test lamp is a device used to detect the presence of voltage. This workstation is using 12 volts. A standard neon test light works at 80-550 volts. We have substituted a low voltage tester that works on the same principle, but has probes that operate from 0-90 volts. If you apply more than 90 volts, you will damage the test lamp.



12 Volt Test Lamp

The tester is used by first attaching one of the clips to a ground connection. The other clip is then attached or simply touched to any connection you want to test. If there is voltage in the circuit within the limits of the tester (0 - 90 volts), the lamp will glow.

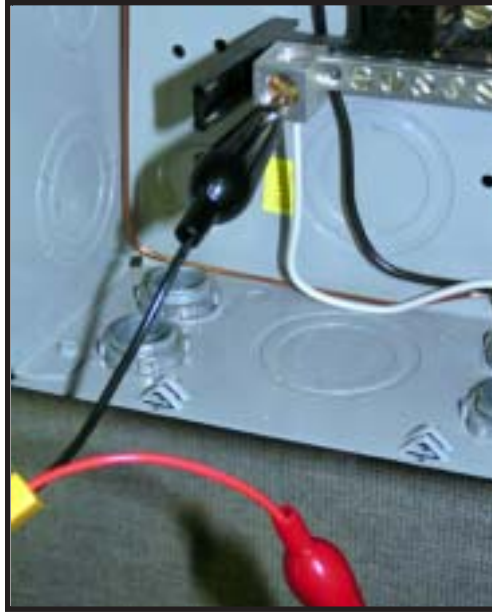


Never touch a live connection yourself to test it!

Step-By-Step Instructions

To use the 12 volt test lamp inside the circuit breaker box:

1. Refer to the photo below. Attach one testing clip to the neutral bus bar at the point where it is attached to the entrance cable neutral (white) wire.



One Testing Clip Attached

2. Refer to the photo below. Attach the other testing clip to the hot bus bar at the point where it is attached to the entrance cable hot wire (black wire). In this position, the tester will always glow when there is electrical current coming into the building from the power utility company.



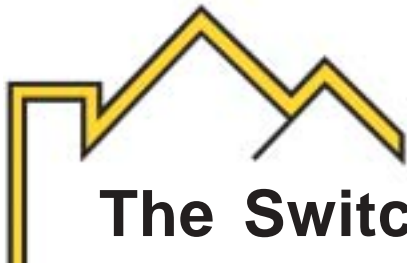
Test Lamp

3. Install one circuit breaker. First, place the bottom of the circuit breaker into the cradle on the left side of the circuit breaker slot. Then, push the right side of the breaker onto the mount until you feel it snap into place. It is a tight fit.
4. Keep one tester clip attached to the neutral bus bar as before. Attach the other clip to the screw located at the edge of the circuit breaker, as shown in the photo below. Does the lamp glow? In this position, the test lamp will glow only when the circuit breaker switch is on. Turn the switch on. The lamp will glow.



Test Lamp on Circuit Breaker

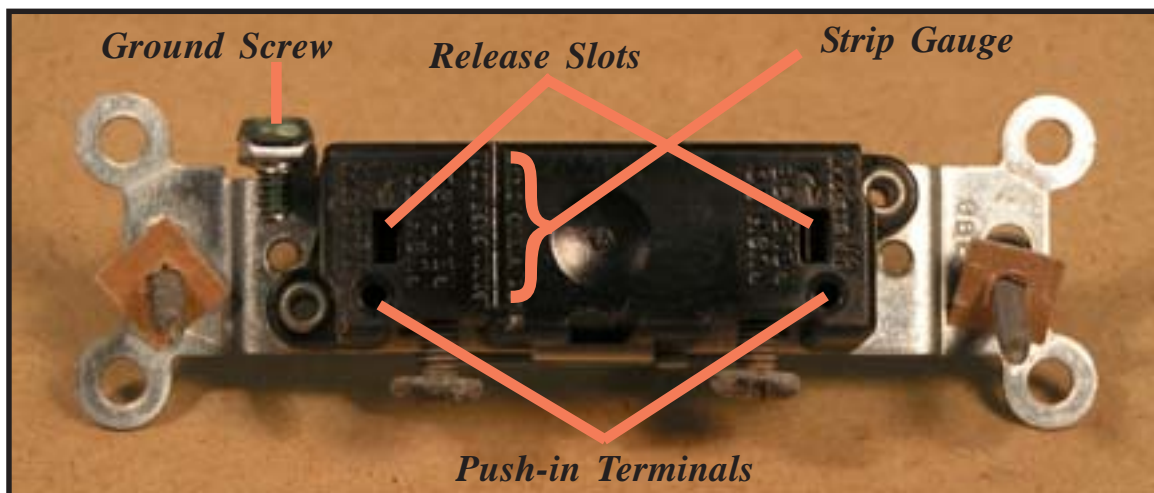
5. Remember, the circuit breaker switch can be opened (tripped) by a person, or opened automatically in the case of a circuit overload. Turn the breaker switch off.
6. Replace the circuit breaker box cover plate. Return all the tools to their labeled places in the tool module. Clean up the workstation, and put away unused materials.



The Switch

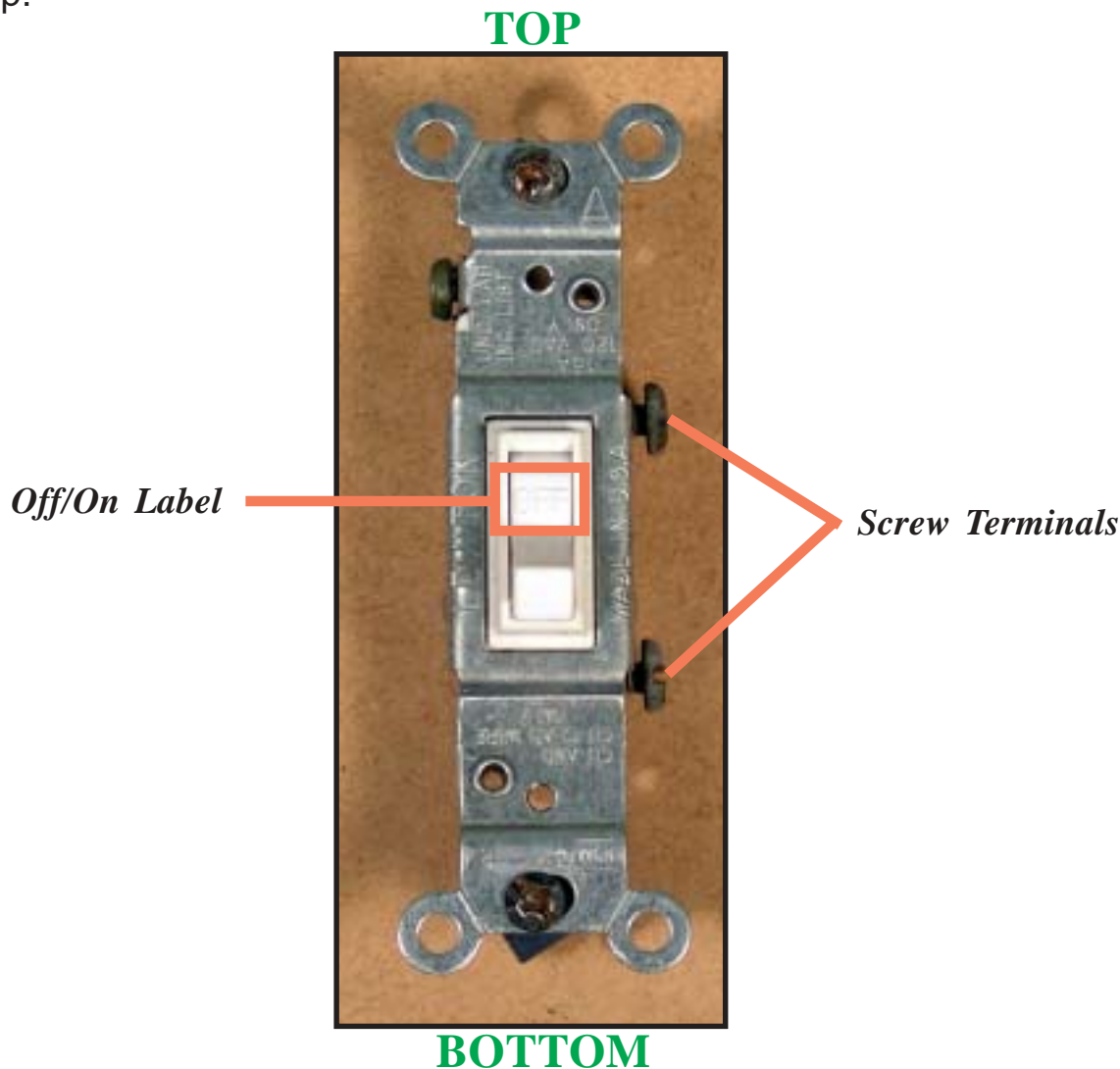
Locate the light switch in the workstation drawer. This switch has both push-in terminals and screw terminals.

Study the push-in type of connections on the back of the switch as shown below. These terminals require that wire be stripped so that its bare end is as long as the strip gauge on the back of the switch. To make the connection, push the wires into the terminals as far as they will go. If release is required, insert an awl or small screwdriver into the release slot while pulling the wire out.




Backside of Light Switch

Study the screw terminals on the side of the switch as shown below. These terminals require that the end of the wire be stripped so that its bare end is as long as the strip gauge on the back of the switch and formed into a wire end loop.



Front of Light Switch

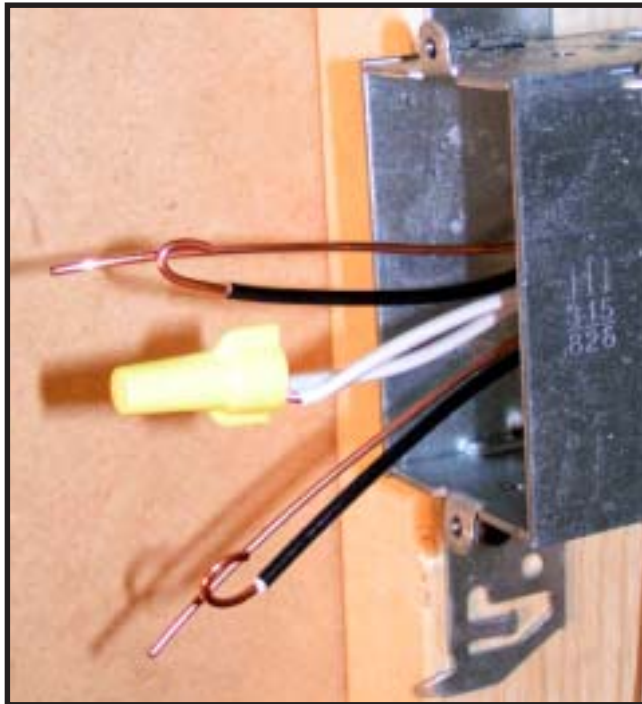
To make the connection, loosen the terminal and fit the hook under the screwhead. Attach the loop in the direction that the screw turns (clockwise )

The terminals are not labeled black/white or hot/neutral. Connections are made to either the top or bottom of the switch. To determine the correct orientation of the switch, place the switch so that the OFF/ON labels are right-side-up.

Step-By-Step Instructions

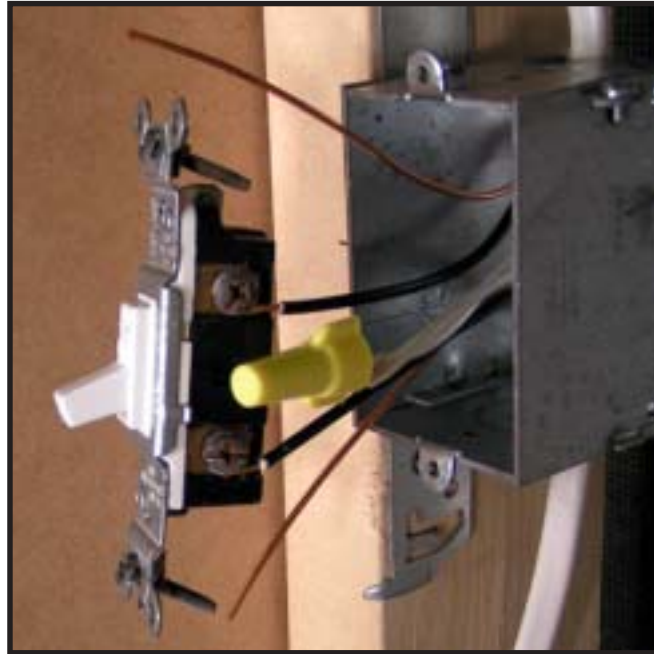
To install the light switch:

1. Strip all the wires in the switch box (1/2 to 3/4 inches)
2. Make wire end loops in the ends of the black wires.
3. Twist both white wires together and secure with a wire nut.



Wiring a Light Switch Electrical Box

4. Connect one black wire to the top terminal screw, and connect the other black wire to the bottom terminal screw.



Black Wires Connected to Terminal Screws

5. Splice the two copper wires by twisting them together as shown below.



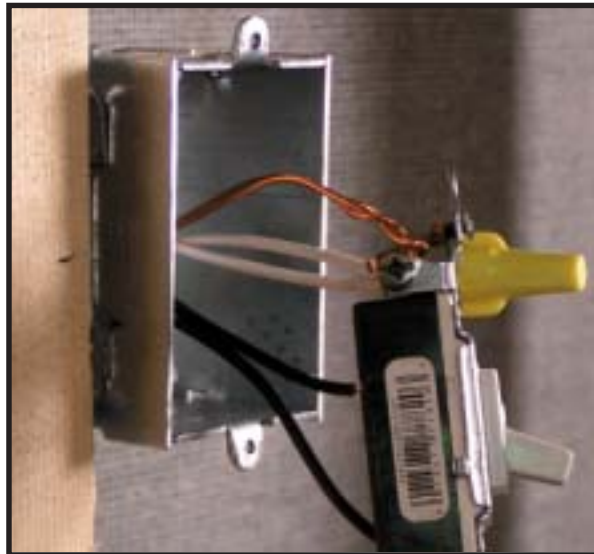
Splicing Ground Wires

- Unwrap the twisted section enough to make a wire end loop with one of the ends. Cut the remaining end off where it starts to twist.



Copper Wires Ready for Connection

- Attach the wire end loop to the green, or colored, grounding screw on the switch as shown below.



Grounded Light Switch

- Turn the switch to the off position. Draw the cable connections you just made in Section 4 of your work order.
- Replace the circuit breaker box cover plate if it has been removed. Return all the tools to their labeled places in the tool module. Clean up the workstation, and put away unused materials.

Name: _____ Date: _____

Electrician - Activity Day 3 Workbook Questions

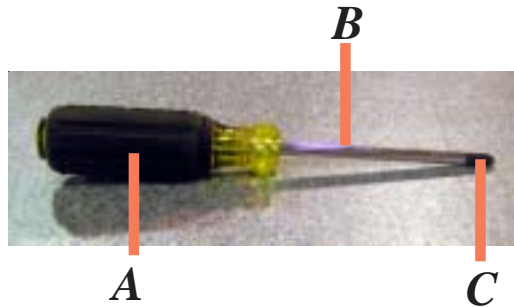
1. List three functions of a circuit breaker box.

Match the terms on the left with the parts of a screwdriver.

2. Shank _____

3. Handle _____

4. Tip _____



5. Define the term circuit breaker.

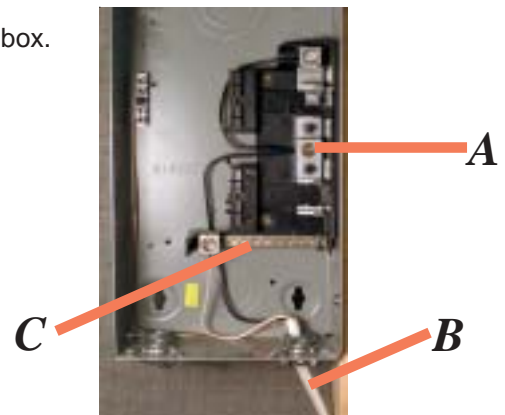
6. Why are circuit breakers more convenient than fuses?

Match the terms on the left with the components of a circuit breaker box.

7. Entrance Cable _____

8. Neutral Bus Bar _____

9. Hot Bus Bar _____



10. When using a test lamp, first attach a testing clip to a _____ .

A. Ground connection

B. Hot wire

