**Assemble an Extension Cord**

**Description**

Extension cords are part of any job site. All construction sites require many trades to operate portable equipment. This is a job for an industrial extension cord that can stand up to the immense wear and tear of the work site. Outdoor-rated extension cords have a heavier insulation jacket rated for rugged use to better protect against mechanical damage and wet environments. The ends of the cords also take abuse, and if the cable or cord end gets damaged it may need to be replaced. Knowing how to change an extension cord end properly and safely is a basic skill for electricians. If an extension cord end is improperly grounded, is wired poorly, or has frayed or loose wires, it is a very serious shock or electrocution hazard that could result in injury or death.

|  |  |
| --- | --- |
| 1. Power cord 2. Rubber housing 3. Wiring module 4. Power cord lamps 5. Power cord clamp screws 6. Assembly screw (3) 7. Terminal screw (3)   Green terminal (ground wire) Silver terminal (white wire) Brass terminal (black wire)   1. Key guide on wiring module (to be aligned with key on housing) |  |
| Male End |
|  |
| Female End |

**Figure 1—**Male and female ends of an extension cord



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## Lesson Outcomes

The student will be able to:

* Safely and properly change three-prong male and female cord end
* Understand the safety implications of improperly wired extension cords
* Use hand tools appropriately

## Assumptions

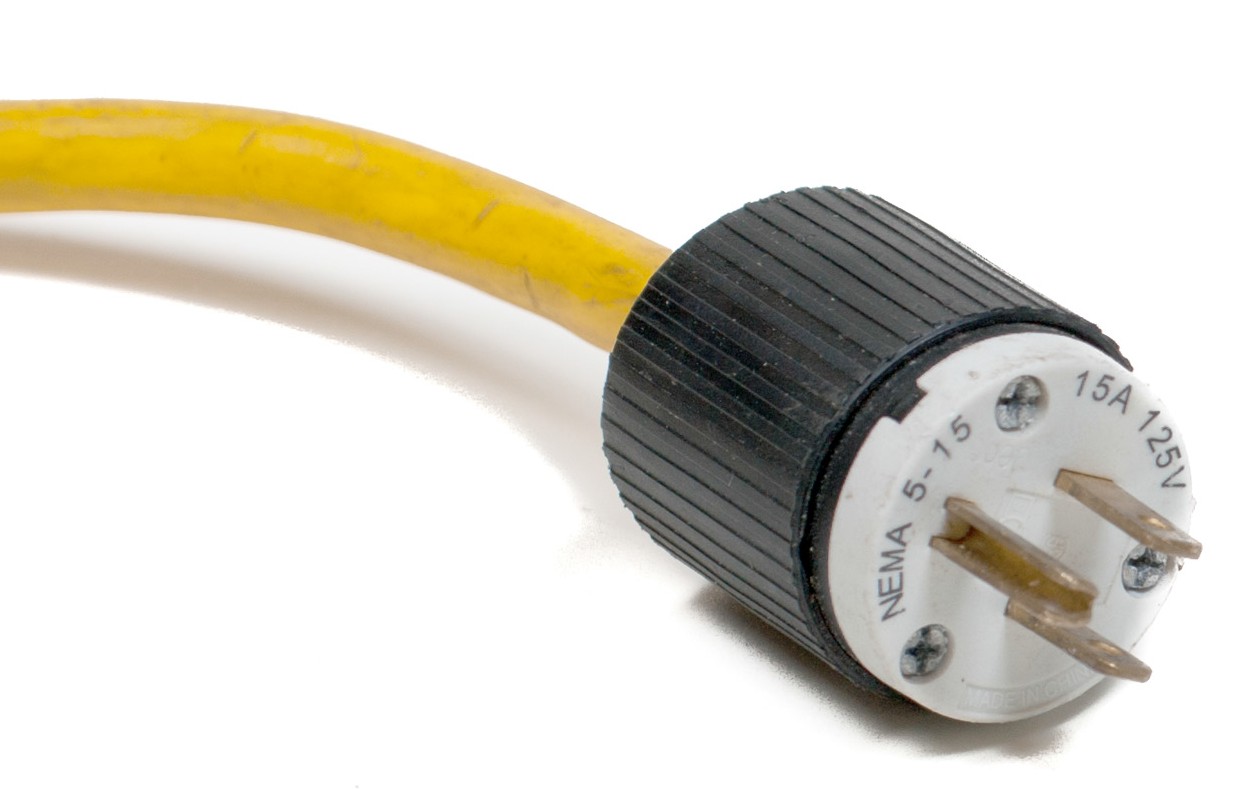
The student:

* Knows how to use hand tools safely
* Understands basic electricity concepts
* Knows how to strip wire

## Terminology

**Female cord end**: a socket that receives the male end of an electrical device or extension cord.

**Male cord end**: a two- or three-prong plug that fits into a wall receptacle. A three-prong plug is preferred as it contains a ground wire pin.



**Figure 2—**Male end of an extension cord

**Plug tester**: a device used to verify that an AC wall outlet (or extension cord) is wired properly.



**Figure 3—**Plug (receptacle) tester

**Power cord/extension cord (trade name, *cabtire*)**: the wire count on cabtire is based on the number of insulated wires inside the jacket. All wires inside the jacket are insulated. Therefore, a three-wire cabtire contains a black, a white, and a green wire. The number preceding the count is the wire’s size or gauge (e.g., 14/3 or 16/3).

**Stranded wire**: a group of conductor strands bundled or twisted together and insulated to make a stranded wire. Used when wires need to be more pliable, such as extension cords. If solid conductors were used, the extension cord would be stiff and the conductors would break when flexed.

## Estimated Time

1 hour

## Recommended Number of Students

20, based on *BC Technology Educators’ Best Practice Guide*

## Facilities

Technology education shop with benches

## Tools

* Side cutters
* Wire strippers
* Utility knife
* Robertson® #1, Phillips® #2, and slot screwdrivers

## Materials

Male and female 3-wire industrial cord ends and 14/3 cabtire. Type and lengths are to be determined by the teacher according to available materials.

## Optional

There are several styles of extension cord ends. In most (particularly those of better quality), the cable goes straight into a clamping device under the terminal screw. In other types, the cable is looped under the terminal screw. Students will benefit from using both designs.

## Resources

### Replacing the Male Plug on an Extension Cord or Power Cord

<http://www.hammerzone.com/archives/elect/accessories/ext_cord/end1/replace.htm>

# Activity

1. Cut the male end from an existing extension cord. Cut the wire close to the cord end so wire is not wasted.
2. To install a male cord end, remove roughly 1" of the insulating jacket from the extension cord. To do this, strip the cabtire jacket by making two cuts, with the side cutters, to the jacket at the end of the cabtire cord. Then grip the two equal halves and pull with equal force. The jacket will peel like a banana. Then cut the jacket from the cabtire using the side cutters. Packing paper between the conductors may also require neat trimming. It is safer not to use a knife so the conductors are not cut.
3. Loosen the male socket outer housing with the appropriate screwdriver. The socket will usually have three screws, but this depends on the manufacturer. Remove the outer housing. Loosen the clamp screws on the outer housing and slide it over the cabtire.
4. Use the appropriate screwdriver to loosen the terminal screws and remove the cut conductors (only if doing a repair demonstration).
5. Strip about ¾" of insulation from the black, white, and green conductors. The stranded wire inside should then be twisted (clockwise) to ensure the strands will have no frays when they are inserted into the terminals. Do not over-twist or the strands will not push into the terminals.

**Note:** The length of conductors to be stripped should be the same as on the wires being removed; different styles of male ends will require wire stripped to different lengths.

Generally about ⅜".

1. The terminals should be colour-coded the same as a receptacle: green for ground, silver for white, and gold or bronze for the black conductor. Insert the conductors into the terminals ensuring all strands enter the clamping device. It may be easier to insert all wires into the terminals before tightening any terminal screws. Tighten the terminal screws until snug.

**Note:** If the terminals do not have a clamping device for the conductors, a hook or loop must be formed. If forming a loop, be careful not to have frayed wire protruding from under the terminal screws. After tightening the terminal screws, gently wiggle the conductors to make sure they are secure under the terminal.

1. Slide the outer housing up to the terminal cord end and tighten the three screws. Tighten the clamp screws.
2. The outer jacket must be clamped under the outer housing. If conductors are visible, the cord end must be taken apart and then reconnected with shorter wire lengths. If water can penetrate inside the housing because of improper installation or there are loose or stray strands of conductor, there could be a shock hazard.
3. The end may now be energized and tested for proper operation. Use the plug tester for testing.
4. Check for understanding and have students commence with the activity.

## Evaluation Guidelines

* Students work appropriately and safely with hand tools.
* No exposed conductors protrude from the housing.
* The extension cord works properly when completed.
* Students understand safety concerns resulting from damaged or improperly wired extension cords.

## Extension Activity

Students wire the female end of an extension cord.