

# AGRICULTURAL GUIDE

Published by the University of Missouri-Columbia Extension Division

Electricity

## Replacing wall switches and receptacles

This guide sheet will help you safely and successfully replace a defective electrical switch or receptacle. For other wiring problems beyond the scope of this publication, consult the National Electric Code.

**Work safely.** First, shut off the electricity to the circuit where you will be working. If you have circuit breakers, trip the appropriate breaker to the off position. If you have fuses, remove the fuse for the circuit. It's a good idea to attach a note telling why the circuit is shut off.

If in doubt, shut off the power at the main switch. Lock it in the off position if there is a chance that someone may turn it back on.

**Few tools needed.** A medium-sized screwdriver and needle-nosed pliers are usually the only tools needed. Pliers are helpful for removing and attaching wires to screws.

You may need a small-bladed screwdriver to disengage wire from the *push-in* terminals on some switches and receptacles.

### Single pole switches

Most lighting loads are operated by single pole snap switches (Figures 2-7, next page). The switch is always placed in the hot line as shown in Figure 1.

#### Steps for replacing a single pole switch

1. Shut off power to the circuit.
2. Remove cover plate (2).
3. Remove screws holding device in wall box (3).
4. Pull device from box (4).
5. Loosen terminal screws (5).
6. Remove conductor wires. Needle-nosed pliers may be needed (6).
7. In case of *push-in* terminals, push small screwdriver into slot near conductor to release conductor (7).

### Graphic symbols

These are some standard graphic symbols to help you understand the wiring diagrams used in this guide sheet.

- ceiling light
- ⊖ duplex receptacle outlet
- S single pole switch
- S<sub>3</sub> three-way switch
- S<sub>4</sub> four-way switch

8. After removing defective switch install new switch using reverse procedure from that described in the steps above.

A white wire may be used as a hot wire in switch loops when wiring with cable as shown in Figure 1 provided that the white wire is not the return conductor from the switch to the outlet. The grounded conductor must always be white and must be connected to the silver-colored screw on the outlet. The hot wire must be connected to the brass screw. It is not permissible to connect more than one wire to the screw terminal.

### Three-way switches

A light or other electrical load can be operated from two locations by using two three-way switches. These switches have three terminals, one of which is called a common terminal (8).

Figure 9 illustrates how two lighting outlets should be connected for operation of both lights from either of two locations. If wired with cable, it would require a two-wire cable from the source to the first light, three-wire cables from the lights to the switches, and two two-wire cables between the lights.

#### Note

1. The grounded wire is connected to the silver-colored terminals of the lights.
2. The hot wire from the source is connected to the common terminal of one three-way switch.
3. The common terminal of the other three-way switch is connected to the lights.
4. The two remaining terminals of one switch are connected to the two remaining terminals of the other switch.

## Steps for Replacing a Single Pole Switch

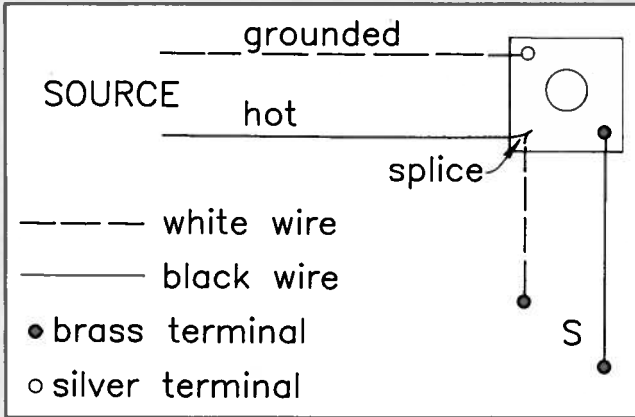


Figure 1. Circuit for light operated by a single pole switch.

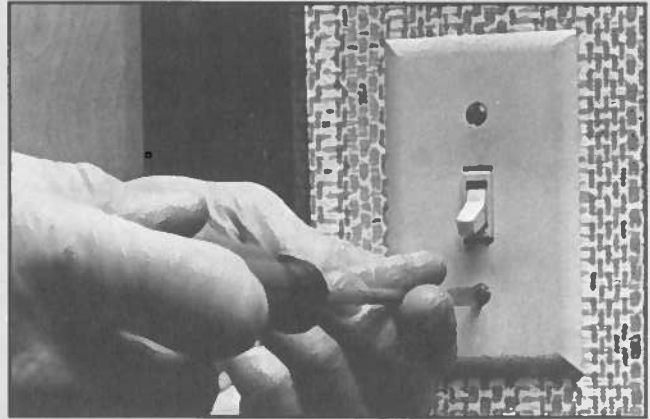


Figure 2. Removing the cover plate.

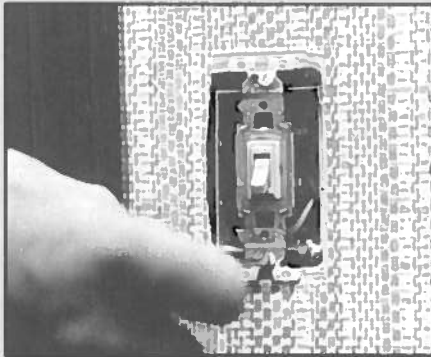


Figure 3. Removing screws holding device in wall box.

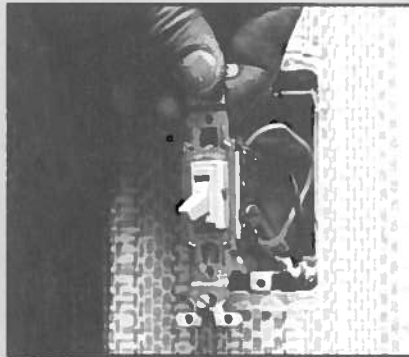


Figure 4. Pulling device from box.

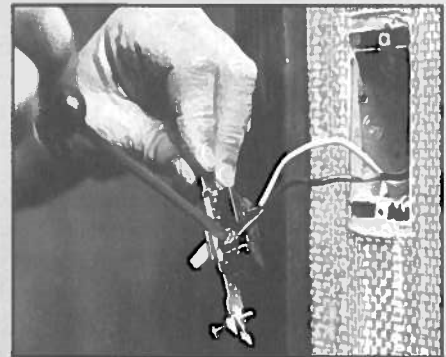


Figure 5. Loosening terminal screws.

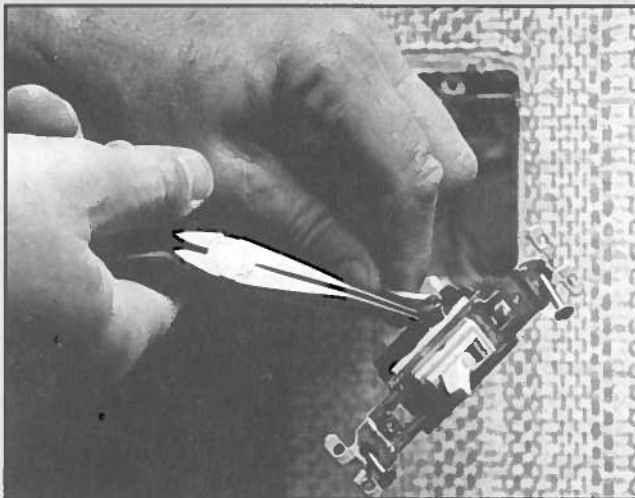


Figure 6. Using needlenose pliers to remove conductors.



Figure 7. Pushing small screwdriver in slot to release conductor.

### Steps for replacing a three-way switch

1. Follow procedure for single pole switch in removing switch from box.
2. Note one terminal (10) is darker than the other two and that three wires are connected to the switch. Remove conductor from the dark termi-

nal and attach to dark terminal of new switch. Attach the other two conductors to the light-colored terminals and replace in wall box in reverse procedure to that of removal.

## Steps for Replacing Three-Way Switches

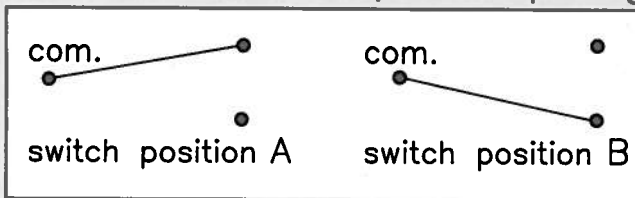


Figure 8. Switching action for a three-way switch.

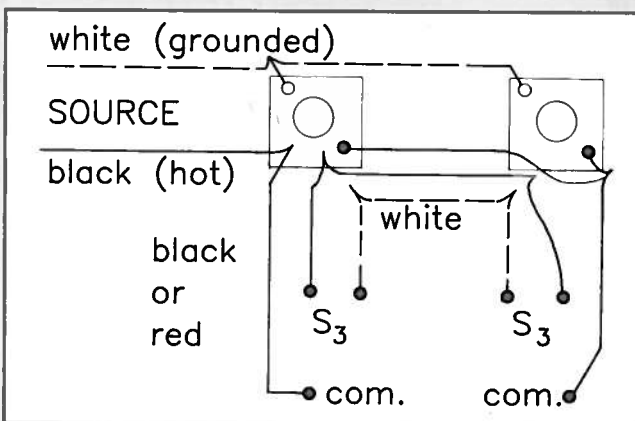


Figure 9. Circuit for operating two lights from either of two locations.

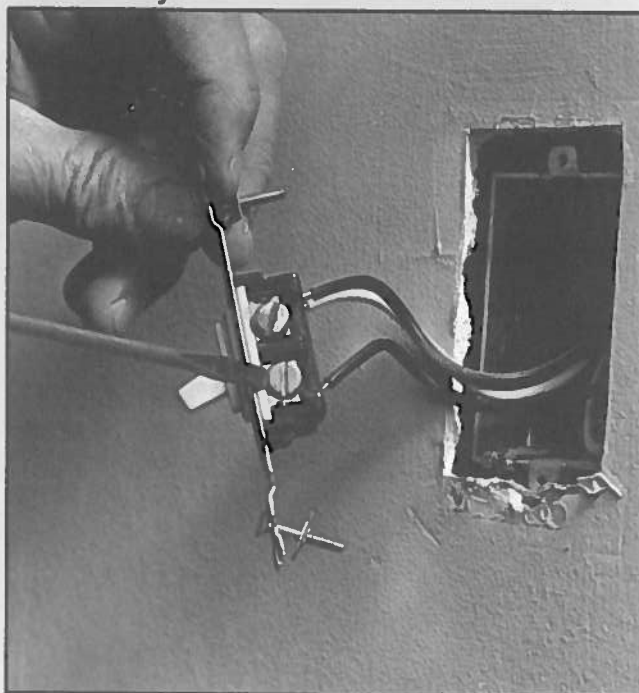


Figure 10. One terminal is darker than the other two.

## Four-way switches

Four-way switches are normally constructed so that the switching action occurs as illustrated in Figure 11.

A light can be operated from any of three locations by connecting two three-way switches and a four-way switch in the manner shown in Figure 12.

### Steps for replacing a four-way switch

1. Follow procedure for single pole switch in removing switch from wall box.
2. Note that (13) four conductors are connected to this switch. Remove two wires from one end and attach to the corresponding terminals of the new switch. Then, remove the other two and connect to the remaining terminals.

**Check:** Before replacing the switch, test to make certain that light may be turned on and off from any switch, regardless of the position of the other switches. If it does not perform properly, interchange any two wires on the four-way switch diagonally opposite each other. Replace in wall box.

**Control from more than three locations.** Lights may be controlled from more than three locations by placing additional four-way switches in the circuit between the three-way switches (12.)

## Receptacle outlets

The National Electric Code (NEC) requires that all outlets in new construction be of the grounding type (Figure 14). When receptacle outlets of the non-grounding type are replaced, the NEC requires that they be replaced with grounding-type outlets if the receptacle outlet can be grounded to an equipment grounding conductor. (NEC Section 210-7(d).)

**Note:** An equipment-grounding conductor must either be bare or have green insulation. The green screw on the outlet must **not** be connected to the white, grounded conductor.

A grounding-type receptacle outlet may also be grounded to a properly bonded water pipe (NEC Section 250-50(b)). Where a grounding means does not exist in the receptacle enclosure, either a non-grounding receptacle or a ground-fault circuit-interrupter (GFCI) type of receptacle must be used, provided that the GFCI does not supply other outlets. See Guide 1023 for further information on ground-fault circuit-interrupters.

### Steps for replacing wall receptacle

1. The procedure for removing a receptacle from the wall box is the same as that for a single pole switch (Figures 2-7).

## Four-Way Switches

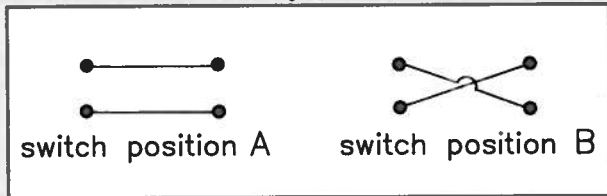


Figure 11. Switching action for a four-way switch.

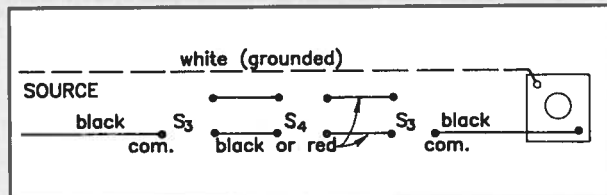


Figure 12. Circuit for operating a light from any of three locations.

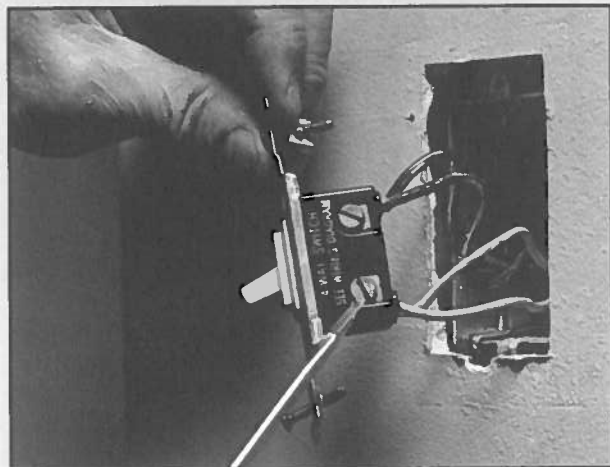


Figure 13. Four-way switch has four conductors.

2. Note that the screws on the one side are silver and that the screws (or the plate under the screws) on the other side are brass or copper colored (16). The white conductors (grounded) should be attached to the silver screws and the black or red (hot) conductors to the brass. (In case there are only push-in terminals, those for the white conductors will be marked "white.")
3. The bare or green grounding conductor, if any, should be connected to the grounding screw, usually painted green (17).
4. Replace receptacle in wall box.

**Test the circuit.** Once a device has been replaced, turn the circuit on and test, to make certain it works.

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■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. Leonard C. Douglas, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. ■ An equal opportunity institution.

## Receptacle Outlets

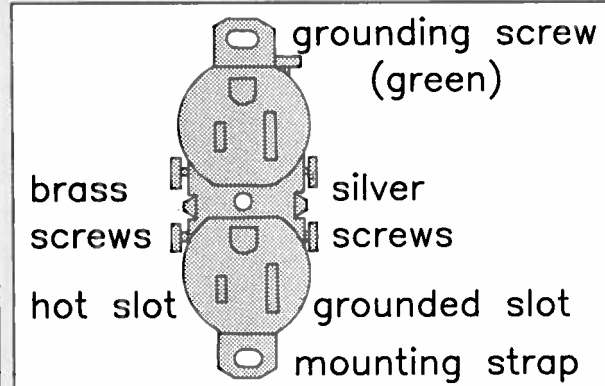


Figure 14. Grounding type of receptacle outlet.

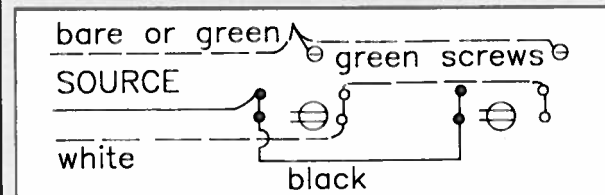


Figure 15. Circuit for two grounding-type receptacles.

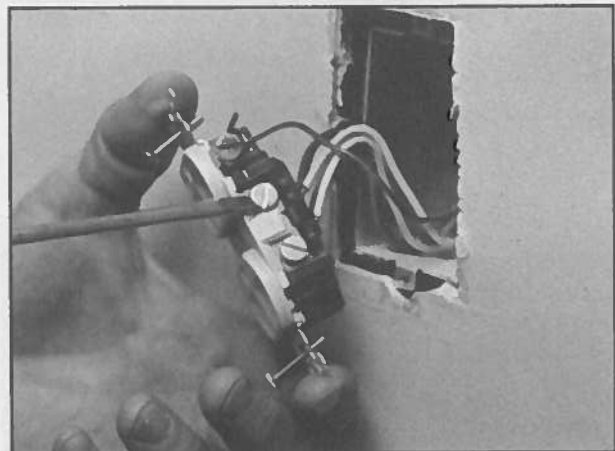


Figure 16. Connect brass terminal to either black or red wires. Connect silver terminal to white wire.

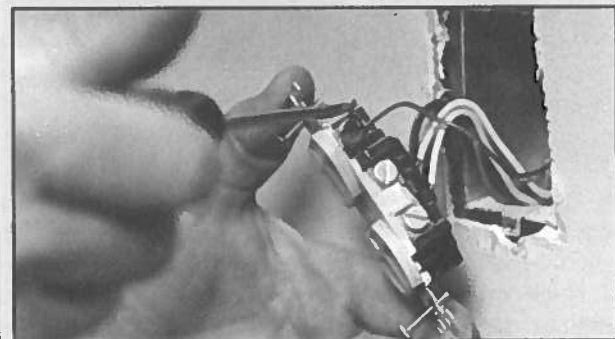


Figure 17. Color code for grounding terminal is green.