HOW TO HOOK UP SWITCHES & PLUG-INS

Your job is nearing completion. If you made up the wire splices as you installed the wiring, all you have left to do is to install the switches, outlets, and the light fixtures.

Many switches and outlets have both push-in (E-Z wire) and conventional screw terminals. When using the push-in connections, be sure to strip the correct length of insulation from the wires. A gauge for making the proper determination is usually molded into the back of the device. Most push-in terminals will only work with #14 AWG wire so you will need to verify the allowed sizes of wire for the brand of device you have. If your wire is too large to use the push-in terminals you will need to use the screw-down terminals.

Push in E-Z wire terminals are normally marked as to which wires they are supposed to hold. If not marked, the wire connection can be determined by the screw terminal to which they correspond. Silver screws are found on one side of outlets and brass on the other. White (neutral) wires connect to the silver screws and the black (hot) wires hook to the brass. Plug-ins and switches have a green screw to which must be connected the bare ground wire. Occasionally, the ground wire is covered with green insulation. If metal boxes are used, the ground wire must also be attached to them. This step should have been completed earlier during the roughing in. Refer to diagrams 1 & 2 of "How-To-Do-It" Sheet #15 *"Device Wiring Diagrams"* which show this outlet connection.

Many outlets have a break-away bar between common terminals. When removed, it separates the top plug from the bottom. Often, rooms that rely on outlet lighting will have all the bottom plugs controlled by a switch. Diagram #7 of the aforementioned sheet shows this use. Kitchens are also more convenient when wired with a split receptacle circuit as it avoids overloading a circuit when multiple, heavy appliances are plugged into a favorite receptacle. This type of circuit might be permitted on a three-conductor cable with a neutral wire that is common to both circuits **BUT** it should be checked out with local authorities for acceptance before being installed. Care must be taken to ensure that both circuits sharing the common connect to breakers on different phases (referred to as an "Edison" circuit) or the common will become overloaded. If someone re-arranges the breakers later (unaware of the need to follow proper phasing) it will result in an overload of the common. A double pole circuit breaker is recommended for this application (and required in some areas) as it will disconnect power to both circuits when tripped and keep them correctly phased. Edison circuits will generally not work with GFCI (ground fault) and AFCI (arc fault) devices.

The most common switch connection is shown in Diagram #2 of the "How-To-Do-It" Sheet #15, *"Device Wiring Diagrams."* It is a simple switch leg hooking to a single pole switch. One wire connects to each of its two brass terminals. Some single pole switches have "common" written between two terminals. This means that the hot wire could be continued through the switch by using these terminals. This common should not be confused with the common terminal on a 3-way switch. This will be discussed shortly.

In Diagram #3, both wires (hot and neutral) pass through the switch box with the hot side being switched while the neutral is spliced. Notice that in Diagram #5, a third wire must be used between the fixture outlet and the switch box in order to be able to use a switch and outlet combination. This combination device can also be used when the wiring passes through the switch box as it does in Diagram #3.

(continued on the reverse side)

Three-way switches have one terminal that is much darker in color than the other two brass ones. This is called the common terminal and is the point on one of the switches to which the incoming hot is connected. The common terminal of the other switch is where the final power leg to the fixture is connected. Follow these wires in Diagrams #8 thru #10. Note: The common terminals on three-way switches are not always in the same place. Our Diagram shows them in the upper left side of the switch as you look directly at the front of the switch, but other manufacturers or models may have them in the lower right position. Look for the darkest of the three terminals, this is the common.

The wires that hook to the common terminals should be connected first. The other two wires carry power from switch to switch are called the "travelers" because the current is always flowing through one of them. Determining which wire goes to the common first will help prevent problems later when hooking up the travelers as they really can't be connected incorrectly.

A dimmer switch can be used on a three-way circuit. A three-way dimmer can replace the switch located at one end of the circuit. The device at other end remains a three-way switch. The light will come on at whatever level the dimmer is set. Special electronic dimming devices are available that enable one to control the light level at both ends of the circuit. See a Grover Salesperson to explore this option.

Incorporating a 4-way switch into a 3-way switching circuit as shown in Diagram #11 is a simple matter. This switch merely reverses the travelers when the handle is moved. Add as many 4-way switches as you need for convenient on-off switching points.

All electrical connections should be tightly made up. E-Z wire connections are held by tension and, if removal becomes necessary, it can be done by inserting the blade of a small screwdriver into the slot and pushing it to release the clip that holds the wire.

Once the wires are connected to the device, they should be folded so they will allow the device to be fastened into the box without strain. Switches and outlet receptacles have bendable mounting tabs that can be adjusted to hold the device in a position that will allow the wall plate to fit properly to both the device and the wall.