

# HOW-TO BOOKLET #3007

## OUTDOOR WIRING

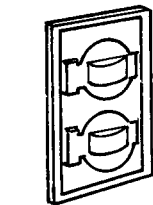
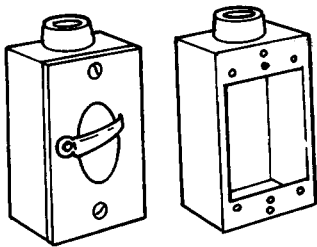


### TOOL & MATERIAL CHECKLIST

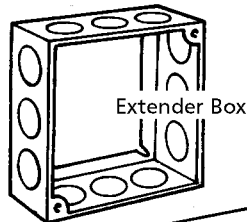
- Cable (Wire) for External Use (Check Codes)
- Outdoor Switches
- LB Fittings
- GFCI
- Lineman's Pliers
- Wire Nuts
- Outdoor Receptacles
- Box Extenders
- Lighting Devices
- Wire Strippers
- Electrician's Tape

**Fig. 1**

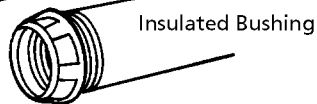
Outdoor Outlet Box and Cover



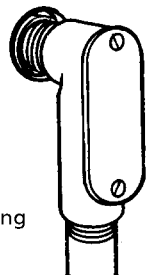
Outdoor Switch Box



Extender Box



Insulated Bushing



LB Connector

**Typical outdoor wiring equipment**

*Read This Entire How-To Booklet for Specific Tools and Materials Not Noted in The Basics Listed Above.*

Exterior wiring is different than interior wiring because water and extreme dampness are involved. Outdoor wiring projects are not difficult for a do-it-yourselfer, but, for safety reasons, outdoor wiring codes must be followed. Outdoor wiring projects fall into two general categories: functional and decorative. Functional lighting illuminates high-use areas such as steps, stairs, gates, walkways, and outdoor grills. Decorative lighting adds dimension and mood to an exterior space such as highlighting trees and shrubs with light. (See How-To Booklet #3088: Lightscaping.) Functional lighting can also be decorative.

### LOCAL CODES

First, contact the municipal building inspector to determine the requirements for outdoor wiring—if the home center or building material outlet where you do business doesn't know. Sometimes these retailers service many different communities with many code variations, and, therefore, may not know specific codes in your specific neighborhood. In some areas, only a professional electrician can make the final electrical hookup. In other areas, the work must be inspected before it can be put into operation.

Find out if local code permits the use of Type UF cable, or if it specifies Type TW wire and conduit. Generally, local codes require that outdoor wiring be protected by conduit in an instance in which outdoor wiring is installed above ground. If wiring will be buried, most cables allow Type UF cable. However, some require that Type TW wire and conduit be used.

The National Electrical Codes (NEC) now requires No. 12 gauge wire for all residential electrical wire.

## GROUND FAULT CIRCUIT INTERRUPTERS

Ground fault interrupters (GFCI) are now required by the NEC in all outdoor areas. Complete information on GFCI outlets can be found in How-To Booklet #1002: Circuit Breakers.

## MATERIALS FOR OUTDOOR WIRING

Outdoor electrical equipment, such as fixture boxes, switches and outlets is especially manufactured to meet codes and resist the elements (**Fig. 1**). You also should use weather-proof light bulbs in outdoor fixtures. These resist shattering when the temperature drops.

### CAUTION: Do not use electrical products specified for indoor use outdoors.

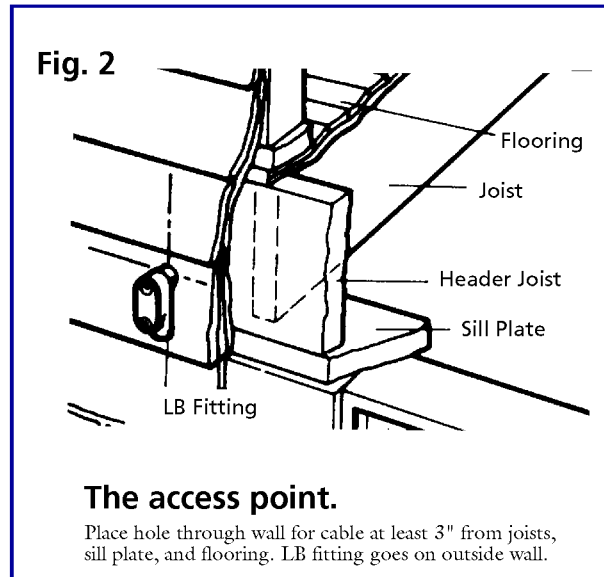
**Connections and Fittings.** An LB fitting is a right-angle connector that is used with a conduit to bring cable through the wall of a house. The fitting routes cable toward a trench that has been dug from the house to the area where the electricity is needed.

LB fittings are threaded on both ends. Conduit passing through the house wall to the outside is screwed to one end. Conduit leading down the side of the house to the trench is screwed to the other end. Thus, cable is enclosed in the metal to provide an efficient seal from the time it leaves the house to the time it enters the ground. LB connectors are outfitted with thick gaskets and metal cover plates.

Box extenders are used when tapping an existing outdoor receptacle or fixture junction box for power. The extender may have a nipple and a 90-degree elbow so that the wires may be brought from the fixture, through the conduit, to the point where power is wanted.

**Outdoor Conduit.** Three types are available, but check the codes before you buy.

Rigid aluminum and rigid steel conduit provide equal protection to the wires that pass through them. Rigid aluminum is easier to work with, but



if it is going to be buried in concrete, first coat it with bituminous paint to keep it from corroding.

Both types of metal conduit come with a variety of fittings, including elbows, offsets, bushings, couplings, and connectors. If offsets and elbows do not provide the necessary turns in rigid metal or EMT conduit, you will need a bending tool called a hickey.

Nonmetallic conduit is made from either polyvinyl chloride (PVC), which is normally used above ground, or high-density polyethylene, which is suitable for burial. If PVC is going to be exposed to direct sunlight, it must be labeled as suitable for use in sunlight. But before you purchase nonmetallic conduit, be sure you check local codes. Don't assume that it's approved. An inspection might require you to replace the nonmetallic materials with another product; this can be very costly and time consuming.

**Outdoor Accessories.** Hardware stores and home centers offer a wide variety of electrical accessories made for outdoor use. These include all types of lighting fixtures, such as spotlights and lamp posts as well as outdoor cooking appliances, pool lights,

and devices to control insects. Most of the accessories run on regular 120-volt power, so connecting power from your home to the devices is fairly easy to do.

## EXTENDING POWER OUTSIDE THE HOUSE

There are two ways to extend electricity from the house to the outside. You can run the power cable through the basement—or basement crawl space—or through the attic.

**CAUTION:** Regardless of the method used to extend the power, turn off the power, if it is on the "working" circuit, at the main service panel before starting any electrical work. Do not work with the power on.

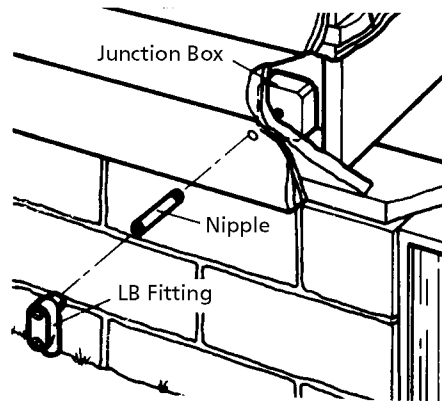
**Through the Basement.** Follow these procedures for a basement exit:

- 1 Pick a reference point on an exterior wall that is identifiable on both the inside and outside of the house.
- 2 Locate the exit point for the cable. It may be near a water pipe that extends through the wall or at a corner. The spot where you go through the wall should be at least 3" from a joist, sill plate, or floor to allow clearance for a junction box (**Fig. 2**).
- 3 Outside, measure from the common reference point to the spot selected for the exit. If the spot is on the foundation, make sure the spot does not fall on a joint between concrete blocks or where two pieces of siding join. The spot has to provide a firm base for the LB fitting. At this point outside, drill a small hole through the wall to verify that the path is clear. If the hole is in a block wall, don't drill through the top block.

Blocks below the top have a hollow center; top blocks often are filled with concrete.

- 4 Use a star drill and small sledgehammer to cut the opening for the extender in masonry. Wear safety glasses and gloves while working with concrete.
- 5 Back inside, open one of the knockouts from the back of a junction box and mount the box so the hole matches the hole through the wall. The box is mounted with masonry shields (anchors) and screws.
- 6 Outside, dig the cable trench.
- 7 Screw onto an LB fitting a nipple long enough to extend from inside the box through the hole to the outside (Fig. 3). Outside, attach conduit to the LB fitting and run the conduit down the side of the house to the trench. Then seal the joint around the fitting with quality caulking compound. Inside, secure the nipple to the box with a connector. The opening is now ready for the cable.

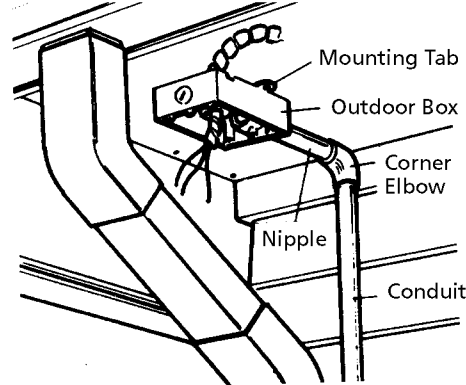
Fig. 3



### Box Location.

Mount box inside. Nipple goes through wall and screws into box. LB fitting screws onto nipple; conduit screws into fitting.

Fig. 4



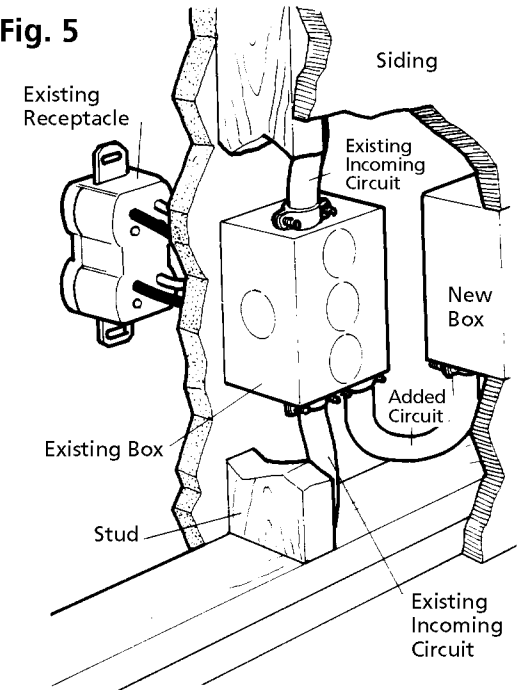
### Box at the soffit.

Cable runs from attic to box fastened to soffit exterior. Conduit drops to trench on ground. Run conduit next to downspout, if possible.

**Through the Attic.** To bring power through the attic and an eave, you will need an outdoor outlet box, nipple, 90-degree corner elbow, and a length of conduit to extend down the side of the house to the trench.

- 1 Hold the assembly against the overhang of the roof so the box and nipple are against the soffit and the conduit is against the wall. Try to run the conduit near a downspout to make it inconspicuous (Fig. 4).
- 2 Mark the soffit where the cable will pass through the soffit into the box. Use a 1-1/8" bit to drill a hole through the soffit for the cable. Then remove a knockout to correspond with the hole, and fasten the box to the soffit with screws.
- 3 Run the cable from the attic power source and out the hole in the soffit. Clamp the cable to the box. With conduit straps, strap the nipple and conduit into place and complete the installation by running conduit down the side of the house. The path is now ready for the cable installation. Be sure to check the codes for the type of cable and/or conduit you can use.

Fig. 5



### Tap into existing outlet.

Turn off power and remove existing outlet from interior box. Drill hole through back of box to exterior. You will tap this outlet.

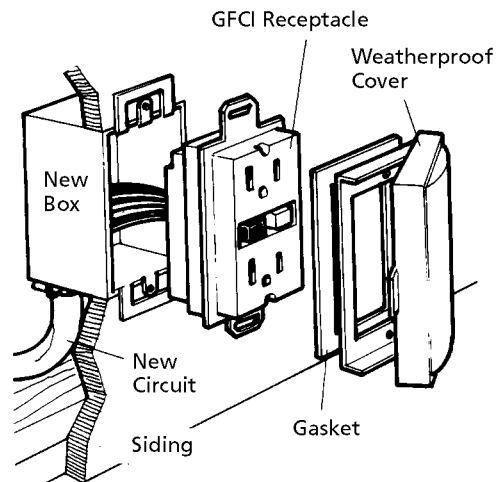
**Going Through Siding.** If at all possible, locate the exterior outlet directly opposite an interior outlet. This way, you can use the same power source for both outlets.

- 1 Shut off the power to the circuit that operates the interior outlet. Remove the faceplate and the outlet. Then with a long 3/4" drill bit, drill a hole through an opening in the back of the box through the sheathing and siding (Fig. 5).
- 2 Outside, locate the drilled hole. Then with a keyhole or saber saw, cut away the sheathing and siding to fit the exterior box that you will install in the exterior wall. Set the saw so the blade won't enter the interior box.

- 3 Remove the back knockout on the cast metal box and screw this box into the house with the knockout hole aligned with the hole in the wall. Insert a 10" length of cable in the hole.
- 4 Connect the cable inside the terminals of the receptacle and the cable outside the new GFCI receptacle (Fig. 6). Then install a waterproof gasket and faceplate over the outside outlet.

**Through Masonry Walls.** Outline the shape of the box on the masonry surface with masking tape. Then drill a series of holes within that border with a masonry bit in a power drill. Clean out the area with a cold chisel and small sledgehammer. Wear safety glasses and gloves.

Fig. 6



### Install outside box.

Cut hole in siding and sheathing from outside and insert exterior box. Run cable through knockout to inside box and make power hookup.

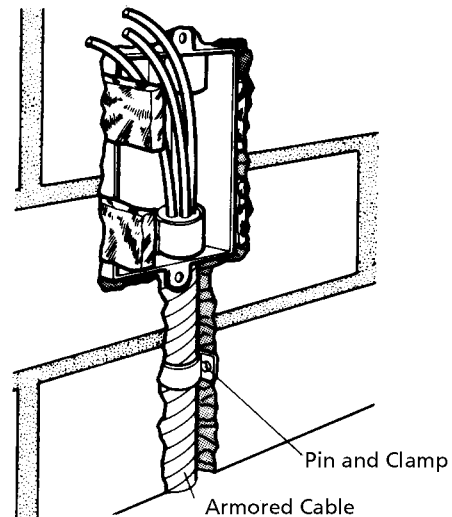
Fig. 7 illustrates how the cable is run to the junction box and how the box fits into a masonry wall. When all wiring and connections have been made, the channel for the cable may be covered with mortar applied with a trowel. If the outlet will be covered with stucco or plaster, fit the outlet with a plaster or "mud" ring so that the box is flush with the surrounding surface. Mortar mix cement is troweled over the mud ring and then finished to match the masonry.

### INSTALLING POWER CABLE OUTSIDE

You will have to pull the cable through the pathway you have made for it. Then the cable can be connected to the power source inside the house. The best plan is to complete the entire project first—hooking up the outside lights and appliances—before connecting to power.

Running the cable from the house out to the yard, pool, garden, or wherever you want it involves digging a shallow trench and building an anchor for each receptacle.

Fig 7



Going through a masonry wall

**Digging a Trench.** First, call the utility company for a plot of pipes and wiring that may be running underground on your property. In some areas you are required by law to do this. Check your local code on depth requirements. Generally, cable not in conduit must be buried at least 24" deep, with expansion loops as shown in Fig. 8. Put intermediate metallic conduit at least 6" deep, rigid nonmetallic conduit at least 18" deep.

If the wires have to go under a sidewalk or driveway, you can use this technique: Dig the trench up to the obstruction. Then continue the trench on the other side of it. Cut a piece of conduit 10" longer than the span. Hammer a point on one end of the conduit. Now hammer the conduit under the obstruction. When it appears on the other side, cut off the point with a hacksaw. You now can connect another piece of conduit to it or run the cable through the conduit under the obstruction.

Fig. 8

