Fishing a Receptacle Into a Wall Section

Description

Once a house has been built and finished, it’s much more difficult for electricians to install more electrical devices into walls. Many homeowners want to do minor renovations and add receptacles, switches, and lights to their existing electrical installations. Many of those renovations are smaller in scale and don’t require removal of walls and drywall. This is a situation where electrical workers do installations with minimal construction and disruptions to homeowners. Fishing a switch, light, receptacle, or another electrical device into an existing home is a faster, more economical way to add devices or circuits to a home. The term fishing, when used with regard to electrical work, means to pull cable through inaccessible spaces with a fish tape (Figure 2). A fish tape is a very long metal strip with a hook at the end, which can be used to grab a wire or another fish tape, somewhat like catching fish with a hook on a line. Most often fishing wire is done in a finished drywall wall.

Fishing wires into walls requires the electrician to tap into existing power sources and find the least invasive way to do so. The skill of fishing wire takes time to master. Even then, there are always challenges to overcome. Many small electrical jobs involve only one electrician. Being able to fish a wire without help requires good technique and skill. As will many tasks, practice makes you better. There are many different scenarios for fishing wire in a home. A receptacle might need to be fished vertically through a wall, horizontally into a light fixture, or between floors in a house. A wire fishing job will be made easier by taking the time to investigate the location of the studs and joist framing of the house.

Lesson Outcomes

The student will be able to:

• Fish a wire into a vertical wall space to add a receptacle
• Know how to locate studs in a wall
• Work safely from a stepladder
• Cut accurately through drywall

Assumptions

All students:

• Know how to use hand tools safely
• Know how to strip wire
• Understand basic branch circuit wiring
• Have been trained in stepladder use
• Know how to use a tape measure and torpedo level
**Terminology**

**Drywall or keyhole saw:** a hand saw used to create holes and cutouts in drywall panels.

![Keyhole saw](image1.png)

**Figure 1**—Keyhole saw

**Fish tape:** a tool for pulling cables through inaccessible spaces. A fish tape is a very long metal strip with a hook at the end, which can be used to grab a wire or another fish tape, somewhat like catching fish with a hook on a line.

![Fish tape](image2.png)

**Figure 2**—Fish tape

**Flange:** an edge projecting from an object that is used for strength, for guiding, or for attachment to another object.

**Joist:** a length of timber or steel supporting part of the structure of a building, typically arranged in parallel series to support a floor or ceiling.

**Plumb bob:** a weight, usually with a pointed tip on the bottom, that is suspended from a string and used as a vertical reference line, or plumb line.

![Plumb bob](image3.png)

**Figure 3**—Plumb bob
Rework device boxes: device boxes used for installation into an existing wall. Used in conjunction with device box support clips, they are inexpensive and easy to install.

![Support clips and rework device box](image)

**Figure 4**—Support clips and rework device box

**Note:** There are a few different methods for attaching boxes when adding devices. Boxes may be added to a stud or attached to drywall between studs. Each electrician will likely have a preferred method and box style that they use. It’s important for electricians to know how to install boxes in existing walls using different methods and types of boxes. For this activity, the method will be explained using a specific type of box. If the teacher prefers to use another type of box or would like to introduce a few different methods, the students will benefit from experiencing all of them.

![4 x 2⅜ octagon](image)  ![Finished surface EZ box](image)  ![Loomex 2¼” rework device box](image)

**Figure 5**—4 x 2⅜ octagon  **Figure 6**—Finished surface EZ box  **Figure 7**—Loomex 2¼” rework device box

**Stud:** an upright support in the wall of a building to which sheathing, drywall, etc., are attached.
Stud finder (also stud detector or stud sensor): a handheld device used to determine the location of wood and metal framing studs in light-frame construction, after the wall surface has been installed. There are different models ranging in price from $20 to $60. Some people do not use stud finders and prefer different methods of finding studs.

![Stud finder](image)

Figure 8—Stud finder

Top plate: a member on top of a stud wall on which joists rest to support an additional floor or to form a ceiling.

Torpedo level: an instrument designed to indicate whether a surface is horizontal (level) or vertical (plumb).

![Torpedo level](image)

Figure 9—Torpedo level

Estimated Time
1–2 hours

Recommended Number of Students
20 maximum, based on BC Technology Educators’ Best Practice Guide. Students can be divided into pairs or groups of four depending on materials available. Students could do this activity in pairs while other students are working on other activities. Pairs could then be rotated through the station.

Facilities
Technology education shop or similar environment
Electrician

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Tools

- Fish tape
- Plumb bob
- Lineman pliers
- Needle-nose pliers
- Drywall saw
- Torpedo level
- Tape measure
- Electrical tape
- Robertson® #1 and #2 screwdrivers
- 5 or 6’ stepladder
- Wire strippers
- Utility knife
- Small flathead screwdriver
- Pencil
- Hard hat (for ladder climb)

Materials

To optimize this activity, a section of wall at least 8’ tall × 32” wide should be provided. The wall section may be wider to allow more students to cut access holes and to practise using the stud finder. The wall section must have ½” drywall attached to the front side and some sort of backing on the back (drywall, plywood). Studs should be installed at 16” centres. A false wall could be built and temporarily attached to an existing wall in a shop or outside wall, or a temporary free-standing wall section with supports could be built. Ensure the wall is properly supported and that students will be able to fish wires into the wall. The teacher will have to decide what will work in his or her classroom/shop environment.

Getting students to cut an access hole and climb a ladder to fish the wires is crucial for developing the skills needed for this activity.

Other materials include:

- 14/2 plastic-sheathed cable, 20’ (7 m)
  - Trade name: Loomex
  - CEC name: non-metallic sheathed cable (NMSC)
- Rework device box with support clips, or teacher’s preferred style of box
- Duplex receptacle and wall plate
Optional

Use a shorter wall section to perform this activity. If it is not to the dimensions required, it will at least give students some practice in fishing wires into a wall.

Resources

Fishing Electrical Wire Through Walls
http://www.familyhandyman.com/electrical/wiring/fishing-electrical-wire-through-walls/view-all

DIY Running New Electrical Cable
Activity

1. The teacher should demonstrate how to perform this activity, keeping in mind ladder safety. If ladder safety has not been discussed or demonstrated, it should be done before commencing this activity.

2. The teacher should show students how to use a stud finder on the sample wall to mark stud locations. The height from the floor to the bottom of the receptacle will be 12" (30 cm), so this is the height at which the studs should be marked on the wall.

3. If a stud finder is not used, another method to find the studs is to tap on the drywall in various horizontal locations with the handle of a screwdriver or pliers and listen for sound changes. When tapping on a hollow wall (a wall without insulation), the sound should change when the stud is located.
   
   When the stud is located, make a light mark with a pencil, and then measure 16" horizontally to locate the next stud and mark it. Verify with the stud finder that the next stud has been correctly located.

4. Once studs have been located and marked, measure and mark to the centre between the two studs at 12" (30 cm) from the floor.

5. Using a stepladder, climb up to a height where the top of the wall may be reached.
   
   Note: Do not stand on the top two steps of the ladder. Make sure students understand the safety issues involved in using ladders.

6. Once in a good position to work, there are a few different methods to transfer the centre of the stud space mark to the top of the wall. The wall in this activity is not a full-width wall, so it should be easy to determine visually where the mark should be placed. This is not always the case when fishing walls, so students should be shown how to transfer the mark by other methods. A good method is to use a plumb bob and hang it down from the top of the wall until it lines up with the centre mark at the bottom. If this method is used, mark the wall space at the top when the plumb bob lines up with the bottom mark. Another method is to measure from a point of reference (such as a corner) to the mark at the bottom, and then transfer that mark to the top of the wall.

7. With the drywall saw, cut an access hole in the drywall at the top of the wall just below the top plate. Access should be roughly 3 x 3" (8 x 8 cm).
   
   Note: When cutting pieces out of drywall that will be replaced later, make sure to cut neat square or rectangular shapes for easier repair later.

8. Mark out the hole for the receptacle box. Use a tape measure to check that the pencil mark is at 12" (30 cm) above the floor. With a torpedo level, make a 2" (5 cm) horizontal mark to reference with the rework device box. Place the bottom of the box on the mark with the open side of the box against the wall. Place the torpedo level on the top of the box, ensuring the bottom of the box is on the 12" mark. When the box is level, press the box firmly against the wall so it doesn’t move and trace all four sides of the box onto the drywall.
**Note:** Do not trace the flanges on the top and bottom of the box. Just trace the rectangular shape of the box.

9. When the shape has been traced, cut the drywall with the drywall saw. Begin the cut by gently tapping the tip of the saw into the drywall. Then carefully and accurately start cutting to the outside of the lines until the place of drywall is detached.

10. Before mounting the box, loosen the small screws in the flanges at the top and bottom of the box and pull the flanges out to the farthest point toward the open side of the box. Retighten the screws. Adjusting the flanges allows the box to sit level with the drywall. Without adjusting the flanges the box will sit past the level of the drywall. This procedure must be done before putting the box into the wall.

![Figure 10—2½" deep Loomex device box](image)

11. It is time to fit the box. There are screw hole plates at the top and bottom of the box, used to attach a faceplate to the box with screws. The drywall will need to be notched slightly with the drywall saw to account for where the screw hole plates are positioned. Once all cuts are complete, gently push the box into the cut out section. When the box is pushed all the way in, it should sit level with the drywall. If the box extends past the drywall, trim the cutout with the saw until the box fits correctly. When the box is fitted correctly, remove it from the wall.

12. Now fish the cable into the wall. Climb the ladder and insert the fish tape into the upper access point. Feed the tape down the wall and have a student try to capture the tape at the receptacle cutout. It might take some practice to align the tape with the bottom cutout. Patience and communication between the two people is important. If the fish tape travels to the floor it will need to be brought back up slowly to the cutout opening. Occasionally the person at the bottom will need to make a hook with a scrap piece of wire to capture the fish tape. When the person at the receptacle cutout secures the fish tape, pull about 2' (60 cm) of tape through the opening.

13. The teacher should change positions with the student at the receptacle cutout so the teacher may demonstrate how to attach wire to the fish tape.
14. Measure enough cable to allow for 1' (30 cm) of extra cable at the receptacle and 2–3' (60–90 cm) at the top access point. Strip 8–10" (20–30 cm) of sheathing from the 14/2 cable. Strip about 2" (5 cm) of insulation from the conductors. Run all three cables through the fish tape hook and bend them back on each other to form a strong hook. Hook only the stripped portion of the cables. The attached wires should be no larger than the 14/2 cable sheathing width when complete; make sure the wires are not bunched up. Wrap electrical tape over the bent wires to prevent them from becoming disconnected.

A good connection between the wires and the fish tape is needed so the cable does not get caught up when pulling the cable up, and so that it does not become disconnected from the fish tape. Many walls have insulation, pipes, and other obstructions in them, so a small and sturdy connection between wire and fish tape is best. Ensure the electrical tape wrapped around the fish tape has no sharp or blunt edges; this could be a point for the connection to get caught up when drawing the cable through the wall. It’s well worth the effort to ensure a good joint between the fish tape and wire is made so the fish tape does not come off.

15. Have the student at the top of the ladder gently pull up the fish tape while the teacher feeds the cable into the opening. Continue until the cable comes out at the top access point. Leave enough cable to allow 8–10" (20–30 cm) of wire for wiring the receptacle. The student at the top of the ladder can cut off (with pliers) the cable connection close to the fish tape. Cut the cable, not the fish tape. Make a loop of cable at the top and put a wrap of electrical tape around it to ensure it does not fall back down through the access point.

16. At the receptacle opening, remove the tab from the device box to allow the cable to be brought into the box. Strip 8" (20 cm) of the outer sheath from the cable without damaging the conductor insulation. Insert the stripped end of the cable into the box. Make sure the sheathing enters the box and is secured in place with no more than ½" (1 cm) of sheathing in the box. Run the bonding wire clockwise around the bonding screw and tighten.

17. Insert one of the box support clips into the receptacle opening with the two open wings facing outward. Hold one of the wings so the clip does not fall into the opening. With your other hand, place the box into the opening. When moving the box into position, hold the wing of the clip so it stays in place. When the box is in place, bend over the wing of the clip so it sits inside the box. Use needle-nose pliers to squeeze the clip so it sits tightly inside the box. The next clip will be harder to place. Start by pushing one end in first. The other end of the clip will not fit into the opening because it is too long. Using a small flat screwdriver, gently tap the long vertical point of the clip until it moves through the drywall and past the box into position. Squeeze the wings into position in the same way as on the other side.
18. Install the receptacle, making sure it sits level with the drywall. Install the receptacle plate.

19. Remove the receptacle, box, clips, and wire. The clips should be able to be straightened and used again, and the wire may be used again as well.

20. The teacher may choose whether to use the same access points for all students or to cut different accesses for each group, depending on resources.

21. Check for understanding and start students on the activity.

**Evaluation Guidelines**

The student:

- Works safely and responsibly
- Works safely on a ladder
- Performs the activity competently
- Uses tools appropriately
- Produces quality workmanship

**Extension Activity**

- Students could attempt to do this activity without the help of a partner.
- The teacher could add insulation bats into a section of wall to make the fishing activity more challenging.