Photos by Roe Osborn

Rough-In Wiring

Keep everything neat and orderly to eliminate confusion later

BY BEN GILES

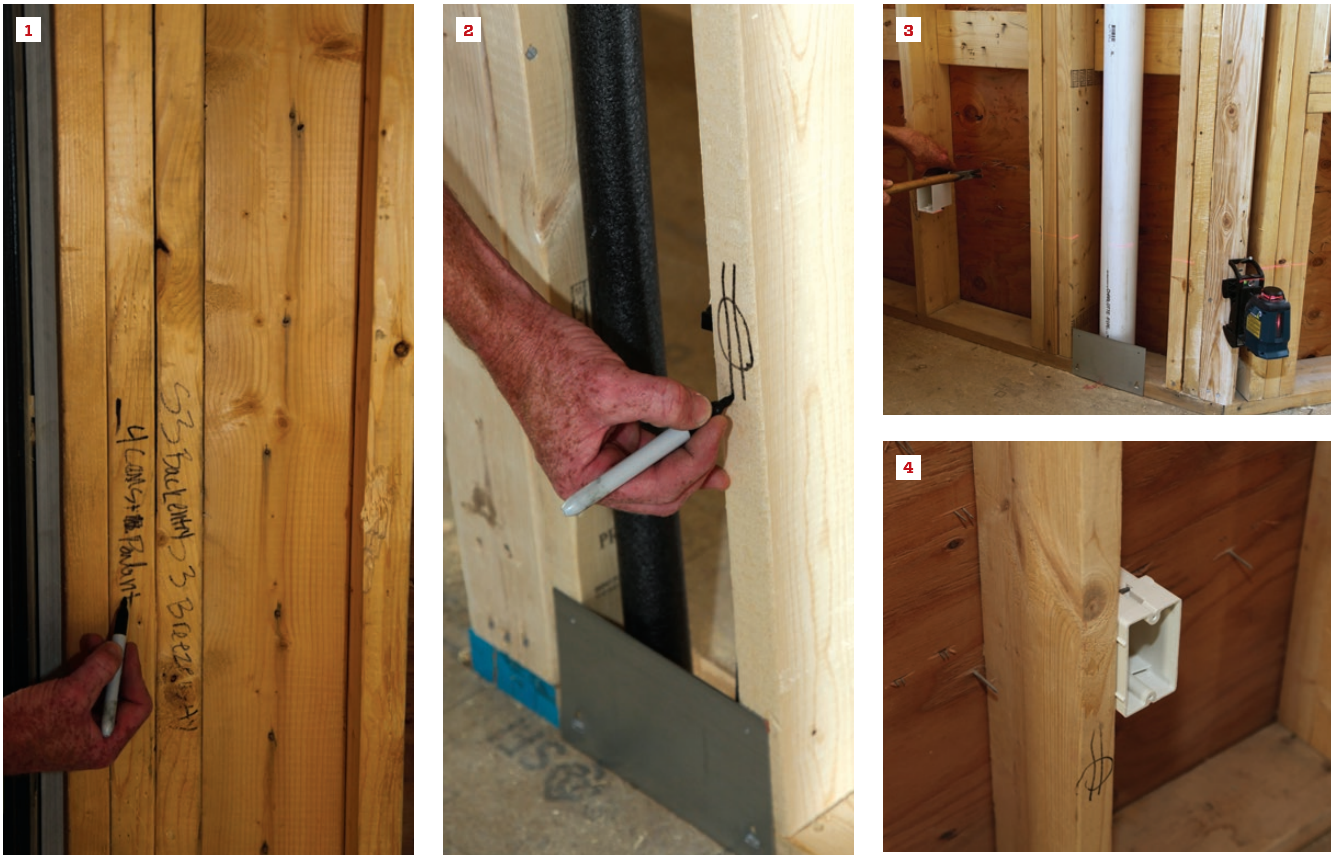
Flipping a light switch and plugging something into a receptacle are things we do every day without a second thought. Most of us can't recall a time when electricity was not an integral part of our lives. But few people realize how much work goes into making sure that everything behind those devices—inside the walls—is installed properly to deliver electricity for our needs. In the industry, that part of wiring is called "roughing in."

AN ORGANIZED AND CONSISTENT APPROACH

Earning a living by wiring houses, as with every job done by a professional contractor, requires doing the job as efficiently and safely as possible. The rough-in methods that I describe in this article have been learned and honed over decades of experience.

One prerequisite for a successful rough-in is keeping all the work neat, organized, and consistent. Most of the homes that we wire are custom-built for clients who expect meticulous work—regardless of whether the work is visible. That level of neatness reflects on the general contractor as well as on my company as the electrical contractor.

More importantly, my organized approach to roughing in makes it easy to trace or follow any circuit. When we finish roughing in a house, I'm confident that any member of our crew can ascertain at



Getting started. Before running cable, the author marks the switch locations and notes what each switch will control **(1)**. A circle with two vertical lines indicates a receptacle location **(2)**. The crew installs receptacle boxes using a laser level to keep the boxes at a consistent height **(3)**. Small plastic nubs on the side of the box align it at the proper depth for the drywall **(4)**.

a glance what any circuit is meant to supply or control, as well as the path that the wires followed to get there. With dozens of circuits and many thousands of feet of wire in each of the homes we work on, keeping everything organized to an almost obsessive level means that in the end everything will work as it should without a lot of time-consuming troubleshooting.

Consistency in our work as a group means that any crew member following another to wire a switch or receptacle will always know exactly what every conductor in a box is meant for. This consistent approach lets the crew work at the most efficient speed to complete the project.

GENTLE WIRING

Wiring a house—especially at rough-in—means pulling, stapling, twisting, and cutting the wires. In spite of that, the task of the electrician is to do all of those things in a way that creates minimal stress on the conductors—the actual metal that will be carrying the electricity. So I try to convey the mindset of "gentle wiring" to my crew.

The conductors in the cable that we use for most domestic wiring are made of copper, which is soft and malleable. While the flexibility of the material lets us easily fish the cable just about any place we want it, the soft, metal conductors are also subject to metal fatigue from continuous stress, such as sharp or repeated bends. Metal fatigue can result in scored or broken conductors, which in turn can cause short circuits, heat buildup, and in the worst cases, fire. Installing a safe electrical system is a huge responsibility that guides our work at rough-in and at every stage of wiring a house.

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Drilling and fishing. The author drills a 3/4-inch-diameter hole (big enough for a maximum of two cables) through the plates and into a joist bay **(5)**. A spooler keeps the cable straight and flat as it comes off the roll **(6)**. The author feeds a length of cable through a joist bay **(7)** and then loops it as he feeds it into the drilled hole, to keep the cable flat and without a twist **(8)**.

Stapling 101. To staple a run of cable to the side of a joist, the author hooks the cable with one finger and flattens the cable against the joist with the side of his hand **(9)**. While holding the cable flat, he drives a cable staple about three-quarters of the way in **(10)**. Then he reaches over and pulls the cable tight while he finishes driving the staple into the joist **(11)**.

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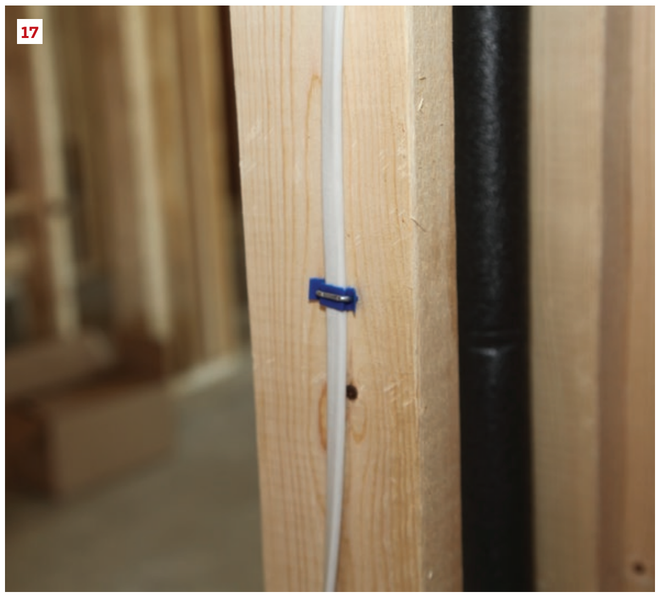
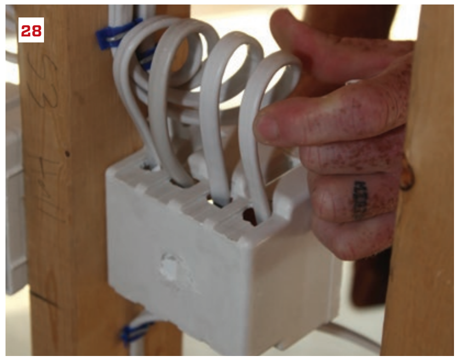


Changing direction. Strapped ceilings allow cable to run perpendicular to the joists if the cable is kept a minimum of 2 inches from the strapping **(12)**. When changing the cable's direction—from perpendicular to the joists to parallel, or from a horizontal to a vertical run—the author makes a wide loop to keep the cable flat and relaxed **(13)**. In a stud bay, he drives the first staple about 6 inches down from the plate **(14)**. Working down the stud, he drives staples every few feet, pulling the cables tight as he moves along **(15)**. A staple just above the electrical box holds the cables before they are fed into the box **(16)**. Drive staples to a uniform depth with the plastic crown protector even, and without dimpling or distorting the outer jacket of the cable **(17)**.

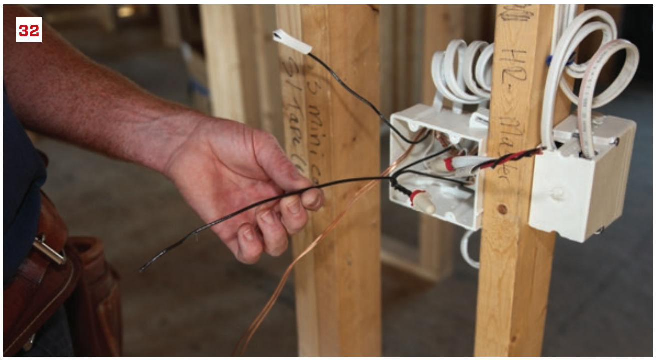
Receptacle box. The author's finger gauges where to strip off the outer jacket **(18)**. A utility knife slits the jacket **(19)**. (He adds an inch for slitting the second cable.) Looping cable into the box **(20)** provides extra cable in case of damage during drywalling.

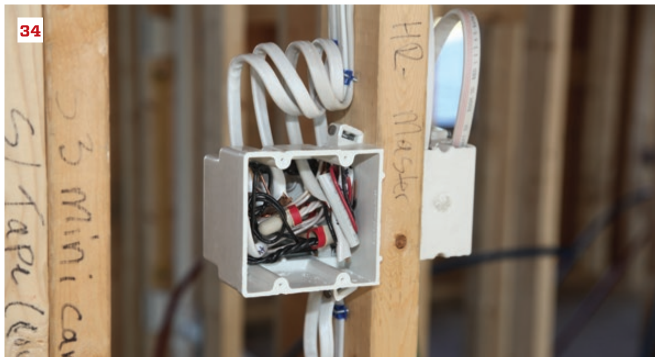
Prep the conductors. Next, the author twists the ground conductors together **(21)**. He cuts back one of the conductors, leaving the other to be attached to the receptacle **(22)**. He slips a copper barrel sleeve onto the twisted wires and crimps the sleeve with pliers **(23)**. After cutting all the conductors to the same length (6 to 8 inches out from the box), the author gently folds the conductors and pushes them into the box **(24)**.



Switch boxes. This switch box has five cables for controlling two switches. A bent end identifies the supply cable **(25)**. As cables are run to the box for the various lighting circuits, each is labeled **(26)**. Then as each jacket is stripped and the cable is looped into the box, the jacket label is re-attached to the conductor **(27)**—in this case, the supply conductor of a 3-way switch that controls mini cans. The fourth cable is looped into the top of the box **(28)**, and an additional cable enters from below.

Ground connection. After twisting the ground wires together from all five cables, the author cuts back all but two of the conductors—one for each of the switches. A crimp sleeve large enough for the entire bundle then slips over the twisted wires **(29)**. A special crimping jaw on the pliers collapses and tightens the sleeve to secure the grounds together **(30)**.





The rest of the box. Conductors are sorted and grouped by type and use and cut 6 to 8 inches long. The author groups the neutral (white) conductors for each switch separately, strips the ends, and twists them together, securing them with a wire nut **(31)**. A pigtail twisted with the supply conductors will feed one of the switches **(32)**. Stripping back the insulation on the supply conductor identifies it for installing the switches **(33)**. The conductors are pushed into the box as far as possible **(34)**.

Finishing up. To finish the rough-in work, a crew member fills every penetration between floors with fire-resistant expanding foam to insulate against air movement and to help impede the potential spread of fire in the stud bays **(35)**. If the cable is within 1 1/4 inches of the stud surface, metal plates are required to prevent damage from errant drywall screws. Here, the angled hole to route a cable around a corner is too near the surface, so metal plates protect the cable on both sides of the corner **(36)**.