They weren't thinking about the electrician (or the plumber) when they buried this hot-tub motor and pump under a deck set 18 inches off the ground—says the author, who faced this mess on a recent job.

How to Remodel Around Electrical Systems

An electrician's advice on how to work on your system without accidentally changing his.

by David Shapiro

I recently spent a frustrating afternoon with another electrician troubleshooting a material conveyor at a steel plant. The conveyer ran on electric trolley wires along the outside of a building. It ran fine, until one day when it failed to start. The problem? A week before, the roof had been painted, with ample dripping on the power conductor. Now, whenever the power-takeoff wheel landed on dried paint, the conveyor lost power from the trolley wire. Had the painters spent a few minutes setting up drop cloths, several hours of circuit tracing by two electricians could have been saved.

Whether painting, or adding a room, it is important to respect the electrical system you are working around. You don't need to know how to work on it, but you do need to know some of its requirements. Something as simple as paneling a room can place it in violation of the National Electrical Code (referred to as Code from here on). *And* it can create a safety hazard—even if you have not so much as touched the wiring! This article will review an assortment of projects, from cosmetic changes to additions. In some cases, you need an electrician. In others, all you need is common sense.

Be Neat with Paint and Paper

The conveyor problem I mentioned earlier was caused by dripping paint. There are other problems that can be prevented through commonsense painting precautions. To begin with, it is a bad idea to paint over electrical devices. Cable, conduits, and raceways are normally fine to paint. But, don't paint over light fixtures, switches, or receptacles.

One problem with painting over light fixtures, switch and receptacle covers, and electrical panel covers, is that when an electrician next works on the item, he is likely to damage the paint, and sometimes the equipment as well. I have not only destroyed cover plates painted solidly to receptacles, but I have actually pulled apart receptacles trying to get the covers off. In addition, if paint gets in the slots of a receptacle or modular phone jack, they may need replacement.

Paint can also cover up important information about the electrical system. For example, sometimes I find electrical panels with circuit directories on the cover—or they were on the cover, before being covered with paint. I've also found "on" and "off" switches—including the lighted type—painted over.

To avoid these problems, carefully cut around, mask, or remove cover plates. Unscrew and lower light fixtures while you work around them if you can. Even if the light fixture or cover plate is to be painted, you are better off removing it and painting it separately—so it can be easily removed later.

All I've said so far has assumed the electrical installation is complete. Many painting jobs take place while switches, receptacles, or rough wiring still hang out of the walls. In such cases, do not assume anything electrical is dead. Most paints and drywall muds will conduct. Second, do *not* paint wires. The Code specifies the colors permitted for specific conductors. When you change the color of a conductor it is probably in violation—and much chancier and more troublesome to work on. An electrician will have to go back and repaint it or tape it the right color. If it is not corrected, someone may get shocked.

The solution is simple. Before you start painting, make *sure* power is off where you are working. Then, if the conductors cannot be safely tucked away, mask the electrical box and wiring. If you get more than a few specks of paint on the wires, wipe it right off. I've worked on ceiling outlets where every conductor was painted entirely white.

From painting, we move on to wallpaper. Because wall paper does not flow like paint, there are only three cautions to mention. First, as with painting, remove the cover plates if you want to paper them. Otherwise, a future electrician will have to cut your paper—and may not have any matching paper to patch his mistakes. My second caution is that paper has no business *inside* electrical boxes. It may be combustible, and it may be conductive, but even if not, it is foreign to the electrical outlet. Sure, hang your paper uninterrupted and wrap covers, but then cut it back so that it is not in there between the box and cover. Third, do not hide any electrical boxes. It does not matter that the customer has put a blank plate over the former wall sconce, ceiling outlet, or kitchen clock. Electric boxes must remain accessible according to the Code.

A thin plaster skim coat can be treated like paint with regard to electrical systems. But it's even more important to keep it out—or immediately wiped out—of electrical boxes and screw holes before it hardens. It may pay to stick nails in the screw holes to keep mud out, although this makes troweling a bit harder.

Paneling & Plasterboard

When drywall or paneling will be installed, new difficulties arise. Electrical boxes are meant to be flush with—or surface-mounted on—the finish. If you add 1/4 to 1/2 inch more material, you have recessed the boxes. The maximum setback allowed by Code is 1/4 inch in noncombustible surfaces such as plaster and masonry. Zero setback is allowed in combustible surfaces such as wood paneling. It is dangerous to use wood as part of the electrical-box enclosure. Even if you find the existing box recessed 1/2 inch or more in a sloppy old

installation, once you work on it you need to bring it up to Code.

If your new (incombustible) finish creates a recess of more than 1/4 inch, something must change. What can you do? Several commonly used styles of electrical box can be extended forward either fixed or variable depths using special fittings. Otherwise, you have to chop them out and resecure them at the appropriate depth.

A word of caution when working with drywall. Electrical boxes, and their supports, are not wonderfully strong. Prying at them, or beating drywall against them in order to mark cutouts, can break, distort, or loosen them. Also, remember that the Code now specifies that the gap between the box and the surrounding wall must not exceed 1/8 inch in width. Finally, if you misplace screws, do not substitute! Electrical boxes most commonly take 6-32 or 8-32 pan-head machine screws. A drywall screw will ruin the tapped threads.

Occasionally drywall or paneling is added over walls or ceilings that have surface wiring. This is especially common when finishing basements or attics. Although the wiring may have been fine for open runs, it may need to be changed substantially to meet the Code requirements for concealed wiring. For example, you cannot cover junction boxes, metal Wiremold, or other fittings that require access.

If fittings are recessed from the finish surface, you must leave a removable cover (lift-up suspended-ceiling panels are usually okay). Also, you cannot sandwich wiring between two surfaces: it must be free and clear of nails or other interference. For example, you cannot squeeze a wire between the back of the baseboard and the wall. Where a wire passes across a stud or ceiling joist, you can notch the wire into the wood and cover it with a steel plate, but few inspectors will allow you to notch and plate an entire job. Also the Code and common sense forbid you to violate structural standards with your notches. Where wire must cross studs or joists, typically you should rerun the wire—through holes drilled in the center of the studs or at least two inches from the edges of the joists.

One of the nastiest electrical finishing jobs can be laying an attic floor. Attic wiring is often run right across the joists, and spliced in junction boxes secured to them. If you then lay flooring right over the joists, the cables will be dangerous and illegal (still illegal if you notch the joists) and the junction boxes will be buried. Your best bet, when covering any open wiring, is to check with an electrician.

Finally, if you are furring out a wall, and plan to run wiring in the furring space, use nominal 2-inch stock, not 3/4-inch furring: it does not leave enough clearance for the wiring.

New Walls and Spaces

Whenever a new wall or space is added, or a storage area is changed to habitable space, it is subject to the requirements of new construction. It must have a wall-switch-operated lighting outlet. Also, a wall space 2 feet or wider must have a receptacle within 6 feet of every point along the perimeter, measured along uninterrupted wall. If you add or lengthen a wall, you may need additional receptacles on each side. Kitchens and baths have special requirements.

If you add any circuits or space to a home, it may call into question the adequacy of the house's electrical service. In addition, your jurisdiction may have special requirements, such as smoke detectors or outside lights.

Adding or moving partitions, doors, windows, or stairs can unexpectedly require the services of an electrician. The most common cases are where cables are exposed inside a cavity, or where switches must be moved. When electrical devices or cables are moved, your customer can either undertake the mess and expense of replacing the cable from box to box, or else accept intermediate junction boxes—with permanently-accessible cover plates. Buried splices are strictly forbidden.

Insulation

New partitions lead to the subject of insulation. Most cable installed prior to 1987 requires heat dissipation around the wiring, and thus it should be free of building insulation. (This is not a problem with the new "high-heat" cable required by the 1987 Code.) Even more important, light fixtures need free space to dissipate heat from ballasts and bulbs. The most common place I find deteriorated wiring is right above ceiling light fixtures. Some heat is normally generated in any outlet box containing splices and feeding fixtures. Concentrating that heat by putting insulation over the box will shorten the life of the wiring.

This is particularly critical with recessed lighting fixtures, which *must* be kept at least 3 inches away from insulation (except with special fixtures rated for insulation-contact). A sheet-metal collar is a good way to ensure this, especially with poured insulation. In addition, recessed fixtures must also be kept at least 1/2 inch away from combustible materials such as lumber, except right at the point of attachment.

The recessed fixtures rated for insulation-contact should be treated like ordinary ceiling fixtures—that is, it's not illegal to bury them in insulation, but it's still not advisable. For one thing, the insulation can cause the "thermal protectors" that come with most recessed fixtures to malfunction.

One final note on insulation: If you run into old knob-and-tube wiring, don't just cover it over with insulation. It was not designed to be buried, and others will have trouble locating it later. Run new cable before insulating.

Outside Work

The main problems I encounter with outside work relate to the electric service. Siding installers sometimes pry away cables, or even meters, to avoid cutting siding around them. Service cable is supposed to be strapped or stapled every 2 feet; if you must pull it away from the wall, resecure it solidly. Leave the meter alone. It contains live wires that no one but the utility can kill. If you loosen it, even without opening it, a mounting screw could loosen and cause arcing.

When building additions, be aware that you usually cannot enclose the service nor move the meter inside. Sometimes, when the wall on which the service enters is to be enclosed, not only must the service be rerun, but the main electrical panel must be converted to a subpanel and a new disconnect installed adjacent to the new service location. Consider this when planning the job.

In doing foundation and grounds work, there are two important warnings. First, before digging or burying, check with your local utilities' locator service. Second, make sure that you do not disconnect ground rods protecting house wiring or lightning arresters. If cut, the wires from these must be replaced; it is not safe to splice them.

Plumbing

There are three ways in which plumbers can inadvertently put an electrical system into violation. First, they can actually damage cables with solvents or torches. Second, plumbers and installers can run hot pipes or ducts against electrical equipment that is not designed to take the heat. Third, they can interrupt grounding. This can happen in two ways. First, the electrical system is bonded to the plumbing with a listed clamp, which is supposed to be on the entering cold-water pipe. If the pipe is changed, the clamp may be displaced. The second way grounding is interrupted is when metal pipe is replaced with non-conductive plastic. To maintain the grounding, you must bypass the plastic section with a jumper wire bonded from metal pipe to metal pipe with listed clamps.

In old houses with ungrounded cable, replacement outlets may be grounded to the nearest cold-water pipe. But how is the plumber to know?

The most difficult electrical safety problem for plumbers arises in old houses which were initially wired with ungrounded cable. Replacement outlets in these may legally be grounded to the nearest cold water pipe. But how is a plumber to know that this has been done? Unless working on the particular section of pipe with the bonding clamp, he could easily remove its ground by installing plastic pipe upstream.

Respecting the System

There are many shortcuts used by non-electricians, and by thoughtless electricians, that abuse the electric system and create hazards. These include illegal fixture, appliance, and fan installations; using the wrong cables, connectors, and boxes; bad splices; putting in the wrong size fuses; bypassing fuses; locating circuit breakers by tripping them; and installing circuit breakers in violation of panel listings. If you're not an electrician, you have no business getting involved in this work. Stay clear of it and you won't risk subjecting your customers to any hazards. What you can do for customers is to make sure they do not overlamp lighting fixtures (modem fixtures are marked with maximum safe wattages) and to see that they do not block their electrical panels with storage.

I have one final suggestion for non-electricians: if you have a question about the electrical aspect of your job, check with your electrical contractor, serving utility, or inspector. They are not there to teach you electrical work, but they'll tell you if you need an electrician. On the other hand, counter personnel at supply houses may or may not give you advice—but whether they do or not, they are not trained electricians.

Please send questions or other responses to this article to me care of *New England Builder.* ■

David Shapiro is a master electrician and the principle of Safety First Electrical Contracting, Consulting & Safety Education, in Colmar Manor, Md.