



Hangers allow you to center the fan between the joists. Metal hangers locate the fan box at the proper height and allow some flexibility in fan positioning.

Choosing and Installing a Bathroom-Vent Fan

Pick a fan that's quiet and powerful,
and keep the duct short

by Rex Cauldwell

I once received a call from a homeowner complaining that his bathroom fan was not working. Although I responded within a few hours, I was too late to save the fan and far too late to save the bathroom. The room was victim to moisture damage from humid air: The wallpaper had begun to peel, and the drywall was blackened around the shower. It was obvious this fan had not worked in a long time. As the homeowner witnessed, moisture-laden air over time can cause a lot of damage in a bathroom, such as corroded light fixtures, rotted wood, and peeling wallpaper and paint. Moisture can also hasten the spread of unhealthful mold and mildew. A properly operating fan removes moisture-laden air from the bathroom and replaces it with dry air from outside the room.



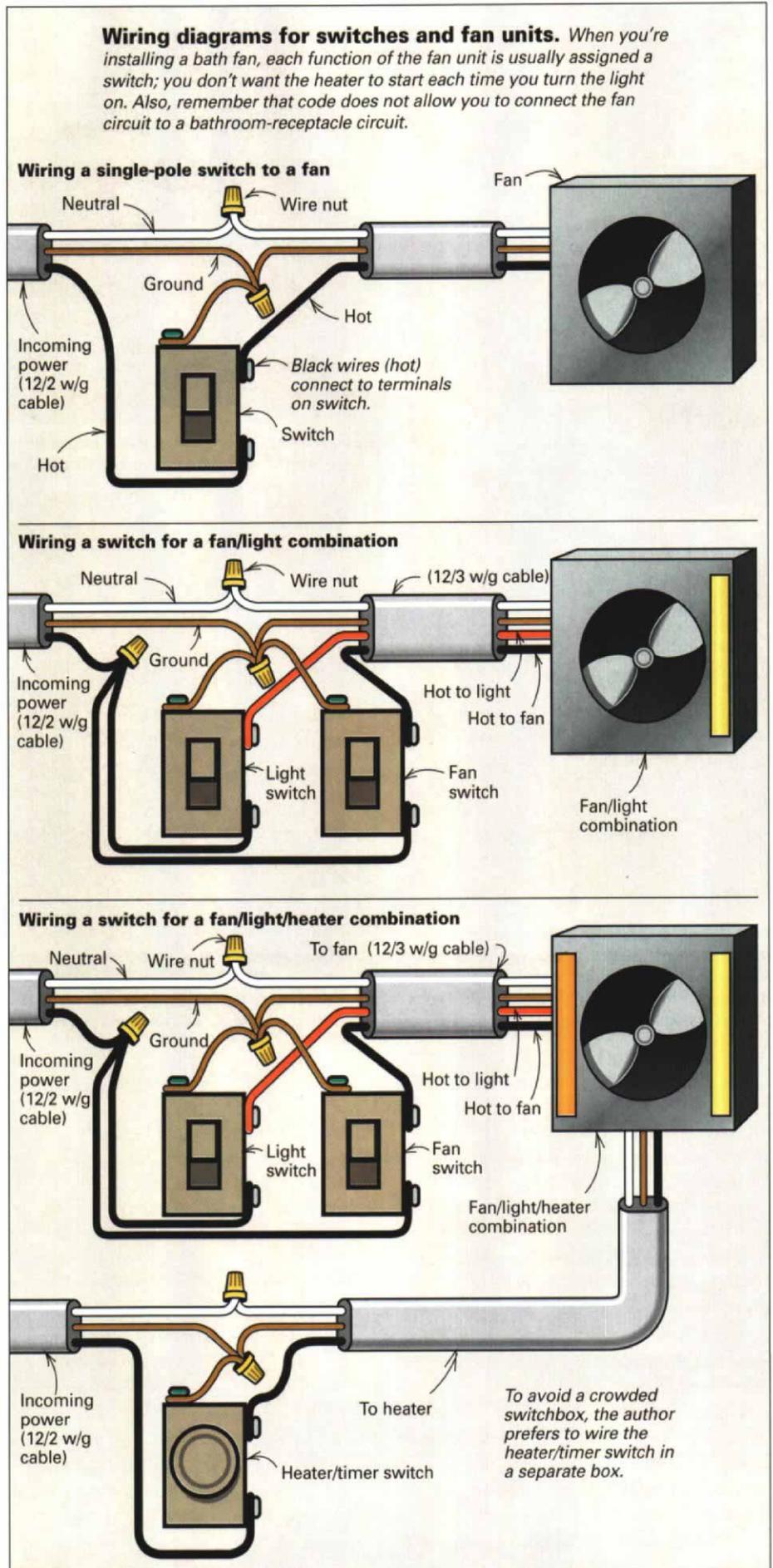
The fan's power and noise ratings are listed on the label. Every fan has its cubic feet/minute (cfm) airflow and noise ratings (measured in sones) listed on the motor housing. The lower the sone rating, the quieter the fan. However, the noise ratings usually rise as the cfm rating increases.

Most building codes require fans in bathrooms that have no windows. But fans should be installed in all bathrooms, window or not, especially in cold climates (it's ludicrous to think a person would open a window to ventilate the room when it's freezing outside). There are many types of bathroom fans out there, and the choice may seem simple: choosing the unit with the best price. But remember that the best price is not always the cheapest price—you get what you pay for.

Choose a fan that moves a sufficient amount of air—First consider the size of the bathroom, and then choose a fan large enough to move air adequately for that size room. The volume of air the fan moves is measured in cubic feet per minute (cfm) and will be listed on the unit (bottom photo, facing page). To choose the fan with the correct cfm rating for the room size, first figure the volume of air in the bathroom and then divide that number by 7.5, per guidelines of the Home Ventilation Institute (a division of the Air Movement and Control Association International Inc., 30 W. University Drive, Arlington Heights, IL 60004; 847-394-0150; www.amca.org). Assuming 8-ft. ceilings, you typically would choose a 50-cfm unit for a small bathroom (around 5 ft. by 8 ft.), an 80-cfm unit for a midsize bathroom (around 8 ft. by 8 ft.) and a 110-cfm unit for a large bathroom (around 10 ft. by 10 ft.). For larger bathrooms, companies such as Panasonic make 190-cfm fans.

Quiet fans are better fans—In general, the higher the cfm rating a fan has, the more noise it makes. But the noise doesn't have to shake the floor. You should choose the quietest unit for the amount of air that must be moved. A fan's noise is measured in sones, and each unit should have this measurement clearly labeled on the box or in the product literature. A noisy fan is one that's rated above 3 sones. You'll be able to hear a fan this loud even while the shower is running (it will sound like a helicopter landing on your roof). A quiet fan, on the other hand, measures around 2 sones to 3 sones. An ultraquiet fan will be 1 sone or less.

Combination units should be heat resistant—It's common for manufacturers to sell fan units combined with lights or heaters or both. However, these units come with inherent problems. Because of the heat generated by incandescent bulbs, ceiling fixtures are often limited to lower-watt bulbs, which do not provide abundant illumination. This heat, along with the bulb's ultraviolet (UV) rays, may degrade cheap-plastic light covers, turning them an unsightly brown. To combat this, either get a fan/light with a glass cover (preferred) or a UV-resistant plastic





To gain access to the splice box, remove the fan from the fan housing. After loosening the two bottom screws on the housing, slide the fan out. Usually tucked into the box's corner, the splice box can be opened with a nut driver.

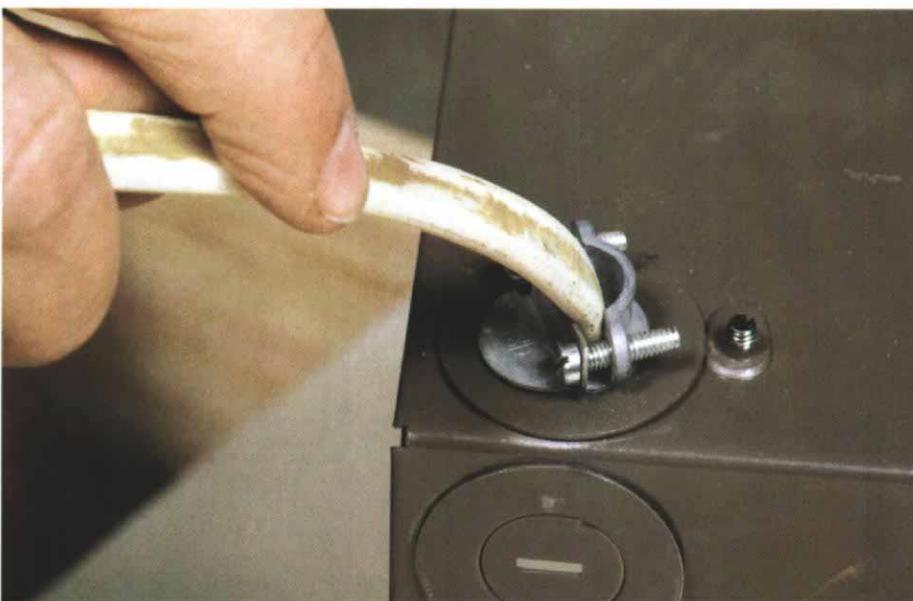
cover. I recommend that you install a fan-only unit and install a separate light.

Fans with heaters are popular, but I don't like them. The fan will suck heated air outside, defeating the purpose of the heater. I prefer wall-mounted, fan-operated heaters with thermostats. These types of units can also keep plumbing from freezing.

Installing the fan—The first installation step is choosing a location for the fan. It should be installed as close as possible to the shower without actually being in the shower, unless it is rated for wet locations. Any fan within arm's reach of the shower should be protected by a ground-fault circuit interrupter. Typically, the fan unit is mounted between the ceiling joists, a determining factor in the fan's position.



Remove the knockout with a screwdriver. Locate the nearest knockout to the incoming wires, insert a screwdriver into the slot, and wiggle the knockout loose.



NM connector keeps the wire's insulation from getting cut. After threading the NM connector into the knockout hole, slide the cable into the fan box, and tighten the connector's screws.

Some units require you to remove the fan module from its housing before mounting (photo above left). To do this, loosen the bottom screws and pull out the fan assembly. In one corner of the box, you will see a splice box that the fan plugs into; remove the splice box, too.

In new ceiling installations, the instructions say simply to attach the unit's arms to the ceiling joist, allowing just enough of the fan to hang below the joist for the drywall to fit within the lip of the fan's frame (top photo, p. 106). I normally throw the arms away and screw the fan directly to the joist: It's much more secure that way, as well as faster and simpler. If you're installing your own drywall, you will immediately note a problem: How in the heck do you get the drywall into the lipped frame? Well, you don't. You have to cut the drywall carefully to fit around

the fan. You can install the drywall first, cut the hole exactly, and then insert the fan. But here is another way: Cut the drywall (the entire sheet) to stop at the joist the fan is attached to, cut a U-shape into the next sheet and insert it under the fan's lip. Fans do not have to be mounted only in the ceiling; they also can be placed in a wall. If the wall is exterior, it makes for a fast duct nun (for information on installing ductwork, see sidebar, facing page).

Wiring the fan—It's best to bring the power to the switch first and then to the fan. That makes it easier to troubleshoot the circuit. Use a screwdriver to remove the knockout on the fan's splice box (photo top right). Remove the splice-box cover, and insert a nonmetallic (NM) connector (photo bottom right) into the knockout

When venting a bathroom fan, keep the run short and smooth

A common error in bathroom-fan installations is venting the fan into the attic. Sending moist air into attic spaces could damage wood members and insulation, so you must vent the fan outside, which means running ductwork.

There are several types of duct available: rigid (metal, PVC) and flexible (insulated, noninsulated) vinyl pipe. The two types of rigid duct, metal and schedule-20 (thin-wall) PVC are the best because

they have smooth inner walls that don't impede airflow. The rigid types are more time-consuming to install (each turn in direction requires a separate fitting) but have better seals and last longer. Flexible pipe is the easiest to install but has greater air resistance because of the accordionlike folds of the pipe wall. If you choose flexible duct, it's best to use the wider 6-in. dia. pipe; the larger diameter will

offset decreased airflow. Both types of rigid duct, as well as the flexible kind, can be found at your local home center. Whatever type of duct is used, be sure to seal the joints properly. Remember that in unheated spaces, ducting must be insulated to reduce condensation.

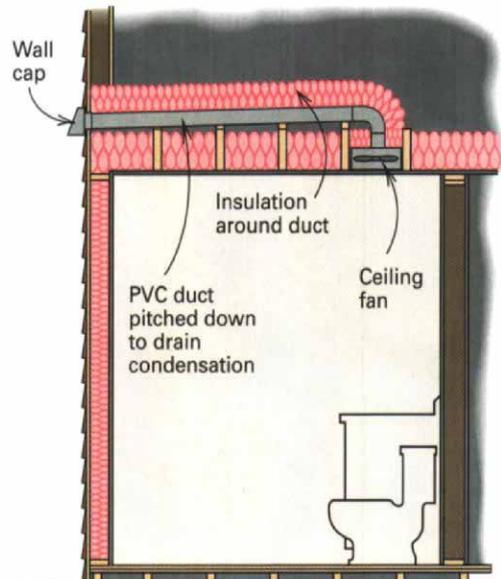
Running duct—For the most efficient airflow, try to run the duct in a straight line to the

exterior, pitching the duct down at a slight angle to the outside wall so that condensation will drain out and not back into the fan (drawing below). For every significant bend, you slow airflow; gradual turns are better than right-angle ones. In my experience, if you have more than four significant turns, you may have to increase the cfm of the fan to provide sufficient air movement.—**R. C.**



Rigid-PVC ductwork decreases air resistance. Although more labor intensive to install, rigid ductwork has smooth inner walls that don't impede airflow.

Ducting a bath fan. The best way to increase airflow is to reduce the amount of air resistance in the ducting. Ideally, the run of the duct should be short, straight and pitched slightly to the outside to drain any water that condenses in the duct.



and screw on the nut. Don't just bring the cable in through the sharp bare metal hole; vibration will cause a sharp edge to cut through the cable insulation. Bring in 6 in. of cable (trim as necessary), strip the cable's sheathing to within ¼ in. of the housing, and in a simple installation, connect black to black and white to white. Don't forget to attach the bare ground wire to the metal box. (For more wiring details, see drawing, p. 107). If you have a fan/light combo and if you want the fan and light to be on at different times, you will need two hot feeds and one white neutral return. Use three-way switch cable (black, red, white and bare ground). If you also have a night-light in the combo, you will need three-way cable for the fan/light and another cable (12/2 or 14/2 with ground) to feed the night-light. If you also have a heater, you'll need to run two

three-way cables into the housing. With all these cables, you must make a neat splice within the combo's splice box, or there won't be enough room for all the wires to fold back in.

Wiring the switches—You have two basic wiring options. The first is to bring the power feed into the fan splice box; I don't recommend that you do this because the box is too crowded already. The second option is bringing the power feed to the switch. Wire the neutrals together, and bring the black wires to the switch. There are three general choices for bathroom fans: standard switches, dimmers and timers. You'll need a large-volume box (at least 30 cu. in.) to fit all the wires to the multitude of switches. Many manufacturers make a special switch for combination units; it's a pair or trio of switches

that fit in the space normally occupied by one. These switches are meant for a single gang box, and there may not be enough room to squeeze all the wires in. However, you can get a special cover that converts a large square box with screws on its corners to a single. This gives you lots of splicing room. Remember not to power the fan from the bath receptacle. The bath receptacle must have its own 20-amp circuit. Power the fan or fan/light from a living room or bedroom circuit. If you have a heater in the fan, bring in a separate circuit for the fixture. □

Rex Caldwell is a master electrician/plumber living in rural Virginia. This article is adapted from his book Safe Home Wiring Projects, published this year by The Taunton Press. Photos by Susan Kahn, except where noted.