# Q&A

## Q. Stopping Condensation Behind Knee Walls

*A house we built about eight years ago here in Tennessee has ductwork running through the space behind the upstairs knee walls. The exterior side of the framing has been developing condensation, but only in extremely cold weather. There are no vents in the knee wall, so we are wondering where warm air is escaping from to meet the cold outside air, and what the best way is to resolve the problem. Should we condition the air in the knee wall?*

**A.** *Paul Eldrenkamp, owner of Byggmeister, a custom remodeling firm in Newton, Mass., responds:* Eaves areas behind knee walls are notoriously leaky. If you run hvac ducts in that space, you complicate things even more — especially if the ducts are also leaky.

It would indeed be a good idea to bring that eaves area — and particularly those ducts — into the conditioned part of the house. This means that the insulation and the air barrier need to be in the rafter plane rather than in the knee wall. Stuffing fiberglass batts in the rafters will provide the insulation but not the continuous air barrier. You'll probably have to use housewrap or rigid foam in conjunction with the fiberglass, or use spray foam for a less labor-intensive job.

I would not use polyethylene as an air barrier in that area (current best practice for any but the coldest climates seems to be to avoid polyethylene, to allow for drying). And don't forget that the rim-joist area needs to be insulated and air-sealed as well. The insulation/air barrier should be continuous: roof plane sealed to rim joist, rim joist sealed to wall plane, with no gaps in between.

Regardless of what materials you use, you're going to have a hard time knowing if you got the job done right without doing a blower-door test. You should be able to run the blower door and not find any significant air leakage out of the knee-wall access hatches — or out of any penetrations between the eaves area and the living quarters, for that matter. Air leakage would indicate that there's too much communication between the eaves area and the outdoors.

Your local utility should be able to help you find a diagnostician with a blower door. The Web site of the Energy Conservatory (www.energyconservatory.com), supplier of the most readily available blower-door equipment, also has a list of airtightness testing contractors, organized by state.

You should also try to determine the source of the moisture that's condensing on the framing. It's worth checking the relative humidity at various places in the house. Test the basement, too: Air-transported moisture from a basement or crawlspace could easily travel up a duct chase to an eaves area and condense on a cold surface. (The blower door can help identify such leakage paths.) Anything with more than 50 percent relative humidity in the winter is possibly worth some remedial action.

It may be that the insulation and air-sealing strategies described above will solve the problem just by warming the eaves area up above the dew point, but it's always worth considering a two-pronged approach: One, stop the leakage of humid air into cold cavities; and two, control the humidity of the air to begin with. If you're getting only a small amount of condensation, and only on the coldest days, your challenge is probably primarily air-sealing rather than humidity reduction.

By the way, if someone's at the house doing a blower test, it's worth paying extra for a duct-leakage test, too.

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## Q. Does a Bathroom Fan/Light/Heater Unit Require a Separate Circuit?

*Can a fan/light/heater unit be placed on the same circuit as the bathroom's required 20-amp receptacles, or does it require its own separate circuit?*

**A.** *Lynn Underwood, an engineer, licensed contractor, and building code official in Norfolk, Va., responds:* Section E3603.4 of the 2006 IRC requires that at least one 20-amp circuit supply the bathroom's GFCI-protected outlets. And while outlets in other rooms can't be placed on this circuit, other minor equipment within the bathroom (like an exhaust fan) can be, according to the code — but only if the circuit serves just one bathroom. So a combo unit placed on the circuit may technically meet code.

In practice, however, electricians almost always add a separate circuit matching the rating for the ventilation fan motor and demand from the unit's heat lamp (or blower) to avoid callbacks for tripping failures. A 20-amp circuit can safely deliver 80 percent of its load, or 1,920 watts,

before running a risk of tripping (20 amps x 120 volts = 2,400 watts; 2,400 x .80 = 1,920). An average-sized hair dryer is typically rated at 1,000 watts, and the rating of a curling iron can be even higher; plug them in and turn both on at the same time and you've already exceeded the circuit's safe capacity without even switching on the combo unit. That's why some manufacturers specify a dedicated circuit (which doesn't require GFCI protection) for some of their combo units.

Not only is wiring a separate circuit good practice, but section E3601.2 of the IRC specifies that branch circuits must have ampacities equal to the loads expected on the circuit. An installation must comply with *all* parts of the code, not just one provision.

## Q. Will Radiant Heat Melt a Wax Ring?

*My company has been contracted to build a new bathroom. Plans include a tile floor installed over a radiant-heated slab. Will the heat generated by the hydronic tubing embedded in the slab cause problems with the wax seal between the toilet and the drain?*

A. *Mike Casey, a licensed plumber in Connecticut and California and coauthor of* Code Check Plumbing, *responds:* Yes, both electric and hydronic radiant systems can get hot enough to melt wax, leading to failure of the toilet's wax ring. While neither the IRC nor the Uniform Plumbing Code specifically addresses this issue, both do state that installation of radiant systems should comply with manufacturers' instructions. And every instruction manual I've read notes that it's important to keep a heat source — such as an electric heating mat or hydronic tubing — 4 to 6 inches away from the toilet-floor waste penetration. Some even recommend insulating around the penetration to further prevent heat transfer, particularly with metal drain pipes.

A concerned installer could provide additional insurance by using a neoprene ring in lieu of the standard wax ring — but in my experience, the neoprene rings tend not to seal as well as wax.

To play it safe, keep the radiant pipes or heating mat 6 inches away from the drain, stick with the wax-type seal, and insulate only if the drainpipe is metal.