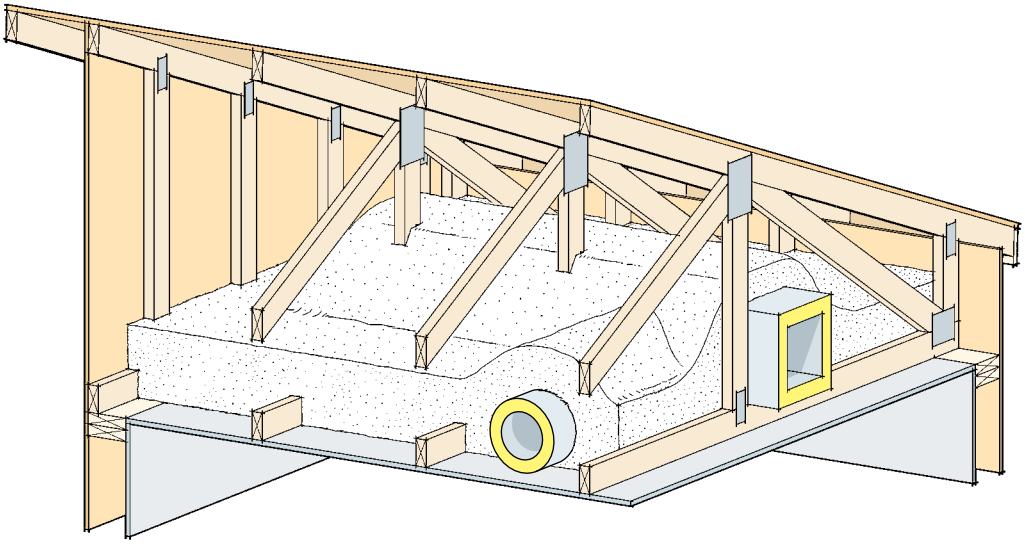
BY TED CUSHMAN

Buried Ductwork In the Energy Code

These days, when you see ductwork in the attic space of a truss roof, it's likely to be the economical solution: insulated duct-board trunk lines and distribution boxes, with insulated flex-duct supply or return lines that lead to registers or grilles in the conditioned rooms. Typically, the flex duct will be hanging from the truss webs or chords, suspended by plastic straps.

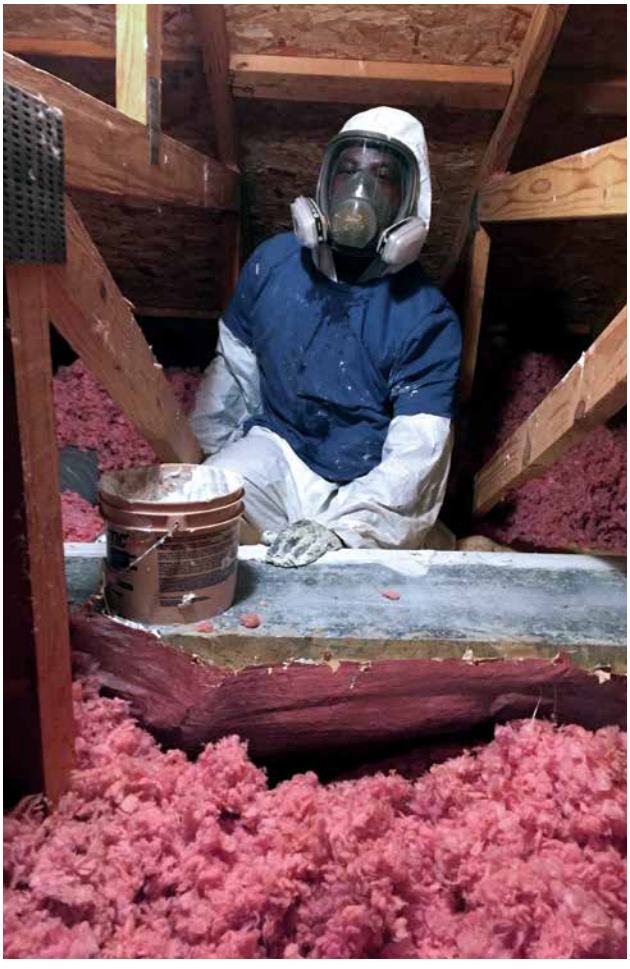
If the house is air conditioned, you may have wondered, why is all this flex duct located up next to the hot underside of the roof sheathing, instead of down on the attic floor where the ducts could be covered up with blown insulation? By the same token, in a cold climate, you might have wondered why heating ducts should be suspended up in the air in a cold vented attic, rather than lying on the nice, warm attic floor under a blanket of blown insulation.

Those questions have also occurred to Craig Drumheller, the director for construction codes and standards at the National Association of Home Builders (NAHB). When Drumheller asked a local building official why the flex duct in his own house was up near the roof in the hot attic, the answer was that code required it—but, Drumheller says, the reason wasn't completely clear.



The 2018 IECC will allow low-lying ducts in attic space, with rules for each climate zone that specify insulation coverage above and below the ductwork. For builders following the performance path, buried ducts may be considered as insulated to R-25, and sufficiently well-sealed ducts may be treated as located within the conditioned space.

Illustration: Tim Healey



An Edge Energy installer seals a trunk line in an existing home before burying the duct with blown cellulose—a safe and routine practice in mixed climates, says Gary Boyer.

Photo: Robert Champ III

Later, in a brainstorming session with NAHB members to gather ideas for amending the International Energy Conservation Code (IECC), a member suggested allowing duct runs to be located on the attic floor and buried under blown insulation. Says Drumheller: "Since I already had the issue in the back of my mind, I thought, absolutely!"

After working on the idea with builders, contractors, and industry experts, Drumheller proposed a code change at an International Code Council (ICC) meeting, and the council voted to accept it. Starting with the 2018 IECC, buried ductwork will be explicitly allowed in the attic. If you're following the performance path, your calculations can treat buried ductwork as being insulated to R-25, as long as it's covered by an R-19 layer of insulation in addition to the R-8 duct wrap. And if you meet a strict duct airtightness criterion (1.5 CFM25 of leakage per 100 square feet of occupied space), you can even consider the ductwork as equivalent to ducts located inside the conditioned envelope of the building.

Just to be clear: Buried ductwork may already be allowed in your jurisdiction. Previous editions of the code did not explicitly prohibit buried ductwork, and in general, codes tend to be permissive; things that aren't prohibited are often considered to be allowed. But enforcement varies from one place to the next, and code officials in some jurisdictions have traditionally required ductwork to be suspended above the attic floor.

CONDENSATION CONCERNS

Depending on the climate, there could be good reasons not to bury ducts under insulation. In hot, humid climates, air in the attic can be very humid, and there's a significant risk of that moisture condensing on the cold surface of a duct carrying cold air—or even on the exterior vapor barrier skin of a flex-duct insulation sleeve.

If cold ducts are buried under blown fiber insulation, the duct surface may be even colder than if it were exposed, making condensation more likely. Moisture could soak the insulation, stain the ceiling below, and support mold and mildew.

But there's persuasive research to support the idea that flex duct insulated with R-8 duct wrap and buried under insulation is safe from condensation problems in most U.S. climate zones. In a field study by Home Innovation Research Labs in Beaufort County, S.C., supply and return trunks made with R-8.7 duct board and branch ducts made with R-8 flex duct were buried under blankets of R-30 blown insulation. Over the course of a hot, humid summer with an air conditioner operating, temperatures measured at the flex-duct and duct-board surfaces remained safely above the dew points for those locations. And as the study author, David Mallay, points out, summer conditions in Beaufort County are not much different than in cities farther south, such as Jacksonville, Fla., New Orleans, and Houston.

Mallay's report is consistent with research by Steven Winter Associates that documented the performance of ductwork encapsulated with spray foam and buried under blown insulation. The research team reconfigured three existing vented attics in Jacksonville, Fla., by removing the insulation, relocating the ductwork to the attic floor, spraying the ducts and distribution boxes with 1.5 inches of closed-cell spray polyurethane foam, and then burying the ducts with a fresh application of blown fiberglass. Measured energy savings in the houses were dramatic, as predicted. Instruments also confirmed that there was no condensation on the ducts delivering cold air to the living space.

Gary Boyer, an energy rater with home performance contractor Edge Energy, says his field experience in Maryland and Virginia is consistent with those research results. In retrofit work, Edge Energy crews routinely seal ductwork with mastic (or, if the ducts are not accessible, using the Aeroseal latex aerosol process), then bury the ducts under a deep blanket of blown cellulose insulation. Says Boyer, "I have yet to see a low-lying duct that is buried in insulation that has had condensation, either in the retrofit or in the new-construction areas."

Contractor Curt Kinder in the encapsulated attic of a custom home in Jacksonville, Fla. Compared with ducts buried under blown insulation, the "civilized space" of a sealed attic allows easier maintenance and quality control, argues Kinder, and makes the area under the roof available for storage.

Photo: Ted Cushman

But Maryland is not Florida—and in considering the building code amendment, the ICC took the elevated risk in hot, humid climates into account. Under the new provision, in climate zones 1A, 2A, and 3A—which covers most of the Southeast, including Florida, Georgia, Alabama, Mississippi, and South Carolina—ductwork will have to be insulated to R-13 if it's buried under insulation. "If we go to R-13 in the hot-humid climates," says Drumheller, "it will push the dew point far enough out that there shouldn't be any significant condensation."

PROCEED WITH CAUTION

Not everyone is convinced. Jacksonville, Fla., air-conditioning contractor Curt Kinder is a skeptic. First of all, Kinder points out, there's currently no such thing as R-13 duct wrap or R-13 duct board. "The only reason we can even buy R-8 flex duct here is because it's required across the state line in Georgia," he says, "and even so, it's hard to get." The Steven Winter Associates' Jacksonville study used spray-applied polyurethane to achieve the specified R-13 duct insulation level, but as Kinder notes, that approach introduces a whole new trade coordination, scheduling, and quality-control problem.

"R-13, successfully implemented on the ducts themselves, passes the 'sniff test' for me," Kinder says. "But foam encapsulation seems difficult to ensure in the field. Foam guys have enough problems with simple planes—how are you going to ensure consistent coverage under ducts?" (And in fact, even in the Steven Winter Jacksonville pilot study, researchers noted thin coverage on some elements of the ductwork assemblies.)

Kinder points out non-energy benefits to his preferred approach of sealing the entire attic with closed-cell spray foam on the roof underside: "Additional strength, an improved vapor barrier, civilizing the volume for storage, reducing outdoor contaminants, and preventing pest entry."

But conditioned attics cost much more than buried ductwork. And in predominantly heating climates in the north, or in dry cooling climates out west, the moisture risk is a relatively insignificant issue, while the energy-saving opportunity is real—and the required R-8 insulated duct products, while they may not be on local shelves, are at least being manufactured. Craig Drumheller says he doesn't expect builders to take up the buried ductwork practice casually, but he says it's good that the code will now allow the option. And conversations with suppliers lead him to expect that eventually duct board and flex duct that can meet the new R-13 criterion will appear in the marketplace.

Drumheller doesn't expect builders to rush into things, he says: "I would encourage any builders that are going to make a major change in the way that they build their houses, whether it's structural, or energy-saving, or a new technology, to proceed with caution. If this is the way you choose to build, I encourage you to do your research and make sure that it is something you are comfortable with. Because at the end of the day, it's the builder whose reputation and money are on the line."

"But we're not shooting from the hip here," Drumheller says. "This is based on research. This provision does not force this on anybody, but it puts it in play as a responsible new option, first, to bury the ducts, and second, if you're burying them, to get credit for them. It's an opportunity for builders to save money and to save energy."

Ted Cushman is a senior editor at JLC.