A Drywaller's Approach to Air Sealing Homes

One air barrier is not enough

BY MYRON FERGUSON

Photos: courtesy Ferguson Drywall Innovations

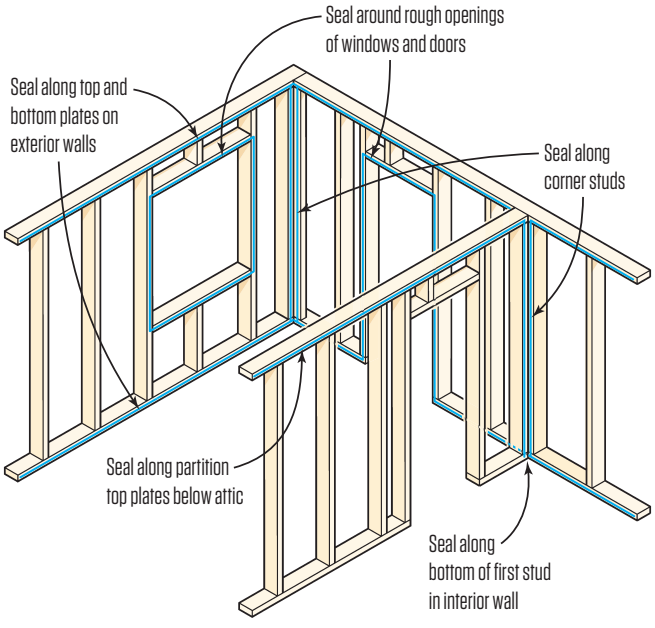
Air leaks through the building shell can have a significant effect on a home's durability, energy use, and indoor air quality. You've heard this before, or at least I hope you have by now. But I'm a drywall contractor. What do air leaks have to do with my work? Well, I believe that drywall can be an important part of the air barrier of an enclosure. Once I recognized this, it changed the way I do my work.

NOT JUST ONE AIR BARRIER

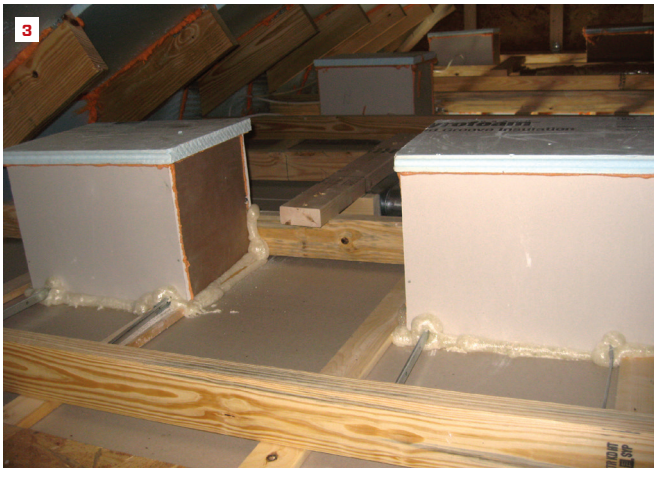
For most houses, I don't think it makes sense to consider the air barrier as a single plane. It's typically described that way, and folks get hung up about continuity, thinking there needs to be a single perfect plane on either the inside or the outside of the enclosure. In the 1980s, the Airtight Drywall Approach was developed as one answer for creating an air barrier on the interior. It sounded good in theory, but it didn't get a lot of traction, perhaps because no one seriously believed that you could ever get the drywall guys to install gaskets and sealants. Though this might sometimes be true, there's a real opportunity to significantly improve the air barrier when the drywall is hung. The only mistake is thinking that the drywall alone is the ultimate solution.

Think of the whole assembly as the air barrier. You can have both

Sealing the Drywall Perimeter



The top and bottom plates of exterior walls, all exterior room corners, and the perimeter of window and door openings need sealant—preferably a flexible one. (Adapted from BSC Information Sheet 401: Air Barriers—Airtight Drywall Approach.)



air-sealed exterior sheathing and airtight drywall on the same enclosure. Remember, we're talking about an air barrier, not a vapor retarder; there's no harm in having a double-sided air barrier. In fact, Energy Star requires that insulation be installed "in full contact" with *both* a sealed interior and an exterior air barrier.

For most jobs, we need to stop thinking of different locations as separate air barriers. Instead, I recommend that GCs think of the entire assembly as the air barrier, and I urge them to build tight at every opportunity. Tighten up the outside, in the wall or ceiling, and along the inside. That's your air barrier.

Air sealing throughout the assembly slows the movement of pressure-driven air. Air sealing on the exterior will limit wind-washing, which can reduce insulation effectiveness. And air sealing on the interior will reduce convective looping in building cavities. All these efforts together will reduce infiltration and exfiltration—the stuff that air changes are made of.

Certainly it's possible to make one single, perfect plane your air barrier. Passive House builders do it all the time and are creating very tight envelopes (0.6 ACH50 is the standard to qualify). But I'm talking about a more conventional approach—what's "usual" for the building industry on the kind of jobs I most often get called in for.

This is a world that builders are starting to have to pay attention to: The 2012 International Energy Conservation Code (IECC) requires blower-door testing along with a "visual inspection" of the air barrier. In climate zones 1 and 2 (hot, humid places), a house needs to reach a 5 ACH50 threshold, down from 7 ACH50. In all other climate zones (including the one where I work), homes need to reach 3 ACH50, which is a monumental leap from 7 ACH50. While not every state has adopted this code yet, it's coming, and builders who haven't started complying will eventually have to get on board.

1. The cutouts for every switch, outlet, and light fixture need to be sealed before the drywall is hung.

2. A foam Energy Block provides an efficient way to seal all the little holes in an electrical box. Before installing the drywall, the author will apply a thick bead of caulk to the stud and the block's wide forward-facing edge to seal the outlet perimeter.

3. Recessed lights in an unconditioned attic can be sealed at any time before insulation with site-made boxes.

4. Recessed lights in a cathedral ceiling must be addressed before the lid is hung. Here, the author surrounds a fixture with a box made of foil-faced foam.

5. Use expanding foam to seal around the electrical feed and the mounting brackets.

Photos: courtesy Ferguson Drywall Innovations

AIR SEALING WITH DRYWALL

It's important to distinguish between an air-barrier material, such as drywall, and an air-barrier assembly. The assembly may be the exterior wall, which includes the drywall as well as isolation boxes for electrical boxes, caulks, sealants, insulation, and, typically, exterior sheathing. If I wanted to talk about drywall as an air-barrier material, this article would be just about hanging and taping the drywall.

When I'm talking about air sealing the assembly with drywall, my focus is on caulking and foaming the drywall panel edges, sealing electrical boxes and recessed lights, and sealing the intersections where interior partitions attach to exterior walls and ceilings. (Air leaks in hidden places such as the rim-joist and ceiling-joist areas should also be addressed, but those places are usually beyond the scope of my work.) All this attention to detail helps the drywall work become part of the assembly that serves as an air barrier.

To create a good air barrier, two things must happen: The drywall must be attached to the framing in an airtight manner; and all possible air leaks around holes cut into the drywall must be properly sealed. The combination of the drywall, framing, caulks, and sealants makes up the air-barrier assembly.

PREPARING FOR DRYWALL

A sheet of drywall by itself is a good air barrier. But as you know, it isn't very often that a piece of drywall is hung without a lot of holes for electrical boxes, ductwork, windows, doors, and the like **(1)**.

Before the drywall is hung, attention needs to be paid to sealing electrical boxes and other penetrations. Caulk or a non-hardening clay, such as the acoustic outlet backer from Kinetics Sound Control (kineticsnoise.com), can be used to plug the holes in electrical boxes. But applying either product is exacting work, and it's easy to have gaps in the seal if you aren't meticulous.

I prefer to isolate electrical boxes with Energy Blocks (energyblock.com). These are fairly quick to install, and when I'm installing the drywall, I can caulk the thick edge around the box to create a tight seal **(2)**.

Isolating fixtures in ceilings is especially important because of the stack effect in a building. In a home with an unconditioned attic, recessed lights can be isolated with site-made boxes sealed to the drywall either as the lid is hung or from the attic-side after drywall **(3)**. This is recommended even for so-called "airtight" fixtures. In most cathedral ceilings, however, the fixtures need to be sealed before drywall. I like to use a box made of foil-faced foam insulation board to isolate the fixtures, and once the box is in place, use spray foam to seal around the wire penetration and mounting brackets **(4, 5)**.

To complete the seal around the perimeter of each cut-out, I apply a thick bead of caulk to the edges of the isolation box just prior to hanging the drywall. If you have to seal around a box or fixture after the drywall is hung, a good tape such as one from Siga (sigatapes.com) will work much better than caulk **(6)**.

You don't have to seal around electrical boxes and other openings in interior partitions. Air will still be able to move through these assemblies, but this is okay as long as any penetrations through the thermal boundary—namely, electrical wires and plumbing vents—are sealed **(7)**.

AIRTIGHT PERIMETER

Turning the drywall into an air barrier requires a tight seal at the room perimeter (see "Sealing the Drywall Perimeter," page 68). Drywall adhesive can be used, and most production crews will prefer this out of convenience, but they need to slow down and apply a continuous bead along the perimeter of each wall, as well as around the framing of window and door openings. (Typically, crews only apply beads along the framing in the center of panels.)

One of the most important locations to seal is along the shoe plate. Usually there is about a ½-inch gap at the bottom of the wall that is not covered by drywall. Running the adhesive or sealant along the top edge of the shoe plate will pick up the drywall, but the joint between the floor and the bottom of the shoe plate also needs to be sealed.

When I can, I prefer to apply a flexible caulking or an acoustical sealant, which remains elastic over time. Just make sure that the bead is continuous.

Because of the way that ceilings are constructed, it's usually more difficult to seal the perimeter of the ceiling than it is to seal the perimeter of the walls. Where trusses cross an interior partition, there's no continuous framing to seal against. In theory, if the wall panels are properly sealed to the top plates, and the wall panels are tightly butted to the ceiling and are taped, very little air will find its way past the ceiling. But this relies heavily on the paper tape and cured drywall compound as the corner seal, which is not enough. I suggest sealing the perimeter of the ceiling with expanding foam. This must be applied after the lid has been hung, but before the walls are hung.

In an unconditioned attic, the sealing can be done from above any time before the insulation is installed **(8)**.

IT ALL COMES DOWN TO MONEY

I also install insulation, but typically I'm called just to do the drywall work. I generally stop by the project to measure for drywall materials before any insulation is installed. I see this as a chance to talk about what is being done for air sealing. I also ask about what types of insulation are going to be installed, who is insulating, and where the GC or owner sees the air-barrier location. Depending on the answers I get, I may then pitch my experience with air sealing, or what I simply call "getting ready for insulation." I explain that this prep work, combined with air sealing at the drywall surface, will help complete a good air barrier. If the house is already insulated and I determine that very little air sealing has been done, or if it doesn't appear to be continuous, I offer

Photos: 6, Terry Nordbye; 7-9, courtesy Ferguson Drywall Innovations

6. Taping the edges of a fixture is easier than applying caulk, but will do nothing to seal holes in the fixture itself.

7. All wire penetrations through framing next to unconditioned spaces must be sealed before drywall. This applies to penetrations in exterior walls as well as interior partitions.

8. To seal the drywall perimeter, a helper applying sealant needs to stay in front of the crew hanging the panels.

9. Any penetration into the attic should be sealed with spray foam. This needs to happen before insulation.

airtight drywall as the next and maybe last chance to establish a good air barrier.

I know that the drywall phase of the job is often not given much thought. Typically, the contractor gets some bids, works out schedules, and gets it done as soon as possible so the finish work can begin. But I come in with all my ideas—saying this needs a level 5 finish (see "Specifying Drywall Finishes," Nov/09), and asking about decorative beads, decorative finishes, and the like (see "Drywall Upgrades," Jul/10). You can imagine the response. There is seldom money allotted for any of the upgrades, and on top of that I am suggesting some air sealing before insulation and this crazy idea of airtight drywall. I'm not just trying to run up the price, but that's often the reaction I get.

The drywall contractors you've always used may not be interested in doing the extra air-sealing work, or you may judge that they are not capable of doing the job. I have run into this when subbing out the hanging. The answer is most often about money; you can't expect this extra work to be done for free. One technique that I have often used is to supply the hanging crew with a helper. It doesn't have to be a highly paid employee, just someone who understands the air-sealing work that must be done and who can stay ahead of the hangers.

The cost of establishing the drywall as an air barrier is not huge, but there will be a cost. To air seal the drywall only with caulks and foams is cheap—from $300 to $800 per house. To air seal before drywall, including the electrical boxes, light fixtures, and wall-plate penetrations (what is typically "getting ready for drywall"), usually costs more and takes more time—with a skilled helper, it will take me two days or more depending on the size of the house. The key is to plan for it early and to make the process part of the work scope right from the start.

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