Get Builder News in your Inbox Every Day! Click Here
Log In or Register

This is a CMS preview. All ad calls and content gating are disabled.

AVOIDING COMMON CALLBACKS UNDERWRITTEN BY TRIM-TEX DRYWALL PRODUCTS

July 24, 2020 0

BUILDER

EXTERIOR FOAM INSULATION: PROBLEMS AND SOLUTIONS

For a successful outcome, builders need to pay strict attention to air-sealing, water and moisture management, and recommended window installation methods.

By Steve Easley

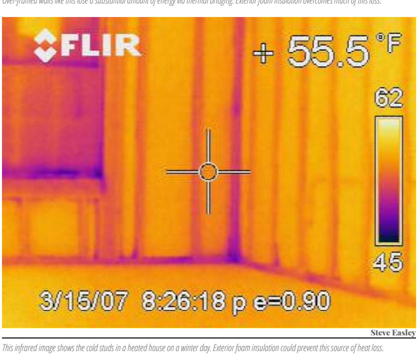
Tim Healey
Sherman Plumley of Resourceful Renovator in Richmond, Vt.

If you've watched the evolution of energy codes over the past couple of decades, you've probably noticed an increasing emphasis on exterior insulation for walls. As early as 2006, the International Energy Conservation Code (IECC) specifically allowed exterior insulation as an option in its insulation tables. In the upcoming 2021 IECC, required insulation levels for walls are being stepped up, and choices are being added. As that happens, the option of insulating the wall exterior becomes more compelling. In many situations, augmenting cavity insulation with exterior foam will increasingly be the most practical alternative for builders.

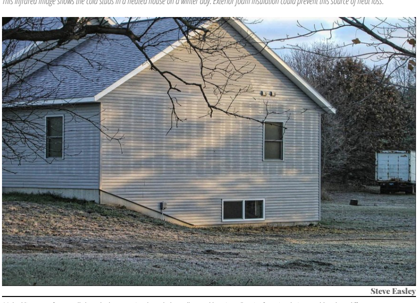
Exterior insulation has advantages. First of all, it substantially increases the true R-value of walls at a fairly low cost. For example, adding one inch of R-5 exterior insulation raises the real R-value of a 2x4 wall with R-12 cavity insulation from just R-10.7 to R-16. Secondly, most homes have framing factors of 25% (meaning that the true R-value of 25% of the windowless walls is the R-value of the wood, or R-3.5). Exterior foam insulation reduces thermal bridging across the wall through framing members, and it keeps the sheathing warmer (which reduces the risk of condensation and mold growth on the sheathing). But the practice of applying foam insulation to wall exteriors can be complicated, and it comes with some drawbacks. In particular, plastic foam is vapor impermeable, which means walls can't dry to the outside if they do get wet. And foam sheathing doesn't provide a positive attachment for the nailing fins of windows or doors.

To avoid callbacks caused by these factors, you have to address water and moisture management with greater diligence when you make the move to exterior foam insulation. And you may have to rethink the way you attach and flash your windows and do diligent inspections.

Steve Easley
Over-framed walls like this lose a substantial amount of energy via thermal bridging. Exterior foam insulation overcomes much of this loss.



Steve Easley
This infrared image shows the cold studs in a heated house on a winter day. Exterior foam insulation could prevent this source of heat loss.


Steve Easley
Melted lines on a frosty wall show the heat passing through the wall at stud locations. Exterior foam insulation would make a difference.

The Advancing Code

In the prescriptive tables of the upcoming 2021 IECC, a combination of cavity insulation with exterior insulation is strongly favored. In climate zones 6, 7, and 8, you can have either R-30 in the wall cavity, or a combination of R-20 cavity insulation with R-5 exterior insulation (R-20+5), or a combination of R-13 cavity insulation and R-10 exterior insulation (R-13+10). In climate zones 4 and 5, your options are R-20+5 or R-13+10. In climate zone 3, you can choose among R-20 in the cavity, R-13+5, or R-0+15. And in climate zones 1 and 2, you can choose between R-13 in the cavity or R-0+10.

Extruded polystyrene foam is rated at R-5 per inch and Polyiso at R-6.5 per inch. So depending on the options they choose, builders may need to apply an inch, 2 inches, or sometimes even 3 inches of foam. The energy benefit aside, there are practical problems to applying that much foam to a building exterior.

Moisture Risks

In the 1980s, we built a demonstration home at Purdue University that had heating and cooling costs of less than $200 a year. Part of how we accomplished that was by sheathing the exterior of the building with polystyrene. At that time, structural codes allowed us to install wood structural panel sheathing only at the building corners. But modern wall bracing codes in most regions require more extensive use of structural panels, and using continuous structural wood panel sheathing is the best way to get a stiff, rugged building. Although installing exterior insulation is still a way to get a high-performing building, there's an increased level of risk when you cover a hygroscopic material like OSB sheathing with an impermeable material like rigid polystyrene foam. To forestall this risk, follow good moisture management principles and inspect everything *before* cladding is installed.

Moisture problems come from two places—they come from inside the home, or outside it. If there is a big moisture drive from inside to outside, and there is an impermeable material on the outside, that moisture is not going to dry to the outside so well. So you need to make sure that you pay particular attention to air-sealing. Do an air-sealing inspection *before* the insulation is installed.

That's because most of the moisture that enters the wall cavity from the interior is driven by air currents. And when the moisture comes in contact with a cold surface, it dampens that surface. If the surface relative humidity moves up above 70% or 80% range, then mold can start growing. How do you solve that problem? You prevent the moisture from getting there in the first place. You do that by providing good spot ventilation in the home, with bathroom and kitchen exhaust fans. Ideally, you should install technology that can automatically sense and control humidity.

The good news about exterior insulation is that because the insulation is outboard of the sheathing, that sheathing stays warmer. Warmer sheathing surface temperatures mean lower surface relative humidity. This means that the sheathing is less likely to dampen to the point that it reaches the threshold for mold growth. Even so, when you apply impermeable foam insulation to the outside of a building, you need to be fastidious about air-sealing the walls so that air currents across the wall are minimized.

Steve Easley
Good air-sealing becomes critical when walls are vapor-closed to the outside. Here, a builder did it right, as they have caulked the sheathing joint to the wall plate and the plate to the floor. (Yes, you need to do both.)

One option is to install the foam board first, then sheathe over it. That lets the sheathing dry to the outside. But if you build in a location where higher levels of wall bracing or shear walls are required, you'll want to check with an engineer and make sure that the shear capacity of your sheathing is adequate. When sheathing is held away from the studs by insulation, its ability to resist racking forces is reduced.

Steve Easley
Here, foam insulation has been applied directly to the studs, with sheathing applied outboard of that.

The Window Installation Puzzle

Controlling the indoor humidity and building an airtight enclosure reduces the moisture risk from inside the home. That leaves the risk from outside the home—which is primarily found at penetrations like windows, doors and roof wall intersections. Most builders have plenty of experience at installing windows in a wood-frame wall without exterior insulation. But many builders may not have a usual method for installing windows when the wall has been packed out with an inch or two of extruded polystyrene.

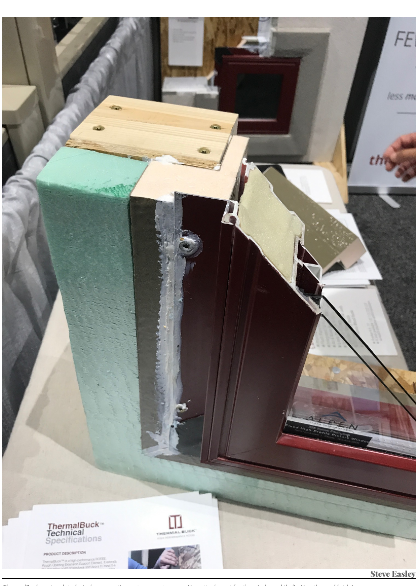
And while the code may require exterior foam insulation, the code doesn't tell you how to fasten and flash the windows into that foam-insulated wall. However, there is a resource for builders: a document called FMA/AAMA/WDMA 500-16, which goes by the title "Standard Practice for the Installation of Mounting Flange Windows into Walls Utilizing Foam Plastic Insulating Sheathing (FPIS) with a Separate Water-Resistive Barrier." This document is a joint production of the Fenestration Manufacturers Association, the American Architectural Manufacturers Association, and the Window & Door Manufacturing Association. Also be sure to follow the window, housewrap, and flashing manufacturers' guidelines for their products.

A lot of testing and thought went into the creation of FMA/AAMA/WDMA 500-16. Recognizing that the sequencing of the trades varies from builder to builder, the standard practice offers multiple alternatives for how to install the windows. In one method, housewrap is applied to the building before the window bucks and foam are attached; in another, the housewrap goes on after the bucks and the insulation. In a third method, the window is applied directly to the wall with no bucks. In every case, the flashing and housewrap are designed to direct water down and out of the wall assembly.

In one version of Method A from the standard practice, the foam is applied directly to the sheathing and the housewrap is applied over the foam. The window buck (termed a "Rough Opening Extension Support Element," or "ROESE," by the document) goes on the wall first. The full sequence is as follows: window buck; insulating foam; housewrap (WRB); sill flashing; window; jamb flashing; head flashing; head tape.

In another version of Method A, the housewrap is applied after the window is installed. In this version, the sequence is: window buck; insulating foam; skirt; sill flashing; window; jamb flashing; head flashing; housewrap (WRB); jamb tape; head tape.

If you are concerned about thermal bridging at the window buck, or ROESE, consider a rigid-foam prefabricated product that is designed to take the place of the wood buck. The product shown here is called ThermalBuck.

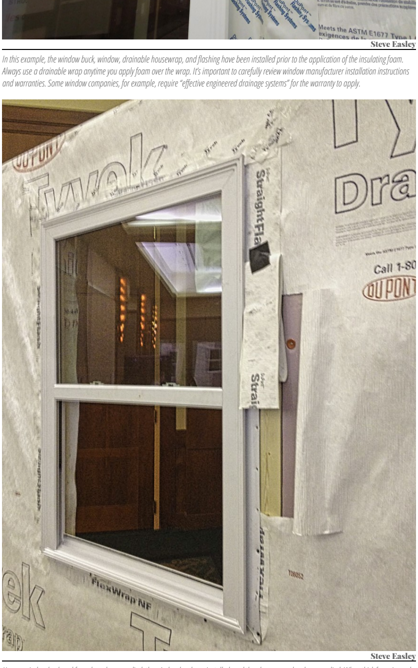


Steve Easley
ThermalBuck, an insulated window mounting system, creates a positive attachment for the window while limiting thermal bridging.

Method B describes a situation where the window is installed into the window buck over the housewrap, and the foam insulation is applied next. This method uses either fluid-applied or peel-and-stick flashing.

Method C takes a different approach, applying the housewrap and the window to the wall before the foam is applied. In this case, there's no window buck.

Steve Easley
In this example, the window buck, window, drainable housewrap, and flashing have been installed prior to the application of the insulating foam. Always use a drainable wrap anytime you apply foam over the wrap. It's important to carefully review window manufacturer installation instructions and warranties. Some window companies, for example, require "effective engineered drainage systems" for the warranty to apply.



Steve Easley
Here, a window buck and foam have been applied, the window has been installed, and then housewrap has been applied. When thick foam is used, window manufacturers may require metal jamb installation brackets to adequately support the window.

Steve Easley
Here, the window has been applied directly to the wall before the application of foam, and then housewrap and flashing are applied.

For added security, I recommend that builders consider a rainscreen wall assembly. With a rainscreen, water striking the cladding has to jump across a ¼- to ¾-inch gap to reach the weather barrier, and even if that happens, the water just hits the weather barrier and runs down. So rainscreens provide you with exponentially better protection against water getting behind the foam.

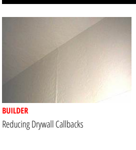
ABOUT THE AUTHOR

STEVE EASLEY
Steve Easley is principal of Steve Easley Associates, a company based in Scottsdale, Ariz., that provides building-science consulting, training, and quality assurance for builders nationwide.

Advertisement

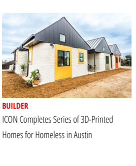
Keywords:
Subject:
Insulation Building Performance Building Envelope Building Codes Green Building

More from Builder

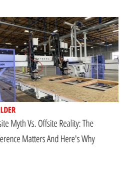

BUILDER
Reducing Drywall Callbacks

BUILDER
How Japan's Sekisui House Could Change U.S. Framing: From Fast Assembly To Lateral Load Capacity

BUILDER
Why Off-Site Construction's Future Just Moved Up In Time


BUILDER
ICON Completes Series of 3D-Printed Homes for Homeless in Austin

REMODELING
The Freedonia Group: Demand for Modular Housing to Grow 5% Annually Through 2024


BUILDER
Offsite Myth Vs. Offsite Reality: The Difference Matters And Here's Why

This is a CMS preview. All ad calls and content gating are disabled.

remodeling
Construction Employment Increases in 31 States and D.C. From May to June
Study: More Homeowners Planning to Complete Home Improvement Projects in 2020 Despite COVID-19 Pandemic
Survey: Time at Home Due to COVID-19 Allows Homeowners to Complete Home Improvement Projects
Home Depot Accelerates Investments in Outdoor Power Categories
Lowe's Expands Outdoor Product Offering, Launches Exclusive Partnership With EGO
QuinStreet Acquires Home Improvement Marketplace Modernize

MFE MULTIFAMILY EXECUTIVE
Multifamily Developments Honored at 2020 Virtual Gold Nugget Awards
NMHC: Deteriorating Conditions Continue for Second Quarter
The Top Companies in Division II, III, and IV by Online Reputation
Harbor Group International Sells Kansas City Multifamily Community
To Be or Not To Be? How to Handle Cutting Amenities During COVID-19

JLC
Working Around COVID-19: A JLC Resource
Review: 'Nail Your Numbers: A Path to Skilled Construction Estimating and Bidding'
Low-Slope Roofing Details That Work
Builder's Guide to Working With Steel
Roofing Details That Work
Learning Building Science Fundamentals

2020 DIGITAL EDITION
BUILDER analyzes how off-site construction's future just got moved up in time; plus, the America at Home study provides insight on what consumers want in their future homes.
Subscribe

BUILDER Online provides home builders with home building news, home plans, home design ideas, and building product information, helping them manage their home building operations efficiently and profitably.

Copyright © 2020 Hanley Wood Media, Inc. All rights reserved.