

Built-Out Trim for Exterior Foam

by Joe Cracco

My clients' 80-year-old Rhode Island home was suffering from chronic peeling paint, deteriorating shingles, and high energy bills. It was a prime candidate for new siding installed over a layer of rigid foam insulation. The standard 2x4 stud walls were already insulated with blown cellulose, but we estimated we could improve their thermal performance by almost 50 percent just by retrofitting an inch of R-5 XPS rigid foam to the exterior. The new foam also promised to significantly cut down on air infiltration — a big problem that we discovered during our initial blower-door testing — without overly complicating the installation of new red-cedar shingles.

Although the house could have used new high-performance replacement windows, too, the budget was already exhausted. Fortunately, the existing 6-over-1 double-hung windows and triple-track aluminum storms were in decent condition — but even with sizeable back band moldings, the casings and sills weren't really deep enough to accommodate an inch of foam plus the 1/4-inch-thick Home Slicker (benjaminobdyke.com, 800/346-7655) that we planned to install underneath the shingles.

Rather than try to fit the foam around the windows, we decided it would be better to remove the old casings along with the existing shingles and tar paper and retrim the windows with



PVC trim provided the depth needed to accommodate an inch of insulation board





Figure 1. After cutting each sill flush with the sheathing (A) and planing down the tongues on the jambs (B), the author ripped kerfs in the sills (C) to accept a custom-bent aluminum flashing (D). The metal flashings are bedded in sealant and overlap the new layer of 1-inch-thick rigid XPS foam used to wrap the house.

low-maintenance PVC trim assembled to look just like the original. That way, we'd be able to insulate the sash-weight pockets and get the tricky drainage plane, air barrier, and flashing details around the windows right without changing the outward appearance of the home.

Window Prep

There's no easy way to extend existing sills by an inch and make them look good, so we decided to trim the old ones flush with the sheathing and then add new stock sills padded out with extensions made from 5/4 PVC trim. We made our rough cuts with a reciprocating saw and cleaned up the sills with a power plane (see Figure 1).

The old jambs had tongues that fit into dadoes cut into the backs of the original casings. We planed the tongues down until they were about 1/8 inch proud of

the edge of the jambs, so that the paint-encrusted sash wouldn't bind up against the new casings, which would act as stops for the top sash.

Next we ripped a 1/2-inch-deep kerf into the face of each sill with a circular saw equipped with an edge guide. The kerf extends slightly beyond the window into the sheathing on either side of the sill and receives a custom-bent flashing made from aluminum coil stock. We used Bond&Fill Flex (877/822-4615, bondfill.com) to bed the flashing in the kerf. Though expensive — more than \$12 per 10.1-ounce tube — this sealant is extremely tenacious, flexible, and paintable. The flashing projects an inch away from the face of the sheathing to overlap the insulation underneath.

The sash-weight pockets on old windows like these are cavernous, but it's hard to insulate them without interfer-

ing with the weights and pulleys. We did the best we could with strips of rigid foam and our foam gun, concentrating mainly on air-sealing the cavities (Figure 2, next page).

On most of the windows, we flashed the jambs to the sheathing with Grace Vycor Plus, an asphalt-based self-adhering flashing. We also stapled the Vycor to the jambs. While Vycor is fine here, because the adhesive doesn't contact the foam, it doesn't seem to be compatible with XPS insulation. Petroleum products don't mix well with some plastics, and we've noticed significant discoloration with some housewraps and rigid foams that have come in contact with Vycor. On the window shown on these pages — the last one on the job — we also used DuPont's butyl-based StraightFlash, but only because we ran out of Vycor. StraightFlash is about four times more expensive than Vycor,



Figure 2. The author insulated around the jambs and in the sash-weight pockets with a combination of rigid and spray foam (above), then flashed the jambs to the sheathing with self-adhering flashing tape (right).

but has better adhesion and is compatible with Tyvek and XPS foam; normally we use it to tape head flashings to the foam.

Installing the Rigid Foam

We took a number of steps to improve this home's thermal performance, such as air-sealing and insulating the attic and rim joists with spray foam and adding 2 inches of rigid foam to the basement walls. But for exterior walls, we settled for just one inch of foam. This would beef up the wall's R-value from about R-10 to R-15, yet still allow us to nail the shingles through the foam and into the sheathing, rather than to cleats installed over the foam.

Although Foamular 250 (800/438-7465, owenscorning.com) has higher compressive strength than Foamular 150 (25 pounds per square inch vs. 15 pounds per square inch), it's only slightly more expensive in our area, making it a better choice under nailed-up cedar shingles. On this job, the rigid foam functions as both an air barrier and a drainage plane, so we were careful to seal the edges of the foam panels to the sheathing and their butt ends to each other. We've experimented



Figure 3. To help make a continuous air barrier, the rigid foam was glued to the flashing tape at the jambs (above left) and to itself at the butt joints (above). The long horizontal tongue-and-groove joints in the rigid foam were left unglued to provide for thermal expansion, but all the joints were taped, and the foam was also taped to the flashings (left).

with several different caulks and sealants but have gotten the best results with GE's Silicone II paintable silicone; other caulks, including regular silicone, simply peel right off the foam after they've cured. We held the rigid foam in place with a few roofing nails while the adhesive set.

Around the flashed window openings, we applied continuous beads of silicone

caulk on top of the flashing tape before installing the foam. The foam was bedded in the caulk and held back far enough to leave room for the casings. To complete the semipermeable air barrier, we sealed the seams and edges of the foam with Owens-Corning Bild-R-Tape, designed specifically for XPS insulation (**Figure 3**). Along with the flashings and caulk, this



Figure 4. Sealant was applied to both the jambs and the foam (A) before the pre-assembled PVC casings were fastened in place with Cortex and stainless steel trim-head screws (B,C). The metal drip caps were bedded in sealant, then sealed to the foam with flashing tape (D).

belt-and-suspenders approach provides an extra layer of protection against air and water infiltration. And with no interior vapor retarder and a perm rating of 1.1 for the rigid foam, these walls can dry both to the interior and the exterior.

Casing Installation

We preassembled the casings in our shop from 1-inch-by-5-inch Versatex PVC stock (724/857-1111, versatex.com) and special-profile PVC back-band moldings and 2x2 sills (877/822-7745, advancedtrimwright.com). We used stainless steel fasteners and Bond&Fill structural adhesive. After gluing and pocket-screwing the head and side casings together, we glued

and screwed 2x2 PVC sills to the casings from underneath. The back band — which matches the original moldings — was glued with Bond&Fill's FastCure, an adhesive with an eight-minute curing time, and then clamped to the casings.

Next we padded out the assembled casings with 5/4x1¹/₂-inch PVC extensions (see illustration, next page). The sill extensions have a 15-degree bevel to match the existing sills, and — like the jamb extensions — they're completely bonded to the trim with adhesive and tacked in place with 16-gauge stainless steel finish nails. Even in a production setting, building retrofit PVC casings is expensive. The materials to trim five mulled and 12 single units

cost about \$3,500, plus another \$2,000 to fabricate and assemble the frames.

Before fastening the casings to the jambs, we dry fit them and marked their outside edges on the foam. We then applied heavy beads of Bond&Fill Flex to account for the uneven walls and ensure waterproof joints between the rigid foam and the back of the casings. We also applied sealant between the casings and the jambs — enough to cover the edge of the flashing tape, but not so much that it would squeeze out and bond to the upper sash (which would make the sash inoperable). Taping the top of the sills made it easy to clean up any sealant that squeezed out there.



Figure 5. To allow for water and air movement between the shingles and the foam, the shingles were installed over Home Slicker, a 1/4-inch-thick nylon mesh (above left). Screening over windows (above right) and at other terminations is needed to keep insects out. When painted, the new windows (right) look nearly identical to the originals.



The most critical part of the installation was mating the sloped sill extension to the original sill (**Figure 4, previous page**). We aligned these two parts with our fingers and shot a couple of 2 $\frac{1}{2}$ -inch 16-gauge stainless steel finish nails through the side casings and into the jambs just above the sill to tack the casings in place. Then we adjusted the fit: Though old windows are often out of square, PVC is flexible, so bending the trim to fit was easy. Next, we used Cortex screws to pull the casings tight to the jambs. These screws are self-drilling and cut a clean hole in the PVC that's the exact size of the supplied plugs (800/518-3569, fastenmaster.com).

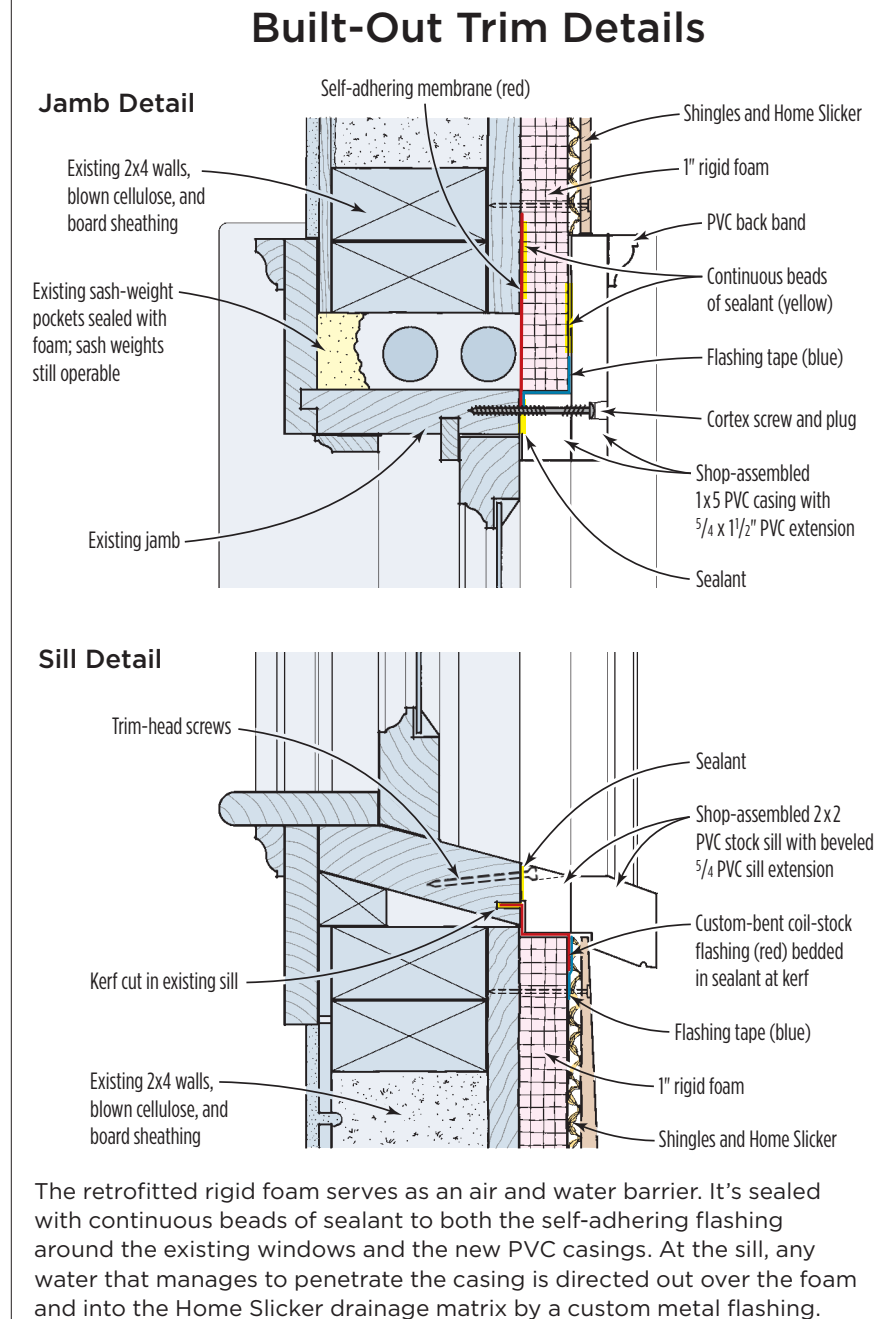
We also used stainless steel trim-head screws through the sill extension and into the original sill to pull this critical joint tightly together. Afterwards, we cleaned up the squeeze-out at the joints and filled in any holes with Bond&Fill in preparation for priming and painting.

After installing the trim, we sealed the sides and tops of the casings to the foam with more Bond&Fill Flex. Then we added a 1 $\frac{5}{8}$ -inch metal drip cap over the top of the casing, giving it a slight slope to help drain water away, and flashed the drip cap to the foam with StraightFlash butyl tape.

To provide a drying air space between the foam and the back of the shingles, we installed the red-cedar shingle siding over Benjamin Obdyke Home Slicker (**Figure 5, previous page**). Because red cedar is fairly rugged and we had added only an inch of foam, we were able to use a siding nailer to fasten the shingles directly to the sheathing underneath with 2 $\frac{1}{2}$ -inch stainless steel ring-shank nails.

Performance and Cost

The upcharge for adding the layer of foam to this siding job was about \$9,000 to \$10,000. With all of the air-sealing and insulation work we did, we were able to improve the home's airtightness from



8.01 air changes per hour at 50 pascals (ACH50) to 3.24 ACH50 — almost a 60 percent decrease — without visibly altering the home's appearance.

The owners will be happy with their lower energy bills, but already they're noticing elevated humidity levels in their home. We plan to address that issue by installing a heat recovery ventilation system, or HRV — an additional expense they're not happy about. We've

also noticed that moisture from the dryer exhaust and side-vented gas boiler is getting up behind the siding, wetting the shingles, and causing some tannin-bleed. We've tried blocking off the air space in those locations; however, I suspect that we might have to extend both vents well clear of the siding to solve the problem.

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