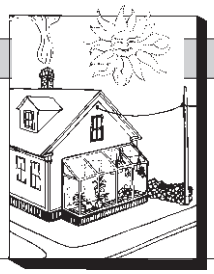
Vapor Barriers the Easy Way



by Chuck Silver and Terry Brennan

Ah, vapor barriers! I remember the first time I decided to try and make a house as airtight as I could. "We'll just run poly continuously over the inside of the outside walls and across the ceiling. That way we'll get a vapor barrier and an air barrier," I thought.

So simple in concept, such a pain in practice. How do you get it on top of load-bearing walls, through the joists of a cantilevered overhang or the second floor of a Cape Cod? Or through the intersection of an interior partition and an exterior wall? What about recessed lights? On those first houses I used a lot of caulk. Cases of caulk. And even then I didn't have really good solutions for these problem areas.

Eventually people came up with details that made it possible to get a good continuous vapor barrier in these situations. I'll get to them later. But first I want to stress the best solution, which is to plan the house to simplify the vapor-barrier installation. Which details you use depends in part on what kind of material you are using for the vapor barrier. Your choices are the following:

- plastic film
- rigid foil-faced foam board
- vapor barrier paint on the drywall

Plastic Film

If you use plastic film, try to plan the house with no interior load-bearing walls, no plumbing in the exterior walls, and no recessed lighting fixtures. The Exterior walls then can be insulated, the wiring run, and an ocean of poly quickly stapled to the studs and ceiling joists. This eliminates the problems where interior walls meet exterior walls and ceilings. In two-story houses this would apply to the upper level as well as the lower. Remember to use steel fasteners to attach top plates where the interior partitions meet the exterior walls because the plates will not be interlocked with this detailing.

This type of design does not address the electrical boxes. Two solutions to this problem are sold over the counter, The first is a poly box, which is nailed up first and the electrical box installed inside it. A flange on the poly box provides a place to attach the poly vapor barrier with goop (acoustic sealant or butyl rubber caulk). These poly "mittens" have been around for several years and are available from a number of suppliers. A newer product simply molds a flange right into plastic electrical boxes. If the box is installed correctly a mushy foam gasket seals the poly to the back of the drywall. I have never seen either of these products at a regular local supplier, but they are both available from specialty supplier.

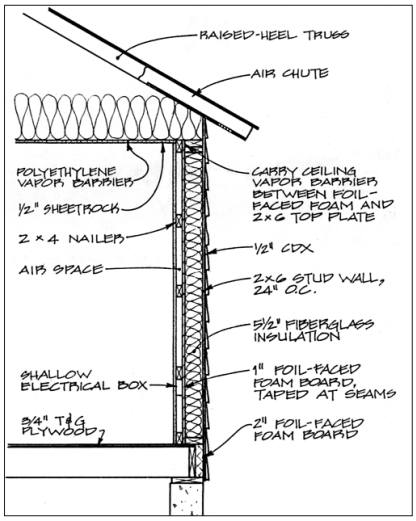


Figure 1. Foil-faced foam on interior. The 2x4 furring provides a nail and glue base for the drywall. With wide, shallow electrical boxes, no electrical penetrations are needed.

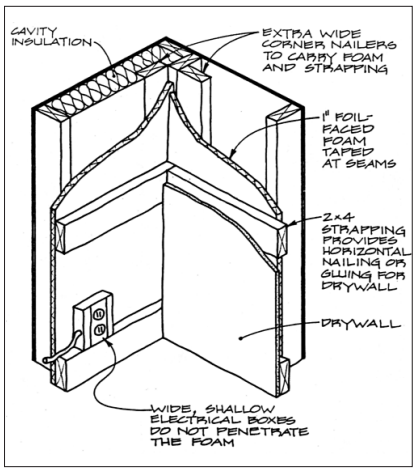


Figure 2. Extra nailers. With interior foam and strapping, remember to put corner nailers in the right places. Also, leave out the last stud where interior partitions join outside walls, so the foam board can run continuously.

Foil-Faced Foam Board

Foil-faced foam board can be used to make a vapor barrier by nailing it up to the inside of the exterior wall studs. It also cuts stud loss in single stud systems. I personally find it easier to work with a rigid board than a film.

This method is a bit easier to plan than using plastic films because the interior walls can be framed before the foam is placed. This is accomplished by not installing the interior wall stud nearest the exterior wall until after the foam has been placed. The foam is installed after the wall insulation and before the drywall. Joints are taped and cracks at the edges are caulked or foamed. When I use rigid foam insulation as the vapor barrier in this way I also use horizontal 2x4 strapping on 2-foot centers vertically and around window and door openings (see Figure 1). This allows the use of wide, shallow electrical boxes so there are no electrical box penetrations to deal with.

The important details to remember with this system are to put corner nailers in the right place (see Figure 2), leave out the last stud of interior/exterior wall intersections, and to offset interior walls that join the exterior wall at an inside corner to allow for the foam and strapping. This system is thoroughly described in an earlier column (JLC Focus on Energy, 7/89). It handles all the difficult problems without fouling up scheduling, and the Sheetrock can be installed in long horizontal sheets (using glue even). There are still the problem areas, however, of cantilevered overhangs and joists between the first and second floor.

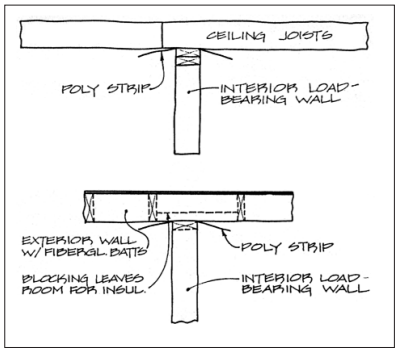


Figure 3. Poly patches. Place a 2-foot-wide poly strip over the top of load-bearing walls (top) before setting the joists. Place a similar strip where partitions meet exterior walls (bottom).

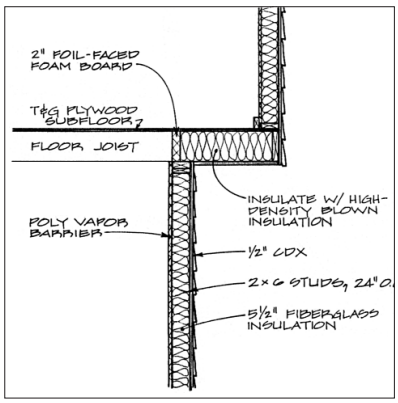


Figure 4. Cantilevered overhang. Overhangs are tricky to seal and insulate. Because they face high wind pressures, rigid foam is best here. Use slightly oversized foam blocks tapped in place with a 2x4 block and a hammer.

Airtight Drywall Approach

This method uses the drywall as a substrate for a painted-on vapor barrier. It schedules about as easily as the foam board method but still leaves you to deal with the electrical boxes. Joints are gasketed using silicone tapes or sealed using caulks. A number of builders have used this technique and modified it to their liking. However, it has the same problem areas of cantilevered overhangs and joists between the first and second floor that occur with other methods.

Trouble Spots

No matter how clever the planning or system used, trouble spots remain: cantilevered overhangs, joists between the first and second floor, intersections between interior load-bearing walls and exterior walls or ceilings, and plumbing, ductwork, and electri-

cal penetrations. Details for these areas are shown in the accompanying illustrations.

The trick with load-bearing walls (or carrying beams for vaulted ceilings) that must be framed at the same time as the building shell is to place a 2-foot-wide strip of poly film between the interior framing and the exterior framing (see Figure 3). This "poly patch" can later be attached to the vapor barrier.

The trick where vapor barriers must magically pass between the floor joists, as with cantilevered overhangs, is to use foam board. The rigid foam is pushed into place and attached to the vapor barrier (see Figure 4). In some cases, the process can be simplified by adopting a new framing detail. For example, frame the second floor of a Cape Cod or saltbox with a rim joist, cover it with plywood subfloor and place the rafters on a stringer nailed to the edge of the floor deck (see Figure 5). By holding the rim joist in 2-inches from the exterior framing surface, 2-inch foil-faced foam board can be placed in 8-foot-long pieces around the exterior of the rim joist where it will seal and insulate the rim joist area. This is much easier to deal with than trying to get a good seal with the floor joists nailed to the sides of the rafter. Be sure that the second-floor deck is securely fastened to the wall tops so that the horizontal thrust from the rafters doesn't push the wall apart. Check with your engineer.

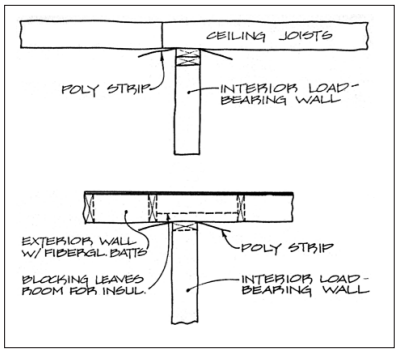


Figure 5. Cape Cod rafters. To simplify sealing and insulating, build the second-floor deck first, then set the roof rafters (check out eaves joint with an engineer). Also, if you hold the rim joist back 2-inches, you can install 8-foot lengths of foam board rather than tedious little pieces.

When plumbing or ductwork penetrates a vapor barrier, the trick is to surround the penetration with a piece of plywood. This gives something to goop the vapor barrier to and something to seal the pipe to. If you expect the pipe to move due to expansion and contractions (a plumbing vent stack or a hot water line) then seal it to the plywood backer by pushing the pipe through a sheets of EDPM rubber roofing. This gives a good seal that the pipe can slide through. I make my plywood backers by cutting scraps of plywood so they just fit between the joists or studs. Then I nail flat metal sheets to the ends as nailing tabs.

Other Techniques

There are two other wall types that do not use ordinary studs. One is stress-skin foam panels and the other is a system that uses manufactured I-beam studs with foam board for insulation and vapor barrier. Neither of these will be covered in this column, but both provide airtight walls with built-in vapor barriers that are relatively easy to install and schedule.

Wrap Up

It is possible to get a very airtight building shell with a good vapor barrier without driving yourself crazy. It can be done using a variety of approaches and materials. Details have been developed by builders all over the country and have found their way onto many construction sites. This column has been a roundup of the details I like best. If you have others that make installing a vapor barrier easier or better, please send them to Terry Brennan, c/o JLC, RR #2, Box 146, Richmond, VT 05477. ■

Chuck Silver designs custom homes, and Terry Brennan consults on energy design. They currently run training seminars on energy-efficient construction for the New York Energy Office.