ing and wiring runs, should be sealed. It's smart to pay particular attention to electrical receptacles on outside walls and make sure the barrier is sealed to electrical boxes. Or consider using special receptacles that come with their own gasketing system like those by R&S Enviro Products Limited (1 Church St., Keswick, Ont., Canada L4P 3E9; 905-476-5336). The ceiling between an unheated attic and the house should be sealed carefully, with the air/vapor barrier lapped over the barrier on the sidewall and taped and caulked. Don't forget the floor. Air leaks can reduce the R-value of insulation between an unheated basement and the house by 20%.

A poly air/vapor barrier isn't the only choice, though it may be the best one in a heating climate. Foil or kraft-paper backing on fiberglass insulation (if stapled to the faces of studs) or foil-backed drywall also make reasonably good vapor barriers. But these materials by themselves are not effective air barriers because of the leaks along joints and between framing members. So if you rely on kraft paper or foil insulation backing as the vapor barrier, you'll have to add a separate air barrier. One way to accomplish that is with housewrap sealed to the building and taped at the seams or with insulated sheathing, which I'll explain in a minute. Another choice is the Airtight Drywall Approach (ADA), pioneered by Lstiburek in the 1980s. ADA uses gaskets or caulk to seal gaps between framing members and between drywall and framing for the air barrier. Vapor-retarding paint provides a vapor barrier (for more on ADA, see *FHB* #37, pp. 62-65).

Keeping the wall cavity warm—Rigid-foam insulation, such as extruded polystyrene, can provide an external air barrier as long as all joints and seams are sealed. Polystyrene insulation has low vapor permeability (extruded polystyrene has a lower perm rating than expanded polystyrene), so the technique, in effect, creates a vapor barrier on the cold side of the house. This seems like a violation of the cardinal rule in heating climates of putting the vapor barrier only on the warm side of the building. But as research by George Tsongas of Portland State University found, this apparent disadvantage is outweighed by the benefits. An adequate thickness of insulation keeps the temperature of the wall cavity high enough to prevent warm house air from condensing if it does get into the wall cavity. Lstiburek recommends 1½ in. to 2 in. of rigid-foam insulation on the outside in heating climates in conjunction with an air/vapor barrier on the inside. The extra precaution of the poly inside is smart in a heating climate, Lstiburek says, but may not be crucial in milder climates.

The other advantage of using rigid-foam insulation is that it provides a capillary break between the siding and the wall cavity. That means any moisture that would normally be wicked from wet siding into wood sheathing or framing lumber won't pass through the rigid insulating sheathing. An exhaustive study in the Northwest convinced Tsongas that, in general, moisture getting into a house from the outside does a lot

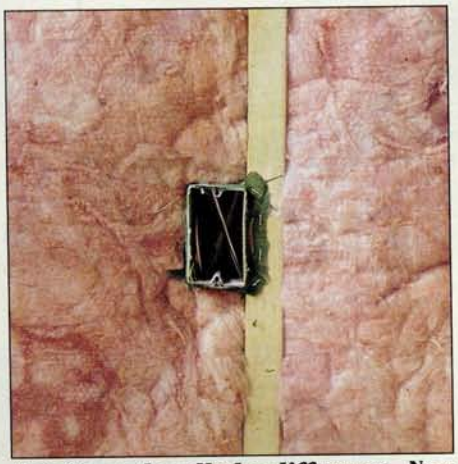
Techniques for an airtight house

Builders in the United States and Canada have been tinkering for years to come up with reliable ways of making houses airtight. New products make the process easier and more reliable, but the technique still depends on careful detailing.

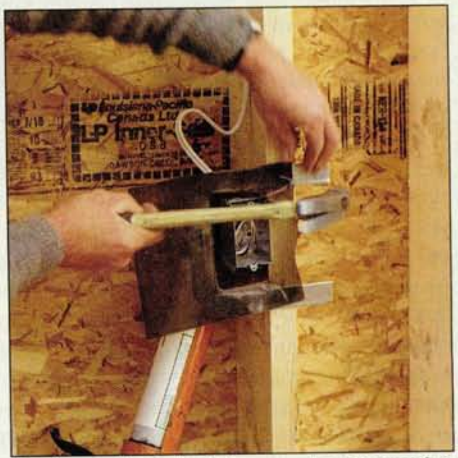
Doug George of Dover, New Hampshire, builds only superinsulated houses in a part of the country where the climate can be harsh. His houses have two air/vapor barriers—one on the inside and one on the outside—to control moisture and heat loss. Inside, George puts a layer of 8-mil Tenoarm polyethylene (see bottom sidebar, p. 53) over the 2x6 stud wall (top left photo, below). To bond seams he uses the Teno sealant that comes with the poly or Sikaflex polyurethane sealant (Sika Corp., Construction Products Div., Lyndhurst, N. J. 07071; 201-933-8800). Outside, George bonds 7⁄16-in. oriented strand board (OSB) sheathing to the frame with construction adhesive and seals joints between panels with Sikaflex. On top of the OSB is 1½ in. of extruded polystyrene with taped seams. Over the rigid insulation goes 1x3 strapping vertically 2 ft. o. c. to create a vented rain screen and then, finally, the finish siding.

The wall has two impermeable layers—the poly on the inside and the foam and the OSB sheathing on the outside—so it won't dry readily if it becomes wet. George counts on moisture not getting in the wall to begin with, so sealing seams in the poly air/vapor barrier is critical. He uses as few sheets as possible to minimize seams and puts up all of his ceiling poly before erecting interior partitions. The poly is sealed with Sikaflex to electrical boxes (top right photo, below), and gaps between windows and framing material are filled with polyurethane foam.

Rim joists and framing members—Rim joists are a real headache because



***Details make all the difference.* New Hampshire builder Doug George uses an 8-mil polyethylene air/vapor barrier on the warm side of the wall. The poly is caulked to framing members and electrical outlet boxes to prevent leaks.**



***Sealing electrical boxes.* An alternative method for sealing electrical boxes on outside walls is the "poly hat," which forms an air seal around receptacles. This technique is used by builder Peter Amerongen of Edmonton, Canada.**

***Sealing the rim joist.* Builder Peter Amerongen devised an air-barrier technique that uses polyethylene on inside walls and strips of Tyvek housewrap to seal the rim joists. Acoustical caulk seals the top edge of the housewrap to the frame.**

***Second-floor rim-joist seal.* To provide an air barrier at second-floor rim joists, Tyvek strips are sealed with acoustical caulk to top and bottom wall plates. Here, David Schuman puts a bead of acoustical caulk along the wall before it's raised into place.**