Insulating and Parging Foundations

Covering concrete walls with rigid foam insulation and troweling on stucco requires experience with the materials

by Bob Syvanen

If you've got the idea that a builder's skill is an unchanging body of knowledge passed down through the generations, think for a minute about insulating a foundation from the exterior. Even in cold climates, what you used to see between the bottom of the siding and the grade was the bare concrete foundation wall. But these days, with estimates of heat lost in a house through the foundation running as high as 30%, what looks like concrete is more likely parging, or stucco, applied over rigid foam insulation.

Insulating the outside of foundations has been a problem for a lot of builders, including me, because many of the materials and methods are new. Although rigid foam-board insulation doesn't look like much of a problem, it isn't as simple as it first appears. Polystyrene is the insulating material most often used. It comes in 2-ft. wide panels and handles like plywood, but it's a lot lighter. You can cut it with anything from a knife to a table saw. But polystyrene foam is produced in two forms: expanded and extruded. Expanded polystyrene (EPS), also known as headboard, is more susceptible to soaking up moisture than its extruded cousin, say the researchers on one side of this controversy. This could lead to a considerable loss in R-value. Although I used expanded polystyrene on the job shown here, 1 think the extruded version is probably the better bet despite its higher cost.

There are more than 100 makers of EPS; but extruded polystyrene is made in the U. S. by only three companies: Dow Chemical (Midland, Mich. 48640), whose blue-tinted Styrofoam is often called blueboard; Minnesota Diversified Products (1901 13th St. N. E., New Brighton, Minn. 55112), whose yellow product is trademarked Certifoam; and U. S. Gypsum (101 S. Wacker Dr., Chicago, Ill. 60606), the makers of pink Foamular.

Whichever brand you use, the process of applying it is the same, and so are the problems. For instance, asphalt-based products dissolve most foams, so my usual method of waterproofing a foundation is suddenly out the window. And to complicate things even more, polystyrene needs to be protected above grade from impact as well as from deterioration by ultraviolet light from the sun.

I wanted a protective coating that was easy to install, good looking and long lasting. There are many commercial systems—fiberglass panels, super stucco mixes, and even a rigid insulation with a factory-applied coating that can be attached to concrete forms before pouring—but I wanted to use more traditional materials (see p. 8 for several alternatives).

I first used asbestos board cemented on the foam, but it is fragile, hard to repair, impossible to glue, and required a lot of fitting time at corners, doors and windows. I also tried a latex-cement product applied directly on the foam. Unfortunately, it didn't age well. In fact, I have repaired not only the job I did with it, but several others in my area.

I finally settled on covering the foam with cement-stucco, called parging where I live. When stucco is used for exterior wall finish on a house, it is usually done in three coats like plaster. I was determined to come up with a single application process. Although parging and surface-bonding mixes can be applied directly to the insulation, I don't trust the bond, and want a thicker parging for durability. This means using some kind of lath.

On the first parging job, I used small-mesh chicken wire. I stretched it over ⅜-in. wood lath at 12 in. o. c. both horizontally and vertically to hold it off the surface of the insulation. Chicken wire wasn't the answer. Although my mason got the chicken wire to support the cement out of sheer stubbornness, the diamond-shaped pattern showed through a little, and there were some shrinkage cracks.

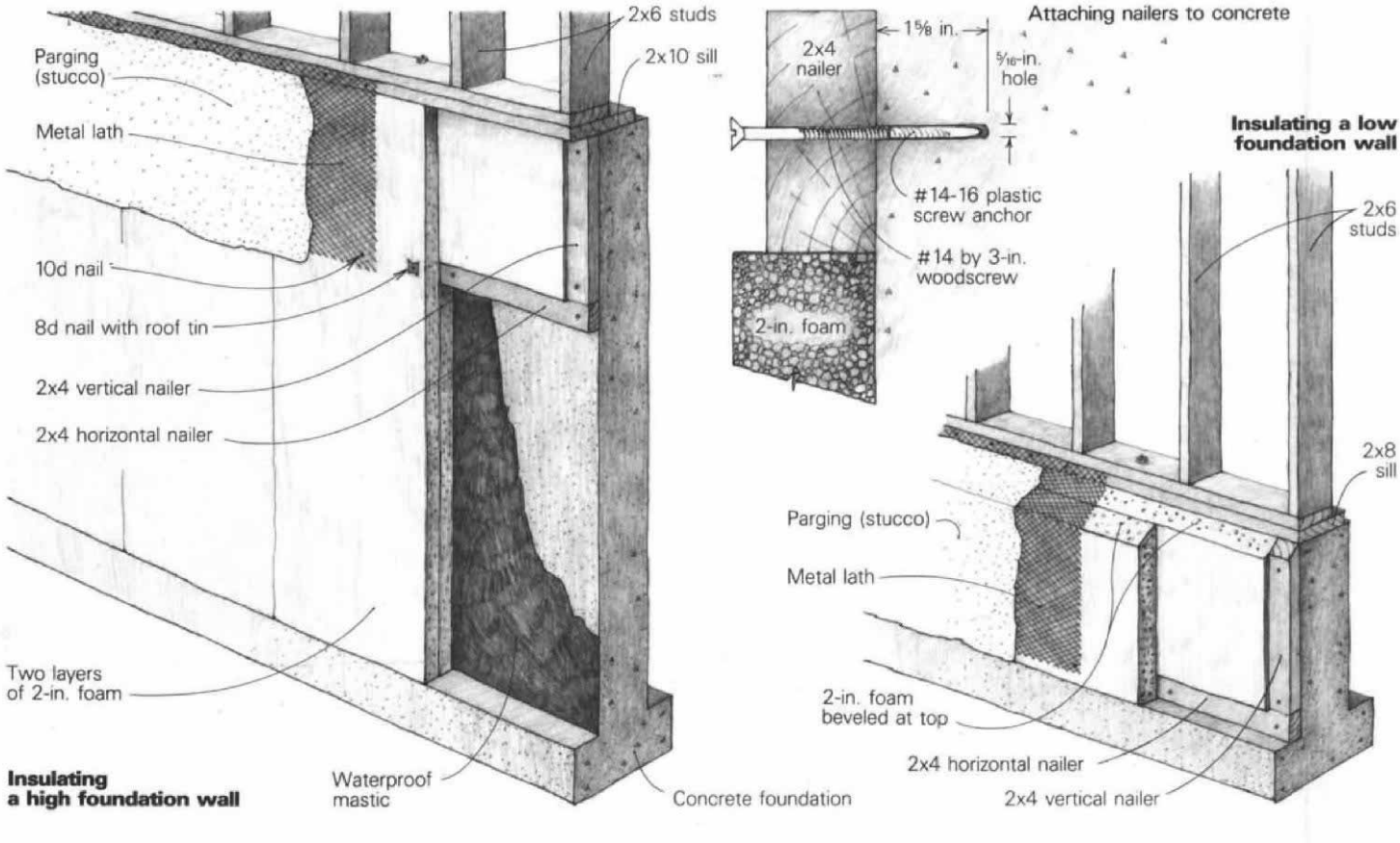
I refined the system by using metal lath, and by reducing the thickness of the wood lath to ¼ in. This worked much better for the mason, but the lath strips were still tedious to install. Next I eliminated the wood lath and applied the metal lath directly to the foam. What I ended up with is a protective coating that is long lasting, attractive and relatively easy to install. Although it is a little expensive, after seeing some of the jobs using cheaper materials other local builders and I have done, I think it's worth the cost.

Since the insulation and lath-work usually fall to the carpenter or contractor who is on the site every day, the only sub I use is my mason, who is much faster and neater than I am with a trowel. I am used to paying anywhere from $2 to $4 a square foot for parging, although conditions vary enough that both the mason and I get the best deal when I use him on a time-and-materials basis. Since a bag of masonry cement covers 20 to 30 sq. ft. of wall, most of the expense is in the labor.

Installing rigid foam insulation—A partially earth-sheltered, passive-solar house I just completed gave me a good chance to try my new system. The plans called for its concrete walls to be insulated with two layers of 2-in. foam. One wall is 7 ft. 10 in. high, and the other three are 2 ft. high. The parging was to cover the first 2 ft. below the mudsill on all of them. Some folks also use insulation laid horizontally below grade (see *FHB* #8, p. 6), but I simply ran my panels down to the footings.

The first thing I needed was a good adhesive, since there shouldn't be any give in the plane of the insulation panels if the parging is going to last. But the high wall is also below grade and part of the living space, so it had to be well waterproofed. Since asphalt-based products can't be used with foam, I looked

Installing foam insolation. **First, a waterproofing agent that also serves as a mastic is spread directly on the concrete. Temporary braces hold the foam panels in place while the mastic dries. Two-by-four nailers are used between the two 2-in. layers. The horizontal nailer is 27 in. down from the sill—the width of the metal lath that will be applied next.**



around for something else. What I found was a mastic, Karnak 920 (Karnak Chemical Corp. 330 Central Ave., Clark, N.J. 07066), which is marketed as both an adhesive and a waterproofing agent. Theoretically, you trowel the mastic waterproofing on the concrete and then press the foam panels in place. But the walls had enough irregularity that the panels contacted the mastic in only a few places, and they fell off about as fast as I put them on. I then found out that the foam has to be applied before the mastic skins over. This is enough time to apply just one or two panels and brace them with sticks, 2x4s, stones or buckets (photo previous page). When the foam was applied in this way, the adhesive held.

In this case, I installed 2x4 pressure-treated wood nailers with the first layer of foam panels in order to get nailing for the second layer. On the 7-ft. 10-in. wall, 1 began by placing a horizontal nailer 27 in. down from the sill. It was used to attach both the second layer of insulation and the lath, which comes 27 in. wide. Next, I attached vertical nailers above the horizontal at 24 in. o. c. because the panels are 2 ft. wide. I also filled in with nailers at windows and corners to catch the edges of the panels. A quick, easy way to fasten these 2x4s to concrete is to hold the nailer in place and drill through the wood into the concrete. Using a hammer-drill makes this almost fun.

For 2x4s, I use a #14-16 screw anchor, **1½** in. long, with a #14 by 3-in. flat-head woodscrew. Use a piece of tape on a **5⁄16**-in. masonry bit, at 3 in. from the tip, to limit the hole depth. Most hammer-drills have an attached depth guide. If the hole is too shallow, the tip of the woodscrew won't hit the concrete before snugging up the 2x4. If the hole is too deep, the screw won't grab the anchor.

After drilling, insert a plastic screw anchor into the hole in the nailer and turn a woodscrew a few turns into it. Then hammer the screw-and-anchor combination through the nailer into the concrete. Last, screw the woodscrew home (drawing, above center).

On the 2-ft. wall, I cut the first layer of foam to fit between the footing and the horizontal nailer and installed it before the nailers. This way, 1 could wedge the nailers between the foam and the footing while I fastened them.

On the high wall (drawing, above left), I cantilevered the mudsill Over the concrete by the depth of the foam so that I could nail the metal lath directly to its top edge. This meant that the second vertical layer of foam tucked up underneath it, flush with its outside edge. This layer is held in place with 8d nails wherever there are nailers. The 8d nail reaches through to the nailer, and when given an extra tap, the foam compresses and snugs up the panel nicely. I use a roofing tin on each of these nails to increase its bearing surface. This is a stamped 2-in. by 2-in. flat metal plate with a hole in the center, and is typically used to hold down roofing felt on windy days. You can buy them from a roofing-supply yard or make your own by cutting out sheet-metal squares. I have also seen pins and plastic shields manufactured for this purpose.

The 2-ft. wall was insulated in a similar manner, but here the sill is flush with the outside face of the foundation wall (drawing above right). Since the foam projects past the sill, I beveled the top edge of the foam at a 45° angle. The vertical 2x4 nailers were also beveled at the top before 1 fastened them to the concrete. The corner nailers are beveled from each direction (photo facing page, top left). To make a neat bevel cut in the foam, I snapped a chalkline the length of the foundation on the face of the panels and sawed along it with a bread knife. This bevel design worked well here because the finished grade was to come at the bottom of the bevel.

Installing metal lath—The galvanized metal lath I use measures 27 in. by 96 in. It is sold in single sheets or in bundles of ten. There are two things to keep in mind when you're working with metal lath. First, the diamond-mesh pattern is formed on an angle between the front and back of a sheet. This means that the dividing wire that is roughly horizontal forms a small lip or cup at the bottom of each hole. Make sure these cups are facing up to catch and hold the parging. It will work both ways, but things go better if the cups are up. The other thing to remember is that metal lath is sharp. 1 don't think I have ever worked with the stuff without cutting myself. The cuts are not bad, just annoying. Wearing gloves helps, but I find that more annoying than the cuts.

On the high wall, I nailed the mesh to the top edge of the sill. The bottom of the mesh nails through the foam into the horizontal nailer 27 in. below. I used leftover 3d shingle nails at the top, and 10d commons on the bottom and along the edges wherever I had a nailer. The 2-ft. walls were fastened similarly, but because of the beveled top, I had to bend the lath before I nailed it in place.

For corners, expanded corner bead—the plasterer's version of a metal sheetrock cor-

Photos: Bob Syvanen; Illustration: Frances Ashforth

ner—is the best way to go because it forms a neat, stiff straight line. But I didn't have any on the job, so I pre-bent the lath at 90° before installing it (photo top right). Bending sheet metal, particularly metal lath, on the job site isn't hard if you think of how it's done in the shop and duplicate the procedure. The shop uses a brake, which is a cast-iron table and a bar that folds the sheet metal over the edge of the table. On site, I sandwich the sheet between two 2x boards and "break," or fold, the piece that sticks out over the bottom 2x using a scrap block about 2 ft. long. Nailing the sheet metal to the top of the bottom 2x keeps it from creeping out as the bend progresses. This system is particularly good for metal lath because you don't have to handle the material constantly as you bend it.

Parging—Parging is not impossible for a novice, but a good finish takes experience. The first job I did turned out okay, but there was lots of room for improvement, so I went to school by watching mason John Hilley.

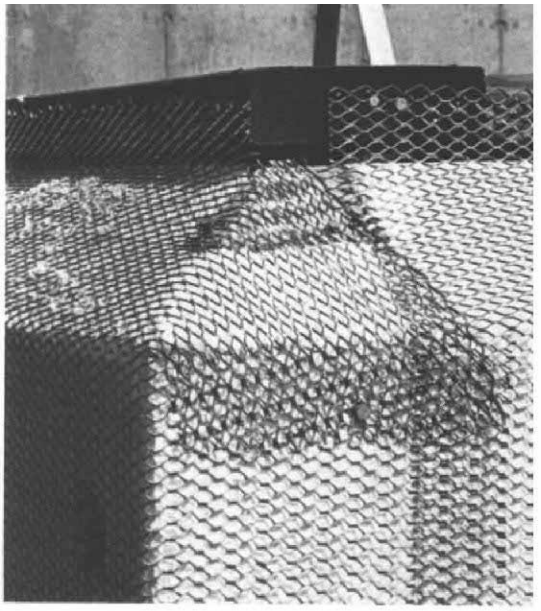
The parging he uses is a one-coat stucco with a steel-trowel finish. Other finishes might work better, but I am satisfied with this one. The mix he uses is 16 shovels of sand per bag of masonry cement. He doesn't have any trouble using up a batch that size before it begins to set. Masonry cement is a mix of portland cement, hydrated lime and additives that combine with water and sand to form mortar or stucco. For a parging mix, use Type M for higher compressive strength and greater resistance to water.

Large expanses of stucco are usually worked with darbies and floats. For foundations, though, a standard mason's trowel is easier. The mud is picked up on the bottom surface of the trowel and immediately applied to the lath. The free hand assists by pushing against the top face of the trowel, forcing the mud into the mesh. It is a quick process—pick up, apply, press. With each pressing motion, the excess cement gets pulled along with the sliding trowel (photo center right).

At the same time that the parging is applied, it should be roughly surfaced, to establish an even thickness. As with brick jointing and slab work, compressing the material is what finishing is all about. This requires a bit of pressure, but it should be with good control. Use two hands on the trowel, one on the handle and the other on the flat of the blade, and keep your arms straight.

The finishing is done when the shine leaves the surface of the parging. The trowel is dipped into water, shaken once to get the excess off, then pressed against the surface of the stucco using both hands (photo bottom right). Try to get a smooth finish in just a few strokes so you don't overwork the cement.

A cloudy, cool day is best for parging because the mix can be worked longer before it sets. If the parged wall is in direct sun, mist the surface with a pump-up garden sprayer filled with water to keep the surface of the stucco from drying out too fast, which will cause shrinking and surface cracks. □



Preparation. **This foundation corner (top left) is ready for lath. Cutting the double bevel on the top of the corner nailer to match the bevel on the two layers of foam requires much less work later when the stucco is finish-troweled. An 8d nail and its roof tin, which acts like a large nailhead, are just visible at the bottom of the photo. This same corner is ready for parging once it is wrapped in metal lath (top right), which is pre-bent on a brake. The lath is nailed to the sill at the top, and through the second layer of polystyrene into the horizontal 2x4 nailer at the bottom.**

Parging. **Mason John Hilley forces the stucco mud into the lath (above), using two hands and the weight of his body. Just one coat of parging is used, but it is troweled twice. The first time is a rough troweling. When the shine disappears, the surface is smoothed with the same trowel, dipped frequently in water. This finish process is also done with one hand on the face of the trowel for direct pressure (right), and with arms held straight for good control.**