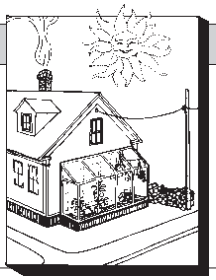
Insulating Basements in New Construction

by Alex Wilson

Foundation Insulation, Part 2



How should full basements, the most common type of foundation in New England, be insulated? There are many approaches that work fine in particular situations, of course, but for most applications, I believe the methods covered here will result in the best performance with the least worry.

1. Assume the basement will be heated. Insulate the foundation even if your clients don't expect to heat it. Otherwise, if they later decide to turn the basement into a living or working space, dealing with retrofit insulation will be difficult, expensive and probably not entirely satisfactory.

In addition, an insulated, tight foundation means greater comfort upstairs with fewer drafts, as well as better drainage and a reduced risk of frost heaves. The other alternative—simply insulating the floor—would have to be done very carefully to avoid moisture damage and the nuisance of bits of fiberglass insulation coming loose in the basement.

2. Insulate on the outside of a poured-concrete or concrete-block foundation—not on the inside. Insulating on the outside will reduce thermal bridging at the top of the foundation wall and minimize the risk of damage by frost.

3. Use extruded polystyrene insulation for exterior foundation insulation. While debate continues on the use of *expanded* polystyrene (EPS, or beadboard) below grade, those wanting to take the safe route should stick with extruded polystyrene. EPS is poorly made and absorbs water easily, while extruded polystyrene is much stronger and therefore less likely to be damaged or compressed by backfilling.

If you can find it, "Warm-N-Dri," a rigid fiberglass board introduced by Owens-Corning in 1984, is another option for exterior foundation insulation. Though not as well tested as Dow Styrofoam and other extruded polystyrene materials, "Warm-N-Dri" has the added benefit of aiding drainage and being less susceptible to breakdown by sunlight and insects.

"Base-Clad, a similar product marketed by Fiberglas Canada since 1981, also has proved very successful in field applications.

4. Insulate the entire height of the foundation wall, from footing to sill. This is particularly important when using "Warm-N-Dri" or special drainage products in conjunction with the insulation (see 8 and 9).

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5. Taper the insulation so that there are more layers near the top of the wall than near the bottom. Although this is more time consuming, it makes the best use of the money spent. Because the ground itself provides some resistance to heat flow (about R-1 per foot of depth; see last month's column), you don't need to add a uniform amount of insulation from footing to sill.

Assuming an eight-foot foundation wall on a well-insulated house, for example, you could place 2' by 8' sheets of one-inch tongue-and-groove extruded polystyrene vertically from footing to sill, followed by half sheets extending down four feet from the sill (offsetting the joints for added strength and protection). Finally, a third layer could be added running horizontally at the top of the wall and extending down two feet from the sill.

This arrangement provides much better thermal protection than two inches of insulation running the full height of the wall—and with much less insulation. For extremely well-insulated houses, follow the same procedure but use additional layers or two-inch-thick sheets.

6. Install a polyethylene moisture barrier under the slab floor. The barrier should be at least six mils thick and ideally placed between two layers of compacted sand. (Adding sand between the poly and concrete protects the poly from damage during the pour of the foundation and from possible degradation due to contact with the concrete. It also helps the concrete set up.)

In addition, a poly moisture barrier is a good defense against radon gas, which percolates up from the ground and adds radiation to many houses.

7. Insulate under the slab floor for greater comfort. While this may not be justified by energy savings alone, it will provide a warmer floor and therefore greater comfort if the basement is to be used as a living space.

Extruded polystyrene should be used for subfloor insulation, but make sure you choose a product that can withstand compression. A thickness of one inch is plenty; thicker insulation is a waste of money.

The insulation should be installed as follows: Lay and compact a layer of sand; spread out the poly barrier (at least six mils thick, remember); install the one-inch tongue-and-groove insulation; lay a second layer of sand (one and a half to three inches thick) over the insulation and tamp it firm; then pour the concrete (which should should be as thick as possible). Extra time will be required for finishing.

8. Consider using a specialized drainage product on the outside of the insulation in wet areas and where surrounding soil has poor drainage. This will help keep water away from the insulation and the wall.

In recent years, a number of products have been introduced specifically for drainage by such companies as Enka, Geofab, Miradrain, GeoTech and Elgen. These products are very porous and allow any water seeping toward the foundation to quickly flow down to the drainage tile. ("Warm-N-Dri" serves both insulating and drainage needs.)

9. Install drainage tile at the base of perimeter footings. The tile should be surrounded by four to eight inches of crushed stone on all sides, although crushed stone or gravel ideally should be backfilled all the way up the foundation wall to a few inches below grade (see number 10).

At its highest point, the bottom of the tile should be below floor level, but try to keep the tile above the bottom of the footing to avoid disrupting the soil under the footing (and thereby potentially destablizing the foundation). The tile should be covered with a porous filter fabric to keep silt out of the holes.

10. Backfill with crushed stone or gravel from the bottom of the footing up to near grade, allowing several inches for topsoil. This will aid drainage, keep moisture away from the wall and reduce the risk of frost heaves. The backfill should be tamped carefully as it is placed to avoid settling later.

11. Grade to create natural drainage away from the house. The ground surface must slope away from the house so that surface water flows away from the foundation. Similarly, downspouts should be installed so that they drain well away from the house wall.

12. Make sure the basement is tight. Use tight-fitting, insulated casement windows, and caulk all joints and the sill carefully. Infiltration should be kept to a minimum in the winter, but make sure there are windows with screens that can be opened in the summer. ■

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