EN13 Slab-on-Grade Floors, Unheated (Climate Zones: 5 6 7 8)

As shown in Figure 5-12, (a) rigid c.i. should be used around the perimeter of the slab and should reach the depth listed in the recommendation or to the bottom of the footing, whichever is less; (b) additionally, in climate zones 5 through 8 and in cases where the frost line is deeper than the footing, c.i. should be placed beneath the slab as well.

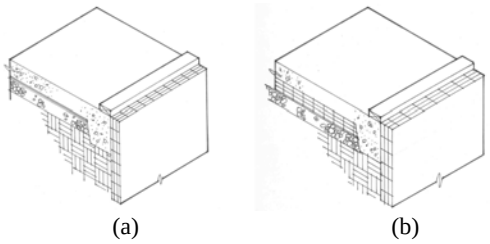

Figure 5-12. (EN13) Slab-on-grade floors, unheated—no heating elements either within or below the slab.

EN14 Slab-on-Grade Floors, Heated (Climate Zones: all)

When slabs are heated (see Figure 5-13), rigid c.i. should be used around the perimeter of the slab and should reach to the depth listed in the recommendation or to the bottom of the footing, whichever is less. Additionally, in climate zones 5 through 8, c.i. should be placed below the slab as well. Note that it is important to use the conductive R-value for the insulation as radiative heat transfer is small in this application.

Note: In areas where termites are a concern and rigid insulation is not recommended for use under the slab, a different heating system should be used.

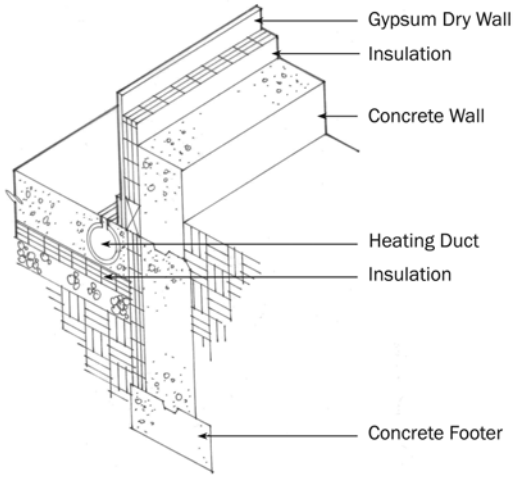

Figure 5-13. (EN14) Slab-on-grade floors, heated—heating elements either within (as shown) or below the slab.

EN15 Doors, Opaque and Swinging (Climate Zones: all)

A U-factor of 0.37 corresponds to an insulated double-panel metal door. A U-factor of 0.61 corresponds to a double-panel metal door. If at all possible, single swinging doors should be used. Double swinging doors are difficult to seal at the center of the doors (see Figure 5-14) unless there is a center post. Double swinging doors without a center post should be minimized and limited to areas where width is important. Vestibules can be added to further improve the energy efficiency.

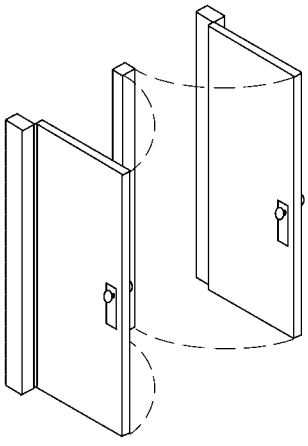

Figure 5-14. (EN15) Doors, swinging—opaque doors with hinges on one side.

EN16 Doors, Opaque and Roll-Up or Sliding (Climate Zones: all)

Roll-up or sliding doors are recommended to have R-4.75 rigid insulation or meet the recommended U-factor. When meeting the recommended U-factor, the thermal bridging at the door and section edges is to be included in the analysis. Roll-up doors that have solar exposure should be painted with a reflective paint (or high emmissivity) and/or should be shaded. Metal doors are a problem in that they typically have poor emmissivity and collect heat, which is transmitted through even the best insulated door, causing cooling loads and thermal comfort issues in the space.

If at all possible, use insulated panel doors over roll-up doors, as the insulation values can approach R-10 and provide a tighter seal to minimize infiltration.

Options

EN17 Alternative Constructions (Climate Zones: all)

The climate zone recommendations provide only one solution for upgrading the thermal performance of the envelope. Other constructions can be equally effective, but they are not provided in this Guide. Any alternative construction that is less than or equal to the U-factor, C-factor, or F-factor for the appropriate climate zone construction is equally acceptable. A table of U-factors, C-factors, and F-factors that corresponds to all of the recommendations is presented in Appendix A.

Procedures to calculate U-factors and C-factors are presented in *ASHRAE Handbook—Fundamentals*, and expanded U-factor, C-factor, and F-factor tables are presented in Standard 90.1, Appendix A.

Cautions

The design of building envelopes for durability, indoor environmental quality, and energy conservation should not create conditions of accelerated deterioration, reduced thermal performance, or problems associated with moisture and air infiltration. The following cautions should be incorporated into the design and construction of the building.

EN18 Heel Heights (Climate Zones: all)

When insulation levels are increased in attic spaces, the heel height should be raised to avoid or at least minimize the eave compression.

EN19 Slab Edge Insulation (Climate Zones: all)

Use of slab-edge insulation improves thermal performance, but problems can occur in regions of the country that have termites.

EN20 Moisture Control (Climate Zones: all)

Building envelope assemblies (see Figures 5-15a and 5-15b) should be designed to prevent wetting, high moisture content, liquid water intrusion, and condensation caused by diffusion of water vapor. See *2005 ASHRAE Handbook—Fundamentals*, Chapter 24.

EN21 Air Infiltration Control (Climate Zones: all)

The building envelope should be designed and constructed with a continuous air barrier system to control air leakage into or out of the conditioned space. An air barrier system should also be provided for interior separations between conditioned space and space designed to maintain temperature or humidity levels that differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The air barrier system should have the following characteristics:

- It should be continuous, with all joints made airtight.
- Air barrier materials used in frame walls should have an air permeability not to exceed 0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2) when tested in accordance with ASTM E 2178.