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Material	Density (lb/ft³)	R-Value per Inch of Thickness	Water Vapor Permeability (perm-In.)	Water Absorption (% by weight)	Dimensional Stability
Molded polystyrene	0.9-1.8	3.6-4.4	1.2-5.0	2-3§	no change
Extruded polystyrene	1.6-3.0	4.0-6.0	0.3-0.9	1-4	no change
Polyurethane, unfaced	1.7-4.0	5.8-6.2	2.0-3.0	negligible	0-12% change
Polyisocyanurate, unfaced	1.7-4.0	5.8-7.8	2.5-3.0	negligible	0-12% change
Perlite, loose fill	5.0-8.0	2.63	100	low	settles 0-10%
Vermiculite, loose fill	4.0-10.0	2.4-3.0	100	none	settles 0-10%

§ Water absorption given as percent by volume for molded polystyrene only.

Figure 8-33 Properties of insulation materials. (*From* Architectural Graphic Standards, *John Wiley, New York.*)

- The insulation must not interfere with proper cavity drainage.
- Thermal insulating efficiency must not be impaired by retained moisture from any source (e.g., rain penetration or vapor condensation within the cavity).
- Granular fill materials must be able to support their own weight without settlement, to assure that no portion of the wall is without insulation.
- Insulating materials must be inorganic, or be resistant to rot, fire, and vermin.
- Granular insulating materials must be "pourable" in lifts of at least 4 ft for practical installation.

8.6.1 Granular Fills

Two types of granular fill insulation have been tested by researchers at the Brick Industry Association and found to comply with these criteria: water-repellent-treated *vermiculite* and *perlite* fills.

Vermiculite is an inert, lightweight insulating material made from aluminum silicate expanded into cellular granules about 15 times their original size. Perlite is a white, inert, lightweight granular insulating material made from volcanic siliceous rock expanded up to 20 times its original volume. Specifications for water-repellent-treated vermiculite and perlite are published by the Vermiculite Association and the Perlite Institute, Inc. Each of these specifications contains limits on density, grading, thermal conductivity, and water repellency. Loose fill insulation should not settle more than 0.5% after placement, or a thermal bridge will be created at the top of the wall.

Cavity wall construction permits natural drainage of moisture or condensation. If insulating materials absorb excessive moisture, the cavity can no longer drain effectively, and the insulation acts as a bridge to transfer moisture across the cavity to the interior wythe. Untreated vermiculite and perlite will accumulate moisture, and suffer an accompanying decrease in thermal resistance.

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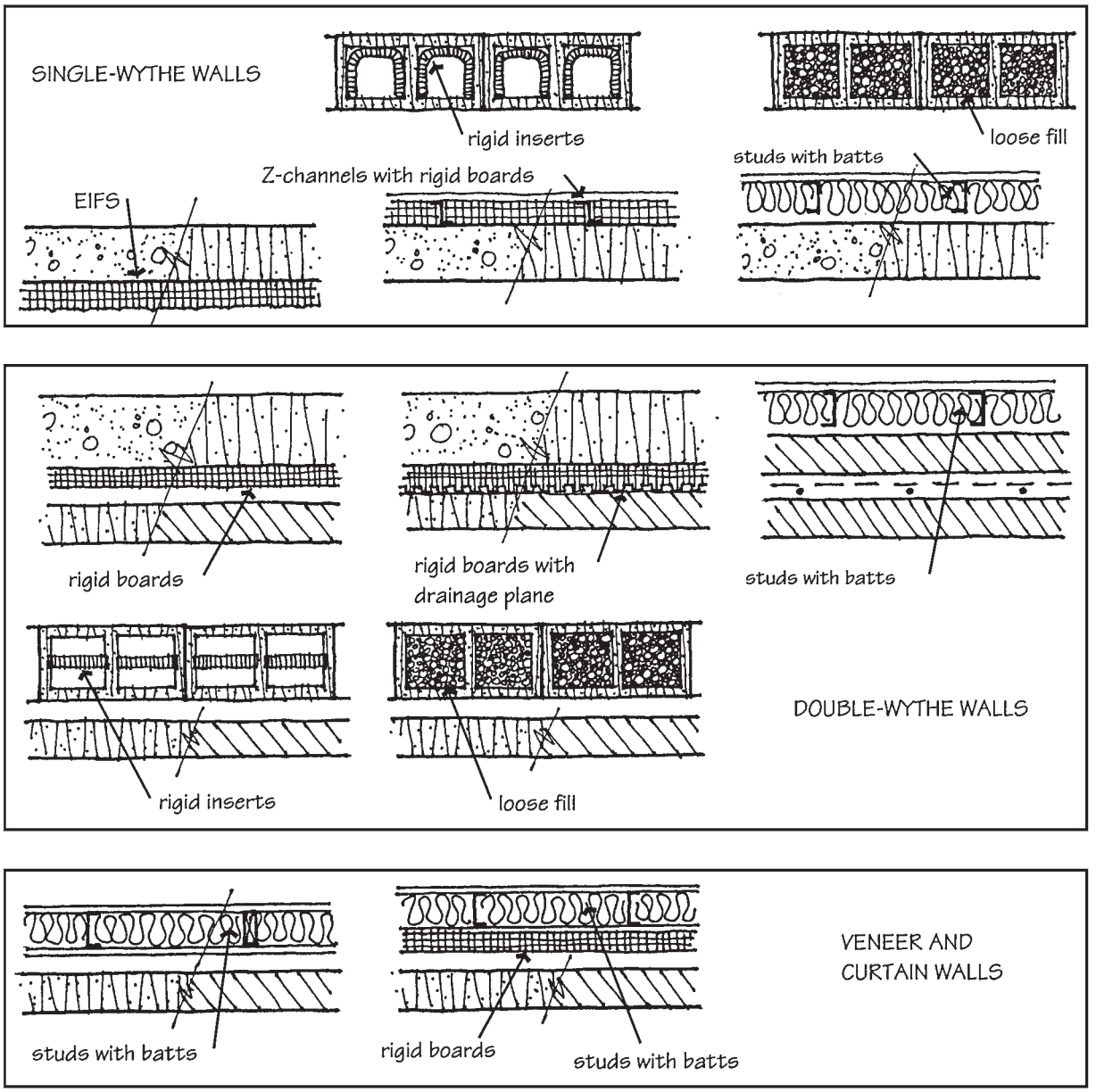

Figure 8-34 Methods of insulating concrete and masonry walls. (*Adapted from Beall and Jaffe,* Concrete and Masonry Databook, *McGraw-Hill, New York, 2003.*)

Loose fill insulation is usually poured directly into the cavity from the bag or from a hopper placed on top of the wall. Pours can be made at any convenient interval, but the height of any pour should not exceed 20 ft. Rodding or tamping is not necessary and may in fact reduce the thermal resistance of the material. The insulation in the wall should be protected from weather during construction, and weep holes should be screened to prevent the granules from leaking out or from plugging the drainage path.

8.6.2 Rigid Board Insulation and Insulation Inserts

Rigid board insulations can be used in masonry cavity and veneer walls. Extruded polystyrene is the most moisture resistant and the most widely used.

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