Condensation may lead to metal corrosion, growth of mold and mildew, loss of insulating properties, and ruined finishes. It can be minimized by a vapor retarder installed on the warm side of the wall (or, more precisely, on the side with the higher vapor pressure). Vapor retarder slows down moisture transfer toward a cooler surface. Unfortunately, it is not always easy to determine where the vapor retarder should be placed. A cliché about placing it on the inside in cold climates and on the outside in warm climates only goes so far, because in many locations in winter months the warm side is the inner surface of the wall; during hot summer months it is the outside surface. Most roofing and siding is virtually vapor-impermeable and is quite able to act as a vapor retarder for hot-weather conditions; it's the cold-weather condensation protection that is normally needed for interior surfaces.

The term *vapor retarder* is more accurate than a frequently used *vapor barrier,* because building materials do not totally stop moisture movement and can only slow it down. Retarders may not be needed at all in moderate dry climates but are important in humid locales and in buildings where moisture is released.

8.3 TYPES OF INSULATION

Type and thickness of insulation have the largest influence on thermal efficiency of a building. Indeed, spending money on insulation could be among the best investments ever made by a building owner. Properly selected roof insulation does even more for thermal performance of a single-story metal building than for a multistory structure.

All insulation functions by entrapping still air, which slows down conductive heat transfer through the insulating medium. The various types differ mainly in *how* this is accomplished. Four basic types of insulation are available for metal building systems: fiberglass, rigid, spray-on, and foam core.

8.3.1 Fiberglass Blanket Insulation

Fiberglass functions similarly to a fur coat: Both trap air on the surface of numerous individual fibers. Fiberglass blankets are the most common kind of insulation used in roofs and walls of pre-engineered buildings because of their low cost, fire and sound resistance, and ease of installation. The *R* value of fiberglass insulation ranges between 3 and 3.33 per inch of thickness. The blankets are normally provided with a vapor retarder that is "laminated" on the fiberglass (Fig. 8.1*a*). In addition to serving its main purpose, vapor retarder often doubles as the only ceiling finish found in metal buildings; accordingly, the facing is usually white for better light reflectivity.

Fiberglass insulation for metal buildings is not quite the kind used by homeowners to insulate their attics. First, it is wider, corresponding to typical metal girt and purlin spacing (5 ft and up), rather than to that of wood studs and rafters (16 or 24 in). Second, it uses a different type of vapor retarder, as will be explained in Sec. 8.4.

The certified insulation conforming to the North American Insulation Manufacturers Association (NAIMA) standard 202 must meet a set of stringent criteria, such as maintaining dimensional stability after application of a vapor retarder and during construction. It is tested for fire safety, as well as for its resistance to corrosion, mold, odor, and moisture.[3] The NAIMA 202 certification is imprinted on the unfaced side of the fiberglass rolls. According to the association, such insulation has been tested with all UL-approved facings. In addition to NAIMA certification, some specifiers require compliance with ASTM E 553[4] as well.

Another product name that should be familiar to specifiers is Certified Faced Insulation, by the National Insulation Association (NIA). This standard was formerly known as NIA 404, a standard product specification for flexible-faced fiberglass metal building insulation. Using NAIMA 202 fiberglass insulation allows facing laminators to meet the NIA standard.

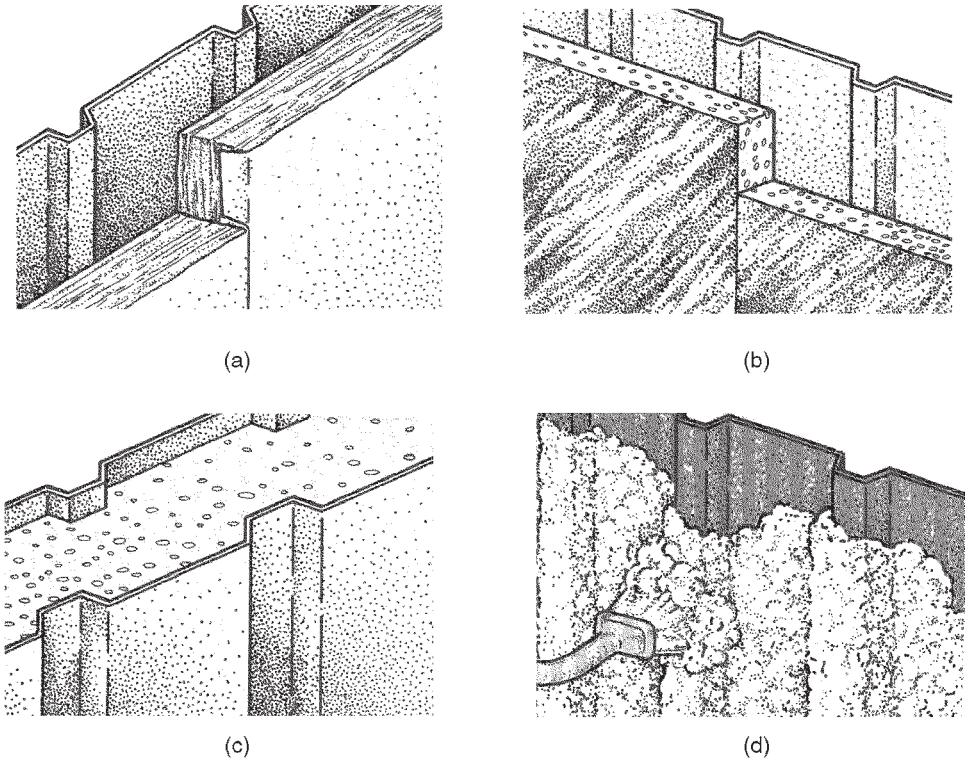

FIGURE 8.1 Four basic types of insulation used in metal buildings: (*a*) Fiberglass with laminated facing; (*b*) foam boards; (*c*) pre-insulated panels; (*d*) spray-on cellulose. (*Courtesy of NAIMA Metal Building Committee.*)

Some information on the NAIMA, which represents fiberglass insulation manufacturers, is given in Chap. 2. By contrast, the NIA represents mostly contractors, distributors, and laminators.

Still another type of fiberglass insulation for pre-engineered buildings is metal building insulation (MBI) that does not have a vapor retarder and is intended to serve as a second layer over the faced insulation. MBI comes in both batts and rolls. Owens-Corning's Metal Building Insulation—Plus is one example of this kind.

Fiberglass insulation is produced by a few major companies (mostly NAIMA members) and is normally purchased by the builder from the laminators who apply vapor retarders. Some major metal building manufacturers such as VP Buildings and Butler offer a complete range of insulation products for one-stop shopping.

8.3.2 Rigid Insulation

Rigid insulation, also known as foam board, functions by entrapping air in a multitude of individual foam cells. Most often, the foam is made with polystyrene, polyisocyanurate, and phenolic materials (Fig. 8.1*b*).

Rigid insulation offers excellent thermal efficiency (*R* value), vapor retardance, and dimension stability but lacks in acoustical performance. Rigid insulation is more expensive to make and install than fiberglass. The insulation can be applied both inside and outside the framing and can be faced with