Preventing moisture entry

by Joan P. Crowe, AIA

A roof assembly’s primary purpose is to keep exterior water from entering a building through the roof. However, water vapor inside a building may enter a roof assembly and condense, causing problems such as corrosion of steel decks and fasteners, microorganism growth and reduction of roof insulation’s thermal resistance.

One method to prevent moisture from entering a roof assembly is to incorporate a vapor retarder. In low-slope roof assemblies, vapor retarders typically are roll materials or sheet materials with relatively low permeance values, expressed as “perms.” Materials with low perm values are more resistant to water vapor diffusion than materials with high perm values. NRCA considers appropriate materials with perm ratings less than 0.5 perms to be effective vapor retarders.

Design guidelines

There are two categories of vapor retarders: bituminous vapor retarder membranes and nonbituminous vapor retarder materials.

The most common vapor retarder is a bituminous vapor retarder membrane, and the most common bituminous construction consists of two plies of a Type IV fiberglass ply sheet applied with two or three moppings of hot steep asphalt. Similarly, steep asphalt can be combined with organic felt (such as No. 15 or a coated sheet) or various base sheets. Plastic sheets or films, kraft paper, kraft laminates and aluminum foil combinations are examples of nonbituminous vapor retarder materials.

When specifying vapor retarders for use in low-slope roof assemblies, consider the following guidelines:

- Perm ratings should approach 0 perms, but should not be 0.5 perms or greater to be considered effective.
- Vapor retarder materials must be able to resist damage from hot asphalt or adhesives and should be compatible with common roof system application practices.
- Vapor retarders should be chemically compatible with conventional roofing materials and specified interfacing roof system components.
- Vapor retarders may need to have good adhesion and shear properties if a roof system’s structural integrity depends on the secure adhesion or attachment of the vapor retarder and roof insulation.
- Vapor retarders should be completely sealed at side and end laps and flashed at all roof perimeters and penetrations.
- Other trades should be notified to exercise care when working on or over a vapor retarder or cutting through a vapor retarder.
- The temperature at the bottom side of a vapor retarder must be warmer than the dew-point temperature. Sufficient insulation should be designed and installed over a vapor retarder to ensure the vapor retarder’s temperature is higher than the dew-point temperature.

Attachment

Roof system designers should use caution when specifying the use of nonbituminous vapor retarder membranes with mechanically attached insulation and/or single-ply membrane roof systems. These types of vapor retarders are not self-sealing, and the fasteners create multiple holes and breaches that allow air to pass through. The net effect of this application is not known.

Placing bituminous vapor retarders directly over a steel deck has proved to be ineffective. A vapor retarder is extremely vulnerable to puncture damage from traffic along the open flutes of steel deck panels. In addition, there are many times when insulation and/or a roof covering is mechanically attached to the steel deck and the fasteners make holes in the vapor retarder. Also, asphalt on a steel deck as an adhesive can affect fire resistance and wind resistance.

Bituminous vapor retarders can be installed directly over cast-in-place structural concrete and nailable roof decks. For structural concrete, bituminous vapor retarders should be solid-mopped to a clean, primed deck. For nailable decks, the base ply should be mechanically fastened to a roof deck. Succeeding plies should be adhered in solid moppings of hot asphalt.

NRCA recommends sandwich-type construction be used for vapor retarders installed over steel decks. One layer of noncombustible insulation board or moisture-resistant gypsum board capable of spanning steel deck flutes first should be mechanically attached directly to the steel deck. The boards will serve as a supporting base layer for the vapor retarder. Subsequent layers of insulation usually having higher R-values than the base layer are adhered to the vapor retarder to serve as the primary roof insulation.

For more information about vapor retarders, refer to The NRCA Roofing and Waterproofing Manual, Fifth Edition.

Joan P. Crowe is an NRCA manager of technical services.