INSULATION FACTS #4

Facts About Fiber Glass Insulation and Vapor Retarders

Information from NAIMA

In this issue we discuss when and where to use vapor retarders.

NAIMA
North American Insulation Manufacturers Association

A vapor retarder is defined as a material or system which adequately retards the transmission of water vapor. For residential construction, the permeance of an adequate vapor retarder should not exceed 1 perm. In some cases it must be lower. The units of permeance are grains per hour by square foot per inch of mercury pressure differential, grain/hr. ft^2 in Hg.

The main reason to retard the transmission of water vapor through building envelopes is to prevent it from condensing to liquid water within the structure.

Components of the building envelope that are outside the insulation, such as roof and wall sheathings, are commonly cooler than the dew-point temperature of the air in the conditioned space. If sufficient moisture vapor contacts those cold surfaces, it will condense to liquid, just as moisture vapor from humid air condenses on the inside of windows in cold weather. We can avoid condensation on cold surfaces by reducing the amount of moisture vapor that contacts them. We do this by installing a warm (interior) side vapor retarder because, unless relative humidity is extremely high, moisture will not condense on a warm surface. This is usually accomplished by using vapor retarder-faced insulation or unfaced insulation plus a separate polyethylene vapor retarder.

The preceding explanation makes sense for preventing wintertime condensation, but what about the summertime when buildings are cooled instead of heated? The answer to that question is that, even though an interior side vapor retarder is on the "cold" side in summer, the dew-point temperature of hot, humid summer air is nearly always lower than the temperature to which we cool buildings. That means that an interior side vapor retarder will nearly always be warmer than the dew-point temperature and, therefore, condensation will occur only very rarely and will be of very short duration, causing no problems.

This holds true for southern as well as northern U.S. locations: The highest dew-point temperatures in the U.S. occur in places like Biloxi, MS and Galveston, TX, where dew-point temperatures sometimes reach 78°F. Fortunately, this happens rarely; dew-point temperatures are nearly always 75° or lower. And because winter temperatures in Biloxi and Galveston drop into the 20's on occasion, there is some justification for interior side vapor retarders in those places.

It is also true that in humid climates where very little heating is required, vapor retarders can be placed on the exterior side of insulation without causing problems in winter.

Recommendations for Humid Areas

A reasonable recommendation for humid (Gulf Coast) and cooler "fringe" areas is: Use either an interior or exterior side vapor retarder with moderate permeance. Inset stapled (or Unstapled) kraft facing, with a permeance of about 1 perm, meets this requirement; foil and polyethylene do not; their permeance ratings are much lower. (Omitting the vapor retarder entirely would work, but would not provide energy-efficient cooling. However, if the building structure itself is a vapor retarder, unfaced insulation would be suitable.)

If an interior vapor retarder is used, do not cool the building below 76°F on the most humid days. If an exterior vapor retarder is used, do not humidify the building. Keep relative humidity below 30% in cold weather.

Check local practice; if it causes no problems, follow it. Also, when specifying condensation control strategies for hot, humid locations, keep in mind that housewraps are barriers to air and liquid water but not to water vapor. Typical exterior housewraps are *not* vapor retarders.

Vapor Retarders and Blown-in Insulation

Insulation of any form should not be relied upon to prevent moisture movement within an insulated cavity. Whether blown-in fiber glass or cellulose, vapor retarders are required unless proper ventilation is provided. As with fiber glass batt insulation, materials used for vapor retarders for blown-in insulations must have a perm rating of less than 1 perm. In a ceiling where the space above is adequately ventilated, a vapor retarder may not be required. The exception would be in cases where the cold side cannot be ventilated.

If you are reinsulating a home with blown-in insulation, installing a vapor retarder onto the sidewalls if one has not been previously installed can be quite difficult. If the cold side of the wall cannot be ventilated, it may be necessary to paint the interior surfaces of exterior walls and ceilings with a vapor retarder forming paint.

Do Attics Need Vapor Retarders?

Attic vapor retarders are commonly omitted when blown-in insulations are used. If sufficient attic ventilation exists, condensation problems do not occur in most U.S. climates. Sufficient attic ventilation is usually defined as having a net free ventilating area equal to 1/150 of the attic floor area. When an attic vapor retarder is used, ventilation requirements are halved; net free vent area can be 1/300 of the attic floor area.

Even when not required to prevent condensation problems, attic vapor retarders may be worthwhile; their presence may help maintain more comfortable humidity levels. When a vapor retarder is desired and blown-in ceiling insulation is used, a combination of faced batts/blown-in insulation or a vapor retarder ceiling paint can be used.

What Determines How "Tight" a Vapor Retarder is Required in Walls?

In general, the colder the climate, the tighter the vapor retarder should be. Also, the more vapor-tight the building's outer skin, the tighter the vapor retarder should be. In milder climates of less than 4000 heating degrees days (HDD), inset stapled kraft facing is adequate for most installations. Inset stapled kraft is also adequate in cooler climates in buildings whose outer skins are vapor-permeable, like wood fiber sheathing and vinyl or aluminum siding. In northern areas of 6000+ HDD, face stapled or separate polyethylene vapor retarders should be considered. Polyethylene or other tight, continuous vapor retarders should be used in all but deep south/Gulf Coast areas when very low permeance exterior sheathing/siding combinations are used.

Plywood is commonly used as wall sheathing for its structural capabilities. It should be noted that 1/2″ exterior grade plywood has a vapor permeance of approximately 1/2 perm. When it is used in areas that experience more than 4000 HDD, vapor retarders tighter than inset stapled kraft should be considered.

How are Condensation Problems Avoided in Cathedral (Sloped) Ceilings?

Since commonly used asphalt roof shingles have very low vapor permeance, cathedral ceilings can be likened to walls with very low permeance exterior skins. As in walls, the use of very tight, continuous vapor retarders can prevent condensation problems in cathedral ceilings. Problems can occur, however, if a vapor retarder is not continuous. Recessed lights are a typical cause of problems. To prevent loss of conditioned air around recessed lights, one can cover them with "boxes" constructed of drywall or plywood that are 3″ from the fixture. If the vapor retarder is penetrated by recessed lights that are not air/vapor-tight, some means must be provided to allow moisture to escape. This can be accomplished with eave and/or ridge vents. When both eave and ridge vents are provided, a 1/2″ or thicker airspace between the top of the insulation and the roof sheathing is desirable. This arrangement can also help remove heat in hot weather.

Note that airspaces without *both* eave and ridge vents, will not add protection against moisture condensation in sloped ceilings; air won't move through a space unless it has a place to exit as well as a place to enter.

Moisture vapor can move through many materials, including fibrous insulation, by diffusion. Therefore, moisture vapor that gets around or through a vapor retarder can exit a cathedral ceiling rafter bay through a vent opening even when an airspace does not exist. Moving air can carry lots of moisture, but air movement is not necessary for moisture to escape from buildings.

The best strategy for cathedral ceilings in cold areas would be to use a tight vapor retarder and, if recessed lights are used, air/vapor-tight fixtures. Additionally, ventilation openings at eaves and ridges should be provided. In hot areas, ventilated airspaces become more important. When ventilated airspaces are provided in milder climate areas, kraft vapor retarders are adequate.

Skylight caution:

Skylights in cathedral ceilings can create unventilated areas unless both high and low ventilation openings are provided.

Should Vapor Retarders be Used in Insulated Basements?

Research indicates that vapor retarders may not be required for basements, but it is prudent to keep moisture vapor away from cold surfaces like basement walls where they are above grade. Therefore, for water-tight walls in cool climate areas, vapor retarders are recommended. Unfortunately, not all basement walls are water-tight. While poured concrete walls are usually both water and vapor-tight, block walls are often neither. For this reason, vapor retarders are not recommended for below grade block basement walls unless they have been waterproofed as opposed to the usual "damp-proofed." Incidentally, when a vapor retarder is *not* desired, slashing a faced product's sheathing is not recommended because narrow cuts are unlikely to significantly increase vapor transmission. Facings should be removed when a vapor retarder is undesirable.

Safety Issues

Some insulation facings are intended only for installation behind ceiling, wall or flooring materials because they are flammable. NAIMA recommends that an appropriate warning statement be printed on all flammable facings:

This vapor retarder facing is flammable and should not be left exposed; cover with ceiling, wall or flooring material as soon as possible. This facing must be installed in substantial contact with the ceiling, wall or flooring material as required by building codes. Special care should be taken when working close to this facing with an open flame.

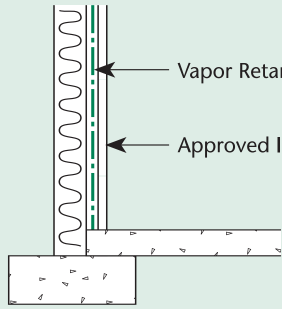
If this insulation is applied over existing insulation or between wood framing and chimneys, flues or similar heat sources, the facing should be removed. To prevent overheating of recessed light fixtures, do not insulate on top of, or within 3″ of, such devices. This warning does not apply to type IC light fixtures.

For exposed applications such as unfinished basement walls or attic ceilings, insulations with special strong, reinforced flame resistant facings are available and must be used.

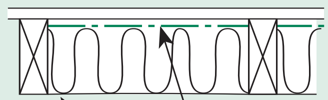
Take care to avoid stapling into electrical wiring when installing faced insulations or separate vapor retarders.

Building Section

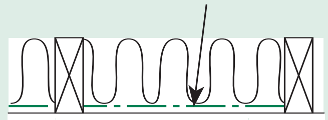
Garage wall



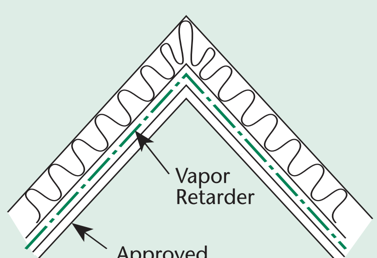
Floor above crawl space



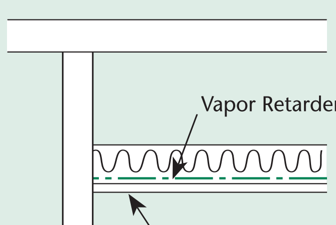
Floor of unfinished attic



Pitched roof



Roof above suspended ceiling



About NAIMA

NAIMA is a trade association of North American manufacturers of fiber glass, rock wool, and slag wool insulation products. NAIMA's role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation products and to encourage safe production and use of these insulation products.

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