below 1.5, combustion and solid-fuel burning appliances must be provided with adequate combustion and ventilation air from outside the structure in accordance with the requirements of ASHRAE Standard 62.2 Section 6.4.

Refer to Chapter 4 Section 6 of this manual for information about the ASHRAE Standard 62.2 requirements. Section 4.6.5 provides information about the requirements for Combustion and Solid-fuel Burning Appliances.

3.6 Vapor Barriers and Moisture Protection

A vapor barrier or retarder is a special covering over framing and insulation that helps protect the building envelope components from possible damage due to moisture condensation. During cold weather, the inside of the house is warm and moist (from breathing, showers, and cooking, etc.) and the outside is cold and dry. Moisture laden air will move from more pressure to areas of less pressure in a home and find its way through warmer surfaces to colder ones. When water vapor reaches a point in the wall or roof assembly that has a temperature below the dew point, it will condense. This water build up can cause structural damage, create mold that may contribute to indoor air quality problems and can cause the insulation to lose its effectiveness. Vapor barriers can be a valuable asset to a home's durability in all climate zones.

3.6.1 Mandatory Measures

§150(g) Reference Residential Appendix RA4.5.2

In climate zones 14 and 16, a vapor barrier must be installed on the conditioned space side of all insulation in all exterior walls, on the floors of unvented attics, and on floors over unvented crawl spaces to protect against moisture condensation.

If a building has a controlled ventilation crawl space (see Section 3.3.7), a vapor barrier must be placed over the earth floor of the crawl space to reduce moisture entry and protect insulation from condensation in accordance with Reference Residential Appendix RA4.5.2.

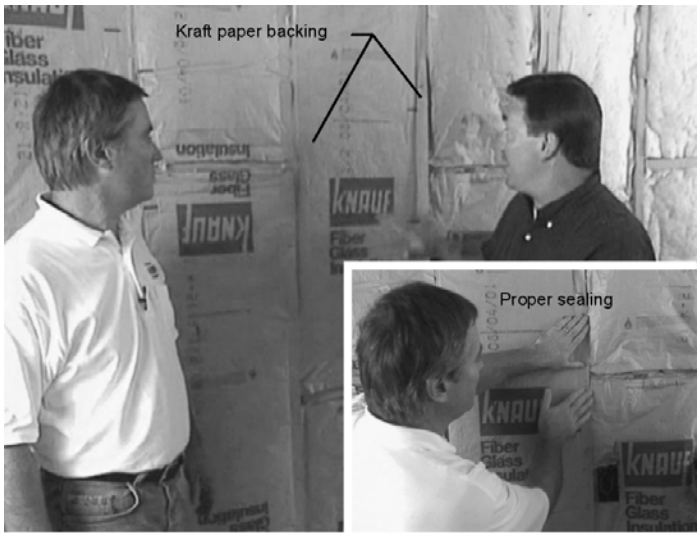
The Standards define a vapor barrier as a material with a permeance of one perm or less. The performance test for vapor barriers or retarders is ASTM E96. A perm is a measure of resistance to the transmission of water vapor and is equal to the number of grains of water vapor (7000 grains = 1 lb.) that passes through 1 sq ft. of the material in 1 hour when the vapor pressure differential between two sides of the material equals 1 inch of mercury pressure (0.49 psi). For all types of vapor barriers, care should be taken to seal and repair any tears and penetrations through the material, such as electric outlets, protruding plumbing on exterior walls, and around recessed lighting fixtures on the roof ceiling.

Examples of commonly used vapor barrier/retarder materials recognized by the Energy Commission are:

- Interior paint provided the paint product's performance and testing information shows its conformance to ASTM E96 as a vapor retarder and it is applied to the correct thickness (mil) in the field.
  - Installation: Vapor retarder paints must show proof of compliance to ASTM E96 either on the can or in the product's specification/data sheet and applied to the manufacturer's specified thickness (mil) to achieve the perm rating.
- Sheet membrane material such as 4-6 mil polyethylene or other similar tested material.
  - Installation: Membrane materials are typically installed in a continuous fashion across the plane of the framing surface with staples or glue as the fastening agent.
- Kraft-faced type insulation batts which are produced in two forms: with side fastening flanges, and without side fastening flanges. Kraft-faced batts must be installed such that the facing material is in substantial contact with the finished wall material, such as gypboard, per Chapter 7 of the CBC.

- Installation: Batt insulation must fill the entire cavity with little to no compression, side-to-side and top-to-bottom. Faced batts with flanges can be installed by: (1) fastening the flange across the face edge of the framing (i.e., face stapling; see Figure 3-28), (2) side stapling of the flange to the inside edge of the framing ensuring the edge of the flange is even with the face of the framing, or (3) friction fitting of the batt with no fastening of the flanges. Faced batts without fastening flanges are friction-fitted into framing cavities. Also see Wall Insulation in Reference Residential Appendix RA3.5 and RA3.5.4 for further insulation procedures.

- Encapsulated fiberglass or other insulation encapsulated in a poly-type material where one or more surfaces of the encapsulation material has been tested and complies with the vapor barrier/retarder requirements.
  - Installation: Encapsulated insulation products may or may not incorporate fastening flanges. Their installation is the same as for faced batt insulation products.
- Faced gyp/wallboard where the facing meets the vapor retarder requirements.
  - Installation: The faced side of the gyp/wallboard is to the inside of the framing against the cavity insulation material.



Source: California Energy Commission

Figure 3-28 – Vapor Barriers with Kraft Paper

3.7 Roofing Products (Cool Roof)

Roofing products with high solar reflectance and thermal emittance are referred to as “cool roof”, which is the outer layer or exterior surface of a roof. As the term implies, the temperature of a cool roof is lower on hot sunny days than for a conventional roof, reducing cooling loads and the energy required to provide air conditioning. Compliance credit may be taken when a cool roof is installed when using the performance approach. The credit is available only if there is no radiant barrier installed. In the performance method calculations, the cooling benefit of a cool roof is assumed to be equal to that of a radiant barrier. There is no heating impact calculated for a cool roof (while there is some heating benefit assumed for a radiant barrier).

The benefit of a high reflectance surface is obvious: while dark surfaces absorb the sun’s energy (visible light, invisible infrared. and ultraviolet radiation) and become hot, light-colored surfaces reflect solar energy and stay cooler. However,