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Vapor Barriers and Ventilation

When you install insulation — or "weatherize" your home in other ways — you may alter the movement of moisture through the walls, ceilings and floors. Signs of undesirable moisture movement are: peeling paint, water stains in the attic or an extremely damp crawl space. Trapped moisture invites decay and insects.

Moisture which gets into insulation also increases the rate of heat loss; therefore, you should control moisture as an essential part of your own energy conservation plan.

During the heating season, warm indoor air holds more moisture than cold outdoor air (Fig. 1). This creates vapor pressure inside which constantly forces water vapor out through walls and ceilings as it seeks lower moisture levels outside. When moisture levels within walls, attics or crawl spaces become high, the water vapor tends to condense on cold surfaces. In moist structures, moisture can escape to the outside, but if moisture moves into the walls, ceiling or crawl space faster than it can escape to outside air, the moisture will build up.

Here are three things you can do to control moisture buildup: (1) control humidity in the house; (2) install vapor barriers in walls, floors and ceilings; and (3) ventilate attics and crawl spaces.

Control Household Humidity

In cold climates, set your indoor controls for relative humidity in the winter no higher than 35 to 40 percent. When outdoor temperatures are 20° F or lower, reduce the humidity to less than 35 percent. Although a higher humidity might be healthier and might improve the performance of your heating system, it could cause serious condensation problems in your home. When condensation develops on insulated glass windows, you know that the relative humidity is definitely too high.

You add to the moisture level inside your home by bathing, cooking and doing laundry. These activities can raise the humidity level too high. Exhaust fans in baths and kitchens will help eliminate this moisture before it spreads through the house. Clothes dryers should be vented to the outdoors. If high humidity persists, you might consider using a dehumidifier, even in winter. This, however, would be necessary only in an exceptional situation.

If your home is too dry, use a humidifier. Set the controls no higher than the humidity that is recommended for your climatic zone. Watch the windows, and turn down the humidifier if you see excessive condensation forming on them. Major humidifier manufacturers provide a schedule of settings that are appropriate for outdoor temperature levels.

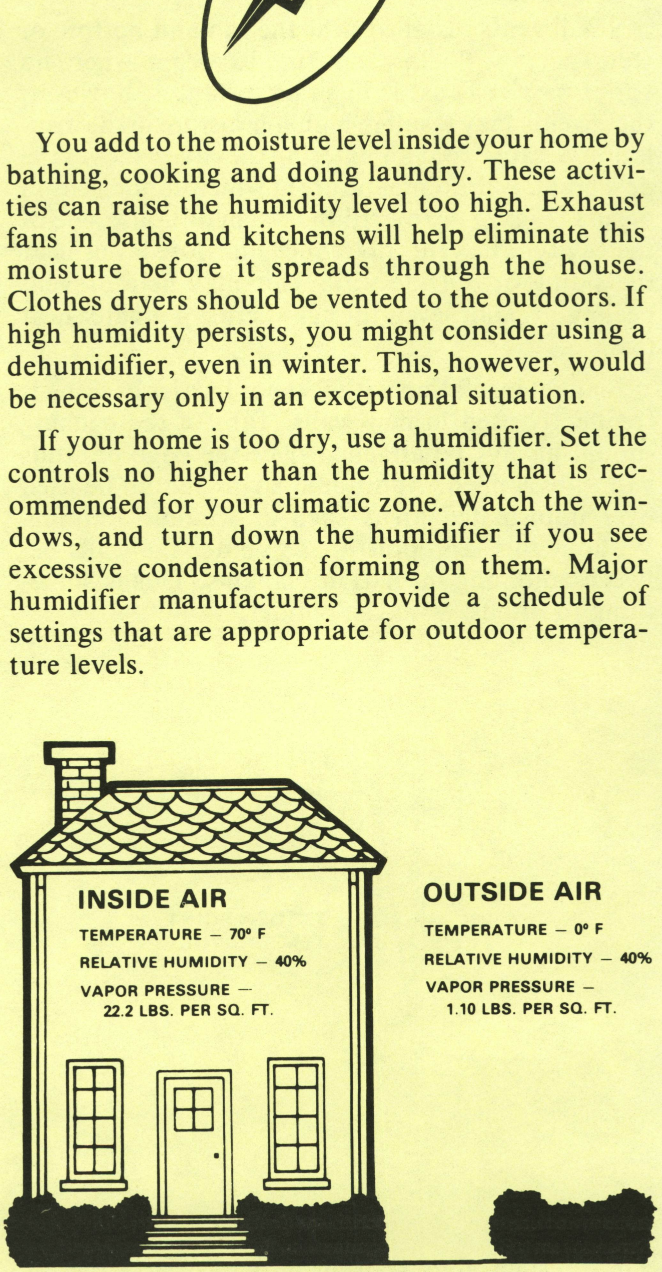

Fig. 1. Vapor pressure difference between indoors and outdoors causes the movement of moisture into the walls.

Vapor Barriers

A vapor barrier is any material that effectively slows the movement of moisture from a point of high vapor pressure to one of lower vapor pressure — such as from the inside of a warm home toward the outside cold air. Vapor barriers should always be placed near the warm side of the wall, ceiling or floor. Materials near the cold side should permit moisture to escape out of the wall or ceiling to the outside. A vapor barrier that is placed on both the inside and outside of a wall will trap moisture and invite decay.

Small vents installed near the top and bottom of stud spaces will allow moisture to escape where no vapor barrier is used. In some instances, however, these vents may result in higher moisture in the insulation because cold air entering the cavity moves the dew point — the temperature at which condensation occurs (Fig. 2) — toward the warm or house side of the cavity. The vents do reduce moisture levels near the siding or outside wall. This may help prevent peeling of paint, even though there is a greater heat loss.

Blanket insulation with a vapor barrier backing is frequently used in new walls. Tabs of the backing should always be attached over the edge of studs with tabs lapped. Additional strips should be used over uninsulated areas such as window framing. Without this lap, moisture can enter the walls between adjoining insulation blankets. This is something to discuss with the builder.

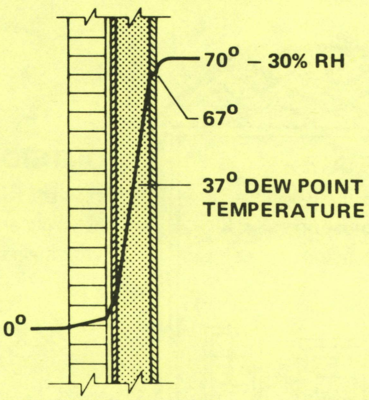

Fig. 2. Temperature gradient for an insulated wall exposed to 70°F inside air and 0°F outside air, showing dew point temperature location.

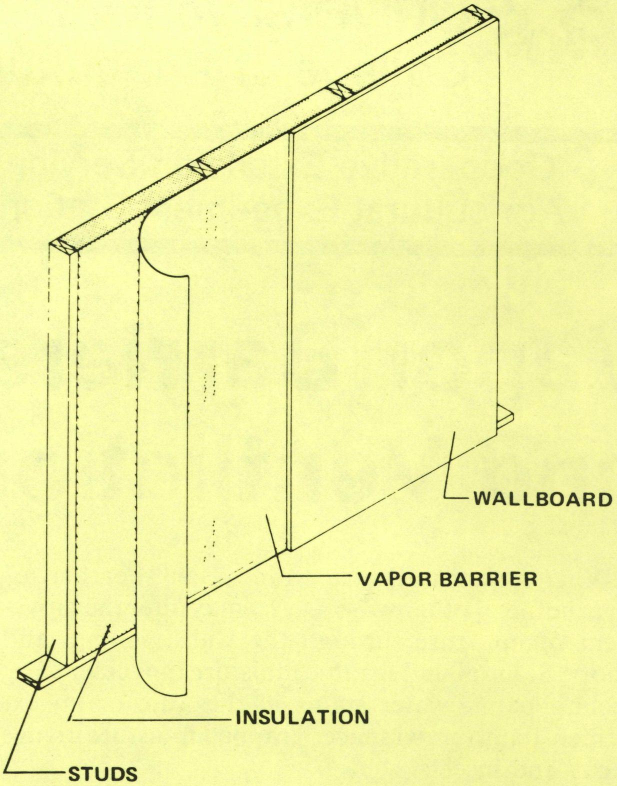

Fig. 3. Plastic sheeting used as vapor barrier for wood frame construction.

Another commonly used vapor barrier in new buildings is polyethylene film in large rolls (Fig. 3). The film is applied continuously over the inside face of studs, over the bottom of ceiling joists and on top of floor joists over a crawl space. Such a film has the advantage of being continuous, so the only gaps are where holes are cut for openings such as windows and electrical outlets. These holes should be cut carefully to prevent as much moisture leakage as possible. Unsealed electrical switch and outlet boxes can substantially reduce the effectiveness of a vapor barrier. Caulking material or spray-in insulation (available in small, pressurized cans) can be used as a sealant. Be sure the electrical power is disconnected during application.

Adding a vapor barrier to existing construction is difficult. Often, older homes have several coats of oil-based paint on the walls. These may serve as an adequate vapor barrier if you maintain reasonable household humidities. A good quality alkyd enamel properly applied can also perform satisfactorily. Some vinyl wallpapers will also act as a vapor shield. However, to be certain of an adequate barrier, add a vapor barrier to the walls and apply new paneling or other drywall over the barrier. Attics and crawl spaces can generally be vented enough to carry moisture out, so barriers in floors and ceilings are not as critical as barriers on walls.

A major source of moisture in houses can be eliminated almost completely by placing a vapor barrier over the soil in a crawl space. This prevents deterioration of floor framing because of high moisture levels and keeps moisture from moving up through walls to living areas.

Ventilation

The main areas requiring ventilation are attics and crawl spaces. In both instances, it is necessary to have a good distribution of air movement over the entire area. Attic ventilation is essential. Without it, moisture that moves through the ceiling will be trapped in the attic because most roofing materials prevent moisture from escaping. Flat roofs or cathedral ceilings also must provide for ventilation between the insulation and the roofing.

You can provide attic ventilation with inlet vents distributed along the eave and with outlet vents near the ridge. Eave vents must not be blocked by ceiling insulation (Fig. 4.). Warm air in the attic rises and escapes through the ridge vents; cooler outside air enters at the eaves (Fig. 5). Thus, the ventilation is continuous and does not depend on the wind.

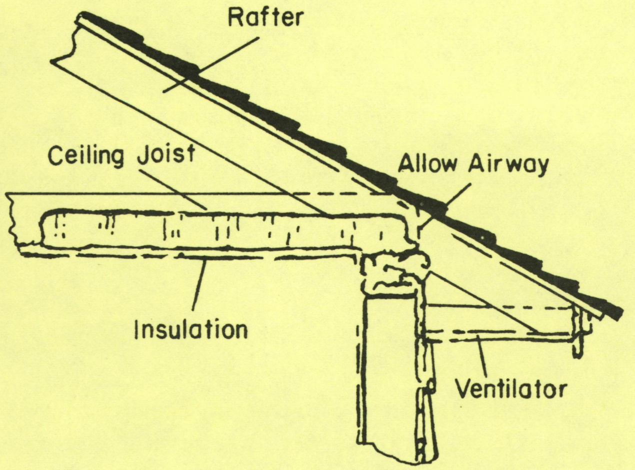

Fig. 4. Airway at eave must not be blocked by insulation.

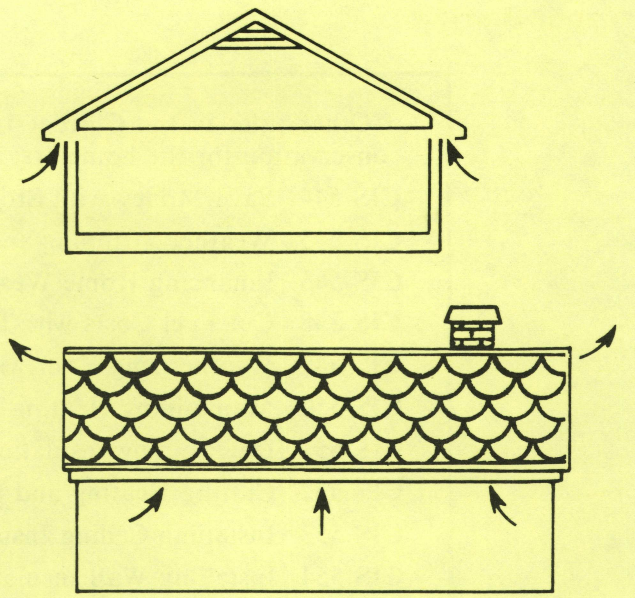

Fig. 5. Inlets at eave, outlets at ridge for good ventilation.

This ventilation also slows the melting of snow from the roof in cold climates, reducing the possibility of ice dam problems. In the summer, such ventilation reduces buildup of heat in the attic which otherwise would cause uncomfortably high temperatures in the house or at least higher air conditioning costs. For adequate ventilation, the area of inlet vents each should be at least 1/900th of the ceiling area. Outlet vents also should be at least 1/900th of the ceiling area. Where vents are provided at only one level, such as at gable ends, the total of all the vent areas should be at least 1/300th of the ceiling area.

Crawl spaces should be vented to the outdoors. If the vents are located near each corner, the vents will permit good air movement through the crawl space. The total of all the vent areas where there is no vapor barrier as a ground cover should be at least 1 square foot for each 150 square feet of floor area. Where such a vapor barrier is used, the vent area may be reduced to 1/1500th of the floor area.

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*Adapted from U.S.D.A. Fact Sheet 2-3-4. Recommended to Idaho residents by Shirley Nilsson, Extension housing and equipment specialist, and Roy Taylor, Extension agricultural engineer, both at the University of Idaho, Moscow.

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