



# Facts About Ventilation and Moisture Control

## Information from NAIMA

*In this issue, we examine attic ventilation, crawl space ventilation, and vapor retarders.*

**M**oisture accumulation within a building structure can cause problems such as water stains, ice damage, peeling paint, wood deterioration, mold and mildew. Water forms when water vapor migrates through the structure and condenses on a cool surface.

There are three basic ways to minimize potential water vapor condensation problems in attics, floors and walls:

- n Provide sufficient ventilation to reduce excessive water vapor build-up within the home;
- n Ventilate building sections so that excessive water vapor is dissipated to the outdoor air;
- n Use vapor retarders to limit water vapor transmission into building cavities.

Ventilation and circulation with outdoor air are the major moisture control strategies for attics and crawl spaces. In most parts of the country, passive ventilation is important for attics and crawl spaces, and mechanical ventilation is desirable for kitchens, laundries and baths. All of these strategies are designed to remove water vapor from the structure so that condensation will not occur.

Vapor retarders limit the migration of water vapors from warmer areas to the cold surfaces in walls, roof/ceilings and sometimes areas below floors. Vapor retarders reduce the amount of water vapor available for condensation.

## Attic Ventilation

NAIMA recommends the following widely used ventilation strategies:

- n Provide ventilation for each separate space to the outside with ventilating openings protected against the entry of rain and snow.
- n The total net free ventilating area shall be no less than 1/150 of the attic floor area if no vapor retarders are used, or 1/300 of the attic floor area when a vapor retarder having a permeance of one perm or less is used.

## Steps to Determine Attic Ventilation Needs

- n Measure area to be vented.
- n Divide this number by either 150 (no vapor retarder) or by 300 (vapor retarder in place).
- n Multiply by the appropriate factor from Table 1 (on the next page) to learn the total gross vent area needed.
- n Determine where vents will be located. (See examples in Figure 1.)  
Cathedral, flat and hip roof/ceilings with vapor retarders need a vent area of 1 sq. ft./300 sq. ft. of ceiling. Total ventilation may be achieved by placing half of the required vent area at each eave. Without a vapor retarder, the vent area should be doubled.

The most effective ventilation is provided by a combination placement of the vents with 50 percent of the area at the roof peak and 50 percent at the soffits or eaves.

**Table 1****Obstruction Chart**

TYPE OF COVERING	AREA OF OPENING
¼" hardware cloth	1 times required net free area
¼" hardware cloth and rain louvers	2 times required net free area
⅝" mesh screen	1.25 times required net free area
⅝" mesh screen and rain louvers	2.25 times required net free area
⅞" mesh screen	2 times required net free area
⅞" mesh screen and rain louvers	3 times required net free area

Caution should always be exercised to assure that ventilators are not obstructed. Blocking or baffles should be used at the eaves to keep insulation material away from soffit vents and provide a 1" free airspace.

## Net Free Vent Area

The stated vent areas for attics, roof/ceilings, and crawl spaces refer to net free areas through which air can pass unobstructed. When screening, louvers, or rain/snow shields cover vents, the area of vent openings should be increased to offset the area of the obstruction. Use manufacturers' stated net free areas whenever available. If no information is available, use the conversion factors for determining gross area of vent openings listed in Table 1. Caution should always be exercised to assure that ventilators are not obstructed. Blocking or baffles should be used at the eaves to keep insulation material away from soffit vents. Recommendations for air space between the roof sheathing and the insulation may vary. As a general rule of thumb 1" is often used. (See Figure 2.)

## Crawl Space Ventilation Recommendations

The Building Foundation Design Handbook (Labs et al. 1988) notes that ground cover membranes such as 6-mil (0.006 in.) polyethylene that restrict evaporation of soil moisture are the single most important way to prevent condensation and wood decay problems in crawl spaces. The ground cover material should have a perm rating of no more than 1.0 and must be rugged enough to withstand foot and knee traffic.

All debris must be removed and the soil should be leveled before

laying the membrane. Overlap edges 4 to 6 in., and continue the membrane up the face of the wall to the grade level if the interior grade is below the outside grade.

Traditional building practices and building codes have included provisions for crawl space ventilation. In recent years, some researchers are finding that crawl space vents may not be necessary, especially in southern climates where vents can introduce hot, humid air into the crawl space. As more information becomes available, building codes may change their ventilation requirements. The following vent area recommenda-

tions reflect the current prevalent building code requirements.

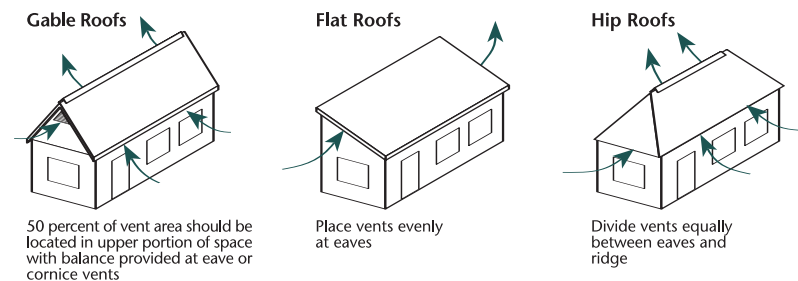
A rectangular crawl space requires a minimum of two vents, located no farther than 3 ft. from corners. The vents should be as high on the wall as possible to best capture breezes, and landscaping should be planned to prevent obstruction of the vents. The total free (open) area of all vents should be at least 1/1500 of the floor area. In the absence of a ground cover, the vent area should be increased to 1/150 of the floor area. Ventilation alone should not be relied upon where soils are known to be moist.

## Steps to Determine Crawl Space Ventilation Needs

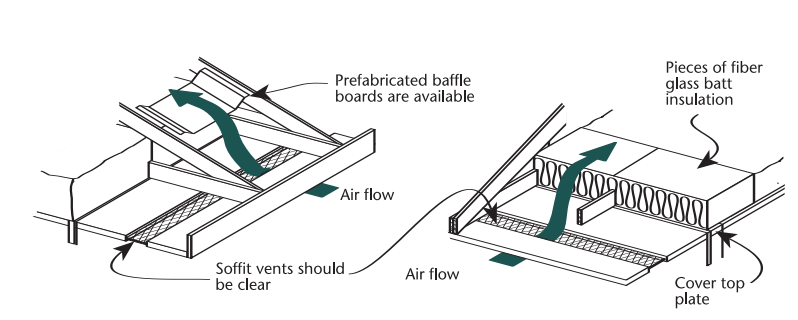
- n Measure square footage to be ventilated.
- n If ground cover vapor retarder is not used, divide the square footage by 150 to determine needed vent space. Then consult the obstructions chart and multiply venting by the number given for the type of material used.

**Figure 1**

### Location of Attic and Roof Vents

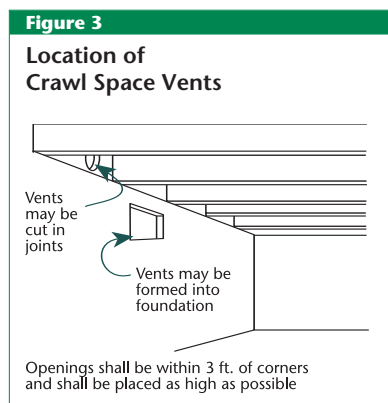
**Figure 2**

### Clearance of Eave Vents



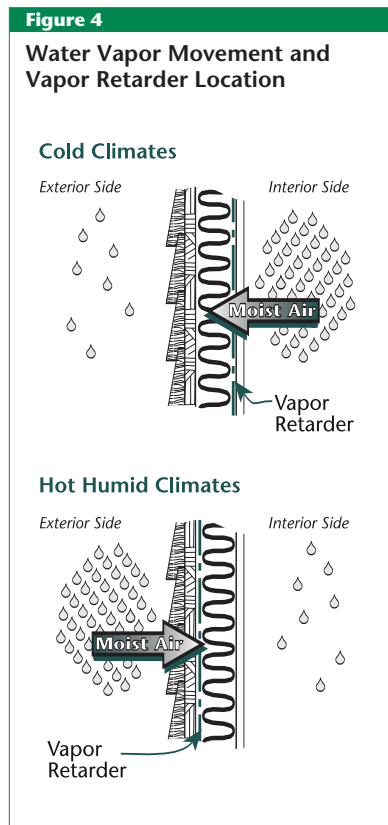
If ground cover vapor retarder is used, vented area may be reduced to 1/1500 of the floor area.

- n Determine location of needed vents. (See Figure 3.)



## Vapor Retarders

A vapor retarder (barrier) is defined by ASTM C 755 as a material that has a water vapor permeance (perm) rating of one (1) or less. The terms vapor retarder and vapor barrier are used interchangeably and describe the same materials. For consistency, the term retarder will be used here.



## What Does A Vapor Retarder Do?

Occupants of buildings, appliances, and plumbing equipment generate moisture that is carried in the air as a vapor. As moisture vapor moves from a warmer interior through construction materials to a cooler surface, the moisture may condense as water, which may damage the building. It is for this reason that vapor retarders, which retard the flow of moisture through construction materials, are installed in buildings. By locating vapor retarders as close as possible to the warm-in-winter (heated interior) surface of the building, the moisture vapor flow is restricted before it has a chance to condense to water. (See Figure 4.)

## Vapor Retarder-Faced Insulations

The vapor retarder facing should be installed toward the warm-in-winter side of the construction except where noted. This means that in ceilings the vapor retarder faces down, in walls it faces the inside, and in floors over unheated spaces it faces up. With the exception of reverse-flange insulation, the stapling flanges are on the same side as the vapor retarder. In warm, humid climates local practice should be followed regarding the use of and/or placement of vapor retarders.

*Note: The ASHRAE Handbook of Fundamentals, Chapter 23, Thermal and Moisture Control in Insulated Assembly Application, contains information on the placement and use of vapor retarders in various climates including humid climates such as Florida, the Gulf Coast, or Hawaii.*

## When Is A Vapor Retarder Required?

Good construction practice calls for installing vapor retarders in walls of all new buildings. Local building codes should be followed with regard to the need for vapor

retarders in ceilings. When it is convenient to do so, vapor retarders should be installed in existing buildings. In some cases local building codes may conflict with common building practices regarding the use of vapor retarders. Always confer with local building departments before beginning construction.

## Cautions!

Always follow these rules when working with vapor retarder-faced insulation:

- n Many facings are flammable. Because of this, when vapor retarders face building spaces intended for human use, they must be covered. These spaces include garages, storage rooms, utility rooms and laundries. NAIMA recommends that this statement be printed on all combustible facings:

*“This vapor retarder is flammable and should not be left exposed. Special care should be taken when working close to the facing with an open flame.”*

(For exposed applications, insulations with special, strong, reinforced flame resistant facings are available.)

- n Batt and blanket insulations may be installed one on top of the other in ceilings where there is adequate space. Only the bottom layer should have a vapor retarder, which should face down toward the space that is warm-in-winter. Additional layers should be unfaced. If unfaced insulation is not available, use the faced type but remove the facing completely before installation.

- n Repair damaged vapor retarders. Rips or tears in the vapor retarder facing may be repaired by covering the damaged area with scrap vapor retarder material and taping it in place or, in the case of small rips, by using duct tape or polyvinyl tape. Gaps around windows, doors and other openings

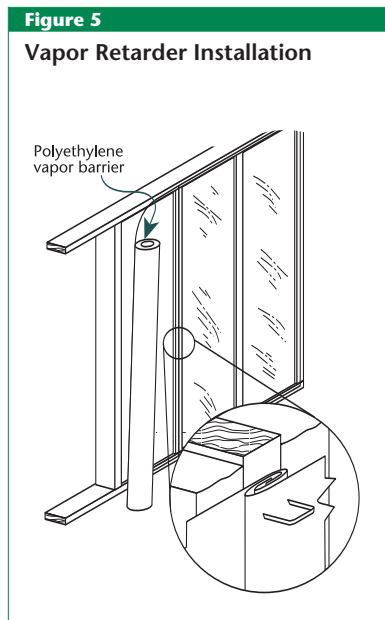
should be covered with vapor retarder facing or taped.

n Avoid electrical wiring when stapling vapor retarders or facings. Care should be taken not to staple into electrical wiring when installing faced batts and blankets or separate vapor retarders.

## Other Vapor Retarder Materials

The use of separate vapor retarders with unfaced insulation is becoming more common. They should face the warm-in-winter side of the framing. Four-mil, or thicker, polyethylene sheeting, available in rolls, is rolled out horizontally and stapled to the face of the framing, at top, bottom and the side. If one sheet of poly is not wide enough to cover the area and a second sheet of polyethylene is required, they should be overlapped on the stud space where they meet and stapled to adjoining studs.

Foil-backed gypsum board is also an effective vapor retarder. Other options for providing a vapor retarder include gypsum board manufactured with a vapor retarder or vapor retarder type paint, which may be used in renovations.



## References

For more information consult the following:

1. *ASHRAE Handbook of Fundamentals*, Chapters 20 and 23, American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. Atlanta, GA.
2. *C755-Selection of Vapor Retarders for Thermal Insulation*, ASTM, Philadelphia, PA.
3. *Covering Vapor Barriers*, NAIMA, 1988, Alexandria, VA.
4. *Mineral Fiber Batts and Blankets*, NAIMA, 1989, Alexandria, VA.
5. *Loose Fill Mineral Fiber*, NAIMA, 1989, Alexandria, VA.
6. *Moisture Control Handbook*, ORNL/SUB/89-SD350/1, Oct. '91, Oak Ridge National Laboratory, Oak ridge, TN.
7. *National Center for Appropriate Technology, Moisture and Home Energy Conservation*, 1983, Butte, MT.
8. *Building Foundation Design Handbook*, Oak Ridge National Laboratory, 1988.
9. *Builders' Manual*, Canadian Home Builders Association, Ottawa, Ontario, 1994.
10. *EEBA Field Guides for Different Climates*, Energy Efficient Building Association, Minneapolis, MN, 1997.
11. *CABO One & Two Family Dwelling Code*, 1995 Edition. The Council of Building Officials, Falls Church, VA 1995.
12. "Moisture Control Handbook," J. Istiburek, J. Carmody 1991.

Additional, more current, references suggested include the following:

9. *Builders' Manual*, Canadian Home Builders Association, Ottawa, Ontario, 1994.
10. *EEBA Field Guides for Different Climates*, Energy Efficient Building Association, Minneapolis, MN, 1997.
11. *CABO One & Two Family Dwelling Code*, 1995 Edition. The Council of Building Officials, Falls Church, VA 1995.
12. "Moisture Control Handbook," J. Istiburek, J. Carmody 1991.

## 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.

For additional information on building insulation contact:

**NAIMA**  
44 Canal Center Plaza, Suite 310  
Alexandria, VA 22314  
Tel: 703/684-0084  
Fax: 703/684-0427  
E-mail: [insulation@naima.org](mailto:insulation@naima.org)  
Website: <http://www.naima.org>

NAIMA BUILDING INSULATION  
COMMITTEE MEMBERS:

CertainTeed Corporation  
PO Box 860  
Valley Forge, PA 19482  
800/233-8990

Johns Manville  
PO Box 5108  
Denver, CO 80217-5108  
800/654-3103

Knauf Fiber Glass  
One Knauf Drive  
Shelbyville, IN 46176  
800/825-4434

Owens Corning  
One Owens Corning Parkway  
Toledo, OH 43659  
800/GET-PINK