



Moisture Control Measures

This pamphlet is one in a series that describes residential energy conservation requirements of the Oregon Residential Specialty Code and the Structural Specialty Code for Group R buildings three stories and less in height. Other pamphlets in this series may be obtained from Oregon Dept of Energy at www.oregon.gov/energy/ or local building departments or from Oregon Building Codes Division.

Moisture control measures required by the Oregon Residential Energy Code include vapor retarders in walls, floors, and ceilings without attics and a ground cover in crawl spaces and below slabs in heated spaces. Section drawings or written specifications that accompany the plans must show moisture control measures.

Along with damp-proofing and ventilation requirements, moisture control reduces moisture problems in homes and multifamily buildings.

Vapor retarder requirements

Vapor retarders reduce moisture condensation within floor, wall and ceiling cavities. Most interior finish materials are permeable. Water vapor can move through them, by a process called "diffusion," into structural cavities. If vapor diffuses into structural cavities, and if the cavities are cold enough, water vapor can condense on insulation, sheathing, or framing members. Wet insulation loses its R-value. Wet structural cavities can promote growth of damaging mold and dry rot.

"Perm ratings" indicate how well materials resist moisture penetration. The lower the perm rating, the better a material prevents moisture diffusion.

Installing a vapor retarder on the warm side of insulation prevents water vapor diffusion into the cavity. Facing on insulation is a vapor retarder. Polyethylene

sheets may serve as vapor retarders for unfaced insulation. Certain paints are formulated to act as vapor retarders. Check with your building official to be sure paints are locally accepted.

Figure 1 shows the diffusion process and how vapor retarders work.

Wall vapor retarders

Energy code requires a one-perm vapor retarder in walls. Faced insulation may meet both R-value and vapor retarder requirements. When unfaced batts or blown-in batts are used, a vapor retarder must be provided. Vapor retarder paints or polyethylene sheets are common wall vapor retarders.

Floor vapor retarders

A one-perm formulated vapor retarder is also required on floors. The vapor retarder requirement is often met by using exterior grade plywood or strand board sheathing for the floor. The exterior glue in structural floor panels typically has a perm rating of one or less. In post-and-beam floor systems, a separate vapor retarder must be installed if the vapor retarder is not an integral part of the insulation. Typically, kraft paper (rated at one perm or less) installed above decking and below finish floor underlayment serves as the vapor retarder.

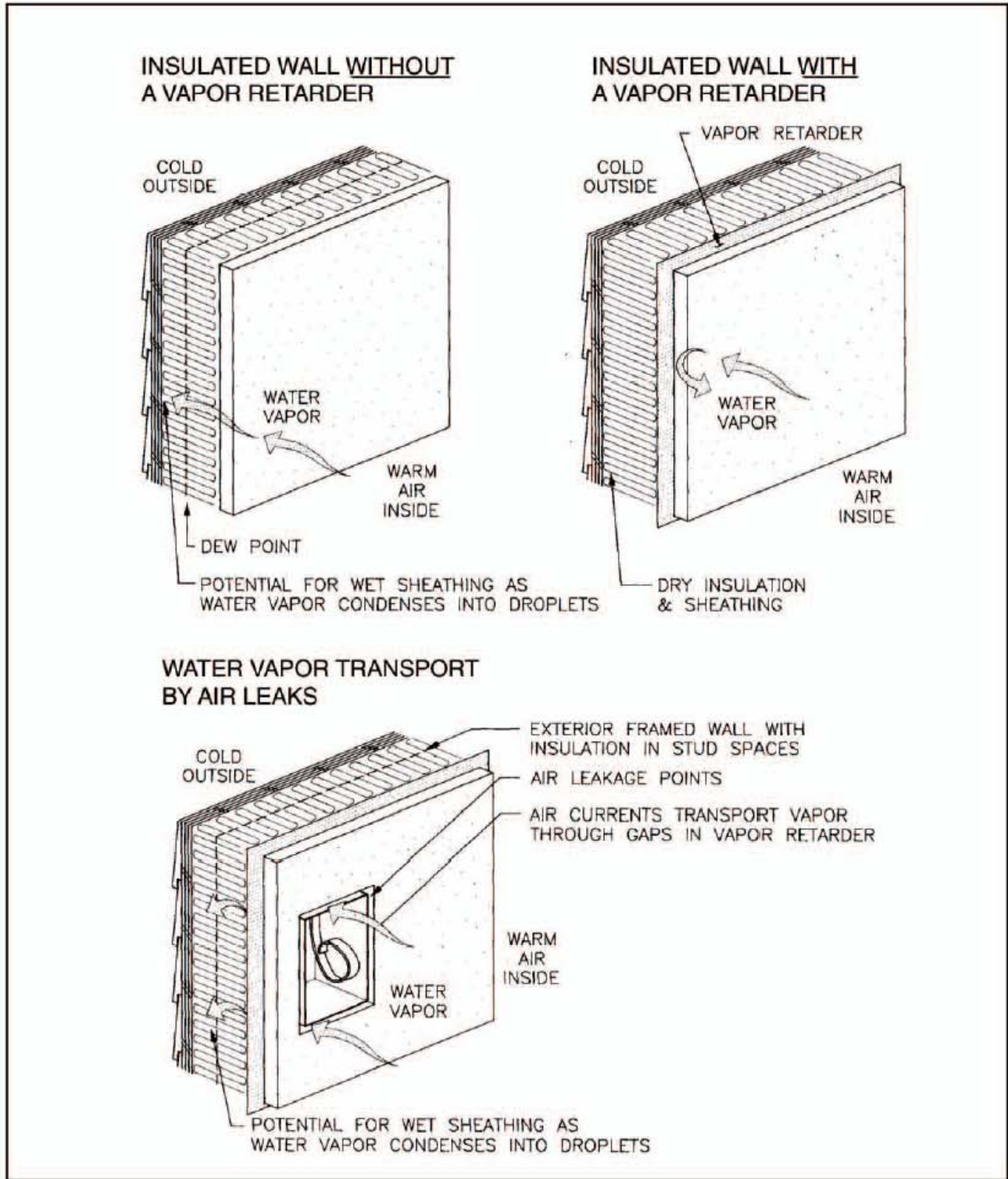
Don't confuse the floor vapor barrier with the ground moisture barrier. They are two separate code requirements.

Slab floors do not require vapor retarders.

Ceiling vapor retarders

No vapor retarder is required for ceilings with attics above them. Attic ventilation presumably counteracts moisture diffusion into the attic space.

Figure 1
Controlling Moisture Diffusion with Vapor Retarders



A 0.5 perm vapor retarder is required in ceilings without attic spaces above them, such as single rafter vaults. Polyethylene sheets meet this requirement and can be used with unfaced batts. Foil faced batts also meet this requirement. If faced batts are used, code requires that flanges be lapped and stapled at framing members to provide a more continuous barrier to moisture penetration. Some, but not all, vapor retarder paints have a tested perm rating of 0.5 or less. These paints cannot have any tint added. Tint increases porosity, reducing the paint's effectiveness as a vapor retarder.

Ground cover

Vapor retarders protect structural cavities from moisture sources inside the home. Ground covers protect the home from moisture sources in the ground. Ground covers are required in crawl spaces and below slabs. Six-mil black plastic is commonly used. Clear plastic is not permitted because it is subject to ultraviolet degradation and allows light penetration, which may allow plant growth.

The ground cover must be lapped 12 inches at all joints, cover the entire underfloor area, and extend 12 inches up the foundation wall. A ground cover of 55-pound rolled roofing or an approved equivalent must be installed below slab floors in heated spaces.

Ventilation requirements work with energy code moisture control measures

Energy code measures that control moisture work together with measures in the Residential Specialty Code (ORSC), Mechanical Code (OMSC) and Structural Code (OSSC) that address:

- Ventilation of attics (ORSC R806 and OSSC 1203.2).
- Ventilation of crawl spaces (ORSC R408 and OSSC 2516 (c)).
- Ventilation of living spaces (ORSC R303, OSSC 1203.4 [natural ventilation], or OSMC Chapter 4 [mechanical ventilation]).
- Range hoods (ORSC M1502 and OMSC 505).
- Clothes dryers (ORSC M1501 and OMSC 504.6).

Residential Code and Structural Code require waterproofing and dampproofing for below-grade walls (ORSC R406 and OSSC 1807).

Special systems

Occasionally homes will include features with exceptional potential for moisture damage. Indoor swimming pools and hot tubs are examples. In these instances, additional moisture protection measures are advisable and may be required by the code official.

Perm ratings of common building materials

Perm rating (dry cup) is a measure of the ability of a material of specific thickness to transmit moisture. It's expressed in terms of the amount of moisture transmitted per unit time for a specified area and differential pressure. Dry cup perm rating is expressed in grains/hr/ft²/inches of Hg. Permeance may be measured by using ASTM E96-72 or other approved dry cup method. The closer the dry cup perm rating is to zero, the better the vapor barrier. Permeability is permeance of a material of a specified unit length (perm/inch).

Perm ratings of common building materials

Material	Thickness	Permeance ¹	Material	Permeance ¹
Structural Materials			Paints (1 coat)	
Concrete (1:2:4 mix)	1	3.2 ²	Vapor retarder paint	0.6-0.9 ⁵
Brick masonry	4	0.8 ²	Selected primer-sealer paint	0.9 ⁵
Concrete block	8	2.4 ²	Primer-sealer	6.28
Plaster on wood lath	3/4	11.0 ³	Vinyl-acrylic primer	8.62
Gypsum wall board	3/8	50.0 ²	Semi-gloss vinyl-acrylic enamel	6.61
Exterior plywood	1/4	0.7 ²	Paints (2 coats)	
Interior plywood	1/4	1.9 ²	Aluminum varnish on wood	0.3-0.5
Thermal Insulations			Enamels on smooth plaster	0.5-1.5
Air (still)	1	120.0 ²	Various primers plus	1 coat
Extruded polystyrene	1	0.4-1.2 ⁴	flat oil paint on plaster	1.6-3.0
Expanded polystyrene	1	2.0-5.8 ⁴	¹ Values from 1981 ASHRAE Fundamentals Handbook unless otherwise noted. ² Other than wet or dry cup method. ³ Wet cup method. ⁴ Value supplied by manufacturer. ⁵ Value from Rodale Products Testing Laboratory.	
Polyisocyanurate	1 (foil face)	0.05 ⁴		
Polyisocyanurate	1 (no foil)	26.0	Perm ratings for specific paints should be verified by independent testing using ASTM E-96A or equivalent TAPPI test standards.	
Plastic Films and Metal Foils				
Aluminum foil	1 mil	0		
Polyethylene	4 mil	0.08		
Polyethylene	6 mil	0.06		
Polyethylene cross laminated high density (Tu-Tuff™)	4 mil	0.02		
Building Paper, Felts and Roofing Papers				
Saturated and coated rolled roofing		0.05		
Kraft paper and asphalt laminated reinforced 30-120-30		0.3		
Kraft thermal insulation facing		1.0 ⁴		
Foil thermal insulation facing		0.5 ⁴		
15 lb. asphalt felt		1.0		
Olefin, spunbond high density fiber (Tyvek™, Parsec™)		94.0 ⁴		

Information presented in this publication supports the Oregon Residential Specialty Code, or Chapter 13 of the Oregon Structural Specialty Code. This publication does not include all code requirements. Refer to the code and check with your code official for additional requirements. If information in this publication conflicts with code or your local officials, follow requirements of code and your local officials.

For more information about the residential energy code, call the Building Codes Division at (503)378-4133 or the Oregon Dept of Energy (503)378-4040 in Salem or toll-free, 1-800-221-8035.

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