**Understanding the Terms Barrier and Retarder for Vapor and Air**
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Vapor Retarders and Vapor Barriers

A vapor retarder is defined by the 2000 IRC as a material having a permeance rating of 1.0 or less when tested in accordance with ASTM E 96. The code goes on to require installation on the warm winter side of all assemblies – except in hot-humid climates listed on a county-by-county basis. This needs to change.

What is interesting about this definition of a vapor retarder is that ASTM E 96 has two fundamentally different test procedures: a dry cup test and a wet cup test. The kraft facing on a fiberglass batt meets the definition of a vapor retarder only if tested under a dry cup test procedure. In other words, the kraft facing is only a vapor retarder if there is no moisture, i.e. relative humidities less than 35 percent.

This is actually good for wall assemblies in cold climates and mixed climates. In the summer, interior relative humidities are typically above 50 percent and the kraft facing becomes semi-vapor permeable (in the 5 to 10 perm range) allowing the wall to dry to the interior. In the winter, if the interior relative humidities are kept low (in the 30 to 35 percent range) the kraft facing becomes a vapor barrier (in the 1 perm range). This is in essence a "smart" vapor barrier – a vapor barrier on the inside during the winter that becomes semi-vapor permeable in the summer.

Now, it turns out that latex paint applied over paper faced gypsum performs in a very similar manner to the kraft facing on a fiberglass batt.

What is required is to define vapor control measures on a more regional climatic basis and to define the vapor control measures more precisely. I propose the following:

- Severe Cold Climates: Class I vapor barriers are required on the warm winter side of all assemblies.
- Cold Climates: Class II vapor barriers are required on the warm winter side of all assemblies.
- Mixed Climates: Class III vapor barriers (or vapor retarders) are required on the warm winter side of all assemblies.
- Hot-Dry Climates: vapor barriers are not required.
- Hot-Humid Climates: Class II vapor barriers (or vapor retarders) are required on the warm summer side of assemblies that are not ventilated and are not required on the warm winter side of any assemblies.

See *Houses That Work* for a map of the Climate Zones.

## Classes of Vapor Barriers and Vapor Retarders

The unit of measurement typically used in characterizing the water vapor permeability of materials is the "perm." Materials can be separated into three general classes based on their permeability:

Vapor impermeable – referred to as vapor barriers
- 0.1 perms or less Class I vapor barriers
- 1.0 perms or less Class II vapor barriers

Vapor semi-permeable – referred to as vapor retarders
- 10 perms or less (or a class III vapor barrier)

Vapor permeable – referred to as breathable
- more than 10 perms

Materials that are generally classed as impermeable to water vapor are:
- Rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, oil-based paints, vinyl wall coverings, and foil-faced insulating sheathings.

Materials that are generally classed as vapor semi-permeable to water vapor are:
- Plywood, OSB, unfaced expanded polystyrene (EPS), fiberfaced isocyanurate, heavy asphalt impregnated building papers, the paper and bitumen facing on most fiberglass batt insulation and most latex based paints.

Materials that are generally classed as permeable to water vapor are:
- Unpainted gypsum board and plaster, unfaced fiberglass insulation, cellulose insulation, unpainted stucco, lightweight asphalt impregnated building papers, asphalt impregnated fiberboard, exterior gypsum sheathings, cement sheathings, and "housewraps."

## Air Barriers and Air Retarders

The physical properties, which distinguish air barriers from other materials, are the ability to resist air flow and air pressure. Air barriers are typically systems of materials that completely enclose the air within a building. Continuity of air barrier systems at holes, openings and penetrations of the building envelope is a key performance parameter.

Air barriers must resist the air pressure differences that act on them. Rigid materials such as gypsum board, exterior sheathing materials such as plywood and OSB and supported films such as "housewraps" installed over exterior sheathing are effective air barriers if their joints are sealed. Their rigidity aids their ability to resist air pressure differences. Often, rubber or bitumen based membranes are adhered to masonry or sheathing materials to create an air barrier system. These rubber or bitumen based membranes are also impermeable and are therefore also vapor barriers.

Not all air barriers are vapor barriers and not all vapor barriers are air barriers.

Air barriers typically define the location of the “pressure boundary” of the building envelope. The pressure boundary is defined as the location where 50 percent or more of the air pressure drop across an assembly occurs.

Materials or systems that reduce air flow or control air flow but do not resist 50 percent or more of the air pressure drop across an assembly are called air retarders.

## What This Really Means From A Practical Perspective

It means changing the definition of vapor retarder from 1 perm or less to 10 perms or less. This means that latex painted gypsum board will work as a vapor retarder everywhere in mixed climates. Unfaced fiberglass batts could be installed in wall cavities as well as damp spray cellulose.

Polyethylene would be a Class I vapor barrier. A kraft faced fiberglass batt or vapor barrier paint (a latex primer topcoated with a latex paint – i.e. two coats of paint rather than one) would be a Class II vapor barrier. Latex painted gypsum board (one coat of latex paint) would be a Class III vapor barrier.