

Air Barriers Versus Vapor Barriers

BY CARSON, DUNLOP & ASSOCIATES LTD.

WHILE WE OFTEN USE THE SAME MATERIAL to act as both an air barrier and a vapor barrier, the functions are different.

Function Of Air Barriers

Air barriers are designed to stop air movement through the building walls and roof. There are two reasons this is important:

- Air carries heat. We want to minimize the flow of building heat to the outdoors.
- Air carries moisture. This moisture may be deposited in the building structure as it cools and condenses. This can cause damage to the building.

Function Of Vapor Barriers

A vapor barrier, vapor retarder or vapor diffusion retarder (VDR) is designed to protect the building from moisture damage. A VDR minimizes (but does not completely stop) the diffusion of vapor from inside the house to the wall or roof cavity. Remember that no air movement is necessary for vapor diffusion to take place. We also said that air leakage is roughly one hundred times more important than vapor diffusion with respect to moisture damage to buildings.

As you can see, a vapor diffusion retarder has fewer functions and is less critical than an air barrier. Let's look at air barriers first.

Qualities of a Good Air Barrier

- These are qualities of a good air barrier:
- Stops air movement.

- Durable, ideally lasting the life of the building.
- Strong and either rigid or well enough supported to stay in place.
- Continuous. A bucket that is missing one percent of its bottom cannot do its job. Similarly, an air barrier that is 99 percent intact cannot do its job.
- Inexpensive.
- Resistant to moisture, rot and chemicals.

Common materials

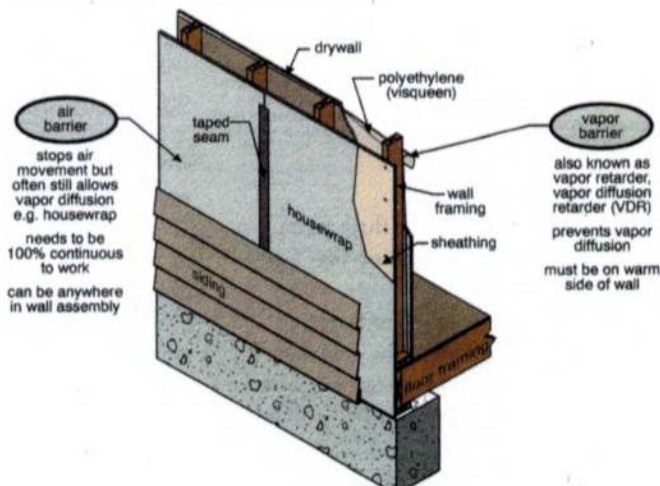
Common air barrier materials include polyethylene film and housewraps. We'll look at those first, and then look at several other materials that act as part of the air barrier system in a house, sometimes by accident.

Polyethylene - Polyethylene sheets have traditionally been provided on the inside face of wall studs and on the underside of ceilings, immediately behind the plaster or drywall. Polyethylene film is light and inexpensive to work with. It is also a vapor barrier.

Housewraps - Housewraps are typically spun-bonded polyolefin or polypropylene fabrics. These are good air barriers, but are not vapor barriers. You can think of them as a windbreaker. They will allow vapor diffusion readily, but will not allow wind to blow through them.

Foam insulation boards - Most of the foam insulation boards, including polysty-

Air barrier versus vapor barrier



rene, polyurethane, isocyanurate and phenolic board, are good air barriers as long as their seams are sealed with tape, caulking or gaskets. These are typically installed on the outside of a building.

Drywall, plaster and wood paneling -

Most interior wall and ceiling finishes are effective air barriers, but there are many gaps at the edges and penetrations through the finishes. Conventional wisdom has suggested we cannot rely on these systems as air barriers.

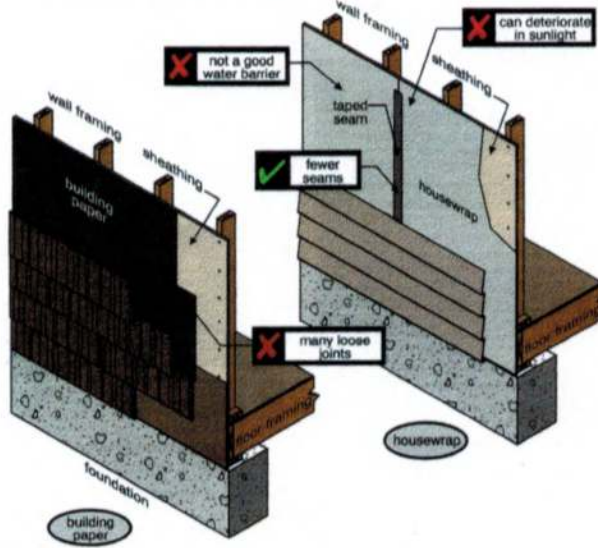
Sheathing - We've talked about plywood and OSB sheathings. We've explained how they are usually not effective air barriers because of the intentional gaps at the joints. Lumber sheathing is not an effective air or vapor barrier because of the large number of unsealed joints.

Building paper - Building paper does not perform well as an air barrier because of the many loose joints in a typical building-paper application.

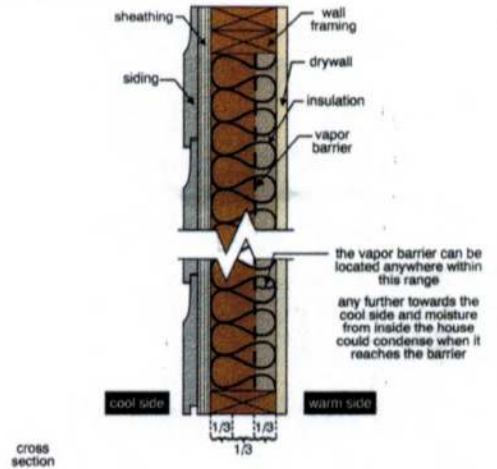
Other common air barrier materials include:

- Sill gaskets
- Gaskets for electrical boxes and plastic enclosures around electrical boxes
- Backer Rods
- Caulking and Weatherstripping
- Polyurethane foams
- Duct Tape and Duct Mastic

Housewrap versus building paper



Vapor barrier location



Vapor Barriers

Vapor barriers, vapor retarders or vapor diffusion retarders (VDRs) have a different function than air barriers, although the same materials are sometimes used for both. Let's look at the properties of a good vapor barrier:

- Vapor-diffusion-resistant
- Durable
- Moisture-and rot-resistant
- Chemically inert
- Inexpensive

Vapor Barrier Defined

How do we know if a material is a vapor barrier? Vapor barriers are described by their permeance. The unit of permeance is the perm. The lower the perms, the more effective the vapor barrier. Unfortunately, there are metric and imperial perms. An imperial perm is the number of grains of water that will move through one square foot of material in one hour, under a pressure difference of one inch of mercury. One grain is 0.002285 ounces.

Must be on the Warm Side

Vapor barriers must be on the warm side of the wall to perform their function. We said that air barriers could be on the warm side, in the middle or on the cool side of a wall assembly. A vapor retarder must be on the warm side. If the water molecules are allowed to move into a cool space, they are likely to condense. A vapor retarder on the outside will not protect the wall from moisture damage due to vapor diffusion.

Common Vapor Barrier Materials

Let's look at some of the materials that are commonly used as vapor barriers.

Polyethylene film (visqueen) - This is probably the most common material used as a vapor barrier. As we discussed, it's typically also used as an air barrier, immediately behind the drywall in wall and ceiling assemblies.

Kraft paper - Old fiberglass and mineral wool insulation batts were often faced with brown kraft paper, which is a vapor barrier.

Aluminum foil - This vapor barrier may also be used as a radiant barrier to reflect heat.

Oil-based paints and vapor-retardant paints - Many paints act as vapor barriers. Latex paints generally do not unless they are specially formulated to act this way. Varnishes and shellacs also act as vapor barriers.



Although building paper can be used as an air barrier, it is often ineffective because of loose joints



Damaged polyethylene film such as this is an ineffective vapor barrier, and an even more ineffective air barrier.

Insulations - Some insulation materials act as vapor barriers. This includes polyethylene and polyisocyanurate boards. Expanded and extruded polystyrene boards can also act as vapor barriers if they are thick enough. The same is true of foamed-in-place polyurethane and isocyanates.

Vinyl wallpaper - Vinyl wallpapers make quite good vapor barriers. This is unfortunate for people in hot climates who don't want vapor barriers on the interior of their wall assemblies.

Plywood and OSB sheathings - While these materials may or may not be quite vapor barriers in the true sense of the word, they do have fairly low perm ratings. They are almost vapor barriers. ■

Summary

We have introduced the difference between air barriers and vapor barriers, and outlined some of the common materials used. A more detailed explanation involving conditions, implications and strategies for inspection can be found in the ASHI@HOME training program



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