DRAUGHT FINDER
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Barriers - Air & Vapour

What is an Air or Vapour Barrier?

An Air Barrier or a Vapour Barrier is a control layer that is installed in a building to prevent;

1. Air from travelling through the structure, that will otherwise increase the Air permeability of the building leading to increased energy usage.
2. Vapour from entering the building wall & insulation, & as a result of a lower temperature condense within the thickness of the structure reducing the insulation performance & lead to structural damage due to rotting over time.

Air or Vapour Barriers are used within modern building constructions as part of energy conservation measures & to protect the structure.

These barriers can be used to prevent Air or Vapour, but are generally used to prevent Air & Vapour from entering the structure.

Vapour Barriers are slightly different in that they MUST stop water vapour, as a consequence they also stop Air.

Air Barriers - while they will prevent Air from passing they may <u>not</u> stop Water Vapour.

Why do we need a Barrier?

We need barriers to stop Air & Vapour from entering or leaving the Conditioned Space by passing through the Conditioned Spaces Envelope Area. This may be the whole building in a domestic dwelling or each single Apartment in a block of dwellings.

Air will find a way though any small gap, crack or fissure to enter the building. In doing so it requires more energy input to bring it up to Comfort Condition temperature.

Air inside a building will find a way though any small gap, crack or fissure to exit the building. In doing so it takes with it the energy that was used to heat to Comfort Conditions, wasting the energy used to heat the conditioned space.

As a consequence of air being able to escape (exfiltrate) from the conditioned space the water vapour carried by the air travels with it, leading to potential damage to the structure.

Water Vapour will if the temperature difference is right between inside & outside the conditioned space condense within the structures, walls, ceiling or flooring as it passes from the warm internal conditions to the cold external conditions (Interstitial Condensation). This condensed water will reduce the performance of the insulation layer & eventually start the process of rotting the structure. This happens slowly over time & will probably go unnoticed by the occupiers until a structural failure occurs.

An effective Vapour Barrier is essential if the life of the structure is to be maintained over its predicted lifespan, while an Air Barrier may not be so critical, it should be considered to be performing the same critical role. Therefore the choice of material should include the ability to prevent both air & more importantly water vapour from crossing the barrier.

The Perfect Wall

The perfect wall, roof (ceiling), or floor is an environmental separator - it has to keep the outside out & the inside in. In order to do this the wall assembly has to control rain, air, vapour and heat. Today walls need control layers. They are presented in order of importance:

- a rain control layer
- a thermal control layer
- a vapour & air control layer
- a surface finish layer

A point to this importance order thing here, if you;

- can't keep the rain out don't waste your time on the air.
- can't keep the air out don't waste your time on the vapour.

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Air & Vapour Barrier System

For this we consider that the Air & Vapour Barrier are one in the same, all the details below apply to both Barriers.

NOTE: *Please consult the manufacturers material specification sheet before using any barrier material.* ***DO NOT*** *take the information contained within the information sheet as being acceptable by Building Control.*

You ***MUST*** *satisfy yourself that the best materials is being used before installing.*

The important features of an air barrier system in a building are:

1. Continuity
2. Structural Support
3. Air Permeability
4. Durability

1. Continuity

To ensure continuity, each component serving its role in resisting infiltration, such as a wall or a window assembly or a foundation or a roof, must all be interconnected to prevent air leakage at the joints between materials, components, assemblies, and systems and penetrations through them, such as conduits and pipes. Window & Door frames should be sealed into the structure using a suitable material that may require adhesion to the wall of the structure.

2. Structural Support

Effective structural support requires that any component of the air barrier system must resist the positive or negative structural loads that are imposed on that component by wind, stack effect, and HVAC fan pressures without rupture, displacement or undue deflection. This load must then be safely transferred to the structure. Design consideration must determine adequate resistance to these pressures by fasteners, tapes, adhesives, etc.

While the air barrier requires some flexibility, ensure it is well supported. using a plastic membrane without adequate support can increase the air transfer as the rising & falling of the membrane can act like an air pump, pushing & sucking air in & out of the conditioned space!

3. Air Permeability

Materials chosen to be part of the air barrier system should be chosen with care to avoid selecting materials that are air-permeable (*allow air to pass through*), such as fibreboard, perlite board, and uncoated concrete block.

The Air Permeance of a material is measured using a test protocol and is reported in Litres/second per square meter at 75 Pa pressure, which happens to be the air permeance of a sheet of 12.5 mm unpainted gypsum wall board, as the maximum allowable air leakage for a material that can be used as part of the air barrier system for the opaque enclosure. *(Note: unpainted Gypsum board is NOT a Vapour Barrier!)*

This maximum allowable air permeance for materials is more airtight than the requirements for windows and curtain walls, but it must be remembered that windows and curtain walls are assemblies of materials and also these materials are more resistant to damage due to condensation than ordinary building materials.

It is to be expected that when fairly airtight materials are assembled together by sealing, taping screws, etc., that the assembly will leak more air than the original material that is being used as the basic material. Also, when these assemblies are joined together into a whole building, the building enclosure will leak more air than the individual assemblies joined together in the first place.

In order to achieve a reasonable end result, the basic materials selected for the air barrier must have a High Air Permeability *(High resistance to air passing through material).*

4. Durability

Materials selected for the air barrier system must perform their function for the expected life of the structure; otherwise they must be accessible for periodic maintenance, such as elastomeric paint coatings on concrete block.

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In summary, air barrier system requirements may require:

- A continuous plane of airtightness must be traced throughout the building enclosure with all moving joints made flexible & sealed.
- The air barrier system must be able to withstand the maximum design positive and negative air pressure and must transfer the load to the structure.
- The air barrier must not displace under load or displace adjacent materials.
- The air barrier material used must be durable or accessible for maintenance.
- Connections between roof air barrier, wall air barrier, window frames, door frames, foundations, floors over crawl spaces, ceilings under attics and across building joints must be flexible to withstand building movements due to thermal, seismic, moisture content changes and creep; the joint must support the same air pressures as the air barrier material without displacement.
- Penetrations through the air barrier must be sealed.
- An air barrier must be provided between spaces that have either significantly different temperature or humidity requirements.
- Lighting fixtures are required to be special low leakage gasket fixtures when installed through the air barrier or the air barrier must be designed around the fixture.
- To control stack pressure transfer to the enclosure, stairwells, shafts, chutes, and elevator lobbies must be decoupled from the floors they serve by providing doors that meet air leakage criteria for exterior doors, or the doors must have adequate gaskets.

Note: There are some common building materials that will not prevent air passing through, however there are other materials that are used in current construction methods that can and do reduce this air passage. The weak points are the joints between the same and different materials and intended openings, doors and windows and any penetrations that pass through the envelope area wall structure. There are also specialised materials that perform much better than the traditional materials.

The following material may be considered suitable for Air & Vapour Barrier use. (*subject to confirmation that they meet any applicable fire regulations in the area intended for use*)

Foil backed urethane insulation board, provided that the board is used in complete sheets and all joints are taped. At junctions to either ceiling or walls are adequately foamed, surplus cut off, & joints taped.

The foil is subject to easy damage, & as such needs protection from physical damage by covering with plasterboard or other fire spread limiting sheeting.

Provision for building services need to be made in order that cables for lighting, power, telecommunications etc can be easily be installed & repairs at a later date. Also pipework for waste water etc need to be considered when penetrating this barrier. These services made require a void to be built into the structure by cross battening after the foil board has been installed with service trucking & penetrations sealed to the foil before final fixing of plasterboard or finish layer.

Watch this video for a better understanding on the above, but be aware it is in Norwegian I think!
https://www.youtube.com/watch?v=UW-HQFU7b-w

Also if undertaking a refurbishment project, it is very difficult to obtain a continuous Barrier as it is impossible to get behind the existing junctions between walls, ceilings & floors. In this case you have to provide the best barrier you can install.

Consider using an Elastomeric paint, this paint will dry as a thin plastic film while being considered to provide a reasonable vapour barrier when applied over a suitable substrate such as a block wall or plasterboard covering. Be sure to fill all gaps before applying to support the pressure differences that may be in force over the length of time the barrier will be in place.

Trevor Clark - 07.08.2015