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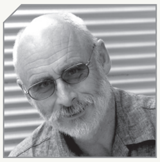

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Air barriers vs vapour barriers

An aura of confusion often exists around air and vapour barriers. So, what are they, what do they do and when should we install one or the other?

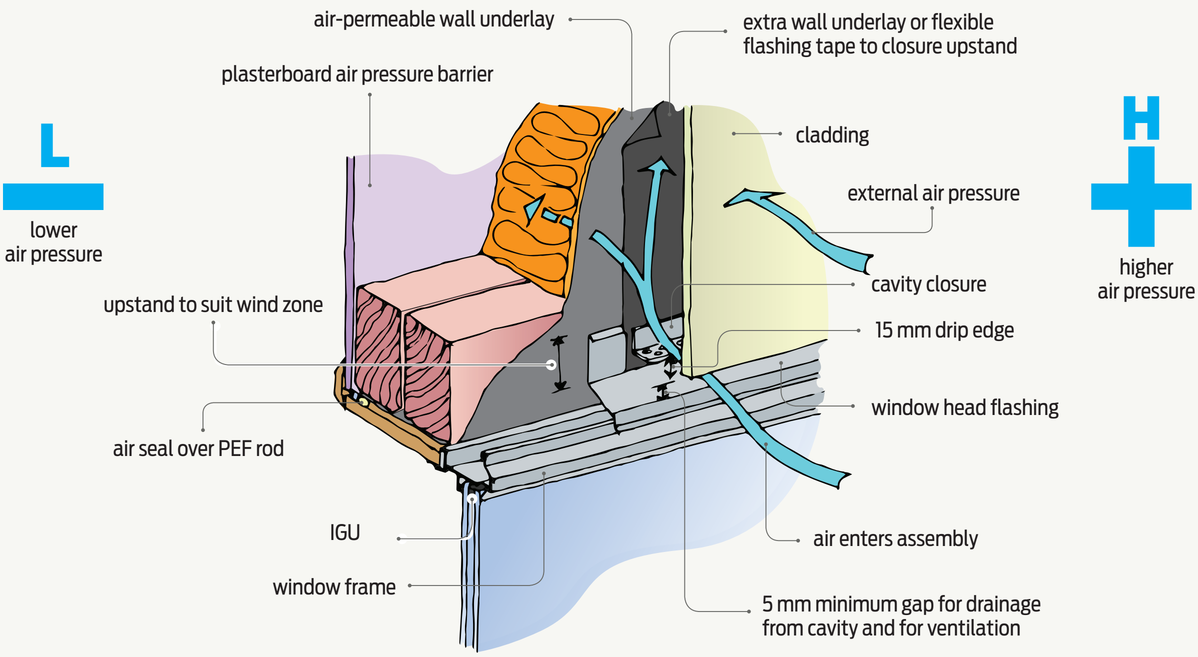

Figure 1 **An air barrier moderates the movement of outside air into the building.**

CONFUSION BETWEEN air and vapour barriers arises because air holds a great deal of moisture in the vapour form. When this air moves from location to location due to an air pressure difference, the moisture moves with it.

What do they do?

Let's start by looking at the function of these barriers:

- An air barrier stops air movement through a construction element but can still allow some migration of moisture vapour.
- A vapour barrier prevents moisture vapour moving through a construction element or material by diffusion, and because it stops the smaller air molecules, it also stops air.

For each, the driver is pressure difference – both air and vapour will move from an area of higher pressure to an area of lower pressure. For air, the pressure difference is due to drivers such as wind and temperature difference. For vapour, it depends on the amount of moisture in the air – the vapour pressure.

Air barriers in walls

A key premise of E2/AS1 is providing an air barrier component in all wall systems. This limits the risk of water droplets being carried by airflows into the wall assembly. When wind impacts on a façade, it creates a pressure difference across the assembly, and if a path exists from outside to inside, air will flow along that path. If liquid water is present, that airflow will carry the water with it.

Traditionally, the air barrier function has been provided by the internal sheet linings plus the air seals installed around windows and doors. However, the air barrier function may be provided by:

- a flexible wall underlay meeting the air barrier requirements of E2/AS1 Table 23
- a proprietary rigid air barrier installed to the outer face of the framing
- an E2/AS1 rigid wall underlay.

Air barriers in ceilings

BRANZ research has shown that, where a roof space moisture issue is present, the most significant mechanism for moisture to get in to the roof space is via air movement through the ceiling from the spaces below. The air pressure within the roof space is typically lower than that of the spaces below, and this drives an airflow that transports the moisture.

An effective ceiling air barrier is typically tight-stopped plasterboard. Where ceiling linings are not airtight (for example, tongue and groove boards or lightweight ceiling tiles), the design must incorporate an air barrier immediately behind the ceiling lining. The most common solution is to install a flexible wall underlay meeting the air barrier requirements of E2/AS1 Table 23 with the lapped joints taped.

The most common breach of a ceiling air barrier are open downlights that allow air to flow into the ceiling. Airflow may also occur where wires puncture the ceiling, unless the penetration is sealed.

Vapour barriers seldom necessary

BRANZ research has shown that, under New Zealand conditions, levels of water vapour transmission through building materials is seldom sufficient to require the installation of a vapour barrier.

Why? The moderate New Zealand temperatures, even in winter, do not generate sufficient vapour pressure differences for long enough to transport or diffuse water vapour through materials such as a plasterboard lining.

When are vapour barriers needed?

The exceptions include intermittently occupied buildings in alpine locations and enclosures around swimming pools. Solutions that include vapour barriers need to be specifically designed for these situations.

In Building Science Digest 106 *Understanding Vapor Barriers* (published by the Building Science Corporation), acknowledged Canadian expert Joseph Lstiburek writes, 'Vapor barriers are also a cold climate artefact that have diffused into other climates more from ignorance than need.'

Location of vapour barrier critical

Where a vapour barrier is installed, its location within the built element is critical – for typical habitable spaces, it must be on the warm side of the element.

Incorrectly locating a vapour barrier is likely to cause more problems than it solves. When located on the cold side of a building element, the risk of condensation forming on the vapour barrier significantly increases.

Vapour barrier materials

Materials that form a vapour barrier include:

- aluminium foils
- polythene sheet
- concrete underlays
- damp-proof courses.

To perform effectively, a vapour barrier must also be airtight as typically airflows carry moisture at a much greater rate than diffusion, which would undermine the effectiveness of the vapour barrier.

Some materials are vapour checks

To complicate matters, there are materials described as vapour checks or vapour retarders. These have a lower vapour resistance and are designed to impede vapour movement much less than a vapour barrier.

Any material with a relatively low vapour resistance can be considered a vapour check. Examples include conventional wall underlay or paint systems. Plywood and underlays with variable resistance (dependent on the relative humidity) also fall into this category.

Specifications will reveal barrier type

To clarify if a product is an air barrier or vapour barrier, check the product's specifications:

- Air barrier – a flexible or rigid wall underlay under Table 23 of E2/AS1 must have an air resistance of greater than or equal to 0.1 MN s/m^3 when tested to BS 6538-3:1987 *Air permeance of paper and board* to be considered an air barrier. Wall underlays must also be breathable – have a vapour permeability of less than or equal to 7 MN s/g (low in AS/NZS 4200.1:2017 *Pliable building membranes and underlays*).
- Vapour barrier – to be considered a vapour barrier, the material must have a vapour permeability of greater than or equal to 90 MN s/g (high in AS/NZS 4200.1:2017).