

Airtightness and Intelligent moisture management for healthy construction

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Airtightness is an essential part of creating a healthy, comfortable, energy-efficient living environment. Air leakage is one of the most significant contributors to inefficiently heated buildings. Research confirms that air leakage can account for up to half of all heat losses in modern buildings and reduce insulation performance by as much as 480%. Considering Ireland is one of the dampest and windiest climates in Europe, it's no surprise that airtightness is now seen as a fundamental element in the construction of low energy, healthy buildings. When we increase the airtightness of the building envelope on the inside with various tapes, glues and vapour control membranes, and windtightness externally, selecting a suitable membrane, perfectly sealed, in the correct location is vital,

ventilation, which is the controlled flow of air into and out of the building through a purpose built ventilation system that is required for the comfort and safety of the occupants. The term airtightness refers to the minimisation of these gaps and cracks (see Fig. 1).

As insulation levels have increased over the decades, the proportion of heat loss in buildings due to air leakage has increased dramatically. Whereas ventilation is intended, air leakage or draughts are not. The key is to "Build Tight and Ventilate Right".

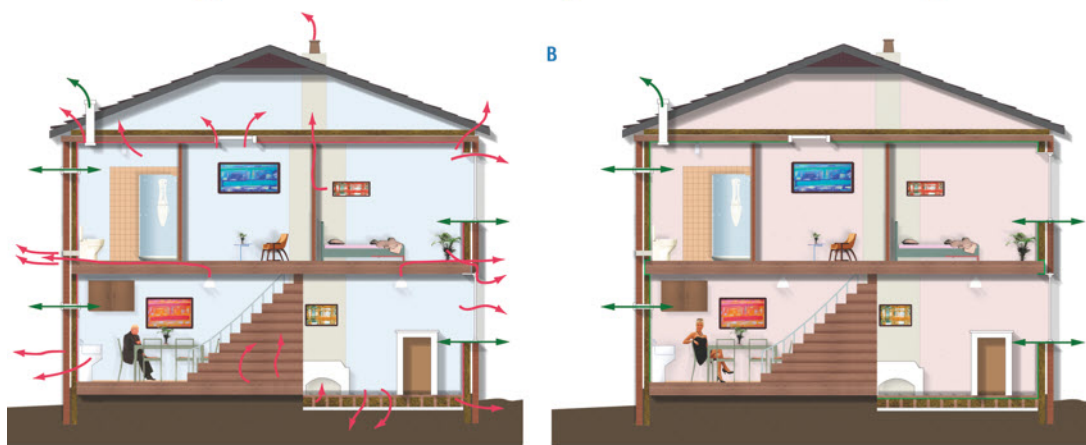
Air leakage can also lead to extensive building damage and have a direct impact on internal air quality. Air within the living space is generally 20 °C and approximately 50% humidity. Under these conditions air can maintain a large

volume of moisture. As this penetrates the building envelope in winter months; this can lead to a significant increase of interstitial condensation. Airtightly sealing the vapour control layer is detrimental for the long term durability of the construction, insulation, and of course for building health. Condensation within the building envelope presents ideal conditions for mould formation on dust and dirt or on building materials. As bad as it is to have

mould growth on the internal lining of a building where it is seen, it is much worse if it occurs unseen, within the building envelope.

While the use of more vapour permeable materials externally such as GUTEX woodfibre softboards or Solitex PLUS can reduce the risk of condensation within the building envelope, it is best to deal with the source of vapour

Airtightness, Build Tight, Ventilate Right



House with a low-level of Airtightness.
A low-level of Airtightness leads to energy leakage, increased CO₂ emissions, creating unnecessarily high energy bills, an uncomfortable living environment & structural degradation due to lack of protection from mould growth, caused by trapped moisture.

B House with a high-level of Airtightness.
A high-level of Airtightness ensures reduced energy usage, lower energy bills & CO₂ emissions, increased comfort & a healthier living environment. Long-term structural protection from moisture damage, mould growth, rot, damp & condensation is also achieved.

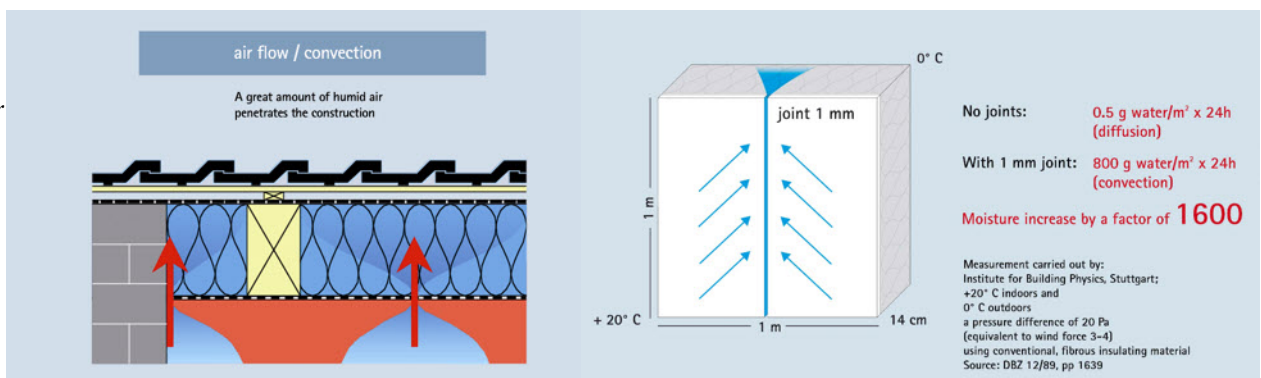
Figure 1: A leaky inefficient building and an airtight building (Red arrows indicate air leakage and green arrows intended openings)

particularly in timber based constructions.

Moisture management and timber built constructions

Air leakage is the uncontrolled flow of air through gaps and cracks in the fabric of a building (sometimes referred to as infiltration or draughts). This is not to be confused with

Figure 2: Research highlights that a 1mm tear in the vapour control layer can reduce its performance by up to 1600 times!



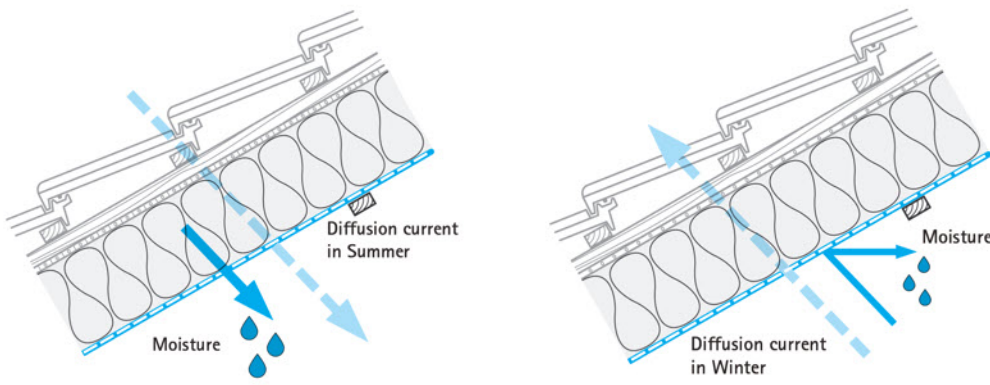


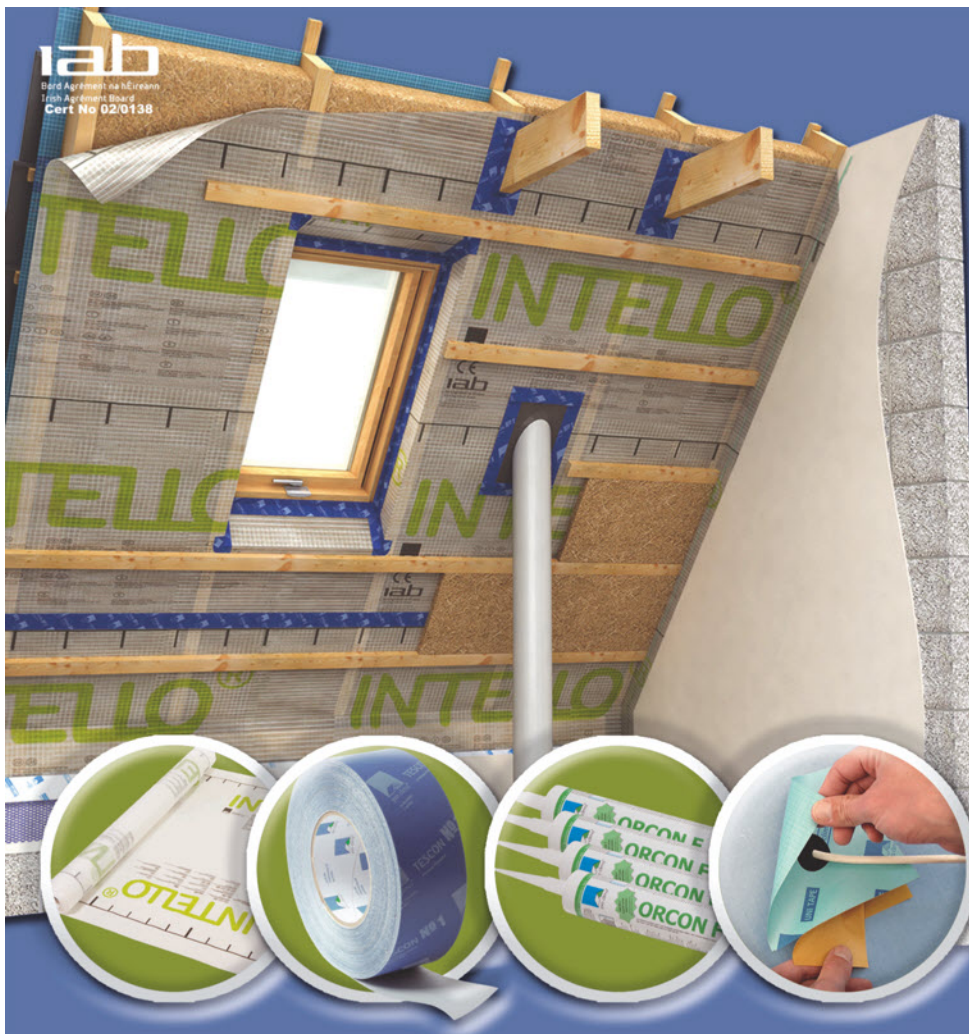
Figure 3: Temperature direction in winter and summer and seasonal vapour diffusion through Intello Plus Intelligent vapour check

penetration into the building envelope, due to air leakage. This is particularly pertinent when one considers research conducted by the Institute of Building physics in Stuttgart, where it was demonstrated that a 1mm tear in the vapour control layer can reduce its performance by up to 1600 times! A “leak” in the vapour barrier/check therefore not only becomes important from an energy perspective, but also from a moisture management perspective (see Fig. 2) While an extremely high level of airtightness is desirable, the practicalities of ensuring the complete airtightness of a vapour control layer with absolutely no tears is impossible on site. Even a Passiv Haus has some level of air leakage, be it extremely small. As the illustration highlights, even the smallest leakage in the vapour control layer can lead to a significant increase in vapour penetration.

In this way an effective moisture management strategy not only minimise vapour penetration into the building envelope in the first instance, but also, in the event of unforeseen moisture penetration into the building envelope, it can dry out as quickly as possible. Drying potential refers to the

layer. It is desirable to minimise the potential for moisture to penetrate the building envelope, however in the event of moisture penetration it should be able to dry out as quickly as possible. Intelligent membranes, such as pro clima INTELLO PLUS, ensure constructions have exceptionally high levels of safety against moisture penetration and accumulation within the building envelope, particularly in timber based constructions.

An intelligent membrane is completely air impermeable and can alter its vapour resistance / permeability depending on the direction of heat flow and the average relative humidity between both sides of the membrane (see Fig. 3). It allows vapour to diffuse through it when humidity is high within structural elements either due to seasonal change or unexpected moisture intrusion. When the average humidity is low (winter condition), the membrane resists the penetration of vapour into structural elements, preventing interstitial condensation. If the average humidity at the membrane is high (summer conditions), the membranes vapour resistance decreases substantially.



pro clima Intelligent Airtight Systems

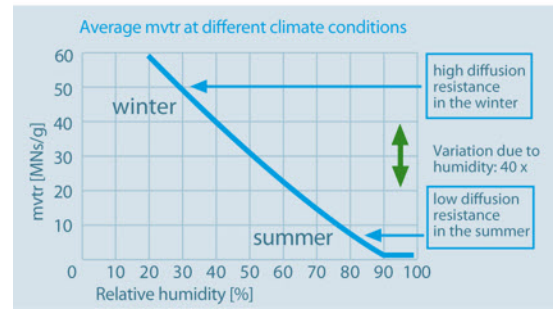
- For The Best Air Permeability Results
- The Complete Intelligent Airtight System For Premium Air Permeability Results
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 - Ensures Optimum Insulation Performance
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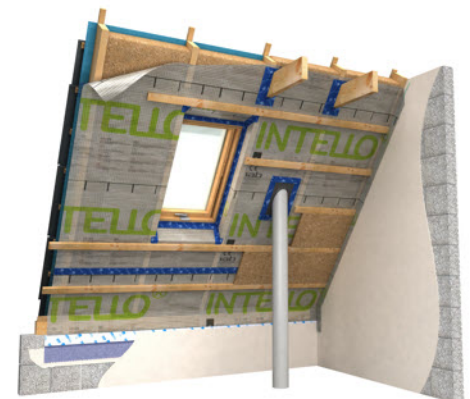
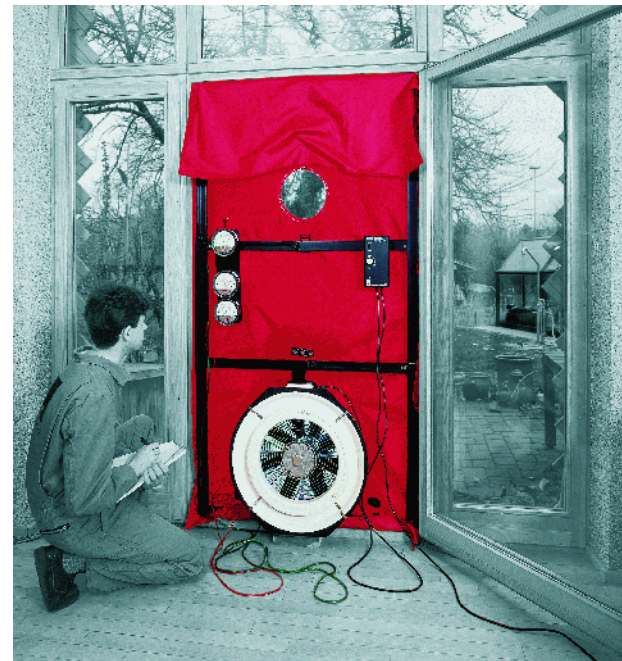
This permits drying to occur in summer months, if required and decreases moisture accumulation within the construction over seasonal periods, something traditional vapour barriers/checks cannot do. In this way, these membranes are characterised as Intelligent. An Intelligent vapour check controls the moisture which may otherwise become trapped within structural elements, even after the building is sealed airtightly and complete. The diagram (on the right) illustrates the performance of INTELLO PLUS, the world's highest performing Intelligent vapour check, over various conditions.



Even in constructions which are exceptionally vapour diffusion resistant externally and which present a high risk of interstitial condensation, such as flat roofs with an EPDM membrane, INTELLO PLUS can alleviate the necessity to ventilate these challenging constructions. This can also assist in reducing the height of buildings in built up areas, and increase the amount of insulation which can be applied in such constructions. Of course, any moisture management strategy is only as effective as the quality of the installation.

Intelligent Moisture Management and Quality Control on Site

As the blower door test is carried out when the building is complete, it is generally very difficult and much more costly to seal up leaks at this stage. Ideally, an intermediate airtightness quality assessment test should be conducted prior to the internal lining been applied. This can be conducted by using a blower door or pro clima Wincon airtightness quality control unit (photo on the right). At this stage areas where air leakage is occurring can be easily identified and sealed cost effectively. Achieving high levels of airtightness and effective moisture management is very much down to forethought & detailing in design, good building practice, and using the proper materials to achieve a durable airtight seal. Some of these details are highlighted in the selection of images shown below.



Above: A pro clima service grommet sealing a pipe penetration of the airtightness layer (left); A “service batten” on the inside of the INTELLO PLUS which reduces likely service penetrations of the membrane (middle); Overlaps of the Intelligent vapour check, INTELLO PLUS, sealed at critical junctions with pro clima airtight system proprietary seals (right)

While insulation is central to low energy construction, air and windtightness must also be central to an energy efficient design strategy to reduce unnecessary heat loss. More central to all this is living healthily and comfortably. Heat that escapes from buildings carries a significant amount of moisture. This can lead to damage to buildings and building materials, and may have a severe effect on the air quality of the living space. This is why pro clima develop a range of Intelligent diffusion open airtightness solutions to reduce the risk of condensation within structural elements and encourage vapour diffusion.

pro clima provides complete airtightness and moisture management systems including intelligent high-performance vapour control membranes, vapour permeable external membranes as well as a complete range of durable glues, tapes and seals.

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