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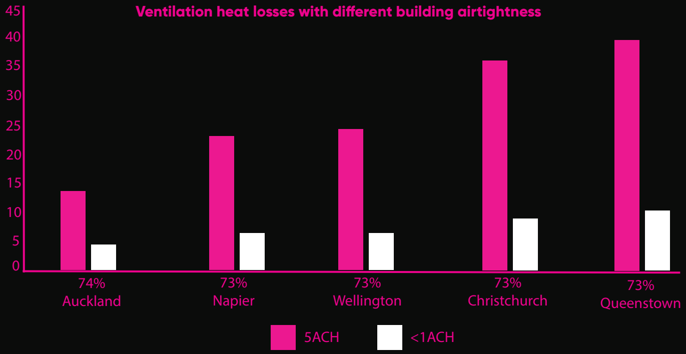
Airtightness of the building envelope

The aim of renovations and new buildings is to create comfortable living and working spaces and at the same time to increase the energy efficiency of a building. For this reason, uncontrolled energy losses should be prevented.

The limit values, i.e. the permissible air permeability due to uncontrolled, unplanned leaks, are not currently regulated, nor has there been an attempt at implementing guidance or regulations with the proposed changes.

Airtightness of the building envelope is the most underestimated aspect of building performance with effects on:

• Energy Efficiency



Energy demand for ventilation increases by 75% on average when the building is less airtight.

• Moisture protection
• Acoustic performance
• Fire performance
• Ventilation design

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Existing construction can be upgraded using suitable sealant materials and products to minimise air leakage around the building, such as:

- Silicone sealant for corners and connection details around floors, walls and installation details for Doors and windows, see images.
- Where trim can be removed temporarily a tape product can be used
- Replacing power sockets, light sockets and recessed light fittings with newer ones, such as IC Rated lights
- Where applicable replace extract fans that pose a permanent opening with newer airtight ones.

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Blower door test

The differential pressure measurement method (colloquially known as an airtightness measurement or blower door test) determines how often the air in an enclosed building is changed per m2 of building envelope by creating an artificial pressure difference. Other parameters commonly know are the air change rate, or ACH. This term comes from testing buildings to the Passive house Standard, where the internal building volume is the reference value.

Various devices are now available for carrying out the test. These are installed airtight in an opening in the outer shell (window, balcony door or front door) using an airtight tarpaulin. All doors inside the house are opened, all openings to the outside are closed. At the beginning of the test, the existing air is sucked out of the house until a pressure difference of 50 Pascal between inside and outside is reached. A connected computer determines how fast the fan has to turn in order to maintain the negative pressure in the building. Using this speed, software calculates how often the air is exchanged.

Airtight building requires ventilation strategy to match however as leakage through the building envelope can no longer be considered effective ventilation. The Airtightness Testing and Measurement Association has published a technical standard which can be referenced for residential buildings.

(i) **Table 1 – Best Practice Air Leakage Against Ventilation Strategy**

Ventilation Strategy	Best practice / Target Air Permeability ($m^3.h^{-1}.m^{-2}$ *at 50 Pa*)	Best practice / Target Air Change Rate (h^{-1} *at 50 Pa*)
Trickle Ventilators and/or intermittent extractors	3.0 - 5.0	-
Passive Stack	3.0 - 5.0	-
Continuous Mechanical Ventilation	2.0 – 4.0	-
Continuous Mechanical Ventilation – with Heat Recovery	1.0 – 2.0	-
Other	Seek Specialist Advice	-
Passivhaus Standard	-	0.6*

* See guidance in 1.4 – Passivhaus Testing   ATTMA TSL1: Table 1

A designated air (and vapour control) layer can be a membrane product (usable in all climate zones) or a rigid board product such as OSB (Oriented Strand Board, applicable in some climate zones).

A vapour barrier, or infrared reflective foil material is not suitable in most climates and should only be used with further expert advice. Vapour barriers are applicable in more extreme weather conditions with temperature gradients usually larger than 20° C, e.g. North America (Canada), or in cold store situations.
They should be avoided in residential construction across the New Zealand Climate Zones.

Installation examples new Houses:

Vapour Variable Control Layer

OSB, Oriented Strand Board

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