Air tightness and ventilation

Energy is not only lost through walls and roofs, but also through buildings being un-necessarily draughty and leaky. This increases energy bills, making them more costly to heat and increasing their carbon footprint.

Houses need ventilation to ensure the internal environment remains healthy for its occupants - pollutants from us and our activities (such as CO_2 and Volatile Organic Compounds) need to be removed, together with water vapour. Persistently excessive amounts of moisture in air can result in condensation, trigger mould growth, increase dust mite activity and have implications for health.
Ventilation also prevents the build up of moisture in building fabric, such as timber joists which may lead to decay of attack by insects. However, this fact sheet considers only the ventilation of occupied rooms rather than areas such as sub-floors or roof voids where ventilation must carry on un-heeded.

But what is ventilation?

A building is not only ventilated through open windows, trickle vents and extractors in use but also through the building fabric, such as gaps in windows and doors, up between floor boards from voids below and through walls, especially where there is plaster missing. These are examples of *infiltration.*
In older buildings, a significant amount of air is drawn through the building by open chimneys, whether in use or not.

How much ventilation do buildings need?

This is going depend on a number of factors:

- How many people live in the house and their lifestyle of the occupants - like whether clothes are dried indoors
- The construction and type of building materials used
- Any inherent building moisture problems such as rising damp
- Use of boilers or stoves.

Despite the UK having around 6 million homes which were built before 1919, there is little knowledge about how the ventilation needs of these buildings differ from modern homes. However, there is some research currently being undertaken by bodies such as Historic Scotland, English Heritage and the Society for the Protection of Ancient Buildings (SPAB) into how older buildings perform (references overleaf).

How much ventilation is a particular house currently receiving?

The amount of deliberate ventilation is going to depend on how often windows are opened and whether extractor fans are fitted and used in kitchens and bathrooms. This will be supplemented by air being drawn by any open chimneys or flues.

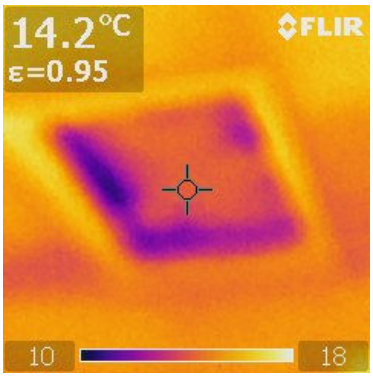
With respect to infiltration, this can vary dramatically and just because you live in an older house, you should not assume it is more “leaky” than a modern one – in fact a Building Research Establishment study concluded buildings constructed between 1930 and 1980 had more infiltration than Victorian houses.

It is likely that most older homes receive their ventilation from draughts and air flow through cracks and gaps in the building fabric. If you are going to increase the air tightness, you need to make sure there is still enough ventilation to maintain a good indoor air quality.
A way of quantifying the level of infiltration is by performing an air permeability or blower door test. The result is measured in m^3 per hour per m^2 of total building envelope ($m^3h^{-1}m^{-2}$ @50Pa) or air changes per hour.
This test is a requirement for new build houses and can identify where the main infiltration points are in an older home undergoing refurbishment (using either thermal imaging or smoke pens), allowing problem areas to be targeted.

Basic steps to reduce energy loss through excessive ventilation in older houses:

There are a number of things you can do at minimal cost:

- Try to reduce how much moisture you produce in your home – like trying to dry clothes outside wherever possible – a family can put up to 15kg of water **per day** into the air in their home!
- Make sure you use the extraction from your kitchen and bathroom or you get into the habit of opening the window when cooking / bathing.
- Unused chimneys – reduce the air flow through using a chimney balloon or a bung of newspaper/rags
- Draught proofing – a key part of reducing infiltration is attention to detail and much can be done on a DIY basis:
    - Ensuring windows and doors are draught proofed including letter boxes
    - Sealing gaps between floor boards and around room edges
    - Draught proof and insulate loft hatches – the thermal image shows cold air coming in around a loft hatch
    - Pay particular attention to where waste pipes go through walls and floors as there may be gaps around them.



However, always ensure there is adequate ventilation to provide good air quality and supply for any heating appliances.

Information on draught proofing available at http://www.energysavingtrust.org.uk/In-your-home/Roofs-floors-walls-and-windows/Draught-proofing

If a major refurbishment of a property is being considered, further measures action be taken to reduce unwanted air flows, but these will vary between buildings and a blower door test would be advised.

Different forms of mechanical ventilation

Mechanical ventilation may improve the living conditions in homes and perhaps reduce energy bills, but most of them rely on the fact that the building has been made relatively air tight before they are installed.

In addition to opening windows, trickle vents and extractors, other forms of mechanical ventilation include:

- Single room heat recovery units – fitted like an extractor fan, but with a heat exchanger to recover heat from air being extracted and transfer it to the air being pulled into the house.
- Positive input ventilation -air is pushed into the building as a whole, forcing moist air inside the building to leave through the infiltration points.
- Whole house ventilation – where the air supply and extract from rooms in controlled mechanically
- Whole house mechanical ventilation with heat recovery (MVHR) – control of the air supply and extract, with heat from the outgoing air recovered and used to heat the cooler incoming air in winter.

To save money on heating bills by using MVHR, it is widely held that air permeability should be less than 3 $m^3h^{-1}m^{-2}$ @50Pa and ideally 1.5 $m^3h^{-1}m^{-2}$ @50Pa.

If the infiltration is greater, the air may not be travelling the designed paths and may not prove as effective as it should be - though it will remove moisture problems from kitchens and bathrooms, it will prove an expensive way of achieving this – in this instance, installing or improving extraction would be considerably cheaper.

Where can I find out more information?

Information on draught proofing available at http://www.energysavingtrust.org.uk/In-your-home/Roofs-floors-walls-and-windows/Draught-proofing

Air tightness in new homes – information available at http://www.energysavingtrust/Publications2/Housing-professionals/Insulation-and-ventilation/Achieving-air-tightness-in-new-dwellings-case-studies-2007-edition

Ventilation in older buildings – *Indoor environmental quality in refurbishment* – report available at http://www.historic-scotland.gov.uk/technicalpaper12.pdf

Study of a group of older dwellings - *SPAB Building Performance Survey Interim Report 2011* – report available from www.spab.org.uk

Information on ventilation and condensation in Lakeland dwellings – research information available from www.greenfootstepscumbria.co.uk

Information on ventilation equipment available from HEVAC Residential Ventilation Association – www.feta.co.uk

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