Airtightness FAQ

An advance diagnostic test, ahead of a final airtightness test seems a good idea, particularly to identify any weakness in repeating details/workmanship.
However, the building is often not fully airtight at this stage.
Smoke pencils? Other tips?

As soon as you are aiming for a good level of airtightness, it is wise to also carry out a preliminary airtightness test rather than just a single acceptance airtightness test when the dwelling is finished. This certainly applies to Passivhaus projects (target ≤0.6 AC/hr @ 50 Pa for newbuild, ≤1.0 AC/hr @ 50 Pa for refurbishment projects) or the AECB Building Standard (≤1.5 AC/hr @ 50 Pa) and commonly when an Air Permeability target of ≤3.0 m3/hr/m2 @ 50 Pa, is specified for a sample dwelling being tested when similar dwellings are not being tested (because in that case you add 2 to the measured Air Permeability to apply to the similar non-tested dwellings).

Essentially it is too dangerous to undertake a single acceptance airtightness test in such circumstances - the risk of failure with consequent delays and often significant additional costs is too high.

Preliminary airtightness test should be carried out when the elements forming the airtightness envelope are accessible. Many of them are routinely airtight - concrete floors, glass windows and doors, CLT (cross-laminated timber) walls and ceilings, masonry walls that are wet plastered or have one of the airtight paints, such as Blowerproof, professionally applied. But there are generally interfaces between elements, or penetrations through elements, where the airtightness can go wrong.

As an example, I failed a Passivhaus project on yesterday. This property had four socket boxes flush mounted into a polished concrete floor - and there was a lot of air around these units. This wasn't something that was immediately fixable - there was a delay on the surrounds. With hindsight, the contractor would have been wiser to postpone the test. We also found substantial leakage on some large sliding glazed doors. The contractor was able to reduce this substantially by adjusting them whilst I was on site - but not enough to achieve a satisfactory level of airtightness. The final result was 0.7 AC/hr @ 50 Pa, which was gutting for the contractor, but that is why you carry out preliminary testing at an earlier stage.

When searching for leaks, usually whilst a building is depressurised, I start by using the back of my hand to search for leaks. Because of my experience and years of practice, I am certainly more sensitive to small draughts than many people, but most people can find gross leaks - it depends on the airtightness target that applies and therefore how small the allowable leakage has to be.

After direct physical inspection, I might use non-toxic smoke to search for leaks, although it is actually aimed at making leakage visible to the contractor who has to fix it. My preferred approach, provided there is a sufficient temperature difference between the internal volume and the eternal environment (at least 10 degrees, ideally 15 degrees) is to use a thermographic camera (infra-red) to check for temperature differences. Usually we look internally whilst the building is depressurised, sometimes we will look externally whilst the building is pressurised as well, especially when we are investigating major defects that are buried in the wall or roof build-up.

The beauty of thermographic inspections is that the air leakage cools (if looking internally) the surfaces around the leak. So, if you are patient, the leaking cooler external air becomes visible not of itself, but because the surfaces adjacent to the leak show a significantly reduced temperature differential. This is particularly useful in very airtight dwellings, Passivhaus or other, where the actual leaks may be so small as to make them difficult to find by direct inspection.

On occasion we will also compare a thermographic image of a building as found, with another image of the same location after a pressure differential has been applied for 20 minutes or so. In this case, if the image appears identical or nearly so, then any significantly colder spots (if looking internally) will generally be due to failures of insulation - for example the dots of fixative behind a sheet of plasterboard drylining will often show up, or timber joists in an insulated roof can commonly be discerned.

However, if there is a significant difference in the thermographic images of a particular location between unpressurised and pressurised, then this strongly suggests that significant air leakage is taking place.