Air Tightness:

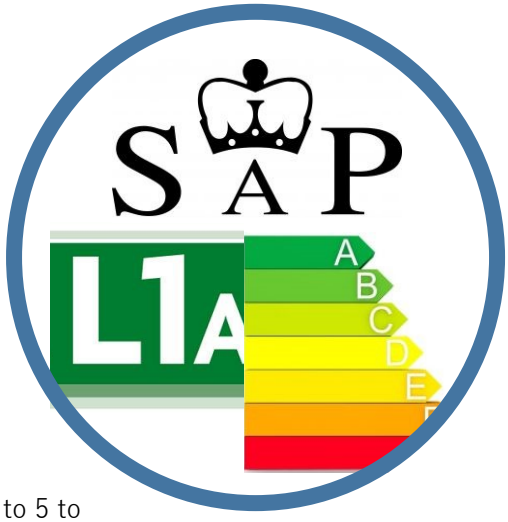
Guidance for Housebuilders

Introduction

Essentially, air tightness is about improving energy efficiency by **reducing draughts** to minimise loss of heated air and ingress of cold air. Air tightness is determined by a pressure test on the building which is a requirement of Approved Document L1A of the Building Regulations. **Testing will almost certainly be required** on all new build houses and flats as, following a series of improvements to the overall energy targets, sampling or exceptions for one-off builds tend not to be applicable.

Achieving air tightness is generally not rocket science but **requires consideration in the design and awareness throughout the construction process**. It is important not to assume that air tightness can be addressed at the end of the build or there is the risk of delays and/or unforeseen costs in adding extra energy saving measures to achieve Part L.

Design



Know the target. This will come from the Design SAP calculation of the overall energy performance of the building. Air tightness (or air permeability) tends to be determined once all the known factors that affect energy efficiency have been accounted for (insulation, heating, lighting, etc). The Regulations set the maximum air tightness as 10m ^{3} of air leaking through every square metre of the building envelope (the surface area) every hour at a pressure difference of 50Pa, which is basically pretty leaky. In practice, most buildings need to achieve closer to 5 to make the SAP calculation add up and, in some cases, tighter performance is needed or specified.

Air tightness should be **balanced against ventilation**, air 'tightness' of 5 or above is still relatively leaky and natural ventilation, trickle vents and extracts should provide the necessary ventilation to avoid any air quality issues. Air tightness of less than 5 may require mechanical ventilation to ensure that the appropriate levels of air circulation are maintained. There are no hard and fast rules but air tightness and ventilation should be considered together to make sure that improved energy performance isn't achieved at the expense of air quality.

Insulation should work in tandem with air tightness but achieving one does not guarantee the other, so it is important not to assume that the air tightness will be achieved because a lot of Insulation has been installed e.g. mineral wool insulation allows air to pass through it.

Theoretically, achieving a continuous air barrier is simply about ensuring there is a seal between walls and floors/ceilings and around anything that goes through the wall/floor/ceiling (services and openings). Air tightness is typically more difficult to achieve in smaller units (with less envelope area) and/or buildings with more 'interesting' designs which may have more complex junctions:

Target	Design Considerations
8-10	This should be relatively simple to achieve but it is still worth considering whether there could be any issues in creating a seal between walls and floors/ceilings
5-7	This is the most commonly required level of air tightness currently and can be achieved by sealing visible gaps and holes during the construction, However, a review of the design is advisable to ensure there is awareness of potential problems at an early stage e.g. areas that may be hidden or inaccessible at the end of the build (which may prevent sealing of them if not carried out at the appropriate time), potential details that may complicate the air barrier and allow air to bypass sealing e.g. integral garages, warm roofs, chimneys, etc. It is important that any air tightness measures are understood and communicated to the relevant parties.
3-5	It is recommended to draw a red line on drawings to identify the location of the air barrier and confirm that it is made up of impermeable materials and is continuous, it may require specific details to clarify how elements of the barrier are joined together. At this level, it is advised to avoid reliance on the final finish of dry lining. Where possible, the air barrier should be created behind plasterboard (if the walls are being lined rather than wet plastered). For example, parge coat of block work and seals between wall and floor/ceiling/roof and around doors/windows/ services (using flexible, airtight sealants/foams and/or EPDM for masonry construction and membranes/tapes/EPDM on timber frame construction. Communication is key of what needs sealing, how, when and by whom.
Less than 3	At this level, air tightness needs careful consideration from first principles, in addition to the above considerations, specialist products (tapes, grommets, putties) or methods may be needed, as well as a defined strategy regarding who is responsible for achieving/maintaining air tightness. Achieving air tightness at this level is challenging and potentially time-consuming to achieve especially on more complex designs so requires commitment from all parties from the outset.

Build

Even with the best air tightness design, the build is still key in achieving air tightness, again awareness, attention to detail and timing are key:

Target	Build Considerations
8-10	Unless any concerns were identified during the design, it should be a case of simply completely, finishing the building, with all services fully fitted and sealed and no obvious gaps.
5-7	Timing is key, typically problems result from key leakage paths not being sealed when they are accessible (e.g. SVP behind kitchen units, behind bath panels or under shower trays). A common air paths is leakage around the bottom of the plasterboard which is then able to move behind the dot and dab and move into cavities and floor spaces allowing escape through openings in the wall or via ventilated roof spaces. Typically, this is addressed by mastic sealing of skirtings but it would be preferable if a continuous ribbon of plaster is run around the edges of each board. Attention to detail is important, areas being partly sealed is often not sufficient – an area that is 90% sealed won't stop 90% of the air, it is likely that air will escape at a much higher flow rate through the gap that is left. Then it is down to everything being finished and fitted before the test is undertaken.
3-5	Hopefully, the design will have addressed the most significant leakage paths and a solution for each while maintaining continuity between the different elements that make up the envelope. Therefore, the key is communication (to all the relevant trades) and timely checking of work to ensure everything is appropriately sealed before being closed off.
Less than 3	Further to the above, it is recommended to have a 'strategy' related to air tightness with a 'champion' on site to take responsibility for seeing it through. At this level, relatively small leakage points can be more significant (especially in smaller units).

Testing

The test involves creating a pressure difference using a fan (typically installed into a doorway) and measuring how much air is required to create this pressure difference. This allows calculation of the amount of air leaking across the envelope area. The test typically only takes a few minutes but preparation is required in advance of the testing, including sealing of ventilation, installation of the equipment, calculation of the envelope area and measurement of the environmental conditions.

If the design and construction have been undertaken with air tightness in mind the test should be done at the very end of the build to get the best result. if there are doubts over the air barrier or a very low score has been targeted, it may be worth considering undertaking one or more preliminary tests to confirm everything is on track at an earlier stage or following completion of key aspects of the air barrier. A final test needs to be done when all services are in place for regulatory purposes.

If the required air tightness is not achieved, it should be possible to diagnose the air leakage paths by using the fan to draw air through gaps and cracks and/or by using smoke to identify where air is going and/or escaping.

Air testing should be conducted by a member of competent person scheme (e.g. ATTMA)

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