



Improving airtightness
in dwellings



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Introduction

Home energy use is responsible for 28 per cent of UK carbon dioxide emissions which contribute to climate change. By following the Energy Saving Trust's best practice standards, new build and existing housing will be more energy efficient and will reduce these emissions, saving energy, money and the environment. Air leakage from buildings, both new build and existing, is a major cause of energy loss and increasing emissions.

Improving airtightness in dwellings will reduce air leakage – the uncontrolled flow of air through gaps

and cracks in the fabric of dwellings (sometimes referred to as infiltration, exfiltration or draughts). This is not to be confused with ventilation, the controlled flow of air into and out of the dwelling through purpose-built ventilators that is required for the comfort and safety of the occupants. Too much air leakage leads to unnecessary heat loss and discomfort from cold draughts. With more stringent building regulations requiring better energy efficiency, airtightness is an increasingly important issue. The aim should be to 'build tight – ventilate right'. Buildings cannot be too airtight; it is, however, essential to ensure appropriate ventilation.

Table 1 Air permeability

Ventilation system*	Maximum air permeability (m ³ /h/m ²)	
	Good practice	Best practice
Dwellings with whole house mechanical ventilation (with or without heat recovery)	4	3
Dwellings with other systems	7	3

* More information on ventilation systems can be found in GPG268 – see back page for more information.

Air leakage is quantified as air permeability. This is the rate of leakage (m³/h/m²) in or out of the dwelling. It is measured at a reference pressure difference of 50Pa between the inside and outside of the dwelling. In the UK the good and best practice standards for air permeability in dwellings are shown in Table 1.

However, in a recent study of 100 new dwellings of all types in England and Wales, none achieved the best practice performance of 3m³/h/m². The research, undertaken by the Energy Efficiency Partnership for Homes (EEPfH), showed that around a third even failed to achieve the worst acceptable permeability (10m³/h/m²) expected in the new building regulations for England and Wales and Northern Ireland. Less than 20 per cent of these dwellings tested met the good practice standard of 7m³/h/m². More information on the results of this study can be found on the website: www.est.org.uk/partnership

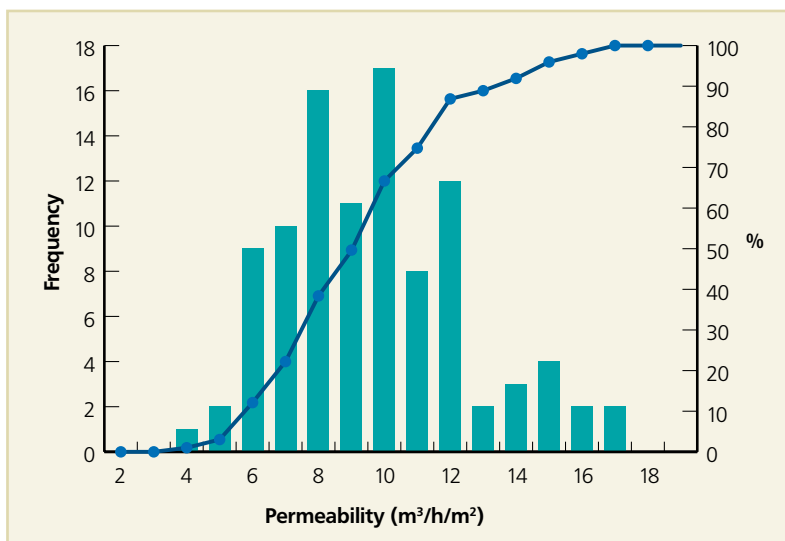


Figure 1
Air permeabilities of 100 dwellings of all types in England and Wales (m³/h/m² at 50Pa)

Airtightness in new dwellings is about good design and construction – not just filling gaps!

To ensure airtightness, the issue needs to be addressed at design stage. At an early stage the designer should identify a line through the envelope of the dwelling where the barrier to air leakage will be: this is the dwelling's air barrier. Details that are vital to achieving good airtightness need to be identified at this point. Careful thought must be given to sealing gaps and ensuring the continuity of the air barrier. The next and equally important step, is to ensure these details are carried over into the construction phase. It is far simpler to design and build an airtight dwelling than to carry out remedial measures in a draughty home.

This guide explains where air leakage commonly occurs in existing dwellings, and suggests how airtightness can be significantly improved with careful design and construction. Airtight construction combined with well-designed ventilation will improve energy efficiency and comfort levels.

Air leakage

A building's design and the quality of its construction will have a major effect on the amount of air leakage. Other factors include wind against the side of the dwelling and the buoyancy effect (warm air rises and creates a drawing effect, pulling air in through gaps in the ground floor and walls).

Cold outside air may be drawn into the home through gaps in the walls, ground floor and ceiling (infiltration), resulting in cold draughts. In some cases, infiltration can cool the surfaces of elements in the structure, leading to condensation.

Warm air leaking out through gaps in the dwelling's envelope (exfiltration) is a major cause of heat loss and, consequently, wasted energy.

Disadvantages of draughty dwellings

- CO₂ emissions
 - A leaky dwelling will result in higher emissions.
- Space heating
 - The additional heat loss will mean that a correctly sized heating system may not be able to meet the demand temperature.
- Comfort
 - Draughts and localised cold spots can cause discomfort. In extreme cases, excessive infiltration may make rooms uncomfortably cold during cooler periods. Leaky dwellings may also give rise to complaints from occupants.
- Risk of deterioration
 - Excessive air leakage can allow damp air to penetrate the building fabric, degrading the structure and reducing the effectiveness of the insulation.
 - Air leakage paths often lead to dust marks on carpets and wall coverings that look unsightly.

Adequate ventilation

While the main focus of this guide is the achievement of an airtight dwelling, ventilation must not be forgotten. It is necessary for a comfortable and healthy environment as it removes or dilutes pollutants that accumulate in the building.

There are many different types and sources of pollution within the home, for example:

- Moisture.
- Volatile organic compounds (VOCs) such as formaldehyde, which can give off gas from carpets and furniture.
- House dust mites.
- Oxides of nitrogen.
- Carbon monoxide (CO).
- Carbon dioxide (CO₂).
- Tobacco smoke.
- Food smells.
- Body odours.

Rooms with open-flued combustion appliances, such as gas fires, must have a direct fresh air supply for safe operation. Separate provision for such a supply should be made and a combustion product spillage test undertaken whenever airtightness work is carried out.

It is generally acknowledged that moisture is the most significant source of pollution within a dwelling, with high quantities generated by common activities such as cooking, showering, bathing and laundry. Moisture from these activities can result in condensation and, in extreme cases, mould growth.

To prevent moisture spreading around the home, some form of local extraction will be required (fans in the bathroom and kitchen), with the overall objective being to keep relative humidity levels below 70 per cent for most of the time.

The ventilation rates required to provide effective moisture control are higher than those needed simply to provide oxygen for occupants to breathe. A typical ventilation strategy, therefore, involves the rapid removal of moisture at its point of production and the provision of secure, controllable background ventilation, often by trickle ventilators. Openable windows allow occupants to air a room rapidly and so remove stale air.

As a first step to providing effective, controllable and energy efficient ventilation, air leakage must be minimised.

Further guidance on effective ventilation can be found in GPG 268 (see back page for more information).

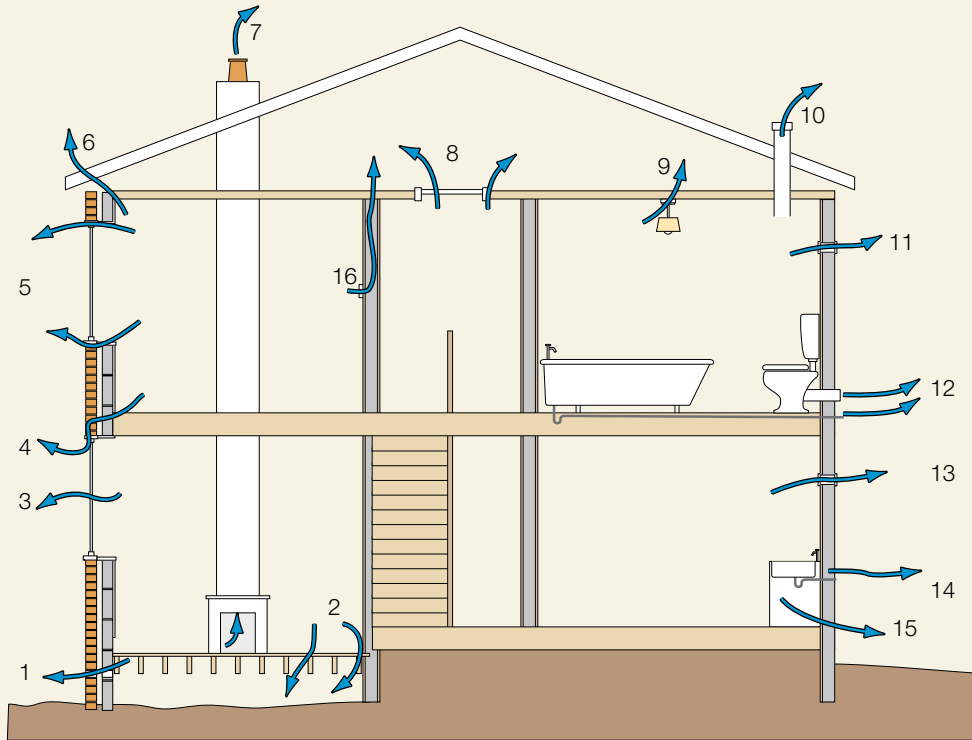
Remember: build tight – ventilate right!

Understanding air leakage paths

To avoid air leakage in new dwellings it is necessary to know where leaks might occur.

Figure 2 shows the most common air leakage paths.

Many of the paths shown in Figure 2 were found in the dwellings investigated in the Energy Efficiency Partnership for Homes study, referred to earlier. Here, they are examined in more detail.



Most common air leakage paths:

- | | | | |
|---|---|----|--|
| 1 | Underfloor ventilator grilles. | 8 | Gaps around loft hatches. |
| 2 | Gaps in and around suspended timber floors. | 9 | Service penetrations through ceilings. |
| 3 | Leaky windows or doors. | 10 | Vents penetrating the ceiling/roof. |
| 4 | Pathways through floor/ceiling voids into cavity walls and then to the outside. | 11 | Bathroom wall vent or extract fan. |
| 5 | Gaps around windows. | 12 | Gaps around bathroom waste pipes. |
| 6 | Gaps at the ceiling-to-wall joint at the eaves. | 13 | Kitchen wall vent or extractor fan. |
| 7 | Open chimneys. | 14 | Gaps around kitchen waste pipes. |
| | | 15 | Gaps around floor-to-wall joints (particularly with timber frame). |
| | | 16 | Gaps in and around electrical fittings in hollow walls. |

Figure 2
Common air leakage paths

Solid ground floors

Junctions between the ground floor slab and the external walls are usually hidden from view by the skirting board (Figures 3 and 4). However, air can leak through the small gap under the skirting board, causing a cold draught across the floor. In some cases, a dirty mark may result as dust is filtered by the carpet along the perimeter of the room.

Gaps and cracks in the ground floor can allow air and, even more importantly, ground gases (e.g. radon and landfill gas) to be drawn into the home. They may develop in solid floors as the concrete cures and shrinks away from the walls. While these small cracks do not necessarily pose any structural concern, they do provide air leakage paths.



Figure 3
Air leakage path hidden behind skirting board

Suspended floors

Suspended timber floors have a myriad of gaps around the boards, at the junctions with walls (internal and external) and around service pipes (Figure 5). Air can leak down through these gaps into the unheated floor void. Large area boards and tongue-and-groove edges can reduce air leakage, but it is essential to seal all the gaps and holes before floor coverings are laid.

Beam-and-block floors may have a large number of gaps and cracks, particularly if the screed is poor. Major areas of air leakage are around the edges (see Figure 6) and at service entry points (water pipes behind baths, sinks and WCs). Often one or more blocks are omitted, or large holes are cut through them, in order to allow the pipes to pass through the floor. These large holes are hidden from view by bath panels, sink pedestals, vanity units, floor coverings, etc.



Figure 5
Air leakage through gaps around service pipes in suspended timber floors

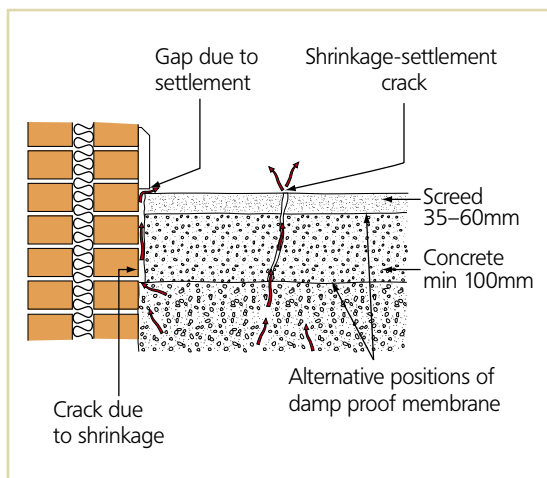


Figure 4
Air leakage paths through solid floors

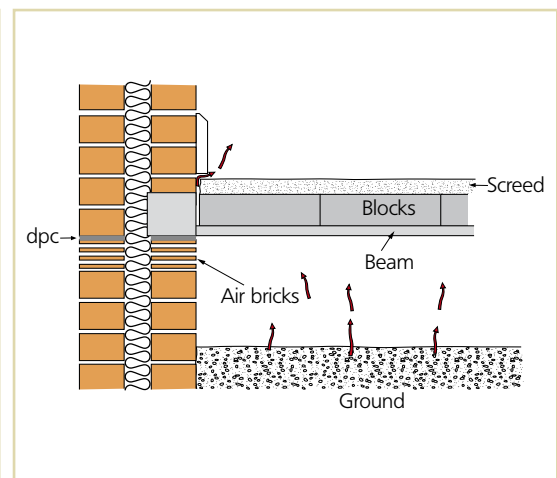


Figure 6
Air leakage around perimeter of beam-and-block floors

Windows and doors

It is common to find gaps between the window frame and the wall. They may also occur between the frame and the opening casements, lights and sashes (Figure 7). The window's opening/closing mechanism can become loose with time, and may not close as tightly. If this is the case, a draughtstrip may not be sufficient to seal the widening gap. In timber windows, excessive swelling and shrinking, as well as decay, may result in air leakage through the frames and around the opening window lights.

Air leakage can also occur around the window reveals and window board (Figure 8).



Figure 7
Air leakage around opening window casements

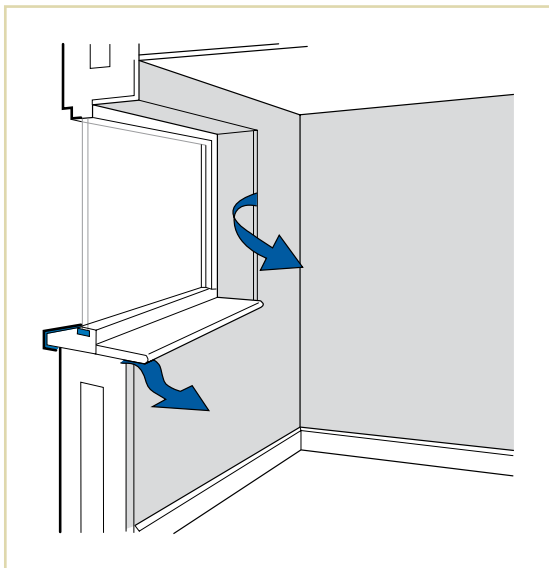


Figure 8
Air leakage can occur through gaps between the reveals/window boards and the window frame

Large gaps between the bottom of an external door and the threshold are common, especially around slider mechanisms for patio doors (Figure 9). Another common air leakage path is the letterbox.

Leakage into ceiling voids and the roof space

Air can leak past a poorly fitting loft hatch up into the unheated roof void. Warm moist air from the house may then condense on cold surfaces in the unheated loft and lead to condensation problems.

Light fittings – and gaps around them – can offer a path into the roof void and also into the void between the ceiling and the next floor (Figure 10). Air can leak out indirectly from this void through gaps in the external walls (such as those around joists that penetrate the air barrier) and through unfinished mortar joints.



Figure 9
Air leakage around the slide mechanism of patio doors



Figure 10
Air can leak through gaps around light fittings into the roof void

Masonry wall construction

Masonry external walls, especially those built from lightweight concrete blocks, have varying degrees of porosity, allowing air through (Figure 11). Unfinished mortar joints also provide air leakage routes.

Dry lining

If the dry lining (plasterboard) sheets have not been sealed at the junctions with the ceiling and floor – as well as from sheet to sheet – air can leak through the gaps (Figure 12).



Figure 11
Air passing through porous concrete blocks

Service pipes and cables that penetrate the air barrier

Gaps in the air barrier are common around water pipes, gas pipes, boiler flues and electric cables that pass through external walls (Figure 13), although they are generally hidden from view behind kitchen cupboards, bath panels, sink pedestals, toilet basins and vanity units. Cold draughts from these areas will be an unpleasant indicator of inadequate sealing (see Figures 14 and 15). Draughts in bathrooms/shower rooms are particularly uncomfortable for occupants.



Figure 13
Air leakage around pipes that penetrate the air barrier

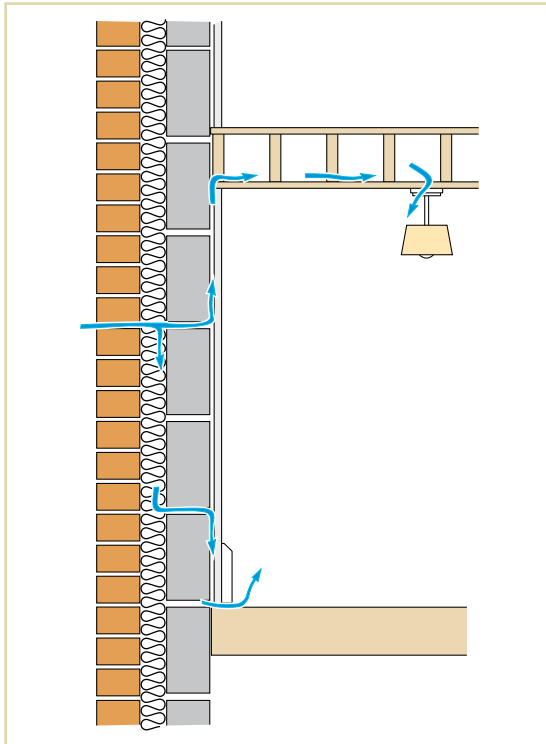


Figure 12
Air leakage through gaps and cracks in masonry and behind plasterboard sheets



Figure 14
Draughts may be felt around kitchen appliances like washing machines and dishwashers



Figure 15
Draughts may be felt around bathroom sinks and vanity units

New Build

Principles

Airtightness is all about avoiding gaps – gaps in contractual arrangements and the design process as well as those between components and those left during installation. They are usually caused either by a lack of awareness of the importance of airtightness or by a lack of contractual responsibility for ensuring airtightness.

Airtightness needs to be a priority throughout the construction process – before, during and after.

The adoption of an 'airtightness strategy' should be seriously considered (see Box 1).

Box 1: An airtightness strategy

- Consider the appointment of an independent airtightness adviser.
- Appoint an air barrier manager.
- Identify the line of the air barrier at an early stage of design.
- Inform the project teams of the importance of the air barrier.
- Refer to airtightness in all contracts which impact on the air barrier.
- Specify and/or select airtight components.
- Check interfaces between components and work packages to ensure the continuity of the air barrier.
- Inform the site management team of the location and importance of the air barrier.
- Explain to site operatives the critical importance of airtightness.
- Check air barrier completeness before it becomes impossible to access.
- Schedule an airtightness test by a competent body well in advance.
- A pre-test visit to site by the testing body is recommended for larger sites.
- Ensure all airtightness works are complete.
- Contractor to have responsibility for sealing vents and open flues, closing trickle vents, external doors and windows, in preparation for airtightness test.
- Airtightness test carried out and results issued.
- Results submitted to Building Control/client by contractor.

Design practice

Airtightness should be considered at every stage of the design process. The line of the airtightness barrier should be established very early on. One way of doing this is to mark a set of drawings with a red line. This should be a continuous line around the building, passing through all elements in the building that separate heated and unheated spaces (see Figure 16).

Identify areas where additional detailing will be required and apportion responsibility for design and construction of the air barrier. Provided attention is paid to the detailing at joints, the principal construction phase of house building will give adequate airtightness. It is also helpful to indicate on construction details the location of airtightness-critical items.

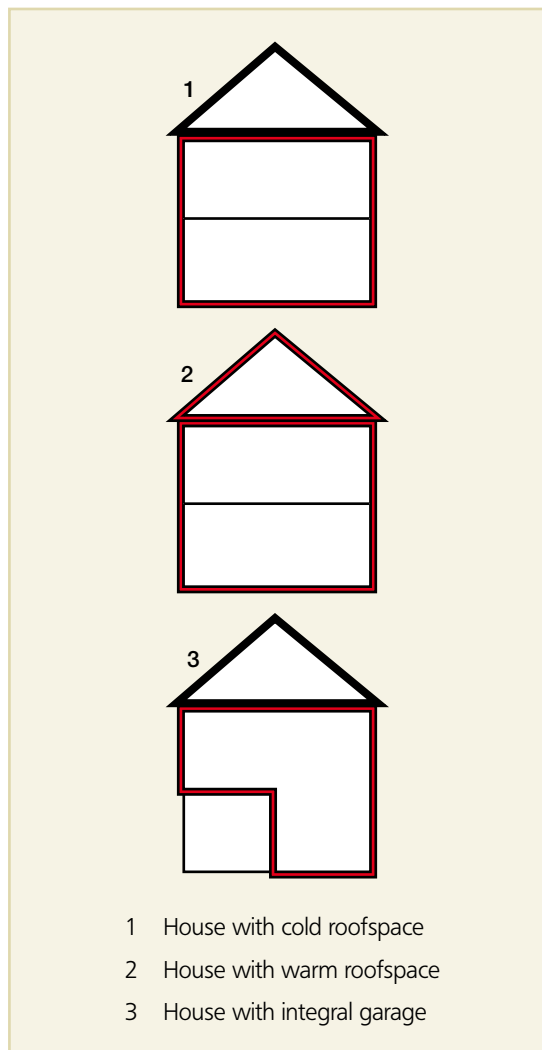


Figure 16
Examples of options for routing the air barrier

Construction practice

Building work must be sequenced so that each part of the air barrier is completed before following trades cover the work. The 'out of sight – out of mind' approach will not achieve airtightness: a subsequent pressure test will show up any inadequacies. It is important to recognise that the test simply shows the overall airtightness, with a subsequent air leakage audit being needed to identify significant leakage paths. This can prove very disruptive, time consuming and costly once the air barrier has been concealed. It is therefore extremely important to 'build tight, first time, every time'.

The following trades must not compromise the air barrier by accidentally damaging it, or even deliberately penetrating it in order to complete their work. If additional service penetrations are needed after the air barrier has been completed, the damage caused to the barrier must be repaired. These repairs must be made before the air barrier is concealed.

Inspection and supervision

All works will need to be inspected as construction proceeds. Once the building work is completed it may be difficult to examine the airtightness layer as it is usually covered by internal fixtures and finishes. Inspection is also an opportunity to ensure that the construction team has a clear understanding of the

importance of the airtightness layer and how it is to be incorporated. Inspection should concentrate on the continuity of the air barrier, particularly parts that will be hidden on completion.

The main objective should be to ensure that there is an adequate understanding on site of the airtightness requirements at joints, intersections and junctions of different wall, roof and floor types. Supervisory staff need to ensure that all operatives carrying out airtightness-critical operations are aware of the significance of the work. Any uncertainties about detailing or materials should be checked with the designer.

Recommended inspection points

Foundation/ground floor

- Check that the wall and floor damp-proof course/membrane forms an adequate airtight layer.
- Check that any penetrations through the air barrier (e.g. service pipes) have been dressed. Pre-formed collars, sometimes referred to as 'top hats', which seal to the membrane and around the throat of the pipes are effective means of achieving a good airtightness seal (Figure 17).
- With timber frame construction, check that the sole plate is sealed to the foundation/floorslab.

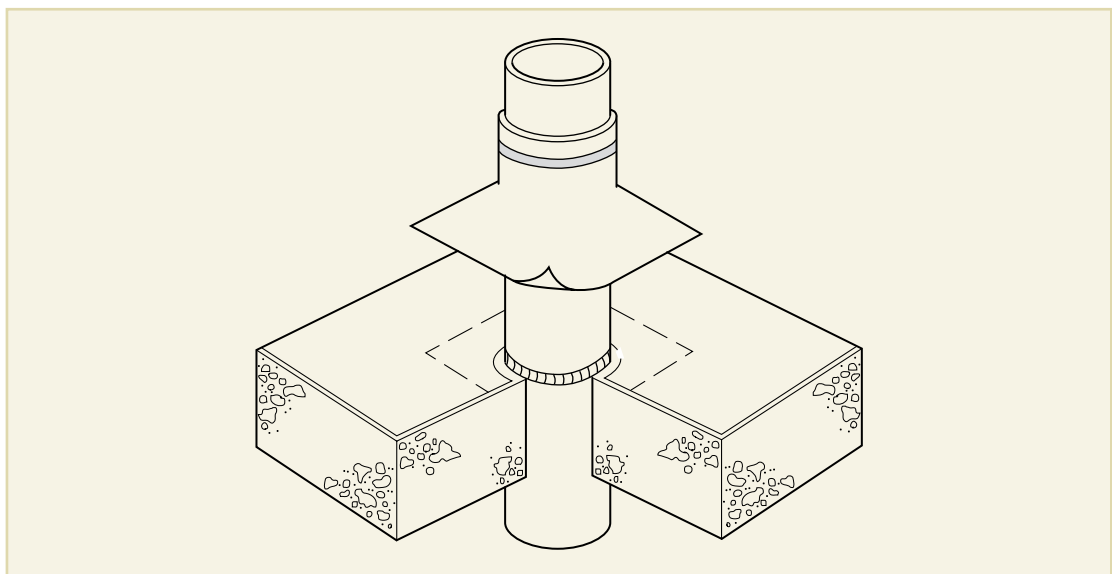


Figure 17

Pre-formed collar to seal around service pipe that penetrates through the floor

Intermediate floors

- Joist hangers can limit penetrations through the air barrier.
- If joists are to be supported by the wall, check that there is no air leakage into the cavity.
- Ensure timber floorsheets/boards are well fitted and sealed at their edges as well as at junctions with perimeter walls.
- Check that the ceiling-to-wall joint has been sealed.

Eaves

- Check that the airtightness layer between the wall and ceiling/roof is continuous (Figure 18).

Ceiling below the roof space.

This normally forms the air barrier in domestic construction.

- Check that there is a continuous air barrier over the whole ceiling area.
- Check that service penetrations (ventilation ducts from extract fans and light fittings) have been properly sealed where they penetrate the air barrier.
- Check that loft hatches are airtight and surrounds are sealed where they penetrate the air barrier.

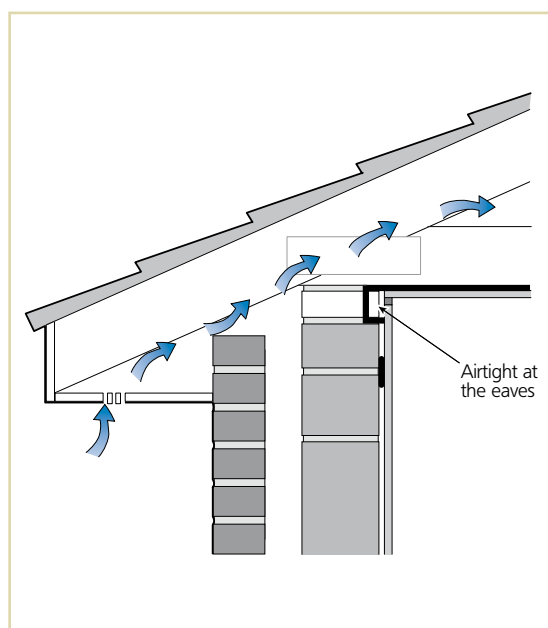


Figure 18
Airtightness seals at eaves level

Alternatively, consider using a membrane that follows the pitch of the roof.

- Sealing this membrane at eaves level can be difficult. It will need careful detailing and construction.

Windows and doors

- Specify good quality windows and doors.
- Check that the wall-to-frame junction is properly sealed and continuous with the wall's airtightness layer, particularly at sills (Figure 19).
- Check that all the windows and doors have an appropriate weatherseal between the opening unit and the frame.
- External doors (and letterboxes) should be fitted with draught excluders.

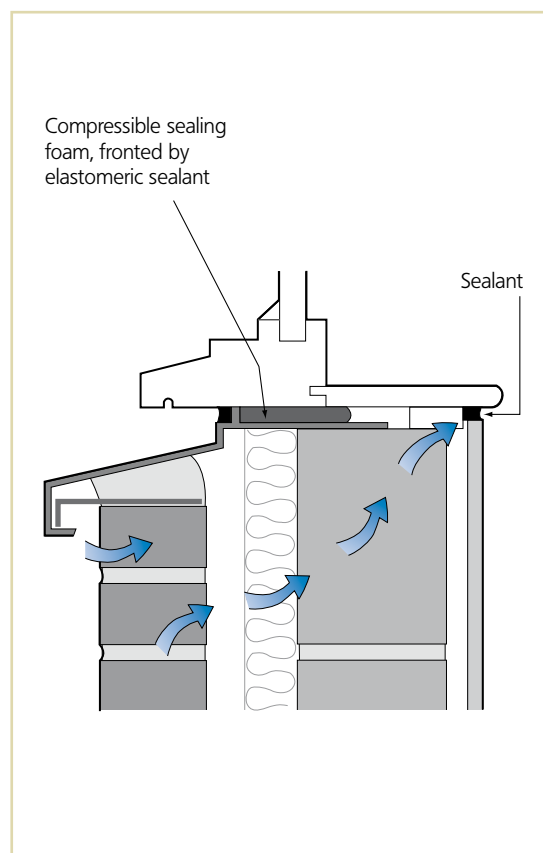


Figure 19
Sealing the sills at the base of window units

Service penetration

- Check for seals at service entry points (pipe and cable routes), e.g. around incoming water pipes, gas pipes, electrical cabling, as well as waste water pipes for sinks, baths, washing machines, dishwashers, etc. Seals should be provided internally and externally (see Figure 20 for masonry construction and Figure 21 for timber frame).
- Where several services penetrate at the same point, there should be sufficient space to fully seal round each of them.

Brick/block masonry construction

- Check the quality of construction as the work proceeds. Good mortar joints are required (i.e. no gaps around the blocks or bricks) on both internal and external faces.
- Blockwork is unlikely to provide an adequate air barrier on its own. However, the application of wet plastering, parging or the addition of fully-sealed dry lining will create a good air seal.
- Parging is an effective method of sealing around joists that penetrate the inner leaf of an external wall.
- Check that there is a good seal around all services that penetrate the wall.

Dry lining

- Check the plasterboard is continuous (e.g. there are no large holes behind the kitchen units/bath). Ensure that airtightness measures have been incorporated at all edges, particularly at the floor/ceiling junctions and around openings.
- Check the plasterboard is correctly detailed at joints, corners, reveals and window sills. Plasterboard should be mounted on ribbons of plaster or adhesive around all the edges (rather than dabs) to prevent air leaking through the porous blockwork behind.
- Parging the blockwork prior to applying the plasterboard will improve airtightness.
- In timber frame construction, the edges of the boards can be sealed direct to the timber framing.

Wet plaster

- The application of a wet plaster finish can provide an adequate seal to what would otherwise be a leaky brick or blockwork wall.
- Check that the wet plaster finish covers the whole surface of the wall or ceiling.

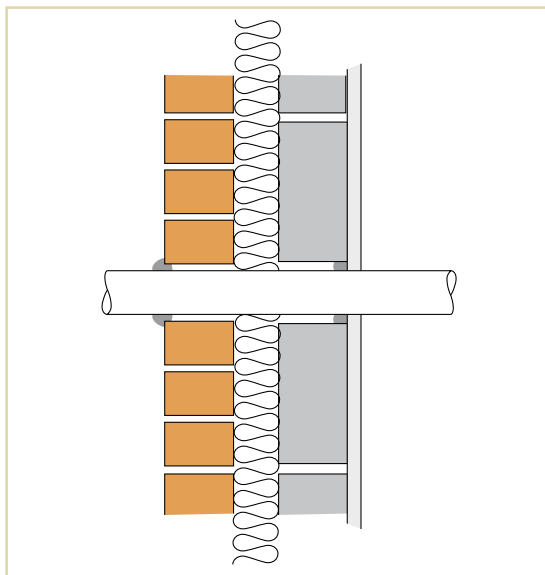


Figure 20
Gun-applied sealant around a service pipe through an external wall, prior to the application of plasterboard

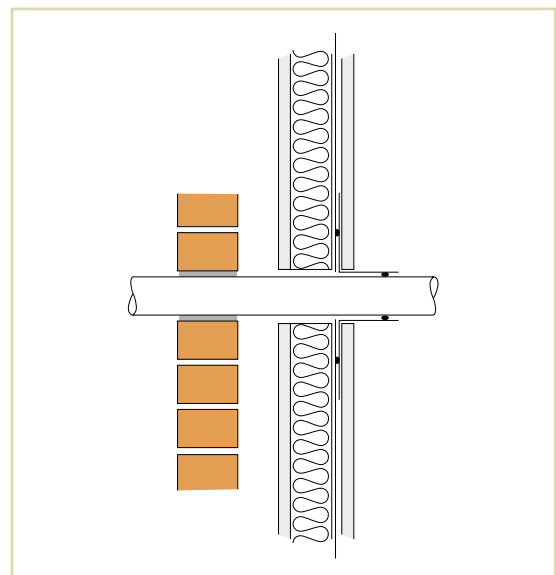


Figure 21
Pre-formed collar around service pipes, sealing the air barrier in timber frame construction

Vapour barrier

- Where the vapour barrier is used as an air barrier, check that it is complete, that all joints have been sealed and that the material has not been damaged.

Timber frame construction.

- In general it is easier to make a timber frame dwelling airtight than other forms of construction. This is partly due to pre-fabricated construction and the use of the impermeable vapour barrier as the air barrier, but also because the plasterboard itself can be sealed to form an air barrier.
- Where the vapour barrier is used as the air barrier, care will be needed to avoid it being torn. Any damage to the vapour barrier must be repaired.

Sealant materials

There is a range of different sealant materials available. The main choices are:

- Membranes
 - Polyethylene sheeting is widely used when a sheet vapour control layer or airtightness layer is needed in timber frame construction. While 500 gauge polyethylene is sometimes used, 1000 gauge polyethylene is more robust.
 - Ensure all penetrations through the membrane (for example, service pipes and cables) are well sealed.
 - Joints need to be sealed with appropriate tapes or sealant strips.
- Expanding foam sealants
 - While these can be used to fill large voids, not all expanding foam products are airtight. Care is needed to ensure that the whole of the opening being filled is sealed. It may be necessary to cap the foam sealant with an airtight finish.
- Gun-applied sealants
 - Check that the material has fully filled the gap and is correctly bonded to the surface.
 - Gun-applied sealants must NOT be applied to dusty or wet surfaces as they will not adhere properly.
- Tapes
 - Tapes used to seal polyethylene (or similar membranes) being used as air barriers must be fit for purpose. It is advisable to check this with the manufacturers as not all tapes will be suitable.

- Fillers
 - Not all the fillers available for filling larger gaps will be airtight: some may crack on drying.
- Fire stopping
 - Some products used for fire stopping are not airtight when installed. Intumescent products, for example, only expand to fill gaps when they are exposed to heat. It may be necessary to use additional sealing to provide airtightness in these areas.

Repairs

If the air barrier is damaged, it must be repaired. The materials used must provide at least the same level of airtightness as the original construction. Gun-applied sealants are usually suitable for sealing around service penetrations. Larger openings through walls and floors can often be filled with mortar.

Holes or tears in membranes can be sealed with appropriate adhesive tapes or heat welded patches. Not all sealants will be appropriate, though: some, such as intumescent fire stop materials, may still allow air leakage even though they fill voids.

Blocks of flats

There are other issues to be considered in the case of flats:

- Each flat must be treated as a separate airtight environment, independent of neighbouring dwellings. Therefore the air barrier will include walls to corridors and party-walls with other flats.
- There will be different airtightness 'zones' within the block – corridors, staircases and lift shafts, for example. Some larger blocks may have plant rooms: these are not conditioned spaces and must be screened off from the heated accommodation by use of an air barrier.
- In high rise blocks of flats, the stack effect and the wind effect will be enhanced and so the air leakage may be greater.
- High rise blocks are likely to be of frame construction. Therefore there is a need to seal where any steel or reinforced concrete structural elements penetrate the cladding. For more guidance on how to achieve airtightness when using frame construction, see the Further Information section.

Airtightness testing of dwellings

Fan pressure testing allows the permeability, or airtightness performance, of the dwelling to be assessed. The technique is straightforward and can be carried out when the envelope is complete.

The airtightness test can be used in several ways:

- Assessing the air permeability of the building, i.e. the air leakage for the whole envelope area of the building.
- Identifying the air leakage paths, which will allow targeted remedial sealing.
- Measuring the effectiveness of remedial sealing.

In the UK the testing methodology should conform to BS EN 13829 Thermal Performance of Buildings – Determination of air permeability of buildings – Fan pressurisation method (2001) and CIBSE TM:23 Testing buildings for air leakage (2000). Further details on post construction testing can be found in the Further Information section.

To carry out the test, a fan is mounted in a temporary screen (the original door remains in place, but is held open to enable the screen to be mounted in the rebate, see Figure 22). The fan is used to move air into or out of the building. The air leakage characteristics are

determined by measuring the rates of air flow through the fan while a range of pressure differences between the inside and outside of the building are maintained.

Air leakage audits

A draught can be difficult to locate. The occupant may feel cold air, but may not be able to trace exactly where it is coming from. Often the source of the problem (the air leakage path) is hidden by kitchen units, bath panels or other boarding and so it can be very difficult to pinpoint it without a thorough audit.

Air leakage audits identify air leakage paths in the fabric of the dwelling. While the fan is pressurising the dwelling, hand-held smoke pencils are used to find air leaks. The smoke is released in a small controllable trickle and is a visible means of showing air movement. Pressurising the dwelling increases air leakage. Smoke can be seen issuing through the gaps and cracks to the outside. Smoke can also be very useful in identifying flanking (or indirect) air leakage paths.

Post construction

Having constructed an airtight dwelling, it is important to make the owner aware of the fact. The owner needs to know the location of the air barrier in order not to compromise its effectiveness when carrying out future alterations. The efficiency of the heating and ventilation provided to the house depend upon the air barrier being maintained.



Figure 22
Fan pressurisation equipment used for dwellings

Existing dwellings

The techniques described in this guide refer to the application of airtightness details within new dwellings. Many of these techniques are straightforward and simple to incorporate at the design stage.

To upgrade existing dwellings, the same constructional elements need to be considered. In some instances, the methods will be the same as in new buildings, for example gun-applied seals around service penetrations and the gaps around windows and doors.

However, in many cases it will be difficult to access the air leakage points to apply sealants without removing fixtures and fittings e.g. kitchen units, bathroom fittings, skirting boards, ceilings, boxed-in pipework/services etc.

A list of suggested airtightness techniques that can be used to improve the performance of existing dwellings is given below:

Improving airtightness in an existing dwelling

- Use sealant materials to fill the gaps around windows and doors to prevent air leakage from the reveals and thresholds.
- Apply an external mastic seal to all window and door frames.
- Apply a bead of mastic to seal any internal gaps between the wall reveals/window boards and window units or external doors.
- Repair any damage to window frames and ensure the casements, sashes and top-lights close firmly. It may be necessary to replace closing mechanisms.
- Apply draught proofing to gaps around window opening casements, sashes and top-lights.
- In dry-lining applications, inject continuous ribbons of expanding polyurethane foam between the plasterboard sheets and the inner leaf blockwork: this will prevent air leakage into this space from the void between the ground floor ceiling and first floor, or from internal partition walls. Drill small holes (approximately 9mm) at regular intervals (approximately every 100mm) around the edges of the plasterboard to allow the foam to be injected into the void.
- Make good damage to mortar joints and fill any holes in the external walls. If the dwelling has been extended and the kitchen/bathroom has been moved to a new location, make sure there are no holes through the external walls where service pipes were previously located.
- Ensure the loft hatch fits into its aperture and apply draught stripping between the hatch and the frame.
- Seal gaps around service pipes and the cables that pass through external walls, ceilings and ground floors. It may be necessary to remove baths, kitchen units, boxing around service pipes, washing machines, etc, to gain access to these pipes and cables.
- Ensure there is a good seal around boiler flue pipes where they pass through the external wall/ceiling. **Check the performance of the sealing material to ensure it will not be affected by heat.**
- The airtightness of suspended timber floors can be improved by laying hardboard sheeting over the top, to cover any gaps between the floorboards. Seal around the edges of the rooms and make good any gaps in the floor around service pipes (it is advisable to check for holes behind baths and under shower trays). Do NOT use plastic sheeting to cover timber floors as this may cause the timber to rot.

Conclusion

Airtightness is an increasingly important part of a 'whole house' approach to building. Airtight buildings will be more comfortable for occupants and also be more energy efficient. Testing for airtightness will also be an integral part of compliance with building regulations, as well as the Energy Saving Trust's best practice standards.

Airtightness must be addressed at both the design and construction stages to be effective. Specifications must clearly address airtightness and subcontracts should include a responsibility for carrying out the necessary sealing work. Gaps in contracts can lead to gaps in the finished dwelling.

Airtightness detailing should be easy to achieve during the construction stage. Many of these measures can be adapted to existing dwellings, although it may be more difficult to gain access to the air leakage paths if they are hidden by fixtures and fittings.

Following the guidance in this report will help to achieve the Energy Saving Trust's best practice airtightness performance in new dwellings. It will also significantly reduce air leakage in existing dwellings.

Remember: build tight – ventilate right!

Further information

The Energy Saving Trust offers information on energy efficiency, sets standards for the housing industry and provides technical guidance, tools and training on how to meet those standards. The standards, covering good practice, best practice and advanced practice, provide an integrated package of measures for all aspects of new build and refurbishment.

For more information, call 0845 120 7799 or visit: www.est.org.uk/housingbuildings

The following publications may be of interest.

Energy-efficient ventilation in housing: A guide for specifiers on the requirements and options for ventilation (GPG268)

Energy efficiency in housing – summary of specifications for England, Wales and Scotland (CE12)

Post-construction testing – a professional's guide to testing housing for energy efficiency (GIR 64)

Other publications

BRE Guide BR 448: Airtightness in commercial and public buildings (2002)

CIBSE TM:23 Testing buildings for air leakage (2000)

BS EN 13829 Thermal Performance of Buildings – Determination of air permeability of buildings
– Fan pressurisation method (2001)



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