Air Tightness and Ventilation

Air Tightness

Basic draught proofing and low-cost ventilation is covered above. When considering a deeper retrofit project (e.g., aiming for net zero carbon for example), an airtightness strategy is necessary. This involves incorporating an airtightness layer around the entirety of the home - a way to imagine this is having a bucket with no holes placed inside a leaky bucket with holes.

A mixture of detailed design and the use of advanced membranes, sealants and insulation is used to help achieve a desired air tightness level. A Retrofit Coordinator or Designer will specify a target airtightness for your retrofit project and airtightness testing typically takes place before and after a project to ensure this has been met. For some retrofit building standards (e.g., EnerPhit) a target air tightness figure is specified.

Ventilation

When the insulation and airtightness of a building is improved, it is important to ensure that adequate ventilation is maintained – the more airtight a building is, the less natural ventilation it receives. It is important to note that just because a house is airtight does not mean it isn't ventilated – either by natural means such as windows and trickle vents, or mechanically by extraction ventilation or Mechanical Ventilation with Heat Recovery (MVHR). The key difference is being able to control how and when air comes in and out of the building rather than allowing it to regularly leak.

MVHR is a whole-house system that extracts stale air from rooms in your house and supplies fresh air. When warm, stale air is extracted from your home through MVHR, the system recovers around 80-90% of the heat to pre-warm the fresh air being supplied back into your home. Air is typically extracted from warm and wet rooms in the house (kitchens, bathrooms) and supplied into bedrooms and living spaces.

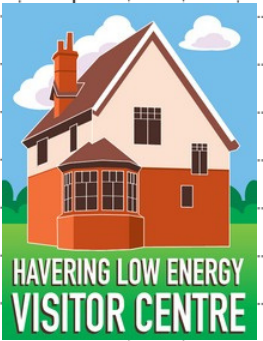
MVHR systems are commonly found in new-build homes and whole-house retrofits which reach high thermal performance and airtightness standards.

A whole-house MVHR system is not cheap and can be complex. It requires air ducting to be installed throughout the house and this can be an intrusive process therefore combining this with other more significant retrofit works is advisable. The MVHR unit itself is around the size of a large suitcase and additional space is required for ducts and exhausts therefore consideration on where this would fit in your home is also necessary. A Retrofit Coordinator or Designer will be able to advise further on the design and requirement of MVHR in your home retrofit.

MVHR is typically only necessary for whole house retrofit projects and therefore should be completed as part of a larger scheme of works due to the intrusiveness of installation.

Regulatory considerations

- Installation of MVHR is not considered to be development requiring planning consent.
- Listed Building Consent required for Listed Buildings (where deemed acceptable).
- Applicable Building Regulations: Part L (Conservation of fuel and power), Part P (Electrical safety), Part F (Ventilation).



Cost: MVHR - **£££+**

Disruption: MVHR: ■■■■□

Basic Draught Proofing

In some homes, particularly older properties, there can be unwanted draughts and leaks. These draughts create uncomfortable living environments and contribute to heat loss and higher energy bills.

Cracks and gaps allow warm air to escape and are usually found around wall openings (including window and door frames and pipework openings), between and around floorboards, around electrical fittings and around the loft hatch. Leaky homes are also harder to keep cool in the summer.

Some basic draught-proofing measures you could install in your home include:

- Exterior doors – fitting brush or hinged-flap draught excluders along the bottom of the door; adding an internal curtain that drops to cover the whole door.
- Windows – Using foam, metal, or plastic draught strips to seal gaps.
- Around pipework entry – Use silicone mastic, wall-filler or expanding foam to fill any gaps in the wall.
- Floorboards and skirting boards – fill the gaps with flexible fillers, clear or brown mastic, decorators' caulk or similar.
- Letterboxes – fit flaps or brushes to keep the cold air out.
- Unused and open chimneys – installing a chimney draught excluder or chimney balloon. Note: chimneys which are not suitably sealed at the top must still be allowed to breathe to prevent moisture build up and potential damp issues.

Important...

It is important to differentiate between unwanted air leaks in our homes and the ventilation necessary to keep us, and our homes, healthy. Never block air bricks, boiler flues or trickle vents on windows. Regularly open windows in kitchens and bathrooms where there is no mechanical ventilation, such as an extractor fan, as moist air needs to escape these rooms regularly.

Cost: **£**

Useful links

- A helpful guide to draught-proofing - Energy Saving Trust
- DIY draught-proofing - Centre for Sustainable Energy (cse.org.uk)
- Draught-Proofing | Historic England
- Draught-proofing · Energy Advice London

Cavity Wall Insulation

Cavity walls are external walls made from two 'skins' with a cavity, or gap, between them. These are typically a brick outer leaf and a blockwork inner leaf. The cavity or gap can be filled with insulation to stop warm air from escaping to the outside. A key advantage to cavity wall insulation is that it does not affect the internal or external appearance of the property.

Cavity walls are commonly insulated by injecting insulation into the cavity through a series of small holes drilled through the outer skin. The holes are then sealed back up once the cavity is filled.

If you think your property could benefit from cavity wall insulation, it is important that an assessment is carried out and any cracks or pre-existing damp problems are resolved prior to installation. A reputable installer will be registered with the Cavity Insulation Guarantee Agency (CIGA) and be able to provide you with a 25-year guarantee for the works.

Risks:

If you have any damp patches on your internal walls then they should not be insulated until the problem is resolved.

Associated works

Loft or roof insulation to ensure continuous line of insulation wrapping the home.

Regulatory considerations

- Cavity wall insulation is not considered to be development requiring planning consent – no planning permission is likely to be required for internal works in properties which are not listed.
- Listed Building Consent likely to be required for listed buildings.
- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. The CWI installer should be able to submit a notice to a building control body on your behalf.
- Applicable Building Regulations: Part A (Structural Safety), Part F (Ventilation), Part L (Conservation of fuel and power).

Cost: ££

Disruption: ■■□□□

Useful links

- How to install cavity wall insulation - Energy Saving Trust
- Cavity wall insulation - Centre for Sustainable Energy (cse.org.uk)
- Building Regulations: Cavity Wall - Insulation - Planning Portal
- Energy Efficiency and Historic Buildings: Early cavity walls | Historic England

External Wall Insulation

External wall insulation involves adding a layer of insulation to the outside walls of your home. External wall insulation won't affect the size of the rooms in your home, but you must consider how it will affect the external appearance and how you will match the existing finish as close as possible.

External wall insulation is typically finished with a protective render coating or cladding such as brick slips/tiles. The total depth of external wall insulation ranges from 50mm to 130mm, depending on the system used.

External wall insulation will not only improve the energy efficiency of your home, but it will also: renew the appearance of outer walls, improve weatherproofing and sound resistance, help keep warm air out in summer months, and it can be installed without disruption to your household.

External wall insulation should be fitted by a specialist installer. These can be found through the National Insulation Association (NIA).

Risks

Whenever you fit solid wall insulation to a building, you will need to take account of water vapour. Your specialist installer should develop a moisture control strategy that is specific to your building

Regulatory considerations

- External wall insulation is Permitted Development for dwellings not in a conservation area (any external materials used must be of a similar appearance to the existing dwellinghouse).
- Planning Permission likely to be required for flats, maisonettes, and homes in conservation areas
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- Planning permission and Listed Building Consent required for Listed Buildings (unlikely to be acceptable due to impact on historic fabric).
- In conservation areas, a combination of external wall insulation to the rear of a property and internal wall insulation to the front may be acceptable where the rear elevation is not of heritage interest.
- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. The EWI installer should be able to submit a notice to a building control body on your behalf.
- Applicable Building Regulations: Part F (Ventilation), Part L (Conservation of fuel and power)

Cost: **££££** Disruption: ■■■□□

Useful links

- Advice on insulating your solid walls - Energy Saving Trust
- Solid wall insulation - external - Centre for Sustainable Energy (cse.org.uk)
- Planning permission - Insulation - Planning Portal
- Building Regulations: Solid Wall - Insulation - Planning Portal
- Energy Efficiency and Historic Buildings: Insulating Solid Walls (historicengland.org.uk)

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Flat Roof Insulation

The easiest way to insulate a flat roof is from above the structure. This can be done as an overlay to the existing roof covering (only if the roof structure is sound) or as a total renewal where the roof is insulated above the structure and a new roof covering is installed.

Insulating above a flat roof is best completed when the roof covering needs to be replaced, at which point it should be upgraded to meet current Building Regulations specification.

Insulating under a flat roof is possible but has a higher risk of condensation problems and should therefore be specified by a competent person such as a Retrofit Designer / Coordinator.

Regulatory considerations:

- Insulating a flat roof is Permitted Development as long as the new roof does not project more than 150 millimetres from the plane of the existing roof.
- Planning Permission required for flats, maisonettes, and listed buildings.
- Listed Building Consent required for Listed Buildings.
- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. Applicable Building Regulations: Part L (Conservation of fuel and power), Part P (Electrical Safety)

Cost: **££**

Disruption: ■□□□□

Useful links

- Roof and loft insulation guide - Energy Saving Trust
- GreenSpec: Housing Retrofit: Timber Flat Roof Insulation
- GreenSpec: Housing Retrofit: Concrete Flat Roof Insulation
- Building Regulations: Insulation and thermal elements - Roof - Planning Portal

Floor Insulation

Insulating the ground floor of your home is an excellent way of keeping your property warm. If you're on an upper floor you don't usually need to insulate the floor space as most heat is lost through the ground floor.

It is important to know what the construction of your ground floor is before you can decide how to insulate it – ground floors are typically solid concrete slabs or suspended timber floors (floorboards laid over timber joists with a void underneath for ventilation).
Insulating the ground floor is disruptive, particularly for solid concrete floors and therefore it is best done when the floor needs replacing or as part of wider works e.g., a ground floor extension.

Solid concrete floors are usually insulated by fitting rigid foam insulation on top of the concrete slab and finishing with chipboard to allow for flooring to be installed. This will raise the level of the floor so consideration for other changes such as doors, skirting and electrical sockets is required. Insulation can be placed underneath concrete slabs; however, this is only advised if the floor needs replacing in its entirety as part of a wider scheme of work.

Timber floors are typically insulated by fitting rigid insulation board between the timber joists (usually supported by small battens) or by installing a windtight breathable membrane over the joists to support a fibrous or wool insulation. The insulation should not extend below the depth of the joist to ensure ventilation under the floor is continued. Natural insulation materials such as wood-fibre or sheep's wool are encouraged in older buildings as they allow both air and moisture vapour to pass through slowly and minimise the risk of condensation.

Risks:

For suspended floors, special care needs to be taken to ensure continued ventilation through the floor void. Careful consideration should be taken for the type of insulation used and a Retrofit Designer / Coordinator should be able to advise on this.

Associated works:

For suspended timber floors, it is important to inspect the floor structure and complete any repairs or maintenance prior to insulating. This also applies to any works required to ensure maintained cross-ventilation within the sub-floor void.

Regulatory considerations:

- Installation of floor insulation is not considered to be development requiring planning consent – no planning permission is likely to be required for internal works in properties which are not listed.
- Listed Building Consent required for Listed Buildings.
- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. Applicable Buildings Regulations: Part L (Conservation of fuel and power), Part P (Electrical safety)

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Cost: **£££-££££**

Disruption: Suspended Floor: ■■■□□ Solid Floor: ■■■■■

Insulating Pipes, Tanks and Radiators

Insulating your pipes, radiators, and hot water tank (if you have one) is a quick and cheap way to save on your energy bills.

To insulate your pipes, you can purchase foam tubes that fit around any exposed pipes which carry hot water. This helps to keep the temperature in the pipes constant and along with frequent usage should help prevent any pipes from freezing.

Cost: **£**

If you have a hot water tank in your home, you can purchase an insulating jacket from DIY shops to fit around the tank. This works in the same way as the pipe insulation in that it helps to prevent heat loss from the tank and save on energy. An 80mm jacket is recommended by British Standards.

Cost: **£**

For radiators fitted on external walls in your home, installing reflector panels behind the radiator will help to stop heat loss through the wall and reflect the heat back into the room. These are particularly helpful for homes with uninsulated solid walls.

Cost: **£**

Useful links

- Insulating tanks and radiators - Energy Saving Trust
- The Complete Guide to Pipe Insulation - The Eco Experts

Internal Wall Insulation

Internal wall insulation is a good option for insulating solid wall buildings where, for heritage or aesthetic reasons, it is not suitable to use external wall insulation.
Internal wall insulation is also an appropriate option for when completing a phased retrofit where you might insulate one room at a time.

Internal wall insulation is more disruptive than external wall insulation, so consider how you might incorporate this into wider home renovation works.

There are several different internal wall insulation products, varying from rigid insulation boards fixed to the existing wall, timber stud frames filled with insulation and insulated plasters. A retrofit designer / coordinator will be able to advise you on the best product for your home.

Regulatory considerations:

- Internal wall insulation or any internal works are not considered to be development requiring planning consent – no planning permission is likely to be required for internal works in properties which are not listed.
- Listed Building Consent required for Listed Buildings.
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- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. Applicable Building Regulations: Part F (Ventilation), Part L (Conservation of fuel and power), Part P (Electrical Safety).

Cost: **£££**

Disruption: ■■■■■

Useful links

- Advice on insulating your solid walls - Energy Saving Trust
- Solid wall insulation - internal - Centre for Sustainable Energy (cse.org.uk)
- Energy Efficiency and Historic Buildings: Insulating Solid Walls (historicengland.org.uk)

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Loft Insulation

Before insulating your loft, it is important to make sure the loft space is in good condition and dry to ensure no moisture or mould is trapped in.

Standard loft insulation is suitable for most homes and is typically supplied in rolls which are laid between or over floor joists. This is seen as a typically straightforward job and rolls of mineral wool insulation can be bought from DIY stores or builder's merchants.
If you need to use your loft space as storage, joist extenders to lift loft boards above the insulation level can be used. It is important to make sure the loft boards don't touch the insulation as a ventilation gap between the insulation and the loft boards is necessary to reduce risks of condensation.

Make sure you don't squash the mineral wool when installing the boards as this will reduce its insulation value!

Insulating your loft will keep your house warmer but make the roof space above colder. The cooler air in your insulated loft could mean that cold draughts come through the loft hatch. To prevent this, you can fit an insulated loft hatch and put strips of draught-excluding material around the hatch edges. Alternatively, you can fit a piece of rigid foam insulation to the back of a loft hatch but make sure to also install draught strips around the edge.

Cost: **£-££**

Disruption: ■□□□□

Useful links

- Loft insulation - Centre for Sustainable Energy (cse.org.uk)
- Roof and loft insulation guide - Energy Saving Trust
- Building Regulations: Loft Insulation - Insulation - Planning Portal

Pitched Roof Insulation

In most homes, insulation is not required in pitched roofs as the insulation layer is in the loft floor (see loft insulation).

If you plan to renovate your loft space into a habitable room, then the pitched roof will need to be insulated. This is not a DIY job, and you will need a competent person to ensure that the insulation is appropriate and complete, and that adequate ventilation is provided where needed.

Risks:

The most significant risk with insulating pitched roofs is condensation/moisture. Maintaining adequate ventilation and ensuring paths for moisture to escape is key.

Associated works:

Repair to roof structure should be made prior to insulating to ensure longevity of the construction.

Regulatory considerations:

- Alterations to the roof of a house (e.g., re-roofing or inserting skylights) is Permitted Development.
- Planning Permission required for flats, maisonettes, and listed buildings.
- Listed Building Consent required for Listed Buildings.
- Making significant changes to thermal elements (walls, roofs or floors) would normally require Building Regulations approval through a building control body. Applicable Building Regulations: Part L (Conservation of fuel and power)

Cost: **££**

Disruption: ■■■□□

Useful links

- Roof and loft insulation guide - Energy Saving Trust
- GreenSpec: Housing Retrofit: Ventilated Pitched Roof Insulation
- GreenSpec: Housing Retrofit: Unventilated Pitched Roof Insulation
- Building Regulations: Insulation and thermal elements - Roof - Planning Portal

The Importance of Ventilation

As we spend most of our time inside buildings, ventilation is important to improve indoor air quality by removing potentially harmful pollutants from the air. Ventilation also helps to regulate internal moisture levels produced by breathing, washing, cooking and drying clothes. Finally, ventilation can also help prevent overheating.

In our homes, ventilation is particularly important in high-moisture areas such as kitchens and bathrooms. Using extractor fans and opening windows will help stop moisture from spreading to other areas of the house where the moist air could condense on cold surfaces which may lead to damp.

Drier areas in your home such as bedrooms also need ventilating. If your windows have trickle vents (small channel vents found on the top and side of modern windows), leave these open to help fresh air get around the room.

Fans are available which recover the warmth from any extracted air and return this back into the room – these are called single-room Mechanical Ventilation with Heat Recovery (MVHR) systems. For more extensive retrofit projects, a whole-house MVHR system could be more suitable (see Airtightness and Ventilation section below for more details).

Windows and Door Upgrades

Installing energy efficient glazing and high thermal performance doors will help reduce heat loss in your home.

Windows

If your home has single glazing, metal frame windows or double-glazing installed prior to 1990 then replacing these with new double or triple glazing will provide significant energy savings. Replacing reasonably well performing double-glazed windows is not advised as the energy saving benefits do not outweigh the additional cost. If some panes in your double-glazing are misted, it means the seal inside the two panes has failed and the windowpane is no longer providing insulation. Check with an installer if you can replace failed panes rather than the whole window to save costs.
If you are aiming for a high performing deep retrofit, then triple glazing would help achieve the required energy performance.

Secondary glazing is an alternative option for homes where new double or triple glazing is not possible (i.e., traditional buildings of heritage value). Secondary glazing is placed on the inside of a window opening and creates a vacuum between the windows which can achieve up to a 60% reduction in heat loss. Secondary glazing can be single or double glazed and is available as hinged, sliding or fixed systems. Thought should be given to cleaning and maintenance of the existing windows.

Doors

Older doors tend to have little insulative properties and can be very draughty. New external doors typically contain insulation to reduce heat loss and comply with current Building Regulations. Doors which are Passivhaus-certified will achieve the highest standard of thermal performance.

Conservation areas and listed buildings

If you live in a conservation area, it is expected that any changes to the exterior of your home continue to preserve or enhance the character of the area. This means that any new windows and doors should complement the character of the building and area. This typically means upgrading existing glazing or replacing windows and doors with good quality products which are in keeping with the original architectural style. Where windows are robust enough to accommodate extra thickness and weight, slim-line double glazing can be retrofitted into existing window frames to improve thermal performance. Thermal single glazing could also be used where double glazing is not possible. Where historic windows cannot be upgraded without causing harm to their significance (e.g. in a listed building) then consideration should be given to additional draught proofing works and the installation of secondary glazing

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Risks:

When your windows are replaced, it is vital to make sure the building remains well-ventilated as new windows and doors will contribute to improving the air tightness of your home. New double glazing is required to have trickle vents and you should keep these open where possible to allow fresh air into your home and moist, stale air to escape.

Regulatory Considerations:

- Installation of new windows and doors is Permitted Development (see the Planning Portal for specific conditions which apply).
- Planning Permission required for flats, maisonettes, and listed buildings.
- Listed Building Consent is required for Listed Buildings.
- If your new windows and doors are installed by a FENSA registered installer, they will be approved to carry out the work to comply with Building Regulations and supply you with a certificate showing the work has been completed by a registered installer upon completion.
- Applicable Building Regulations: Part L (Conservation of fuel and power), Part N (Glazing safety).

Cost: **£££**

Disruption: ■■□□□

Useful links

- Energy efficient windows and doors - Energy Saving Trust
- How to draught-proof your windows and doors - Energy Saving Trust
- Energy efficient glazing & high performance external doors - Centre for Sustainable Energy (cse.org.uk)
- Secondary glazing - Centre for Sustainable Energy (cse.org.uk)
- Planning Permission - Doors and windows - Planning Portal