AUGUST 2018

SWIP Internal Wall Insulation System

DESIGN GUIDE

swipIWI
INTERNAL WALL INSULATION

Keeping the home warm...

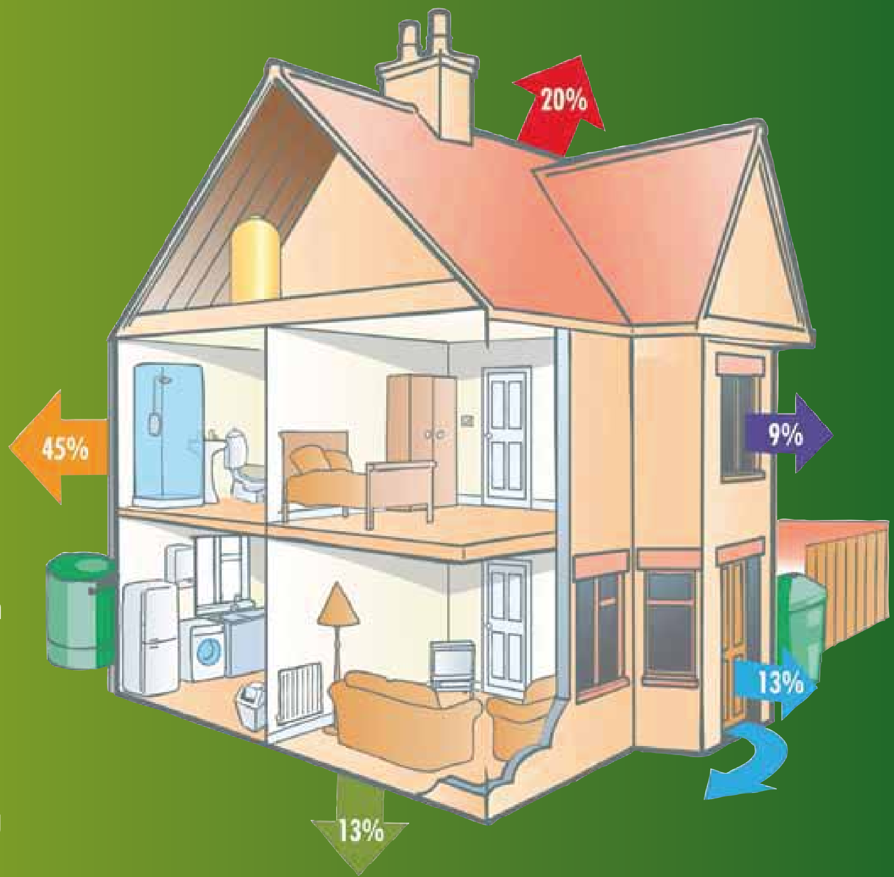
swipiwi.co.uk

The Importance of Wall Insulation in Houses

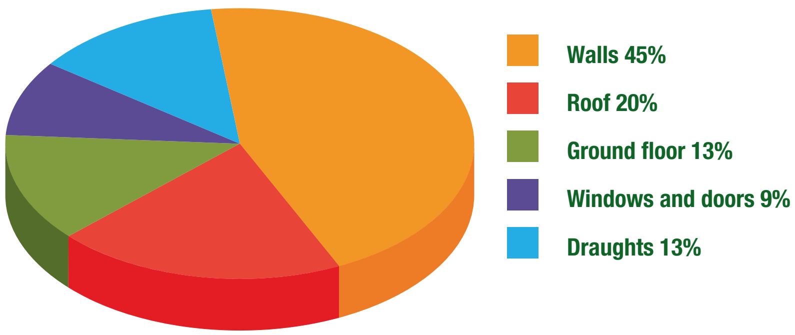
Buildings account for 40% of our energy consumption and in houses the majority of this energy is lost through the walls.
Therefore insulation is one of the most cost effective improvements that can be made and there are various insulation options depending on how the home is constructed. In general, the walls in the home can be categorised into two distinct types. Modern style homes, usually built post-war (1945), are constructed with cavity walls. Older style homes are constructed with solid brick walls.

In a home with cavity walls, around a third of the heat which is lost escapes through the walls. Occupants can make savings around £135 per year* and see a return on investment within a couple of years by insulating their cavities.

However, solid walls can lose even more heat than cavity walls. Typically the total heat loss from an un-insulated house with solid external walls account for 45%.   Insulating solid walls can be more expensive than cavity wall insulation. However, higher savings can be achieved through internal or external insulation for solid walls saving the occupant up to £445 a year* and internal wall insulation offers a quicker payback than external wall insulation.



Where we Loose Heat



Why Insulate a Solid Wall Property

Over a quarter of the UK's CO2 emissions are generated by our homes. Of the estimated 25 million homes in the UK approximately 36% have been labelled as "hard to treat", the majority of which are solid walled properties. Insulating all the solid wall properties in the UK would provide significant reductions in the amount of CO2 we emit and would also help to reduce an occupant's fuel bills.

Save money on energy bills

Homes losing heat, lose money. A poorly insulated home will be costing the occupant significantly more in heating bills than a fully insulated property. Insulation slows the transfer of heat, reducing the amount of energy consumption in the home - keeping it warm in winter.

Eradicate fuel poverty

50 per cent of solid wall properties are occupied by people living in fuel poverty. Fuel poverty is linked to multiple deprivation and unaffordable fuel prices characterised by inadequate insulation and inefficient heating systems. Fuel poverty can be seriously damaging to people's quality of life and can be particularly uncomfortable for the older generation, children and the disabled. Britain is said to have the highest number of avoidable deaths due to winter cold in Western Europe.

Help reduce CO2 emissions

By insulating the solid walls in these properties the environmental impact of providing space heating is significantly reduced. It is estimated that a properly insulated solid wall home could save approximately 2 tonnes of CO2 per year when compared to a poorly insulated one.*

Increase a home's value

Insulating a solid wall home properly can add to a home's market value by significantly improving its Energy Efficiency Rating. In the case of external wall insulation it can improve the overall aesthetics and internal wall insulation can improve the interior décor and appearance of a property.*

Energy Saving Trust May 2012

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Solid Wall Insulation Options

External wall insulation or internal wall insulation?

Solid walls can be insulated externally or internally. Each solution has its merits.

External Wall Insulation (EWI)

External wall insulation systems generally comprise an insulation layer mechanically or adhesively fixed (or both) to the existing wall and covered with a render coat. Timber boarding, concrete and clay tiles or metal cladding can also be applied. An external insulation system can radically improve the appearance of a property and planning permission as well as Building Regulations compliance may well be required prior to installation commencing. Particular attention will need to be paid, for instance, to window sills, rainwater downpipes and gutters, and eaves. Relocation or changes to the roofline may be required to accommodate the thickness of the system. External wall insulation systems (such as the SWIP EWI System) are installed by specialist installers.

Internal Wall Insulation (IWI)

Internal wall insulation solutions usually involve the installation of metal or timber studs with insulation installed between the studs and then overlaid with a vapour control layer and plasterboard. Alternatively, a thermal laminate board or rigid insulation board plus plasterboard can be mechanically fixed to the walls. These systems should not be used to isolate or hide moisture penetration or damp problems in the existing structure. In accordance with Building Regulations, solid walls should prevent moisture ingress arising from exposure to rain and snow without moisture penetrating to the inside and damaging the building. Insulating internally improves the thermal performance of the wall without affecting the external appearance of the building. However, there will be a small reduction in the internal floor area, typically only 1-2%. The SWIP IWI System can generally be installed with minimal disruption to occupants. In a large number of cases, internal wall insulation could be the preferred option because it costs less to install and maintain than external insulation systems, does not require scaffolding during the installation process, the existing appearance of the building is maintained and it provides flexibility during the refurbishment program.

Combination Installations

In many instances (especially mid terraced houses), the optimum solution may be to install a combination of both external and internal wall insulation. An EWI system may suit the back of a house where appearance is less important or already compromised by single storey extensions, outriggers, soil stacks, rainwater downpipes and boiler flues etc. The front of the house can be insulated with the SWIP IWI System, which maintains aesthetic quality of the existing facade, while also delivering high levels of thermal performance and a flexible installation solution.

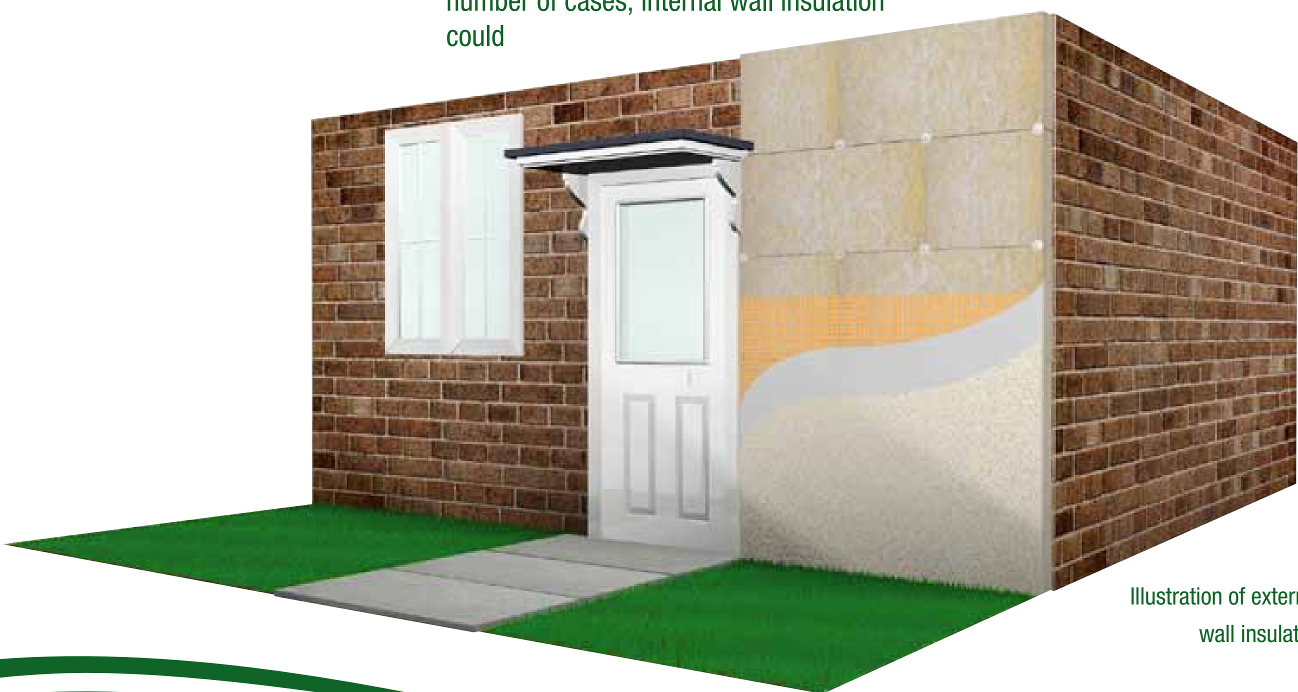


Illustration of external wall insulation

Solid Wall Insulation Options

Advantages of internal over external wall insulation

Solid external masonry walls can be upgraded in two ways, either internally or externally. There are several reasons why internal wall insulation may preferred to external wall insulation for upgrading solid masonry walls:

- It costs less to install than external insulation
- It is easier to maintain than external insulation
- No scaffolding is required
- The external appearance of the building is maintained so it can be installed in conservation areas
- Materials are readily available
- It can be installed on a room-by-room, single façade or whole house basis, as part of a full refurbishment plan
- Installation is not delayed by bad weather

Thermal Comfort

An internal wall insulation system enables comfortable room temperatures to be achieved more quickly than with an external wall insulation system. Heating time periods can be reduced, which, in turn reduces heating costs particularly in intermittently heated buildings such as dwellings.

Taking the Opportunity

An ideal opportunity to install internal insulation on a solid wall is when other work is already required, e.g. when existing plaster is crumbling and needs replacement, when the decorative finish is being removed, or when rewiring or installing central heating, or during total refurbishment. The existing wall should be examined and any remedial work, e.g. the insertion of a damp proof course or the repair of overflowing guttering, carried out before the insulation system is installed. It is important that the internal insulation system is not used to hide or isolate damp or wet walls.

Taking advantage of any opportunity to improve the energy efficiency of a dwelling and upgrading un-insulated external walls provides a number of benefits including:

- Reducing CO2 emissions
- Reduced fuel bills
- Increased thermal comfort for the occupiers
- Reduced risk of condensation and mould growth
- Reduction of fabric damage and maintenance costs.

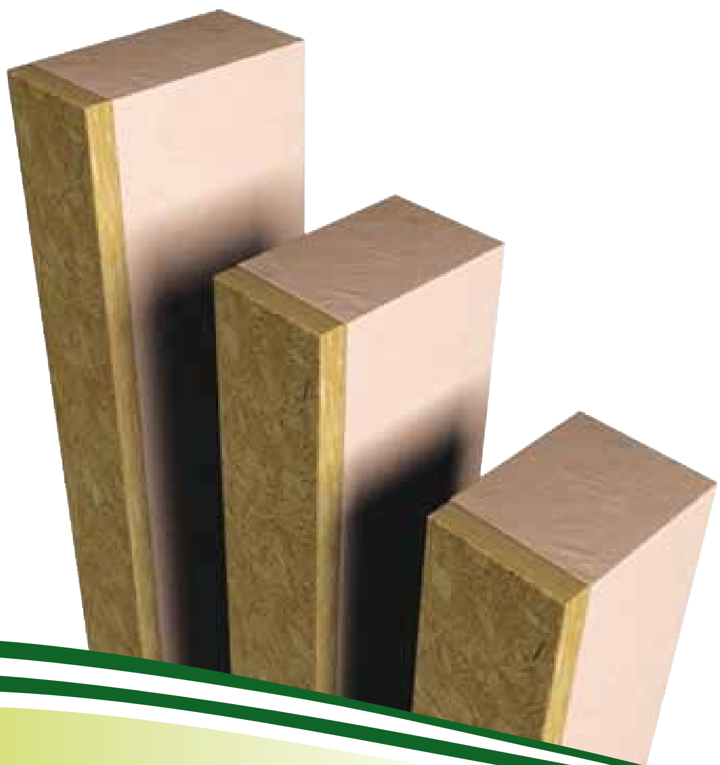
Illustration of internal wall insulation

SWIP Internal Wall Insulation System

SWIP IWI system components SWIP Internal Wall Insulation provides a system based approach to internal wall insulation. The system has been tested and certified to demonstrate that all components work together as designed to deliver the required performance. The SWIP IWI System is designed for upgrading existing solid (or cavity) external walls. It consists of thermally engineered composite studs and insulation slabs, which can be combined to provide greater thicknesses of high performance thermal insulation than achievable by using a single thickness. SWIP Studs are a composite of high performance extruded polystyrene insulation and Oriented Strand Board (OSB). Traditional internal wall insulation which uses traditional timber or metal studs leads to thermal bridging through the studs. This needs to be compensated for by increasing the thickness of the overall system. The innovative use of the thermally insulated SWIP Studs within the SWIP system prevents this and results in an overall thinner system.The SWIP IWI System has been designed to simplify the process of upgrading existing solid (and cavity) masonry walls whilst delivering high levels of thermal performance. Typical U-values

U-values (W/m2K)			
SWIP Stud thickness (mm)	SWIP Stud with SWIP Batt	SWIPStud with SWIP Batt & 35mm SWIP PIR Laminate	SWIP Stud with SWIP Batt & 50mm SWIP PIR Laminate
65	0.43	0.29	0.25
95	0.30	0.22	0.19
2 x 65	0.24	0.19	0.17

For project specific calculations contact our Technical Advice and Support Centre on 0845 402 3508



System Components

SWIP Stud – Extruded polystyrene bonded to Oriented Strand Board (OSB)

SWIP Batt - Water repellent glass mineral wool slab

Plasterboard fixing – Drywall screws

Sealant – SWIP multi purpose sealant

Plasterboard

Fixing to masonry - SWIP IWI fixings manufactured in accordance with BS1210

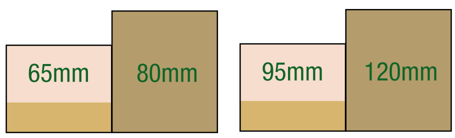
Wall plugs – SWIP IWI wall plugs

SWIP Vapour Control Layer – vapour resistance of 260MN.s/g

SWIP Reveal Boards - Extruded polystyrene bonded to plasterboard. Extruded polystyrene with a cement screen either side

Comparison between SWIP Stud and Timber Stud

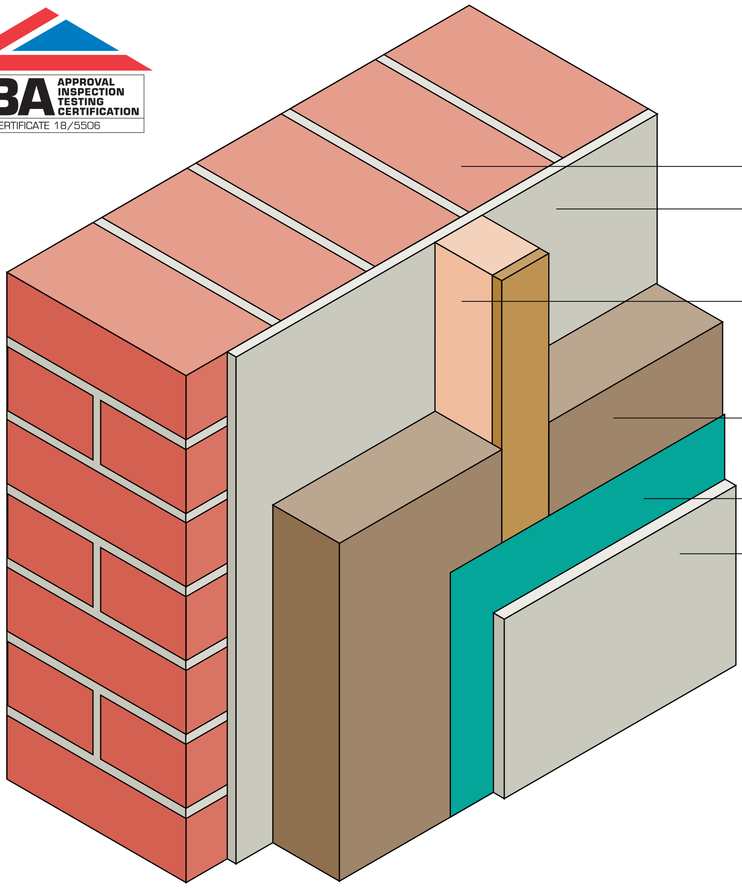
U-value 0.45 W/m2K U-value 0.30 W/m2K



SWIP Stud Timber Stud Ecostud Timber Stud

The Components...

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 18/5506



Existing solid masonry external wall

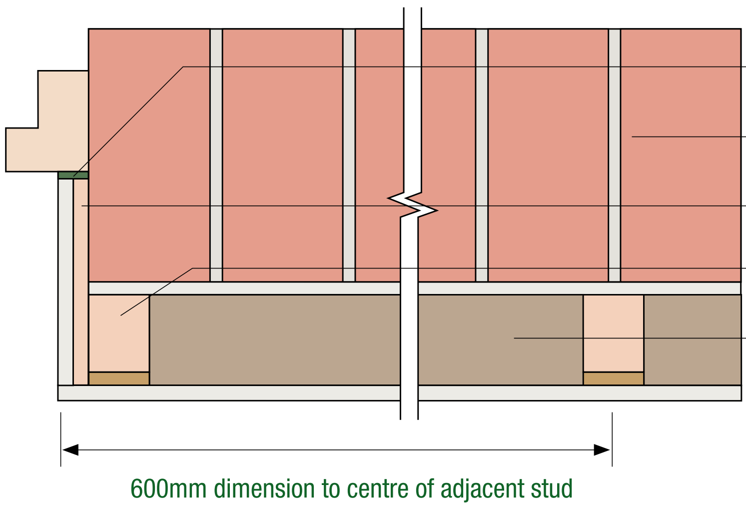
Existing plaster finish (if sound)

Thermally engineered SWIP Stud extruded polystyrene bonded to a 15mm strip of Oriented Strand Board

Earthwool SWIP Batt, water repellent glass mineral wool slab

SWIP Vapour Control Layer

12.5mm plasterboard or SWIP PIR Laminate



Joint sealed with SWIP Sealant

Existing solid masonry external wall with existing plaster

SWIP Reveal lining reveal

SWIP Stud
(jamb stud inline with edge of existing reveal)

Earthwool SWIP Batt between SWIP Studs

SWIP Stud				
Thickness (mm)	Width (mm)	Length (mm)	Thermal conductivity (W/mK)	Thermal resistance (m2K/W)
65	50	2400	n/a	1.63
95	50	2400	n/a	2.54

Earthwool SWIP Batt				
Thickness (mm)	Width (mm)	Length (mm)	Thermal conductivity (W/mK)	Thermal resistance (m2K/W)
65	555	1200	0.035	1.85
95	555	1200	0.032	2.95

Features & Advantages of SWIP IWI System

Features of the SWIP IWI System

- A cost-effective, thermally efficient solution
- Quick and easy to install so rooms are out of commission for the minimum period
- Can improve the acoustic performance of the existing external wall (page 9)
- Finished using a plaster skim coat or dry lining techniques
- No need to remove existing wall finish, unless un-sound
- System can accommodate wall imperfections
- Easily adapted around openings such as windows and doors
- Can easily accommodate fixings for fittings such as radiators, pictures and shelving

Benefits of the SWIP IWI System

The use of SWIP Studs eliminates the thermal bridging issue associated with systems incorporating timber and metal studs. The thermal resistance of SWIP Studs, provides a high level of thermal resistance, which is comparable to that of the Earthwool SWIP Batts fitted between the SWIP Studs. For instance, the SWIP IWI System is almost 13% more thermally efficient than a timber stud system of the same thickness.

Compared with other internal insulation methods, the SWIP IWI System has the following additional advantages:

- The system components are unaffected by moisture
- A minimum number of lightweight, easy to handle, components are required
- System thickness is comparable to alternative solutions, but greater thicknesses can be provided simply by installing two studs, one on top of the other
- Airtight system enables maximum thermal efficiency to be achieved
- Incorporates highly sustainable glass mineral wool insulation (see page 9)
- Earthwool SWIP Batts have the maxi mum Euroclass A1 reaction to fire rating to BS EN 13501: Part 1

Thermal Performance

A typical 225mm (nine inch) thick un-insulated masonry external wall with dense plaster internally will achieve a U-value of approximately 2.00W/m2K. The same wall insulated with the SWIP IWI System, using 95mm thick SWIP Studs, will achieve a U-value of at least 0.30W/m2K, an improvement in thermal performance of over 80%.

If a typical three bedroom semi-detached house were to be upgraded in this manner, it would reduce the carbon emissions associated with the house by approximately 2 tonnes per year.
The tables (on pages 6 and 7) give key thermal performance data for the system. Three SWIP Stud thicknesses are available, 65, 80 and 95mm, which can be combined to give a variety of thickness solutions.

Double stud installation

Enhanced thermal performance can be achieved by installing double layers of SWIP Studs. For instance, a combination of two 65mm SWIP Studs will achieve a U-value of 0.25W/m2K. After securing SWIP Studs in accordance with the installation instructions on pages 15 - 19, screw fix a second SWIP Stud to the first one. Both SWIP Studs should be installed in the vertical position. When fixing the second SWIP Stud it is essential that the screws should be sufficient to ensure a minimum 38mm penetration into the first SWIP Stud. Care should be taken to ensure that the two sets of screws are not installed in coincident positions. Earthwool SWIP Batts, plasterboard and SWIP Vapour Control Layer are installed in the same manner as in a single stud application.

Other Key Issues for the SWIPIWI System

Sustainability
The SWIP IWI System incorporates Earthwool SWIP Batt glass mineral wool insulation, which has the following sustainability credentials:

- It has the maximum A+ generic BRE Green Guide rating
- The basic raw materials are silica sand (the earth's most common mineral) and recycled glass bottles
- It can be recycled at the end of the building's life
- Manufactured using ECOSE® Technol ogy a revolutionary new formaldehyde free binder technology, based on rapidly renewable materials instead of petro-based chemicals. It reduces embodied energy and delivers superior environmental sustainability
- Supakube compression packaging saves energy and delivers more product per pack

Reducing air leakage
Existing dwellings can suffer from excessive air leakage which, if not treated, can lead to high energy costs, occupant discomfort from draughts & external noise, as well as a reduction in indoor air quality. To ensure that upgrading of external walls is as effective as possible, it is important to keep air leakage to an absolute minimum & preferably prevent it. Air leakage can be between the interior & exterior environments, as well as between different elements of the building envelope. Air leakage through the masonry wall occurs through cracks in the bricks, gaps where there is poor adhesion between the mortar & the masonry units, or diffusion through the masonry units themselves. Where the plaster has been removed & air leakage through the wall is thought to be excessive, it should be tackled before the SWIP IWI System is installed by applying a parge coat to the inner surface of the wall. As the insulation component of the SWIP IWI System is in intimate contact with the vapour control layer, air movement behind the system should be negligible. However, to prevent unwanted air leakage all junctions with other elements should be well sealed with particular attention being paid to the joints between the SWIP IWI System and window frames. The SWIP IWI System incorporates SWIP Vapour Control Layer which also acts as an air leakage barrier and enables the system to be integrated with other elements of the building such as ceilings and intermediate floors which is essential if air leakage levels are to be minimised or negated. In addition, SWIP Multi Purpose Sealant should be used to seal electric sockets against the plasterboard, as well as all gaps around plumbing service penetrations. Any large gaps or penetration through the dry lining system can be sealed with expanding foam.

Air leakage in rigid foam board internal wall insulation solutions
Internal wall insulation solutions incorporating rigid foam boards often incorporate a batten airspace, (either behind, or in front of the insulation component) which can lead to air leakage and air movement through the system. Air leakage in, or through, an internal wall insulation solution can lead to a large amount of unnecessary heat loss as well as providing discomfort to the occupants of the dwellings due to the presence of cold draughts.

Note: Air leakage should not confused with ventilation, which is the controlled flow of air into and out of the building and is usually achieved by incorporating ventilators or ventilation systems into the fabric of the building.

Acoustic Performance
Glass mineral wool is inherently good at absorbing sound and allows sound energy to be dissipated within the body of the insulation. This helps to reduce flanking sound transmission across intermediate floors and also provides sound insulation from external noise sources, especially as the plasterboard lining provides additional mass to the existing construction. The airborne sound insulation performance of a solid masonry wall, both to and from the exterior, can be improved significantly by installing the SWIP IWI System; a typical improvement of up to 5dB can be expected. However, to maximise the improvement in acoustic performance, it is important that the installed system is as airtight as possible.

Thermal Mass
Generally speaking the amount of available thermal mass may not be significantly reduced by the installation of an internal wall insulation system in most house types. Whilst there are no definitive rules as to how much thermal mass is required, a general rule of thumb is that the surface area of the walls and floors providing the mass should be at least six times that of the area of glazing in the room. The vast majority of existing houses will have masonry separating and partition walls, which may provide sufficient thermal mass to help stabilise the internal environment.

Thus, in a typical mid-terraced property, where the SWIP IWI System is only installed on the glazed elevations, the thermal mass of the dwelling may not be significantly effected.

Avoiding Dampness within the Construction

Dampness in Walls
The most common causes of dampness in solid masonry external walls are, penetrating damp (often caused by deterioration of the existing mortar, blocked gutters or faulty rainwater goods), rising damp and condensation, particularly surface condensation (see also page 11).

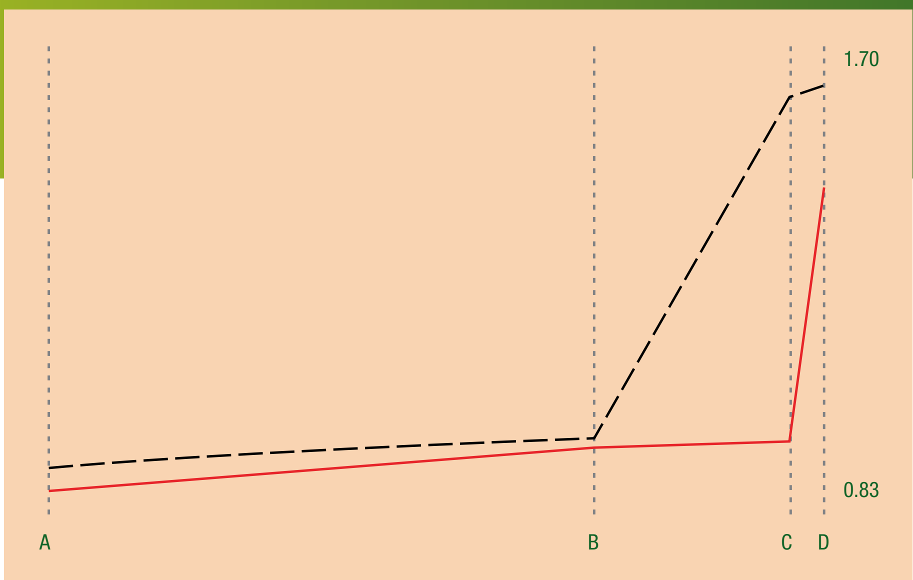
Dampness can have a negative effect on the physical properties of the materials used to construct the wall. Best practice is to cure any damp problems before installing an internal insulation system in order to protect the building fabric from long term damage. For instance, missing or damaged render should be reinstated, faulty or missing flashings should be repaired or replaced and areas suffering from mortar deterioration should be re-pointed with a suitable mortar mix. The fact that the SWIP IWI System uses water repellent insulation between the studs means that it can be installed even on external walls that still have some residual dampness. (i.e. during the drying out period after wall treatment). The extruded polystyrene component of SWIP Studs, being impervious, is also unaffected by exposure to moisture, SWIPStuds should be mechanically fixed to the existing wall using moisture and corrosion resistant fixings and wall plugs. Prior to installation of the SWIP IWI System a comprehensive property survey should be carried out to establish the condition of the building, its suitability to receive the system and also to identify any remedial work required before installation of the system commences.

Interstitial Condensation
Interstitial condensation occurs when warm, moist air from inside a building penetrates into the fabric of a structure and meets a cold surface, where it cools, reducing its ability to carry moisture and increasing the risk of condensation forming within the construction. As can be seen from the condensation analysis graph below (Figure 1), interstitial condensation does not occur within external walls that have been upgraded by the installation of the SWIP IWI System because the actual vapour pressure stays below the saturated vapour pressure through the whole construction. This is due to the presence of the SWIP Vapour Control Layer on the warm side of the insulation, i.e. between the plasterboard and the SWIP Batt insulation.

External conditions:

Temperature: 5° C

Relative humidity: 95%



Internal conditions:

Temperature: 18° C

Relative humidity: 65%

Figure 1 – Condensation prediction graph of a wall insulated with the SWIP IWI System

Saturated vapour pressure

Actual vapour pressure

Avoiding Thermal Bridging and Surface Condensation

Thermal Bridging
Thermal bridging occurs when the continuity of the insulation is broken causing the inner surface of the wall at that point to become much cooler than the surface where the wall is insulated. This typically occurs at the junction of an external wall and a separating wall or floor. Thermal bridging can cause an increase in heat loss, surface condensation and mould growth and can be a particular problem in terraced houses.

Surface Condensation
Simply put, surface condensation occurs when water vapour in the air cools and condenses (reverts to liquid form) when it comes into contact with a cold surface. Reducing the amount of water vapour in the air by extracting moist air from kitchens and bathrooms and increasing the surface temperature will prevent condensation forming on the internal surface of solid external walls. The installation of the SWIP IWI System will raise the surface temperature of the walls to a level whereby condensation will not form under usual maximum humidity conditions experienced in dwellings. As can be seen from Figure 2, the warm surface temperature of the internal walls (red colour) remains constant across the SWIP Studs, reducing the risk of condensation forming on cooler surfaces.

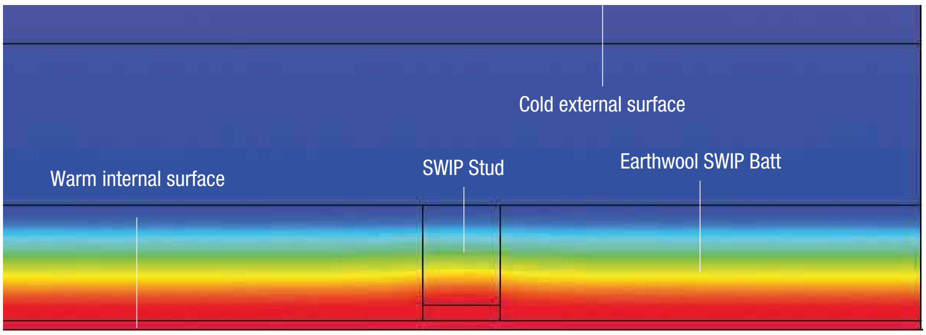
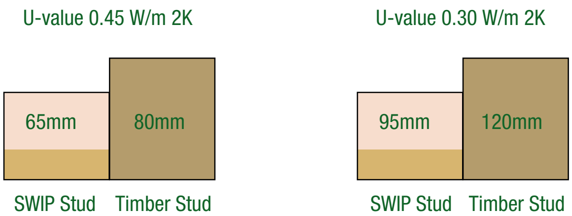


Figure 2 – Thermal contours through the external wall and SWIP IWI System
(Image generated using HEAT 3 software)

Comparison between SWIP Stud and Timber Stud



Combustion Appliances
It is imperative that ventilation requirements for gas, oil or coal fired combustion appliances are not compromised by the installation of the SWIP IWI System and the system does not interfere with the supply of fresh air to the appliance. Recommendations, guidance and compliance with the Building Regulations for the ventilation of combustion appliances can be found in Building Regulations Approved Document J - Combustion appliances and fuel storage systems.

If in any doubt regarding the safety of a combustion appliance consult with a Gas Safe registered engineer.

Flues
Care must be taken to ensure that flues and ventilation measures for gas, oil or coal fired combustion appliances are not blocked or adversely affected by the installation of the SWIP IWI System. Where a flue penetrates the SWIP Shell IWI System, the flue can be completely surrounded and encased by Earthwool SWIP Batt which is a non-combustible glass mineral wool product. The extruded polystyrene content of SWIP Stud should not be subjected to temperatures in excess of 70ºC. The flue can be faced with a non-combustible board, e.g. plasterboard or cement based board, prior to the installation of the SWIP IWI System. However, if in doubt regarding the surface temperature of the flue, contact the manufacturer of the appliance under consideration.

Party Walls

Figure 3 –Thermal contours at the junction of a 225mm solid external wall and a party wall (Images generated using HEAT 3 software)

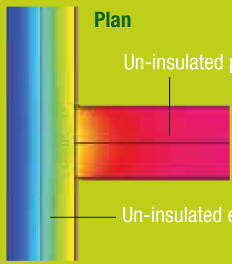


Figure 3a Party wall without insulation

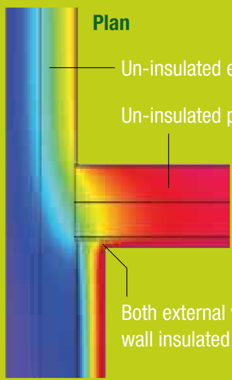


Figure 3b Party wall insulated on one side

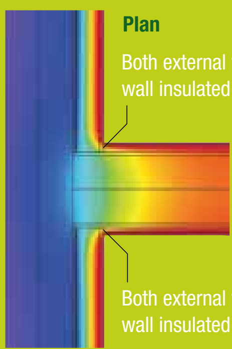


Figure 3c Party wall insulated on both sides

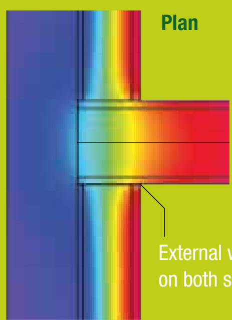


Figure 3d External wall insulated either side of uninsulated party wall

Thermal

The junction of the external wall and the separating wall is the location with the greatest risk of thermal bridging and surface condensation. As well as insulating the external wall, the recommendation is to partially insulate the separating wall using SWIP reveal board for a distance of 400mm back from the external wall. This will prevent excessive heat loss and keep the surface temperature high enough to avoid the risk of surface condensation.

Acoustic

When installing SWIP reveal board on separating walls there is potential to reduce the acoustic performance of the separating wall, due to the transfer of vibrations that can occur if the thermal laminate board is of the rigid foam type.In instances where the acoustic performance of the separating wall is of overriding concern a mineral wool thermal laminate should be installed. Alternatively, install an independent timber stud frame (fixed at the floor and ceiling only) and friction fit 50mm of Acoustic Roll between the studs, finish with two layers of 12.50mm plasterboard and stagger the joints between the plasterboard sheets.

Neither external wall nor party wall insulated

Figure 3a shows the effect of the party wall bridging the external wall. The internal corners are in the yellow contour and are colder than the main body of the external wall, increasing the risk of condensation and mould growth to occur and further reducing the thermal performance of an already poorly performing wall.

External wall and party wall only insulated on one side

Figure 3b demonstrates the difference between insulating and not insulating at the party wall junction with the external wall. The heat loss through the un-insulated external wall is approximately 80% greater than that through the insulated external wall.

External wall and party wall insulated on both sides

Figure 3c shows that when both the external wall and party wall are insulated, there is a fairly even temperature distribution at the party wall junction thus wall surfaces are kept warm, minimising the risk of condensation and mould growth.

External wall insulated party wall un-insulated

Figure 3d shows the effect of not insulating at the party wall junction there is significant additional heat flow through the junction and potential for surface condensation and mould growth to occur.

Insulation Continuity at Floors

Suspended timber ground floors
An un-insulated suspended timber ground floor typically accounts for 13% of the heat loss from a traditionally constructed dwelling and should be insulated whenever possible. Earthwool SWIP Batt can also be used for this application.
The insulation should be the same depth as the floor joists and fully fill the available space so as to be in intimate contact with the underside of the floor deck and tight against the sides of the joists. It should be supported on netting, which is stapled or nailed, to the underside of the joists. The gap between the last joist and any walls should also be insulated to maintain continuity with the SWIP IWI System. If there is a basement or there is a deep enough sub floor void, the insulation can be installed from below and the netting fixed to the underside of the joists. Otherwise, the only practical way to insulate the floor is to lift the floorboards and form a 'cradle' by running the netting over and between the joists and then install the insulation from above.To minimise air leakage the SWIP Vapour Control Layer should be overlapped onto the floor deck and the following joints should be sealed with SWIP Multi Purpose Sealant:

1. Between the floor deck and external wall.
2. Between the VCL and the floor deck.
3. Between the plasterboard sheet and the VCL.
4. Between the underside of the skirting board and the VCL. ***(Figure 4, page 14)***

Gaps where radiator pipes and electric cables penetrate the floorboards should also be sealed, as should any gaps between individual tongued and grooved floorboards.Where the joints between floorboards are open, or square edged boards have been used, a more efficient way of sealing the floor is to lay hardboard sheets over the complete floor area.

Intermediate floors : Insulation continuity
When upgrading external walls, the insulation layer should be as continuous as possible across intermediate floors. Failure to insulate the floor joist zone results in a major thermal bridge across the SWIP IWI System which can significantly reduce the overall thermal performance of the external wall.
For example, the effect on the front elevation of a typical mid terraced house insulated with the SWIP IWI System would be to reduce the U-value from 0.35W/m2K with the floor zone insulated, to an average of 0.41W/m2K with an un-insulated floor zone, equivalent to a 15% increase in heat loss through the wall.The loss of thermal performance can be avoided by filling the floor zone (i.e. the ceiling void between the floor boarding and the ceiling) with Earthwool SWIP Batt insulation for a certain distance from the external wall, the extent depending on the direction of the floor joists in relation to the external wall or party wall.

Joists parallel with separating wall
Insulation should be installed between the last joist & the party wall & extend along the party wall by at least 400mm. Insulation should also be installed between the joists that are built into the external wall & extend into the room by at least 300mm. (Figure 5, page 14). As can be seen from the thermal contours in Figure 6, page 14, insulating between the joists of an intermediate floor & the space between the last joist & the party wall ***(right of diagram)*** substantially improves thermal performance, compared with the un-insulated floor zone (left of diagram) both through the plain areas of the external wall and through the party wall junction. Timber joists are usually built into the external walls when they run parallel to the party walls. In this instance the mortar joints at the interface between the joists and the masonry infill will almost always be partially open or cracked due to shrinkage of the mortar, lack of mortar adhesion to timber or due to the joints being poorly filled during the construction process .In order to prevent and reduce air movement and leakage these joints should be filled with SWIP Multi Purpose Sealant.

Joists parallel with external wall
Insulation should be installed between the last joist and the external wall and within the first joist space for the full length of the external wall (Figure 7, page 14).

Sealing to prevent air leakage
To ensure that the SWIP IWI System achieves its intended performance, it is important that the perimeter joints at the floor and ceiling are sealed with a continuous bead of SWIP Multi Purpose Sealant. In particular, the gap between the floor and wall and the ceiling and wall should be sealed, as well as the joint between the skirting board and the floor. Continuity of the SWIP Vapour Control Layer should be maintained across the floor zone, and the SWIP Vapour Control Layer should be in intimate contact with the floor joists and mechanically fixed to them with staples or timber battens. (Figure 8, page 15). Failure to seal these joints could result in cold air entering the building, which could lead to harmful condensation occurring in the timber, and also reduce the thermal and acoustic performance of the SWIP IWI system.

Insulation Continuity at Floors

Timber lintels and joist ends built into the external wall

Many existing solid wall properties will have timber components built into the internal leaf, e.g. lintels over openings and built in floor joists, in these instances the installation of the SWIP IWI System will not increase the risk of interstitial or surface condensation forming.

Timber lintels

Condensation analysis based on the methodologies detailed in EN ISO 13788 and BS 5250 also confirms that when the SWIP IWI System is installed (and timber lintels built into the internal leaf of the external wall are present), the lintels will not suffer from either surface or interstitial condensation. As with any internal wall insulation solution the delivered performance of the SWIP Vapour Control Layer is important if a successful installation is to be achieved. Therefore, the SWIP Vapour Control Layer should be free from holes, gaps should be made good, tears repaired and overlaps sealed with aluminised tape. Good workmanship and integration of the SWIP Vapour Control Layer to other parts of the building is important if a vapour and air tight system is to be achieved.

Floor joist ends

Condensation analysis based on the methodologies detailed in EN ISO 13788 and BS 5250 (and assuming a high internal temperature and relative humidity) shows that condensation will not form in the inter-floor zone bounded by the ceiling and first floor deck. Wetting of the internal masonry leaf by penetrating driving rain is likely to be more of a problem.

Insulation Continuity at Floors

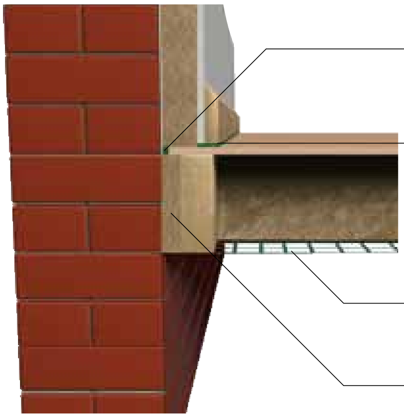


Figure 4 – Detail at suspended timber ground floor

Figure 5 – Floor zone insulation – joists parallel with separating wall

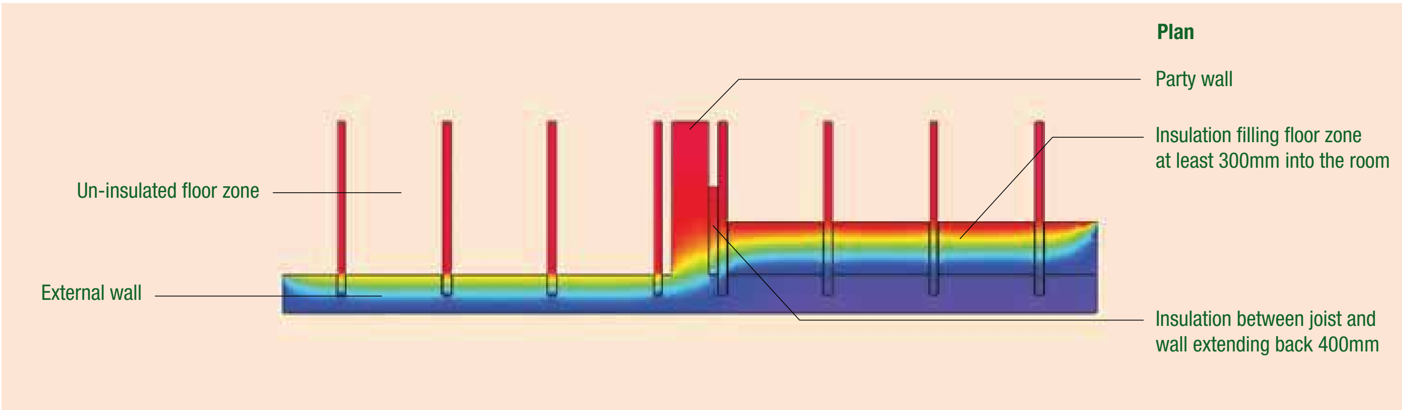


Figure 6 – Thermal contours with and without floor zone insulated (Images generated using HEAT 3 software)

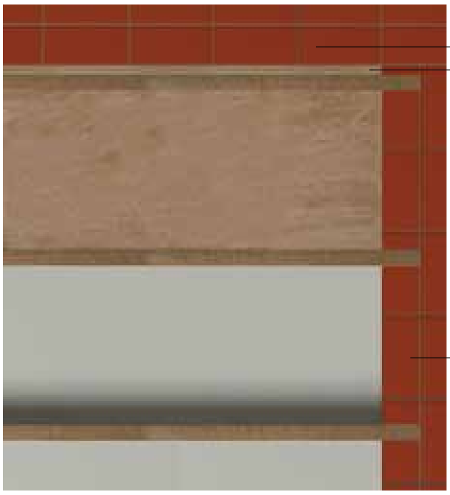


Figure 7 – Floor zone insulation – joists parallel with external wall

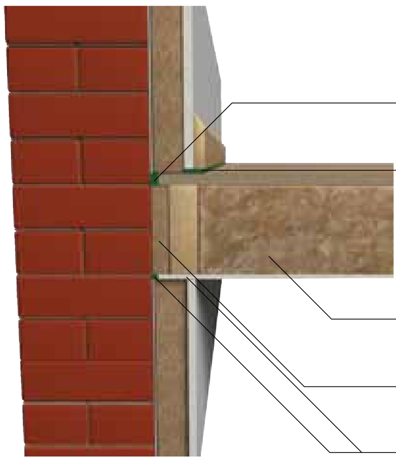


Figure 8 – Detail at intermediate timber floor

Insulation of SWIP IWI System

Figure 9

Figure 10

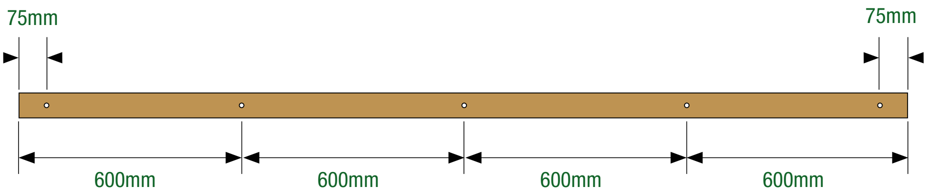
Figure 11

Note: The SWIP IWI system can only be installed by SWIP Insulation approved SWIP IWI installers

Before installing the SWIP IWI System a comprehensive property survey should be carried out to establish the condition of the building, its suitability to receive the system and identify any remedial work needed prior to starting the upgrade process. At this point a decision can be made as to whether an internal or external wall insulation system is most appropriate for the property under survey.

1. Where plaster is sound, fix directly through it, removing existing skirting boards if required before fixing the SWIP Studs (Figure 9). If not sound, remove decayed plaster and, for greatest airtightness, seal with a parge coat. SWIP Studs are to be installed with the OSB facing into the room.

2. Screw fix SWIP Studs horizontally to the foot of the existing wall. A minimum fixing penetration of 40mm is required into the existing masonry wall (excluding thickness of plaster). Five fixings per SWIP Stud are required but the number can be increased as required, or as dictated by site conditions. Position the fixings at 600mm maximum centres and 75mm from the end of each SWIP Stud as shown below. These SWIP Studs should be positioned so that, if the wall is bowed or not vertical, the verticality of the SWIP IWI System is maintained. The horizontal SWIP Studs should also be located to that the OSB facing can provide a fixing point for the skirting board (Figure 10).



3. Screw fix SWIP Studs horizontally at the head of the wall following the same process as in step 2. Then, fix SWIP Studs vertically between the top and bottom horizontal SWIP Studs as indicated in step.
4, spacing them at 600mm horizontal centres to coincide with plasterboard dimensions. Ensure that the vertical SWIP Studs are cut and installed so as to be in close contact with the horizontal studs at floor and ceiling level (Figure 11). Where the ceiling line is irregular, cut SWIP Studs to extend from the horizontal SWIP Stud at the foot of the wall to the ceiling and fix as described in step 2. Once the SWIP Studs are fixed in position, mechanically fix SWIP Stud noggins between the studs at ceiling level to receive plasterboard fixings.

4. Fix all vertical SWIP Studs to the existing wall using screws and suitable universal wall plugs.

5. If there are irregularities in the wall surfaces, pack out the SWIP Studs using suitable materials which are unaffected by moisture such as marine ply, preservative treated timber or plastic packing pieces (Figure 12).

6. Friction fit SWIP Batts between the SWIP Studs ensuring the insulation zone is completely filled. There should be no gaps between the SWIP Batts and they should be installed so as to be in intimate contact with the SWIP Studs and the SWIP Vapour Control Layer (Figure13). Where SWIP Batts require cutting, they should be cut 5mm wider than the space thay are intended to fill (Figure 14).

Insulation of SWIP IWI System

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

7. Once the insulation has been installed, staple SWIP Vapour Control Layer, to the SWIP Studs. SWIP Vapour Control Layer should be free from holes, any gaps should be made good, with tears repaired and overlaps sealed with aluminised tape. Screw 12.5mm standard plasterboard to the SWIP Studs using 38mm drywall screws, or wood screws, at nominal 300mm horizontal and vertical centres, reducing to 200mm centres at corners. Ensure that there is a 3-5mm gap between the plasterboard and the existing floor to allow space for sealing, as in step 8. The plasterboard sheets should be installed full height vertically. (Figure 15)

8. Seal all joints at the perimeter of the plasterboard using SWIP Multi Purpose Sealant to prevent air movement behind or through the SWIP IWI System. (Figure 16)

9. Mechanically fix the skirting boards through the plasterboard to the horizontal SWIP Studs at the foot of the wall, or fix them with a high strength instant grab adhesive to the plasterboard. Seal the skirting to the floor with SWIP Multi Purpose Sealant as a final precaution against air leakage. See page 18 for an alternative method for fixing skirting boards Footnote: The plasterboard selected should be suitable for the activities to be undertaken within the space being upgraded. For instance, where the walls may be subject to mechanical damage, consider using an impact-resistant plasterboard such as SWIP Denseshield.

Pullout strength Pullout strength tests have confirmed that SWIP Stud performs equally to that of metal or timber studs, 38mm Drywall screws or wood screws should be used when securing plasterboard to SWIP Studs.

Installing SWIP Vapour Control Layer

SWIP Vapour Control Layer should be installed in accordance with the recommendations of BS 5250: 2011 ‘Code of practice for control of condensation in buildings’ and should be installed on the warm side of the insulation.

All laps in SWIP Vapour Control Layer and junctions at interfaces with other elements and materials in the building e.g. metal and timber studs and joists, cementitious boards and uPVC window frames should be sealed with an aluminised tape. The layer of the SWIP Vapour Control will be reduced unless it is effectively sealed to other elements of the building.

All joints in the SWIP Vapour Control should be lapped by a minimum of 75mm, and sealed with aluminised tape, which should be applied equidistantly over the lap.

Whenever possible, laps in the SWIP Vapour Control Layer should be coincident with an SWIP Stud in order to aid the sealing process. The number of laps can be kept to a minimum by installing full roll widths of SWIP Vapour Control Layer.

Where the heads of fixings penetrate the SWIP Vapour Control Layer they should be sealed with an aluminised tape, as should any tears, holes or cuts. The tape should overlap the damaged area by a minimum of 75mm.

Where larger areas of damage occur they should be repaired with a patch of SWIP Vapour Control Layer and aluminised tape applied as detailed above.

Insulation at Window and Door Openings

Figure 17

Figure 18

Figure 19

Figure 20

Wall Openings

10. Around openings (windows, doors etc), screw fix SWIP Studs to the wall at the edge of jambs, sills and heads as determined by on site requirements (Figure 17).

11. Line the openings with a SWIP reveal board, preferably, with a minimum thermal resistance of 0.34m2K/W. If there are thickness constraints due to the size of the window or door frame, install as thick a thermal laminate board as is practicable. The edge of the thermal laminate board should finish flush with the face of the SWIP Studs (Figure 18).

12. The thermal laminate reveal board should be fully bedded into position (a multi purpose plaster adhesive is suitable) in order to prevent air move-ment behind the board. Once the adhesive has set, secure the thermal laminate with localised mechanical fixings, typically at 600mm vertical centres, or as determined by on site requirements Complete continuity of insulation should be achieved around the opening at the junctions of heads, jambs & sills by cutting back the plasterboard at the edge of the thermal laminate board (Figure 19).

13. When setting out SWIP Studs adjacent to openings in relation to plasterboard dimensions, make allow-ance for the fact that the plasterboard needs to extend beyond the centre line of the jamb SWIP Stud to cover the thermal laminate board. For example, the dimension between the centre lines of the jamb SWIP Stud & the next SWIP Stud needs to be 600mm, less the thermal laminate thickness (inc adhesive dabs), less 25mm (half the SWIP Stud width) (Fig 20).

Installation Method at Skirting Board Level

Whenever possible skirting boards should be removed prior to installation in order to maintain insulation thickness and continuity.However, where this is not possible the following method may be used. Screw fix horizontal SWIP Studs (between vertical SWIP Studs) at the appropriate height in order to provide a fixing point for new skirting board and facilitate securement and sealing of the SWIP Vapour Control Layer.The depth of the horizontal SWIP Studs should be reduced accordingly to ensure that they are installed in line with the face of the vertical SWIP Studs. Where necessary reduce the thickness of the SWIP Batts to suit the reduction in depth of the SWIP Studs.

Fixings should be located 75mm in from each end and one in the centre of the horizontal SWIP Stud. A minimum fixing penetration of 40mm is required into the existing masonry wall (excluding thickness of skirting board and plaster).

Insulation at Window and Door Openings

Figure 21

Figure 22

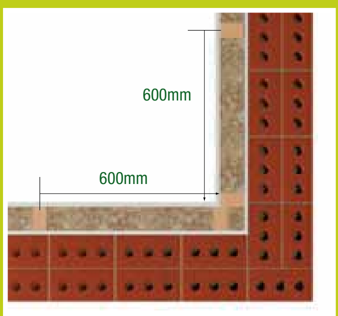


Figure 23

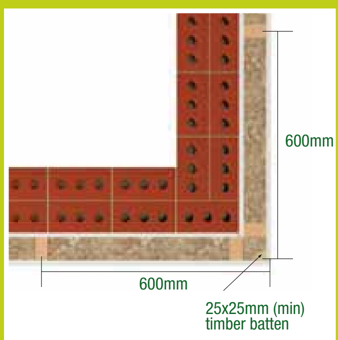


Figure 24

Stepped or Check Reveals

14. Install a new window frame towards the outside of the wall and build out head and jamb reveals with a suitably sized timber infill piece to accommodate the recommended thickness of thermal laminate board, ensuring a strip of damp proof membrane is fixed to the back of the timber using galvanised nails or stainless steel staples, i.e. between the timber and the external wall (Figure 21).

15. Fix SWIP Studs to the face of the jambs and flush with the timber infill piece and form a continuous insulated lining around the opening with the plasterboard cut back accordingly (Figure 22). Internal cornerInternal corners should be installed in accordance with Figure 23 and the corner void fully filled with SWIP Batt. The centre of the SWIP Stud adjacent to the corner SWIP Stud should be adjusted to accommodate the corner detail (Figure 23).

External Corner

External corners should be installed in accordance with figure 24. In order to provide additional rigidity at the junction of the plasterboard linings a timber batten (minimum 25mm x 25mm) should be screwed fixed in position as indicated and the corner void fully filled with SWIP Batt. The centre of the SWIP Stud adjacent to the corner SWIP Stud should be adjusted to accommodate the corner detail (Figure 24).

Plasterboard Finishing Techniques

Taping and jointing

In order to accommodate a taped and jointed finish, taper edged plasterboards should be installed. After applying a primer coat over the plasterboard and joints, a reinforced tape and jointing compound should be used to achieve a seamless finish. SWIP Drywall provides a comprehensive range of jointing compounds and tapes. In all instances follow the plasterboard manufacturers instructions.

Skim Coat

A 2mm to 5mm thick coat of SWIP Multicover or SWIP Universal Board Finish can be applied to the face of the plasterboards. The board joints should be reinforced with paper or fibre tape.

Decoration

Follow manufacturer's instructions regarding priming requirements prior to the installation of wallpaper or specialist coverings.

Tiling

Face SWIP Studs with SWIP Moisturesh-ield or Aquapanel when the SWIP IWI System is installed in humid or wet areas such as kitchens and bathrooms. The weight of tiling (including adhesive) fixed direct to plasterboard (without plaster skim) should not exceed 32kg/m2.

Follow guidance and recommendations from tiling manufacturers and BS 5385 accordingly.

Accomodating Fixtures and Fittings

Heating Radiators

Installing the SWIP IWI System on the external wall of a room may provide an opportunity to install a smaller radiator and also allow it to be re-sited on an internal wall. Alternatively, it may be possible to replace wall hung radiators with skirting radiators. Further information should be obtained from, for instance, a heating engineer or radiator manufacturer.

Fixing Radiators

Do not fix radiators to plasterboard alone. Sufficient support is provided only when radiator brackets are fixed:

- Through the plasterboard into the SWIP Studs
- To horizontal timber battens (fixed over the plasterboard)
- To horizontal timber battens, fixed between the SWIP Studs and to the masonry wall
- To SWIP Drywall Fixing Channels, screw fixed to the SWIP Studs behind the plasterboard to the masonry wall using suitable stand-off fixings. Timber battens are suitable for loads up to 75kg per metre run acting parallel to the plasterboard and should be used for heavier radiators.

SWIP Drywall Fixing Channels are suitable for loads up to 50kg per metre run acting parallel to the plasterboard and can be used for small radiators.

Picture Rails and Dado Rails

Picture rails and dado rails should be removed before installing the SWIP IWI System as they will prevent the SWIP Studs being fixed tightly against the wall. However, picture rails and dado rails can be fixed to the new plasterboard lining using an instant grab adhesive after installation of the SWIP IWI System, or the rails can be fixed to the SWIP Studs using suitable screws.

Fixing to Plasterboard

Light to medium weight items such as mirrors, pictures, shelving and curtain poles can be fixed in position using standard self drilling, winged or toggled plasterboard fixings and fixings such as SWIP Drywall anchors which are suitable for loads up to 20kg acting parallel to the plasterboard.

For heavier items, such as kitchen cupboards, specialist heavy duty cavity anchor fixings should be used or they can be fixed to timber battens which have been secured to the existing external walls at pre-determined positions. Heavier items can also be secured by fixing back to the masonry wall using proprietary stand-off fixings or a suitably sized standard screw. Alternatively, screw fixing an 18mm plywood sheet to the face of the SWIP Studs over the entire wall area (after installing the SWIP Vapour Control Layer) to provide a solution to a wide range of fixing problems.

NB: If in any doubt as to the suitability of fixings, consult the fixings manufacturer.

Electric Cables and Fittings

Electric Cables in Existing Walls
In a large number of instances the SWIP IWI System will be installed onto existing walls where the electric cables will be buried within the internal finishes. The current carrying capacities for electric cables buried in plaster are contained in Appendix 4 of BS 7671, Requirements for electrical installations - *IET Wiring Regulations - Seventeenth* edition.

The most commonly used cable sizes in domestic properties are 2.50mm for 32 amp ring circuits serving socket outlets and 1.00mm or 1.50mm for lighting circuits.

The current-carrying capacity for the 2.50 mm cables sunk into plaster are given in BS 7671 as 27 amps for twin and earth cable and 24 amps for wiring in conduit.

The effect of installing a layer of insulation over the inner surface of the wall would reduce the current-carrying capacity of the 2.50mm cables to 25 amps and 22 amps for the twin and earth and conduit wiring respectively, and apply when insulation has been installed only on one side of the wall. Where the SWIP IWI System is installed and there is also existing cavity wall insulation, the cables should not require any additional de-rating due to the high thermal mass of the wall which will in effect negate the risk of the cables reaching elevated temperatures. Regulation 433.1.5 of BS7671 requires cables used for 32 amp ring circuits to have a minimum current-carrying capacity of 20 amps. Because the ratings derived above are greater than 20 amps existing 2.50mm, 32 amp ring circuit cables will continue to meet the requirements of BS 7671 for current carrying capacity after the internal wall insulation system has been installed.

Lighting Circuits
Lighting circuits are generally protected by either 6 amp of 10 amp fuses or circuit breakers. The current-carrying capacity of 1.00mm or 1.50mm cables sunk into plaster will remain suitable for lighting circuits when an internal wall insulation system is fitted. Larger cable sizes, such as 6.00mm twin and earth, are likely to be used with 45 amp fuses or circuit breakers for heavier loads such as electric cookers or electric showers. The current-carrying capacity of a 6.00mm cable sunk into plaster will be such that it will still be suitably protected by a 45 amp device after the installation of an internal wall insulation system. From the above it is concluded that the current carrying capacity of existing ring circuits, lighting circuits and 6.00mm cable circuits for cookers or electric showers will remain adequate after the installation of an internal wall insulation system.

Note: As with all electrical work, if at all in doubt consult a suitably competent person such as a qualified electrician.

Electric cables & extruded polystyrene
PVC insulated cables should be located in suitable conduit to avoid being in direct contact with extruded polystyrene insulation in order to prevent plasticiser migration which can cause loss of protection to the conductors.

Extending cables for socket outlets & accessories
When socket outlets on the existing external wall need to be repositioned on the new SWIP Stud lining, it is likely that the existing cables will need to be extended. If there is sufficient spare length in the existing cables then they should be pulled through so that they can be re-connected to the accessory fitted to the SWIP IWI System.

However, if the existing cable has to be extended BS 7671 requires joints and terminations to be made in suitable enclosures, one solution is for the additional length of cable to be connected into the back-box of the existing accessory which is then fitted with a blank cover plate.

The additional cable could then be taken through a knock-out panel in the existing back box (with a grommet fitted) and fed through to the new fitting.

The section of cable running from the old socket outlet position to the new position needs to be considered in accordance with BS 7671 and de-rating factors may need to be applied as detailed in Table 52.2 of BS 7671. The application of a de-rating factor to the cable used in this situation is unlikely to result in the cable rating falling below 20 amps (as detailed in BS 7671) although each case should be judged upon its own merits. Further requirements for joints and terminations are detailed in BS 7671. BS 7671 also requires (with some exceptions) that 'every connection shall be accessible for inspection testing and maintenance'. BS 7671 published on 1st July 2011 has added another 'exception' to the list which applies in this instance. Insulation displacement or insulation piercing connections complying to BS 5733 and marked MF (maintenance free) do not need to be accessible.Electric cables that have been extended can then be run forward in conduit and sealed to the vapour barrier.Extending cables in this manner is not classified as "notified work" (according to Approved Document P, 2006 Design and installation of electrical installations)

Accomodating Fixtures and Fittings

and can be carried out by a suitably competent person. All electrical work should be carried out in accordance with Approved Document P, the relevant part of the current IEE Regulations and associated Guidance.

Note: As with all electrical work, if at all in doubt consult a suitably competent person such as a qualified electrician.

Socket and Switch Boxes

Socket and switch boxes should be fixed into the plasterboard lining in accordance with the manufacturer's instructions. Plasterboard and drywall socket and switch boxes simply clip into place when inserted into a pre-prepared opening. When the face plate is tightened onto the socket box, the box grips against the plasterboard, before the face plate is finally fixed, the boxes should be sealed against the plasterboard using SWIP Multi Purpose Sealant to prevent air leakage. Cables penetrating the socket box should be sealed with SWIP Multi Purpose Sealant. (Figure 25).As with an existing installation, back-boxes fitted into the front plasterboard face of the insulated wall should be of the type intended for plasterboard or dry walls. The SWIP Batt insulation behind the back box should be cut away to the depth of the back-box rather than forcing the back-box in and compressing the SWIP Batt.

Figure 25

A plasterboard socket box

Surface Mounting of New Cables

Where new surface mounted electric cables are installed (horizontally) on the room side of the SWIP IWI System they should be run in metal conduit to where the fixings/outlets are required prior to the installation of the vapour control layer. The SWIP Studs should be notched to suit the dimensions and shape of the metal conduit.

Installation of New Circuits

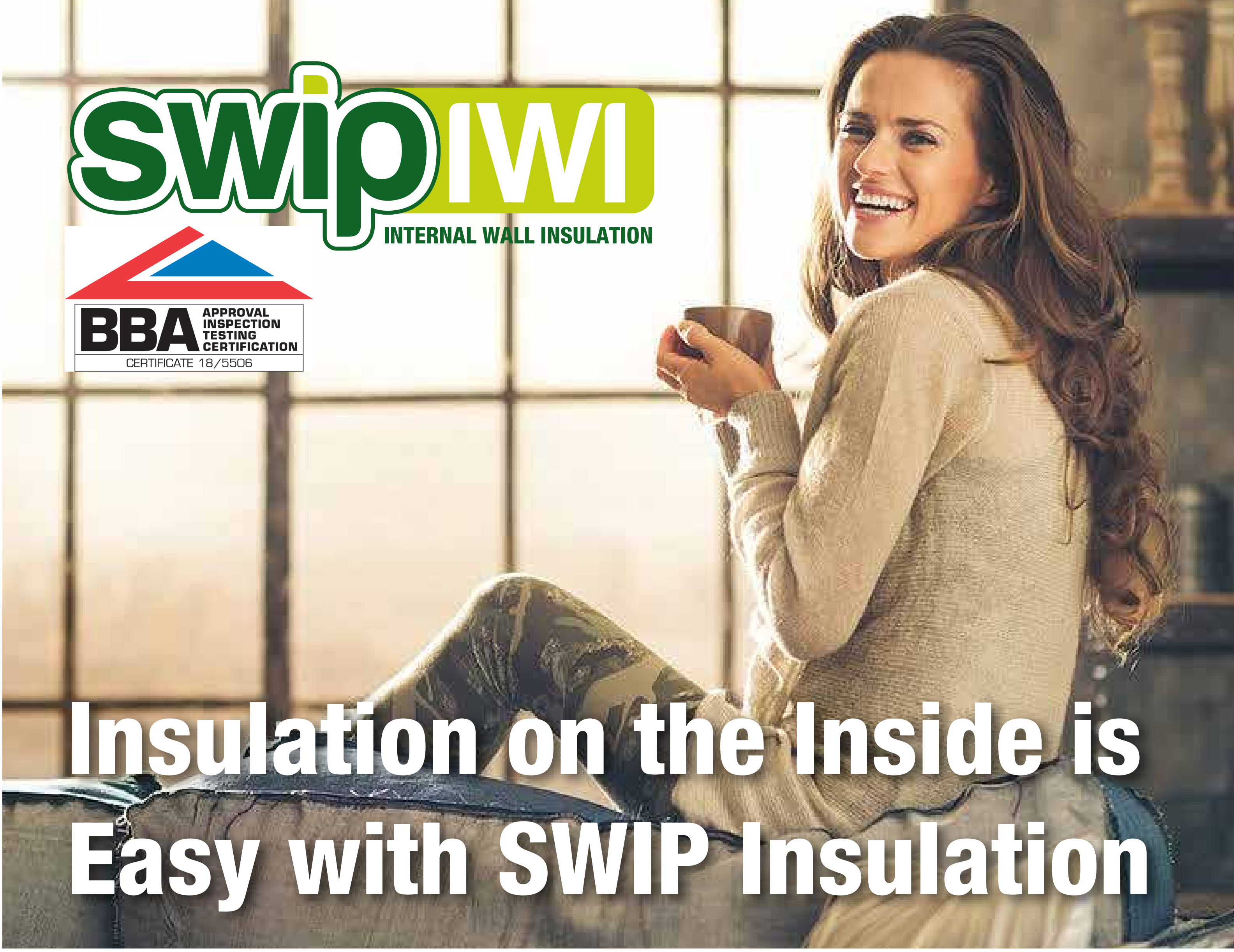
The requirements of Part P of the Building Regulations and BS 7671 must be adhered to when installing new ring circuits. Where a complete new electrical installation, or a single new circuit, is to be fitted in a house having internal wall insulation installed the electric cabling should be run behind the plasterboard but in front of the SWIP Batt insulation slabs. The cable ratings for this situation should be taken as those given for Reference Method A in BS 7671. The rating for a 2.50mm flat twin and earth cable installed in this position is 21 amps (Table 4, D5, Col 4, BS 7671) of 20 amps if in conduit in this position. Thus with this installation method a 2.50mm cable is suitable for a 32 amp ring circuit. Also 1.00mm or 1.50mm cables are suitable for lighting circuits protected by 6 amp or 10 amp fuses or circuit breakers. For a circuit supplying a cooker or electric shower which is protected by a 45 amp device a 10.00mm cable would be required.

BS 7671 includes specific requirements for cables that are concealed in a wall or partition at a depth of less than 500mm from the surface. Cables installed in an internal wall insulation system fall into this category. The specific requirements include the use of metal conduit or trunking or other mechanical protection against penetration by nails and the like, the use of armoured cables or cables to BS 8436 and running the cables in specific zones. If the option of running the cables in specific zones is selected then additional protection by means or a residual current breaker (RCD) is also required. The recommended option is that of running the cables in the zones specified in Regulation 522.6.6 with the installation of an RCD.

Note: As with all electrical work, if at all in doubt consult a suitably competent person such as a qualified electrician.

swipIWI
INTERNAL WALL INSULATION

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 18/5506



Insulation on the Inside is Easy with SWIP Insulation

- An ideal solution to install to voided properties
- Can also be installed with minimal disruption in occupied homes
- Reduced thickness compared to traditional stud systems

1. SWIP Studs fixed to wall

2. SWIP Batt between SWIP Studs

3. Plasterboard finish

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