1. Foreword

The following text describes best practice solutions for a range of challenges that are regularly queried for energy efficiency measures (EEM's), that are not generally detailed within any existing best practice, Building Regulations or PAS2035.

This document has been prepared by **ecmk** in consultation with Trustmark and other scheme providers including: Elmhurst Energy, The Installation Assurance Authority (The IAA) and Quidos Ltd.

These are for recommendations only, the actual detailed design specific to each dwelling, should be prepared and agreed by the Retrofit Coordinator, Designer, and installer.

In many cases, the solutions are provided as guidance on how to treat potential thermal bridges, in most of these examples, a temperature factor (f_{RSi}) calculation will be required for the thermal bridge, prepared in accordance with BRE IP1/06 and in compliance with PAS2035, demonstrating the temperature factor $\mathbf{f_{RSi} \geq 0.75}$.

2. External Wall Insulation (EWI)

a. Insulation Requirements for Chimneys – Where Chimney Forms Part of the Heat Loss Perimeter

Chimney in Use
Where the chimney is in use (for an open fire or being used as a gas flue), there is no benefit in insulating the chimney, or in the case of a gas flue, it may be unsafe to do so. This should therefore be left uninsulated (subject to approval and sign-off from the Retrofit Coordinator).

Capped Unused Chimney
Where the chimney is capped off and sealed at room level, then the chimney should be insulated using non-flammable insulation (mineral wool) – to cover the eventuality that the chimney might be used at some point in the future. Note the chimney must be insulated up to the top crown unless this is broken by a roofline with sufficient overhang. Also where the crown does not offer sufficient overhang, this should be extended.

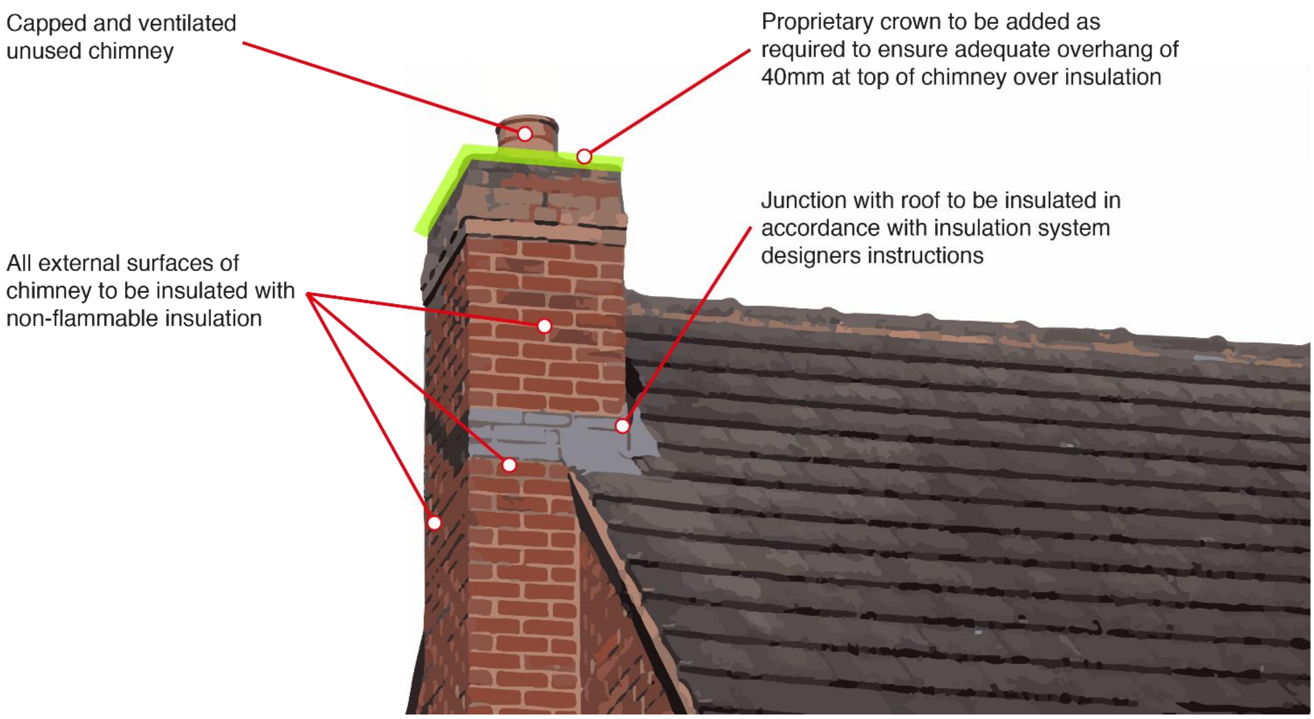

Figure 1 Unused external chimney insulation requirements

Note - care should be taken to ensure that the construction of the chimney is not fully penetrated with insulation fixings into the void.

b. External Wall Insulation and External Meter Boxes

The INCA SWIGA EWI Guidance (External-wall-insulation-specification-for-weathering-and-thermal-bridge-control-Guide.-June-19) recommends that external meter boxes be removed, and insulation placed behind the meter box, ref Drg No. WRD-SB001 Service Box - Removable Box. However, this may not be achievable in practice, where the lead time required for the network operator to visit the site to disconnect and remove the meter box may prevent the retrofit project from progressing, or it may not be possible for the occupant to be without gas and or electricity for any period of time. Also, it is not possible to remove recessed meter boxes for this purpose or gas meter boxes that contain an isolation valve.

Electric Meter Boxes

There are various products available that can be used to insulate electric meter boxes, including insulated doors, panels, and covers that fit over the existing meter housing without the need to move the meter.

Before installing this type of cover, the Retrofit Coordinator must ensure that the electricity Distribution Network Operator (DNO) is contacted to ensure it will be permissible to use the cover and to check to see if there are any special space or access requirements.

(Sample image from Jupiter Blue https://www.jupiterblue.co.uk/meter-boxes)

Figure 2 Electric Meter Box for External Wall Insulation (EWI) retrofits

Gas Meter Boxes

It is not permissible to use any form of insulated covers for gas meter boxes. Where the meter box cannot be removed and insulation installed behind the box, there are various recommended solutions in best practice documents. For the most suitable solution, the Retrofit Coordinator and Designer should first contact the EWI system designer to see what their recommended solution is and how the EWI system is to be sealed around or adjacent to the meter box.

Plan Section View of Front Opening Gas Meter Box EWI Installation

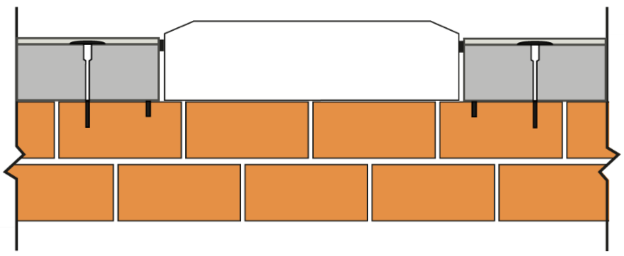

Figure 3 EWI Installed around and sealed against the meter box

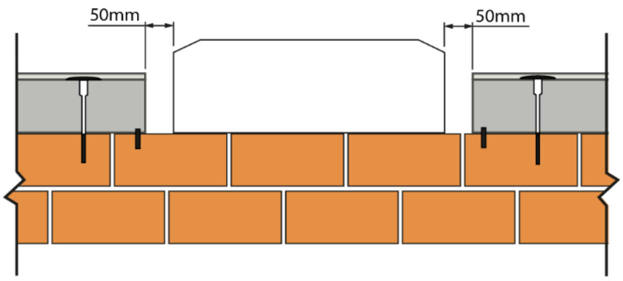

Figure 4 EWI Installed up to 50mm around the meter box

Both examples in figures 3 and 4 above, will result in a thermal bridge being created. The thermal bridge must therefore be calculated in accordance with BRE IP1/06 to demonstrate that the temperature factor (f_{Rsi}) of each detail $\mathbf{f_{Rsi} \geq 0.75}$.

Alternatively, internal wall insulation should be installed on the internal wall behind the existing meter, providing a 300mm overlap to the EWI on the external wall to mitigate the thermal bridge.

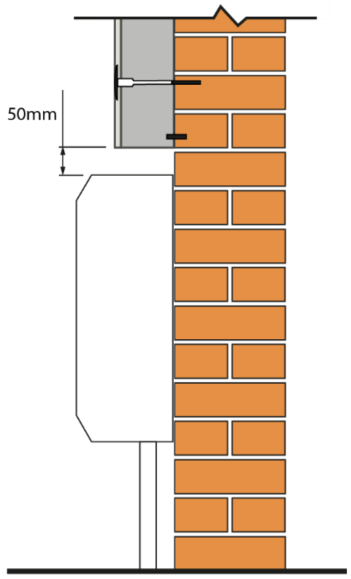

Figure 5 Section Through Gas Meter Box

c. Gas Delivery Pipe (Tee)

EWI Design around gas delivery pipes should ensure that a channel at least 100mm wide be left and an area above the Tee of 250mm is left to ensure that the valve can be accessed to isolate when required. This is illustrated in Figures 6 and 7.

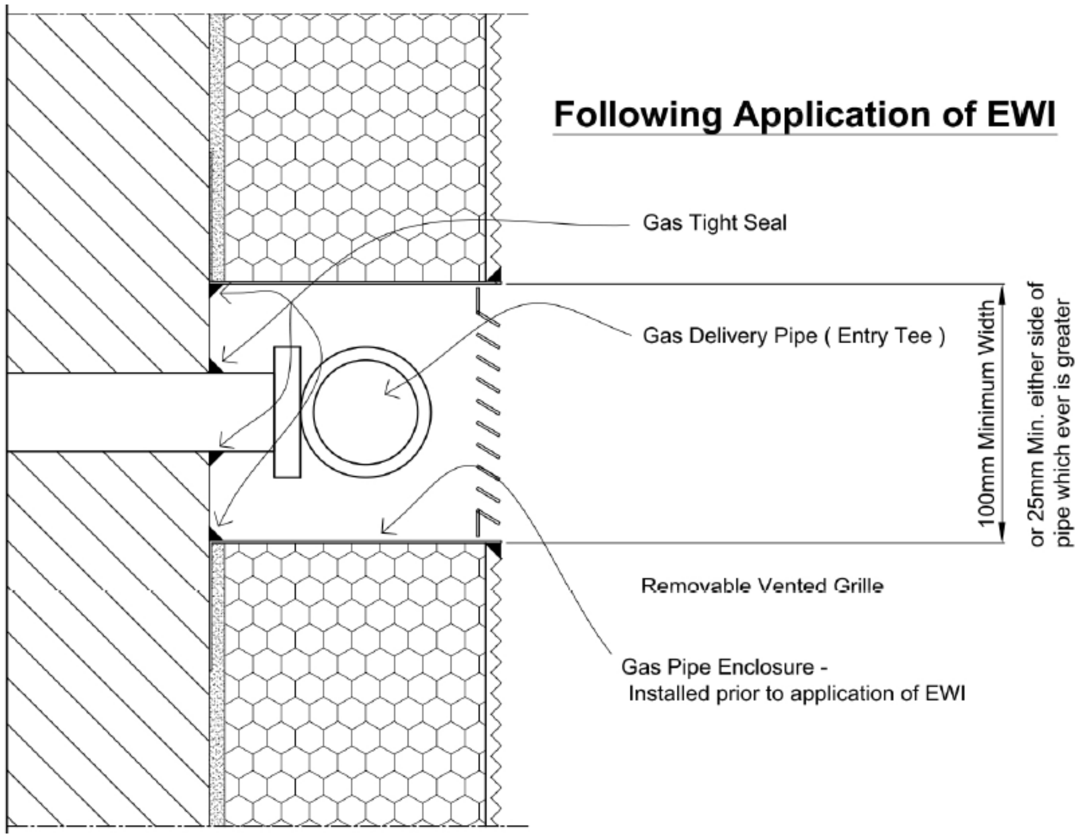

Figure 6 Section above gas delivery pipe

To avoid the ingress of water and for aesthetics, (where the DNO permits) a proprietary aluminium vented grille plate should be installed and fixed to the EWI system using Spiral Anchors and screws.

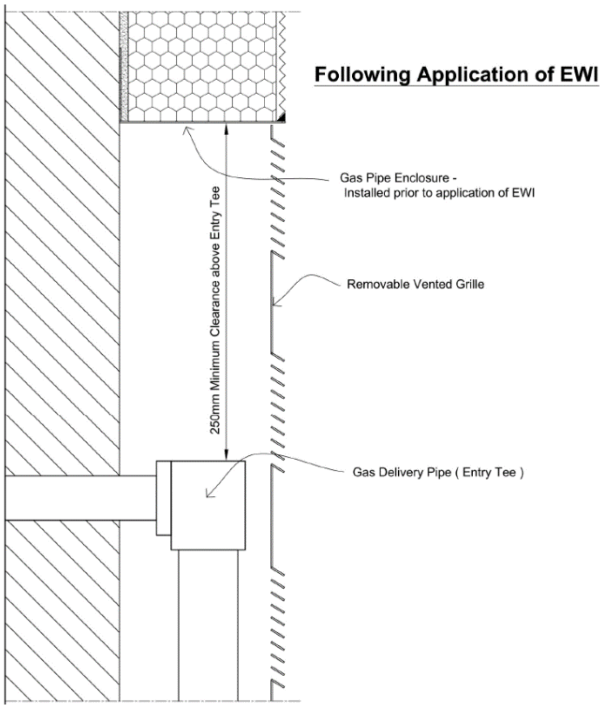

Figure 7 Vertical section through gas delivery pipe enclosure

Figures 6 and 7 are extracts from - Specification for the installation of external wall insulation ensuring the safety and operation of fuel burning appliances V1.0 March 2017.

As with the meter boxes, this specification will result in a thermal bridge which must be calculated in accordance with BRE IP1/06 to demonstrate that the temperature factor (f_{Rsi}) of each detail $\mathbf{f_{RSi} \geq 0.75}$.

d. Treatment of Unheated Structures Attached to Dwelling e.g. Conservatories, Porch, and Garages

Where an unheated structure such as a porch, conservatory, or garage, is attached to a dwelling on a heat loss wall, this should be insulated to achieve the same U value as heat loss walls (i.e. 0.30 W/m^{2}K). This can be achieved by either insulating the external wall inside the structure or the internal wall area on the opposite side of the structure to mitigate any thermal bridges.

Figure 8 Examples showing the internal heat loss walls in the red and blue dotted area requiring insulating

In cases where there is a roof abutment e.g. the porch in Figure 8, the wall area inside the roof void must also be insulated (blue dotted line) to prevent a thermal bridge. This also applies to any heated extensions with roof abutments.

If the reduced floor area is an issue or results in clearance issues with door openings, a thinner high-performance insulation board should be considered.

Where there is a junction between the external wall of the dwelling and the roof of the structure, this should be correctly detailed as per the insulation system designer's instructions. The actual design for this may vary greatly depending upon the design of the roof (e.g. flat or tiled). The installer/retrofit designer should contact the system designer for the best solution and include this with the PAS design document for thermal bridge considerations.

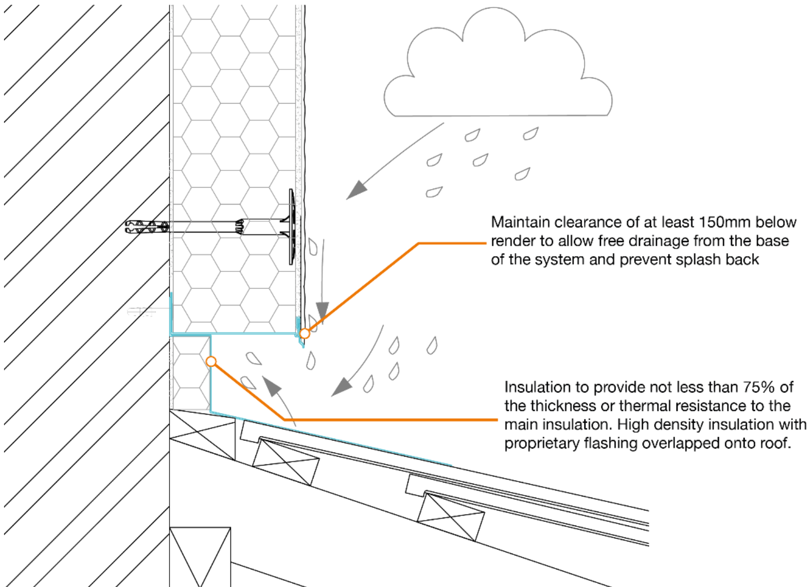

Figure 9 Insulation requirements for roof junctions with external wall insulation Ref INCA/SWIGA Guidance Drg No WRD-RA001

e. Untreated Areas Due to Soil Vent Pipe Junctions

In most properties there are areas around soil vent pipe junctions that cannot be treated with external wall insulation either due to practicality or cost viability, these include:

- Elbows fitted at wall junctions – often including junctions with grey water pipework;
- Where the soil pipe is encased in concrete at ground level;
- Where the soil pipe passes through a roof structure.

Figure 10 a), b) & c) Various locations of soil vent pipes junctions resulting in thermal bridges

As with all other thermal bridges, the areas illustrated in Fig 10. a), b) & c) must be calculated in accordance with BRE IP1/06 to demonstrate that the temperature factor (f_{Rsi}) of each detail $\mathbf{f_{RSi} \geq 0.75}$.

f. External Wall Insulation - Insulating the Underside and Ceiling of Cantilevered Bay Windows

The area under the cantilevered bay should be insulated to the same U-value as required for the walls - 0.3 W/m^{2}K.

Similarly, where not already insulated, the internal ceiling area of the bay window should be insulated with Internal wall insulation.

Best practice should be to also apply this approach to park homes dwellings even though under PAS2035, no consideration for thermal bridges is required for park homes.

Figure 11 Example of a typical cantilevered bay window

g. Tiled Bay Windows - How to Ensure Correct Insulation

Where the tiling decorative features are to be maintained, the bay can be insulated in one of two ways to mitigate the thermal bridge:

- Where the construction of the bay window permits - by removing the tiles and insulating behind the tiled area.
- Alternatively this can be insulated by Installing internal wall insulation internally in the bay window to provide a hybrid solution.

Whichever method is followed, the insulation should achieve the same U-value as required for the walls - 0.3 W/m^{2}K.

Figure 12 Tiled bay window

h. EWI Installation Requirements for Insulation Below DPC Level for Both Suspended and Solid Floor Dwellings

Installing Insulation Below the Damp Proof Course (DPC)

Generally, the most practical solution for insulating the area below the DPC to prevent the thermal bridge in this area is to install the main insulation system down to the DPC level. Below the DPC, a vapour closed high-density insulation such as XPS, should be installed with the base track fitted at least 10mm above ground level.

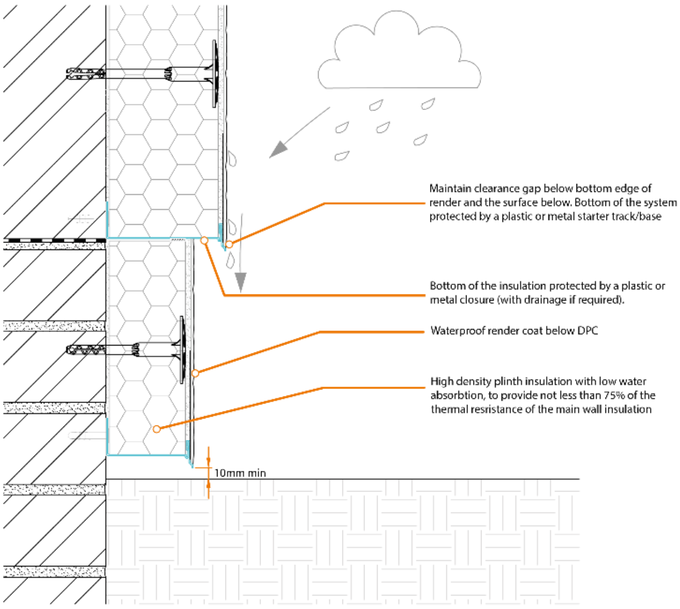

Figure 13 Ref INCA/SWIGA Guidance Drg WRD-B002

Note, most system guarantees, and insurance-backed guarantees will not cover any insulation installed below the DPC.

Leaving the Area Below the DPC Uninsulated

On occasion, it may not be possible to install insulation below the DPC, due to lack of space below the DPC or other physical constraints. In this case, a calculation of the resultant thermal bridge on each façade affected must be calculated in accordance with BRE IP1/06 to demonstrate that the temperature factor (f_{Rsi}) of each detail $\mathbf{f_{RSi} \geq 0.75}$.

System Designer Guidance

As with all measures, the system designer's measure-specific guidance should be followed. Most EWI system designers will specify that the main EWI insulation should not be installed any lower than 150mm above the finished ground level.

In this instance, the main insulation should be installed down to a level 150mm above ground level. The area below this should be insulated with XPS insulation and below the DPC, where possible as per Figure 13.

i. EWI and the Requirement for Pull-out Tests

Pull-out tests for external wall insulation (EWI) should be conducted to assess the potential bond strength between the insulation material and the substrate (existing wall). The tests are essential to ensure the proper adhesion of the insulation materials to prevent detachment or failure over the lifetime of the insulation system.

Pre-Installation Testing
Substrate testing should be conducted before installation, to assess the existing substrate's strength and to ensure that it can adequately support the new insulation system.

Testing Post Installation
Once the external wall insulation system is fully installed, a predetermined set of pull-out tests should be carried out across different sections of the property. This ensures that the entire system is correctly adhered to and meets the necessary standards for bond strength.

Figure 14 Pull Test equipment - image courtesy of Hilti GB

Conditions Where Testing is Required

- Where the survey has identified potential issues with the strength or condition of the substrate, or the existing substrate cannot be classified;
- Where the wall is of cavity construction (i.e. to ensure the wall ties are sound);
- Where the property is constructed from No-fines aggregate concrete or any other system build construction;
- Where a high-rise property is being insulated, to ensure that the fixing capacity is sufficient to resist higher wind-loading;
- To satisfy Guarantee and Warranty Requirements.

Further Guidance
Guidance from industry bodies such as INCA / SWIGA should be followed for the specific requirements of testing. Also ETAG 014 Guidance on Tests to be carried out on construction works.

The installer should also always consult with the system designer and warranty provider to check for any specific requirements.

j. External Wall and Internal Insulation Hybrid Solutions – Requirement for Returns

Where a hybrid approach is being adopted using IWI and EWI on different façades on a dwelling, where the insulation type differs on wall junctions, to prevent any resultant thermal bridges, a 400mm return should be included on internal wall insulation where an IWI insulated wall intersects with an EWI insulated wall.

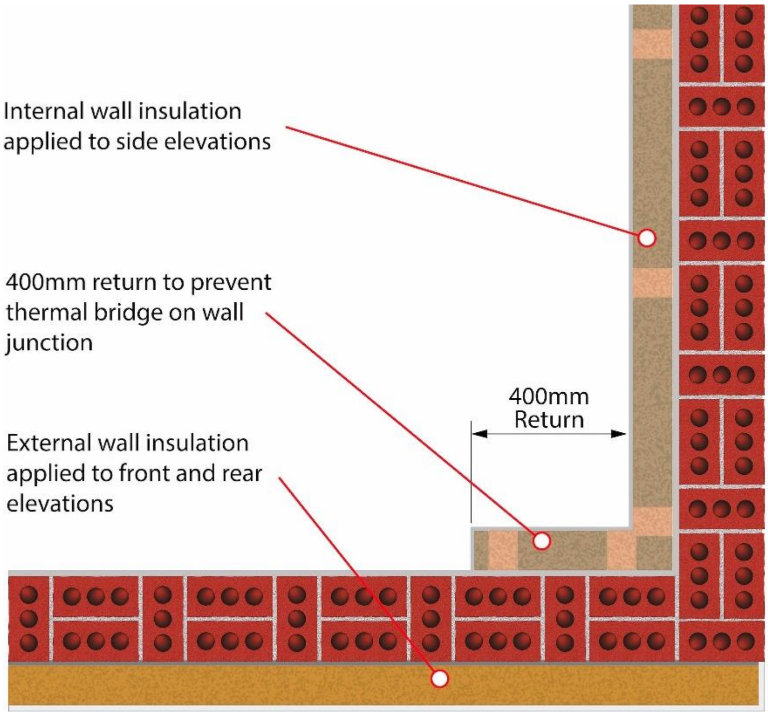

Figure 15 Section through hybrid EWI/EWI Insulated wall junction showing required return.

3. Internal Wall Insulation (IWI)

a. Further Guidance on Vapour Closed insulation materials for solid wall properties, additional guidance following BEIS Guidance update

BEIS guidance regarding IWI and moisture-closed systems was issued in August 2022, which added:

> "*The BEIS Retrofit Internal Wall Insulation, Best Practice guidance does not prohibit the use of moisture-closed internal wall insulation systems on existing solid walls.*
>
> *The insulation choice and moisture strategy should be based upon a multitude of factors, not least a robust retrofit assessment, and a good understanding of moisture risks in internal wall insulation*."
>
> https://www.ecmk.co.uk/beis-iwi-and-moisture-closed-systems-clarification/

For moisture-closed systems to be considered for application on solid-walled properties, the following should be satisfied to provide a more robust assessment of the moisture risks:

I. The property or walls must not be in highly exposed areas where the walls will be subject to excessive driving rain;

II. The DPC must be intact and fully functioning – with no evidence of any rising damp;

III. There must not be any evidence of existing dampness issues anywhere in the property;

IV. The external walls should have already been treated with some form of outside weatherproofing coating e.g. render or a water repellent product.

However, it should be noted that - for traditional or system-built solid walled properties – the use of moisture-open internal wall insulation is always the best solution.

b. Insulation of Internal Chimneys Best Practice

In a similar manner to the application of EWI on an external chimney breast, if the chimney is in use for an open fire or for a gas flue, the chimney breast should not be insulated (subject to approval and sign-off from Retrofit Coordinator).

Where the chimney is no longer in use and has been capped and ventilated, the chimney breast should be insulated using non-flammable materials only (to cover the eventuality that the chimney may be used again at some time in the future). Care should be taken to ensure that the construction of the chimney is not fully penetrated with insulation fixings into the void.

c. Guidance on Returns Required for Internal Wall Insulation for Party Walls

Where IWI is being installed in a room that contains a party wall returns in the IWI should only be applied to party / separating walls where it is known that the wall in the neighbouring property / room is insulated otherwise this could cause condensation and mould. – "***Rule of thumb: both sides or no sides.***"

Note any returns applied to internal wall insulation, should follow the system designer's specifications.

d. Combined Kitchen and Living Accommodation

Where a property has kitchen and living room accommodation that are not separate rooms (i.e. open plan), there is effectively a combination of habitable and wet rooms.

BEIS Guide to Best Practice Retrofit Internal Wall Insulation, September 2021 paragraph 63. enables wet rooms to be omitted from the application of internal wall insulation, as long as the room can be heated to a minimum of 18^{o}C and that continuous mechanical extract ventilation is installed.

Therefore as a solution to applying internal wall insulation to walls with external façades in combined living accommodation, the following should be complied with:

I. The room should be heated to a minimum of 18^{o}C;

II. Continuous mechanical extract ventilation should be installed;

III. All areas in the room with external walls should be insulated as far as practicable, ensuring consideration is given to all thermal bridges;

IV. Background ventilation of equivalent area 4,000mm^2, should be installed in the habitable area of the of the room, as far away as possible from the extract ventilation – to be reviewed and agreed with the Retrofit Coordinator, Retrofit Designers, and qualified Ventilation Installer;

V. A suitable schedule of monitoring and evaluation should be prepared to assess any potential issues with mould and damp caused by any non-insulated walls in the kitchen area. This should be documented and included as part of the retrofit design.

4. Loft Insulation

a. Loft Ventilation Requirements Ref BS 5250:2021

This is an area that is covered in detail in BS5250:2021 Management of moisture in buildings - Code of practice, however this appears to be poorly understood and therefore, not well followed : The following is an extract from Section 12.5.4 Ventilation in Lofts:

12.5.4.1 General

It is important to allow continuous air movement to draw air from the loft and allow it to be replaced with an equal quantity of external air. Ventilation should be designed to avoid creating pockets of stagnant air. In order to overcome surface resistance to airflow, **airways inside the roof structure should be at least 25 mm deep**. Vents should be designed to prevent the entry of birds, bats and large insects (a 4 mm mesh or grill can achieve that without excessive resistance to airflow), and should remain unobstructed during the life of the roof.

Table 5 Minimum Free Area of Openings for Loft-Space Ventilation

Roof Pitch	Underlay	Ceiling	Low-level vents [A),B)] (e.g. eaves) mm^2/m
10° to 15°	High vapour resistance (HR)[C)] *(Water Vapour Resistance > 50 MNs/g)*	Any	25,000mm^2
>15° to <75°	High vapour resistance (HR) [C)] *(Water Vapour Resistance > 50 MNs/g)*	Any	10,000mm^2
10° to <75°	Low Vapour Resistance (LR) *(Water Vapour Resistance > 0.25 MNs/g)*	Normal[D)]	7,000mm^2
		Well Sealed [D)]	3,000mm^2 [E)]

A) Based on the longest horizontal dimension of roof.
B) Seek manufacturer's guidance
C) An additional high-level vent 5,000mm^2/m based on the longest horizontal dimension of roof should be provided where the roof pitch exceeds 35°. or the span exceeds 10m, or the roof is a lean-to or monopitch.
D) A normal ceiling typically has an air permeability of 300mm^2/m^2. A well-sealed ceiling conforms to BS 9250 and typically has an air permeability of not more than 30mm^2/m^2.
E) Alternatively, a high-level vent of 5,000mm^2 based on the longest horizontal dimension of roof can be provided.

Simplified Approach to Loft Ventilation Compliance for the Purposes of Retrofit

In practice for retrofit, the above can be difficult to assess and deliver. As the standard range of roof pitching in the UK is typically between 30° to 50°, and for most roofs, the longest horizontal dimension will be no more than 10m from eaves to eaves, in such cases the minimum free area should be:

I. 10,000mm^2/m (longest horizontal dimension of the roof) for High Vapour Resistance (HR) underlays*;
II. 7,000mm^2/m (longest horizontal dimension of the roof) for Low Vapour Resistance (LR) underlays;
III. A gap of at least 25mm deep should be maintained between loft insulation and the roofing felt to prevent resistance to airflow (Ref Fig 15);
IV. Where high water vapour-resistant (type HR) underlay (e.g. types 1F/5U felts) is used, eaves ventilation should be provided on opposite sides of the roof to permit cross-ventilation;
V. For monopitch roofs, roofs where the span exceeds 10m, or where a cold roof has a pitch less than 15°, ventilation equivalent to a 25mm slot running the full length of the eaves should be provided (a nominal clearance of 50mm should be maintained between the insulation and the roof underlay).

Note*: where the underlay cannot be identified, High vapour resistance (HR) should be assumed.

Points I. II. can generally be achieved by providing a 10mm slot running the full length of the eaves.

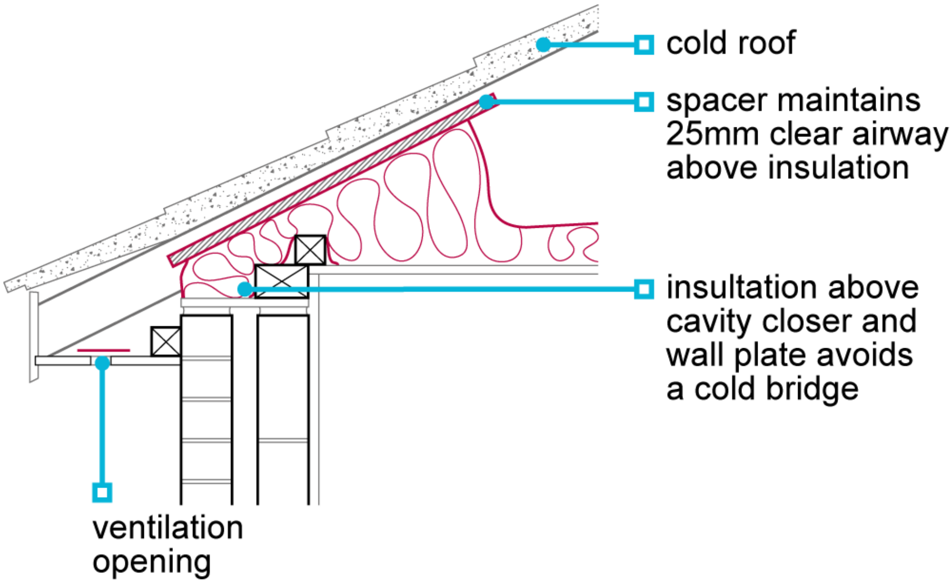

Figure 16 Ref NHBC 7.2.15Ventilation, vapour control and insulation

Where loft ventilation is being upgraded by means of proprietary devices such as felt or lap vents, tile vents or soffit vents, manufacturer's specifications for effective ventilation areas should be followed to ensure compliance with the above.

b. Laying Insulation Over the Top of Loft Boards

Where a loft has been insulated and then boarded, under no circumstances should the existing loft insulation be topped up by laying this over the boards. The many potential hazards include:

- The condition of the existing insulation under the boards cannot be assessed, this could be damp, compressed, inconsistent, or degraded all resulting in thermal bridge issues - the existing insulation should always be assessed first to ensure that the correct U value can be achieved;
- There could be gaps between the existing insulation and the underside of the boards allowing air currents to flow in the voids reducing the effectiveness of the insulation, and possibly carrying and allowing for the collection of moisture/interstitial condensation;
- There is a possibility that electric cables running on top of the insulation underneath the boards will need to be lifted above any new insulation;
- There could be existing recessed light fittings under the boards that are not fire-rated or "F-Capped", these should be checked to see if correctly capped and sealed before further insulation is added.

To avoid any such hazards, when topping up loft insulation, boards should be removed, and the existing insulation inspected and if required, replaced. New or additional insulation should then be laid in accordance with the manufacturer's guidelines – typically laid between the joists to the depth of the joists and then cross-laid on top to a depth of at least 270mm.

Once the insulation has been topped up, this will now typically be at least 170mm above the joists. For the loft boards to be re-laid, these will have to be laid on top of proprietary loft stilts or legs and support beams.

Figure 17 Example of a proprietary system to raise loft boards above insulation Ref LoftZone StoreFloor system.

c. Insulation of Skeilings

A skeiling is a small upward-sloping area of a ceiling where the eaves meet the roof, and the ceiling follows the fall of the roof. Traditionally, this area can be very difficult to insulate, but where the loft has been insulated and this area is omitted, the resulting thermal bridge commonly leads to mould and dampness problems.

Figure 18 opposite shows the results where the skeiling section of a roof has not been insulated, thermal bridges can be seen where mould has formed.

Figures 19, 20 & 21 show three possible designs for mitigating the thermal bridge caused by leaving the skeiling section uninsulated. This can be achieved where possible by inserting either loft insulation or rigid insulation board between the rafters of the skeiling section (Fig 19 & 21), or where this is not possible, insulating the inside surface of the roof with plasterboard-backed rigid insulation board (Fig 20).

Figure 18 Uninsulated Skeiling

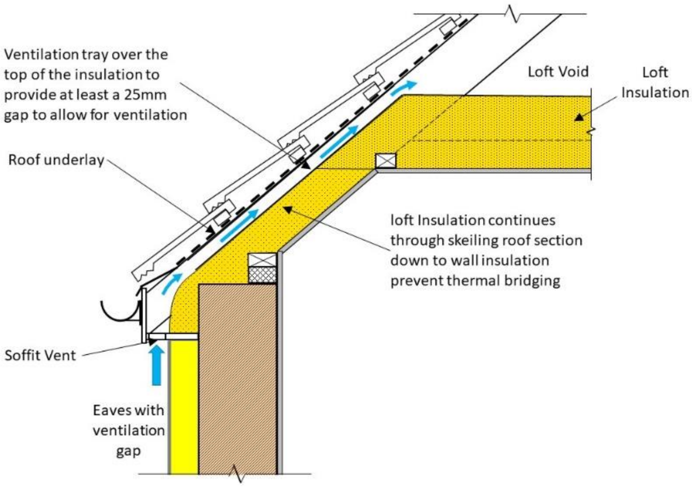

Figure 19 Skeiling Insulated with Loft Insulation Between the Rafters

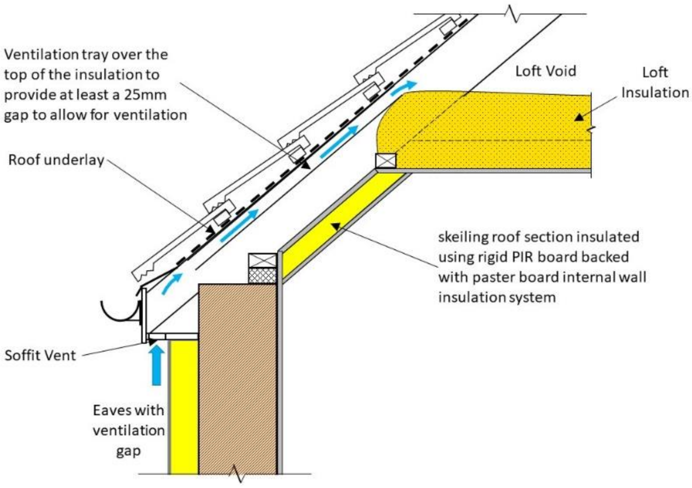

Figure 20 Skeiling Insulated with Internal Wall Insulation

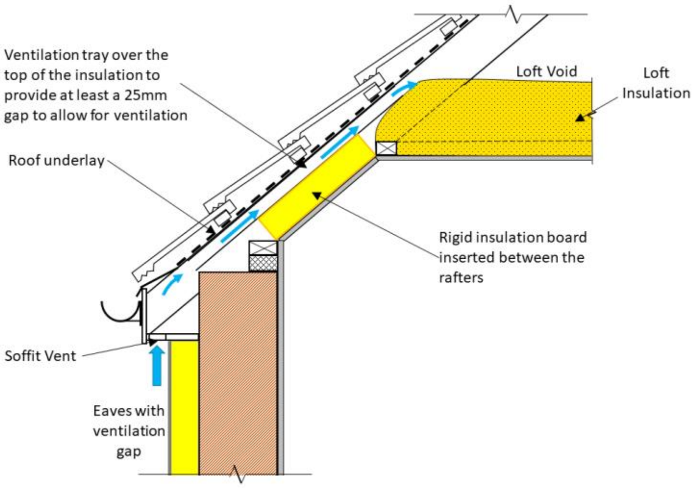

Figure 21 Skeiling Insulated with Rigid Insulation Board Between the Rafters

5. Underfloor Insulation

a. Crossflow Ventilation Requirements

The following is existing guidance as detailed in Approved Document C Site preparation and resistance to contaminates and moisture. This has been included in this guidance for clarity as this is regularly raised in queries received.

Excerpt from Approved Document C, Technical Solution 4.4 b.

Two opposing external walls should have ventilation openings placed so that the ventilation air will have a free path between opposite sides and to all parts. The openings shall be not less than either 1,500mm^2/m run of external wall or 500mm^2/m^2 of floor area, whichever gives the greater.

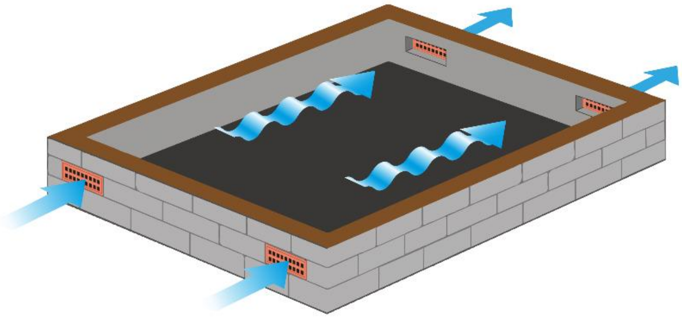

Figure 22 Crossflow Ventilation Created by Ventilation Openings on Opposing Walls

Worked Example Semi-detached property:

I. Floor area = 7.42m x 5.783m **= 42.91m^2** x 500mm^2/m^2 **= 21,455mm^2**
II. External wall run = 7.42m + 5.783m + 5.783m = **18.99m** x 1,500mm^2/m **= 28,479mm^2**

28,479mm^2 being the larger of the two calculations.

Figure 24 Traditional Clay Airbrick

Figure 23 Modern Polypropylene Airbrick

Number of Airbricks Required

Standard 215 x 65mm terracotta airbricks have an effective area of 1,290mm^2 (Ref BS 493:1995 +A1:2010).

Number of existing standard airbricks required $= \frac{28,479mm^2}{1,290mm^2}$ = **22 airbricks**

Polypropylene airbricks are available to upgrade the current ventilation and provide an effective area of up to 7,800mm^2 for a 215 x 65mm airbrick:

Upgrade polypropylene airbricks required $= \frac{\underline{28{,}479mm^2}}{7{,}8000mm^2}$ = **4 airbricks**

When installing underfloor insulation, compliance with underfloor ventilation should be demonstrated with a simple calculation as above and evidenced with post-installation photographs and airbrick product details.

b. Solid Floor Sections in Properties

Where solid floor extensions or conservatories have been built onto a suspended floor property, without underfloor ventilation being extended through the solid floor, resulting in one or more airbricks on the extended façade being blocked, crossflow ventilation has not been maintained. This could result in stagnant pockets of air in the underfloor void. In such cases, underfloor insulation should not be installed to prevent the risk of dampness and mould growth.

In cases where suspended floored properties have been built with a solid kitchen or pantry floor. In these properties, crossflow ventilation is generally maintained by casting 100mm internal diameter terracotta pipes in the solid floor to connect the suspended subfloor void to air bricks on the outside wall of the solid floored area.

In this instance, before installing underfloor insulation, clear photographic evidence should be provided to the retrofit coordinator demonstrating that such ducts are unobscured, allowing the free flow of air to and from the subfloor void.

c. Moisture Readings in Timber Floor Joists

The following is covered within BEIS Guide to Best Practice Retrofit Floor Insulation – Suspended Timber Floors but is regularly missed when assessing the suitability of a property to have underfloor insulation installed.

> **Excerpt 47. Building Suitability Assessment & Risks**
>
> Timber moisture content should not exceed 20%. Timbers are generally understood to be free from the risk of decay below 20% moisture content.
>
> Insulating timber with high levels of moisture/rot or decay can lead to adding additional stress to the timbers and accelerating their decay or covering up an existing problem (inadequate ventilation, weather ingress, leaks, etc).

During the assessment, moisture readings should be taken for a sample of joists at the junctions with the walls to ensure that the moisture content does not exceed 20%.

6. References

- PAS 2035:2023 Retrofitting dwellings for improved energy efficiency – Specification and guidance
- BRE Group IP 1/06 Assessing the effects of thermal bridging at junctions and around openings, March 2006.
- External-wall-insulation-specification-for-weathering-and-thermal-bridge-control-Guide.-June-19 External-wall-insulation-specification-for-weathering-and-thermal-bridge....pdf (inca-ltd.org.uk)
- Specification for the installation of external wall insulation ensuring the safety and operation of fuel-burning appliances V1.0 March 2017 Document 1 FINAL.pdf (dropbox.com)
- BEIS Guide to Best Practice Retrofit Internal Wall Insulation, September 2021 https://assets.publishing.service.gov.uk/media/614b30aad3bf7f718a54c0be/iwi-guidance.pdf
- BEIS Guide to Best Practice Retrofit Floor Insulation – Suspended Timber Floors https://assets.publishing.service.gov.uk/media/5f05d211d3bf7f2be6e0217a/suspended-timber-floors-underfloor-insulation-best-practice.pdf
- The Building Regulations 2010 Site Preparation of Resistance to Contaminants and Moisture, Approved Document C https://www.gov.uk/government/publications/site-preparation-and-resistance-to-contaminates-and-moisture-approved-document-c
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- ETAG 014 Edition January 2002, Revised 2008, 2011, Guideline for European Technical Approval of Plastic Anchors for Fixing of External Thermal Insulation Composite Systems with Rendering. https://www.eota.eu/sites/default/files/uploads/ETAGs/etag-014-en.pdf
- BS5250:2021 Management of moisture in buildings —Code of practice
- CITB - General Requirements and Guidance for the Installation of Cold Roof Loft Insulation, Version 2 CITB 2013
- NHBC 7.2.15 Ventilation, vapour control and insulation
- BS 493:1995 Specification for airbricks and gratings for wall ventilation (+A1:2010)

7. Revision Notes

01. Typographical error corrected from inflammable to non-flammable. Additional note added regarding laying loft boards after loft insulation has been topped up.