Insulation Manufacturers Association

A guide to the use of PIR in flat roofs

in England

Version 2 November 2024

First published November 2021

Insulation Manufacturers Association (IMA) is the Trade Association that represents both the polyisocyanurate (PIR) and polyurethane (PUR) insulation industry in the UK. Its members manufacture rigid insulation that provides around 40 per cent of the total thermal insulation market into the UK. IMA's membership comprises all of the major companies in the industry, including manufacturers of finished PIR and PUR insulation products, as well as suppliers of raw materials and associated services.

IMA represents the industry's views across all government and industry stakeholders and decision makers and promotes a positive and dynamic business environment for the PIR and PUR insulation industry in the UK.

Published by:

IMA
Insulation Manufacturers Association

Registered Office:
2 Heap Bridge
Bury
BL9 7HR

www.insulationmanufacturers.org.uk

IMA and any contributors believe that the guidance and information contained in this guide is correct. All parties must rely on their own skill and judgement when making use of it.

This guide is not exhaustive and building designers will be required to check constructions against guidance for a number of functional standards. It is recommended that project specifics are discussed with the local authority and a qualified fire engineer, particularly when following alternative guidance or a fire safety engineered approach.

Neither IMA nor any contributor assumes any liability to anyone for any loss or damage caused by any error or omission in this guide, whether such error or omission is the result of negligence or any other cause. Where reference is made to legislation, it is not to be considered as legal advice. Any and all such liability is disclaimed.

Contents

1 Introduction 4

2 Scope of the document 4

3 Definitions and terms used in this document 5

4 Fire performance 6

5 Compressive strength... 14

6 Thermal performance 15

7 Control of moisture in flat roofs using PIR insulation.............. 18

8 Other benefits of using PIR insulation 19

9 Publications referred to in this document 19

1 Introduction

It is widely accepted that insulation is the single most important energy efficient element in the specification of a building. Ensuring that the fabric of a building is insulated is the most cost effective and easiest way to improve its energy efficiency regardless of whether the building is old or new. Greater energy efficiency means that less energy is needed to either warm or to cool a building. In turn this leads to lower fuel consumption, lower energy bills, greater comfort for the consumer and fewer carbon emissions to damage the environment.

Changes to Approved Document B (ADB) with regard to the use of combustible materials in the external walls of buildings have led to some confusion about how and where PIR insulation can be used. In particular there is confusion around the terms ‘balcony’ and ‘specified attachment’.

This document serves to explain the background to roofing classifications, looks at the terms ‘balcony’ and 'specified attachment’ and gives further information on some of the thermal and strength characteristics of PIR foam to help designers understand how and where PIR can be used.

2 Scope of the document

This document gives guidance on how to meet the requirements of the Approved Document B of the Building Regulations 2010 for England when using PIR insulation in flat roofing applications. The document was drawn up using the version of Approved Document B which came into effect on 30 August 2019 incorporating the 2020 and 2022 amendments. It relates to the following:

- Volume 1 – Dwellings
- Volume 2 – Buildings other than Dwellings

Based on these regulations, PIR insulation, as part of a suitable system, can be used on all flat roofs of buildings in England regardless of height.

The document also gives guidance on other properties pertinent to the use of PIR in flat roofing such as thermal performance, compressive strength and control of moisture.

The document covers the use of PIR in warm roof applications, which accounts for the major part of its use, but does not cover cold roofs or inverted roofs.

Whilst this document primarily covers the regulations in England, it largely reflects the situation in Scotland, Wales and Northern Ireland. Users of the document should check with the relevant regulations or codes for the relevant nation.

Insulation Manufacturers Association

3 Definitions and terms used in this document

3.1 PIR (polyisocyanurate) insulation

Rigid PIR insulation products are made by reacting a liquid polyol with a liquid polymeric isocyanate in the presence of a blowing agent and other additives. The mixed components then react exothermically to form a rigid thermosetting polymer (3.2). The blowing agent evaporates during the reaction process and a rigid closed cell low density insulation product is created. The resulting product does not melt when exposed to fire but forms a carbonaceous char, unlike thermoplastic materials. Excellent insulation performance is achieved because the gas trapped within the closed cell structure has a very low thermal conductivity and there is minimal heat conduction through the solid cell walls due to the low density.

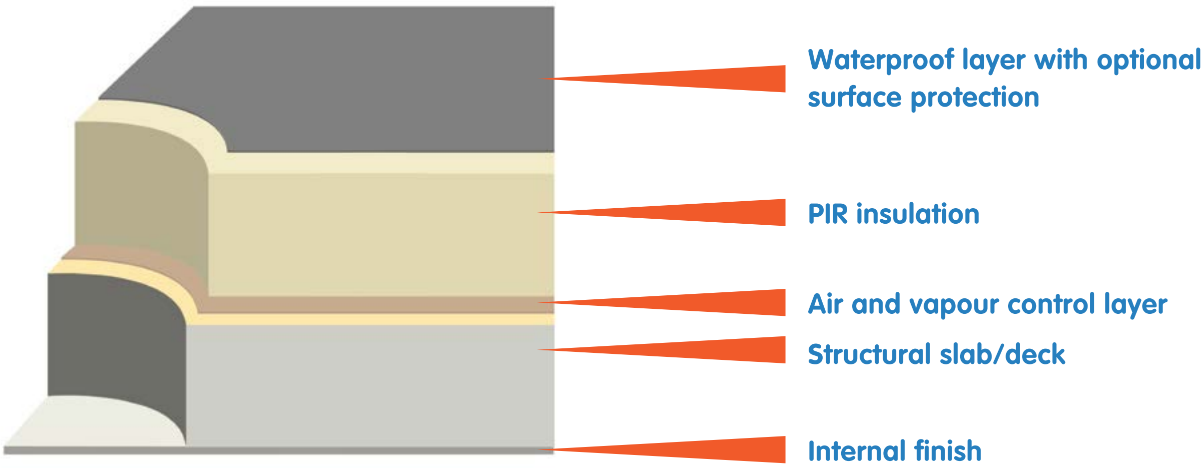
3.2 Thermoset and thermoplastic

The key differences between thermoset and thermoplastic insulation materials relate to thermal performance as well as their response to heat. Thermoplastic products (typically polystyrene) are synthetic polymeric materials with a softening point below 200°C if tested to BS EN ISO 306 Method A120. When softened they depolymerise to create flammable decomposition products similar to the oil-based products used for their creation, whereas thermosetting products such as polyurethane and polyisocyanurate carbonise slowly to form a "char" at higher temperatures but because of their cross-linked structure do not lose their structural integrity.

3.3 Warm flat roof

A warm flat roof is designed as a roof with a pitch between 1:80 and 10 degrees where all the insulation is above the joists/deck, making them part of the warm fabric of the building. The PIR insulation is immediately below the waterproofing layer. The air and vapour control layer is above the decking but below the insulation. The insulation can be adhered, mechanically fixed or loose laid (subject to ballast).

Diagram 1: Typical build up of a warm flat roof



Insulation Manufacturers Association

4 Fire performance

4.1 Understanding the European Standards and classifications relating to flat roofing

The 2019 edition of the Approved Document B brought a number of changes for flat roofing. The European Classification system set out in BS EN 13501-5, that has run alongside the National Classification system for many years, is now the main reference for external fire performance of roofs in England. Reference to the national classification system, set out in BS 476-3:2004 as the principal means of determining the external fire performance for roofs, has now been removed (with exception of a listing in Appendix B Table B2 that sets out the old classification system for historic projects or where a BS 476-3 tested system is still valid).

The classification in BS EN 13501-5 still covers external fire penetration and spread of flame of roof systems when responding to fire from outside the building but does not deal with the fire behaviour of roofs when exposed to fire from within the building. This classification is different to that in BS EN 13501-1 which deals with individual components being tested for reaction to fire. A reaction to fire classification is required for individual products for the "Declaration of performance/conformity" in order to be able to apply CE/CA marking.

Roof systems incorporating PIR insulation are able to achieve the highest fire classification of B_{ROOF}(t4) when tested in accordance with DD CEN/TS 1187 (TS 1187) Test 4 and classified to EN 13501-5.

In order to bring clarity to the many fire standards dealing with external fire performance of roofs across Europe, the roofing industry has been going through a changeover from the test and classification of BS 476-3:2004 to the tests of Technical Standard TS 1187. It is expected that this TS will become BS EN 1187 in the coming years.

However, trying to standardise all the European tests into one single test proved impossible due to the differing national regulations and so four test standards were required to cover the legislation in place within the various member states at the time. As such, the TS 1187 has four tests as follows:

- t1 for Germany
- t2 for Scandinavia
- t3 for France
- t4 for the UK (also used in the Republic of Ireland).

The results from testing to TS 1187 t4 are classified against BS EN 13501-5 and are given as European Class ratings B_{ROOF}(t4), C_{ROOF}(t4), D_{ROOF}(t4), E_{ROOF}(t4) and F_{ROOF}(t4).

The easiest way of explaining how to achieve these class ratings is to relate back to the BS 476-3 classification system.

Table 1 National class ratings compared to European class ratings

National Class*	European Class	Minimum distance from any point on relevant boundary (England)
AA, AB or AC	$B_{ROOF}(t4)$	Unrestricted and can be used anywhere on the roof
BA, BB or BC	$C_{ROOF}(t4)$	At least 6m from the boundary
CA, CB or CC	$D_{ROOF}(t4)$	At least 6,12 or 20m from the boundary depending on the building type and use
AD, BD or CD	$E_{ROOF}(t4)$	At least 6,12 or 20m from the boundary depending on the building type and use
DA, DB, DC or DD	$F_{ROOF}(t4)$	At least 20m from the boundary depending on the building type and use

For TS 1187 Test 4 (the UK test) the previous requirement of Approved Document B was Class AC to BS 476: Part 3.

- A for Penetration - not penetrated within one hour, and
- C for Spread of Flame - more than 533mm.

This meant that Test 4 needed to replicate the penetration test, but did not require the spread of flame full test because the preliminary test allowed the tester to determine if classification D or better was achieved. If the preliminary test specimen did not burn for more than five minutes after removal of the test flame, and spread of flame was not more than 381mm, then class C is achieved. Therefore test 4 just requires the preliminary test and penetration test.

It should be noted that the classification is for all types of roof system. However, with virtually all commonly used flat roof build-ups the aim is to achieve $B_{ROOF}(t4)$ when tested.

This classification is required to determine how close the roof is to the boundary and therefore adjacent buildings. The advantage of using systems which achieve the highest $B_{ROOF}(t4)$ is that there is no minimum distance required between adjacent buildings and this result is often referred to as 'unrestricted'.

* **First Letter - Fire Penetration Classification (BS 476-3)**

A: Those specimens which have not been penetrated within one hour.

B: Those specimens which are penetrated in not less than 30 minutes.

C: Those specimens which are penetrated in less than 30 minutes.

D: Those specimens which are penetrated in the preliminary flame test.

Second Letter - Spread of Flame Classification (BS 476-3)

A: Those specimens on which there is no spread of flame.

B: Those specimens on which there is not more than 533mm, spread of flame.

C: Those specimens on which there is more than 533mm, spread of flame.

D: Those specimens which continue to burn for five minutes after the removal of the test flame or with spread of flame more than 381mm, in the preliminary test.

The table shows that the closer the proximity of adjacent buildings, then a higher performance of roof system is required.

In order to meet the Building Regulations the 'as installed' system should have a valid test certificate. There are currently hundreds of system permutations and it is unlikely that all build-ups will have been tested.

In roofs that incorporate non-combustible surface finishes as set out in European Commission Directive 2000/553/EC and listed below these are deemed to fully satisfy the regulations to B_{ROOF}(t4) without testing

- Minimum 50mm thickness of stone ballast; or
- Minimum 40mm thick stone or concrete paving slabs; or
- Minimum 30mm thick sand and cement screed fully covering the roof

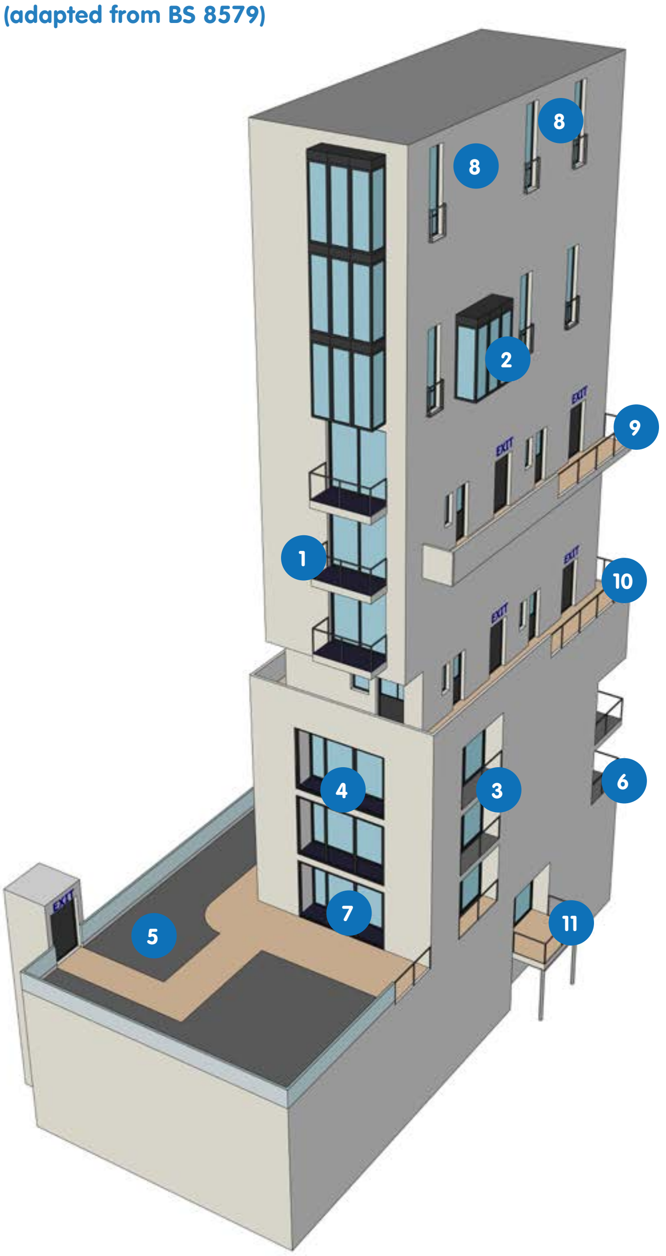
4.2 Specified attachments

In late 2018 Approved Document B was amended to incorporate in Requirement B4 Regulation 7 - the Government requirement to ban combustible materials as part of the external wall in buildings containing one or more dwellings or an institution. In June 2022, Approved Document B had a further enhancement, mainly in response to the public consultation in 2020, these “Relevant buildings” include student accommodation, care homes, sheltered housing, hospitals, school dormitories, and also added were hotels, hostels and boarding houses in buildings where there is a storey at least 18 m above ground level. It should be noted that in response to the Public Consultation, the applicable height for balconies for Purpose Groups 1 and 2 (residential) has been reduced to 11 m (Cl.10.10 Vol1 and Cl.12.11 Vol2) along with the extended scope of “Relevant buildings". Regulation 7 also introduced a new term 'Specified attachment' (defined in Regulation 2) which was included in the ban of combustible materials along with other parts of an external wall. The definition includes a balcony 'attached' to an external wall.

Notable exclusions to the ban are membranes, thermal break materials, any part of a roof (except habited mansards with a slope greater than 70°) and (added in 2022) the top layer of the balcony floor if it achieves A2fl-s1 or better, provided it is over an imperforate substrate.

This new term has caused much misunderstanding with what the definition of a balcony is, and it appears to contradict the European Commission Directive 2000/553/EC and Regulation 7(3) if the definition of a balcony is deemed to include an insulated roof.

Diagram 2: Balconies and terraces (adapted from BS 8579)

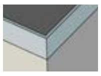


1. Projecting open balcony
2. Projecting enclosed balcony
3. Recessed open balcony
4. Recessed enclosed balcony
5. Terrace
6. Recessed opening terrace
7. Recessed enclosed terrace
8. Juliet guarding
9. Access balcony (can be referred to as 'access deck' or 'walkway')
10. Access terrace (can be referred to as 'access deck' or 'walkway')
11. Free-standing balcony


Terrace, access terrace and access balcony surfaces with fire performance $B_{ROOF}(t4)$ or better


Imperforate (as BS 9991) guarding materials reaction to fire class as set out in BS 8579


Other guarding materials reaction to fire class as set out in BS 8579


Other guarding

Insulation Manufacturers Association

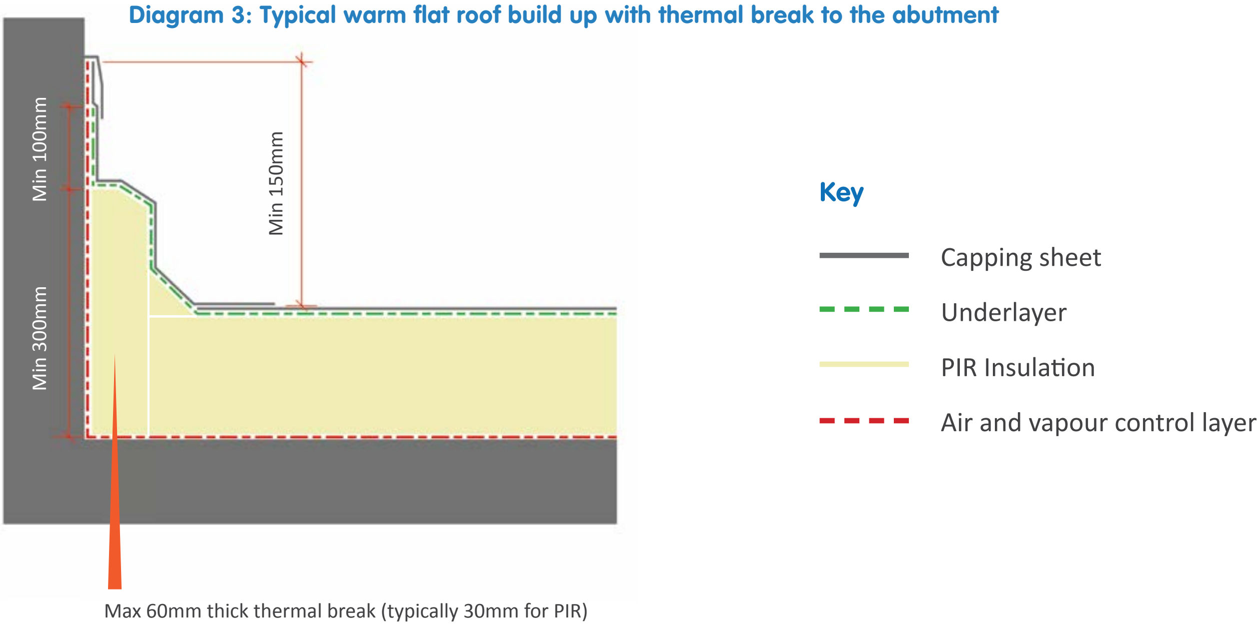
The flat roofing industry has worked with the NHBC to come to a common understanding which also mirrors the new British Standard BS 8579 “Guide to the Design of Balconies and Terraces”. Attached balconies are differentiated from roof terraces in that they are not situated over habited conditioned spaces and are usually bolted to, or cantilevering from, the external wall. This also includes most inset balconies. Therefore, for the purposes of Approved Document B, balconies are not deemed to be roofs.

For areas established correctly as balconies on “relevant buildings”, Regulation 7(2) states only materials achieving A1 or A2-s1,d0 should be used. However, the waterproofing membrane is excluded from this by Regulation 7(3)(g). Further, Approved Document B B4 Section 10.15 (Vol 1)/12.16 (Vol 2), contrary to many interpretations, does not mention or include for “specified attachments”. Therefore, a typical roof waterproofing membrane can be used on balconies.

A key area that has been highlighted by the latest version of Approved Document B that has existed for years and now needs to be clarified is “When is a wall a roof”? Confusion arises where the flat roof waterproofing abuts a perimeter or roof penetration and is traditionally dressed a minimum 150mm above the finished roof level or walking surface (as set out in BS 6229).

The definition of a roof is 0-70 degrees and anything steeper than this is a wall, yet 7(3) excludes any part of a roof connected to an external wall. In a letter from the Ministry of Housing, Communities and Local Government (MHCLG) to the flat roofing industry (in November 2019) it was acknowledged that the part of the roof dressed up the wall is exempt but with no clarification on the extent i.e. max height. Again, the flat roofing industry working with the NHBC have developed some guidelines which also deals with the supplemental queries about the insulation often used at these points. Insulation on the face of the wall/abutment is usually a thermal break and subsequently exempt from the ban. Therefore, for the area up to 150mm above the finished roof level or walking surface, insulation could be used provided that it is no thicker than 60mm (deemed sufficient thickness for a thermal break) and does not span across a compartment line. For heights above this, the insulation is recommended to be non-combustible and, for the NHBC, typically limited to approximately 1100mm for parapets and lift/stair overruns.

Diagram 3: Typical warm flat roof build up with thermal break to the abutment



4.3 Green roofs

Approved Document B references 'Fire Performance of Green Roofs and Walls' published in 2013 by the Department of Communities and Local Government (DCLG). This document is the basis of the Green Roof Organisation (GRO) "Fire Risk Guidance Document".

To summarise, the growing medium used should be minimum 80mm thick, certified for use on green roofs and, where there is no permanent irrigation, organic content should be <50% and peat free.

Fire breaks 300mm wide should be:

- a minimum of 50mm thick 20-40mm rounded pebbles; or
- a minimum of 40mm thick concrete or stone paving slabs around all perimeters

Fire breaks should be 500mm wide if adjacent to an opening window, rooflight or similar that could allow fire to enter the building, with a 1m wide fire break across the roof every 40m.

Maintenance is very important to prevent vegetation growing over fire breaks and to remove wildflower dry thatch in the Autumn.

NHBC follows this guidance but also has its own additional guidance for escape routes in landscaped roofs which it describes as "Protected Walkways" to give pedestrians protection from fire on an adjacent area. They should be a minimum of 1.8m wide and the roof build-up, including walkway finish, should achieve B_{ROOF}(t4) or be "classified without further test" (CWFT) as B_{ROOF}(t4). However, any void formed under the protected walkway should be filled with a suitable granular fill e.g. 20-40mm stones, whilst maintaining drainage.

4.4 Compartmentation – junction of compartment wall with roof

Approved Document B provides a few possible scenarios for dealing with the junction of a compartment wall with a roof. In Approved Document B 'Roof covering' describes one or more layers of material, but not the roof structure as a whole. TS 1187 gives the definition of the roof as "covering and sealing system including any insulation layer or vapour barriers normally provided together with their supporting element including attachment (glued, mechanically fastened, etc.)".

As detailed in an Interim Report published by BRE for DCLG in 2015 which covered compartment sizes, resistance to fire and a fire safety project, the existing guidance in Approved Document B may appear to be complicated but, broadly speaking, involves;

- Either fire stopping up to the underside of the roof covering or deck and restricting flame spread in the area around the junction or
- Continuing the compartment wall up through the roof extending beyond the top surface of the roof covering.

Another document which should also be referred to is the Approved Document B FAQ published by DCLG which confirms that where there is existing guidance precluding the use of composite panels with thermoplastic cores (see Option B) , this does not extend to panels with thermosetting cores. This demonstrates that there is a clear distinction between thermoplastic and thermosetting insulation materials when it comes to applying the guidance in Approved Document B.

The three options from Approved Document B are detailed below. It is recommended that Approved Document B is read alongside this guide.

Option A - To reduce the risk of fire spreading over the roof from one compartment to another, a 1500mm wide zone of the roof, either side of the wall, should have a covering classified as B_{ROOF}(t4), on a substrate or deck of a material rated class A2-s3, d2 (e.g. steel or concrete) or better. It is possible for roof coverings incorporating PIR to meet the B_{ROOF}(t4) criteria, and therefore a tested system can be taken over the compartment wall provided the conditions for fire stopping and fire protection are met.

Option B (see diagram 4) - Materials achieving class B-s3, d2 or worse (e.g. timber or plywood) used as a substrate to the roof covering and any timber tiling battens, fully bedded in mortar or other suitable material for the width of the wall may extend over the compartment wall in buildings that are both of the following;

a. A maximum of 15m high.

b. In one of the following purpose groups.

   i. All residential purpose groups (purpose groups 1 and 2) other than 'residential (institutional)' (purpose group 2(a)).

   ii. 'Office' (purpose group 3).

   iii. 'Assembly and recreation' (purpose group 5)

Buildings above 15m or from a different purpose group would require the deck to be changed to a suitable A2-s3,d2 deck for 1500mm either side of the wall or for the compartment wall to pass entirely through the roof covering (see option C). It is possible for roof coverings incorporating PIR to meet the B_{ROOF}(t4) criteria, and therefore a tested system can be taken over the compartment wall provided the conditions for fire stopping and fire protection are met. There are restrictions for taking thermoplastic insulation materials over the compartment wall in this scenario, however this would not affect PIR as it is a thermosetting insulation material.

Option C – As an alternative to the provisions in Option A and B, the compartment wall may extend through the roof for a minimum of either of the following;

a. Where the height difference between the two roofs is less than 375mm, 375mm above the top surface of the adjoining roof covering.

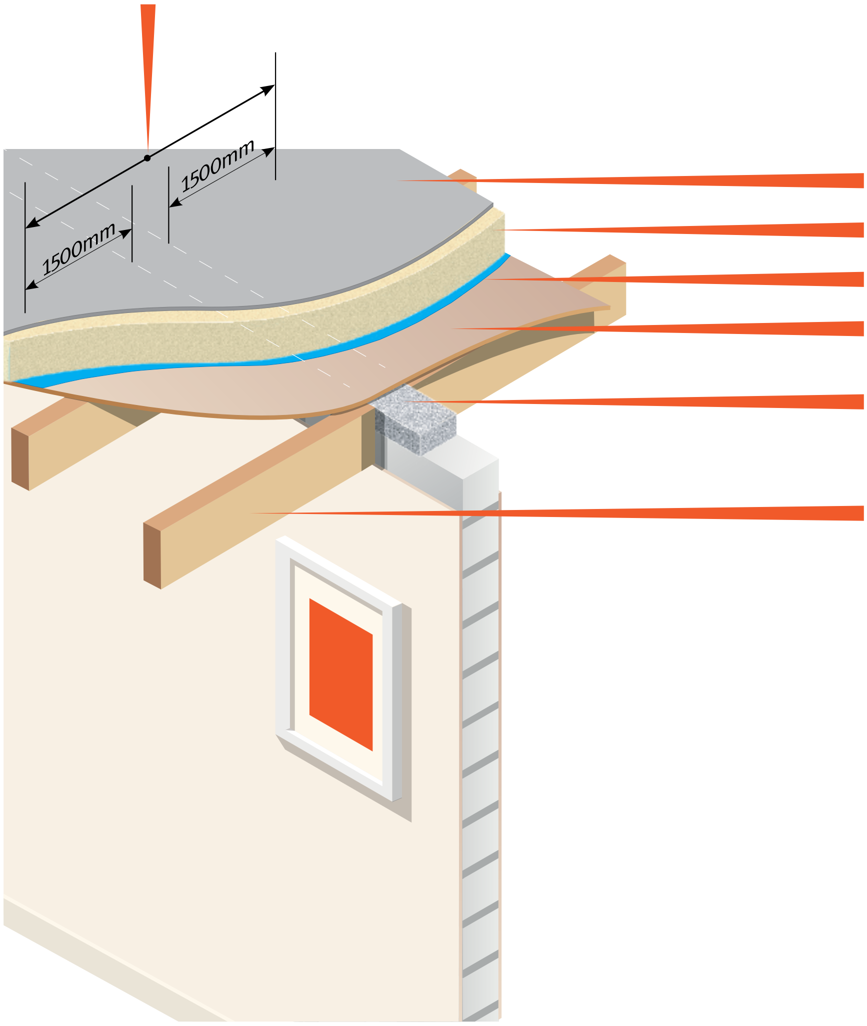
b. 200mm above the top surface of the adjoining roof covering where either of the following applies.

   i. The height difference between the two roofs is 375mm or more.

   ii. The roof coverings either side of the wall are of a material classified as B_{ROOF}(t4).

This section of Approved Document B only received a minor update in 2019 as part of the publication of the clarified versions and there was no change to the technical content. MHCLG and the flat roofing industry have acknowledged that the guidance should be considered as part of the Technical Review of Approved Document B which is currently underway.

Diagram 4: Diagram to show Option B - flat roof over compartment wall junction



5 Compressive strength

The typical compressive strength of PIR roofboards is at least 120 kilopascals (kPa) at 10% compression. So this means that when installed with a durable waterproof system they are suitable for use on roof decks which are likely to see occasional foot traffic from maintenance such as bi-annual check-ups.

All insulation materials, including PIR, are assessed using the standard BS EN 826:2013. In this test, a square section of insulation is placed on a compression testing machine. A load is applied and steadily increased until the material either gives way (yields) or the stress from the loading causes the material to deform by 10% (typically referred to as 10% compression). The pressure measurement taken at this point provides the maximum compressive strength which should not be exceeded.

Within this test, pressure is measured in kilopascals (kPa). The measurement is affected by the weight of the object and the size of the contact point. For example, a person standing on one foot would have a higher kPa measurement than if they spread their weight across two feet. Materials with higher pressure measurements (in kPa) have greater compressive strength. This can make them suitable for applications where they may be exposed to greater loads.

Flat roofs are often exposed to dynamic compressive loads, e.g. pedestrian traffic. These loads occur during construction of the building and during regular maintenance or plant installations on the roof post-construction.

When walking on any surface of a flat roof, a compressive load is applied on the insulation underneath. Even flat roofs which are not designed for pedestrian access can be exposed to these loads on a frequent basis either during the initial installation or during maintenance.

When exposed to this occasional dynamic loading, some insulation materials can lose their compressive strength. As a result, insulation could begin to collapse, thermal performance could start to reduce and low points or ponding areas could develop. Water and water ponding can be a serious threat to flat roofs. It can allow moss and algae to grow and, in winter, can cause the membrane to expand and contract as water freezes. These issues can reduce the lifespan of the roof and may require costly repair work to fix. Using PIR insulation can help to prevent these issues occurring.

Regular maintenance is particularly important on flat roofs as their extremely low pitch angle means that debris on the surface or in drains could build up. Typically, these surfaces should be assessed and maintained at least twice a year – before and after the winter period which is generally the most challenging time for roofs.

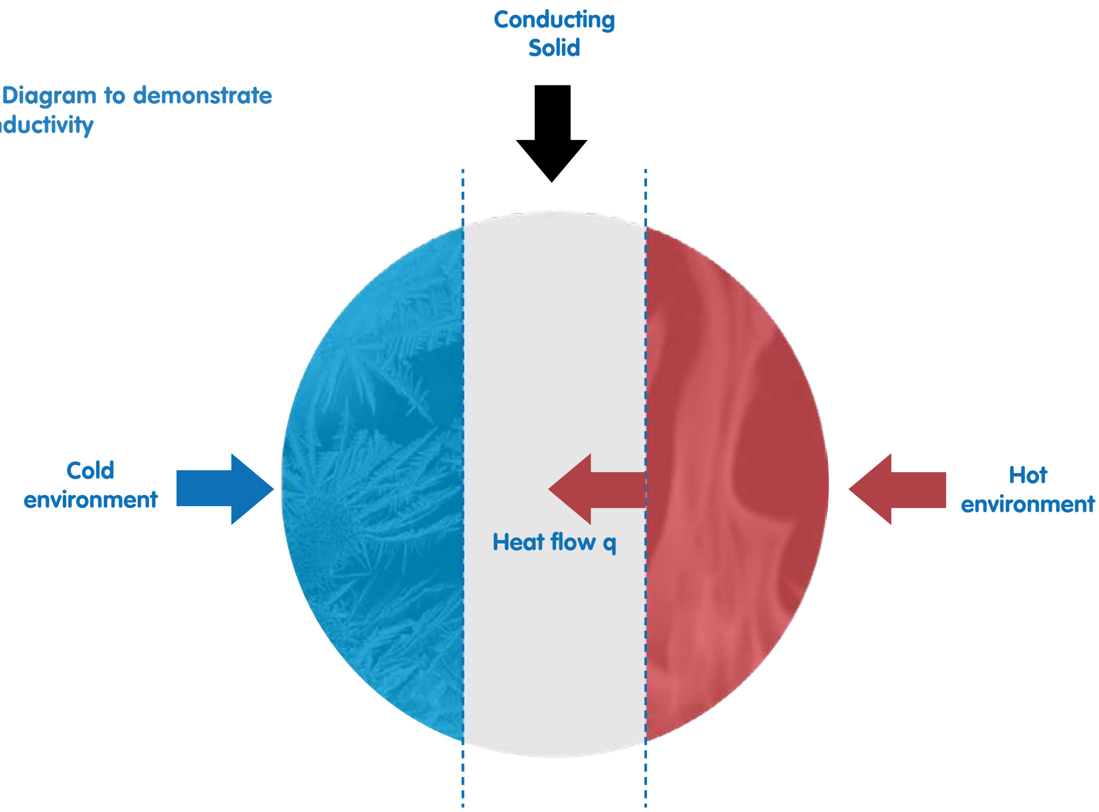
6 Thermal performance

Thermal conductivity, also referred to as the lambda value, dictates the insulating ability of a material and is a key factor in designing insulation strategies that achieve stringent building fabric thermal performance. Thermal conductivity is the rate of transmission of energy through $1m^2$ of material, 1m thick with a 10^oC temperature difference on both sides. The unit measurement is watts per metre Kelvin.

The lambda value, dictates the insulating ability of a material and is a key factor in designing insulation strategies that achieve stringent building fabric thermal performance. The lower the lambda value of an insulation product, the better it performs.

Thermal conductivity is the heat flow q across a temperature difference

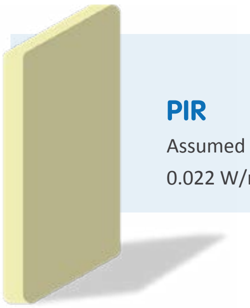
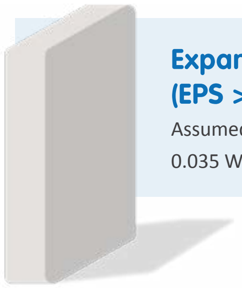
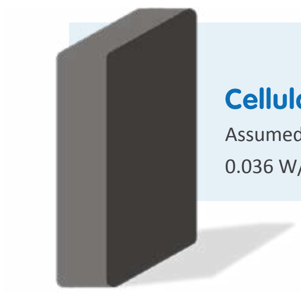
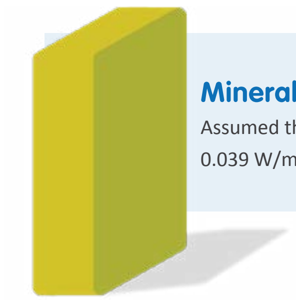
Diagram 5: Diagram to demonstrate thermal conductivity



PIR is characterised by its excellent thermal performance compared to other products, which need to be much thicker to achieve the same performance.

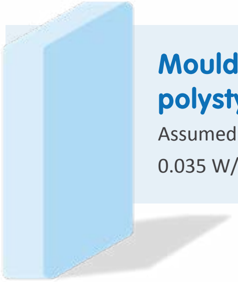
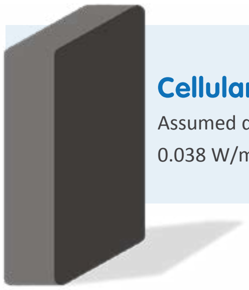
The diagrams below show the thicknesses of insulation products needed to achieve a given U-value depending on the application

Diagram 6: Thicknesses of insulation products to achieve a given U-value for a warm roof

Insulation type	Typical insulation thickness to achieve a U-value of 0.11 W/m^2K on an 18mm plywood / OSB 3 deck	Typical insulation thickness to achieve a U-value of 0.15 W/m^2K on an 18mm plywood / OSB 3 deck	Typical insulation thickness to achieve a U-value of 0.18 W/m^2K on an 18mm plywood / OSB 3 deck
For warm roofs:			
 **PIR** Assumed thermal conductivity 0.022 W/m^2K	**190mm**	**140mm**	**120mm**
 **Expanded polystyrene (EPS >150 kPa)** Assumed thermal conductivity 0.035 W/m^2K	**300mm**	**220mm**	**180mm**
 **Cellular Glass** Assumed thermal conductivity 0.036 W/m^2K	**310mm**	**230mm**	**190mm**
 **Mineral wool (160kg/m²)** Assumed thermal conductivity 0.039 W/m^2K	**355mm**	**255mm**	**205mm**

Insulation Manufacturers Association

Diagram 7: Thicknesses of insulation products to achieve a given U-value for an inverted roof including allowance for rainwater cooling based on London postcodes.

Insulation type	Typical insulation thickness to achieve a U-value of 0.11 W/m²K on a 200mm concrete deck	Typical insulation thickness to achieve a U-value of 0.15 W/m²K on a 200mm concrete deck	Typical insulation thickness to achieve a U-value of 0.18 W/m²K on a 200mm concrete deck
For inverted roofs:			
 **Moulded extruded polystyrene (XPS 300kPa)** Assumed design lambda value 0.035 W/m²K	**310mm**	**230mm**	**190mm**
 **Expanded polystyrene (EPS) (moulded)** Assumed design lambda value 0.031 W/m²K	**265mm**	**195mm**	**160mm**
 **Cellular glass** Assumed design lambda value 0.038 W/m²K	**320mm**	**240mm**	**200mm**

7 Control of moisture in flat roofs using PIR insulation

PIR insulation products are resistant to moisture ingress and unlike some other insulation materials, do not readily depress under foot traffic, so are less susceptible to dips in the roof where water can collect (known as water-ponding). PIR insulation is used on flat roof applications, due to its durability and compatibility with a variety of waterproofing methods.

The roof of any building should be weatherproof, and the roof of a heated building should incorporate thermal insulation. All flat roof coverings should be watertight and water and air impermeable.

Flat roofs typically exclude moisture movement into and through the structure as far as possible. A good understanding of the materials and their interactions with moisture is a key part of the design of building to reduce the risks of moisture damage.

In order to avoid the moisture risk of wind-driven rain penetration in roofs, designers should follow the recommendations given in BS 6229 and follow the wider guidance on control of moisture in buildings found in BS 5250.

When building an exposed (not ballasted) flat roof, it is vital that a degree of falls is built into the construction to ensure rainwater run-off.

Flat roofs can be formed with a concrete slab or with structural framing supporting a deck. The external covering can consist of a fully supported continuous impermeable layer, such as a reinforced bitumen membrane, single-ply polymeric membrane, liquid-applied waterproofing, fully-supported sheet metal (such as zinc or lead, with standing seams), or self-supporting sheets or panels with sealed laps and joints.

Tapered PIR insulation is a flat roof solution which allows falls to be created with specially shaped insulation, rather than requiring screed or timber firrings.

PIR insulation in a flat roof can be placed above the roof deck but beneath the waterproof covering, maintaining the temperature of the deck close to that of the internal occupied space, known as a warm flat roof (see 3.3) or above an existing roof system to thermally upgrade during a flat roof refurbishment.

The design and execution of new flat roofs should aim to:

- minimize thermal bridging, particularly at perimeters and penetrations;
- achieve high level of airtightness between the conditioned space and the roof build-up.

A correctly built flat roof will drain rainwater quickly and effectively into gutters and/or rainwater outlets without allowing water to pond – a small amount of ponding is still possible but this very much depends on the level of drainage.

In order to avoid interstitial condensation in any roof, measures should be taken to minimise the amount of moisture entering the roof.

8 Other benefits of using PIR insulation

As well as considering the fire, thermal and strength characteristics of PIR insulation there are some other non-performance related benefits. The number of sheets needed to attain a particular U-Value may be less than for some other insulants where two layers may be needed. This means they are lighter to handle, speeding up the installation time. A thinner insulation system will mean that shorter fixings will be needed to secure it when compared to thicker products.

Strength and stability is important to provide a solid, stable substrate for the waterproofing. PIR's compressive strength and dimensional stability is integral to its specification for a range of flat roof applications which means it is able to withstand foot traffic; a major benefit in relation to roof maintenance, as well as protecting the waterproofing itself. Many common waterproofing systems are bonded to the insulation so the interlaminar strength of PIR adds to the overall excellent performance of flat roofing systems under wind loading.

All these characteristics provide the long term and reliable performance that have become the minimum expectation of a high performing flat roof system and are the reason why PIR continues to be by far the most commonly used insulation in warm flat roofs.

9 Publications referred to in this document

Approved Document B – Fire Safety www.gov.uk/government/publications/fire-safety-approved-document-b

BS 476-3:2004. Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs

BS EN ISO 306 Plastics. Thermoplastic materials. Determination of Vicat softening temperature (VST)

BS EN 13501-1:2018. Fire classification of construction products and building elements. Classification using data from reaction to fire tests

BS EN 13501-5:2016. Fire classification of construction products and building elements. Classification using data from external fire exposure to roofs tests

DD CEN TS 1187 :2012. Test methods for external fire exposure to roofs

EN 826 : 2013 Thermal insulating products for building applications. Determination of compression behaviour

BS 8579:2020. Guide to the design of balconies and terraces

BS 6229:2018. Flat roofs with continuously supported flexible waterproof coverings. Code of practice

For more details on the benefits of PIR insulation please visit: insulationmanufacturers.org.uk

Insulation Manufacturers Association

Registered Office:
2 Heap Bridge
Bury
BL9 7HR