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**Agrement Certificate**  
**13/5045**  
Product Sheet 3

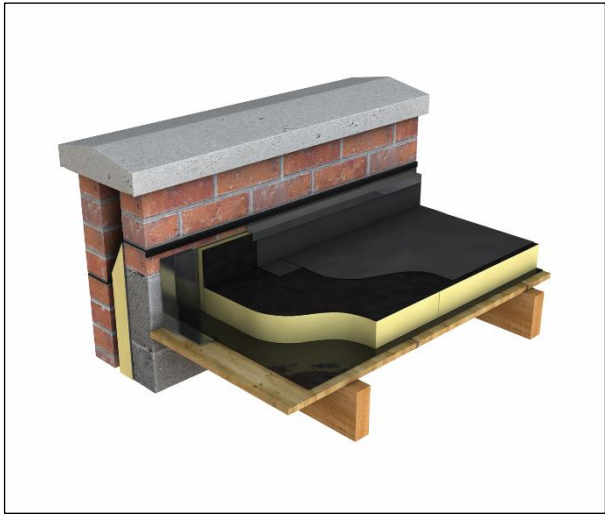
**POWERDECK**

**POWERDECK U**

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to Powerdeck U, comprising a rigid polyisocyanurate (PIR) foam board with a composite bitumen/glassfibre facing on both sides. The product is for use as a thermal insulation layer on limited access concrete, timber or metal flat roof decks. It is for use in conjunction with a vapour control layer and adhesively bonded or mechanically fixed roof waterproofing membranes, in new and existing domestic and non-domestic buildings.

**CERTIFICATION INCLUDES:**

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



**KEY FACTORS ASSESSED**

**Thermal performance** — the product has declared thermal conductivities ( $\lambda_D$ ) from 0.024 W·m<sup>-1</sup>·K<sup>-1</sup> to 0.026 W·m<sup>-1</sup>·K<sup>-1</sup>, depending on the thickness (see section 6).

**Condensation risk** — the product can contribute to limiting the risk of condensation (see section 7).

**Strength and stability** — when installed on suitable substrates using appropriate fixing methods, the product can adequately transfer maintenance traffic loads and wind loads to the roof deck (see section 8).

**Behaviour in relation to fire** — the overall fire rating of any roof containing the product will depend on the type of deck and the nature of the roof waterproof covering (see section 9).

**Durability** — the product, when used as thermal insulation in the roof system described in this Certificate, will have a life at least as long as that of the roof waterproof covering (see section 11).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 13 July 2017

John Albon – Head of Approvals  
Construction Products

Claire Curtis-Thomas  
Chief Executive

*The BBA is a UKAS accredited certification body – Number 113.*

*The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk  
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.*

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## Regulations

In the opinion of the BBA, Powerdeck U, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



### The Building Regulations 2010 (England and Wales) (as amended)

<b>Requirement:</b>	<b>A1</b>	<b>Loading</b>
Comment:		The product can contribute to satisfying this Requirement. See section 8.1 of this Certificate.
<b>Requirement:</b>	<b>B4(2)</b>	<b>External fire spread</b>
Comment:		Roofs incorporating the product can satisfy this Requirement. See sections 9.1 and 9.3 of this Certificate.
<b>Requirement:</b>	<b>C2(c)</b>	<b>Resistance to moisture</b>
Comment:		The product can contribute to satisfying this Requirement. See sections 7.1 and 7.4 of this Certificate.
<b>Requirement:</b>	<b>L1(a)(i)</b>	<b>Conservation of fuel and power</b>
Comment:		The product can contribute to satisfying this Requirement. See section 6 of this Certificate.
<b>Regulation:</b>	<b>7</b>	<b>Materials and workmanship</b>
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
<b>Regulation:</b>	<b>26</b>	<b>CO<sub>2</sub> emission rates for new buildings</b>
<b>Regulation:</b>	<b>26A</b>	<b>Fabric energy efficiency rates for new dwellings (applicable to England only)</b>
<b>Regulation:</b>	<b>26A</b>	<b>Primary energy consumption rates for new buildings (applicable to Wales only)</b>
<b>Regulation:</b>	<b>26B</b>	<b>Fabric energy efficiency rates for new dwellings (applicable to Wales only)</b>
Comment:		The product can contribute to satisfying these Regulations; however, compensating fabric/services measures may be required. See section 6 of this Certificate.



### The Building (Scotland) Regulations 2004 (as amended)

<b>Regulation:</b>	<b>8(1)</b>	<b>Durability, workmanship and fitness of materials</b>
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
<b>Regulation:</b>	<b>9</b>	<b>Building standards applicable to construction</b>
Standard:	<b>1.1</b>	<b>Structure</b>
Comment:		The product can contribute to satisfying this Standard, with reference to clauses 1.1.1 <sup>(1)(2)</sup> , 1.1.2 <sup>(1)(2)</sup> and 1.1.3 <sup>(1)(2)</sup> . See section 8.1 of this Certificate.
Standard:	<b>2.8</b>	<b>Spread from neighbouring buildings</b>
Comment:		Roofs incorporating the product can satisfy this Standard, with reference to clause 2.8.1 <sup>(1)(2)</sup> . See sections 9.1 and 9.3 of this Certificate.
Standard:	<b>3.15</b>	<b>Condensation</b>
Comment:		The product can contribute to satisfying this Standard, with reference to clauses 3.15.1 <sup>(1)(2)</sup> , 3.15.3 <sup>(1)(2)</sup> , 3.15.4 <sup>(1)(2)</sup> , 3.15.5 <sup>(1)(2)</sup> and 3.15.6 <sup>(1)(2)</sup> . See sections 7.1 and 7.5 of this Certificate.
Standard:	<b>6.1(b)</b>	<b>Carbon dioxide emissions</b>
Standard:	<b>6.2</b>	<b>Building insulation envelope</b>
Comment:		The product can contribute to satisfying these Standards, with reference to clauses, or parts of, 6.1.1 <sup>(1)</sup> , 6.1.2 <sup>(2)</sup> , 6.1.6 <sup>(1)</sup> , 6.2.1 <sup>(1)(2)</sup> , 6.2.3 <sup>(1)</sup> , 6.2.4 <sup>(2)</sup> , 6.2.5 <sup>(2)</sup> , 6.2.6 <sup>(1)</sup> , 6.2.7 <sup>(1)</sup> , 6.2.8 <sup>(1)(2)</sup> , 6.2.9 <sup>(1)(2)</sup> , 6.2.10 <sup>(1)(2)</sup> , 6.2.11 <sup>(1)(2)</sup> , 6.2.12 <sup>(2)</sup> and 6.2.13 <sup>(1)(2)</sup> . See section 6 of this Certificate.

**Standard:** 7.1(a) **Statement of sustainability**  
**Comment:** The product can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4<sup>(1)(2)</sup> [Aspects 1<sup>(1)(2)</sup> and 2<sup>(1)</sup>], 7.1.6<sup>(1)(2)</sup> [Aspects 1<sup>(1)(2)</sup> and 2<sup>(1)</sup>] and 7.1.7<sup>(1)(2)</sup> [Aspect 1<sup>(1)(2)</sup>]. See section 6.2 of this Certificate.

**Regulation:** 12 **Building standards applicable to conversions**  
**Comment:** Comments made in relation to the product under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1<sup>(1)(2)</sup> and Schedule 6<sup>(1)(2)</sup>.

(1) Technical Handbook (Domestic).  
(2) Technical Handbook (Non-Domestic).



## The Building Regulations (Northern Ireland) 2012 (as amended)

**Regulation:** 23 **Fitness of materials and workmanship**  
**Comment:** The product is acceptable. See section 11 and the *Installation* part of this Certificate.

**Regulation:** 29 **Condensation**  
**Comment:** The product can contribute to satisfying this Regulation. See section 7.1 of this Certificate.

**Regulation:** 30 **Stability**  
**Comment:** The product can contribute to satisfying this Regulation. See section 8.1 of this Certificate.

**Regulation:** 36(b) **External fire spread**  
**Comment:** The product can contribute to satisfying this Regulation. See sections 9.1 and 9.3 of this Certificate.

**Regulation:** 39(a)(i) **Conservation measures**  
**Regulation:** 40(2) **Target carbon dioxide emission rate**  
**Comment:** The product can contribute to satisfying these Regulations. See section 6 of this Certificate.

## Construction (Design and Management) Regulations 2015

## Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: 3 *Delivery and site handling* (3.4) of this Certificate.

## Additional Information

### NHBC Standards 2017

NHBC accepts the use of Powerdeck U, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

### CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised European Standard BS EN 13165 : 2012. An asterisk (\*) appearing in this Certificate indicates that data shown are given in the manufacturer's Declaration of Performance.

# Technical Specification

## 1 Description

1.1 Powerdeck U is a rigid polyisocyanurate (PIR) foam board with a composite bitumen/glassfibre facing on both sides.

1.2 The product has the nominal characteristics shown in Table 1.

*Table 1 Nominal characteristics*

Characteristic (unit)	Value
Length* x width* (mm)	1200 x 600
Thickness* (mm)	30 to 160 (in 5 mm increments)
Compressive strength at 10% compression* (kPa)	150
Edge detail	Square

1.3 The product is installed as part of a roof system in conjunction with the following items (which are outside the scope of this Certificate):

- waterproofing membrane(s)
- vapour control layer (VCL)
- polyurethane (PU) adhesives and/or mechanical fixings.

## 2 Manufacture

2.1 Raw materials are injected onto the lower insulation facer on a conveyor belt. The exothermic reaction expands the foam, which then comes into contact with the upper insulation facer. An automated process cures and cuts the product to the required size.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Recticel Limited has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 (Certificate ANT951267.1) and BS EN ISO 14001 : 2004 (Certificate 1000665) by Lloyd's Register Quality Assurance.

## 3 Delivery and site handling

3.1 The product is delivered to site in polythene-wrapped packs. Each pack contains a label bearing the Certificate holder's name, board dimensions and the BBA logo incorporating the number of this Certificate.

3.2 The product must be protected from prolonged exposure to sunlight, and stored dry, flat and raised above ground level (to avoid contact with ground moisture). Where possible, packs should be stored inside. If stored outside, they should be under cover, or protected with opaque polythene sheeting.

3.3 The product is light and easy to handle; care should be taken when handling individual items to avoid crushing the edges or corners. If damaged, the product should be discarded.

3.4 The product must not be exposed to open flame or other ignition sources, or to solvents or other chemicals.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Powerdeck U.

### Design Considerations

#### 4 Use

4.1 Powerdeck U is suitable for use as a fully supported thermal insulation layer on flat roofs with concrete, timber and profiled metal roof decks, in conjunction with suitable roof waterproofing membrane system (see section 4.4), with limited access only (see section 4.5).

4.2 Decks should be designed in accordance with the relevant clauses of BS 6229 : 2003, BS 8217 : 2005 or BS EN 13956 : 2012 and, where appropriate, *NHBC Standards 2017*, Chapter 7.1.

4.3 Roofs should incorporate a VCL below the product which is compatible with the product and the waterproofing system. Advice should be sought from the Certificate holder.

4.4 The product must be either adhesively bonded to the VCL using a PU adhesive or mechanically fixed to the roof deck (see section 8), and is for use in conjunction with a suitable torch-on reinforced bitumen membrane<sup>(1)(2)</sup> roof waterproofing system.

(1) Built-up reinforced bitumen membranes to BS 8747 : 2007, laid in accordance with BS 8217 : 2005.

(2) Other bitumen waterproofing systems which are the subject of a current Agrément Certificate and laid in accordance with, and within the limitations imposed by, that Certificate.

4.5 Limited access roofs are defined for the purpose of this Certificate as those roofs subject only to pedestrian traffic for maintenance of the roof covering, cleaning of gutters, etc.

4.6 For the purposes of this Certificate, flat roofs are defined as those having a minimum finished fall of 1:80 and a maximum of 1:6, as defined in BS 6229 : 2003.

4.7 For design purposes on flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available, including overall and local deflections, direction of falls etc.

#### 5 Practicability of installation

Installation of the product must be carried out only by installers trained and approved by the Certificate holder.

#### 6 Thermal performance



6.1 Calculations of thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE Report BR 443 : 2006, using the declared thermal conductivity ( $\lambda_D$ )\* values given in Table 2.

Table 2 Declared thermal conductivity ( $\lambda_D$ )\*

Insulation thickness (mm)	Declared thermal conductivity ( $W \cdot m^{-1} \cdot K^{-1}$ )
<80	0.026
80 to 119	0.025
>120	0.024

6.2 The U value of a completed roof will depend on the thickness of insulation used, the type of fixing and the insulating value of other roof components/layers. Example U values of roofs incorporating the product is given in Tables 3 and 4.

Table 3 Example U values for a fully adhered system

U value (W·m <sup>-2</sup> ·K <sup>-1</sup> )	Insulation thickness <sup>(1)</sup> (mm)		
	Concrete deck <sup>(2)</sup>	Timber deck <sup>(3)</sup>	Metal deck <sup>(4)</sup>
0.13	— <sup>(5)</sup>	— <sup>(5)</sup>	— <sup>(5)</sup>
0.15	150	145	155
0.16	140	135	145
0.18	125	120	125
0.20	115	110	120
0.25	95	85	95

(1) Nearest available thickness.

(2) 150 mm concrete deck — 1.33 W·m<sup>-1</sup>·K<sup>-1</sup>, VCL, insulation, 3-layer bitumen felt waterproofing system.

(3) 12.5 mm plasterboard, 150 mm timber joists (12.5%)/air cavity (87.5%), 18 mm plywood decking, VCL, insulation, 3 layer bitumen felt waterproofing system.

(4) Metal deck, VCL, insulation, 3-layer bitumen felt waterproofing system.

(5) For improved thermal/carbon emission performance, additional insulation thicknesses may be considered.

Table 4 Example U values for constructions with galvanized steel fixings

U value (W·m <sup>-2</sup> ·K <sup>-1</sup> )	Insulation thickness <sup>(1)(2)</sup> (mm)		
	Concrete deck <sup>(3)</sup>	Timber deck <sup>(4)</sup>	Metal deck <sup>(5)</sup>
0.13	— <sup>(6)</sup>	— <sup>(6)</sup>	— <sup>(6)</sup>
0.15	— <sup>(6)</sup>	— <sup>(6)</sup>	— <sup>(6)</sup>
0.16	— <sup>(6)</sup>	155	— <sup>(6)</sup>
0.18	145	140	150
0.20	130	125	135
0.25	105	100	110

(1) Nearest available thickness.

(2) Includes 5.55 galvanized steel insulation fixings per m<sup>2</sup>, with a 4.8 mm cross-sectional diameter.

(3) 150 mm concrete deck — 1.33 W·m<sup>-1</sup>·K<sup>-1</sup>, VCL, insulation, 3-layer bitumen felt waterproofing system.

(4) 12.5 mm plasterboard, 150 mm timber joists (12.5%)/air cavity (87.5%), 18 mm plywood decking, VCL, insulation, 3-layer bitumen felt waterproofing system.

(5) Metal deck, VCL, Insulation, 3-layer bitumen felt waterproofing system.

(6) For improved thermal/carbon emission performance, additional insulation thicknesses may be considered.

## Junctions



6.3 The product can contribute to maintaining continuity of thermal insulation at junctions with other elements and minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

## 7 Condensation risk

### Interstitial condensation



7.1 Roofs will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and H, and the relevant guidance.

7.2 For the purposes of assessing the risk of interstitial condensation, the following vapour resistivity/resistance values of the individual components may be used:

- PIR insulation core — 300 MN·s·g<sup>-1</sup>·m<sup>-1</sup>
- bitumen/glass tissue-facing — 6.6 MN·s·g<sup>-1</sup>.

7.3 To minimise moisture entering the roof, a VCL should be used with joints sealed and lapped, turned up around the insulation and bonded to the waterproofing finish.

### Surface condensation



7.4 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed  $0.35 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$  at any point, and the junctions with other elements are designed in accordance with the guidance referred to in section 6.3 of this Certificate.



7.5 For buildings in Scotland, constructions will be acceptable where the thermal transmittance (U value) does not exceed  $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$  at any point, and the junctions with other elements are designed in accordance with the guidance referred to in BS 5250 : 2011, Annex H. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

## 8 Strength and stability



8.1 When installed on suitable flat roof decks, using appropriate adhesive and/or mechanical fixing methods, the product can adequately transfer maintenance traffic loads and negative and positive (suction and pressure) wind loads to the roof deck.

8.2 For adhesive application of the insulation product, the substrate must be dry and free from dust, and installation should be in accordance with the instructions of the adhesive manufacturer. The surface of the substrate must have sufficient cohesive strength to resist the calculated wind load acting upon the structure.

8.3 When adhering is the chosen method for the insulation or waterproofing, adhesion between the insulation product and VCL, and between the product and overlay, must be adequate to resist the effects of wind suction and thermal cycling likely to be experienced under normal conditions. In areas where high wind speeds can be expected, additional mechanical fixings should be considered. The advice of a suitably qualified and experienced individual should be sought regarding the method of fixing as defined in the relevant clauses of BS EN 1991-1-4 : 2005 and its UK National Annex.

8.4 The roof construction or immediate substrate to which the boards are fixed must be structurally sound and have sufficient strength and stability to resist all dead, imposed and wind loads. It must also have adequate resistance to the pull-out forces created by the wind forces acting on the specified fixings used.

8.5 The suitability of the substrate to accept the adhesive bond or mechanical fixings must be established before installation. Mechanical fixings must be checked before installation by carrying out in-situ pull-out or pull-through testing to determine the minimum safe working load the fixings can resist. The advice of the Certificate holder should be sought in respect of suitable mechanical fixings.

8.6 All design analysis must be in accordance with British or European Standards relevant to the construction. All calculations should be carried out by a suitably qualified and experienced individual.

8.7 The fixing method and, if necessary, the number and type of mechanical fixings required will vary depending on the geographical location of the building, the topographical data, and height and width of the roof concerned, etc (the Certificate holder's advice should be sought in this respect). The Certificate holder recommends a minimum number of fixings per board (see section 13.6).

8.8 Roof waterproofing systems (see section 4.4 for suitable types) must be applied in accordance with the relevant Agrément Certificates and the Certificate holder's instructions.

8.9 For design purposes, the product may be assumed to have an allowable compressive strength at 10% compression\* of  $\geq 150 \text{ kPa}$ .

8.10 The product has not been assessed for use with permanent distributed or concentrated loads, such as air conditioning units, mechanical plants, water tanks, etc. Such loads should be supported directly on the roof construction. The product is not suitable when permanent roof access is required.

8.11 When profiled decking is used, the product will need to span across the ribs. Maximum permissible spans between ribs for the different product thicknesses are given in Table B.1 of BS 4841-4 : 2006 (reproduced in Table 5 of this Certificate). For the minimum adhesive bonding area, see section 8.3 of this Certificate.

Table 5 Maximum clear span

Maximum clear span (mm)	Minimum roofboard thickness (mm)
< 75	25
> 75 ≤ 100	30
> 100 ≤ 125	35
> 125 ≤ 150	40
> 150 ≤ 175	45
> 175 ≤ 200	50
> 200 ≤ 225	55
> 225 ≤ 250	60

8.12 When maintenance is required to the roof waterproofing, protective boarding should be laid over the roof surface to avoid concentrations of load.

## 9 Behaviour in relation to fire



9.1 The product has a reaction to fire classification\* of Class F to BS EN 13501-1 : 2007.

9.2 The fire rating of any roof containing the product will depend on the type of deck and the nature of the roof waterproofing.



9.3 The following system achieved a classification of B<sub>ROOF</sub>(t4) in accordance with BS EN 13501-5 : 2005 and so is unrestricted by the national Building Regulations:

- an adhesively fixed system comprising an 18 mm plywood deck, a 2.0 mm polyester-reinforced foil IKO Systems SA VCL, a 150 mm thick insulation board, a torched-on SBS Standard Underlayer finished with a torched-on SBS Goldseal T/O cap sheet.

9.4 The designation of other specifications should be confirmed by:

**England and Wales** — test or assessment in accordance with Approved Document B, Volumes 1 and 2, Appendix A, Clause 6

**Scotland** — test to conform to clauses 2.C<sup>(1)</sup> and 2.F<sup>(2)</sup>

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

**Northern Ireland** — test to conform to clauses 5.21 and 5.22.

## 10 Maintenance

The product, once installed, does not require any maintenance and has suitable durability (see section 11) provided the roof waterproofing is inspected and maintained at regular intervals.



## 11 Durability



The product is rot resistant and durable, and will have a life at least as long as that of the roof waterproofing.

## Installation

### 12 General

12.1 Powerdeck U must be installed in accordance with the Certificate holder's instructions, BS 6229 : 2003, BS 8217 : 2005, BS EN 13956 : 2012 and the relevant Agrément Certificate, depending on the waterproofing to be applied. Adhesive bonding may be augmented by mechanical fixings where appropriate (see section 8.3 of this Certificate).

12.2 Care should be taken to ensure the deck is graded to the correct fall, is dry, clean and free from any projections or gaps.

12.3 Any hollows, depressions or backfalls found in the roof deck must be rectified prior to laying the insulation.

12.4 The suitability of the substrate deck to accept an adhesive bond or mechanical fixings must be checked prior to the work commencing.

12.5 The deck to which the VCL is to be applied must be even, dry, sound and free from dust, grease and any defects which may impair the bond. All deck joints should be taped.

12.6 To prevent moisture being trapped on or in the insulation, it is essential to:

- protect the product during laying, before the application of the roof waterproofing, or lay the roof covering at the same time as the product. If the product is accidentally wetted, it must be replaced
- install the product only when the ambient temperature is above 5°C, to prevent condensation.

12.7 The product can be cut with a sharp knife or fine-toothed saw, to fit around projections through the roof.

12.8 Once installed, access to the roof should be restricted in accordance with section 4.5.

### 13 Procedure

#### Timber decks (eg tongue-and-groove boards, plywood, OSB)

13.1 For adhered systems, the deck should be treated with a suitable primer, in accordance with the manufacturer's instructions, before applying the VCL, to ensure an adequate bond between the deck and the VCL. The advice of the Certificate holder should be sought in respect of a suitable primer.

13.2 The VCL is torch applied or fully bonded in polyurethane adhesive. For mechanically fixed systems, the VCL is loose laid.

13.3 The VCL should be laid with sealed laps of minimum 150 mm, and be turned up around the insulation and sealed to the waterproof finish at all edges and penetrations such as roof lights. Advice should be sought from the Certificate holder.

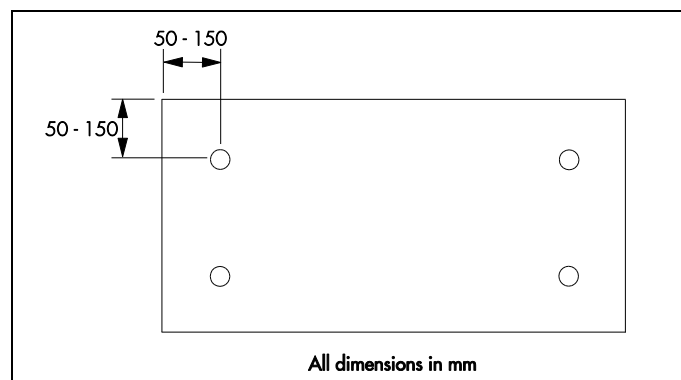
13.4 The insulation boards are laid in a tightly-butted brick bond pattern, with the long edges at right angles to the edge of the roof, or laid diagonally across the deck.

13.5 For adhered systems, a polyurethane adhesive is applied in accordance with the manufacturer's instructions.

13.6 For mechanically fixed systems, thermally broken telescopic tube fixings are recommended to reduce thermal bridging, with a minimum of four mechanical fixings placed within the individual board area (1200 by 600 mm), and sited from all edges as shown in Figure 1. Countersunk washers with circular plates of at least 50 mm diameter or

50 mm square should be used with each fixing. For non-bituminous VCLs, the fixings penetrating the VCL should be self-sealing. For bituminous VCLs, the nail heads should be blanked out with hot bitumen. The requirement for additional fixings is assessed in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex.

Figure 1 Minimum fixing pattern



13.7 The roof waterproofing system (see section 4.4) is then adhesively bonded or mechanically fixed in accordance with the manufacturer's instructions, relevant British Standards and/or Agrément Certificate. Advice should be sought from the Certificate holder.

#### Concrete decks

13.8 The VCL, insulation boards and roof waterproofing system are applied in the manner described for timber decks (see sections 13.1 to 13.7).

13.9 For mechanically fixed systems, the concrete deck may require pre-drilling.

#### Metal decks

13.10 The VCL, insulation boards and roof waterproofing system are applied in the manner described for timber decks (see sections 13.1 to 13.7).

13.11 The insulation boards are laid in a tightly-butted brick bond pattern, with the long edges at right angles to the troughs to ensure the short ends are fully supported, or laid diagonally across the deck corrugations.

13.12 The thickness of the roofboard used depends on the width of the rib openings of the metal deck, as indicated in Table 5.

## Technical Investigations

### 14 Tests

Results of tests were assessed to determine:

- reaction to fire
- thermal conductivity
- compressive strength
- dimensional stability
- wind uplift
- tensile strength perpendicular to faces
- water vapour transmission.

### 15 Investigations

15.1 A calculation was undertaken to confirm the declared thermal conductivity.

15.2 An assessment of the risk of interstitial condensation was made.

15.3 A series of U value calculations was carried out.

15.4 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

## Bibliography

BRE Report BR 262 : 2002 *Thermal insulation: avoiding risks*

BRE Report BR 443 : 2006 *Conventions for U-value calculations*

BS 4841-4 : 2006 *Rigid polyurethane (PUR) and polyisocyanurate (PIR) products for building end-use applications — Specification for laminated insulation boards (roofboards) with auto-adhesively or separately bonded facings for use as roofboard thermal insulation under non-bituminous single-ply roofing membranes*

BS 5250 : 2011 + A1 : 2016 *Code of practice for control of condensation in buildings*

BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*

BS 8217 : 2005 *Reinforced bitumen membranes for roofing — Code of practice*

BS 8747 : 2007 *Reinforced bitumen membranes (RBMs) for roofing — Guide to selection and specification*

BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions — Wind actions*

NA to BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions — Wind actions*

BS EN 13165 : 2012 + A2 : 2016 *Thermal insulation products for buildings — Factory made rigid polyurethane foam (PU) products — Specification*

BS EN 13501-1 : 2007 + A1 : 2009 *Fire classification of construction products and building elements — Classification using test data from reaction to fire tests*

BS EN 13501-5 : 2005 + A1 : 2009 *Fire classification of construction products and building elements — Classification using data from external fire exposure to roofs tests*

BS EN 13956 : 2012 *Flexible sheets for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics.*

BS EN ISO 6946 : 2007 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

BS EN ISO 14001 : 2004 *Environmental management systems — requirements with guidance for use*

### 16 Conditions

16.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

16.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

16.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

16.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

16.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

16.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.