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Agrément Certificate  
**10/4771**  
Product Sheet 1

## DURATHERM OS

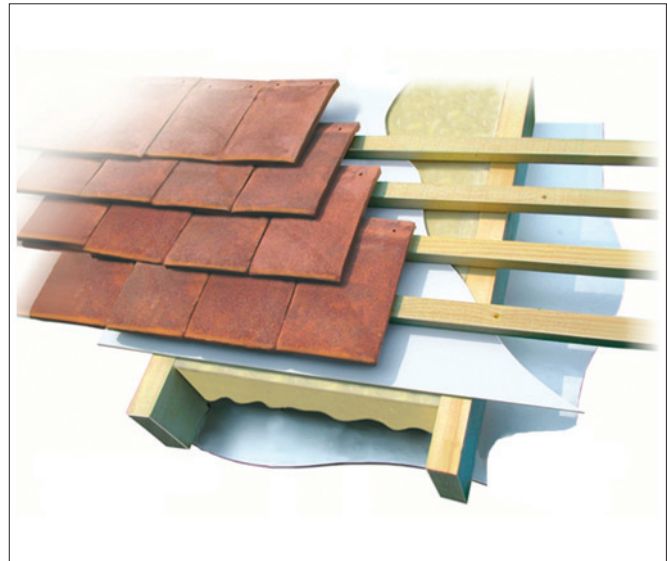
### DURATHERM OS ROOF INSULATION

#### PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to Duratherm OS Roof Insulation, a spray applied expanding polyurethane foam, for use in pitched roofs, including hybrid roofs, or flat timber roof constructions, in new or existing domestic or similar buildings.

#### AGRÉMENT 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

**Practicability of installation** — the product should only be installed by contractors trained and approved by the Certificate holder (see section 4).

**Thermal insulation** — calculations for 'example' roof constructions indicate U values between  $0.16 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$  and  $0.39 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$  (see section 5).

**Condensation risk** — the product has a high water vapour resistivity of approximately  $305 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$  but the risk of interstitial condensation will depend on the roof construction and should be assessed for each project (see section 6).

**Behaviour in relation to fire** — the product has a Class 1 surface spread of flame rating and may be used in suitable roof constructions (see section 7).

**Durability** — the durability of the product is satisfactory and it will have a life equivalent to that of the structure in which it is incorporated (see section 11).

The BBA has awarded this Agrément 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: 20 August 2010

Chris Hunt  
Head of Approvals — Physics

Greg Cooper  
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](http://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, Duratherm OS Roof Insulation, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:



## The Building Regulations 2000 (as amended) (England and Wales)

Requirement:	C2(c)	Resistance to moisture
Comment:		The risk of interstitial condensation must be assessed for each roof. The product can adequately limit the risk of surface condensation. See sections 6.1 and 6.5 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The product can contribute to meeting this Requirement. See section 5.1 of this Certificate.
Requirement:	Regulation 7	Materials and workmanship
Comment:		The product is an acceptable material. See section 11 and the <i>Installation</i> part of this Certificate.



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

Regulation:	8(1)	Fitness and durability of materials and workmanship
Comment:		The product can contribute to a construction satisfying this Regulation. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building Standards – construction
Standard:	3.15	Condensation
Comment:		The risk of interstitial condensation must be assessed for each roof. The product can adequately limit the risk of surface condensation, with reference to clauses 3.15.1 <sup>(1)</sup> , 3.15.3 <sup>(1)</sup> , 3.15.4 <sup>(1)</sup> and 3.15.5 <sup>(1)</sup> . See sections 6.1 and 6.6 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The product can contribute to a roof satisfying these Standards, with reference to clauses, or parts of, 6.1.2 <sup>(1)(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>(1)(2)</sup> , 6.2.5 <sup>(1)(2)</sup> , 6.2.6 <sup>(2)</sup> , 6.2.7 <sup>(1)</sup> , 6.2.8 <sup>(2)</sup> , 6.2.9 <sup>(1)</sup> , 6.2.10 <sup>(1)(2)</sup> , 6.2.11 <sup>(1)(2)</sup> and 6.2.12 <sup>(2)</sup> . See section 5.1 of this Certificate.
Regulation:	12	Building standards – conversions
Comment:		All comments given for this product under Regulation 9, also apply to this Regulation, with reference to clause 0.12.1 <sup>(1)</sup> and Schedule 6 <sup>(1)</sup> . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



## The Building Regulations (Northern Ireland) 2000 (as amended)

Regulation:	B2	Fitness of materials and workmanship
Comment:		The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	C5	Condensation
Comment:		The risk of interstitial condensation must be assessed for each roof. See section 6.1 of this Certificate.
Regulation:	F2(a)(i)	Conservation measures
Regulation:	F3(2)	Target carbon dioxide Emission Rate
Comment:		The product can contribute to meeting this Regulation. See section 5.1 of this Certificate.

### Construction (Design and Management) Regulations 2007

### Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 2 *Delivery and site handling* (2.1 to 2.3) and 12 *Precautions* (12.1 to 12.6) of this Certificate.

# Non-regulatory Information

## NHBC Standards 2010

NHBC accepts the use of Duratherm OS Roof Insulation, when installed and used in accordance with this Certificate, in relation to *NHBC Standards*, Chapters 7.1 *Flat Roofs and Balconies* and 7.2 *Pitched Roofs*.

# General

Duratherm is a registered trademark of Isothane Ltd.

# Technical Specification

## 1 Description

1.1 Duratherm OS Roof Insulation is a spray applied HFC blown, rigid polyurethane foam. It is applied in pitched roofs, including hybrid roofs or flat timber roof constructions as a thermal insulation and built up in layers, not exceeding 20 mm in thickness.

1.2 The foam is prepared from two liquid components, one part by volume of isocyanate to one part by volume of resin mixed within the nozzle of the spray gun during the spraying process. The foam cures within two hours.

1.3 Quality control arrangements on site include checks on density and appearance.

## 2 Delivery and site handling

2.1 The two components of the product are delivered to site in drums (up to 250 kg capacity) bearing the product name, batch number and the BBA identification mark incorporating a BBA Certificate number.

2.2 Drums should be stored in a well-ventilated area, ideally above 10°C and away from possible ignition sources. The drums must be protected from frost.

2.3 The isocyanate component is classified as 'harmful', under *The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009* (CHIP4) and bears the appropriate hazard warning signs. When cured, the product does not constitute a hazard.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Duratherm OS Roof Insulation.

## Design Considerations

### 3 General

3.1 Duratherm OS Roof Insulation is effective in reducing the thermal transmittance (U value) of roofs in new or existing domestic or similar buildings.

#### Pitched roofs, including hybrid roofs tiled or slated to BS 5534

3.2 The product can be applied to bitumen felt, breathable roof tile underlays, timber sarking boards or a plasterboard ceiling lining as follows:

- between timber rafters only
- between and under timber rafters
- as a combination between and under timber rafters and between ceiling joists in a non-habitable roof (hybrid roof, which contain both sloping and horizontal insulation).

#### Flat timber roof constructions to BS 6229

3.3 The product can be used:

- between joists

3.4 The product must not come into direct contact with flue pipes, chimneys or other heat producing appliances (see section 8).

3.5 It is essential that roofs are designed and constructed to incorporate normal precautions against moisture ingress before the application of the product. Care must be taken to ensure the integrity of the roof tile underlay drape when spraying the product (see section 13.6).

3.6 New constructions<sup>(1)</sup> must be designed in accordance with the relevant recommendations of:

- BS 5250 : 2002
- BS 5268-2 : 2002
- BS 5268-3 : 2006
- BS 5534 : 2003
- BS 6229 : 2003.

(1) Further information is given in BRE report (BR 262 : 2002) *Thermal insulation : avoiding risks*.

3.7 Existing constructions must be in a good state of repair with no evidence of rain penetration or damp. Defects should be made good prior to installing the product.

3.8 The product forms a strong bond with clean and dry substrates. This should be taken into account when specifying the product or anticipating future alterations.

3.9 Pitched roofs are defined for the purpose of this Certificate as those roofs having a pitch in excess of 15 degrees.

3.10 The product contributes to the airtightness of the building envelope.

3.11 To satisfy the requirements of NHBC, a vapour control layer of a type specified in their Standards must be applied behind the plasterboard lining, and the product must only be applied to a pitched roof construction incorporating a breathable roof tile underlay.

## 4 Practicability of installation

The product should only be installed by contractors trained and approved by the Certificate holder in accordance with the Certificate holder's Installation Manual.

## 5 Thermal performance



5.1 Calculations of the thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE report (BR 443 : 2006) using the thermal conductivity values in Table 1.

U values of example roofs are shown in Tables 2 to 4 and typical design roof U values in Tables 5 and 6.

Fortuitous air infiltration in hybrid roofs increases the heat loss from the loft void and should be accounted for by adding a 10% correction factor to the calculated roof U value (see Table 3).

*Table 1 Thermal conductivity*

Insulation thickness (mm)	Thermal conductivity(W·m <sup>-1</sup> ·K <sup>-1</sup> )
<80	0.028
80 to 120	0.026
>120	0.025

*Table 2 Pitched roof U values (insulation only between timber rafters)*

Rafter depth (mm)	Insulation thickness (mm)	Thermal conductivity (W·m <sup>-1</sup> ·K <sup>-1</sup> )	Construction U value (W·m <sup>-2</sup> ·K <sup>-1</sup> )
150	75	0.028	0.38
150	120	0.026	0.25
150	150	0.025	0.21
200	175	0.025	0.17
200	200	0.025	0.16

Note: Assuming construction of roof (external to internal):

- foam insulation (91.6%)/timber rafters (8.3%)
- with or without air cavity
- plasterboard – 12.5 mm

*Table 3 Hybrid pitched roof U values including a 10% correction factor*

Roof pitch (θ):	20	30	40	50	60
U value (W·m <sup>-2</sup> ·K <sup>-1</sup> )	0.18	0.18	0.19	0.20	0.22

Note: Assuming construction of roof (external to internal):

- 100 mm foam insulation (91.6%)/100mm deep timber rafters (8.3%)
- loft void air cavity resistance 0.16 m<sup>2</sup>·K·W<sup>-1</sup>
- 100 mm foam insulation (91.6%)/timber ceiling joists (8.3%)
- plasterboard – 12.5 mm

*Table 4 Flat roof U value*

Rafter depth (mm)	Insulation thickness (mm)	Thermal conductivity (W·m <sup>-1</sup> ·K <sup>-1</sup> )	Construction U value (W·m <sup>-2</sup> ·K <sup>-1</sup> )
150	75	0.028	0.39
150	120	0.026	0.27
150	150	0.025	0.23
200	175	0.025	0.19
200	200	0.025	0.17

Note: Assuming construction of roof (external to internal):

- PVC waterproofing – 1.5 mm
- timber deck – 20 mm
- foam insulation (87.5%)/timber rafters (12.5%)
- air cavity where applicable (85%)/timber framing (15%)
- plasterboard – 12.5 mm

**Table 5 Typical design U values for pitched and flat roofs — England and Wales, and Northern Ireland**

Construction type	Pitched roof (insulation at rafters) ( $W \cdot m^{-2} \cdot K^{-1}$ )	Hybrid pitched roof ( $W \cdot m^{-2} \cdot K^{-1}$ )	Flat roof ( $W \cdot m^{-2} \cdot K^{-1}$ )
'Notional' mean in SAP and new dwellings	0.16	0.16	0.16
Limit mean for new extensions	0.20	0.16	0.20
Limit mean for replacement elements	0.20	0.16	0.25
Limit mean for renovated, retained elements and material change of use <sup>(1)</sup> or energy status <sup>(2)</sup>	0.20	0.16	0.25
Limit mean for domestic extensions <sup>(1)</sup> and new dwellings	0.25	0.25	0.25
Limit individual for domestic extensions <sup>(1)</sup> and new domestic	0.35	0.35	0.35

(1) Alternative or flexible approaches are given in relevant documents supporting the national Building Regulations.

(2) England and Wales only.


**Table 6 Typical design U values for pitched and flat roofs — Scotland**

Construction type	U value ( $W \cdot m^{-2} \cdot K^{-1}$ )
Limit mean for new dwellings simplified approach (all fuel packages) and notional dwellings in SAP	0.16
Limit mean for conversions, extensions and alterations <sup>(1)</sup> (pitched roof – insulation between ceiling joists)	0.16
Limit mean for conversions, extensions and alterations <sup>(1)</sup>	0.20
Limit mean for new domestic	0.20
Limit individual element value	0.35

(1) Alternative or flexible approaches are given in relevant documents supporting the national Building Regulations.

## 6 Condensation risk

### Interstitial condensation

 6.1 Roofs should be designed and constructed in accordance with the relevant parts of BS 5250 and Annex D including a well-sealed ceiling, or EN 15026, using a water vapour resistivity of approximately  $305 \text{ MN} \cdot \text{s} \cdot \text{g}^{-1} \cdot \text{m}^{-1}$  for the product.

6.2 It is essential that roof design, construction and maintenance not only limits opportunities for vapour migration by diffusion but also by convection through gaps, cracks and laps in air/vapour controlling layers and through penetrations. This is particularly important when the design includes layers of high resistance to vapour diffusion on both sides of the insulation layer. See also section 3.5.


6.3 Dynamic simulations to EN 15026 : 2007 indicate that the vapour control layer properties (with sealed laps) detailed in Table 7 are acceptable in roofs with no penetrations. The suitability of other constructions may be assessed by using an appropriate dynamic modelling package, see section 15.1.


**Table 7 Vapour control layer properties**

VCL equivalent air layer thickness $s_d$ (m)	VCL water vapour resistance ( $\text{MN} \cdot \text{s} \cdot \text{g}^{-1}$ )	Roof type
10	50	Flat roof
10	50	Hybrid pitched roof
50	250	Pitched roof

6.4 Fortuitous air infiltration in hybrid roofs contributes to reducing the risk of interstitial condensation.

### Surface condensation

 6.5 The risk of surface condensation will be adequately limited when the thermal transmittance (U value) does not exceed  $0.35 \text{ (} W \cdot m^{-2} \cdot K^{-1} \text{)}$ .

 6.6 The risk of surface condensation will be adequately limited when the thermal transmittance (U value) does not exceed  $1.2 \text{ (} W \cdot m^{-2} \cdot K^{-1} \text{)}$  at any point and design is in accordance with the relevant requirements of BS 5250 : 2002, Section 8.

### General

6.7 Care should be taken to provide adequate ventilation, particularly in rooms expected to experience high humidities.

## 7 Properties in relation to fire

7.1 The internal face of the product achieved a Class 1 surface spread of flame rating when tested in accordance with BS 476-7 : 1997.

7.2 The product must be protected from naked flames and other ignition sources during and after installation (see also sections 9.1, 9.2 and 12.5).

7.3 When installed, the product will be contained by a suitable lining board, eg 12.5 mm plasterboard, with all joints fully sealed and supported by rafters, noggins or battens. Therefore, it will not contribute to the development stages of a fire until the lining is compromised. Alternatively, the rafters and the insulation foam in the pitched roof application may remain exposed after conducting a condensation risk analysis in accordance with section 6. Although the insulation foam has a class 1 surface spread of flame rating to BS 476-7 : 1997, it could contribute to the development stages of a fire, however to a limited extent in the early stages of the fire.

7.4 The use of the product should not affect the external fire rating of a slated or tiled roof when evaluated by assessment or test to BS 476-3 : 2004.

### General

7.5 Roofs must incorporate cavity barriers at edges, around openings, at junctions with fire resisting elements and in extensive cavities in accordance with the relevant provisions of the national Building Regulations and relevant purpose group. The design and installation of cavity barriers must take into account any anticipated differential movement.

## 8 Proximity of flues and appliances

When installing the product in close proximity to certain flue pipes and/or heat producing appliances, the relevant provisions of the national Building Regulations are applicable:

**England and Wales** — Approved Document J, sections 1 to 4

**Scotland** — Mandatory Standard 3.19, clauses 3.19.1<sup>(1)(2)</sup> to 3.19.9<sup>(1)(2)</sup>

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

**Northern Ireland** — Technical Booklet L, sections 1 to 4

## 9 Materials in contact — wiring installations


9.1 De-rating of electric cables should be considered in areas where the product restricts the flow of air. Where the foam is likely to bond to electric cables, suitable conduit or trunking should be used.

9.2 Recessed lighting must not be used with this form of insulation.

## 10 Maintenance

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

## 11 Durability

 The durability of the product is satisfactory and will have a life equivalent to that of the structure in which it is incorporated.

# Installation

## 12 Precautions

12.1 The Duratherm OS Roof Insulation process may produce a build-up of harmful vapours. It is required that all personnel in the area for treatment wear the correct protective clothing, breathing equipment and gloves. The Certificate holder's instructions must be followed at all times.

12.2 Vapours given off by certain components of the product, ie 4,4' diphenylmethane diisocyanate (MDI), are generally heavier than air and will tend to move to lower parts of the building. These parts should be suitably ventilated.

12.3 If vapour levels need to be measured, methods should be those recommended by the Health and Safety Executive.

12.4 To comply with the requirements of Section 4 of the Health and Safety at Work Act 1974, it is essential that there is an exchange of information between the client and the installer before spray operations commence on any site. Existing health hazards and those brought into the premises by the installer should be discussed and measures agreed to deal with them effectively.

12.5 After installation in loft voids, fire warning labels are placed in prominent positions if the foam is to be left exposed. The foam is a combustible material; adequate precautions should be taken to avoid ignition at all times.

12.6 To prevent the product from entering the occupied space, the loft hatch/cover must be kept closed during the spraying process. Protective covers must be placed over water tanks to prevent contamination during application, and should not be removed until sufficient time has elapsed for potentially harmful vapours to be ventilated from the roof space.

## 13 Procedure

### General

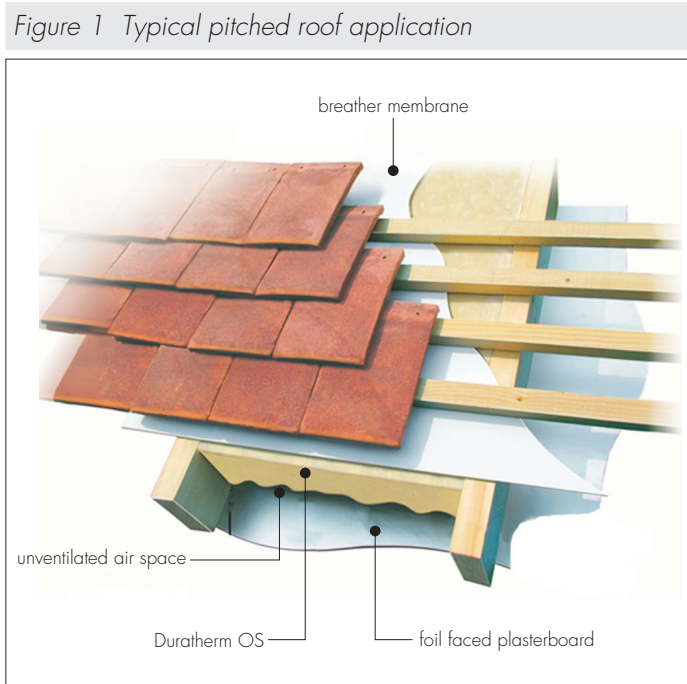
13.1 Roofs to be insulated must be assessed for suitability and any necessary repairs carried out to ensure the roof is weather tight before the application of the product. The positioning and access to services should also be considered.

13.2 Access boards and lighting should be positioned in the roof void. Water tanks are covered to prevent contamination and blockage due to overspray.

13.3 Where there is no provision made for ventilation of the space, care should be taken to ensure that ingress of moisture vapour from the dwelling space below is restricted (see also sections 6.1 and 6.2).

13.4 Where additional insulation to that provided in section 13.5 and 13.6 is required, various forms of insulation, including Duratherm OS Roof Insulation, can be placed between the horizontal ceiling joists, after conducting a condensation risk analysis in accordance with section 6.

**Between rafters application** (see Figure 1)



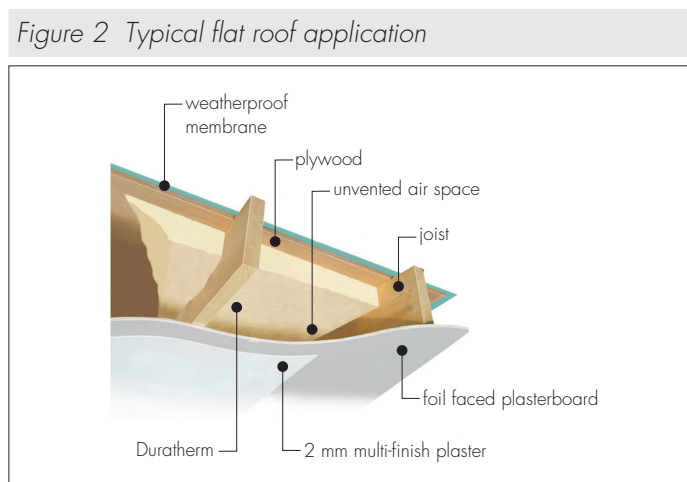
13.5 The product should be spray applied to clean and dry substrates in a flash coat, <10 mm thick and when sprayed to a roof tile underlay, care must be taken to ensure the integrity of the roof tile underlay drape. Subsequent coats not exceeding 20 mm thick are applied once the foam reaction has occurred, and within 10 minutes of the previous coat until the required total thickness is achieved.

**Between and below rafters**

13.6 The foam is spray applied to the depth of the rafters as in section 13.5.

Cross-battens are then mechanically fixed to the rafters. The battens must be of sufficient width and spacing (up to 600 mm) to provide adequate support to which the plasterboard can be mechanically fixed and then filling resumes in 20 mm layers.

**Flat roof application** (see Figure 2)



13.7 The product is sprayed directly to the underside of the roof deck, as described in section 13.5.

## 14 Tests

Tests were carried out on Duratherm OS Roof Insulation to determine:

- thermal conductivity
- behaviour in relation to fire
- water vapour permeability.

## 15 Investigations

15.1 A series of dynamic computer simulations to EN 15026 : 2007 were carried out on a range of roof constructions to assess the risk of interstitial condensation. The simulations included building humidity class 4, meteorological data for solar irradiation (direct and indirect) and rainfall for standard reference years, material moisture storage functions, porosity, specific heat capacity and long term projections of material moisture contents.

15.2 The methods adopted for quality control, relating to incoming materials and the installed product, were examined and found to be satisfactory.



## Bibliography

- BS 476-3 : 2004 *Fire tests on building materials and structures — Classification and method of test for external fire exposure to roofs*
- BS 476-7 : 1997 *Fire tests on building materials and structures — Method of test to determine the classification of the surface spread of flame of products*
- BS 5250 : 2002 *Code of practice for control of condensation in buildings*
- BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*
- BS 5268-3 : 2006 *Structural use of timber — Code of practice for trussed rafter roofs*
- BS 5534 : 2003 *Code of practice for slating and tiling (including shingles)*
- BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*
- BS EN ISO 6946 : 2007 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- BS EN 15026 : 2007 *Hygrothermal performance of building components and building elements— Assessment of moisture transfer by numerical simulation*

## 16 Conditions

16.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- 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 and documents referred to in this Certificate are those that the BBA deems to be relevant at the date of issue or re-issue of this Certificate and include any: Act of Parliament; Statutory Instrument; Directive; Regulation; British, European or International Standard; Code of Practice; manufacturers' instructions; or any other publication or document similar or related to the aforementioned.

16.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant 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 In granting this Certificate, the BBA is not responsible for:

- 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
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

16.5 Any information relating to the manufacture, supply, installation, use and maintenance 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 and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date 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. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.

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