

Saint-Gobain Construction Products UK Limited

trading as Celotex

Lady Lane Industrial Estate
Hadleigh
Ipswich
Suffolk IP7 6BA

Tel: 01473 822 093 Fax: 01473 820880

e-mail: technical@celotex.co.uk

website: www.celotex.co.uk



Agrément Certificate

16/5352

Product Sheet 2

CELOTEX INSULATION

CELOTEX RANGE OF PIR INSULATION BOARDS FOR TIMBER-FRAME DWELLINGS

This Agrément Certificate Product Sheet⁽¹⁾ relates to the Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings, comprising rigid polyisocyanurate (PIR) foam boards with foil-facing, for use as insulation in walls of conventional timber-frame dwellings up to 18 m in height. The products may be installed between studding, or used as an insulated lining or insulated sheathing, or used as part of a system incorporating any combination of these options.

(1) Hereinafter referred to as 'Certificate'.

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

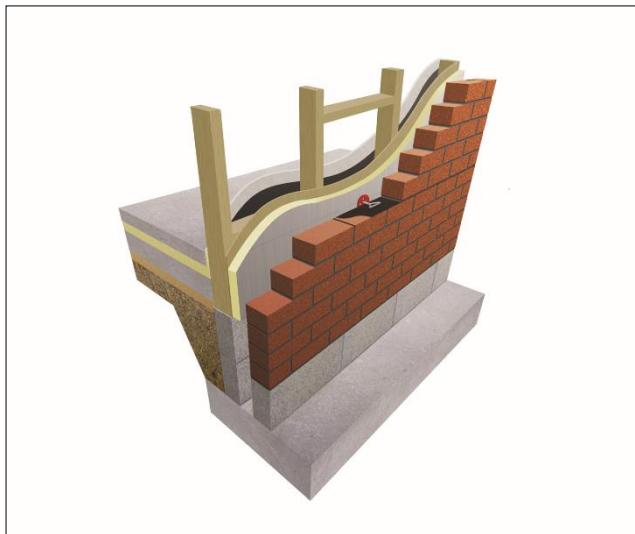
Thermal performance — the products have declared thermal conductivities (λ_D)* of $0.023 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for Celotex TB3000 and GA3000, and $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for Celotex TB4000, GA4000 and XR4000 (see section 6).

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

Behaviour in relation to fire — walls incorporating the products have been tested to BS 476-21 : 1987 (see section 8).

Water resistance — the products will resist water transfer across the cavity (see section 10).

Durability — the products are durable, rot proof and sufficiently stable to remain effective as insulation for the life of the building (see section 14).



The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate

On behalf of the British Board of Agrément

Date of Third issue: 20 November 2018

John Albon – Head of Approvals
Construction Products

Originally certificated on 26 January 2018

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.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

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tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, the Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings, 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)

Requirement:	B3(1)(4)	Internal fire spread (structure)
Comment:		The products can contribute to satisfying this Requirement. See section 8 of this Certificate.
Requirement:	C2(b)	Resistance to moisture
Comment:		The products can contribute to satisfying this Requirement. See section 10.1.
Requirement:	C2(c)	Resistance to moisture
Comment:		The products can contribute to satisfying this Requirement. See sections 7.1 and 7.5 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The products can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The products are acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation:	26B	Fabric performance values for new dwellings (applicable to Wales only)
Comment:		The products can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The products are acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	2.4	Cavities
Comment:		Use of the products is restricted under this Standard, with reference to clause 2.4.2 ⁽¹⁾ . See section 8.4 of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		Walls incorporating the products can contribute to satisfying this Standard, with reference to clause 2.6.1 ⁽¹⁾ . See section 8 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.10.1 ⁽¹⁾ and 3.10.3 ⁽¹⁾ . See section 10.1 of this Certificate.
Standard:	3.15	Condensation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.4 ⁽¹⁾ and 3.15.5 ⁽¹⁾ . See sections 7.1 and 7.6 of this Certificate.

Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:	The products can contribute to satisfying this Standard, with reference to clauses, or parts of clauses, 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾ , 6.2.3 ⁽¹⁾ , 6.2.9 ⁽¹⁾ and 6.2.11 ⁽¹⁾ . See section 6 of this Certificate.	
Standard:	7.1(a)	Statement of sustainability
Comment:	The products 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 products can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾ [Aspects 1 ⁽¹⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾ [Aspects 1 ⁽¹⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾ [Aspect 1 ⁽¹⁾]. See section 6 of this Certificate.	
Regulation:	12	Building standards applicable to conversions
Comment:	All comments given for these products under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾ and Schedule 6 ⁽¹⁾ .	
(1) Technical Handbook (Domestic).		



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

Regulation:	23	Fitness of materials and workmanship
Comment:	The products are acceptable. See section 14 and the <i>Installation</i> part of this Certificate.	
Regulation:	28(b)	Resistance to moisture and weather
Comment:	The products can contribute to satisfying this Regulation. See section 10.1 of this Certificate.	
Regulation:	29	Condensation
Comment:	The products can contribute to satisfying this Regulation. See section 7.1 of this Certificate.	
Regulation:	35(1)(4)	Internal fire spread — Structure
Comment:	Walls incorporating the products can contribute to satisfying this Regulation. See section 8 of this Certificate.	
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:	The products 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 2018

In the opinion of the BBA, and subject to a 50 mm minimum residual cavity being maintained, the Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings, if installed, used and maintained in accordance with this Certificate can satisfy or contribute to satisfying the relevant requirements, in relation to *NHBC Standards*, Chapter 6.2 *External timber framed walls*.

CE marking

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

Technical Specification

1 Description

The Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings comprises rigid polyisocyanurate (PIR) foam boards with foil-facings. The nominal characteristics are given in Table 1 of this Certificate.

Table 1 Nominal characteristics

Product	Facings	Board size (mm)	Thickness range (mm)	Edge profile
Celotex TB3000 ⁽¹⁾	Composite foil-facing both sides (printed on one side only) ⁽²⁾	1200 x 2400	12 to 45	square edge
Celotex GA3000	Composite foil-facing both sides (printed on one side only) ⁽²⁾	1200 x 2400	50 to 95	square edge
Celotex TB4000 ⁽¹⁾	Composite foil-facing both sides (printed on one side only) ⁽²⁾	1200 x 2400	12 to 45	square edge
Celotex GA4000	Composite foil-facing both sides (printed on one side only) ⁽²⁾	1200 x 2400	50 to 100	square edge
Celotex XR4000	Composite foil-facing both sides (printed on one side only) ⁽²⁾	1200 x 2400	110 to 200	square edge

(1) Used as lining only.

(2) See sections 4.9 and 15.4.

2 Manufacture

2.1 Celotex PIR insulation is manufactured by a lamination process, formed between aluminium foil-facings that are glued together in a continuous laminator, where the 'adhesive' is a mixture of two primary chemicals, polyol and MDI. An added blowing agent causes this adhesive to expand into foam that hardens, which is then cut to its finished board size and packed.

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 being operated by the manufacturer are being maintained.

2.3 The management system of Celotex has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 and BS EN ISO 14001 : 2015 by SGS UK Ltd (Certificate GB91/504 and GB11/83526).

3 Delivery and site handling

3.1 The products are delivered to site in polythene-wrapped packs. Each pack contains a label with the manufacturer's name, board dimensions and the BBA logo incorporating the number of this Certificate.

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

3.4 The products 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 the Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings.

Design Considerations

4 Use

4.1 The Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings is satisfactory for use as insulation fixed between the timber studding, a dry lining or insulated sheathing facing the cavity, and are effective in reducing the thermal transmittance (U value) of external walls of timber-frame dwellings up to 18 m in height. It is essential that such walls are designed and constructed to incorporate the precautions in this Certificate to prevent moisture penetration, including the use of a breather membrane over the timber sheathing.

4.2 Buildings subject to the national Building Regulations should be designed and constructed in accordance with the relevant recommendations of:

- BS EN 1995-1-1 : 2004, BS EN 1996-1-1 : 2005 and BS EN 1996-2 : 2006 and their respective UK National Annexes
- BS EN 351-1 : 2007.

4.3 New buildings not subject to these Regulations should also be built in accordance with the Standards given in section 4.2 of this Certificate.

4.4 Wall ties and fixings to BS EN 845-1 : 2013 should be used for structural stability in accordance with BS EN 1995-1-1 : 2004, BS EN 1996-1-1 : 2005 and BS EN 1996-2 : 2006.

4.5 Services which penetrate the dry lining (eg light switches, power outlets) must be kept to a minimum to limit damage to vapour checks. In addition, to preserve the fire resistance of the wall, any penetrations should be enclosed in plasterboard, stone mineral wool or a suitably tested proprietary fire-rated system.

4.6 This application requires a vapour control layer (VCL) behind the internal finish, which should be a minimum thickness of 0.125 mm (500 gauge) polyethylene, or plasterboard backed with a vapour control membrane or similar.

4.7 Installation must not be carried out until the moisture content of the timber frame is less than 20%.

4.8 When used as insulated sheathing, the products will not contribute to the structural performance of the timber frame.

4.9 For optimum thermal performance, the boards must be installed with the correct orientation of their printed foil-facings (see section 15.4).

4.10 Care must be taken in the overall design and construction of walls incorporating the products to ensure the provision of appropriate :

- cavity trays and damp-proof courses (dpc)
- cavity barriers and fire dampers
- resistance to the ingress of precipitation, moisture and dangerous gases from the ground
- resistance to sound transmission when flanking separating walls and floors.

4.11 The use of cavity battens or boards is strongly recommended to prevent thermal bridging by mortar droppings.

Residual cavity width for insulated sheathing (buildings up to 18 metres high)

4.12 The minimum residual cavity width to be maintained during construction must be 25 mm. To achieve this, a greater nominal residual cavity width may need to be specified at the design stage (to allow for inaccuracies inherent in the building process). The specifier may either:

- design a nominal residual cavity width of 50 mm (a residual cavity nominally at least 50 mm wide will be required by the NHBC), or
- design a cavity width which takes into account the dimensional tolerances of the components which make up the wall (by reference to the British Standards relating to the bricks, blocks and boards, or by using the data from the respective manufacturers). Allowances may need to be made for the quality of building operatives and the degree of site supervision or control available. The limitations in respect of exposure of the proposed building as set out in Table 2 must also be observed.

Table 2 Maximum allowable total exposure factors of different constructions

Construction	Maximum allowable exposure factor $E^{(1)}$
All external masonry walls protected by: rendering (to BS EN 13914-1 : 2016), tile or slate hanging, or timber, plastic or metal weatherboarding or cladding	No restriction
One or more external masonry walls constructed from facing clay brickwork or natural stone, the porosity of which exceeds 20% by volume. Mortar joints must be flush pointed or weatherstruck	100
One or more external masonry walls constructed from calcium silicate bricks, concrete blocks, reconstituted stone, or natural stone, the porosity of which is less than 20% by volume, or any material with raked mortar joints	88

(1) To BS 5618 : 1985.

4.13 from ground level, the maximum height of continuous cavity walls must not exceed 12 metres; above 12 metres, the maximum height of continuous cavity walls must not exceed 7 metres. In both cases, breaks should be in the form of continuous horizontal cavity trays and weepholes discharging to the outside.

4.14 An external render coat or other suitable finish should be applied in locations where such application would be normal practice; care should be taken to ensure that the residual cavity is not bridged by mortar.

5 Practicability of installation

The products are designed to be installed by a competent general builder, or a contractor, experienced with these types of products.

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2006, using the following values:

Celotex TB3000 and GA3000

- PIR insulation core — declared thermal conductivity (λ_D)* of 0.023 W·m⁻¹·K⁻¹
- composite foil-facings both sides, printed one side only — for unprinted facing, an aged emissivity (ϵ_D) (to BS EN 15976 : 2011) of 0.05.

Celotex TB4000, GA4000 and XR4000

- PIR insulation core — declared thermal conductivity (λ_D)* of 0.022 W·m⁻¹·K⁻¹
- composite foil-facings both sides, printed one side only — for unprinted facing, an aged emissivity (ϵ_D) (to BS EN 15976 : 2011) of 0.05.

6.2 The U value of a completed wall will depend on the selected insulation thickness, the insulating value of the external substrate masonry and the internal wall finish. Calculated U values for example constructions are given in Table 3.

Table 3 Example U values — New-build timber-framed external cavity wall⁽¹⁾

Target U value (W·m ⁻² ·K ⁻¹)	Celotex TB3000, GA3000, TB4000, GA4000 and XR4000 insulation thickness (mm)				
	Inter stud (140 mm)	Inter stud and dry-lining (140 mm studs)	Sheathing (140 mm studs)	Inter stud and sheathing (140 mm studs)	Dry-lining and sheathing (140 mm studs)
	(System 1) ⁽⁶⁾	(System 2) ⁽⁶⁾	(System 3) ⁽⁶⁾	(System 4) ⁽⁶⁾	(System 5) ⁽⁶⁾
0.18	—	110 ⁽⁵⁾ +12 ^{(1) or (2)}	100 ⁽⁴⁾	70 ⁽⁴⁾ +50 ⁽⁴⁾	50 ⁽⁴⁾ +50 ⁽⁴⁾
0.19	—	95 ⁽⁴⁾ +12 ^{(1) or (2)}	95 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	40 ^{(1) or (2)} +50 ⁽⁴⁾
0.25	95 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	70 ⁽³⁾ or 65 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾
0.26	95 ⁽³⁾ or 90 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	65 ⁽³⁾ or 60 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾
0.27	90 ⁽³⁾ or 85 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	60 ⁽³⁾ or 60 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾
0.28	85 ⁽³⁾ or 80 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	60 ⁽³⁾ or 55 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾
0.30	75 ⁽³⁾ or 70 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	50 ⁽³⁾ or 50 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾
0.35	60 ⁽³⁾ or 60 ⁽⁴⁾	60 ⁽⁴⁾ +12 ^{(1) or (2)}	50 ⁽³⁾ or 50 ⁽⁴⁾	60 ⁽⁴⁾ +50 ⁽⁴⁾	12 ^{(1) or (2)} +50 ⁽⁴⁾

(1) TB3000.

(2) TB4000.

(3) GA3000.

(4) GA4000.

(5) XR4000.

(6) For system construction details, see Table 4 of this Certificate.

- Fixings for plasterboard to be 11 fully penetrating steel ($\lambda = 50 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$) fixings per square metre (150 mm centres) with a cross-sectional area of 13.2 mm² (screw diameter 4.1 mm)
- Fixings for OSB to be 5.2 fully penetrating steel ($\lambda = 50 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$) fixings per square metre (600 mm centres) with a cross-sectional area of 9.6 mm² (screw diameter 3.5 mm)
- Fixings for Celotex insulation sheathing to be 5.6 fully penetrating steel ($\lambda = 50 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$) fixings per square metre with a cross-sectional area of 9.6 mm² (screw diameter 3.5 mm)
- Fixings for timber battens to be 5.6 fully penetrating steel ($\lambda = 50 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$) fixings per square metre (600 mm centres) with a cross-sectional area of 13.2 mm² (screw diameter 4.1 mm)
- Timber frame wall ties to be 3.7 fixings per square metre with a cross-sectional area of 18 mm² ($\lambda = 50 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$) used in accordance with the fixing manufacturer's instructions.

Junctions



6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to 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 Walls will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and G, and the relevant guidance.

7.2 The foil-facings have a water vapour resistance of $1000 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}$, and the insulation core has a water vapour resistivity of $300 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$ and, therefore, will provide a significant resistance to water vapour transmission. Joints between boards are taped for over-stud applications.

7.3 When used as insulated sheathing, the joints between the boards must not be taped.

7.4 If the products are to be used in the external walls of rooms expected to have high humidity, care must be taken to provide adequate permanent ventilation to avoid possible problems from the formation of interstitial condensation in the internal wall leaf.

Surface condensation



7.5 Walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with other elements are designed in accordance with section 6.3 of this Certificate.



7.6 For buildings in Scotland, walls will adequately limit the risk of surface condensation when 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 G. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

8 Behaviour in relation to fire



8.1 The Certificate holder has declared a reaction to fire classification* to EN 13501-1 : 2007 of Class E for TB4000, GA4000 and XR4000 products, and NP (no performance determined) for the TB3000 and GA3000 products.

8.2 The products are not classified as non-combustible or of limited combustibility and are therefore restricted to buildings up to 18 m in height.

8.3 A fire-resistance test was carried out in accordance with BS 476-21 : 1987 on a loadbearing, timber stud wall system. An assessment considered the likely fire-resistance of all systems (see Table 4 of this Certificate) as if they had been tested to BS 476-21 : 1987. The main points of the assessment highlighted that:

- all systems are suitable for applications where a fire resistance of up to 30 minutes is required against the loadbearing capacity, integrity and insulation criteria of BS 476-21 : 1987 [for fire exposure from the inside, when subject to a total imposed load of 60 kN (10 kN load per stud)]⁽¹⁾
- for loads greater than this, a qualified structural engineer can utilise the BS 476-21 : 1987 fire-resistance test report and its accompanying assessment, to alter the design of the timber frame to ensure that the residual timber after 30 minutes will be adequate. The Certificate holder should be contacted for these reports
- openings for doors and windows should be framed out and any exposed timber covered with at least one layer of plasterboard (see also section 4.5).

(1) Relates only to walls with a masonry outer leaf. Other weather-resistant claddings should be demonstrated by an appropriate test or assessment.

Table 4 System construction details

Component	Description	System				
		1	2	3	4	5
		Inter stud	Inter stud and dry-lining	Sheathing	Inter stud and sheathing	Dry-lining and sheathing
Plasterboard	12.5 mm ($\lambda = 0.25 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$)	yes	yes	yes	yes	yes
Batten	25 x 50 mm	—	yes	—	—	yes
Celotex insulation	Minimum 12 mm	—	yes	—	—	yes
Vapour control layer (VCL)*	500 gauge polythene (or plasterboard backed with a vapour control membrane – 0.15 mm) (1) Systems 2 and 5 – foil tape over joints of foil-facing to lining boards in place of separate VCL	yes	no ⁽¹⁾	yes	yes	no ⁽¹⁾
Timber frame	140 mm or 89 by 38 mm timber studs at maximum 600 mm centres, with cross noggings at 1200 mm centres, staggered by 600 mm between bays ($\lambda = 0.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ – 15% default fraction)	yes	yes	yes	yes	yes
Celotex insulation	Minimum 60 mm between studs	yes	yes	—	yes	—
Structural sheathing	9 mm OSB or plywood ($\lambda = 0.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$)	yes	yes	yes	yes	yes
Celotex insulation	Minimum 50 mm	—	—	yes	yes	yes
Breather membrane		yes	yes	no	no	no
Cavity	50 mm	yes	yes	yes	yes	yes
Brick	102.5 mm ($\lambda = 0.77 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$)	yes	yes	yes	yes	yes



8.4 Cavity barriers must be provided to comply with the requirements of the national Building Regulations:

England and Wales — Approved Document B, Volume 1, Section 6

Scotland - Mandatory Standard 2.4, clauses 2.4.1⁽¹⁾, 2.4.2⁽¹⁾ and 2.4.7⁽¹⁾.

(1) Technical Handbook (Domestic).

Northern Ireland — Technical Booklet E, paragraphs 4.36 to 4.39.

9 Proximity of flues and appliances

When installing the products in close proximity to certain flue pipes and/or heat-producing appliances, the following provisions to 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⁽¹⁾ to 3.19.9⁽¹⁾

(1) Technical Handbook (Domestic).

Northern Ireland — Technical Booklet L, sections 1 to 6.

10 Water resistance



10.1 Constructions incorporating the products as insulated sheathing, and built in accordance with the Standards listed in section 4.2, will resist the transfer of precipitation to the inner leaf and satisfy the national Building Regulations.

10.2 In all situations, it is particularly important to ensure during installation that:

- wall ties are installed correctly and are thoroughly clean
- excess mortar is cleaned from the cavity face of the brick leaf and any debris removed from the cavity
- mortar droppings are cleaned from the exposed edges of installed boards
- insulation boards are properly installed and butt-jointed
- installation is carried out to the highest level on each wall, or the top edge of the insulation is protected by a cavity tray
- at lintel level, a cavity tray, stop ends and weep holes, are provided
- cavity battens and/or boards are used during construction to prevent bridging by mortar droppings
- dpc at ground level does not project into the cavity as they can form a trap for mortar bridging
- raked or recessed mortar joints are avoided in very severe exposure areas.

11 De-rating of electrical cables

As with other insulation products, it may be necessary in some cases to de-rate electrical cables buried in insulation. In BS 7671 : 2018, it is recommended that where wiring is completely surrounded by insulation it may need to be de-rated to as low as half its free air current carrying capacity. Guidance should be sought from a qualified electrician.

12 Infestation

Use of the products does not in itself promote infestation. The creation of voids within the structure, ie gaps between the wall lining and the boards, may provide habitation for insects or vermin in areas already infested. Care should be taken to ensure, wherever possible, that all voids are sealed, as any infestation may be difficult to eradicate. There is no food value in the materials used.

13 Maintenance

As the products are confined behind the wall lining and have suitable durability (see section 14), maintenance is not required.

14 Durability



The products are unaffected by the normal conditions in a wall and are durable, rot-proof, water resistant and sufficiently stable to remain effective as insulation for the life of the building.

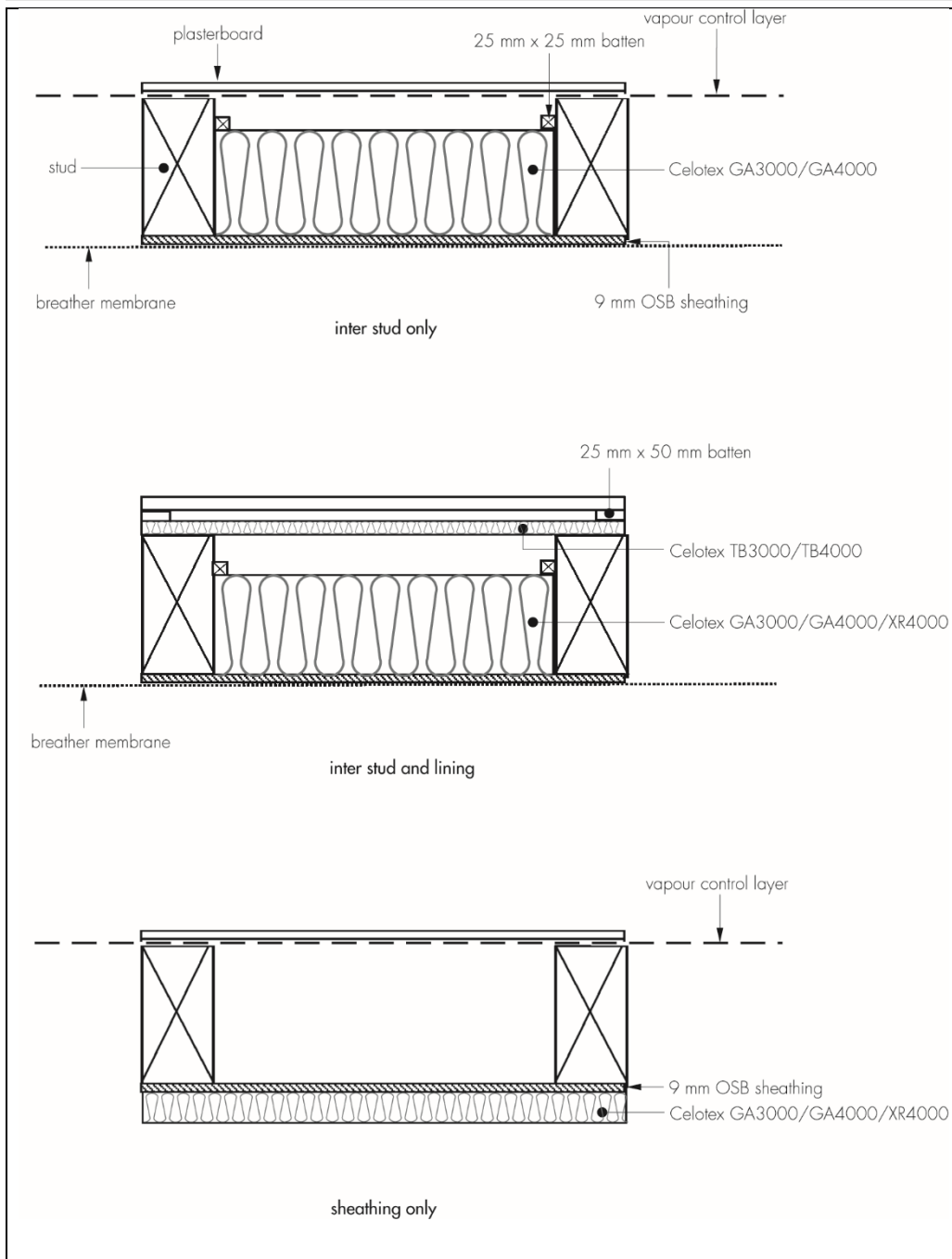
Installation

15 General

15.1 Installation of the Celotex Range of PIR Insulation Boards for Timber-Frame Dwellings must be in accordance with the relevant clauses of the Standards noted in section 4.2 of this Certificate and the Certificate holder's instructions.

15.2 The boards may be installed in between the timber studs (inter stud), as an internal lining, as an outer sheathing, and also as a combination of these (see Table 3 for construction details of the five systems). Typical installation details are shown in Figure 1.

Figure 1 Typical installation details



15.3 The products are light to handle and can be cut easily using a fine-toothed saw, and care must be taken in handling to prevent damage, particularly at edges. Damaged boards should not be used; small areas of damaged faces may be repaired with self-adhesive aluminium foil-tape.

15.4 The products have printed logos applied to the outer foil-facing on one side only. To ensure optimum thermal performance, these boards must be installed with the unprinted foil-face always facing the cavity side.

16 Procedure

Inter stud

16.1 The products should be cut to fit tightly between the timber studding and positioned against the inner face of sheathing board. Any gaps should be filled with expanding insulation foam. The insulation should be held in place by nails or timber battens to the warm side of the insulation. 16.2 The void created by space between the inner surface of the products and the dry lining can be utilised as an insulated service duct.

16.3 A sealed polyethylene VCL with a minimum thickness of 0.125 mm (500 gauge) with lapped and sealed joints is placed over the stud face before applying the internal finish.

Lining

16.4 Insulation boards should be butted tightly against each other to prevent gaps. To satisfy the requirements of the NHBC Standards, a VCL should be placed on the warm side of the wall insulation. However, where a foil-faced lining board is used, taping the joints with aluminium foil/reinforced tape provides an effective VCL and air permeability barrier, and a separate VCL may be omitted. To achieve an adequate bond, the boards should be thoroughly clean and free from any contamination. The insulation is sealed at all service penetrations.

16.5 The insulation boards are temporarily fixed to the inner face of the timber studding, ensuring that the insulation makes contact or overlaps with ceiling and floor insulation.

16.6 The line of the timber studs is marked on the insulation boards to allow fixing of plasterboard.

16.7 The plasterboard is fixed over the board on battens and secured with drywall screws at nominal 150 mm centres, and finished as normal.

Sheathing

16.8 The insulation boards should be installed on the outside of any wood, OSB or board sheathing, closely butted with joints staggered and restrained using galvanized clout nails or screws at 300 mm centres around the board perimeters, and at 400 mm centres for intermediate timbers within the board area.

16.9 It is essential that nails locate the studs; this can be achieved by either using a plumb line from the top of the studs or by marking the stud positions on the boards (or substrate timber sheathing) as the boards are being offered into position.

16.10 The use of self-adhesive foil-tape is not recommended.

16.11 A sealed vapour control layer VCL with a minimum thickness of 0.125 mm (500 gauge) with lapped and sealed joints is placed between the plasterboard and the timber frame.

16.12 Ties securing the external leaf are fixed through the insulation board to the studs and the sheathing is held in place by the retaining discs on the wall ties.

16.13 Internal finishes are applied as normal.

Technical Investigations

17 Investigations

17.1 An examination was made to analyse:

- thermal conductivity
- dimensional accuracy
- compressive strength
- water vapour transmission
- dimensional stability with temperature and humidity
- density.

17.2 A condensation risk analysis was carried out.

17.3 A series of U value calculations was carried out.

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

Bibliography

- BS 476-21 : 1987 *Fire tests on building materials and structures — Methods for determination of the fire resistance of loadbearing elements of construction*
- BS 5250 : 2011 + A1 : 2016 *Code of practice for control of condensation in buildings*
- BS 5618 : 1985 *Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems*
- BS 7671 : 2018 *Requirements for electrical installations — IET Wiring Regulations – Seventeenth Edition*
- BS EN 351-1 : 2007 *Durability of wood and wood-based products — Preservative-treated solid wood — Classification of preservative penetration and retention*
- BS EN 845-1 : 2013 + A1 : 2016 *Specification for ancillary components for masonry — Wall ties, tension straps, hangers and brackets*
- BS EN 1995-1-1 : 2004 + A2 : 2014 *Eurocode 5 : Design of timber structures — General — Common rules and rules for buildings*
NA to BS EN 1995-1-1 : 2004 + A1 : 2008 *UK National Annex to Eurocode 5 : Design of timber structures — General — Common rules and rules for buildings*
- BS EN 1996-1-1 : 2005 + A1 : 2012 *Eurocode 6 : Design of masonry structures — General rules for reinforced and unreinforced masonry structures*
- NA to BS EN 1996-1-1 : 2005 + A1 : 2012 *UK National Annex to Eurocode 6 : Design of masonry structures — General rules for reinforced and unreinforced masonry structures*
- BS EN 1996-2 : 2006 *Eurocode 6 : Design of masonry structures — Design considerations, selection of materials and execution of masonry*
- NA to BS EN 1996-2 : 2006 *UK National Annex to Eurocode 6 : Design of masonry structures — Design considerations, selection of materials and execution of masonry*
- 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 13914-1 : 2016 *Design, preparation and application of external rendering and internal plastering. External rendering*
- BS EN 15976 : 2011 *Flexible sheets for waterproofing — Determination of emissivity*
- BS EN ISO 6946 : 2017 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- BS EN ISO 9001 : 2015 *Quality management systems — Requirements*
- BS EN ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*
- BRE Report (BR 262 : 2002) *Thermal insulation: avoiding risks*
- BRE Report (BR 443 : 2006) *Conventions for U-value calculations*

18 Conditions

18.1 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 or 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.

18.2 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.

18.3 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.

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

18.5 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.

18.6 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.

Saint-Gobain Construction Products UK Limited
trading as Celotex

Lady Lane Industrial Estate
Hadleigh
Ipswich
Suffolk IP7 6BA

Tel: 01473 822093 Fax: 01473 820880

e-mail: technical@celotex.co.uk

website: www.celotex.co.uk



Agrément Certificate

17/5405

Product Sheet 1

CELOTEX INSULATION

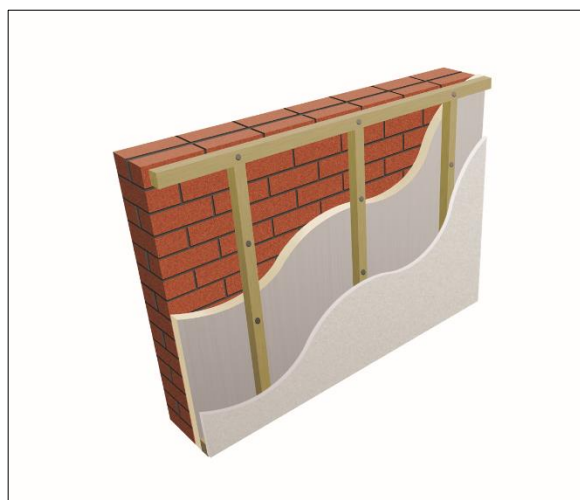
CELOTEX TB4000, GA4000 AND XR4000 PIR INSULATION BOARDS FOR DRY LINING

This Agrément Certificate Product Sheet⁽¹⁾ relates to Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining, comprising rigid polyisocyanurate (PIR) foam boards with foil-facings, for use as insulation within a dry lining system to improve the thermal insulation of new and existing external masonry walls of domestic and non-domestic buildings.

(1) Hereinafter referred to as 'Certificate'.

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 products have a declared thermal conductivity (λ_D) of $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ (see section 6).

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

Durability — the products are durable, rot proof and sufficiently stable to remain effective as insulation for the life of the building (see section 14).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Claire Curtis-Thomas

Date of Fourth issue: 20 November 2018

John Albon – Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

Originally certificated on 20 March 2017

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.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

©2018

tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining, 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)

Requirement:	C2(c)	Resistance to moisture
Comment:		The products can contribute to satisfying this Requirement. See sections 7.1 and 7.6 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The products can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The products are acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation:	26B	Fabric performance values for new dwellings (applicable to Wales only)
Comment:		The products can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The products are acceptable. See section 14 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	3.15	Condensation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾⁽²⁾ , 3.15.4 ⁽¹⁾⁽²⁾ and 3.15.5 ⁽¹⁾⁽²⁾ . See sections 7.1 and 7.7 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The products can contribute to satisfying this Standard with reference to clauses or parts of clauses 6.1.1 ⁽¹⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽¹⁾⁽²⁾ , 6.2.6 ⁽¹⁾⁽²⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See section 6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The products 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 products can contribute to a construction meeting a higher level of sustainability as defined in this Standard with reference to clauses 7.1.4 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾⁽²⁾ [Aspect 1 ⁽¹⁾⁽²⁾]. See section 6.1 of this Certificate.

Regulation:	12	Building standards applicable to conversions
Comment:		Comments made in relation to these products under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .
		(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 products are acceptable. See section 14 and the <i>Installation</i> of this Certificate.
Regulation:	29	Condensation
Comment:		The products can contribute to satisfying this Regulation. See section 7.1 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		The products 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 sections: 3 *Delivery and site handling* (3.4) and 15 *General* (15.8) of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapters 6.1 *External masonry walls* and 9.2 *Wall and ceiling finishes*.

CE marking

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

Technical Specification

1 Description

Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining comprise rigid polyisocyanurate (PIR) foam boards with foil-facings. The nominal characteristics of the products are given in Table 1 of this Certificate.

Table 1 Nominal characteristics

Product	Facings	Board size (mm)	Thickness range (mm)	Edge profile
Celotex TB4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	12 to 45	square edge
Celotex GA4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	50 to 100	square edge
Celotex XR4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	110 to 200	square edge

(1) See sections 4.10 and 15.7.

2 Manufacture

2.1 Celotex PIR insulation is manufactured by a lamination process, formed between aluminium foil-facings that are glued together in a continuous laminator, where the adhesive is a mixture of two primary chemicals, polyol and MDI. An added blowing agent causes the adhesive to expand into foam that hardens, which is then cut to its finished board size and packed.

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

- agreed with the Certificate holder/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 Celotex has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 and BS EN ISO 14001 : 2015 by SGS UK Ltd (Certificates GB91/504 and GB11/83526).

3 Delivery and site handling

3.1 The products are delivered to site in polythene-wrapped packs. Each pack of boards contains a label with the manufacturer's name, board dimensions and the BBA logo incorporating the number of this Certificate.

3.2 The products 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 products are light and easy to handle and care should be exercised to avoid crushing the edges or corners. If damaged, the products should be discarded.

3.4 The products 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 Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining.

4 Use

4.1 Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Dry Lining are suitable for use as insulation within a dry-lining system, and are effective in improving the insulation of solid or cavity masonry walls of new and existing domestic and non-domestic buildings. The boards should be installed in accordance with the Certificate holder's instructions.

4.2 The boards may be installed on masonry construction including clay and calcium silicate bricks, concrete blocks, and natural and reconstituted stone blocks.

4.3 Walls should be designed and constructed in accordance with the relevant clauses of:

- BS EN 1996-1-1 : 2005, BS EN 1996-1-2 : 2005, BS EN 1996-2 : 2006 and BS EN 1996-3 : 2006, and their respective UK National Annexes
- BS 8000-3 : 2001.

4.4 All walls must be in a good state of repair without evidence of rain penetration, damp or frost damage, and be at least two bricks or 200 mm in thickness.

4.5 The surfaces of masonry walls should be sound and free from loose material; large projections should be removed and holes filled and levelled. A survey of the wall may be required to establish the extent of any packing that may be required to ensure the support battens provide a uniform plane for the boards to be fixed.

4.6 The installation of insulated dry lining systems requires careful detailing around doors and windows to achieve a satisfactory surface for finishing. In addition, every attempt should be made to minimise the risk of thermal bridging at reveals and where heavy separating walls are attached to the external wall. In new work, the construction must be designed to accommodate the thickness of the dry lining, particularly at reveals, heads and sills and in relation to ceiling height. On existing walls, consideration should be given to lining the reveals with a thinner layer of insulation and lining board.

4.7 Services can be incorporated in the void formed between the insulation and the lining boards, making chasing of the wall unnecessary. Where the services have a greater depth than the void, the wall should be chased in preference to the insulation. It is recommended that services penetrating the insulation or any vapour check lining board, eg light switches and power outlets, are kept to a minimum to limit damage to vapour checks.

4.8 When the products are to be installed in existing buildings, it should be realised that a small reduction in room size will occur and that permanent fixtures, eg baths, will present difficulties.

4.9 If present, mould or fungal growth should be treated prior to commencement of the installation of the products.

4.10 For optimum thermal performance, the boards must be installed with the correct orientation of their printed foil-facings. See section 15.7.

5 Practicability of installation

The products are designed to be installed by a competent general builder, or a contractor, experienced with these types of products.

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) of specific external wall constructions should be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2006, using the following values:

- PIR insulation core — declared thermal conductivity (λ_D)* of $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
- composite foil-facings both sides, printed on one side only — for unprinted facing, an aged emissivity (ε) (to BS EN 15976 : 2011) of 0.05.

6.2 The U value of a completed wall will depend on the insulation thickness, number and type of fixings, the insulating value of the substrate masonry and its internal finish. Calculated U values for example constructions are given in Tables 2 and 3.

Table 2 Example U values — dry lining to 215 mm solid brickwork wall

Target U value ($\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$)	Insulation thickness (mm)
	Celotex TB4000, GA4000 and XR4000 ⁽¹⁾
0.18	100 ⁽²⁾
0.19	95 ⁽²⁾
0.25	65 ⁽²⁾
0.26	65 ⁽²⁾
0.27	60 ⁽²⁾
0.28	55 ⁽²⁾
0.30	50 ⁽²⁾
0.35	40 ⁽³⁾

(1) Minimum available thickness (110 mm) of XR4000 satisfies all of the above U values

(2) GA4000

(3) TB4000

Construction comprises 215 mm thick external brickwork solid wall ($\lambda = 0.77 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), Celotex insulation board, 22 mm deep timber battens (11.8%, $\lambda = 0.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), 12.5 mm plasterboard ($\lambda = 0.25 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$). Timber battens fixed through Celotex boards using 3.4 mm diameter stainless steel fixings — 4.17 fixings per m^2 (12 fixings per board).

Table 3 Example U values — dry lining to existing uninsulated masonry cavity wall

Target U value ($\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$)	Insulation thickness (mm)
	Celotex TB4000, GA4000 and XR4000 ⁽¹⁾
0.18	95 ⁽²⁾
0.19	90 ⁽²⁾
0.25	65 ⁽²⁾
0.26	60 ⁽²⁾
0.27	55 ⁽²⁾
0.28	55 ⁽²⁾
0.30	50 ⁽²⁾
0.35	40 ⁽³⁾

(1) Minimum available thickness (110 mm) of XR4000 satisfies all of the above U values

(2) GA4000

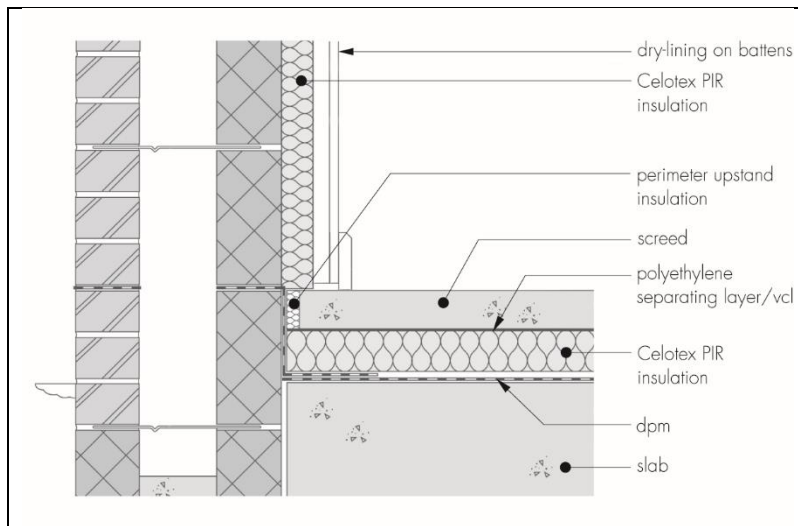
(3) TB4000

Existing construction comprises 103 mm thick external brickwork ($\lambda = 0.77 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), 50 mm clear cavity, 100 mm thick dense blockwork ($\lambda = 1.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), Celotex insulation board, 22 mm deep timber battens (11.8%, $\lambda = 0.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), 12.5 mm plasterboard ($\lambda = 0.25 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$). Timber battens fixed through Celotex boards using 3.4 mm diameter stainless steel fixings — 4.17 fixings per m^2 (12 fixings per board).

Junctions

6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations. An example of an acceptable junction detail is shown in Figure 1.

Figure 1 Junction between the wall and the floor



7 Condensation risk

Interstitial condensation



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

7.2 The risk of summer condensation on the foil component must be considered for solid masonry walls, orientated from ESE through south to WSW, in accordance with BRE Report BR 262 : 2002, section 3.10.

7.3 The foil-facings have a water vapour resistance of $1000 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}$ and the insulation core has a water vapour resistivity of $300 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$ and, therefore, will provide a significant resistance to water vapour transmission.

7.4 Where calculations to Annex D of BS 5250 : 2011 indicate a risk of persistent condensation, a site-specific dynamic analysis to BS EN 15026 : 2007 should be considered.

7.5 Provided all joints between the products are sealed (see section 4.5 and *Installation* part of this Certificate) in accordance with the Certificate holder's instructions, the system can offer a significant resistance to water vapour transmission.

Surface condensation



7.6 Walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with floors, roofs and openings are designed in accordance with section 6.3 of this Certificate.



7.7 Walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point. Guidance may be obtained from BS 5250 : 2011, Annex G. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

8 Behaviour in relation to fire

8.1 The Certificate holder has declared a reaction to fire classification* to EN 13501-1 : 2007 of Class E for the products.

8.2 When properly installed, the insulation will be contained between the wall and internal lining board until one is compromised. Therefore, the insulation will not contribute to the development of a fire.

9 Infestation

The use of the products does not in itself promote infestation. The creation of voids within the structure, ie gaps between the wall lining and the boards, may provide habitation for insects or vermin in areas already infested. Care should be taken to ensure, wherever possible, that all voids are sealed, as any infestation may be difficult to eradicate. There is no food value in the materials used.

10 Proximity of flues and appliances

When installing the products 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⁽¹⁾⁽²⁾ to 3.19.4⁽¹⁾⁽²⁾

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

Northern Ireland — Technical Booklet L, section 2.

11 Materials in contact – wiring installations

11.1 As with any other forms of insulation, de-rating of electrical cables should be considered where the insulation restricts the air cooling of cables.

11.2 Electrical cables that are likely to come into contact with the insulation are required to be protected by a suitable conduit or PVC-U trunking. The installation of electrical services must be carried out in accordance with BS 7671 : 2018.

12 Wall-mounted fittings

The Certificate holder's instructions must be followed. Any objects fixed to the wall, other than lightweight items, are outside the scope of this Certificate.

13 Maintenance

As the products are confined within the wall construction and have suitable durability (see section 14), maintenance is not required.

14 Durability



14.1 The durability of the products is satisfactory. Provided the products are fixed to satisfactory stable and durable backgrounds, the products will have a life equal to the building in which they are installed.

14.2 Under normal conditions of occupancy, the products are unlikely to suffer damage but if damage does occur the product can be repaired or replaced.

Installation

15 General

15.1 A qualified plumber is required to make alterations to heating systems. A qualified electrician must be used to make good the electrical wirings and services.

15.2 The building should be examined for the following:

- suitability of substrate
- detailing around windows and doors
- position and number of electrical sockets and switches
- wall fittings and fixtures – including coving and skirting
- areas where flexible sealants must be used
- ventilation plates.

15.3 Before starting to fit the product, the position of all main service cable and pipe runs must be clearly marked on the walls to avoid damage. All plaster coving, skirting board and laminate floor angle beads must be removed.

15.4 Before fixing the product, sufficient time must be allowed for damp-proofing treatments, where applied, to dry out (for information, see BS 6576 : 2005 for dry-lining in conjunction with a chemical damp-proof course application).

15.5 Care must be taken when exposing electrical cables (see section 11).

15.6 All insulated dry lining installations require careful planning and setting out. Installation should be in accordance with BS 8212 : 1995, good dry lining practice and the Certificate holder's instructions. Typical installation methods are shown in Figures 2 and 3.

15.7 The products have printed logos applied to the outer foil-facing on one side only. To ensure optimum thermal performance, the boards must be installed with the unprinted foil-face always facing the cavity side.

15.8 The boards can be cut using a sharp knife or fine-toothed saw, to fit around windows, doors and air bricks. It is essential that cut pieces completely fill the spaces for which they are intended and are adequately secured. Appropriate Personal Protective Equipment (PPE) must be used when cutting the boards, and cutting should be done in a ventilated space, outside or in an area with dust extraction.

15.9 To avoid thermal bridging, the boards should be used to line window reveals. Thinner boards are available to suit door and window reveal conditions. Suitable provisions will also need to be adopted at junctions and other details such as separating floors. Further guidance can be obtained from BRE Report BR 262 : 2002.

16 Procedure

16.1 The wall is surveyed to establish its flatness and suitability for receiving the dry-lining system. This system may be used on any stable, dry wall capable of taking the fixings for the timber battens.

16.2 The insulation boards are cut to fit and placed against the wall; joints and perforations are sealed with self-adhesive aluminium foil-tape. The insulation boards are temporarily secured in place. Permanent fixing of the internal lining board is carried out using suitable mechanical fixings into the timber battens (see Figures 2 and 3). The timber battens are placed against the insulation boards and mechanically fixed through the top, centre and bottom of the insulation into the wall substrate.

Figure 2 General configuration

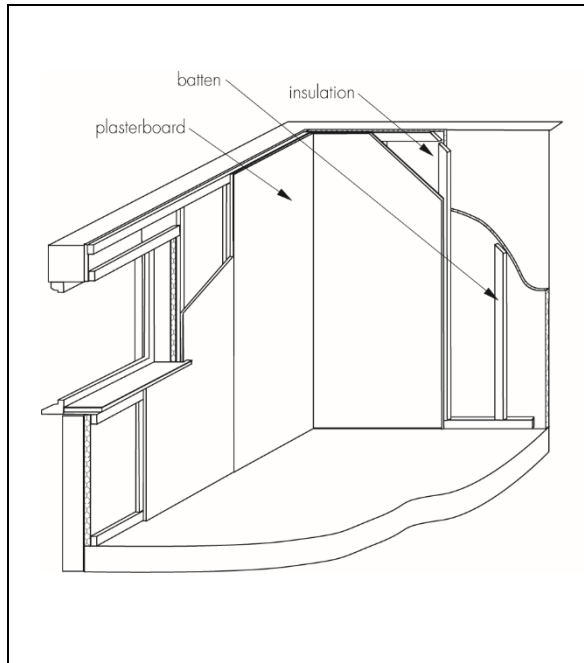
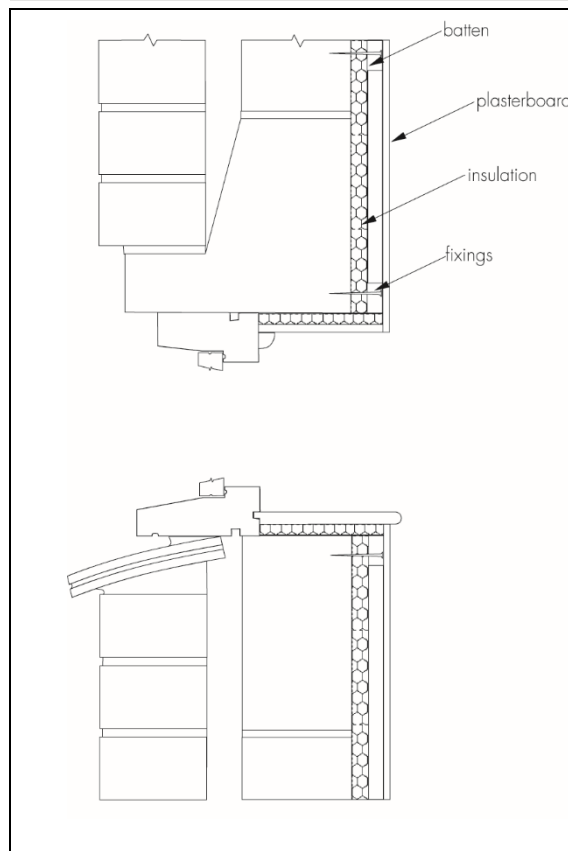


Figure 3 Opening detail



16.3 The battens must be of sufficient thickness and spacing (up to 600 mm) to provide adequate grounds to which the lining board can be fixed, and provide for any services that are to be incorporated into the void between the insulation board and lining board. Horizontal battens should be fitted at the top and bottom of walls and openings.

16.4 It is recommended that the timber battens are treated with a suitable wood preservative.

16.5 Jointing and finishing of the lining is carried out in the appropriate manner. Timber skirting can be fixed into the horizontal batten at floor level.

17 Tests

Results of tests were assessed to determine:

- thermal conductivity.

18 Investigations

18.1 An examination was made of data to analyse:

- dimensional accuracy
- density
- compressive strength
- thermal conductivity
- vapour resistance.

18.2 A condensation risk analysis was carried out.

18.3 A series of U value calculations was carried out.

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

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

Bibliography

- BS 5250 : 2011 + A1 : 2016 *Code of practice for control of condensation in buildings*
- BS 6576 : 2005 + A1:2012 *Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses*
- BS 7671 : 2018 *Requirements for electrical installations – IEE Wiring Regulations – Seventeenth Edition*
- BS 8000-3 : 2001 *Workmanship on building sites — Code of practice for masonry*
- BS 8212 : 1995 *Code of practice for dry lining and partitioning using gypsum plasterboard*
- BS EN 1996-1-1 : 2005 + A1 : 2012 *Eurocode 6 : Design of masonry structures — General rules for reinforced and unreinforced masonry structures*
NA to BS EN 1996-1-1 : 2005 + A1 : 2012 *UK National Annex to Eurocode 6 : Design of masonry structures — General rules for reinforced and unreinforced masonry structures*
- BS EN 1996-1-2 : 2005 BS EN 1996-1-2 : 2005 *Eurocode 6 : Design of masonry structures — General rules — Structural fire design*
NA to BS EN 1996-1-2 : 2005 *UK National Annex to Eurocode 6 : Design of masonry structures — General rules — Structural fire design*
- BS EN 1996-2 : 2006 *Eurocode 6 : Design of masonry structures — Design considerations, selection of materials and execution of masonry*
NA to BS EN 1996-2 : 2006 *UK National Annex to Eurocode 6 : Design of masonry structures — Design considerations, selection of materials and execution of masonry*
- BS EN 1996-3 : 2006 *Eurocode 6 : Design of masonry structures : Simplified calculation methods for unreinforced masonry structures*
NA to BS EN 1996-3 : 2006 *UK National Annex to Eurocode 6 : Design of masonry structures : Simplified calculation methods for unreinforced masonry structures*
- 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. Part 1. Classification using data from reaction to fire tests*
- BS EN 15026 : 2007 *Hygrothermal performance of building components and building elements — Assessment of moisture transfer by numerical simulation*
- BS EN 15976 : 2011 *Flexible sheets for waterproofing — Determination of emissivity*
- BS EN ISO 6946 : 2017 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- BS EN ISO 9001 : 2015 *Quality management systems — Requirements*
- BS EN ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*
- BRE Report (BR 262 : 2002) *Thermal insulation : avoiding risks*
- BRE Report (BR 443 : 2006) *Conventions for U-value calculations*

19 Conditions

19.1 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 or 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.

19.2 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.

19.3 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.

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

19.5 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.

19.6 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.

Saint-Gobain Construction Products UK Limited
trading as Celotex

Lady Lane Industrial Estate
Hadleigh
Ipswich
Suffolk IP7 6BA

Tel: 01473 822093 Fax: 01473 820880

e-mail: technical@celotex.co.uk

website: www.celotex.co.uk



Agrément Certificate

17/5405

Product Sheet 2

CELOTEX INSULATION

CELOTEX TB4000, GA4000 AND XR4000 PIR INSULATION BOARDS FOR FLOOR INSULATION

This Agrément Certificate Product Sheet⁽¹⁾ relates to Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation, comprising rigid polyisocyanurate (PIR) foam boards with foil-facings, for use as insulation in ground-bearing or suspended concrete ground floors or between the joists of suspended timber ground-floors and also for use with exposed or semi-exposed intermediate concrete or timber floors, in new or existing domestic or similar buildings.

(1) Hereinafter referred to as 'Certificate'.

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 products have a declared thermal conductivity (λ_D) of $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ (see section 6).

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

Floor loading — the products, when installed in accordance with this Certificate, can support a design loading for domestic applications (see section 9).

Durability — the products are durable, rot proof and sufficiently stable to remain effective as insulation for the life of the building (see section 12).



The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Claire Curtis-Thomas

Date of Fourth issue: 20 November 2018

John Albon – Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

Originally certificated on 20 March 2017

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.
Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.*

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

©2018

tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Celotex TB4000, GA4000 and XR4000 Insulation Boards for Floor Insulation, 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)

Requirement:	A1	Loading
Comment:		The products can contribute to satisfying this Requirement. See section 9.2 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The products can contribute to satisfying this Requirement. See sections 7.1 and 7.4 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The products can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The products are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation:	26B	Fabric performance values for new dwellings (applicable to Wales only)
Comment:		The products can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The products are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(b)	Structure
Comment:		The products can contribute to satisfying this Standard, with reference to clause 1.1.1 ⁽¹⁾ . See section 9.2 of this Certificate.
Standard:	3.15	Condensation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.4 ⁽¹⁾ and 3.15.5 ⁽¹⁾ . See sections 7.1 and 7.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The products can contribute to satisfying these Standards, with reference to clauses or parts of clauses 6.1.1 ⁽¹⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾ , 6.2.6 ⁽¹⁾ , 6.2.7 ⁽¹⁾ , 6.2.9 ⁽¹⁾ , 6.2.10 ⁽¹⁾ , 6.2.11 ⁽¹⁾ and 6.2.13 ⁽¹⁾ . See section 6 of this Certificate.

Standard: 7.1(a)(b) **Statement of sustainability**
Comment: The products 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 products can contribute to a construction meeting a higher level of sustainability as defined in this Standard with reference to clauses 7.1.4⁽¹⁾ [Aspects 1⁽¹⁾ and 2⁽¹⁾], 7.1.6⁽¹⁾ [Aspects 1⁽¹⁾⁽²⁾ and 2⁽¹⁾] and 7.1.7⁽¹⁾ [Aspect 1⁽¹⁾]. See section 6.1 of this Certificate.

Regulation: 12 **Building standards applicable to conversions**
Comment: Comments made in relation to these products under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1⁽¹⁾ and Schedule 6⁽¹⁾.

(1) Technical Handbook (Domestic).



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

Regulation: 23 **Fitness of materials and workmanship**
Comment: The products are acceptable. See section 12 and the *Installation* of this Certificate.

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

Regulation: 30 **Stability**
Comment: The products can contribute to satisfying this Regulation. See section 9.2 of this Certificate.

Regulation: 39(a)(i) **Conservation measures**
Regulation: 40(2) **Target carbon dioxide emission rate**
Comment: The products 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 2018

In the opinion of the BBA, Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards*, Chapters 5.1 *Substructure and ground bearing floors* and 5.2 *Suspended ground-floors*.

CE marking

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

Technical Specification

1 Description

Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation comprise rigid polyisocyanurate (PIR) foam boards with foil-facings. The nominal characteristics of the products are given in Table 1 of this Certificate.

Table 1 Nominal characteristics

Product	Facings	Board size (mm)	Thickness range (mm)	Edge profile	Deviation from flatness (mm) (board length \leq 2.5 m)
Celotex TB4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	12 to 45	square edge	\leq 10 (area $>$ 0.75 m ²)
Celotex GA4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	50 to 100	square edge	\leq 10 (area $>$ 0.75 m ²)
Celotex XR4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	110 to 200	square edge	\leq 10 (area $>$ 0.75 m ²)

(1) See sections 4.5 and 13.11.

2 Manufacture

2.1 Celotex PIR insulation is manufactured by a lamination process, formed between aluminium foil-facings that are glued together in a continuous laminator, where the adhesive is a mixture of two primary chemicals, polyol and MDI. An added blowing agent causes the adhesive to expand into foam that hardens, which is then cut to its finished board size and packed.

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

- agreed with the Certificate holder/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 Celotex has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 and BS EN ISO 14001 : 2015 by SGS UK Ltd (Certificates GB91/504 and GB11/83526).

3 Delivery and site handling

3.1 The products are delivered to site in polythene-wrapped packs. Each pack of boards contains a label with the manufacturer's name, board dimensions and the BBA logo incorporating the number of this Certificate.

3.2 The products 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 products are light and easy to handle and care should be exercised to avoid crushing the edges or corners. If damaged, the products should be discarded.

3.4 The products 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 Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation.

Design Considerations

4 Use

4.1 Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation are suitable for use as floor insulation and are effective in reducing the thermal transmittance (U value) of ground-bearing or suspended concrete or timber ground-floors, and also exposed or semi-exposed intermediate concrete or timber floors, in new or existing domestic or similar buildings. The products can also be used on suitably designed beam-and-block floors incorporating Type R2 semi-resisting or resisting blocks to BS EN 15037-2 : 2009 and self-bearing beams to BS EN 15037-1 : 2008.

4.2 Ground-bearing floors should only be used where the depth of compacted fill is less than 600 mm and is defined as non-shrinkable. Shrinkable fills are defined as material containing more than 35% fine particles (silt and clay) and having a Plasticity Index of 10% or greater (shrinkable fills are susceptible to clay heave).

4.3 Ground-bearing concrete and suspended concrete ground-floors incorporating the products must include a suitable damp-proof membrane (dpm), laid beneath the insulation, in accordance with the relevant sections of CP 102 : 1973, and BS 8215 : 1991 (see sections 13.5 and 13.6 of this Certificate).

4.4 Suspended concrete or timber ground-floors incorporating the insulation boards must include suitable ventilation of the sub-floor void (minimum 150 mm void between the underside of the floor and the ground surface) or a dpm. For suspended floors in locations where clay heave is anticipated, an additional void of up to 150 mm may be required to accommodate the possible expansion of the ground below the floor. In such cases where the risk of clay heave has been confirmed by geotechnical investigations by a competent individual, a total void of up to 300 mm may be required.

4.5 When used as insulation in suspended timber ground-floors, for optimum thermal performance, the boards must be installed with the correct orientation of their printed foil-facings. See section 13.11 of this Certificate.

4.6 The overlay to the insulation boards should be:

- a vapour control layer (VCL) as required (see sections 4.3 and 7.3)

and:

- a cement-based floor screed of minimum 65 mm thickness⁽¹⁾, laid in accordance with the relevant clauses of BS 8204-1 : 2003 and/or BS 8204-2 : 2003, and BS 8000-9 : 2003

or

- a wood-based floor, eg tongue-and-groove plywood to BS EN 636 : 2012, flooring grade particle board (Types P5 to P7) to BS EN 312 : 2010 or oriented strand board (OSB) of type OSB/3 or OSB/4 to BS EN 300 : 2006, of a suitable thickness (to be determined by a suitably qualified and experienced individual), installed in accordance with PD CEN/TR 12872 : 2014 and BS EN 12871 : 2013

or

- a concrete slab to BS EN 1992-1-1 : 2004.

(1) NHBC only accept ground-bearing floor slabs with at least 100 mm thick concrete including monolithic screed.

4.7 Where a concrete screed or slab finish is to be laid directly over the product, a polyethylene separating layer/VCL must be installed between the insulation and the concrete to prevent chemical attack and seepage between the boards (see section 13.7). Any gaps between insulation boards or around service openings, visible prior to installing the concrete, must be filled with expanding foam or strips of insulation.

4.8 Loadbearing internal walls must not be built on the floor.

4.9 If present, mould or fungal growth should be treated prior to commencement of the installation of the products.

5 Practicability of installation

The products are designed to be installed by a competent general builder, or a contractor, experienced with these types of products.

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) of a floor should be carried out in accordance with BS EN ISO 6946 : 2017, BS EN ISO 13370 : 2017 and BRE Report BR 443 : 2006 using the following values:

- PIR insulation core — declared thermal conductivity(λ_D)* of $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
- composite foil-facings both sides, printed on one side only — for unprinted facing, an aged emissivity (ϵ) (to BS EN 15976 : 2011) of 0.05.

6.2 The U value of a completed floor will depend on the insulation thickness, the perimeter/area ratio and the floor type. Calculated U values for example constructions are given in Table 2.

Table 2 Example U values — ground-floor construction

Celotex TB4000, GA4000 and XR4000 Insulation thickness (mm)						
Floor Type	Target U value ($\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$)	P/A ratio				
		0.2	0.4	0.6	0.8	1.0
Ground-bearing concrete floor ⁽⁴⁾⁽⁷⁾	0.13	90 ⁽²⁾	120 ⁽³⁾	130 ⁽³⁾	140 ⁽³⁾	140 ⁽³⁾
	0.15	70 ⁽²⁾	100 ⁽²⁾	110 ⁽³⁾	120 ⁽³⁾	120 ⁽³⁾
	0.20	40 ⁽¹⁾	65 ⁽²⁾	75 ⁽²⁾	80 ⁽²⁾	85 ⁽²⁾
	0.22	30 ⁽¹⁾	55 ⁽²⁾	65 ⁽²⁾	70 ⁽²⁾	75 ⁽²⁾
	0.25	20 ⁽¹⁾	45 ⁽¹⁾	55 ⁽²⁾	60 ⁽²⁾	65 ⁽²⁾
Suspended concrete ground-floor ⁽⁵⁾⁽⁷⁾	0.13	110 ⁽³⁾	130 ⁽³⁾	140 ⁽³⁾	140 ⁽³⁾	140 ⁽³⁾
	0.15	90 ⁽²⁾	110 ⁽³⁾	120 ⁽³⁾	120 ⁽³⁾	120 ⁽³⁾
	0.20	55 ⁽²⁾	75 ⁽²⁾	80 ⁽²⁾	85 ⁽²⁾	85 ⁽²⁾
	0.22	45 ⁽¹⁾	70 ⁽²⁾	70 ⁽²⁾	75 ⁽²⁾	75 ⁽²⁾
	0.25	35 ⁽¹⁾	50 ⁽²⁾	60 ⁽²⁾	60 ⁽²⁾	65 ⁽²⁾
Suspended timber ground-floor ⁽⁶⁾	0.13	200 ⁽³⁾	200 ⁽³⁾	—	—	—
	0.15	140 ⁽³⁾	165 ⁽³⁾	200 ⁽³⁾	200 ⁽³⁾	200 ⁽³⁾
	0.20	75 ⁽²⁾	110 ⁽³⁾	120 ⁽³⁾	130 ⁽³⁾	130 ⁽³⁾
	0.22	65 ⁽²⁾	90 ⁽²⁾	110 ⁽³⁾	110 ⁽³⁾	120 ⁽³⁾
	0.25	45 ⁽¹⁾	75 ⁽²⁾	85 ⁽²⁾	90 ⁽²⁾	95 ⁽²⁾

(1) Celotex TB4000

(2) Celotex GA4000.

(3) Celotex XR4000.

(4) Ground-bearing concrete floor construction (Celotex insulation on top of slab, under screed finish) 65 mm concrete screed
 $\lambda = 1.15 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$, polyethylene separating layer, Celotex insulation, dpm, 100 mm concrete oversite, 150 mm sand-blinded hardcore.

(5) Suspended concrete ground-floor construction (Celotex insulation on top of beam and block, below screed finish) 65 mm concrete screed
 $\lambda = 1.15 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$, polyethylene separating layer, Celotex insulation, beam and block floor (12%), beam $\lambda = 2.00 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$, dense block infill
 $\lambda = 1.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$, ventilated void.

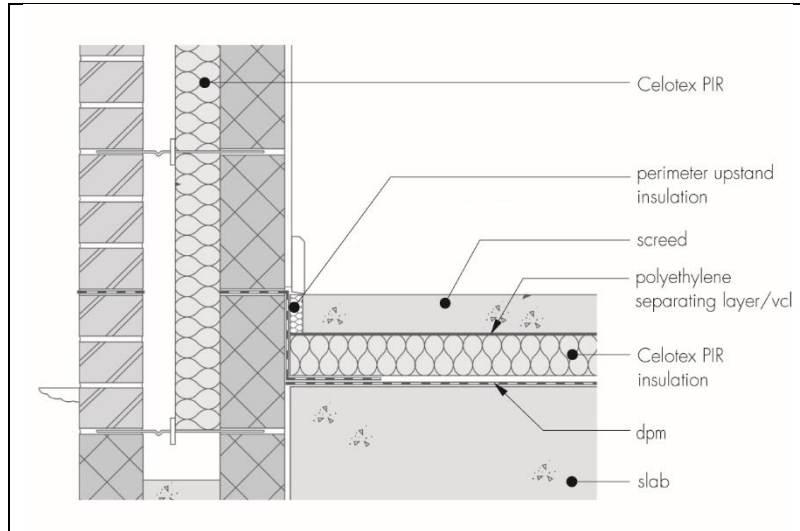
(6) Suspended timber ground-floor construction (Celotex between floor joists) – floor deck thermal resistance $0.169 \text{ m}^2\cdot\text{K}\cdot\text{W}^{-1}$ (based on 22 mm chipboard
 $\lambda = 0.13 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), Celotex insulation (87%) between 47 mm wide joists at 400 mm centres. The depth of the joists = 100 to 200 mm depending on
the depth of insulation between floor joists (13%) based on BR 443 : 2006 (nogging every 3 metres at 38 mm wide).

(7) Edge insulation used, Celotex TB4020 (20 mm thick x 65 mm high).

Junctions

6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations. An example of an acceptable junction detail is shown in Figure 1.

Figure 1 Junction between the wall and the floor



7 Condensation risk

Interstitial condensation



7.1 Floors will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011 Annex F and the relevant guidance.

7.2 The foil-facings have a water vapour resistance of $1000 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$ and the insulation core has a water vapour resistivity of $300 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$ and, therefore, will provide a significant resistance to water vapour transmission.

7.3 When the products are used above the dpm on a ground-supported or a suspended floor, a VCL is installed on the warm side of the insulation to limit the risk of interstitial condensation, unless a risk assessment shows this is not necessary.

Surface condensation



7.4 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with walls are designed in accordance with section 6.3 of this Certificate.



7.5 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point. Guidance may be obtained from BS 5250 : 2011 Annex F. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

8 Behaviour in relation to fire

8.1 The Certificate holder has declared a reaction to fire classification* to EN 13501-1 : 2007 of Class E for the products.

8.2 When properly installed, the products will not add significantly to any existing fire hazard. The products will be contained within the floor by the overlay until the overlay itself is destroyed. Therefore, the products will not contribute to the development stages of a fire or present a smoke or toxic hazard.

9 Floor loading

9.1 The products have a compressive strength (compressive stress at 10% deformation* to BS EN 826 : 2013) of /140KPa.



9.2 The products are suitable for domestic occupancies defined in this Certificate when covered with a suitable floor overlay (see section 4.6), and are capable of resisting a uniformly distributed load of $1.5 \text{ kN}\cdot\text{m}^{-2}$ or a concentrated load of 2 kN for category A1 and A2 (domestic) situations as defined in BS EN 1991-1-1 : 2002 and National Annex Table NA.2. Further assessment is necessary in the case of duty walkways and floors subject to physical activities.

9.3 The performance of the floor construction will depend on the insulation properties and type of floor overlay used (including thickness and strength). When the products are used under a concrete slab, resistance to concentrated and distributed loads is a function of the slab specification. Further guidance on the suitability of floor overlays can be found in BS EN 13810-1 : 2002, DD CEN/TS 13810-2 : 2003, BS 8204-1 : 2003 and BS EN 312 : 2010, and from the flooring manufacturer.

10 Incorporation of services

10.1 De-rating of electrical cables should be considered where installation restricts air cooling of cables; the products must not be used in direct contact with electrical heating cables or hot water pipes. Where underfloor heating systems are to be used, the advice of the Certificate holder should be sought.

10.2 Where possible, electrical conduits, gas and water pipes or other services should be contained within ducts or channels within the concrete slab of ground-bearing floors. Where this is not possible, the services may be accommodated within the insulation, provided they are securely fixed to the concrete slab. Electric cables should be enclosed in a suitable conduit. With hot pipes, the insulation must be cut back to maintain an air space.

10.3 Where water pipes are installed below the insulation, they must be pre-lagged with close-fitting pipe insulation. Pipes installed above the insulation will not require lagging, although some provision needs to be made for expansion and contraction.

10.4 Where the products are installed on a floor of a suspended beam-and-block design, all services must be installed so as not to impair the floor performance.

10.5 On overlay board floors, in situations where access to the services is desirable, a duct may be formed by mechanically fixing to the floor, timber bearers of the same thickness as the insulation to provide support for a particle board cover. The duct should be as narrow as possible and not exceed 400 mm in width or the maximum particle board spans given in PD CEN/TR 12872 : 2014 without intermediate support. Services should be suitably fixed to the floor base and not to the insulation boards.

10.6 On intermediate/exposed floor, all the services should be incorporated beneath the existing floor, above the insulation if possible.

11 Maintenance

As the products are confined within the floor by the overlay and have suitable durability (see section 12), maintenance is not required.

12 Durability



The products are rot proof, dimensionally stable and, when installed with the overlays specified in this Certificate, will remain effective as an insulating material for the life of the building in which they are incorporated.

13 General

13.1 Installation of Celotex TB4000, GA4000 and XR4000 PIR Insulation Boards for Floor Insulation must be in accordance with the Certificate holder's instructions and the requirements of this Certificate.

13.2 Typical methods of installation are shown in Figures 2 and 3. Reference should also be made to BRE Report BR 262 : 2002.

Figure 2 Over a ground-bearing concrete floor slab

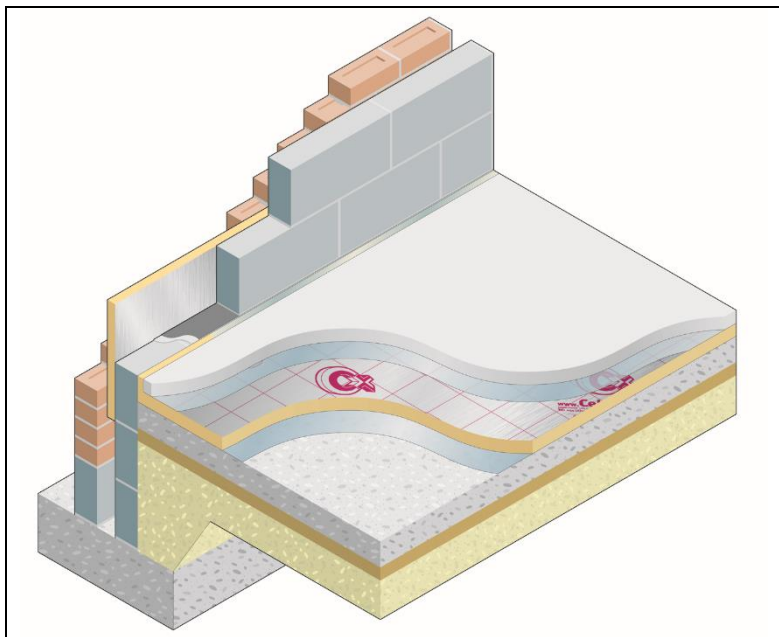
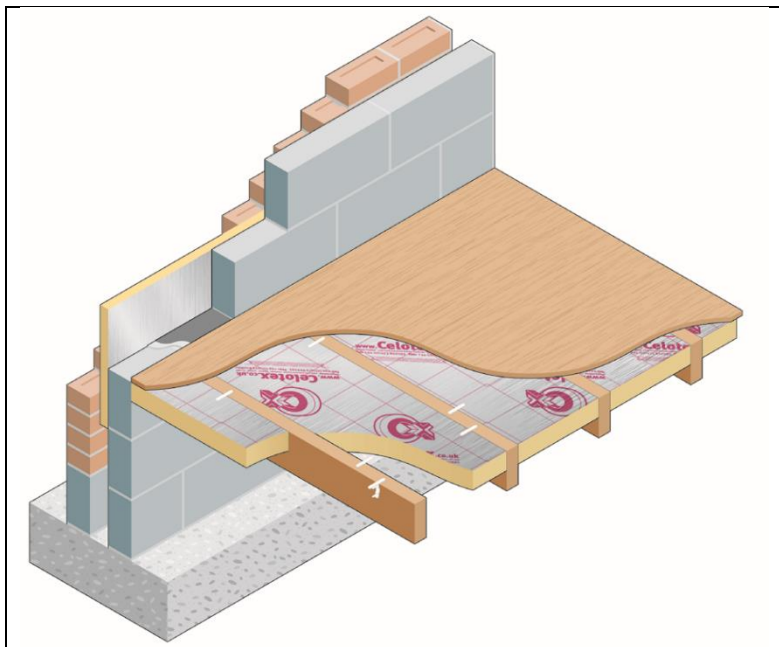


Figure 3 Between the joists in a suspended timber floor



13.3 In ground-bearing concrete floors (see Figure 2), the concrete floor slab over which the boards are to be laid should be left for as long as possible to maximise drying out and dissipation of constructional moisture, in accordance with BS 8203 : 2017, section 3.1.2.

13.4 The concrete floor surface should be smooth, level and flat to within 5 mm when measured with a two-metre straight-edge. Irregularities greater than this must be removed. Minor irregularities (up to 10 mm deep) may be levelled with mortar or thin screed.

13.5 Where the insulation is used over ground-bearing concrete floor slabs, a suitable dpm in accordance with CP 102 : 1973, should be laid to resist moisture from the ground. If a liquid-type dpm is applied to the slabs, it should be of a type compatible with the products and allowed to dry out fully before laying the insulation.

13.6 Where the insulation is used on hardcore bases beneath ground-bearing concrete slabs, the hardcore must be compacted and blinded with a thin layer of sand, before application of the dpm followed by the insulation boards.

13.7 A VCL is installed on the warm side of the insulation to inhibit the risk of interstitial condensation if necessary (see section 7.3). Where a concrete screed or slab finish is to be laid directly over the product, a polyethylene separating layer/VCL must be installed between the insulation and the concrete to prevent chemical attack and seepage between the boards.

13.8 The insulation can be used on suitable beam-and-block suspended concrete floors (see section 4.1).

13.9 Where a screed or concrete slab is laid over the insulation, vertical upstands of insulation should be provided and be of sufficient depth to fully separate the screed or slab from the wall. If used, a suitable cavity wall insulation material should be extended below the dpc level to provide edge insulation to the floor.

13.10 To limit the risk of condensation and other sources of dampness, the insulation and overlays should only be laid after the construction is made substantially weathertight, eg after glazing. During construction, the insulation and overlay must be protected from damage by traffic and moisture sources, such as water spillage and plaster droppings.

13.11 The products may be installed between timber floor joists using Celotex insulation clips or timber stop beads. The products have printed logos applied to the outer foil-facing on one side only. To ensure optimum thermal performance, the products must be installed with the unprinted foil-face always facing the cavity side. Tongue-and-groove particle board flooring or softwood floor boarding is then installed in the conventional manner.

14 Procedure

14.1 The product is cut to size (using a sharp knife or fine-toothed saw), as necessary, and laid with closely butted, staggered cross-joints, ensuring all spaces are completely filled.

14.2 The laying pattern should ensure that all cut edges are at the perimeter of the floor or some other feature, eg matwells, thresholds or access ducts. Spreader boards should be used to protect the insulation.

Cement-based screed overlay (Figure 2)

14.3 Perimeter edge pieces are cut and placed around the edges and taped at joints. A polyethylene VCL, at least 0.125 mm thick (500 gauge), is laid over the insulation. The VCL should have 150 mm overlaps, taped at the joints, and turned up 100 mm at the walls. A properly compacted screed of minimum thickness 65 mm is then laid over. The relevant clauses of BS 8204-1 : 2003 should be followed.

Timber-based board overlay

14.4 Before installing the overlay, preservative-treated timber battens, in accordance with BS 8417 : 2011, are positioned at doorways and access panels. Adequate time should be allowed for preservatives to be fixed, and the solvents from solvent-based preservatives to evaporate.

14.5 A polyethylene VCL of at least 0.125 mm (500 gauge) thickness is laid between the insulation and the timber board overlay. The VCL should have 150 mm overlaps, taped at the joints, and turned up 100 mm at the walls.

14.6 Timber based overlay boards as specified in section 4.6 are laid with staggered cross-joints, in accordance with PD CEN/TR 12872 : 2014 and BS EN 12871 : 2013.

Concrete slab overlay (ground-bearing only)

14.7 Perimeter edge pieces are cut and placed around the edges and taped at the joints. A polyethylene VCL, minimum 0.125 mm thick (500 gauge), is laid over the insulation. The VCL should have 150 mm overlaps, taped at the joints and turned up 100 mm at the walls. The concrete slab is laid to the required thickness in accordance with BS 8000-9 : 2003 and BS 8204-1 : 2003.

Suspended timber floor (Figure 3)

14.8 Insulation boards can be supported between timber joists using either Celotex insulation clips or timber beads. Where timber beads are used, a void may be incorporated above the insulation to accommodate services, if required. For correct orientation of the products, see section 13.11.

14.9 The product is cut to size to fit tightly between the joists. The saddle clip spikes are pressed into the long edges of the insulation board, ensuring the flange sits flat on the face of the board. Clips should be fitted at one metre intervals. The insulation board is then pushed into place until the clip is level with the surface of the joist. For additional security, the clip can be fixed to the joist with a small flat-head nail driven through the flange of the clip.

14.10 Where a service void is required above the insulation, preservative-treated timber beads may be used to retain the insulation boards. Beads should be wide enough to retain the insulation boards in place and secured with corrosion-protected fixings at a depth that will accommodate the thickness of the insulation board and leave a suitable depth void (minimum 25 mm) between the top of the insulation and the underside of the flooring deck. The product is cut to fit between the joists and pushed down onto the beads.

Technical Investigations

15 Tests

- load compression characteristics
- effect of cyclic loading
- thermal conductivity
- compressive strength.

16 Investigations

16.1 An examination was made of data relating to:

- dimensional accuracy
- dimensional stability
- water vapour resistance
- diffusion-tight property of facings
- compressive strength at 10% deformation
- density.

16.2 A condensation risk analysis was carried out.

16.3 A series of U value calculations was carried out

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

Bibliography

- BS 5250 : 2011 + A1 : 2016 *Code of practice for control of condensation in buildings*
- BS 8000-9 : 2003 *Workmanship on building sites — Cementitious levelling screeds and wearing screeds — Code of practice*
- BS 8203 : 2017 *Code of practice for installation of resilient floor coverings*
- BS 8204-1 : 2003 + A1 : 2009 *Screeds, bases and in-situ floorings — Concrete bases and cement sand levelling screeds to receive floorings — Code of practice*
- BS 8204-2 : 2003 + A2 : 2011 *Screeds, bases and in-situ floorings — Concrete wearing surfaces — Code of practice*
- BS 8215 : 1991 *Code of practice for design and installation of damp-proof courses in masonry construction*
- BS 8417 : 2011 + A1 : 2014 *Preservation of wood — Code of practice*
- BS EN 300 : 2006 *Oriented Strand Boards (OSB) — Definitions, classification and specifications*
- BS EN 312 : 2010 *Particleboards — Specifications*
- BS EN 636 : 2012 + A1 : 2015 *Plywood — Specifications*
- BS EN 826 : 2013 *Thermal Insulating Products for Building Applications — Determination of Compression Behaviour*
- BS EN 1991-1-1 : 2002 *Eurocode 1 : Actions on structures — General actions— Densities, self-weight, imposed loads for buildings*
NA to BS EN 1991-1-1 : 2002 *UK National Annex to Eurocode 1 : Actions on structures — General actions— Densities, self-weight, imposed loads for buildings*
- BS EN 1992-1-1 : 2004 + A1 : 2014 *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*
NA + A2 : 2014 to BS EN 1991-1-1 : 2004 *UK National Annex to Eurocode 1 : Actions on structures — General actions— Densities, self-weight, imposed loads for buildings*
- BS EN 12871 : 2013 *Wood-based panels — Performance specifications and requirements for load bearing boards for use in floors, walls and roofs*
- 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 Part 1 — Classification using data from reaction to fire tests*
- BS EN 13810-1 : 2002 *Wood-based panels — Floating floors — Performance specifications and requirements*
- BS EN 15037-1 : 2008 *Precast concrete products — Beam-and-block floor systems — Beams*
- BS EN 15037-2 : 2009 + A1 : 2011 *Precast concrete products — Beam-and-block floor systems — Concrete blocks*
- BS EN 15976 : 2011 *Flexible sheets for waterproofing — Determination of emissivity*
- BS EN ISO 6946 : 2017 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- BS EN ISO 9001 : 2015 *Quality management systems — Requirements*
- BS EN ISO 13370 : 2017 *Thermal Performance of Buildings — Heat Transfer via the Ground — Calculation Methods*

BS EN ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*

CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*

PD CEN/TR 12872 : 2014 *Wood-based panels — Guidance on the use of load-bearing boards in floors, walls and roofs*

DD CEN/TS 13810-2 : 2003 *Wood-based panels — Floating floors — Test methods*

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

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

17 Conditions

17.1 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 or 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.

17.2 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.

17.3 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.

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

17.5 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.

17.6 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.

Saint-Gobain Construction Products UK Limited
trading as Celotex

Lady Lane Industrial Estate
Hadleigh
Ipswich
Suffolk IP7 6BA

Tel: 01473 822093 Fax: 01473 820880

e-mail: technical@celotex.co.uk

website: www.celotex.co.uk



Agrément Certificate

17/5405

Product Sheet 6

CELOTEX INSULATION

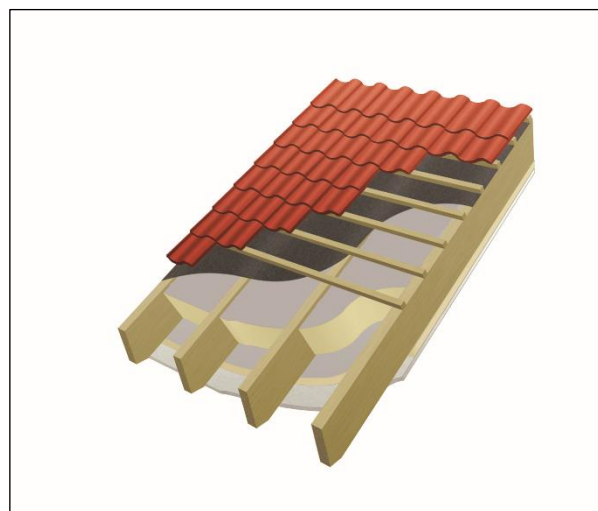
CELOTEX RANGE OF PIR INSULATION BOARDS FOR PITCHED ROOF INSULATION

This Agrément Certificate Product Sheet⁽¹⁾ relates to the Celotex Range of PIR Insulation Boards for Pitched Roof Insulation, comprising rigid polyisocyanurate (PIR) foam boards with foil-facings, for use as insulation installed above, between and/or below rafters in tiled or slated pitched roofs in new and existing domestic and non-domestic buildings.

(1) Hereinafter referred to as 'Certificate'.

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 products have declared thermal conductivities (λ_D) of 0.023 W·m⁻¹·K⁻¹ for Celotex TB3000 and GA3000, and 0.022 W·m⁻¹·K⁻¹ for Celotex TB4000, GA4000 and XR4000 (see section 6).

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

Durability — the products are durable, rot proof and sufficiently stable to remain effective as insulation for the life of the building (see section 11).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Third issue: 20 November 2018

John Albon – Head of Approvals
Construction Products

Originally certificated on 23 January 2018

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.*

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

©2018

tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Celotex Range of PIR Insulation Boards for Pitched Roof Insulation, 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)

Requirement:	C2(c)	Resistance to moisture
Comment:		The products can contribute to satisfying this Requirement. See sections 7.1 and 7.5 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The products can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The products are acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to England only)
Regulation:	26B	Fabric performance values for new dwellings (applicable to Wales only)
Comment:		The products can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The products are acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	3.15	Condensation
Comment:		The products can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾⁽²⁾ , 3.15.3 ⁽¹⁾⁽²⁾ , 3.15.4 ⁽¹⁾⁽²⁾ , 3.15.5 ⁽¹⁾⁽²⁾ and 3.15.7 ⁽¹⁾⁽²⁾ . See sections 7.1 and 7.6 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The products can contribute to satisfying this Standard with reference to clauses or parts of clauses 6.1.1 ⁽¹⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾⁽²⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See section 6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The products 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 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾⁽²⁾ [Aspect 1 ⁽¹⁾⁽²⁾]. See section 6.1 of this Certificate.

Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the products under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .
		(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 products are acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	29	Condensation
Comment:		The products can contribute to satisfying this Regulation. See section 7.1 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		The products 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 sections: *3 Delivery and site handling (3.4) and 12 General (12.2)* of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, the Celotex Range of PIR Insulation Boards for Pitched Roof Insulation, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements in relation to *NHBC Standards, Chapter 7.2 Pitched roofs*.

CE marking

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

Technical Specification

1 Description

The Celotex Range of PIR Insulation Boards for Pitched Roof Insulation comprises rigid polyisocyanurate foam (PIR) boards with foil-facings. The nominal characteristics of the products are given in Table 1.

Table 1 Nominal characteristics

Product	Facings	Board size (mm)	Thickness range (mm)	Edge profile
Celotex TB3000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	12 to 45	square edge
Celotex GA3000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	50 to 95	square edge
Celotex TB4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	12 to 45	square edge
Celotex GA4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	50 to 100	square edge
Celotex XR4000	Composite foil-facing both sides (printed on one side only) ⁽¹⁾	1200 x 2400	110 to 200	square edge

(1) See sections 4.3 and 12.3.

2 Manufacture

2.1 Celotex PIR insulation is manufactured by a lamination process, formed between aluminium foil-facings that are glued together in a continuous laminator, where the adhesive is a mixture of two primary chemicals, polyol and MDI. An added blowing agent causes this adhesive to expand into foam that hardens, which is then cut to its finished board size and packed.

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

- agreed with the Certificate holder/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 Celotex has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 and BS EN ISO 14001 : 2015 by SGS UK Ltd (Certificate Numbers GB91/504 and GB11/83526).

3 Delivery and site handling

3.1 The products are delivered to site in polythene-wrapped packs. Each pack of boards contains a label with the manufacturer's name, board dimensions and the BBA logo incorporating the number of this Certificate.

3.2 The products 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 products are light and easy to handle and care should be taken to avoid crushing the edges or corners. If damaged, the products should be discarded.

3.4 The products 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 the Celotex Range of PIR Insulation Boards for Pitched Roof Insulation.

4 Use

4.1 The Celotex Range of PIR Insulation Boards for Pitched Roof Insulation is suitable for use as insulation within tiled or slated pitched roofs, in conjunction with internal lining board, roof tile underlay, timber counter battens and tiling battens in tiled or slated, in new and existing domestic or non-domestic buildings, and may be installed:

- above sloping rafters
- above and between sloping rafters
- between and below sloping rafters.

4.2 Roofs should be designed and constructed in accordance with the relevant clauses of BS 5250 : 2011, BS 5534 : 2014, BS 8212 : 1995 and BS EN 1995-1-1 : 2004.

4.3 For optimum thermal performance, the boards must be installed with the correct orientation of their printed foil-facings. See section 12.3.

4.4 Vapour permeable roof tile underlays used in conjunction with the product must have a current BBA Certificate and must be used in accordance with, and within the limitations of, that Certificate.

4.5 It is essential that detailing and jointing of the boards achieves a convection-free envelope of high vapour resistance. Any gaps should be filled and/or taped. Ridges, abutments and penetrations should also be sealed. Flue pipes passing through the insulation should be suitably sleeved.

4.6 A ventilated air space of minimum depth 50 mm may be required between the underside of the roof tile underlay and the upper face of the product, dependent on the specification of the roof tile underlay used (see section 7.2).

5 Practicability of installation

The products are designed to be installed by a competent general builder, or a contractor, experienced with these types of products.

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) of specific roof constructions should be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2006, using the following values:

Celotex TB3000 and GA3000

- PIR insulation core — declared thermal conductivity(λ_D)* of $0.023 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
- composite foil-facings both sides, printed on one side only — for unprinted facing, an aged emissivity (ϵ) (to BS EN 15976 : 2011) of 0.05.

Celotex TB4000, GA4000 and XR4000

- PIR insulation core — declared thermal conductivity(λ_D)* of $0.022 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
- composite foil-facings both sides, printed on one side only — for unprinted facing, an aged emissivity (ϵ) (to BS EN 15976 : 2011) of 0.05.

6.2 The U value of a completed roof will depend on the insulation thickness, and the number and type of fixings, and the roof structure and its internal finish. Calculated U values for example constructions in accordance with the national Building Regulations are given in Table 2.

Table 2 Example U values — pitched roof

Target U value ($W \cdot m^{-2} \cdot K^{-1}$)	Celotex TB3000, TB4000, GA3000, GA4000, XR4000 insulation thickness (mm)		
	Over rafters ⁽⁶⁾	Between rafters	Between and under rafters ⁽⁷⁾
0.13	165 ⁽⁵⁾	—	*120 ⁽⁵⁾ + 85 ⁽⁴⁾
0.15	140 ⁽⁵⁾	—	100 ⁽⁴⁾ + 80 ⁽⁴⁾
0.16	130 ⁽⁵⁾	—	100 ⁽⁴⁾ + 70 ⁽⁴⁾
0.18	110 ⁽⁵⁾	*200 ⁽⁵⁾	100 ⁽⁴⁾ + 50 ⁽⁴⁾
0.20	95 ⁽⁴⁾	*165 ⁽⁵⁾	100 ⁽⁴⁾ + 40 ^{(1) or (2)}
0.25	80 ⁽³⁾ or 75 ⁽⁴⁾	*130 ⁽⁵⁾	95 ⁽⁴⁾ + 20 ^{(1) or (2)}

*With additional timber battens added beneath 150 mm rafters, to maintain 50 mm ventilated cavity above the insulation

(1) Celotex TB3000

(2) Celotex TB4000

(3) Celotex GA3000

(4) Celotex GA4000

(5) Celotex XR4000

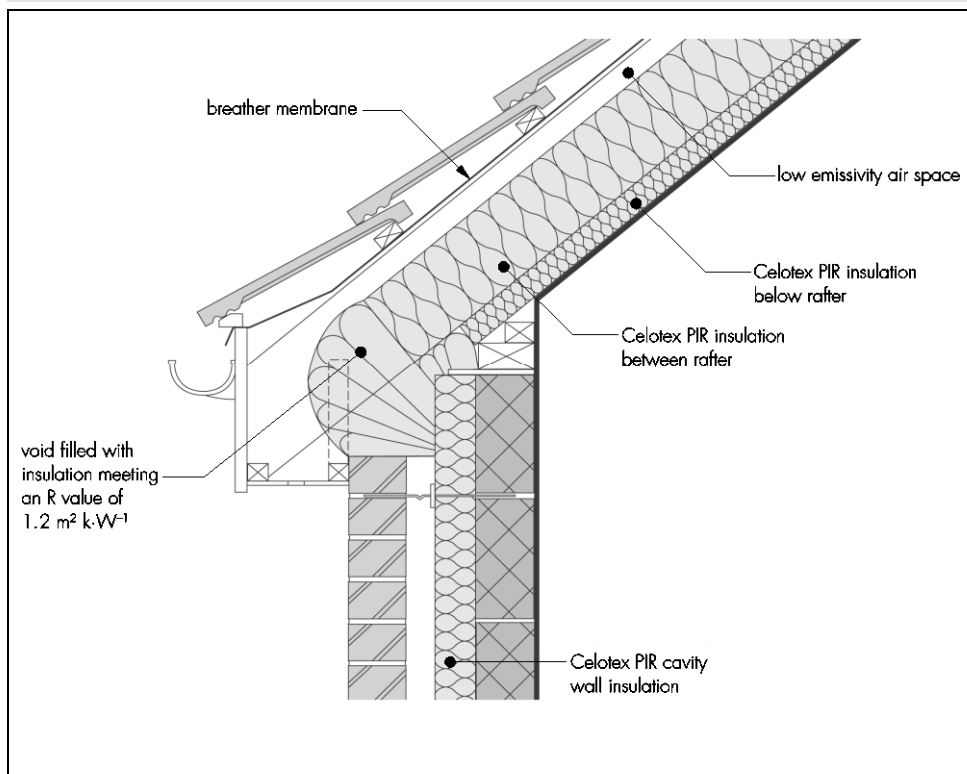
(6) 11 fixings per m^2 – stainless steel ($\lambda = 17 W \cdot m^{-1} \cdot K^{-1}$) with a cross-sectional area of $9 mm^2$

(7) 14.58 fixings per m^2 – mild steel ($\lambda = 50 W \cdot m^{-1} \cdot K^{-1}$) with a cross-sectional area of $10.46 mm^2$ for the insulation under the rafters.

Junctions

6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations. An example of an acceptable junction detail is shown in Figure 1.

Figure 1 Junction between roofs and walls



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 Annex H and the relevant guidance.

7.2 The foil-facings have a water vapour resistance of $1000 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}$ and the insulation core has a water vapour resistivity of $300 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$ and, when installed with tightly butted joints and filled/sealed gaps and joints, will provide a continuous convection-free envelope of high vapour resistance. Therefore, a suitable vapour-permeable (LR) roof tile underlay may be laid over the insulation boards without ventilated air space. When using a high resistance (type HR) underlay, the space below it must be ventilated in accordance with BS 5250 : 2011 Annex H.

7.3 Where the products are installed in a roof with either a horizontal or sloping ceiling (ie room-in-the-roof), a 'warm roof' space is created and ventilation should be designed in accordance with BS 5250 : 2011 Annex H. However, any insulation in a horizontal ceiling should be removed.

7.4 Where high humidity may be expected, a vapour control layer (VCL), such as 0.125 mm thickness polyethylene with sealed and lapped joints, should also be installed unless a site-specific condensation risk analysis in accordance with BS EN 15026 : 2007 indicates otherwise.

Surface condensation



7.5 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 walls are designed in accordance with section 6.3 of this Certificate.



7.6 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point. Guidance may be obtained from 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 (over rafter application only)

8.1 The products, when installed in accordance with the manufacturer's instructions and this Certificate, will resist the loads likely to be met in service. During installation, care should be taken to ensure that the products are not subjected to any construction or foot traffic loads. Roof timbers of adequate strength should be used to support such loads.

8.2 Resistance to wind uplift will depend largely on the building geometry and its geographical location and should be calculated in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex. Snow loadings should be calculated in accordance with BS EN 1991-1-3 : 2003 and its UK National Annex.

8.3 The Certificate holder and fixing manufacturer must advise on the use of the correct proprietary fixings and fixing capacity. When considering this and calculating the fixing spacing required to resist the calculated loadings, the requirements of BS EN 1995-1-1 : 2004 and its National Annex must be followed.

9 Behaviour in relation to fire

9.1 The Certificate holder has declared a reaction to fire classification* to EN 13501-1 : 2007 of Class E for TB4000, GA4000 and XR4000 products, and NPD (no performance determined) for TB3000 and GA3000 products.

9.2 When installed between, under or over rafters, with an internal lining board securely fixed to timber (eg 12.5 mm thick plasterboard), the products will be contained between the element and internal lining board until one is destroyed. Therefore, the products will not contribute to the development stages of a fire until the lining is compromised.

9.3 Elements must incorporate cavity barriers at edges, around openings, at junctions with fire-resisting elements and in cavities, in accordance with the relevant provisions of the national Building Regulations.

10 Maintenance

As the products are confined within the pitched roof by the overlay and have suitable durability (see section 11), maintenance is not required.

11 Durability



The products are durable, rot proof and sufficiently stable to remain effective as an insulation for the life of the building.

Installation

12 General

12.1 Installation of the Celotex Range of PIR Insulation Boards for Pitched Roof Insulation must be in accordance with the relevant clauses of BS 5534 : 2014 and the manufacturer's instructions. Installation can be carried out in all conditions normal to roofing work.

12.2 The products are light to handle but some handling difficulties may be experienced in windy conditions. As the product will not support the weight of operatives, appropriate care must be taken during installation and tiling.

12.3 The products have printed logos applied to the outer foil-facing on one side only. To ensure optimum thermal performance, the boards must be installed with the unprinted foil-face always facing the cavity side.

12.4 The products can be cut easily using a sharp knife or fine-tooth saw. Care must be taken to prevent damage, particularly to edges. Damaged boards should not be used. Small areas of damaged facing may be repaired with self-adhesive aluminium foil tape.

12.5 It is important to fill/seal gaps and joints in the insulation envelope, including at all service penetrations. See section 4.5 of this Certificate.

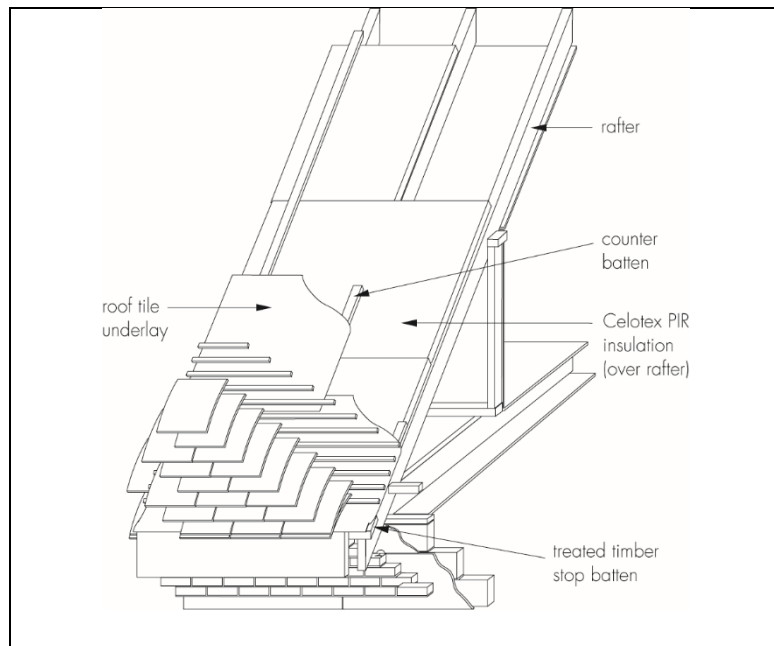
12.6 For installation of roof tiles or slates and internal lining boards, see sections 13.15 and 13.16.

13 Procedure

Insulation above rafters

13.1 A treated-timber stop batten, the same thickness as the insulation board, is fixed to the rafters at eaves level, and the insulation boards are butted directly against it (see Figure 2).

Figure 2 *Insulation above rafters*



13.2 The insulation boards should be temporarily fixed onto the rafters using broad-headed clout nails and with joints running up the roof slope occurring over the rafters. Cross-joints may be unsupported. For correct orientation of boards, see section 12.3.

13.3 All insulation board joints should be tightly butted. At ridges and verges, the boards should be cut to achieve a close butt joint.

13.4 Counter battens, underlay and tiling battens should be installed using one of the following methods of fixing.

Method 1

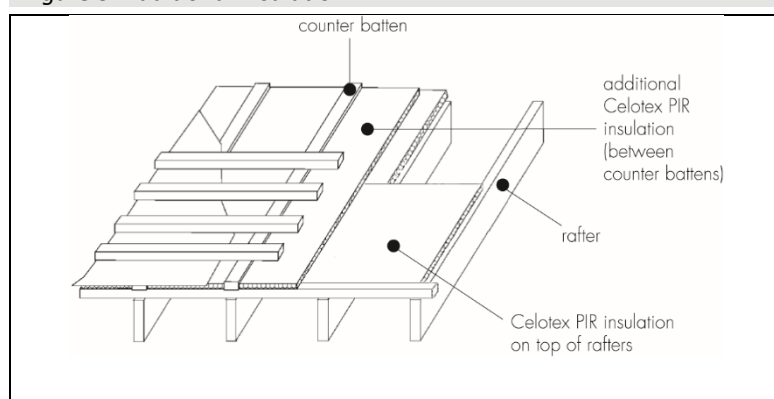
13.5 Counter battens (38 by 50 mm) should be fixed using suitable fixings at maximum centre-to-centre spacing of 400 mm. These fixings should pass through the counter batten and insulation and penetrate the supporting timber by a minimum of 37 mm.

13.6 The roof tile underlay should be installed in the conventional manner. Tiling battens should be nailed through the underlay into the counter batten in accordance with BS 5534 : 2014 at the required batten gauge. Where permeable tile underlays are used, they should be installed in accordance with the appropriate Agrément Certificate.

Method 2

13.7 Where additional insulation is required, an additional layer of insulation can be installed between the counter battens, but the counter battens should be at least 12 mm thicker than the insulation boards (see Figure 3).

Figure 3 *Additional insulation*

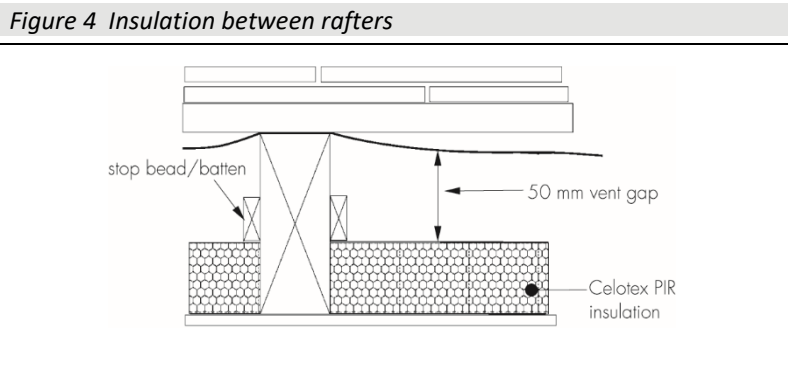


Insulation between and above rafters

13.8 The product is cut and fitted tightly between the rafters and is supported with stop beads or battens. It is to be installed flush with the top of the rafters. The second layer of insulation is then installed above the rafters as described in sections 13.1 to 13.3

Insulation between and below rafters

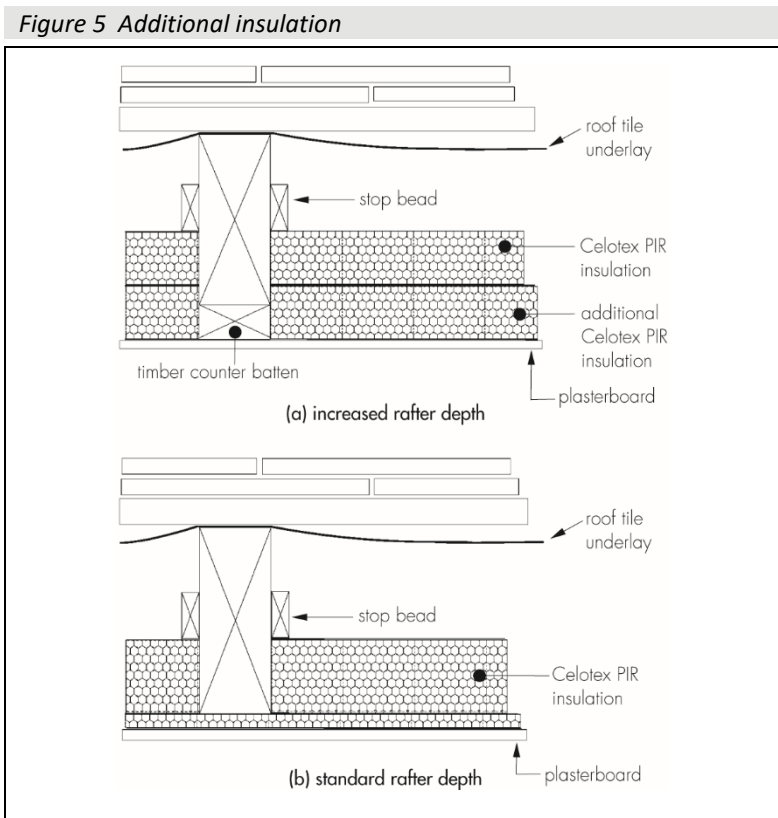
13.9 Following completion of the roof structure, the products are cut and fitted from the inside, tightly between the rafters and flush with the underside, and butted against stop beads or battens which maintain a ventilated air gap at least 50 mm deep (see Figure 4). Where vapour-permeable (LR) roof tile underlays are used, the insulation may be installed without a ventilated air space (see section 7.2).



13.10 A VCL is fitted to the underside of the rafters.

13.11 Where the rafter depth cannot accommodate the required thickness of insulation and maintain the required 50 mm ventilated gap, one of the following options may be considered:

- the rafter depth is increased by attaching timber counter battens to the underside of the rafter [see Figure 5(a)], or preferably,
- a second layer of insulation is added to the underside of the rafters [see Figure 5(b)].

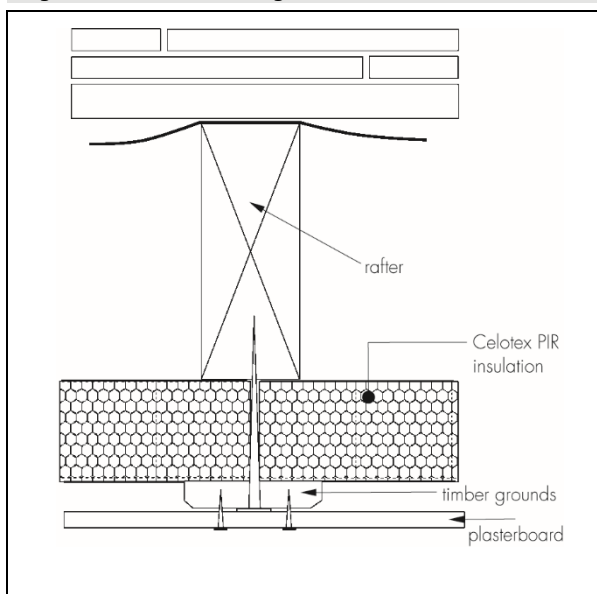


13.12 Boards may be attached to the underside of rafters either as a single layer or in conjunction with insulation boards between the rafters.

13.13 Boards are temporarily fixed with broad-headed clout nails, and joints butted and taped with a self-adhesive aluminium foil tape to provide an effective VCL and air permeability barrier. Appropriate internal lining panels may then be fixed through the insulation and into the underside of the rafters.

13.14 Where the insulation thickness makes securing of the internal lining panels impractical, timber grounds of the appropriate depth may be fixed through to the rafters, and the panels secured to the grounds (see Figure 6).

Figure 6 Added timber grounds



Finishing

13.15 Roof tiles or slates are installed in accordance with the relevant clauses of BS 5534 : 2014. When applying roof tiles or slates, the recommendations of the manufacturer should be followed.

13.16 Internal lining panels appropriate to the application, for example standard gypsum plasterboard to BS EN 520 : 2004, should be fixed in accordance with BS 8212 : 1995 and the required decoration applied.

Technical Investigations

14 Tests

Results of tests were assessed to determine:

- thermal conductivity
- compressive strength
- load compression characteristics
- effect of cyclic loading.

15 Investigations

15.1 An examination was made of data relating to:

- dimensional accuracy
- density
- compressive strength
- dimensional stability

- water vapour transmission
- reaction to fire.

15.2 A condensation risk analysis was carried out.

15.3 A series of U value calculations was carried out.

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

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

Bibliography

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

BS 5534 : 2014 + A2 : 2018 *Code of practice for slating and tiling (including shingles)*

BS 8212 : 1995 *Code of practice for dry lining and partitioning using gypsum plasterboard*

BS EN 520 : 2004 + A1 : 2009 *Gypsum plasterboards — Definitions, requirements and test methods*

BS EN 1991-1-3 : 2003 + A1 : 2015 *Eurocode 1 : Actions on structures — General actions — Snow loads*

NA to BS EN 1991-1-3 : 2003 + A1 : 2015 UK National Annex to *Eurocode 1 : Actions on structures — General actions — Snow loads*

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 UK National Annex to *Eurocode 1 : Actions on structures — General actions — Wind actions*

BS EN 1995-1-1 : 2004 + A2 : 2014 *Eurocode 5 : Design of timber structures — General — Common rules and rules for buildings*

NA to BS EN 1995-1-1 : 2004 + A1 : 2008 UK National Annex to *Eurocode 5 : Design of timber structures — General — Common rules and rules for buildings*

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. Part 1. Classification using data from reaction to fire tests*

BS EN 15026 : 2007 *Hygrothermal performance of building components and building elements. Assessment of moisture transfer by numerical simulation.*

BS EN 15976 : 2011 *Flexible sheets for waterproofing - Determination of emissivity*

BS EN ISO 6946 : 2017 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

BS EN ISO 9001 : 2015 *Quality management systems — Requirements*

BS EN ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*

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

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

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 or 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.