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Agrément Certificate  
**16/5317**  
Product Sheet 1

### CANDIGRÉS — EXTERNAL WALL INSULATION SYSTEMS

### CANDIWALL XPS EXTERNAL WALL INSULATION SYSTEM

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to the Candiwall XPS External Wall Insulation System, comprising adhesively-fixed extruded polystyrene insulation (XPS) with supplementary mechanical fixings, basecoat and a clay brick-slip finish. The system is suitable for use on the outside face of external masonry walls 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 system can be used to improve the thermal performance of external walls and can contribute to meeting the requirements of the national Building Regulations (see section 6).

**Strength and stability** — the system can adequately resist wind loads and has sufficient resistance to impact-damage (see section 7).

**Behaviour in relation to fire** — the system has a reaction to fire classification of B-s1, d0 in accordance with BS EN 13501-1 : 2007 (see section 8).

**Risk of condensation** — the system can contribute to limiting the risk of interstitial and surface condensation (see section 11).

**Durability** — when installed and maintained in accordance with the Certificate holder's recommendations and the terms of the Certificate, the system will remain effective for at least 30 years (see section 13).

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

On behalf of the British Board of Agrément

Date of First issue: 4 May 2016

John Albon — Head of Approvals  
Construction Products

Claire Curtis-Thomas  
Chief Executive



*The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at [www.bbacerts.co.uk](http://www.bbacerts.co.uk)*

*Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.*

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# Regulations

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



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

<b>Requirement:</b>	<b>A1</b>	<b>Loading</b>
<b>Comment:</b>	The system can sustain and transmit wind loads to the substrate wall. See sections 7.1 to 7.5 of this Certificate.	
<b>Requirement:</b>	<b>B4(1)</b>	<b>External fire spread</b>
<b>Comment:</b>	The system can satisfy this Requirement. See sections 8.1 to 8.4 of this Certificate.	
<b>Requirement:</b>	<b>C2(b)</b>	<b>Resistance to moisture</b>
<b>Comment:</b>	The system can provide a degree of protection against rain ingress. See sections 4.4 and 10.1 of this Certificate.	
<b>Requirement:</b>	<b>C2(c)</b>	<b>Resistance to moisture</b>
<b>Comment:</b>	The system can contribute to minimising the risk of interstitial and surface condensation. See sections 11.1, 11.2 and 11.4 of this Certificate.	
<b>Requirement:</b>	<b>L1(a)(i)</b>	<b>Conservation of fuel and power</b>
<b>Comment:</b>	The system can contribute to satisfying this Requirement. See sections 6.2 and 6.3 of this Certificate.	
<b>Regulation:</b>	<b>7</b>	<b>Materials and workmanship</b>
<b>Comment:</b>	The system is acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.	
<b>Regulation:</b>	<b>26</b>	<b>CO<sub>2</sub> emission rates for new buildings</b>
<b>Regulation:</b>	<b>26A</b>	<b>Fabric energy efficiency rates for new dwellings (applicable to England only)</b>
<b>Regulation:</b>	<b>26A</b>	<b>Primary energy consumption rates for new buildings (applicable to Wales only)</b>
<b>Regulation:</b>	<b>26B</b>	<b>Fabric performance values for new dwellings (applicable to Wales only)</b>
<b>Comment:</b>	The system can contribute to satisfying these Regulations; however, compensating fabric/services measures may be required. See sections 6.2 and 6.3 of this Certificate.	



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

<b>Regulation:</b>	<b>8(1)(2)</b>	<b>Durability, workmanship and fitness of materials</b>
<b>Comment:</b>	The system can contribute to a construction satisfying this Regulation. See sections 12 and 13.1 and the <i>Installation</i> part of this Certificate.	
<b>Regulation:</b>	<b>9</b>	<b>Building standards applicable to construction</b>
<b>Standard:</b>	<b>1.1</b>	<b>Structure</b>
<b>Comment:</b>	The system can sustain and transmit wind loads to the substrate wall. See sections 7.1 to 7.5 of this Certificate.	
<b>Standard:</b>	<b>2.6</b>	<b>Spread to neighbouring buildings</b>
<b>Comment:</b>	The system can satisfy this Standard, with reference to clauses 2.6.4 <sup>(1)(2)</sup> , 2.6.5 <sup>(1)</sup> and 2.6.6 <sup>(2)</sup> . See sections 8.1 to 8.6 of this Certificate.	
<b>Standard:</b>	<b>2.7</b>	<b>Spread on external walls</b>
<b>Comment:</b>	The system can satisfy this Standard, and is acceptable for use more than one metre from a boundary, with reference to clauses 2.7.1 <sup>(1)(2)</sup> and 2.7.2 <sup>(2)</sup> , and Annex 2A <sup>(1)</sup> . See sections 8.1 to 8.6 of this Certificate.	
<b>Standard:</b>	<b>3.10</b>	<b>Precipitation</b>
<b>Comment:</b>	The system can contribute to a construction satisfying this Standard, with reference to clauses 3.10.1 <sup>(1)(2)</sup> and 3.10.2 <sup>(1)(2)</sup> . See sections 4.4 and 10.1 of this Certificate.	
<b>Standard:</b>	<b>3.15</b>	<b>Condensation</b>
<b>Comment:</b>	The system can contribute to satisfying this Standard, with reference to clauses 3.15.1 <sup>(1)(2)</sup> , 3.15.4 <sup>(1)(2)</sup> and 3.15.5 <sup>(1)(2)</sup> . See sections 11.3 and 11.4 of this Certificate.	
<b>Standard:</b>	<b>6.1(b)</b>	<b>Carbon dioxide emissions</b>
<b>Standard:</b>	<b>6.2</b>	<b>Building insulation envelope</b>
<b>Comment:</b>	The system can contribute to satisfying these Standards, with reference to clauses (or parts of) 6.1.1 <sup>(1)</sup> , 6.1.2 <sup>(1)(2)</sup> , 6.1.3 <sup>(1)(2)</sup> , 6.1.6 <sup>(1)</sup> , 6.1.10 <sup>(2)</sup> , 6.2.1 <sup>(1)(2)</sup> , 6.2.3 <sup>(1)</sup> , 6.2.4 <sup>(2)</sup> , 6.2.5 <sup>(2)</sup> , 6.2.6 <sup>(1)</sup> , 6.2.7 <sup>(1)</sup> , 6.2.8 <sup>(2)</sup> , 6.2.9 <sup>(1)(2)</sup> , 6.2.10 <sup>(1)</sup> , 6.2.11 <sup>(1)</sup> , 6.2.12 <sup>(2)</sup> and 6.2.13 <sup>(1)(2)</sup> . See sections 6.2 and 6.3 of this Certificate.	
<b>Standard:</b>	<b>7.1(a)(b)</b>	<b>Statement of sustainability</b>
<b>Comment:</b>	The system can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting the bronze level of sustainability as defined in this Standard. In addition, the system can contribute to a construction meeting a higher level of sustainability as defined in this Standard with reference to clauses 7.1.4 <sup>(1)(2)</sup> [Aspect 1 <sup>(1)(2)</sup> and 2 <sup>(1)</sup> ], 7.1.6 <sup>(1)(2)</sup> [Aspect 1 <sup>(1)(2)</sup> and 2 <sup>(1)</sup> ] and 7.1.7 <sup>(1)(2)</sup> [Aspect 1 <sup>(1)(2)</sup> ]. See section 6.2 of this Certificate.	
<b>Regulation:</b>	<b>12</b>	<b>Building standards applicable to conversions</b>
<b>Comment:</b>	All comments given for the system under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 <sup>(1)(2)</sup> and Schedule 6 <sup>(1)(2)</sup> . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).	



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

Regulation:	23	Fitness of materials and workmanship
Comment:		The system is acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.
Regulation:	28(b)	Resistance to moisture and weather
Comment:		Walls insulated with the system can satisfy this Regulation. See sections 4.4 and 10.1 of this Certificate.
Regulation:	29	Condensation
Comment:		Walls insulated with the system can satisfy the requirements of this Regulation. See section 11.4 of this Certificate.
Regulation:	30	Stability
Comment:		The system can sustain and transmit wind loads to the substrate wall. See sections 7.1 to 7.5 of this Certificate.
Regulation:	36(a)	External fire spread
Comment:		The system has a low risk surface and can satisfy this Regulation. See sections 8.1 to 8.4 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40	Target carbon dioxide emission rate
Comment:		The system can contribute to satisfying these Regulations. See sections 6.2 and 6.3 of this Certificate.

### Construction (Design and Management) Regulations 2015

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

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

See section: 3 *Delivery and site handling* (3.2 and 3.4) of this Certificate.

## Additional Information

### NHBC Standards 2016

NHBC accepts the use of the Candiwall XPS External Wall Insulation System, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards, Part 6 Superstructure, Chapter 6.9 Curtain Walling and Cladding*.

## Technical Specification

### 1 Description

1.1 The Candiwall XPS External Wall Insulation System comprises XPS insulation boards which are primarily bonded to the external surfaces of the wall with a minimum of 60% coverage of adhesive (achieved after the boards have been pressed against the wall), with supplementary mechanical fixings applied through the insulation boards. Brick-slip adhesive is applied to surface of the boards to a uniform thickness (3 mm) and a selected brick-slip finish applied. See Figure 1 of this Certificate.

1.2 The system is made up of the following components:

#### Adhesive

- Candiwall Adhesive — a cement-based powder containing cement conforming to BS EN 197-1 : 2011, and additives, mixed with approximately 6 to 6.5 litres of clean water per 25 kg bag of powder to form a paste. This is used to fix the insulation boards to the substrate and applied to 60% of the board's surface.

#### Insulation<sup>(1)</sup>

- Candiwall XPS 300 — extruded polystyrene insulation (XPS) consisting of rebated interlocking insulation boards measuring 1250 mm by 600 mm, in a range of thicknesses between 40 mm<sup>(2)</sup> and 120 mm. The boards have a nominal density of 33 kg·m<sup>-3</sup>, a minimum compressive strength of 300 kPa and a nominal tensile strength (perpendicular to the face) of 500 kPa. The boards are manufactured to comply with the requirements for XPS 300, Class E material to BS EN 13164 : 2012.

(1) For declared thermal conductivity values ( $\lambda_D$ ) see Table 3 of this Certificate.

(2) Insulation thicknesses of 30 mm, 40 mm and 50 mm are also available and are used on reveals.

#### Supplementary mechanical fixings

Mechanical fixings — 60 mm plate sleeve with adequate length to suit the substrate and insulation thickness and selected from:

- WKRET-MET-LTX  $\phi$ 10 — Polypropylene anchor sleeve with grey or black polyamide PA6 GF30 expansion pin.
- WKRET-MET-LMX  $\phi$ 10 — Polypropylene anchor sleeve with galvanized-coated steel expansion pin.

(1) Other fixings may be used provided they can be demonstrated to have equal or higher pull-out (than 0.50 kN), plate diameter and plate stiffness characteristics ( $> 0.2 \text{ kN}\cdot\text{m}^{-2}$ ).

## Brick-slip adhesive

- Candiwall Brick-Slip Adhesive — a cement-based powder containing cement (conforming to BS EN 197-1 : 2011) and additives, mixed with approximately 6 to 6.5 litres of clean water per 25 kg bag of powder to form a paste. It is applied to a thickness of 4 mm to 6 mm.

## Brick-slip finishes

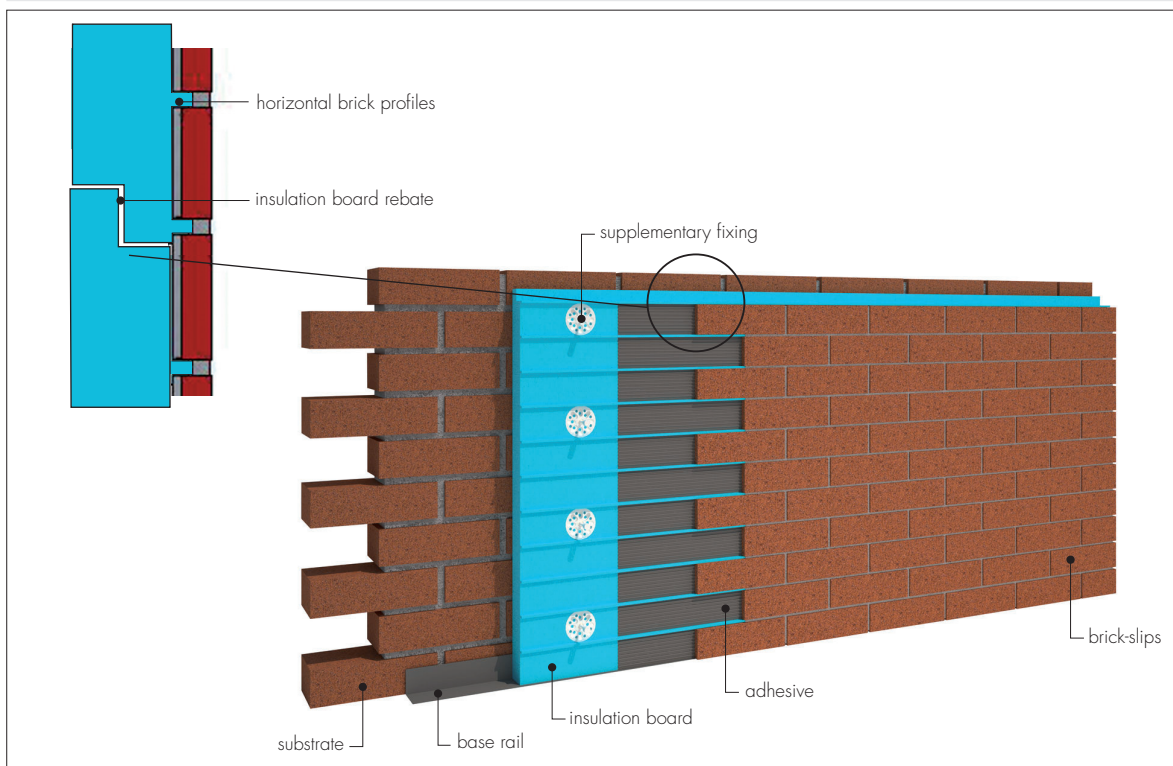
- Candiwall Brick-Slips — fired clay ceramic brick-slips, available in different sizes conforming to BS EN 14411 : 2012 and colours, with and without water-repellent surfaces, and in different surface finishes such as Classic, Prestige and Rustic. See Table 1:

Table 1 Brick-slip characteristics	
Brick-slip types	Characteristics
Rectangular-shape brick-slips	210 mm x 50 mm 210 mm x 65 mm
L-shape corner brick-slips	210 mm x 50 mm + 90 mm x 50 mm 210 mm x 65 mm + 90 mm x 65 mm
Thickness	14 mm
Weight (210 mm x 50 mm)	0.28 kg per brick-slip
Weight (210 mm x 65 mm)	0.36 kg per brick-slip

## Pointing mortar

- Candiwall Pointing Mortar — a pre-coloured water-repellent, frost-resistant, cementitious pointing mortar in accordance with BS EN 13888 : 2009 and containing cement conforming to BS EN 197-1 : 2011, aggregates conforming to BS EN 13139 : 2002 and additives. It is supplied in powder form and mixed with 4 litres to 4.5 litres of clean water per 25 kg bag.

Figure 1 Candiwall XPS External Wall Insulation System



### 1.3 Ancillary materials also used with the system include:

- range of aluminium, PVC-U or stainless steel profiles, comprising:
  - base, edge, corner profiles
  - render stop and connector profiles
  - fire barrier (lamella).

### 1.4 Ancillary materials also used with the system but outside the scope of this Certificate include:

- fungicidal wash, water-based masonry cleaner and steriliser containing biocides
- expansion foam — fire-rated polyurethane foam used for filling gaps between insulation boards
- sealant — one-component polymer-based water-resistant membranes
- mineral wool fire barrier
- movement and expansion joint profiles.

## 2 Manufacture

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

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

## 3 Delivery and site handling

3.1 The insulation boards are delivered to site wrapped in polythene. Each pack carries the product identification and batch numbers.

3.2 The remaining components are delivered in the quantities and packages listed in Table 2. Each package carries the product identification and batch number.

*Table 2 Component supply details*

Component	Quantity and packaging
Candiwall Brick-Slip Adhesive	25 kg bags
Candiwall Pointing Mortar	25 kg bags
Candiwall Brick-slips	22 kg box
Mechanical fixings	200 boxed by manufacturer

3.3 The insulation boards should be stored on a firm, clean, level base, off the ground and under cover until required for use. The boards should be protected from prolonged exposure to sunlight, either by storing opened packs under cover or re-covering with opaque polythene sheeting. Boards that become damaged, soiled or wet should be discarded.

3.4 The boards should not be exposed to open flame or other ignition sources and care must be taken when handling the boards to avoid contact with solvents or materials containing volatile organic components.

3.5 Adhesive and pointing mortar are supplied in powder form and must be stored in dry conditions, off the ground and protected from moisture. Contaminated materials should be discarded.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Candiwall XPS External Wall Insulation System.

## Design Considerations

### 4 General

4.1 The Candiwall XPS External Wall Insulation System, when installed in accordance with this Certificate, is effective in reducing the thermal transmittance (U value) of external masonry walls of new and existing buildings. It is essential that the detailing techniques specified in this Certificate are carried out to a high standard if the ingress of water into the insulation is to be avoided and the full thermal benefit obtained from treatment with the system (eg the insulation must be protected by an overhang, and window sills should be designed and installed so as to direct water away from the building). Only details specified by the Certificate holder should be used.

4.2 The system is for application to the outside face of external walls of masonry, or dense or no-fines concrete construction, on new or existing domestic and non-domestic buildings (with or without existing render) up to 18 metres in height. Prior to installation of the system, wall surfaces should comply with section 14 of this Certificate.

4.3 For improved thermal/carbon-emissions performance, the designer should consider additional/alternative fabric and/or services measures.



4.4 New walls subject to national Building Regulations should be constructed in accordance with the relevant recommendations of:

- BS EN 1996-2 : 2006, in that the designer should select a construction appropriate to the local wind-driven rain index, paying due regard to the design detailing, workmanship and materials to be used
- BS 8000-3 : 2001.

4.5 New walls not subject to regulatory requirements should also be built in accordance with the Standards identified in section 4.4 of this Certificate.



4.6 The system will provide a degree of protection against rain ingress and give a decorative finish. However, care should be taken to ensure that walls are adequately weathertight prior to its application. It may only be installed where there are no signs of dampness on the inner surface of the wall other than those caused solely by condensation.

4.7 The effect of the system on the acoustic performance of a construction has not been assessed and is outside the scope of this Certificate.

4.8 The area of the individual ceramic brick-slips must not exceed  $0.0126 \text{ m}^2$ , the lengths of the sides must not exceed  $0.21 \text{ m}$  and the thickness must be  $14 \text{ mm}$ .

4.9 If the joints make up  $\leq 6\%$  of the area as a whole, evidence must be provided of long-term freedom from condensation with the aid of a calculation method that records transient heat and moisture transfer in accordance with BS EN ISO 13788 : 2012. The water absorption of the brick-slips must not exceed  $6.0\%$  in accordance with BS EN ISO 10545-3 : 1979.

4.10 Expansion joints between building sections must be created using expansion profiles up to the outer edge of the insulation.

4.11 External pipework and ducts should be removed before installation and alterations made to underground drainage, where appropriate, to accommodate repositioning of the pipework to the finished face of the system. The Certificate holder should be contacted for further advice.

4.12 The fixing of sanitary pipework, plumbing, rainwater goods, satellite dishes, clothes lines, hanging baskets and similar items should be repositioned to the finished face of the system (outside the scope of this Certificate).

4.13 It is essential that the insulation system is installed and maintained in accordance with the conditions set out in this Certificate.

## 5 Practicability of installation

The system should only be installed by specialised contractors who have successfully undergone training and registration by the Certificate holder.

Note: The BBA operates a UKAS-accredited Approved Installer Scheme for external wall insulation; details of approved installer companies are included on the BBA's website ([www.bbacerts.co.uk](http://www.bbacerts.co.uk)).

## 6 Thermal performance

6.1 Calculations of thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE Report BR 443 : 2006, using the thermal conductivities ( $\lambda_D$  value) of the insulations given in Table 3 of this Certificate.

*Table 3 Declared thermal conductivity values ( $\lambda_D$ ) and available thicknesses*

Insulation type	Thickness (mm) <sup>(1)</sup>	Thermal conductivity ( $\text{W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ )
XPS	40-60	0.035
	70-80	0.036
	100-120	0.038

(1) The U values are calculated using the overall thickness, reducing by 3 mm rips that the bricks sit into.



6.2 The U value of a completed wall will depend on the selected insulation thickness, the type and number of fixings, the insulating value of the substrate masonry and its internal finish. Calculated U values for sample constructions in accordance with the national Building Regulations are given in Table 4 (these are based on the thermal conductivities given in Table 3 of this Certificate).

**Table 4 Insulation thickness required to achieve design U values<sup>(1)|(2)|(3)</sup>**


U value (W·m <sup>-2</sup> ·K <sup>-1</sup> ) <sup>(4)</sup>	Thickness of insulation <sup>(3)</sup> (mm)	
	215 mm brickwork, $\lambda = 0.56 \text{ W·m}^{-1}\cdot\text{K}^{-1}$	200 mm dense blockwork, $\lambda = 1.75 \text{ W·m}^{-1}\cdot\text{K}^{-1}$
	XPS	XPS
0.18	— <sup>(5)</sup>	— <sup>(5)</sup>
0.19	— <sup>(5)</sup>	— <sup>(5)</sup>
0.25	— <sup>(5)</sup>	— <sup>(5)</sup>
0.26	— <sup>(5)</sup>	— <sup>(5)</sup>
0.28	— <sup>(5)</sup>	— <sup>(5)</sup>
0.30	— <sup>(5)</sup>	— <sup>(5)</sup>
0.35	110	110

- (1) Wall construction inclusive of 13 mm plaster ( $\lambda = 0.57 \text{ W·m}^{-1}\cdot\text{K}^{-1}$ ), brickwork (protected) with 17.1% mortar or dense blockwork with 6.7% mortar ( $\lambda = 0.88 \text{ W·m}^{-1}\cdot\text{K}^{-1}$ ). Declared thermal conductivity of insulation is as shown in Table 2. A 5 mm thick adhesive layer with  $\lambda = 1 \text{ W·m}^{-1}\cdot\text{K}^{-1}$  covering 100% of the area is also included and a board emissivity of 0.9, together with an external render thickness of 19 mm with  $\lambda = 0.77 \text{ W·m}^{-1}\cdot\text{K}^{-1}$ .
- (2) Calculations based on a system that included 9 galvanized steel fixings per square metre with a point thermal transmittance ( $\chi_p$ ) of  $0.004 \text{ W·K}^{-1}$  per steel pin. Use of other types of fixings should be calculated in accordance with BS EN ISO 6946 : 2007. A gap correction ( $\Delta U''$ ) of zero is assumed.
- (3) Based upon incremental insulation thickness of 10 mm.
- (4) When applying the maximum available insulation thickness, these walls can achieve U values of  $0.35 \text{ W·m}^{-2}\cdot\text{K}^{-1}$ .
- (5) See section 4.3 of this Certificate.

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 Strength and stability

### General

 7.1 When installed on suitable walls, the system can adequately transfer to the wall the self-weight and negative (suction) and positive (pressure) wind loads normally experienced in the United Kingdom.

7.2 Positive wind load is transferred to the substrate wall directly via compression of the brick-slips, brick-slip adhesive and insulation.

7.3 Negative wind load is resisted by the bond of the insulation, brick-slip adhesive and brick-slips (resistance  $\geq 80 \text{ kN·m}^{-2}$  and a safety factor of 9 used). The insulation boards are restrained by the external wall insulation system adhesive and supplementary mechanical fixings.

7.4 The wind loads on the wall should be calculated in accordance with BS EN 1991-1-4 : 2005, and its National Annex. Special consideration should be given to locations with high wind-load pressure coefficients, as additional fixings may be necessary. In accordance with BS EN 1990 : 2002, it is recommended that a load factor of 1.5 is used to determine the ultimate wind load to be resisted by the system.

7.5 Assessment of structural performance for individual installations should be carried out by a suitably qualified and experienced individual to confirm that:

- the substrate wall has adequate strength to resist the additional loads that may be applied as a result of installing the system, ignoring any positive contribution that may occur from the system
- the proposed system (with associated supplementary fixing layout) provides adequate resistance to negative wind loads
- an appropriate number of site-specific pull-off (bond strength) tests have been conducted on the substrate of the building to determine the minimum resistance to failure of the bond strength.

7.6 The bond strength between the adhesive and the substrate should be determined on site and taken as the mean of the five results divided by a safety factor of 9 and multiplied by the minimum bond area.

7.7 The minimal admissible calculated bonded surface area (S) for the system is 60%<sup>(1)</sup>, in accordance with ETAG 004 : 2013.

(1) This bonded area should be increased if the bond strength between the adhesive and the substrate is less than the ultimate wind load.

7.8 The initial adhesive bond between the insulation and the substrate will have a minimum failure resistance of  $30 \text{ kN·m}^{-2}$ . For calculating the design resistance, a minimum bonded area should be considered and a safety factor of 9 applied.

7.9 The number of supplementary fixings, and the span between them, should be determined by the system designer. The mechanical fixings, which must be covered by an appropriate European Technical Assessment or Approval (ETA),

will initially transfer the weight of the system to the substrate wall while the adhesive sets (see section 1.2). Fixings must be selected to give adequate support to the weight of the system at the minimum spacing.

### Impact resistance

7.10 Hard body impact tests were carried out in accordance with ETAG 004 : 2000 (amended 2013). The system is suitable for use in all Use Categories<sup>(1)</sup>.

(1) The Use Categories are defined in ETAG 004 : 2013 as follows:

- Category I — a zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use
- Category II — a zone liable to impacts from thrown or kicked objects, but in public locations where the height of the system will limit the size of the impact; or at lower levels where access to the building is primarily to those with some incentive to exercise care
- Category III — a zone not likely to be damaged by normal impacts caused by people or by thrown or kicked objects.


## 8 Behaviour in relation to fire

 8.1 The reaction to fire classification is B-s1, d0 in accordance with BS EN 13501-1 : 2007.

 8.2 The fire classification applies to the full range of thicknesses covered by this Certificate.

8.3 The system is restricted for use in buildings up to 18 metres in height.

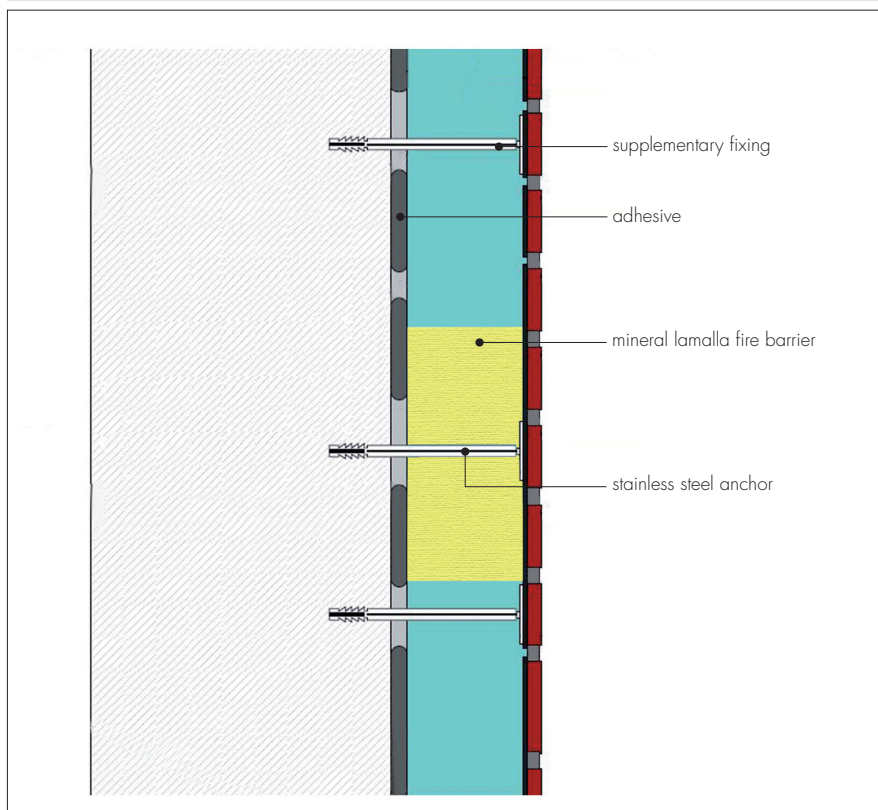
8.4 For houses in Scotland and for all buildings in England, Wales and Northern Ireland, the system is considered suitable for use on, or at any distance from, the boundary.

 8.5 For flats and maisonettes and non-domestic buildings in Scotland, the system is suitable only for use more than one metre from the boundary.

8.6 The system is not classified as 'non-combustible'; therefore, calculations for unprotected areas may apply dependent on the fire resistance characteristics of the wall.

8.7 For application to second storey walls and above, it is recommended that the designer considers at least one stainless steel fixing per square metre and fire barriers in line with compartment walls and floors as advised in BRE Report BR 135 : 2013 (see Figure 2 of this Certificate).

Figure 2 Fire barrier





## 9 Proximity of flues and appliances

When the system is installed in close proximity to certain flue pipes, the relevant provisions of the national Building Regulations should be met:

**England and Wales** — Approved Document J

**Scotland** — Mandatory Standard 3.19, clause 3.19.4<sup>(1)(2)</sup>

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

**Northern Ireland** — Technical Booklet L.

## 10 Water resistance



10.1 The system will provide a degree of protection against water ingress. However, care should be taken to ensure that walls are adequately watertight prior to application of the system. The system must only be installed where there is no sign of dampness on the inner surface of the substrate other than that caused solely by condensation.

10.2 Designers and installers must take particular care in detailing around openings, penetrations and movement joints to minimise the risk of water ingress.

10.3 The guidance given in BRE Report BR 262 : 2002 should be followed in connection with the watertightness of solid wall constructions. The designer should select a construction appropriate to the local wind-driven index, paying due regard to the design detailing, workmanship and materials to be used.

10.4 At the top of walls, the system should be protected by an adequate coping, parapet, overhang or other detail designed for use with this type of system (see section 16).

## 11 Risk of condensation



11.1 Designers must ensure that an appropriate condensation risk analysis has been carried out for all parts of the construction, including openings and penetrations at junctions between the insulation system and windows, to minimise the risk of condensation. The recommendations of BS 5250 : 2011 should be followed.

### Surface condensation

11.2 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 and openings comply with section 6.3 of this Certificate.



11.3 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, section 4 and Annex G, and BRE Report BR 262 : 2002.

### Interstitial condensation



11.4 Walls incorporating the system will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Section 4 and Annexes D and G and Table 7.

11.5 The equivalent air layer thickness ( $S_d$ ) and water vapour resistance ( $\mu$ ) factor for the insulation boards and brick-slips is as given in Table 5 of this Certificate.

Table 5 Water vapour resistance factor and equivalent air layer thickness

Description	Thickness (mm)	$S_d$ (m)	( $\mu$ )
Enhanced XPS insulation boards (Candiwall XPS 300)	30 to 120	—	83 <sup>(1)</sup>
Candiwall clay Brick-slip adhesive + Brick-slips (210 mm x 50 mm)	14	0.06 <sup>(2)</sup>	—
Candiwall clay Brick-slip adhesive + Brick-slips (210 mm x 65 mm)		0.23 <sup>(2)</sup>	—

(1) The water vapour resistance factor ( $\mu$ ) is taken from test data.

(2) The values are obtained from tests, including those on the brick-slip adhesive, brick-slips and pointing mortar, but not the insulation.

## 12 Maintenance and repair



- 12.1 An initial inspection should be made within 12 months and regularly thereafter to include:
- visual inspection of the brick-slips and grout for signs of damage. Cracks exceeding 0.2 mm around the joints must be repaired.
  - examination of the sealant around openings and service entry points
  - visual inspection of architectural details designed to shed water to confirm that they are performing properly
  - visual inspection to ensure that water is not leaking from external downpipes or gutters

- necessary repairs effected immediately and the sealant joints at window and door frames replaced at regular intervals
- maintenance schedules, which should include the replacement and resealing of joints, for example between the insulation system and window and door frame.

12.2 Damaged areas must be repaired using the appropriate components and procedures detailed in the Certificate holder's installation instructions and in accordance with BS EN 13914-1 : 2005.

## 13 Durability



13.1 The system will have a service life of not less than 30 years provided any damage to the surface finish is repaired immediately and regular maintenance is undertaken, as described in section 12.

13.2 Any mortar containing cement may be subject to lime bloom. The occurrence of this may be reduced by avoiding application in adverse weather conditions. The effect is transient and less noticeable on lighter colours.

13.3 The mortar may become discoloured with time, the rate depending on the initial colour, the degree of exposure and atmospheric pollution, as well as the design and detailing of the wall. In common with traditional mortar, discoloration by algae and lichens may occur in wet areas. The appearance may be restored by cleaning in accordance with the Certificate holder's recommendations.

## Installation

### 14 Site survey and preliminary work

14.1 A pre-installation survey of the property must be carried out to determine suitability for treatment and the need for any necessary repairs to the building structure before application of the system. A specification is prepared for each elevation of the building indicating:

- the position of beads
- detailing around windows, doors and at eaves
- damp-proof course (dpc) level
- exact position of expansion joints, if required
- areas where flexible sealants must be used
- any alterations to external plumbing
- the position of fire barriers.

14.2 The survey should include tests conducted on the walls of the building by the Certificate holder or their approved installers to determine the pull-out resistance of the proposed supplementary mechanical fixings. An assessment and recommendation is made on the type and number of fixings required to withstand the building's expected wind loading based on calculations using the test data and pull-out resistance (see section 7) of this Certificate.

14.3 All modifications, such as provision for fire barriers (see section 8) and necessary repairs to the building structure, must be completed before installation of the system commences.

14.4 Wall surfaces must be sound, clean and free from loose material. The flatness of surfaces must be checked; this may be achieved using a straight-edge tool spanning the storey height. Any excessive irregularities, ie greater than 10 mm in one metre, must be made good prior to installation, to ensure that the insulation boards are installed with a smooth, in-plane finished surface.

14.5 Where surfaces are covered with an existing rendering, it is essential that the bond between the background and the render is adequate. All loose areas must be hacked off and reinstated.

14.6 On existing buildings, purpose-made window sills must be fitted to extend beyond the finished face of the system. New buildings should incorporate suitably deep sills.

14.7 Internal wet work, eg screed or plastering, should be completed and allowed to dry prior to the application of the system.

### 15 Approved installers

Application of the system, within the context of this Certificate, must be carried out by approved installers recommended or recognised by the Certificate holder. Such an installer is a company:

- employing operatives who have been trained and recommended by the Certificate holder to install the system
- which has undertaken to comply with the Certificate holder's application procedure, containing the requirement for each application team to include at least one member operative trained by the Certificate holder
- subject to at least one inspection per annum by the Certificate holder to ensure suitable site practices are being employed. This may include unannounced site inspections.

## 16 Procedure

### General

16.1 Installation is carried out in accordance with the Certificate holder's current installation instructions.

16.2 Weather conditions should be monitored to ensure correct application and curing conditions. The adhesive and pointing materials should not be applied at temperatures below 5°C or above 30°C or if exposure to frost is likely, and the coating must be protected from rapid drying. Installation should not take place during rainfall or if rain is anticipated.

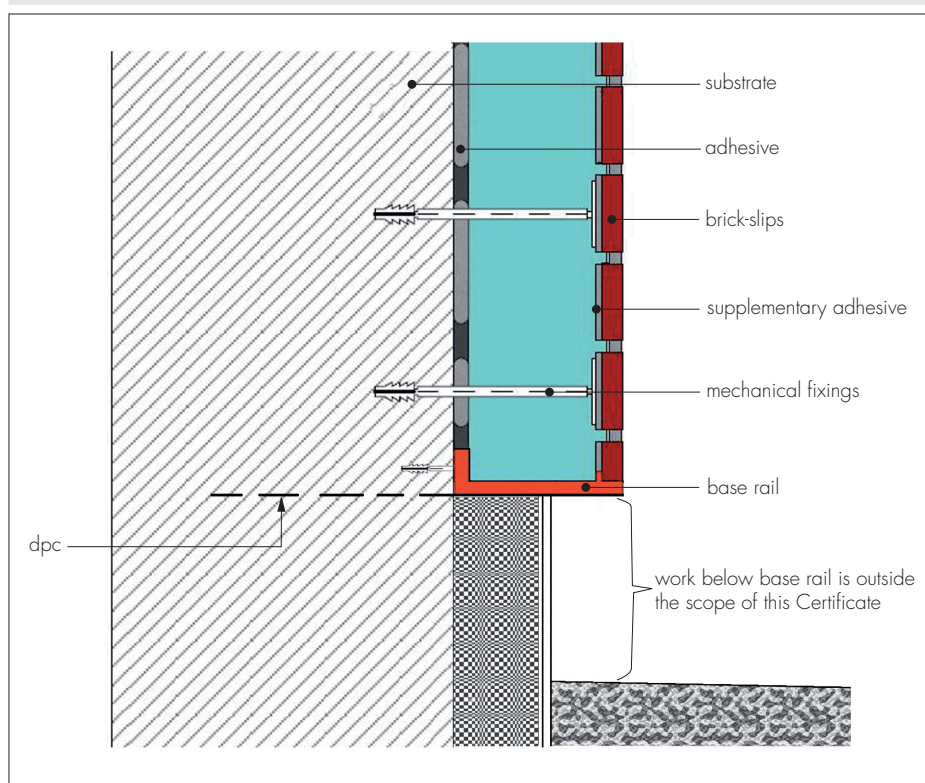
16.3 The planarity of the substrate must be checked to ensure that the insulation boards are level and flat, and any protrusions exceeding 10 mm removed.

16.4 Adhesive and grouting should be in accordance with the relevant recommendations of BS EN 13914-1 : 2005.

### Positioning and securing insulation boards

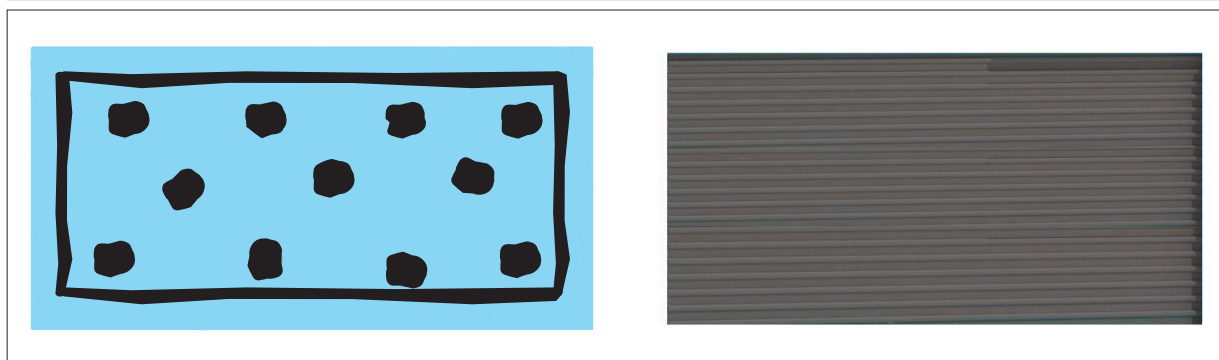
16.5 The Candiwall base profile is fixed level and secured to the external wall above the dpc using the approved profile fixings at approximately 300 mm centres (see Figure 3). Base rail connectors are inserted at all base profile joints. Extension profiles are fixed to the front lip of the base rail or stop end channel where appropriate.

Figure 3 Typical section at base level



16.6 The insulation adhesive is prepared by mixing each bag with 6 or 6.5 litres of water as directed. The adhesive is applied to the back of the boards in a continuous line around the perimeter of the board with several additional dabs of adhesive distributed uniformly over the remaining surface. At least 60% of the board should be covered. Alternatively, the adhesive can be applied over the entire face of the insulation board using a notched trowel (see Figure 4).

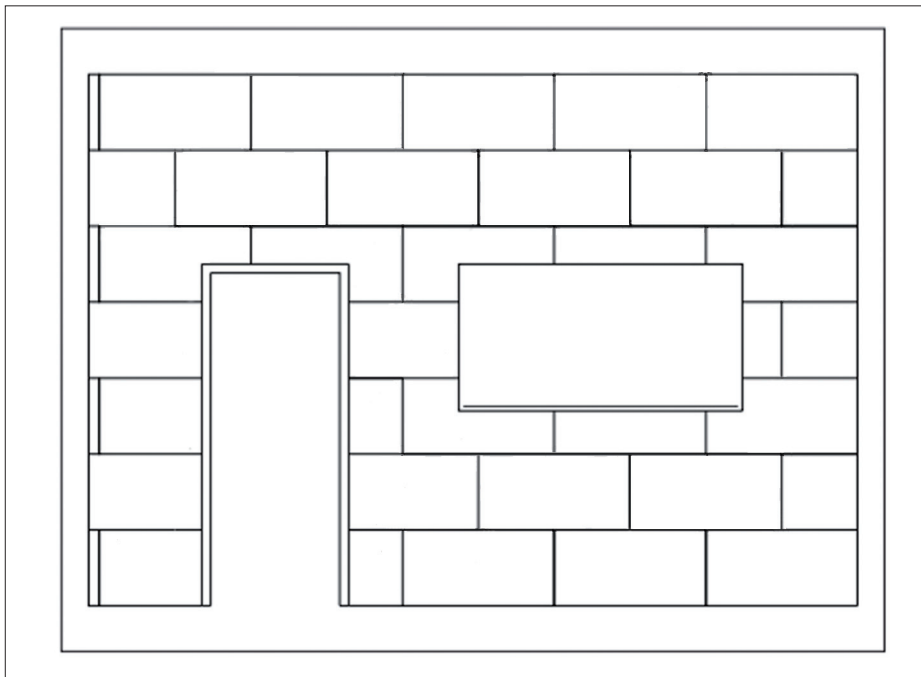
Figure 4 Insulation boards adhesive patterns



16.7 The first run of the insulation boards is positioned on the base profiles and pressed firmly against the wall, butted tightly together and aligned to achieve a level finish.

16.8 Subsequent rows of boards are positioned so that the vertical board joints are staggered and overlapped at the building corners and so that board joints do not occur within 200 mm of the corners of openings (see Figure 5). Gaps greater than 10 mm should be closed by repositioning or, where appropriate, by cutting boards to fit. Alignment should be checked as work proceeds.

*Figure 5 Typical arrangement of insulation boards*



16.9 To fit around details such as doors and windows, insulation boards may be cut with a sharp knife or a fine-tooth saw. If required, purpose-made window sills, designed to prevent water ingress and incorporating drips to shed water clear of the system, are fitted.

16.10 Before the Candiwall adhesive has set, supplementary mechanical fixings are applied through the insulation board into the substrate wall as described in section 16.11. The number of fixings is increased as required (such as in corner zones of the building), depending on the location of the building, wind load calculation and the installation height. Details of supplementary mechanical fixings (including their layout on the insulation boards) are based on pull-out test results, substrate type and wind loading data.

16.11 Holes are drilled through the insulation into the substrate wall to the required depth, one fixing in the centre of the insulation board and one on either side of this fixing, in a horizontal line. For a typical installation, after allowing for extra fixings in the end zones of the building, the average number of supplementary mechanical fixings is equal to nine fixings per square metre. Around openings, additional fixings should be installed as determined by the system designer. The mechanical fixings are inserted and tapped firmly into place, securing the boards to the substrate.

16.12 Window and door reveals should be insulated to minimise the effects of cold bridging. Where clearance is limited, strips of approved insulation should be installed to suit available margins and details. Installation continues until the whole wall is completely covered.

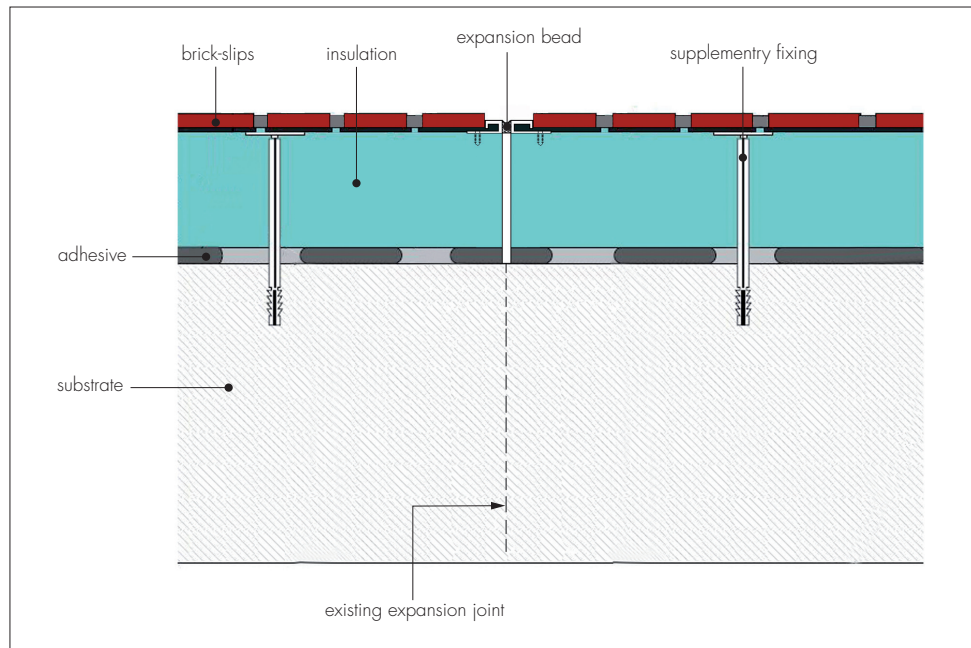
16.13 Prior to the application of the brick-slips, a bead of joint sealant is gun-applied at window and door frames, overhanging eaves, gas and electric meter boxes, wall vents, or where the system abuts any other building material or surface.

16.14 Building corners, door and window heads and jambs can be formed using special brick corner slips bonded to the insulation, in accordance with the Certificate holder's instructions.

### **Movement joints**

16.15 Movement joints in the substrate must be continued through the system. The joint detail using purpose-made PVC or metal trims is illustrated in Figure 6. The system must not be used to bridge existing expansion joints in the outer wall surface.

Figure 6 Movement joint detail



### Brick-slip adhesive and brick-slip application

16.16 Candiwall brick-slip adhesive is prepared by mixing approximately 6 to 6.5 litres of clean water per 25 kg bag of powder, mixing with a slow speed mixer for three to five minutes until homogeneous. The material should be allowed to stand for five minutes then remixed before use. Only full bags should be mixed and only enough material prepared for immediate use.

16.17 The adhesive is applied progressively using a specially notched trowel, working in one-metre sections in a horizontal direction to achieve a coverage of  $3.5 \text{ kg}\cdot\text{m}^{-2}$  to  $4 \text{ kg}\cdot\text{m}^{-2}$ .

16.18 The brick-slip adhesive is lightly buttered to the back of the corner brick-slips, which are then applied to corners and door/window reveals. The distance between corners and/or outer edges should be measured to identify the number of bricks required per course. The brick-slips are then placed between the horizontal rebates in the XPS board.

16.19 Where required, the brick-slips are cut to size using a bench saw or standard tile cutter. Vertical joints are staggered to give the appearance of conventional brickwork or installed in a stack bond pattern in accordance with the specified design. The vertical and horizontal joints between the brick slips must be 10 mm wide.

16.20 After the brick-slip application, sealant is positioned and installed at all openings (eg windows and doors), overhanging eaves, gas and electric meter boxes, wall vents or where the brick-slips abut any other building material or surface. This helps to reduce the risk of water ingress into the structure.

16.21 The drying time is dependent on weather conditions, but will typically be four days. Once the brick-slips have set, pointing is conducted using Candiwall Pointing Mortar and a pointing poly sponge or gun. Once the mortar is dry, walls should be brushed to remove all loose mortar etc.

16.22 Care should be taken in the detailing of the system around features such as openings, projections and at eaves (see Figures 7, 8 and 9) to ensure adequate protection against water ingress and to limit the risk of water penetrating the system (see section 10.4 of this Certificate).



Figure 7 Typical window sill details

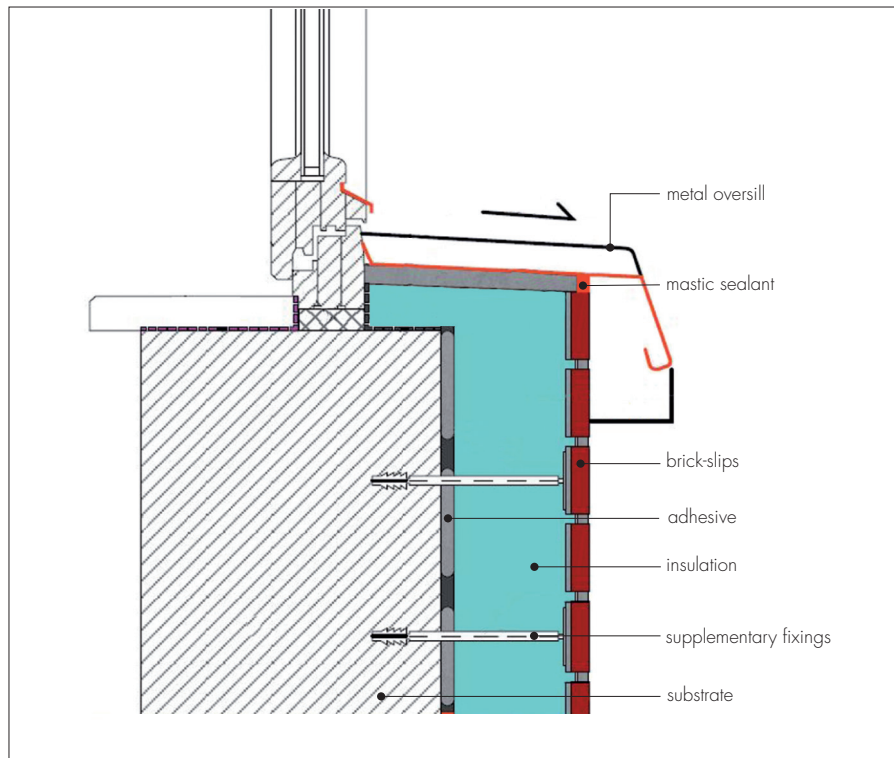


Figure 8 Insulated window or door reveal

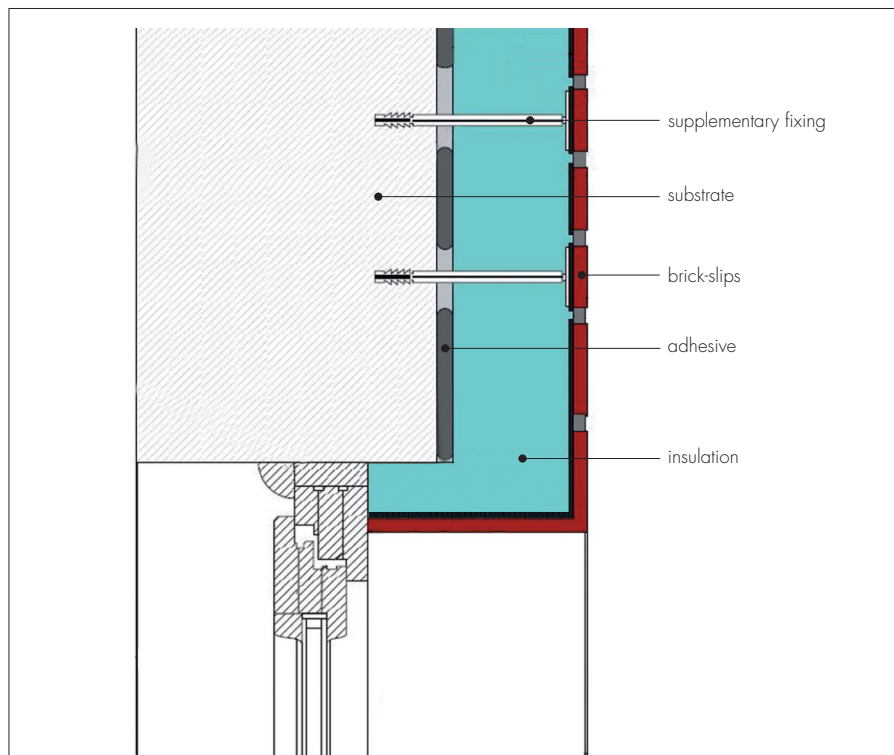
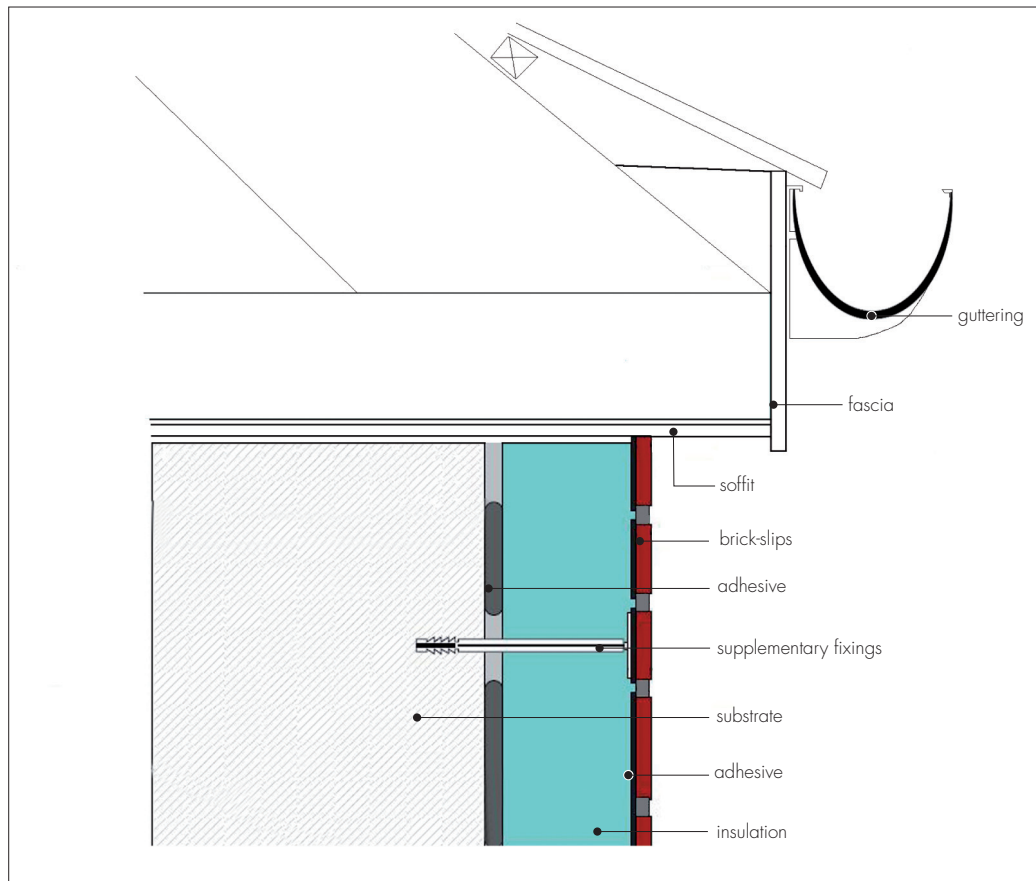


Figure 9 Typical eaves detail



## Technical Investigations

### 17 Tests

17.1 Tests were conducted and the results assessed to determine:

- fire performance
- bond strength
- hygrothermal performance
- resistance to frost
- resistance to impact
- water vapour permeability.

17.2 An assessment was made of data relating to:

- reaction to fire
- thermal conductivity
- the risk of interstitial condensation.

### 18 Investigations

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

18.2 The practicability of installation and the effectiveness of detailing techniques was assessed and found satisfactory.

## Bibliography

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- BS 8000-3 : 2001 *Workmanship on building sites — Code of practice for masonry*
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- BS EN 1990 : 2002 *Eurocode — Basis of structural design*
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- BRE Report (BR 135 : 2013) *Fire performance of external insulation of walls of multistorey buildings*
- BRE Report (BR 262 : 2002) *Thermal insulation: avoiding risks*
- BRE Report (BR 443 : 2006) *Conventions for U-value calculations*
- ETAG 004 : 2000 *Guideline for European Technical Approval of External Thermal Insulation Composite Systems (ETICS) with Rendering*
- ETAG 004 : 2013 *Guideline for European Technical Approval of External Thermal Insulation Composite Systems (ETICS) with Rendering*

## 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.