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Agrément Certificate

18/5601

Product Sheet 1

JABLITE GROUND HEAVE PROTECTION PRODUCTS (JGHP)

JGHP – VERTICAL HEAVE PROTECTION

This Agrément Certificate Product Sheet⁽¹⁾ relates to JGHP – Vertical Heave Protection, an expanded polystyrene (EPS) cellular void former for use in limiting the pressure exerted on in-situ reinforced suspended concrete floors or piled ground beams by expansion of clay soils (clay heave) or ground recovery.

(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

Structural performance — the safe- and fail-load capacities of the product have been assessed. Each grade has adequate strength to support a specified depth of wet concrete during construction and will collapse under its specified fail-load, limiting the upward pressures experienced during periods of clay heave (see section 6).

Thermal performance — the option incorporating an EPS layer can enable a floor to satisfy the design U values specified in the national Building Regulations (see section 7).

Durability — the product will perform effectively as a void former for the life of the building. The option incorporating an EPS layer will perform effectively as insulation for the life of the building (see section 10).



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

On behalf of the British Board of Agrément

Paul Valentine
Technical Excellence Director

Claire Curtis-Thomas
Chief Executive

Date of First issue: 17 December 2018

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

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

In the opinion of the BBA, JGHP – Vertical Heave Protection, 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:	A2	Ground movement
Comment:		The product helps to prevent the stability of the building being impaired by expansion of clay soils. See section 4.1 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The product can contribute to limiting the risk of interstitial and surface condensation. See sections 8.1 and 8.4 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The product can contribute to satisfying this Requirement. See section 7.3 of this Certificate.
Regulation:	7	Materials and workmanship (applicable to Wales only)
Regulation:	7(1)	Materials and workmanship (applicable to England only)
Comment:		The product is acceptable. See section 10 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 product can contribute to satisfying these Regulations. See section 7.3 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The product can contribute to a construction satisfying this Regulation. See section 10 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(b)	Structure
Comment:		The product can contribute to satisfying the relevant requirements of this Standard, with reference to clause 1.1.1 ⁽¹⁾⁽²⁾ . See section 4.1 of this Certificate.
Standard:	3.15	Condensation
Comment:		The product can contribute to limiting the risk of surface and interstitial condensation, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.4 ⁽¹⁾ and 3.15.5 ⁽¹⁾ of this Standard. See sections 8.1 and 8.5 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Comment:		The product can contribute to satisfying the requirements of this Standard, with reference to clauses 6.1.1 ⁽¹⁾ and 6.1.6 ⁽¹⁾ . See section 7.3 of this Certificate.
Standard:	6.2	Building insulation envelope
Comment:		The product can contribute to satisfying the requirements of this Standard, with reference to clauses 6.2.1 ⁽¹⁾ and 6.2.3 ⁽¹⁾ . See section 7.3 of this Certificate.

Standard:	7.1(a)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6, and therefore can contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	12	Building standards applicable to conversions
Comment:		Comments in relation to the product 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(a)(i)	Fitness of materials and workmanship
Comment:	(iii)(b)(i)	The product is acceptable. See section 10 and the <i>Installation</i> part of this Certificate.
Regulation:	29	Condensation
Comment:		The product can contribute to limiting the risk of interstitial condensation. See section 8.1 of this Certificate.
Regulation:	30	Stability
Comment:		The product contributes to satisfying the relevant requirements of this Regulation. See section 4.1 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		The product can contribute to satisfying these Regulations. See section 7.3 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* (3.3) of this Certificate.

Additional Information

NHBC Standards 2018

In the opinion of the BBA, JGHP – Vertical Heave Protection, 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 4.2 *Building near trees* and 4.4 *Raft, pile, pier and beam foundations*.

Technical Specification

1 Description

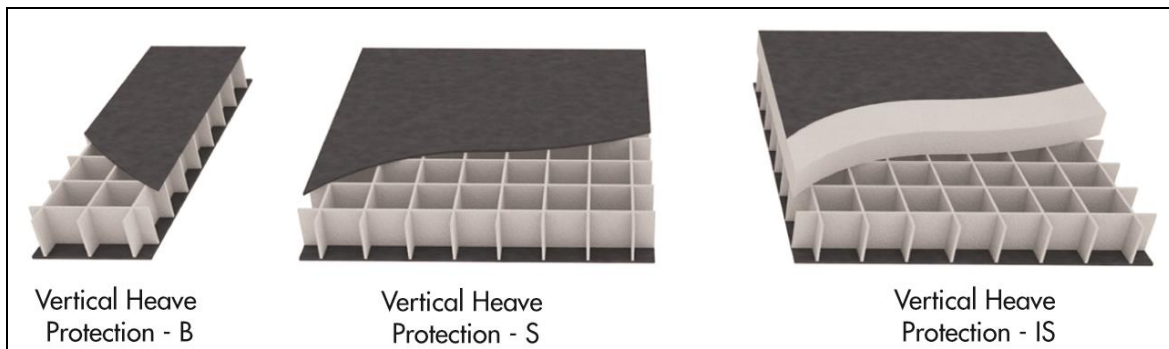
1.1 JGHP – Vertical Heave Protection consists of a cellular EPS compressible base in a range of different grades and depths, with three options for the integrally bonded top sheet (see Figure 1):

- Vertical Heave Protection – B (beam): with 5 mm thick polypropylene top sheet, and overall depths of 90, 155 and 220 mm to provide final voids of 50, 100 and 150 mm respectively
- Ground Heave Protection – S (slab): with 10 mm thick polypropylene top sheet, and overall depths of 95, 160 and 225 mm to provide final voids of 50, 100 and 150 mm respectively

- Vertical Heave Protection – IS (insulated slab): with 98 mm thick EPS 70 insulation layer and 2 mm thick polypropylene top sheet, and overall depths of 185, 250 and 315 mm to provide final voids of 50, 100 and 150 mm respectively

Note: All product types can also be supplied with an additional polypropylene bottom sheet.

Figure 1 JGHP – Vertical Heave Protection



1.2 All variants of the product are available in a standard size of 1200 by 1200 mm (other dimensions are available on request).

1.3 The product is available in 7 grades (see Table 1). Each grade is designed to support its specified safe-load for a period of 16 hours with compression limited to less than 6 mm, and to collapse by a specified amount dependent on the selected product depth under its specified fail-load (see section 6).

Table 1 Product grades and associated safe- and fail- loads

Product reference	Product grade	Safe-load (kN·m ⁻²)	Fail-load (kN·m ⁻²)
1	7/10	7	10
2	9/13	9	13
3	10/15	10	15
4	13/18	13	18
5	18/24	18	24
6	24/32	24	32
7	30/40	30	40

1.4 Each cell contains a drainage slot to prevent water becoming trapped within the cells.

1.5 Ancillary items which may be used with the product, but which are outside the scope of this Certificate, are:

- spacers — for reinforcement steel
- formwork sealing tape — typically 50 mm wide, to seal the joints between adjacent void formers.

2 Manufacture

2.1 The product is manufactured from EPS beads and polypropylene sheets using conventional moulding techniques.

2.2 The EPS blocks are cut to the appropriate size and shape to create interlocking strips and top sheets. The interlocking strips are joined together to form the cellular structure and then bonded to the EPS/polypropylene or polypropylene top sheet.

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

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities

- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.4 The management system of Jablite Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by the BSI (Certificate FM 01260).

3 Delivery and site handling

3.1 The product is normally delivered to site shrink-wrapped in polythene. Each unit carries a label bearing details of the product type, grade, length, width and overall depth.

3.2 The products must be stored flat, and protected from high winds and prolonged exposure to sunlight.

3.3 Contact with solvents and organic-based materials must be avoided.

3.4 The product must not be exposed to flame or ignition sources. Careful consideration should also be given to the management of fire risk when in storage; detailed guidance is given in the health and safety data sheet packaged with the product.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on JGHP – Vertical Heave Protection.

Design Considerations

4 Use



4.1 JGHP – Vertical Heave Protection is satisfactory for use either under reinforced concrete ground beams or under suspended reinforced concrete floor slabs, and is effective in limiting the pressure caused by expansion of clay soils (clay heave). The structural floor or beam must, in addition to normal design criteria, be designed to accommodate the maximum upward forces owing to clay heave (see sections 6.6 and 6.7) exerted by the void former.

4.2 The product must not be used on the vertical faces of concrete foundations.

4.3 Use of the product below the groundwater table, or on sites where hazardous gases such as methane or radon may be encountered, is outside the scope of this Certificate. If site investigations indicate the presence of volatile organic compounds (VOCs), an appropriately qualified person must assess the compatibility of the EPS with the likely emissions, especially for the product intended to perform an insulator function.

5 Practicability of installation

5.1 The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

5.2 Adequate supervision must be maintained to ensure correct installation (see section 12).

6 Structural performance

6.1 The appropriate product for each project is specified by product type, product grade and product depth.

Product type

6.2 The appropriate product type is selected according to the intended use and project specification (see section 1.1).

Product grade

6.3 The appropriate product grade is selected according to the depth of wet concrete that the product will be required to support during construction of the project (see Table 2), and includes an allowance for $1.5 \text{ kN}\cdot\text{m}^{-2}$ for imposed load including heaping of concrete during execution.

Product reference	Product grade	Depth of concrete (mm)
1	7/10	100-220
2	9/13	221-300
3	10/15	301-340
4	13/18	341-460
5	18/24	461-660
6	24/32	661-900
7	30/40	901-1140

6.4 It is normal for this type of product to experience some compression during concrete pouring. This will normally be less than 4 mm, dependent on the depth of the concrete and the method and rate of placement. Once the concrete has been poured, subsequent creep deflections will be minimal.

Product depth

6.5 The appropriate product depth is selected such that its specified deformation under the fail-load is equal to, or greater than, the void required according to the maximum anticipated ground movement owing to clay heave as established from site investigations (see Table 3). Further guidance on predicted ground movements in shrinkable soils is given in *NHBC Standards 2018*, Chapter 4.2.

Table 3 Product depth and deformation under failure load

Volume change potential	Void required (minimum product deformation at fail-load) (mm)	Overall product depth (mm)		
		Vertical Heave Protection - B	Vertical Heave Protection - S	Vertical Heave Protection - IS
Low	50	90	95	185
Medium	100	155	160	250
High	150	220	225	315

Upward pressure on slabs, beams and overall structure

6.6 In addition to the normal gravity loads, the suspended floor slabs, ground beams, connection between the slab and substructure, and – where piles are used – piles and pile/beam connections, should be designed to take account of the upward pressure that will be transferred through the product during periods of clay heave.

6.7 The ultimate upward pressure to be resisted (P_{ult}) should be determined as:

$$P_{ult} = (\gamma_Q \times PFL) - (\gamma_G \times G_k)$$

where:

PFL is the product fail-load (see Table 1)
 G_k is the self-weight of the slab or beam or piled structure, including concrete blinding (when used)
 γ_Q and γ_G are partial factors in accordance with BS EN 1992-1-1 : 2004 and BS EN 1990 : 2002 and their UK National Annexes, where $\gamma_Q = 1.5$ and $\gamma_G = 0.9$.

Temporary loads during construction

6.8 Provided that the recommendations given in sections 12 and 13 are satisfied, JGHP – Vertical Heave Protection will adequately resist the normal foot traffic and other short-term loads commonly associated with installation, and can be used without further protection.

6.9 Where heavy reinforcement (greater than $1 \text{ kN}\cdot\text{m}^{-2}$) is proposed, or where the reinforcement will be subjected to significant point loads from foot traffic or other imposed loading, the void formers should first be covered with a 50 mm thick concrete blinding.

6.10 Reinforcement should be supported on proprietary spacers selected to have a base area of sufficient size, and positioned at appropriate centres, to ensure that the maximum imposed load beneath each spacer is appropriate to the grade of product used. Advice, if required, about suitable reinforcement spacers may be obtained from the Certificate holder.

7 Thermal performance

7.1 Vertical Heave Protection – IS, which incorporates an EPS insulation layer, will contribute to the thermal performance of the floor.

7.2 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 (excluding the EPS cells), using the declared thermal conductivity (λ_D) value* of $0.030 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for grey EPS70 or $0.038 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ for white EPS70.



7.3 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 4. The product with the EPS layer (Ground Heave Protection – Ins. Slab 100) can be used for a floor satisfying the requirements of the national Building Regulations with a target U-value of 0.13 to $0.25 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$.

Table 4 Example U-values for Ground Heave Protection – Ins Slab 100

Concrete slab thickness (mm)	P/A ratio	98 mm EPS and 2 mm PP top sheet	
		White EPS $\lambda = 0.038 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$	Grey EPS $\lambda = 0.030 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$
150	0.4	0.22	0.19
	0.6	0.25	0.21
	0.7	0.25	0.22
	0.9	—	0.23

7.4 Care must be taken in the overall design and construction of junctions between the floor and external, internal and party walls, to limit excessive heat loss and air infiltration.

7.5 The junction ψ -values given in Table 5 may be used in SAP calculations, or values can be modelled in accordance with the requirements and guidance in BRE Report BR 497 : 2007, BRE Information Paper IP 1/06 and the provisions in the documents supporting the national Building Regulations relating to competency to perform calculations, determine robustness of design/construction and limiting heat loss by air infiltration.

Table 5 Junction ψ values

Junction	ψ ($\text{W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$)
External wall	$0.32^{(1)}$
Internal wall	$0.16^{(1)}$

(1) Conservative defaults from SAP 2012, Appendix K.

8 Condensation risk

Interstitial condensation



8.1 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.

8.2 The EPS insulation has a water vapour resistivity of between 100 and 200 MN·s·g·m⁻¹. The least favourable value should be used for condensation risk assessment.

8.3 The polypropylene top sheet will act as an air and vapour control layer (AVCL) when no additional insulation is used. Where additional floor insulation is specified, a calculation in accordance with BS EN ISO 13788 : 2012 must be undertaken.

Surface condensation



8.4 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 W·m⁻²·K⁻¹ at any point and the junctions with walls are in accordance with the relevant requirements of *Limiting thermal bridging and air leakage: Robust construction details for dwellings and similar buildings* TSO 2002 or BRE Information Paper IP 1/06.



8.5 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 W·m⁻²·K⁻¹ at any point and they are designed and constructed to BS 5250 : 2011. Additional guidance can be found in BRE Report BR 262 : 2002.

8.6 To minimise the risk of surface condensation at service penetrations, care should be taken to minimise gaps in the insulation layer.

9 Maintenance

The product is confined within the structure of the floor and does not require maintenance.

10 Durability



The product is dimensionally stable under varying conditions of temperature and humidity. It is rot-proof and water-resistant and will continue to perform effectively as a void former (and thermal insulation, where the product incorporating the EPS layer is used) for the life of the building.

11 Reuse and recyclability

The product contains EPS and polypropylene, which can be recycled.

Installation

12 General

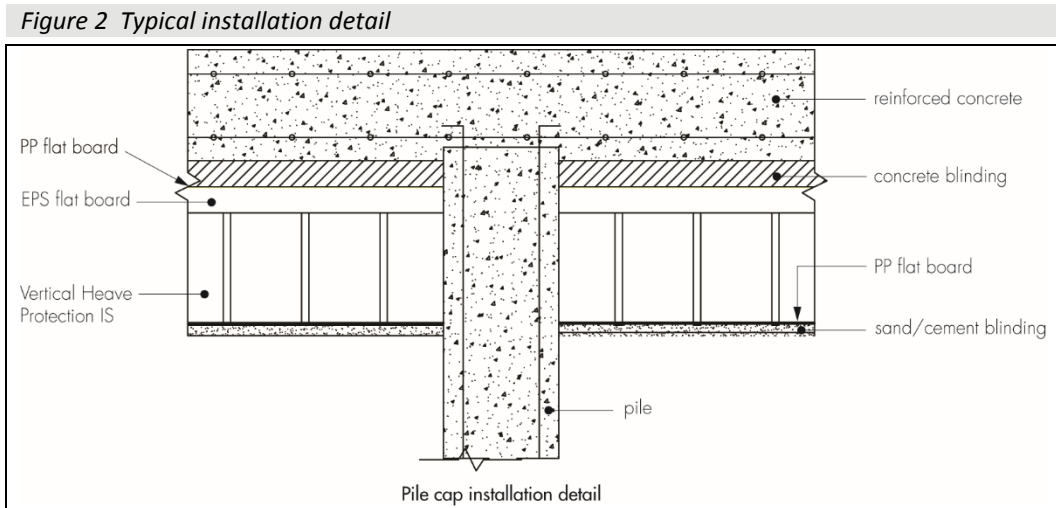
12.1 Adequate supervision must be maintained and, if required, the Certificate holder's specialists, experienced in site practice and installation of the material, will attend the site to provide demonstrations to ensure correct installation.

12.2 Normal precautions for handling EPS materials should be taken to avoid damaging the product during off-loading, storage, handling and installation. Any damaged areas should be repaired or replaced before pouring the concrete.

13 Procedure

13.1 The products must be placed on a firm, level surface with the bottom of the excavation properly compacted and blinded. A layer of sand blinding may be used when the product incorporates a bottom polypropylene sheet; otherwise a concrete blinding is required.

13.2 For piled ground beams, the top of each pile should be trimmed so that it extends slightly above the proposed underside of the ground beam (see Figure 2). Each pile should protrude above the level of the void former, allowing for the thickness of concrete blinding (if used) and a keying depth into the ground beam. Care should be taken to ensure that the void former is cut to fit tightly around the pile and that any gaps are sealed to prevent loss of concrete into the void.



13.3 When required, the product can be cut to shape with a fine-toothed saw. Care should be taken to ensure that, after cutting, exposed ends of the cellular ribs do not exceed 50 mm in length.

13.4 Joints between adjacent void formers should be sealed with formwork tape (supplied by the Certificate holder).

13.5 Reinforcement should be fixed and adequately supported to ensure that the correct depth of concrete cover is achieved, and to ensure that the load beneath each support is appropriate to the grade of product being used (see section 6.9). The void former should be covered with a 50 mm thickness of concrete blinding where heavy reinforcement is proposed, or where the reinforcement will be subjected to significant point loads from foot traffic or other imposed loading.

13.6 During construction, spreader boards are recommended, to reduce localised imposed load transmitted to the void formers.

13.7 Concrete should be placed with care to avoid overloading the void former.

Technical Investigations

14 Tests

Tests were carried out and the results assessed to determine:

- the safe- and fail-loads of each product grade
- the resistance of the top sheet to withstand short-term foot traffic loading, concentrated loads from rebar spacers and other anticipated short-term construction loads
- the ability of the product to withstand the design safe-load for 16 hours, without undue levels of deformation
- that the product compresses to the required amount before the fail-load is achieved
- the transfer of load to the underside of the slab or beam when the product is compressed.

15 Investigations

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

15.2 An assessment was made of the characteristics and durability of the product.

15.3 An evaluation was made of existing data relating to the thermal conductivity of the EPS.

15.4 Floor deck U values were derived by modelling.

Bibliography

BRE Report BR 262 : 2002 *Thermal Insulation: Avoiding Risks*

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

BRE Report BR 497 : 2007 *Thermal performance of buildings*

BRE Information Paper IP 1/06 *Assessing the effects of thermal bridging at junctions and around openings*

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

BS EN 1990 : 2002 *Basis of structural design*

NA to BS EN 1990 : 2002 UK National Annex to *Basis of structural design*

BS EN 1992-1-1 : 2004 *Eurocode 2 : Design of concrete structures — General rules*

NA to BS EN 1992-1-1 : 2004 UK National Annex to *Eurocode 2 : Design of concrete structures — General rules*

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

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

BS EN ISO 13370 : 2017 *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

BS EN ISO 13788 : 2012 *Hygrothermal performance of building components and building elements — Internal surface temperature to avoid critical surface humidity and interstitial condensation — Calculation methods*

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.