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Agrément Certificate

17/5431

Product Sheet 1 Issue 2

S AND B FLOORING SYSTEMS

S AND B WARM BEAM, AND S AND B WARM BEAM PLUS

This Agrément Certificate Product Sheet⁽¹⁾ relates to S and B Warm Beam, and S and B Warm Beam Plus, expanded polystyrene (EPS) blocks for use in conjunction with precast concrete beams, concrete perimeters, concrete closure blocks and steel-mesh-reinforced structural concrete toppings to a given specification, to construct insulated, suspended ground floors in residential and commercial buildings within the load criteria specified in this Certificate.

(1) Hereinafter referred to as 'Certificate'.

The assessment includes

Product factors:

- compliance with Building Regulations
- compliance with additional regulatory or non-regulatory information where applicable
- evaluation against technical specifications
- assessment criteria and technical investigations
- uses and design considerations

Process factors:

- compliance with Scheme requirements
- installation, delivery, handling and storage
- production and quality controls
- maintenance and repair

Ongoing contractual Scheme elements†:

- regular assessment of production
- formal 3-yearly review



KEY FACTORS ASSESSED

- Section 1. Mechanical resistance and stability
- Section 2. Safety in case of fire
- Section 3. Hygiene, health and the environment
- Section 4. Safety and accessibility in use
- Section 5. Protection against noise
- Section 6. Energy economy and heat retention
- Section 7. Sustainable use of natural resources
- Section 8. Durability

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 Second issue: 2 August 2024

Originally certified on 20 June 2017

Hardy Giesler
Chief Executive Officer

This BBA Agrément Certificate is issued under the BBA's Inspection Body accreditation to ISO/IEC 17020. Sections marked with † are not issued under accreditation.

The BBA is a UKAS accredited Inspection Body (No. 4345), Certification Body (No. 0113) and Testing Laboratory (No. 0357).

Readers MUST check that this is the latest issue of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

The Certificate should be read in full as it may be misleading to read clauses in isolation.

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

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SUMMARY OF ASSESSMENT AND COMPLIANCE

This section provides a summary of the assessment conclusions; readers should refer to the later sections of this Certificate for information about the assessments carried out.

Compliance with Regulations

Having assessed the key factors, the opinion of the BBA is that S and B Warm Beam, and S and B Warm Beam Plus, 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 Building Regulations 2010 (England and Wales) (as amended)

Requirement:	A1(1)	Loading
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground. See section 1 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The system can contribute to limiting the risk of condensation. See section 9 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The system can contribute to satisfying this Requirement. See section 6 of this Certificate.
Regulation:	7(1)	Materials and workmanship
Comment:		The system is acceptable. See sections 8 and 9 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)
Regulation:	26C	Target primary energy rates for new buildings (applicable to England only)
Regulation:	26C	Energy efficiency rating (applicable to Wales only)
Comment:		The system can contribute to satisfying these Regulations. See section 6 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The system is acceptable. See sections 8 and 9 of this Certificate.
Regulation:	9	Building standards - construction
Standard:	1.1(a)(b)	Structure
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground, with reference to clause 1.1.1 ⁽¹⁾⁽²⁾ of this Standard. See section 1 of this Certificate.
Standard:	3.15	Condensation
Comment:		The system can contribute to limiting the risk of condensation, with reference to clauses 3.15.1 ⁽¹⁾⁽²⁾ , 3.15.4 ⁽¹⁾⁽²⁾ and 3.15.5 ⁽¹⁾⁽²⁾ of this Standard. See section 9 of this Certificate.
Standard:	6.1(b)(c)	Carbon dioxide emissions
Comment:	(d)	The system can contribute to satisfying the requirements of this Standard, with reference to clauses 6.1.1 ⁽¹⁾ , 6.1.2 ⁽¹⁾ and 6.1.6 ⁽²⁾ . See section 6 of this Certificate.

Standard:	6.2	Building insulation envelope
Comment:		The system will contribute to satisfying this Standard with reference to clauses 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽²⁾ and 6.2.13 ⁽¹⁾ . See section 6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system can contribute to meeting 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 system can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾ . See section 6 of this Certificate.
Regulation:	12	Building standards - conversion
Comment:		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 ⁽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(1)(a)(i)	Fitness of materials and workmanship
Comment:	(iii)(b)	The system is acceptable. See sections 8 and 9 of this Certificate.
Regulation:	29	Condensation
Comment:		The system can contribute to limiting the risk of interstitial condensation. See section 9 of this Certificate.
Regulation:	30	Stability
Comment:		The system can sustain and transmit dead and imposed floor loads to the ground. See section 1 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rates
Regulation:	43(b)	Nearly zero-energy requirements for new buildings
Comment:		The system can contribute to satisfying these Regulations. See section 6 of this Certificate.

Additional Information

NHBC Standards 2024

In the opinion of the BBA, S and B Warm Beam, and S and B Warm Beam Plus, 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 5.2 *Suspended ground floors*.

Fulfilment of Requirements

The BBA has judged S and B Warm Beam, and S and B Warm Beam Plus to be satisfactory for use in conjunction with precast concrete beams, concrete perimeters, concrete closure blocks and steel-mesh-reinforced structural concrete toppings to a given specification, to construct insulated, suspended ground floors in residential and commercial buildings within the load criteria specified in this Certificate.

ASSESSMENT

Product description and intended use

The Certificate holder provided the following description for the system under assessment. S and B Warm Beam, and S and B Warm Beam Plus comprise a range of profiled EPS blocks, for use in conjunction with precast concrete beams, concrete closure blocks, concrete perimeters and steel-mesh-reinforcement structural concrete toppings.

The blocks have the nominal characteristics shown in Table 1 and Figures 1 and 2.

Table 1 Warm Beam and Warm Beam Plus product range

Product reference	System name	For use with: concrete beam depth (mm)	Block dimensions		
			Width at top face (mm)	Overall width (mm)	Overall thickness (mm)
A150	150 beam single max	150	540	725	223 to 370
B150	150 beam double max	150	540	850	223 to 370
C150	150 beam triple max	150	540	975	223 to 370
D150	150 beam single narrow	150	215-270	400-470	223 to 370
E150	150 beam double narrow	150	215-270	525-660	223 to 370
F150	150 beam triple narrow	150	215-270	650-820	223 to 370
A225	225 beam single max	225	540	740	283 to 370
B225	225 beam double max	225	540	895	283 to 370
C225	225 beam triple max	225	540	1050	283 to 370
D225	225 beam single narrow	225	215-270	400-470	283 to 370
E225	225 beam double narrow	225	215-270	525-660	283 to 370
F225	225 beam triple narrow	225	215-270	650-820	283 to 370
G150	150 beam starter block	150	300	465	223 to 370
H150	150 beam finish block	150	300	300	223 to 370
G225	225 beam starter block	225	300	465	283 to 370
H225	225 beam finish block	225	300	300	283 to 370

Figure 1 Warm Beam Plus blocks for use with 150 mm deep beams

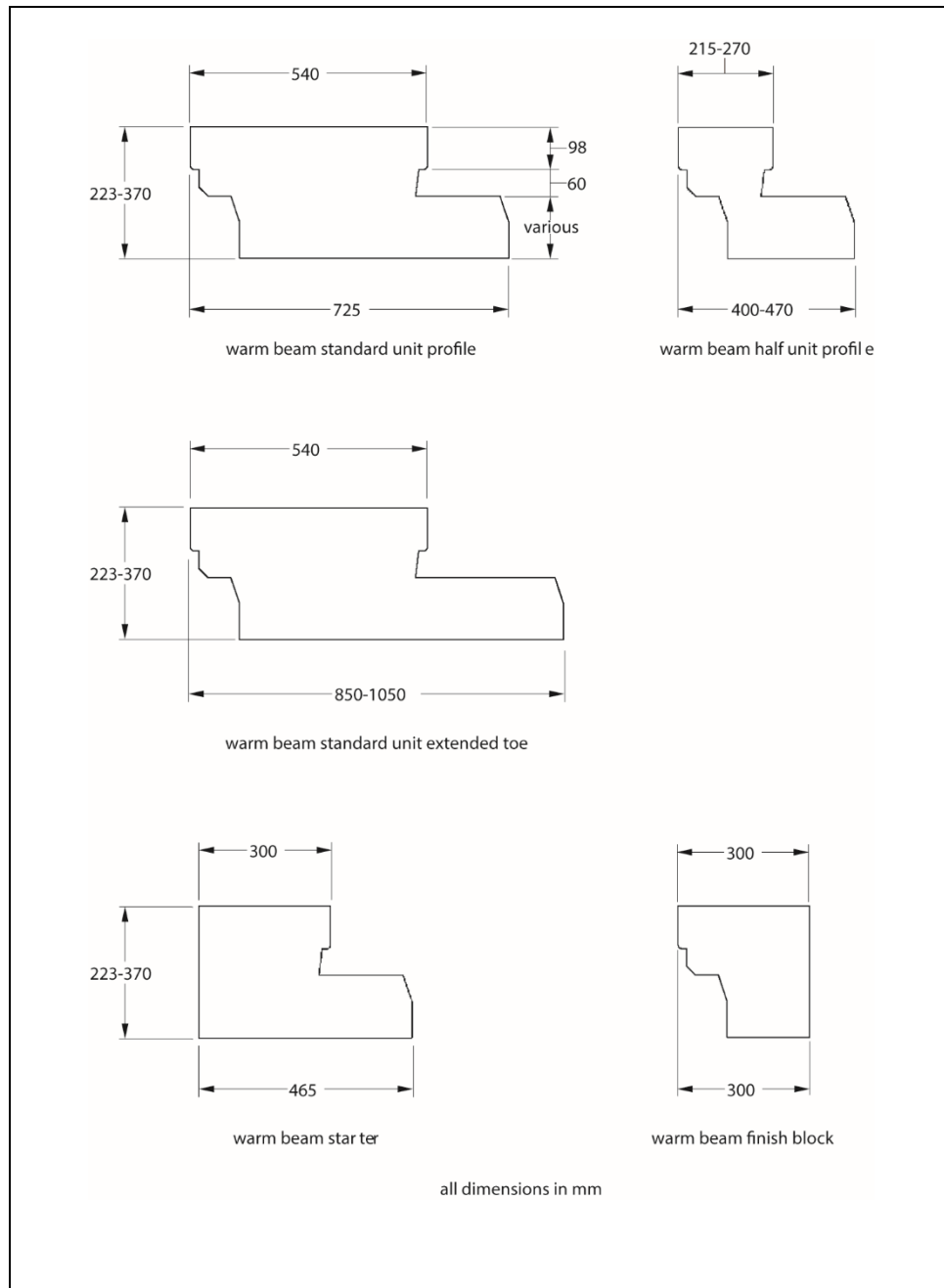
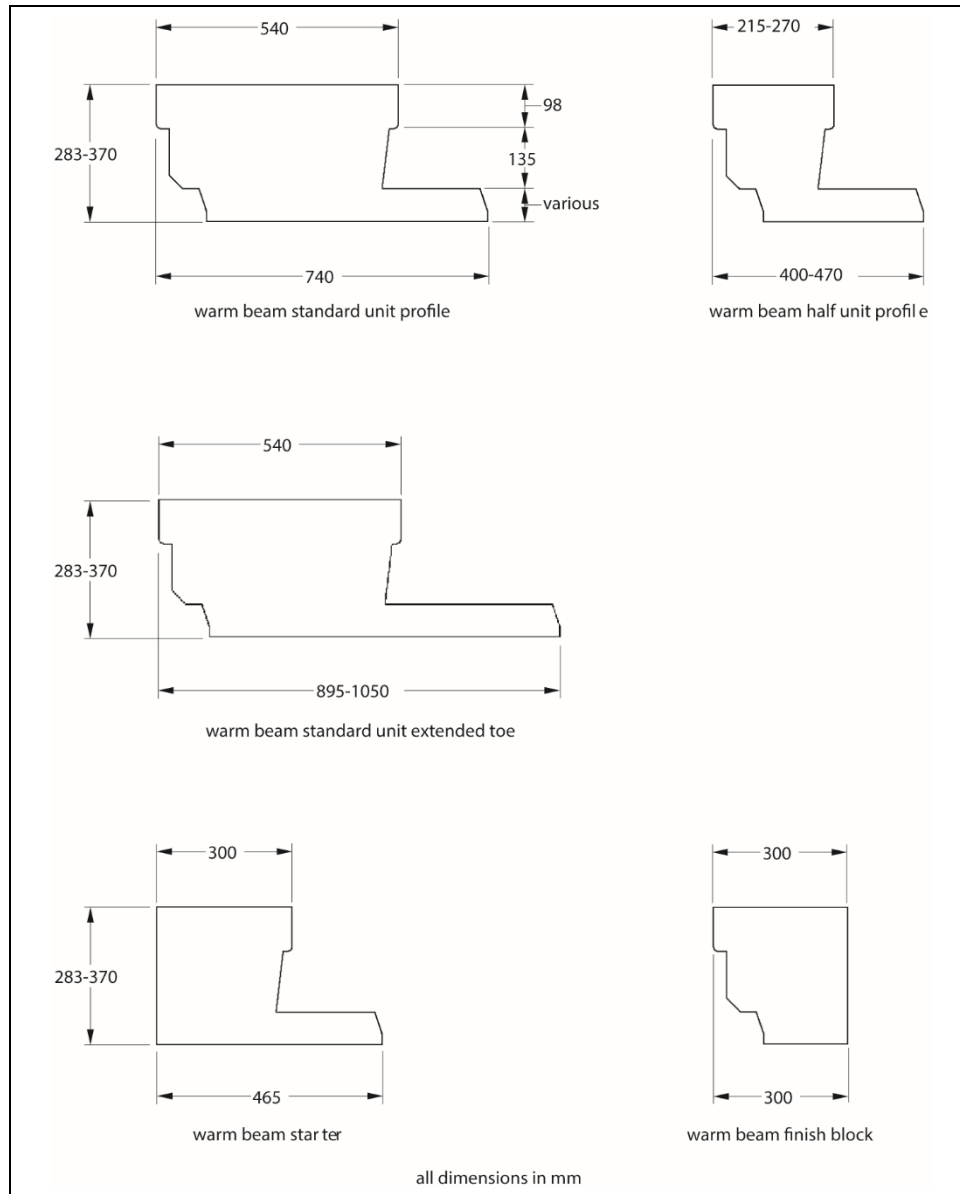


Figure 2 Warm Beam and Warm Beam Plus blocks for use with 225 mm deep beams



Ancillary Items

The following ancillary items are essential to use with the system and have been assessed with the system:

- pre-stressed concrete beams — of the type and size shown in Figure 4 of this Certificate, CE marked and designed in accordance with BS EN 15037-1 : 2008. The pre-stressed concrete beams should also be designed in accordance with BS EN 1992-1-1 : 2023 and its UK National Annex, BS EN 206 : 2013 , BS 8500-1 : 2023 and BS 8500-2 : 2023. See section 1 of this Certificate
- steel-mesh-reinforced structural concrete topping — to one of the specifications given in Table 8, depending on the proposed floor usage
- concrete perimeter and concrete closure blocks — manufactured in accordance with BS EN 771-3 : 2011 with a minimum compressive strength of 7.3 N·mm² (see Figure 3 of this Certificate for detail of concrete closure blocks).

Figure 3 Typical concrete closure blocks

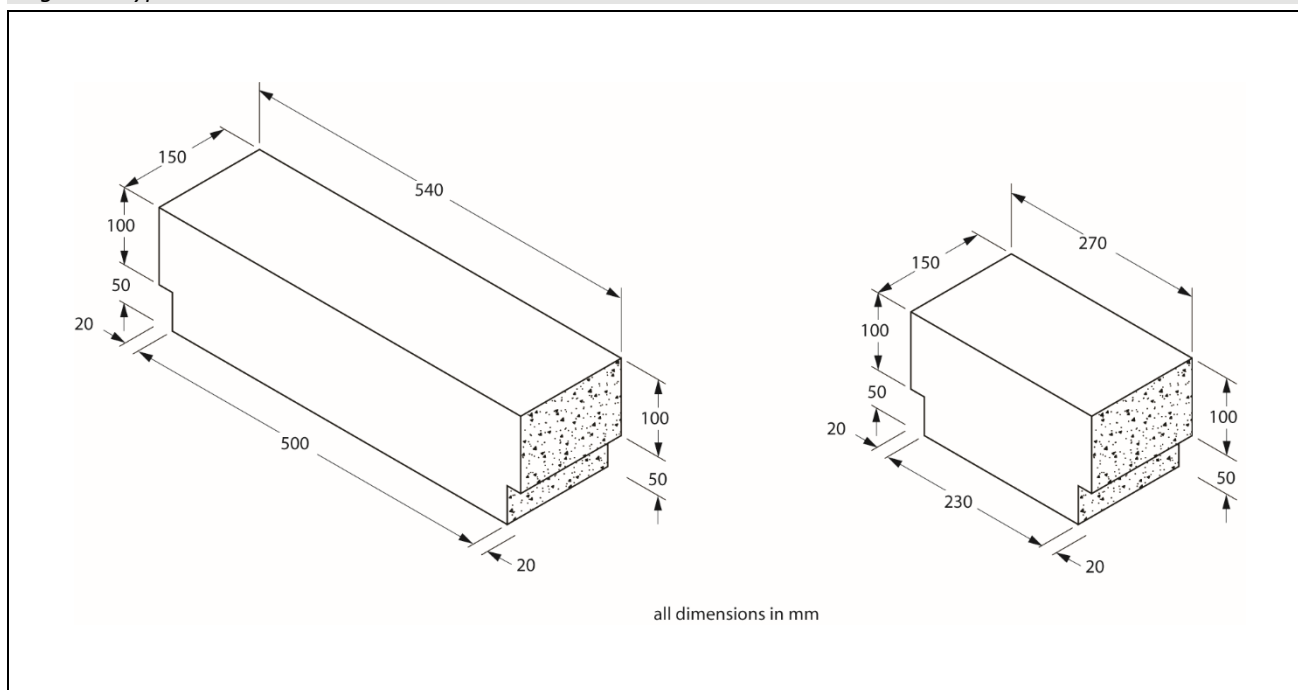
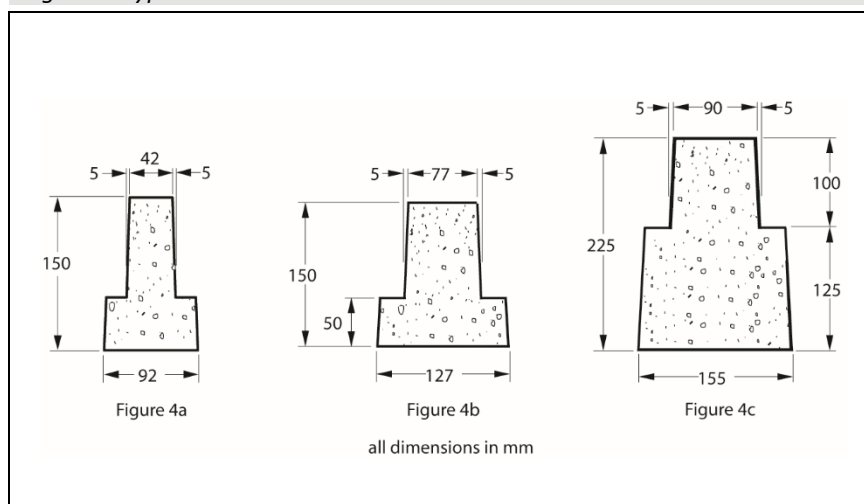


Figure 4 Typical concrete beam section



The Certificate holder recommends the following ancillary items for use with the system, but these materials have not been assessed by the BBA and are outside the scope of this Certificate:

- gas resistant barrier, where required
- damp-proof membranes (DPM) with third-party approval
- insulation strips — for perimeter of steel-mesh-reinforced structural concrete toppings.

Product assessment – key factors

The system was assessed for the following key factors, and the outcome of the assessment is shown below. Conclusions relating to the Building Regulations apply to the whole of the UK unless otherwise stated.

1 Mechanical resistance and stability

Data were assessed for the following characteristics.

1.1 Properties in relation to loading

1.1.1 The resistance of minimum cut length and minimum bearing width S and B Warm Beam blocks to temporary construction phase loading was assessed to a BBA Test specification and the results are given in Table 2.

Table 2 Resistance to construction phase loading of minimum cut length blocks

System assessed ⁽¹⁾	Assessment method	Requirement	Result
S and B Warm Beam EPS 100E	BBA test specification, 0.9 kN uniformly distributed load	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 0.5 kN concentrated load 10mm from front edge of block	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 0.5 kN concentrated load applied at the centre of the block	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 0.5 kN concentrated load 15mm from rear of block edge	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 1.4 kN concentrated load 10 mm from front edge of block	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 1.4 kN concentrated load 10 mm from front edge of block with a 5 mm bearer gap	Sample remains structurally sound under test load	Pass

(1) All samples of dimensions 1200 x 300 x 223 mm with a minimum cut length of 320 mm.

1.1.2 The resistance of full length S and B Warm Beam blocks to temporary construction phase loading was assessed to a BBA Test specification and the results are given in Table 3.

Table 3 Resistance to construction phase loading of full length blocks

System assessed	Assessment method	Requirement	Result
S and B Warm Beam EPS	BBA test specification, 0.67 kN uniformly distributed load	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 0.5 kN concentrated load 10mm from front edge of block	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 0.5 kN concentrated load applied at the centre of the block	Sample remains structurally sound under test load	Pass
S and B Warm Beam EPS 100E	BBA test specification, 1.4 kN concentrated load 10mm from front edge of block	Sample remains structurally sound under test load	Pass

1.1.3 Subject to compliance with the design and installation requirements of this Certificate, the EPS blocks have adequate strength to carry the normal temporary loads expected during the construction phase of the floor system, including the weight of the steel-mesh-reinforced structural concrete topping when poured.

1.1.4 The declared value of compression stress at 10% deformation is given in Table 4.

Table 4 Declared compression stress value at 10% deformation

System assessed	Assessment method	Requirement	Result
S and B Warm Beam and S and B Warm Beam Plus	BS EN 13163 : 2012	Value achieved	100 kPa

1.1.5 The declared value of mechanical resistance to concentrated loads is given in Table 5.

Table 5 Declared compression stress value at 10% deformation

System assessed	Assessment method	Requirement	Result
S and B Warm Beam and S and B Warm Beam Plus	BS EN 15037-4 : 2010	Value achieved	1.5 kN

2 Safety in case of fire

Not applicable.

3 Hygiene, health and the environment

Not applicable.

4 Safety and accessibility in use

Not applicable.

5 Protection against noise

Not applicable.

6 Energy economy and heat retention

Data were assessed for the following characteristics.

6.1 Thermal conductivity

The system was tested for thermal conductivity and the results are given in Table 6.

Table 6 Declared value for thermal conductivity

System assessed	Assessment method	Requirement	Result
S and B Warm Beam EPS blocks (white EPS100E)	BS EN 13163 : 2012	Declared value (λ_D)	0.036
S and B Warm Beam Plus EPS blocks (grey EPS100E)	BS EN 13163 : 2012	Declared value (λ_D)	0.030

6.2 Thermal performance

6.2.1 Example floor U values given in Table 7 indicate that the system can enable a floor to meet, or improve upon, design floor U values of between 0.13 and 0.25 W·m⁻²·K⁻¹ specified in the documents supporting the national Building Regulations.

Table 7 Example U value⁽¹⁾ for a single beam configuration⁽²⁾ ($W \cdot m^{-2} \cdot K^{-1}$)

Beam Option			
92 × 150 mm	p/a ratio $m \cdot m^{-2}$	White EPS 100E (S and B Warm Beam) with 223 mm block	Grey EPS 100E (S and B Warm Beam Plus) with 370 mm block
	0.4	0.18	0.098
	0.6	0.19	0.10
	0.7	0.19	0.10
	0.9	0.20	0.10
127 × 150 mm	p/a ratio $m \cdot m^{-2}$	White EPS 100E (S and B Warm Beam) with 223 mm block	Grey EPS 100E (S and B Warm Beam Plus) with 370 mm block
	0.4	0.19	0.098
	0.6	0.20	0.10
	0.7	0.20	0.10
	0.9	0.21	0.10
155 × 225 mm	p/a ratio $m \cdot m^{-2}$	White EPS 100E (S and B Warm Beam) with 283 mm block	Grey EPS 100E (S and B Warm Beam Plus) with 370 mm block
	0.4	0.20	0.12
	0.6	0.21	0.12
	0.7	0.22	0.13
	0.9	0.22	0.13

(1) These calculations are in accordance with section 9 of this Certificate and assume:

- the beam λ is $2.0 W \cdot m^{-1} \cdot K^{-1}$ and the 60 mm steel-mesh-reinforced concrete topping λ is $1.1.5 W \cdot m^{-1} \cdot K^{-1}$
- a 300 mm thick perimeter wall with a U-value of $0.35 W \cdot m^{-2} \cdot K^{-1}$
- underfloor ventilation area is $0.0015 m^2 \cdot m^{-1}$
- ground floor conductivity is $1.5 W \cdot m^{-1} \cdot K^{-1}$
- all other parameters are default values from BRE Report BR 443 : 2006

(2) Configuration used : 100% single beams at full centres.

6.2.2 The system can contribute towards a floor construction satisfying the national Building Regulations in respect of energy economy and heat retention.

6.2.3 For improved energy or carbon savings, designers must consider appropriate fabric/service measures.

7 Sustainable use of natural resources

EPS material can be readily recycled if free from debris and contamination. The concrete and reinforcement steel can also be recycled.

8 Durability

8.1 The potential mechanisms for degradation and the known performance characteristics of the materials in the system were assessed.

8.2 The exposure condition beneath a suspended ground floor over a ventilated void and soil is class XC1, in accordance with BS EN 1992-1-1 : 2023. The concrete beams will have adequate durability for this exposure condition.

8.3 The steel-mesh-reinforced structural concrete toppings will have adequate durability for exposure class XC1.

8.4 Service life

Under normal service conditions, suspended ground floors incorporating the system will have an adequate durability for the life of the building, provided it is designed, installed and maintained in accordance with this Certificate and the Certificate holder's instructions.

Information provided by the Certificate holder was assessed for the following factors:

9 Design, installation, workmanship and maintenance

9.1 Design

9.1.1 The design process was assessed by the BBA, and the following requirements apply in order to satisfy the performance specified in this Certificate.

9.1.2 Provision must be included for ventilation of the sub-floor space and to resist moisture ingress and must be in accordance with normal good practice, for example, provision of ventilators and adequate drainage of the sub-floor.

9.1.3 Floors constructed using the blocks are not suitable for use in ground floors built above basements.

9.1.4 The system is suitable for use in floors with underfloor heating systems. Care must be taken to ensure that the minimum design thickness of steel-mesh-reinforced structural concrete topping is maintained, eg above pipes.

Structural design

9.1.5 A suitably experienced and competent individual must perform a site-specific assessment/design to ensure that:

9.1.5.1 The EPS blocks, concrete beam and steel-mesh-reinforced structural concrete topping are suitable for the intended use, based on the recommendations contained in this Certificate and the relevant parts of BS EN 15037-1 : 2008 and BS EN 15037-4 : 2010.

9.1.5.2 The floor vibration due to footfall exceeds the natural frequency of 4.0 Hz. The vibration due to rhythmic activity (such as dancing) and external sources (eg building construction or rail traffic) are excluded from the system.

9.1.5.3 The pre-cast concrete beams must be designed in accordance with BS EN 1992-1-1 : 2023 and its UK National Annex, by an appropriately experienced and competent engineer to ensure that the beams are adequate to resist the applied loading.

9.1.5.4 The proposed pre-cast concrete beam must be CE marked and manufactured and designed in accordance with the requirements of BS EN 15037-1 : 2008.

9.1.5.5 The natural frequency of the concrete beam used in the test assemblies due to footfall⁽¹⁾ is greater than 4 Hz, as defined below:

- (a) the concrete beam must have a natural frequency greater than 4 Hz when loaded with full dead load plus 0.1 x imposed load (UDL)
- (b) the natural frequency of a simply supported concrete beam under UDL loading is determined from either equation (A) or (B), shown below:

Equation (a): $f = 18/\delta^{0.5}$

Equation (b): $f = \pi/2(EI/mL^4)^{0.5}$

Where:

δ is the deflection of the concrete beam in mm for UDL

EI is the dynamic flexural rigidity of the member (Nm^2)

m is the effective mass supported by the concrete beam loaded in $\text{kg}\cdot\text{m}$

L is the span of the member (m).

9.1.5.6 The serviceability deflection limit of the proposed concrete beam must be in accordance with BS EN 1992-1-1 : 2023, as summarised in Table 8 of this Certificate.

Table 8 Deflection limitation of pre-cast concrete beams

Description	Limit for deflection
Camber at transfer of pre-stressed force under the self-weight of the beam	span/250
Deflection at application of finishes (permanent dead loads)	span/250
Deflection for long-term under quasi-permanent loads (M_{QP}) ⁽¹⁾ measured below the level of the supports after losses of the pre-stress force and the effect of creep in the modulus of elasticity of the concrete beam ($E_{c,eff}$) ⁽²⁾	span/250
Movement due to quasi-permanent loads after application of finishes	span/500

(1) M_{QP} is the moment under the quasi-permanent load combination (refer to equation 6.16a of BS EN 1990 : 2023).

(2) Effective modulus of elasticity of concrete obtained from equation $E_{cm}/(1+\psi)$, where ψ is the long-term creep coefficient of the concrete beam and assumed to be equal to 2. The value of E_{cm} for limestone and sandstone aggregates should be reduced by 10% and 30% respectively.

9.1.6 A void at least 150 mm deep must be provided for the system between the underside of the floor and the ground surface.

9.1.7 In locations where clay heave is anticipated, a greater void depth must 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, a total void up to 300 mm may be required, as follows:

- high volume change potential (300 mm total void)
- medium volume change potential (250 mm total void)
- low volume change potential (200 mm total void).

9.1.8 The EPS blocks are designed to have a normal bearing of 20 mm, with a 5 mm allowance for misalignment and manufacturing tolerances in the straightness of the beam. A minimum bearing width of 15 mm must therefore be ensured.

9.1.9 Steel mesh and concrete depth must be sized and designed according to BS EN 1990 : 2023, BS EN 1991-1-1 : 2002 and BS EN 1992-1-1 : 2023, and their UK National Annexes. See Table 9 of this Certificate for specification of concrete and steel mesh size for domestic and communal areas in blocks of flats and offices (for permitted loads, see Table 10 of this Certificate). The maximum aggregate size is 10 mm. Start and end panels must be designed as a cantilever slab (see also section 1) and must not exceed 300 mm.

Table 9 Steel-mesh-reinforced structural concrete topping specifications⁽¹⁾⁽²⁾⁽³⁾

Use	Specification
Single-family dwellings	60 mm thick (overall concrete thickness above the services), C28/35 concrete reinforced with one layer of A142 steel mesh located at mid-depth of concrete slab (cover to reinforcement steel mesh 27 mm)
Single-family dwellings and communal areas in blocks of flats and offices	75 mm thick (overall concrete thickness above the services), C25/30 concrete reinforced with one layer of A142 steel mesh located at mid-depth of concrete slab (cover to reinforcement steel mesh 34 mm)

(1) The aggregate for concrete must comply with BS EN 12620 : 2002.

(2) Workability of the concrete should be selected as appropriate for the intended installation method, in accordance with BS 8500-1 : 2023 and BS EN 206 : 2013.

(3) Steel mesh should be in accordance with BS 4483 : 2005 with a characteristic yield strength (f_{yk}) of 500 N·mm⁻².

Table 10 Imposed and partition loads

Description	Maximum characteristic loads for single-family dwellings	Maximum characteristic loads for communal areas in blocks of flats and offices
Imposed uniformly distributed load (UDL) ($\text{kN}\cdot\text{m}^{-2}$)	1.5 ⁽¹⁾	3.0 ⁽¹⁾
Imposed concentrated load (kN)	2.0 ⁽¹⁾⁽²⁾	4.0 ⁽¹⁾⁽²⁾
Line load partition parallel and perpendicular to the beam ($\text{kN}\cdot\text{m}^{-1}$)	3.0 ⁽³⁾	3.0 ⁽³⁾
Allowance for moveable partition ($\text{kN}\cdot\text{m}^{-2}$)	1.0 ⁽³⁾	1.0 ⁽³⁾

(1) Imposed concentrated load must not be combined with the uniformly distributed load, imposed load or other variable actions.

(2) Imposed concentrated load is assumed to be applied over a square plate of area not less than 50 by 50 mm.

(3) Moveable partition loads must not be combined with line load partition walls.

9.1.10 The maximum distance of the concentrated load applied on the cantilever from the top face of the beam must not exceed 233 mm [$300^{(1)} - 42^{(2)} - 25^{(3)} = 233$].

(1) Length of cantilever slab (see Figure 5).

(2) Width of plasterboard, skirting board and skim.

(3) Half of width of a 50 mm square plate (imposed concentrated load for residential buildings is assumed to be applied over a square plate of area not less than 50 by 50 mm).

9.1.11 The EPS blocks are for use with self-bearing pre-cast concrete beams (of normal weight concrete) which provide the final strength of the floor system independently of any other constituent part of the floor system.

9.1.12 The minimum bearing width to support the concrete beam must be 90 mm in accordance with BS EN 8103-1 : 2011.

9.1.13 The maximum effective span of the concrete beam (assumed to be a simply supported and self-bearing beam) must be calculated using the equations from BS EN 1990 : 2023 (6.14a and 6.10, or the less favourable equations in 6.10a and 10b). The lowest effective span obtained from these equations will be considered to be the maximum effective span of the concrete beam.

9.1.14 Where two or more concrete beams are placed side by side, eg beneath loadbearing walls, the spaces between the beam webs should be in-filled with concrete with a minimum strength class of C25/30 to give unity of action.

9.1.15 The concrete beam is self-bearing and no account must be made for possible composite action between the concrete beams and the EPS blocks or the steel-mesh-reinforced concrete topping.

Thermal performance

9.1.16 Lateral restraint should be provided at ground floor level in accordance with the requirements of the national Building Regulations, BS 8103-1 : 2011 and *NHBC Standards* 2024.

9.1.17 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.

Condensation risk

9.1.18 When the system is used on a ground-bearing floor or a suspended concrete floor, an air and vapour control layer must be installed on the warm side of the insulation to inhibit the risk of interstitial condensation, unless a risk assessment shows this is not necessary.

9.1.19 Floors will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2021 and this Certificate.

9.1.20 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 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 IP1/06*.

9.1.21 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 and when designed and constructed to BS 5250 : 2021. Further guidance may be obtained from BRE Report BR 262 : 2002

9.1.22 Voids below suspended timber ground floors must be ventilated. Ventilation may be achieved by installing vents not less than $1500 \text{ mm}^2\cdot\text{m}^{-1}$ run of external wall or $500 \text{ mm}^2\cdot\text{m}^{-2}$ of floor area, whichever is the greater. Ventilation openings must be arranged to prevent the ingress of rain, snow, birds and small mammals and the risk of subsequent blockage by other building operations.

9.2 Installation

9.2.1 Installation instructions provided by the Certificate holder were assessed and judged to be appropriate and adequate.

9.2.2 Installation must be carried out in accordance with this Certificate and the Certificate holder's instructions. A summary of instructions and guidance is provided in Annex A of this Certificate.

9.2.3 The following must be taken into account throughout the installation process:

- cube compressive strength and slump tests for concrete topping, to ensure they are within the acceptable limits
- concrete topping not to be poured below 5°C
- maximum temperature the concrete is placed is 30°C and decreasing
- concrete not to be poured during rainfall
- appropriate joints between the opening of two adjacent rooms to be provided.

9.2.4 The blocks must be fitted tightly around drains and other conduits, with spaces filled in by off-cuts of material.

9.2.5 Before pouring the steel-mesh-reinforced structural concrete topping, it must be ensured that the blocks are centrally located between the beams.

9.2.6 When wheelbarrows are used, heavy duty timber planks must be placed to spread the wheel load to the concrete joists. Spot boards must be used when tipping and shovelling.

9.2.7 A void of sufficient depth must be provided beneath the floor construction to facilitate block installation, provide sub-floor ventilation and, where appropriate, accommodate clay heave.

9.2.8 The ground beneath the floor must be free of topsoil and vegetation. Oversite concrete or other surface seal is not required, but material added to bring the solum to an even surface must be hard and dry.

9.2.9 Electrical cables running below the blocks must be enclosed in a suitable conduit, such as rigid PVC. The Certificate holder should be consulted for further advice, but such advice is outside the scope of this Certificate.

9.2.10 The floor is not loaded with construction materials until the steel-mesh-reinforced structural concrete topping has reached its design strength

9.2.11 S and B Warm Beam, and S and B Warm Beam Plus blocks are cut to the required profile (by a computer-controlled hot-wire cutter) from moulded blocks of EPS manufactured in accordance with BS EN 13163 : 2012.

9.3 Workmanship

Practicability of installation was assessed by the BBA, on the basis of the Certificate holder's information. To achieve the performance described in this Certificate, installation of the system must be carried out by contractors/builders experienced with this type of system.

9.4 Maintenance and repair

As the system is confined within the floor structure and has suitable durability, maintenance is not required.

10 Manufacture

10.1 The production processes for the system have been assessed, and provide assurance that the quality controls are satisfactory according to the following factors:

10.1.1 The manufacturer has provided documented information on the materials, processes, testing and control factors.

10.1.2 The quality control operated over batches of incoming materials has been assessed and deemed appropriate and adequate.

10.1.3 The quality control procedures and system testing to be undertaken have been assessed and deemed appropriate and adequate.

10.1.4 The process for management of non-conformities has been assessed and deemed appropriate and adequate.

10.1.5 An audit of each production location was undertaken, and it was confirmed that the production process was in accordance with the documented process, and that equipment has been properly tested and calibrated.

† 10.2 The BBA has undertaken to review 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.

11 Delivery and site handling

11.1 The blocks are delivered to site wrapped in plastic film. Each block is marked with the Certificate holder's system reference (see Table 1) and, if requested, the customer's own reference code.

11.2 Delivery and site handling must be performed in accordance with the Certificate holder's instructions and this Certificate, including:

11.2.1 The blocks must be handled with care during off loading, storage and installation. Particular attention will be required for blocks with long toe lengths.

11.2.2 The blocks must be stacked on a flat base and protected from direct sunlight and high winds.

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

11.2.4 The blocks must not be exposed to flame or ignition.

11.2.5 Care must be taken when unloading, stacking and storing the concrete beams to prevent damage. They must be lifted as near as possible to each end and must remain the correct way up at all times. On site, concrete beams must be stored on timber bearers on suitable level ground.

11.2.6 The concrete beams must be stacked horizontally, one above the other. Timber bearers must be placed close to the beam ends (within 300 mm) and vertically aligned.

11.2.7 For storage periods exceeding three months, the concrete beams must be kept under cover.

11.3 The blocks are supplied as standard in 1200 and 640 mm lengths and can be cut on site as required to suit various beam lengths, subject to a minimum length of 320 mm.

ANNEX A – SUPPLEMENTARY INFORMATION

Supporting information in this Annex is relevant to the system but has not formed part of the material assessed for the 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.

UKCA marking

The Certificate holder has taken the responsibility of UKCA marking the EPS blocks in accordance with designated European Standard EN 15037-4 : 2010.

Management Systems Certification for production

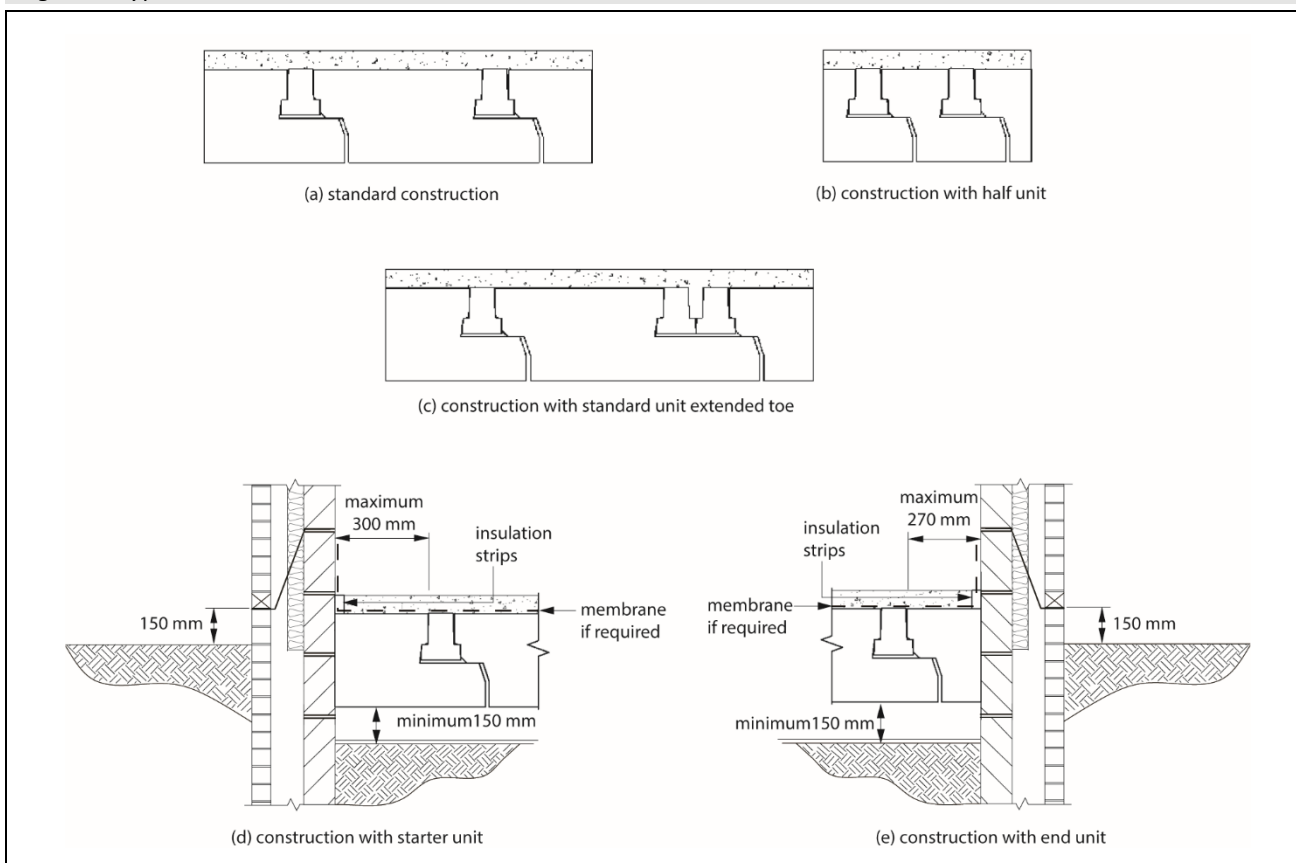
The management system of the manufacturer has been assessed and registered as meeting the requirements of ISO 9001 : 2015 by the BBA (Certificate 03/Q001).

Additional Guidance

A.1 Subject to order size, EPS blocks can be manufactured to suit different beam profiles, widths and heights from those shown in Figure 4. Excluding beam and EPS block tolerances, the nominal toe gap width should be 4 mm, the nominal bearing width should be 20 mm and the nominal gap between the top edge of the EPS block and the beam face should be 3 mm

A.2 Details of a typical S and B EPS system using precast concrete beams and EPS infill is shown in Figure 5.

Figure 5 Typical details



A.3 The overall floor U value will depend significantly on the deck U value, the ratio of the exposed (and semi-exposed) floor perimeter length to floor area (p/a), the amount of underfloor ventilation and the ground thermal conductivity. Each floor U value, therefore, should be calculated to BS EN ISO 13370 : 2017 and BRE Report 443 : 2006.

A.4 A floor deck U value (from inside to the underfloor void) will depend significantly on the types and number of precast concrete beams and EPS infill blocks. The thermal resistance of each beam and EPS configuration should be numerically modelled to BS EN ISO 10211 : 2017 and BS EN 15037-4 : 2010 using a design toe gap width of 9 mm. The floor deck U value may then be taken as an area-weighted average and the overall floor U value calculated as described in this Certificate.

A.5 The junction ψ -values given in Table 11 of this Certificate 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 11 Junction psi values

Junction	Ψ (Wm ⁻¹ .K ⁻¹)
External wall with ground floor (normal) – E5 ⁽¹⁾	0.32 ⁽²⁾
Party wall with ground floor – P1 ⁽¹⁾	0.16 ⁽²⁾

(1) Refer to Standard Assessment Procedure (SAP) 2012 version 9.92.

(2) Conservative defaults from SAP 2012.

A.6 To help minimise the risk of condensation, the void space beneath the lowest point of the floor construction should be at least 150 mm high, with provision for adequate through-ventilation in the form of ventilation openings provided in two opposing external walls. The ventilation openings should be sized at not less than 1500 mm².m⁻¹ run of external wall or 500 mm².m⁻² of floor area, whichever is greater. Where pipes are used to carry ventilating air, these should be at least 100 mm diameter.

A.7 To minimise the risk of interstitial condensation at junctions with external walls, specifiers should ensure that wall insulation extends to at least 150 mm below the bottom of the EPS block.

A.8 The EPS blocks provide a permanent formwork to the steel-mesh-reinforced structural concrete topping. The blocks make no further contribution to the long-term structural performance of the floor, once the steel-mesh-reinforced structural concrete topping has been placed and has obtained its full design strength.

A.9 The steel-mesh-reinforced structural concrete topping should be in accordance with BS 8500-1 : 2023, BS 8500-2 : 2023 and BS EN 206 : 2013, manufactured in plants covered by the Quality Scheme for Ready Mixed Concrete (QSRMC) scheme and laid by personnel with the appropriate skills and experience.

Additional information on installation

A.10 Normal precautions for handling EPS materials should be taken to avoid damage.

A.11 The installer should confirm that the concrete beams and EPS blocks supplied to site agree with the details shown on the engineer's drawings for the project.

A.12 Starting from one edge, the concrete beams are laid into the approximate position in accordance with the specifications. An off-cut of polystyrene block can be used as a spacing guide as installation progresses from one side to the other.

A.13 Starter blocks are fitted into place between the outer wall of the building and the first beam. Once all the starter blocks are in place, the beam is edged back into position holding the blocks tightly against the outer wall. Starter blocks may be cut on site from full width blocks using a saw or hot wire cutter. Alternatively, pre-cut starter blocks are supplied by the Certificate holder. Where long lengths of concrete beam are used, mechanical lifting equipment may be required to aid final location.

A.14 With the first beam accurately positioned, the next row of polystyrene blocks is inserted with the toe of the block wrapped underneath and fitting snugly onto the shoulder of the first beam, before it is rotated into position onto the shoulder of the adjacent beam. The adjacent beam is then edged into position to ensure a close, tight fit. Blocks should be cut to the required length to fit at the end of the rows, subject to a minimum cut length of 320 mm. Closure blocks are used between the beam-bearing ends to ensure the beams are positioned as per the beam centres shown in the Engineer's drawings.

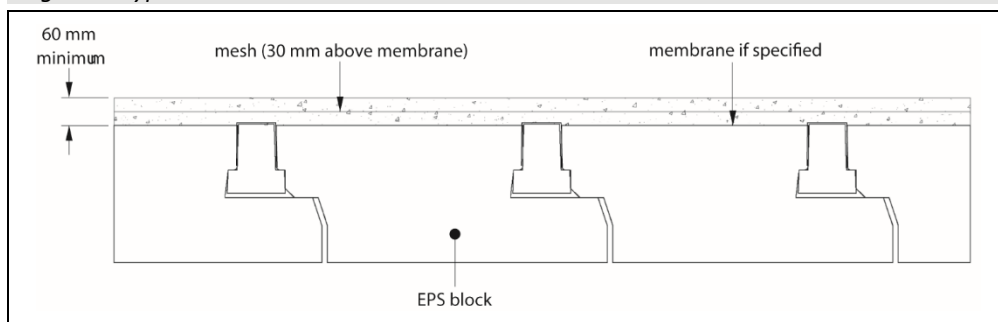
A.15 The installer should check that the EPS blocks are centrally located between the concrete beams, with a maximum gap of 5 mm between the EPS blocks and the beam face. These gaps can be due to normal construction or manufacturing tolerances.

A.16 Once the beams and EPS blocks have been installed, the walls supporting the beams are built up to finished floor level with bricks or concrete blocks cut to suit.

A.17 Care should be taken not to walk over the installed blocks. If a temporary working platform is required, the blocks should be covered with a suitably rigid board.

A.18 If required, a DPM or a radon- or methane-resistant membrane can be installed over the whole floor area in accordance with the membrane manufacturer's instructions (see Figure 6).

Figure 6 Typical membrane installation



A.19 The steel-mesh-reinforced structural concrete topping should be placed in position, supported on propriety spacers located at sufficiently close centres to ensure that the required cover is achieved.

A.20 The steel-mesh-reinforced structural concrete topping should be laid as soon as possible after the blocks have been installed.

A.21 When using a concrete pump, truck or skip, concrete should not be discharged onto the polystyrene blocks from heights greater than 300 mm, and concrete heaps must not be formed over 150 mm high.

A.22 Provision should be made for a suitable concrete finish to be achieved without standing on or overloading the polystyrene panels, for example compacting beams.

A.23 To prevent shrinkage cracking:

- joints should be incorporated into the slab. However, joints must not compromise the structural performance of the topping
- an aspect ratio greater than 2:1 should be avoided
- where the internal walls are built through the slab, a joint should be formed across the door threshold where the wall separates the two rooms
- a compressible insulating material around the perimeter of the plot should be provided
- a steel mesh should be provided at each corner of the openings if the size of the opening exceeds 500 x 500 mm
- consideration should be given to the provision of an appropriate detail on external walls at the position of porches.

A.24 A continuous damp-proof course should be laid along the support wall below the floor in accordance with BS 8102 : 2022.

A.25 EPS blocks (minimum 320 mm long), to accommodate varying beam lengths, should be positioned at the floor edges. Starter and finished blocks should not be more than 300 mm wide at the top.

A.26 Spacers for supporting steel-mesh-reinforced structural concrete topping should be located along the beams or on spreader plates over the EPS blocks. This will reduce the risk of accidental penetration of the EPS during the construction phase and resulting misalignment of the reinforcement within the structural concrete topping depth.

A.27 To minimise the risk of surface condensation at service penetrations, care should be taken to minimise gaps in the insulation layer.

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 *Conventions for calculating linear thermal transmittance and temperature factors*

BS 4483 : 2005 *Steel fabric for the reinforcement of concrete — Specification*

BS 5250 : 2021 *Code of practice for control of condensation in buildings*

BS 8102 : 2022 *Code of practice for protection of below ground structures against water from the ground*

BS 8500-1 : 2023 *Concrete — Complementary British Standard to BS EN 206-1 — Method of specifying and guidance for the specifier*

BS 8500-2 : 2023 *Concrete — Complementary British Standard to BS EN 206-1 — Specification for constituent materials and concrete*

BS EN 206 : 2013 + A2 :2021 *Concrete — Specification, performance, production and conformity*

BS EN 771-3 : 2011 + A1 : 2015 *Specification for masonry units — Aggregate concrete masonry units (Dense and lightweight aggregates)*

BS EN 8103-1 : 2011 *Structural design of low-rise buildings — Code of practice for stability, site investigation, foundations, precast concrete floors and ground floor slabs for housing*

BS EN 1990 : 2023 *Eurocode — Basis of structural design*

NA to BS EN 1990 : 2002 *Eurocode — Basis of structural design*

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 *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

NA to BS EN 1992-1-1 : 2023 *UK National Annex to Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

BS EN 12620 : 2002 *Aggregates for concrete*

BS EN 13163 : 2012 *Thermal insulation products for buildings — Factory made expanded polystyrene (EPS) products — Specification*

BS EN 15037-1 : 2008 *Precast concrete products — Beam-and-block floor systems — Beams*

BS EN 15037-4 : 2010 *Precast concrete products — Beam-and-block floor systems — Expanded polystyrene blocks*

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

BS EN ISO 10211 : 2017 *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

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

TSO 2002 : *Limiting thermal bridging and air leakage : Robust construction details for dwellings and similar buildings*

Conditions of Certificate

Conditions

1 This Certificate:

- relates only to the 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
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- is subject to English Law.

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3 This Certificate will be displayed on the BBA website, and the Certificate Holder is entitled to use the Certificate and Certificate logo, provided that the 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.

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

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:

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

6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this system which is contained or referred to in this Certificate is the minimum required to be met when the 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.

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