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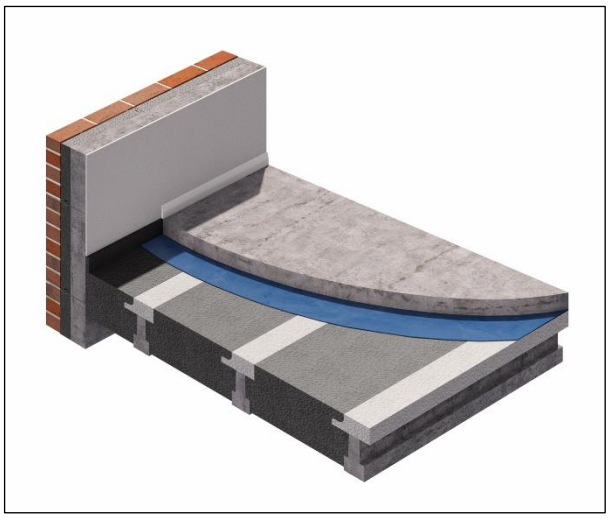
Agrément Certificate
14/5094
Product Sheet 5

JABLITE FLOORING SYSTEMS

JABLITE ALL-IN-ONE THERMAL FLOOR SYSTEM NST (NON-STRUCTURAL TOPPING)



This Agrément Certificate Product Sheet(1) relates to the Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) comprising precast pre-stressed concrete beams; a range of expanded polystyrene Infill Panels (EPS 200) incorporating Connectors (EPS 200); concrete perimeter slip-bricks; and closure blocks. The system is for use in conjunction with a concrete topping, in suspended concrete ground floors for single-family dwellings.

(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

Strength and stability — the system has adequate strength and stiffness to support a suitable concrete topping and can sustain and transmit the design dead and imposed floor loads (see section 6).

Thermal performance — the EPS products can enable a floor to meet the design U values specified in the national Building Regulations (see section 7).

Condensation risk — the system can contribute to limiting the risk of condensation (see section 8).

Durability — the system components will have a design life equivalent to that of the building in which they are incorporated (see section 10).

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: 16 October 2017

Originally certificated on 25 July 2017

Certificate amended on 22 March 2018 to update Table 2 and Section 10

Brian Chamberlain
Head of Technical Excellence

Claire Curtis-Thomas
Chief Executive

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

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

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

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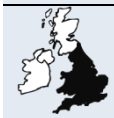
Regulations

In the opinion of the BBA, Jablite All-in-One Thermal Floor System NST (Non-Structural Topping), if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



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

Requirement:	**A1(1)**	**Loading**
Comment:		The system can sustain and transmit the design dead and imposed floor loads to the ground. See sections 6.2 and 6.6 to 6.20 of this Certificate.
Requirement:	**C2(c)**	**Resistance to moisture**
Comment:		The system can contribute to limiting the risk of surface condensation. See sections 8.1, 8.4 and 8.5 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The system can contribute to satisfying this Requirement. See section 7.3 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The system is acceptable. See section 10 and the *Installation* part of this Certificate.
Regulation:	**26**	**CO_2 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 system 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 system can contribute to a construction satisfying this Regulation. See section 10 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	1.1(a)(b)	Structure
Comment:		The system can sustain and transmit the design dead and imposed floor loads to the ground, with reference to clause 1.1.1(1). See sections 6.2 and 6.6 to 6.20 of this Certificate.
Standard:	3.15	Condensation
Comment:		The system 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). See sections 8.1, 8.5 and 8.6 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Comment:		The system can contribute to satisfying 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 system 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 system can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the 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) [Aspects 1(1) and 2(1)], 7.1.6(1) [Aspects 1(1) and 2(1)] and 7.1.7(1) [Aspect 1(1)]. See section 7.3 of this Certificate. (1) Technical Handbook (Domestic).

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

Regulation:	**23(a)(i) (iii)(b)**	**Fitness of materials and workmanship**
Comment:		The system is acceptable. See section 10 and the *Installation* part of this Certificate.
Regulation:	**29**	**Condensation**
Comment:		The system can contribute to limiting the risk of interstitial condensation. See section 8.1 of this Certificate
Regulation:	**30**	**Stability**
Comment:		The system can sustain and transmit the design dead and imposed floor loads to the ground. See sections 6.2 and 6.6 to 6.20 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		The system 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 sections: 3 *Delivery and site handling* (3.6), 6 *Strength and stability* (6.3) and 14 *Procedure* (14.7, 14.8, 14.14 and 14.15) of this Certificate.

Additional Information

NHBC Standards 2017

In the opinion of the BBA, Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) installed with plain concrete toppings, or macro-polymer fibre, micro-polymer fibre or steel fibre concrete toppings, 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.*

CE marking

The Certificate holder has taken the responsibility of CE marking the EPS products in accordance with harmonised European Standard BS EN 15037-4 : 2010 and BS EN 13163 : 2012.

Technical Specification

1 Description

1.1 The Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) comprises precast, pre-stressed concrete beams; a range of expanded polystyrene (EPS) Infill Panels (Full Panel, Half Panel, End Panel, Start Panel, Make up

Panels) incorporating factory-fitted Connectors; concrete closure blocks; and plain or reinforced concrete toppings as defined in Table 2 of this Certificate, for use in suspended ground floors. The Jablite Connectors and Infill Full, Half and End Panels are factory assembled from two elements (see Images 2, 3, 4 7, 8, 9 and 10 of Figure 1). The Connectors and Infill (Full, Half and End) Panels are click jointed by interference fit, negating the need for adhesive.

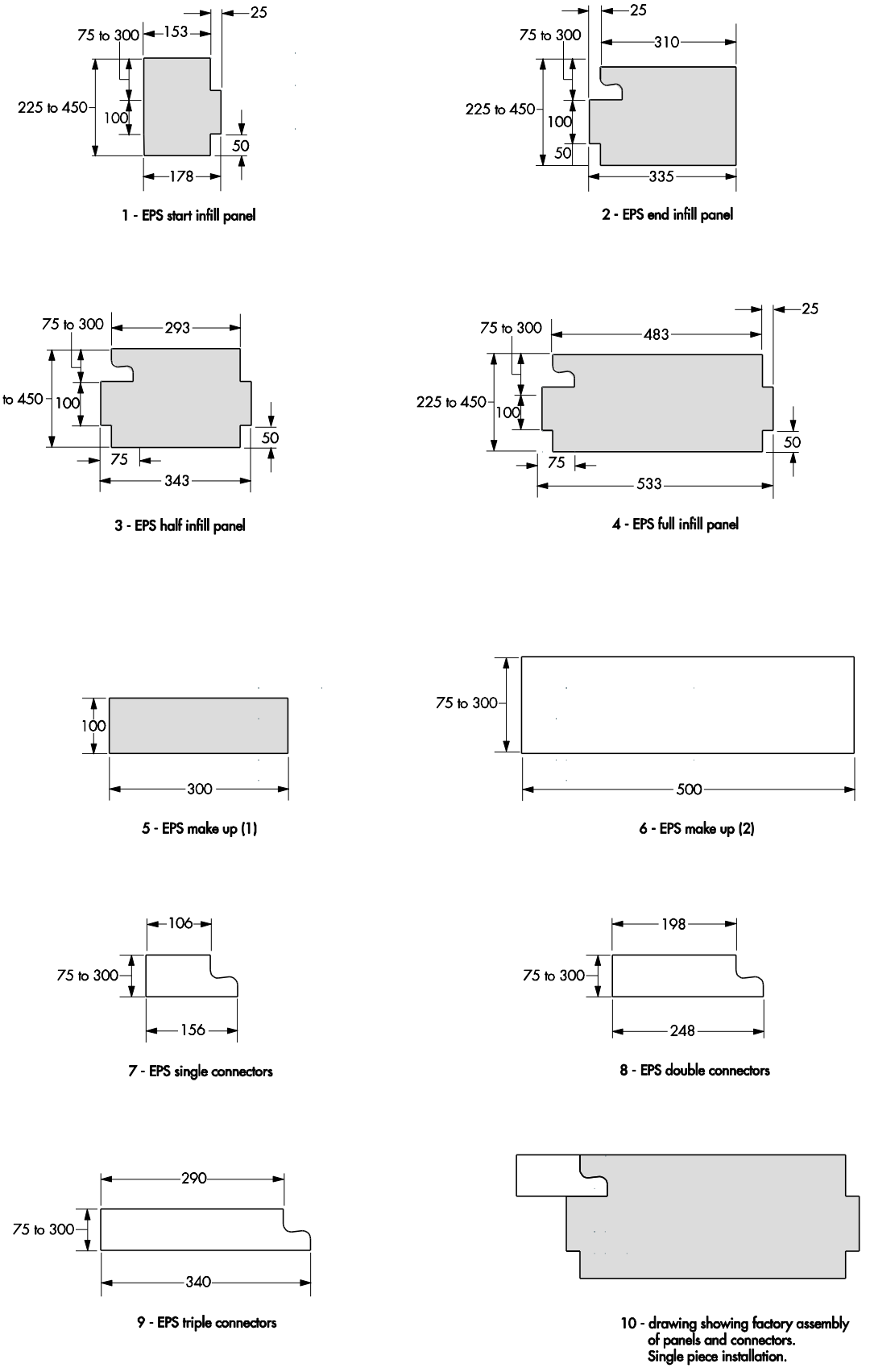
1.2 The Jablite All-in-One EPS products are manufactured from expanded polystyrene (EPS), with the nominal dimensions and characteristic properties given in Figure 1 and Table 1 of this Certificate. The full length of the EPS products is 1220 mm.

Table 1 Characteristic properties of the EPS products

<table>
<tr><th>Description</th><th>Compressive stress at 10% deformation (kPa)</th><th>Bending strength (kPa)</th><th>Mechanical resistance according to BS EN 15037-4 : 2010</th><th>Thermal conductivity λ_D value ($W \cdot m^{-1} \cdot K^{-1}$) and colour</th><th>Moisture diffusion coefficient (μ)</th></tr>
<tr><td>Full Infill Panel</td><td rowspan="10">200</td><td rowspan="10">250</td><td rowspan="10">R2</td><td rowspan="4">0.031 Grey</td><td rowspan="10">40 to 100(1)</td></tr>
<tr><td>Half Infill Panel</td></tr>
<tr><td>End Infill Panel</td></tr>
<tr><td>Start Infill Panel</td></tr>
<tr><td>Single Connector</td><td rowspan="4">0.033 White
0.031 Grey</td></tr>
<tr><td>Double Connector</td></tr>
<tr><td>Triple Connector</td></tr>
<tr><td>Make up (2) Panel</td></tr>
<tr><td>Make up (1) Panel</td><td>0.031 Grey</td></tr>
</table>

(1) It is recommended that the least favourable value is used in calculations of risk of interstitial condensation: see section 8.1 of this Certificate.

Figure 1 Example of Jablite All-In-One EPS products (Infill Panels and Connectors) — dimensions and factory assemblies[1]



(1) For other widths of the top and bottom of the EPS Connectors, the Certificate holder should be contacted.

1.3 The Certificate holder's specifications for ancillary items used in conjunction with the Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) include the following:

- pre-stressed concrete beams(1) — the beams are designed in accordance with BS EN 15037-1 : 2008, BS EN 1992-1-1 : 2004 and its UK National Annex, BS EN 206 : 2013, BS 8500-1 : 2015 and BS 8500-2 : 2015. See sections 6.12 to 6.20 of this Certificate
- plain or reinforced concrete toppings(1)— specifications of plain and reinforced concrete toppings are given in Table 2 of this Certificate

(1) The concrete used in the prestressed beam and concrete toppings must comply with BS EN 206 : 2013, BS 8500-1: 2015 and BS 8500-2: 2015.

- concrete closure blocks — with a compressive strength equal to, or greater than, that of the blocks used to form the inner leaf of the wall. For dimensions of concrete closure blocks, see Figure 2
- stainless steel edge clips — used to provide support to each EPS End and Start Infill Panel against applied design dead and imposed loads. The specification of the clips is shown below. For further details, see Figure 3 and section 6.8 of this Certificate:

Diameter of the clip	2.95 mm
Grade of stainless steel	302
Tensile/yield strength	1470/1710 $N \cdot mm^{-2}$
Modulus of elasticity	187.7 $kN \cdot mm^{-2}$

- insulation edge strips — for application around the perimeter of concrete toppings. The width of the insulation edge strips is 25 mm and 30 mm for grey and white respectively.

Figure 2 Concrete closure blocks

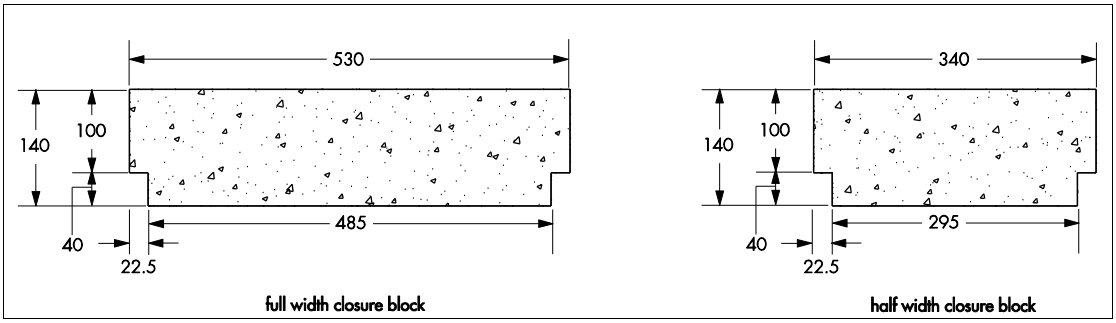
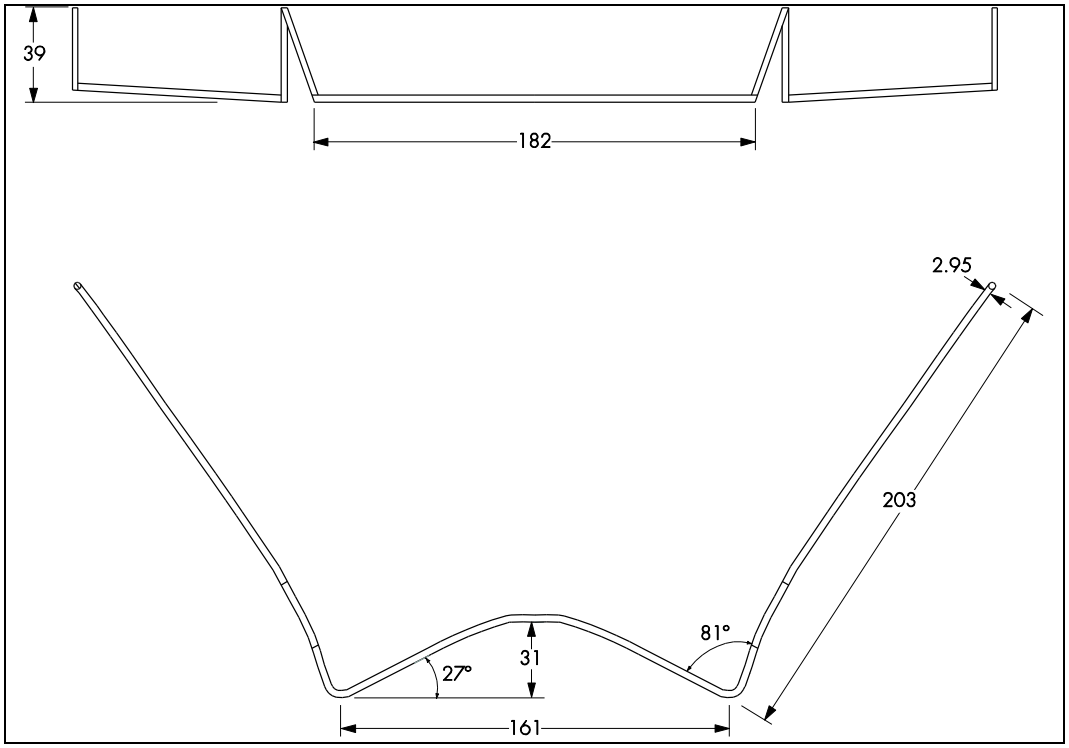


Figure 3 Stainless steel edge clips



1.4 Ancillary items outside the scope of this Certificate include:

- where required, gas barrier membranes(1) with third-party approval
- vapour control layer (VCL)(1)
- damp-proof membranes (dpm)(1) with third-party approval

(1) must be compatible with EPS

2 Manufacture

2.1 The EPS Connectors and Infill Panels are manufactured from expanded polystyrene beads using conventional moulding techniques. The Jablite Connectors and Infill Full, Half and End Panels are clipped together to form Jablite All-In-One EPS products.

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

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

2.3 The management system of Jablite Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001: 2008 by the BSI (Certificate FM01260).

3 Delivery and site handling

3.1 Care must be taken when unloading, stacking and storing the concrete beams to prevent damage. They should 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.

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

3.3 For storage periods exceeding three months, the concrete beams should be kept under cover.

3.4 The EPS products are wrapped in polyethene but are otherwise unprotected. Therefore, reasonable care must be taken during transit and storage to avoid damage.

3.5 The EPS products should be stacked on a flat base, clear of the ground, protected against prolonged direct sunlight and secured to avoid wind damage. Care must be taken to avoid contact with organic solvents.

3.6 The EPS products must not be exposed to flame or ignition sources.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Jablite All-in-One Thermal Floor System NST (Non-Structural Topping).

Design Considerations

4 Use

4.1 Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) is satisfactory for use as part of a suspended ground floor (over a sub-floor void) in single-family dwellings where the characteristic loads do not exceed those specified in Table 3 of this Certificate.

4.2 A suitably experienced/qualified engineer should perform a site-specific assessment/design to ensure that:

- the EPS Connectors, Infill Panels, Make up Infill Panels, concrete beams and plain or reinforced concrete toppings defined in Table 2 are suitable for the intended use, based on the recommendations in this Certificate and the relevant parts of BS EN 15037-1 : 2008 and BS EN 15037-4 : 2010
- the floor is not loaded by construction materials until the plain or reinforced concrete toppings have fully cured
- adequate detail for the concrete topping to avoid shrinkage-induced cracking is provided
- the natural frequency of the floor is greater than 4.0 Hz. Use of the system where vibration due to rhythmic activity (such as dancing) and external sources (eg building construction or rail traffic) may be encountered is outside the scope of this Certificate
- where required, lateral restraint is provided at ground floor level in accordance with the requirements of the national Building Regulations, BS EN 8103-1 : 2011 and NHBC Standards 2017

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

4.4 In locations where clay heave is anticipated, a greater void depth may be required to accommodate the possible expansion of the ground below the floor. In cases where the risk of clay heave has been confirmed by geotechnical investigations, a total void of up to 300 mm (refer to *NHBC Standards* 2017) 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)

4.5 On sites which may be subject to emissions of gas or volatile organic compounds (VOC's), a suitably experienced and qualified person must assess the compatibility of the insulation with any potential emissions.

4.6 Electrical cables in contact with the EPS should be enclosed in a suitable conduit, such as rigid PVC. The Certificate holder should be consulted for further advice.

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

5 Practicability of installation

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

6 Strength and stability

General

6.1 A suitably experienced/qualified engineer must ensure that the concrete beams are suitable for the intended application (see section 4.2 of this Certificate).

EPS products

6.2 Subject to compliance with the design and installation requirements of this Certificate, the EPS products contribute to the mechanical function of the floor system as R2 blocks (as defined in BS EN 15037-4 : 2010) and have adequate design resistance as follows:

- the Jablite All-In-One EPS products provide a permanent formwork for the concrete topping. They carry the normal temporary loads expected during the construction phase of the floor system, including the weight of the concrete topping
- the EPS Connectors and EPS Make up (2) Panels contribute to the short- and long-term structural performance of the floor, by transferring the vertical design imposed and dead loads to the concrete beams
- the strain against stress performance of the EPS Connectors and Make up Infill Panels (2) under the applied loads at SLS (Serviceability Limit State) condition remains within the permitted elastic performance limit of 1.5%
- the long term thickness reduction of the EPS Connectors and Make up (2) Panel remains within the acceptable limit of 2% after 50 years, when subjected to a permanent compressive stress of 0.3 σ_{10} (σ_{10} is the compressive stress of the EPS at 10 % deformation)
- the EPS Infill Panels and Make up (1) and (2) Panels have adequate strength against the applied dead and imposed loads defined in Table 3 of this Certificate at SLS and ULS (Ultimate Limit State) conditions and contribute to the mechanical resistance of the floor.

6.3 The Jablite All-In-One EPS products may be cut to accommodate varying beam lengths; the cut pieces must be at least 300 mm long and should be positioned at the floor edges. The widths of the Start and End Infill Panels are 178 mm and 335 mm respectively.

6.4 The Jablite All-In-One EPS products are designed to have a normal bearing of 18 mm, with a 3 mm allowance for misalignment and manufacturing tolerances in the straightness of the beam, with a minimum bearing width of 15 mm.

6.5 The Make up Panels (1) and (2) (see section 14.8) should not be used at widths greater than 300 mm and 500 mm respectively.

6.6 Connectors and Make up Panels (2) act as R2 blocks and have adequate resistance to short- and long-term compression creep.

6.7 To ensure the elastic performance of the Connectors and Make up Infill Panels (2) remain within the limit of 1.5%, they must be used in conjunction with a concrete beam that has a top flange width equal to or greater than 42 mm. The thickness of plain or reinforced concrete toppings as defined in Table 2 of this Certificate must be equal to or greater than 50 mm.

Stainless steel edge clips

6.8 The stainless steel edge clips have adequate strength to support the Start and End Infill Panels against the applied design dead and imposed loads on the floor at SLS and ULS conditions (see section 1.3 of this Certificate). Three clips are used per full length of EPS Start and End Infill Panels, and one clip is used per minimum cut length of Start and End Infill Panels.

6.9 The concrete toppings should be in accordance with BS 8500-1 : 2015, BS 8500-2 : 2015 and BS EN 206 : 2013, manufactured in plants covered by the QSRMC scheme (Quality Scheme for Ready Mixed Concrete) and laid by personnel with the appropriate skills and experience.

Concrete toppings

6.10 The specification of concrete toppings (plain or reinforced with micro-/macro-polymer fibres, steel fibres and steel mesh) defined in Table 2, in conjunction with the EPS products (200 kPa) shown in Figure 1 and Table 1 and the pre-stressed concrete beams (see section 1.3), is suitable for use in single-family dwellings with the characteristic loads defined in Table 3 of this Certificate.

Table 2 Specifications of 50 mm concrete topping[(1)(2)]

Ref. No.	Reinforcement
1	Plain concrete[(2)]
2	One layer of D49[(2)], D98[(2)] or A142[(2)] steel mesh to BS 4483 : 2005 with a characteristic yield strength (fyk) of 500 N·mm^{-2}. Reinforcement should be placed mid height of the concrete slab
3	Durus S400[(6)] (macro-polymer fibre), dosage rate 4.0 kg·m^{-3}, 45 mm long, 0.9 mm diameter, tensile strength 465 N·mm^{-2} and modulus of elasticity 3350 N·mm^{-2}
4	Novomesh B&BA[(7)] (steel fibre), dosage rate 17.5 kg·m^{-3}, steel flat end, steel fibres, fibre length 50 mm, diameter 1.0 mm, tensile strength 1150 N·mm^{-2}
5	Novomesh B&BA[(6)] (macro-polymer and micro polyolefin fibre), dosage rate 3.84 kg·m^{-3}, shape of macro fibre: continuously deformed, 60 mm long, 0.56 mm diameter, tensile strength 600 N·mm^{-2}, modulus of elasticity 7000 N·mm^{-2}
6	Adfil SF86[(7)] (steel fibre), dosage rate 13.33 kg·m^{-3}, 60 mm long, diameter 0.75 mm, tensile strength 1225 N·mm^{-2}, modulus of elasticity 200000 N·mm^{-2}
7	Durus Easy Finish[(6)] (macro-polymer fibre), dosage rate 3.00 kg·m^{-3}, 40 mm long, 0.7 mm equivalent diameter, tensile strength 470 N·mm^{-2}, modulus of elasticity 6000 N·mm^{-2}
8	Fibrin X-T (monofilament polypropylene micro fibre), minimum dosage rate 0.91 kg·m^{-3}, 12 mm long, 22 microns diameter, tensile strength 280 N·mm^{-2}
9	Fibrin 23 (polypropylene micro fibre), dosage rate 0.90 to 0.91 kg·m^{-3}, 12 mm long, 19.5 microns diameter, tensile strength 312 N·mm^{-2}
10	Fibremesh 120-12 (polypropylene micro fibre), dosage rate 0.90 kg·m^{-3}, 12 mm long, 56 microns diameter
11	Fibremesh 150-e3 (polypropylene micro fibre), dosage rate 0.90 kg·m^{-3}, 12 to 19 mm long, 31 to 56 microns diameter

(1) The concrete can be either C28/35 standard concrete (see note 3, below) with maximum 20 mm aggregate (see note 5, below), or C28/35 self-compacting concrete (see note 4, below) with maximum 10 mm aggregate (see note 5, below)
(2) Plain concrete topping is adequate in all situations mentioned in this Certificate. Concrete incorporating fibre or steel mesh reinforcement is also acceptable.
(3) For standard concrete the slump should be Class S3 (100 to 150 mm) or S4 (for spot samples taken from initial discharge, 140 to 230 mm).
(4) For self-compacting concrete the slump flow class should be SF1 (550 mm to 650mm) or SF2 (660 mm to 750mm). The sand content should be greater than 45%.
(5) The aggregate for concrete must comply with BS EN 12620 : 2013.
(6) For fresh concrete, macro-polymer fibres content should be measured in accordance with BS EN 14488-7 : 2007
(7) For fresh and hardened concrete, steel fibres content should be measured in accordance with BS EN 14721 : 2005.

6.11 Permitted characteristic loadings for plain or reinforced concrete toppings are shown in Table 3. For imposed loads (uniformly distributed loads [UDL] and concentrated loads), refer to BS EN 1991-1-1 : 2002 and its UK National Annex.

Table 3 Maximum characteristic imposed partition loads and weight of finishes for plain or reinforced concrete toppings as defined in Table 2

Description	Characteristic loads for single-family dwellings
Imposed uniformly distributed load (UDL) ($kN \cdot m^{-2}$)	1.5(1)
Imposed concentrated load (kN)	2.0(1)(2)
Line load partition parallel and perpendicular to the beam ($kN \cdot m^{-1}$)	1.0(3)(4)
Allowance for moveable partition ($kN \cdot m^{-2}$)	1.0(3)
Finishes ($kN \cdot m^{-2}$)	0.5

(1) Imposed concentrated load must not be combined with the imposed UDL or other variable actions.
(2) Imposed concentrated load must be applied over a square plate not less than 100 mm by 100 mm.
(3) Moveable and line load partition loads must not be combined with line load partition wall.
(4) The weight of non-load bearing partition walls must not exceed 1 $kN \cdot m^{-1}$. Partitions heavier than 1 $kN.m^{-1}$ must be supported either by the foundation or directly on the concrete beams.

Pre-stressed concrete beam

6.12 The beams must be designed in accordance with BS EN 1992-1-1 : 2004 (Eurocode 2) and its UK National Annex by a suitably experienced/qualified engineer to ensure that the beams are adequate to resist the applied design loads.

6.13 The proposed beam must be CE marked and manufactured and designed in accordance with requirements of BS EN 15037-1 : 2008.

6.14 The self-bearing pre-stressed concrete beams, normal weight concrete, provide the final strength of the floor system independently of any other constituent part of the floor system.

6.15 The natural frequency of the concrete beam used in the floor(1) must be greater than 4 Hz, as defined below. A suitably experienced/qualified engineer must ensure the following criteria are met for other floors under the specified loading conditions:

(a) The concrete beam should have a natural frequency greater than 4 Hz when loaded with full dead load plus 0.1 x imposed 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 dynamic flexural rigidity of the member (Nm^2).
m is the effective mass supported by the concrete beam ($kg \cdot m^{-2}$).
L is the span of the member (m).

(1) The vibration due to rhythmic activity (such as dancing) and the external sources (such as building construction or rail traffic) will be excluded from the beam and block floor systems.

6.16 The serviceability deflection limit of the proposed concrete beam must be in accordance with BS EN 1992-1-1 : 2004, as summarised in Table 4 of this Certificate.

Table 4 Deflection limitation of pre-stressed concrete beams

Description	Limit for deflection
Camber at transfer (upward deflection) of pre-stressed force under the self-weight of the beam	span/250
Deflection at application of finishes – downward from the level of the bearings	span/250
Deflection for long-term quasi permanent loading (M_{QP})(1) after losses in pre-stress force and creep measured from below the level of the bearings	span/250
Movement after application of finishes – increase in deflection due to pre-stress loss and creep	span/500

(1) M_{QP} is the moment under the quasi-permanent load combination (refer to equation 6.16a of BS EN 1990 : 2002 and its UK National Annex).

6.17 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 : 2002 (6.14a and 6.10 or the less favourable equations 6.10a and 6.10b). The lowest effective span obtained from these equations will be considered to be the maximum effective span of the concrete beam.

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

6.19 The minimum bearing length to support the concrete beam is 90 mm, in accordance with BS 8103-1 : 2011.

6.20 The concrete beam is self-bearing and no account should be made for possible composite action between the beams and the EPS Connectors, Make up and Infill Panels, plain or reinforced concrete toppings.

7 Thermal performance

7.1 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 : 2007 and BRE Report 443 : 2006.

7.2 A floor deck U value (from inside to the under floor void) will depend significantly on the types and number of precast concrete beams, EPS Infill Panel and Connectors. The thermal resistance of each T-beam and EPS configuration should be numerically modelled to BS EN ISO 10211 : 2007 and BS EN 15037-4 : 2010. The floor deck U value may then be taken as an area-weighted average and the overall floor U value calculated as described in section 7.1.

7.3 Example floor U values given in Table 5, for a typical floor construction as shown in Figure 4, indicate that the system can enable a floor to meet, or improve upon, design floor U values of between 0.13 $W{\cdot}m^{-2}{\cdot}K^{-1}$ and 0.25 $W{\cdot}m^{-2}{\cdot}K^{-1}$, as specified in the documents supporting the national Building Regulations.

Table 5 Example floor U values(1) for single beam configurations(3) ($W{\cdot}m^{-2}{\cdot}K^{-1}$)

Beam option	p/a ratio (m/m^2)	EPS200 white 75 mm connector	EPS200 grey 75 mm connector(2)	EPS200 grey 100 mm connector(2)(4)	EPS200 grey 300 mm connector
Beam 42 mm x 150 mm Refer to Figure 5a	0.4	0.15	0.15	0.13	0.070
	0.6	0.16	0.15	0.13	0.072
	0.7	0.16	0.16	0.14	0.073
	0.9	0.16	0.16	0.14	0.073
Beam 56 mm x 175 mm Refer to Figure 5b	0.4	0.15	-	-	0.071
	0.6	0.16	-	-	0.073
	0.7	0.16	-	-	0.073
	0.9	0.17	-	-	0.074

(1) These calculations are in accordance with sections 7.1 and 7.2 and assume:
- the T-beam is 2.0 $W{\cdot}m^{-1}{\cdot}K^{-1}$ and 50 mm concrete screed is 1.15 $W{\cdot}m^{-1}{\cdot}K^{-1}$
- 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 $m2{\cdot}m^{-1}$
- ground conductivity is 1.5 $W{\cdot}m^{-1}{\cdot}K^{-1}$
- all other parameters are default values from BRE Report BR 443 : 2006.

(2) Infill panel is EPS 200 high performance (grey).
(3) Configuration used – 100% single beams at full centres.
(4) Floor deck thickness is 300 mm (see figure 4).

Figure 4 Typical floor construction for U value calculation

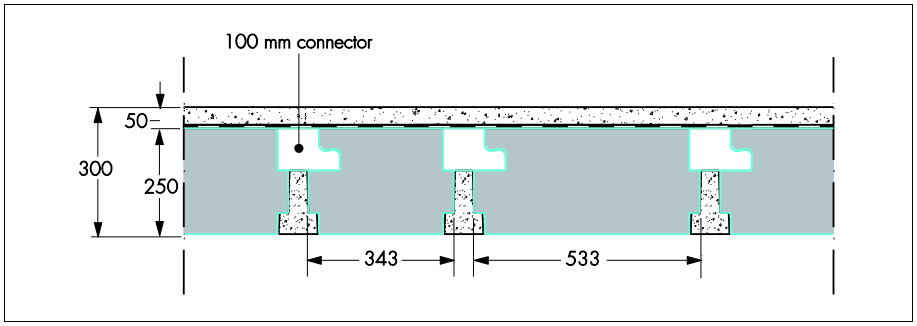
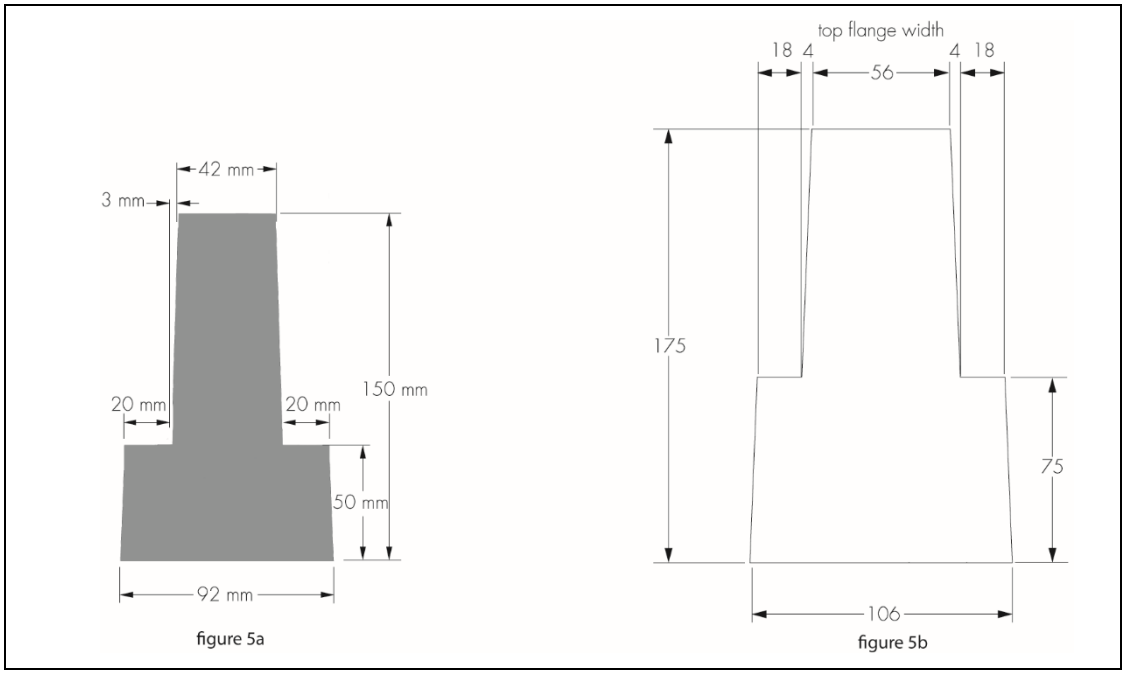


Figure 5 Pre-cast concrete beams used for thermal performance



Junction ψ-values

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.

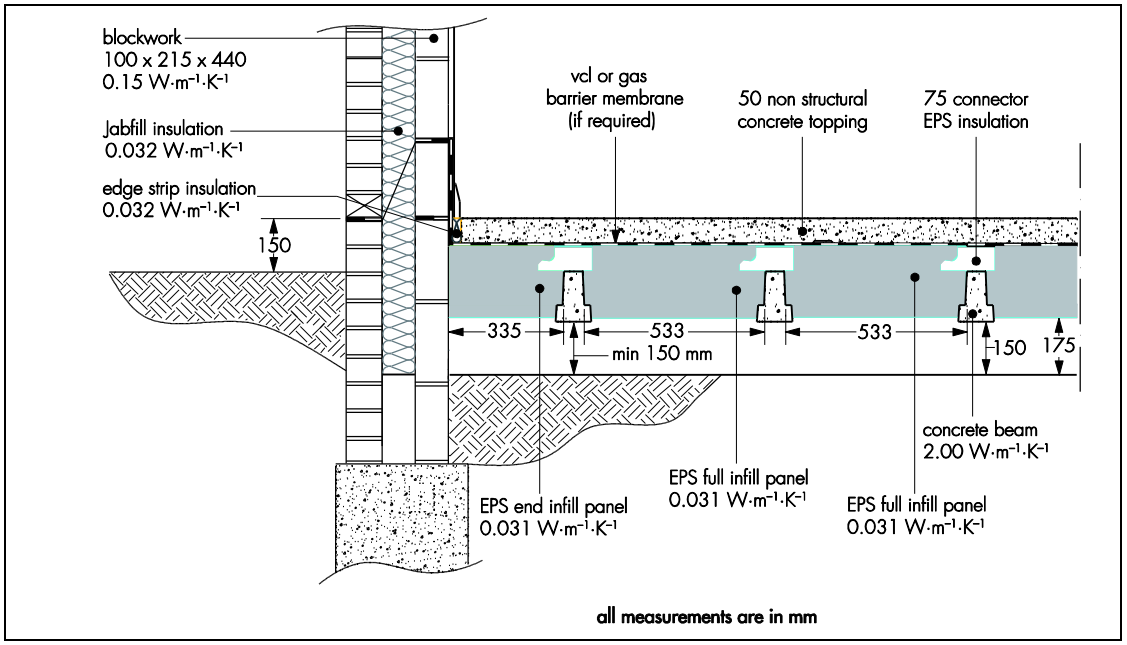
7.5 The junction psi values given in Table 6 may be used in SAP calculations or values can be modelled in accordance with the requirements and guidance in BRE Report BR 497 : 2007, BRE Information Paper IP 1/06 and the provisions in the documents supporting the national Building Regulations relating to competency to perform calculations, determine robustness of design/construction, and limiting heat loss by air infiltration.

Table 6 Junction psi values

Junction	**Ψ ($Wm^{-1}K^{-1}$)**
External wall • example construction – see Figure 6 • other junctions	 0.043(1) 0.32(2)
Party wall	0.16(2)

(1) Value correct for junction shown in Figure 4 for 175 mm beams parallel to wall and for 175 mm beams perpendicular to the wall.
(2) Conservative defaults from SAP 2012.

Figure 6 Example junction construction



8 Condensation risk

Interstitial condensation

8.1 When there is no gas membrane, dpm or VCL located above the insulation, there is a risk of interstitial condensation forming on the concrete beam, which may be persistent. Therefore, the risk for each case should be assessed, both through the beam and through the insulation, in accordance with BS EN ISO 13788 : 2012 and BS 5250 : 2011, Annex D.3, accounting for the slab construction, dwelling humidity class, dwelling type, dwelling location and use of any VCL, dpm and/or gas membrane.

8.2 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 $mm^2 \cdot m^{-1}$ run of external wall or 500 $mm^2 \cdot m^{-2}$ of floor area, whichever is the greater. Where pipes are used to carry ventilating air, they should be at least 100 mm diameter.

8.3 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 Infill Panels.

Surface condensation

8.4 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 $W \cdot m^{-2} \cdot K^{-1}$ 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 The example construction described was used to model a 3D corner which achieved a temperature factor, f_{Rsi}, of 0.90, which equals or improves upon all of the critical temperature factors, f_{CRsi}, detailed in tables 1 and 2 of BRE Information Paper IP 1/06.

8.6 Floors will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2} \cdot K^{-1}$ at any point and floors are designed and constructed to BS 5250 : 2011. Additional guidance can be found in BRE Report BR 262 : 2002.

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

9 Maintenance

The system components are installed within the floor structure and, therefore, do not require maintenance.

10 Durability

10.1 Provided the EPS products are protected in service from organic solvents and substances liable to cause deterioration, they will be effective as insulation for the life of the building in which they are installed.

10.2 The exposure condition beneath a suspended ground floor over a ventilated void and soil is class XC3, in accordance with BS EN 1992-1-1 : 2004. The concrete beam must have adequate durability for this exposure condition.

10.3 The durability of the micro-/macro-polymer or steel fibres concrete topping will be at least equivalent to that of plain concrete of the same grade.

10.4 The stainless steel clips will not be impaired by contact with conventional mortar admixtures or cavity insulation materials and should have a service life of not less than 50 years.

11 Reuse and recyclability

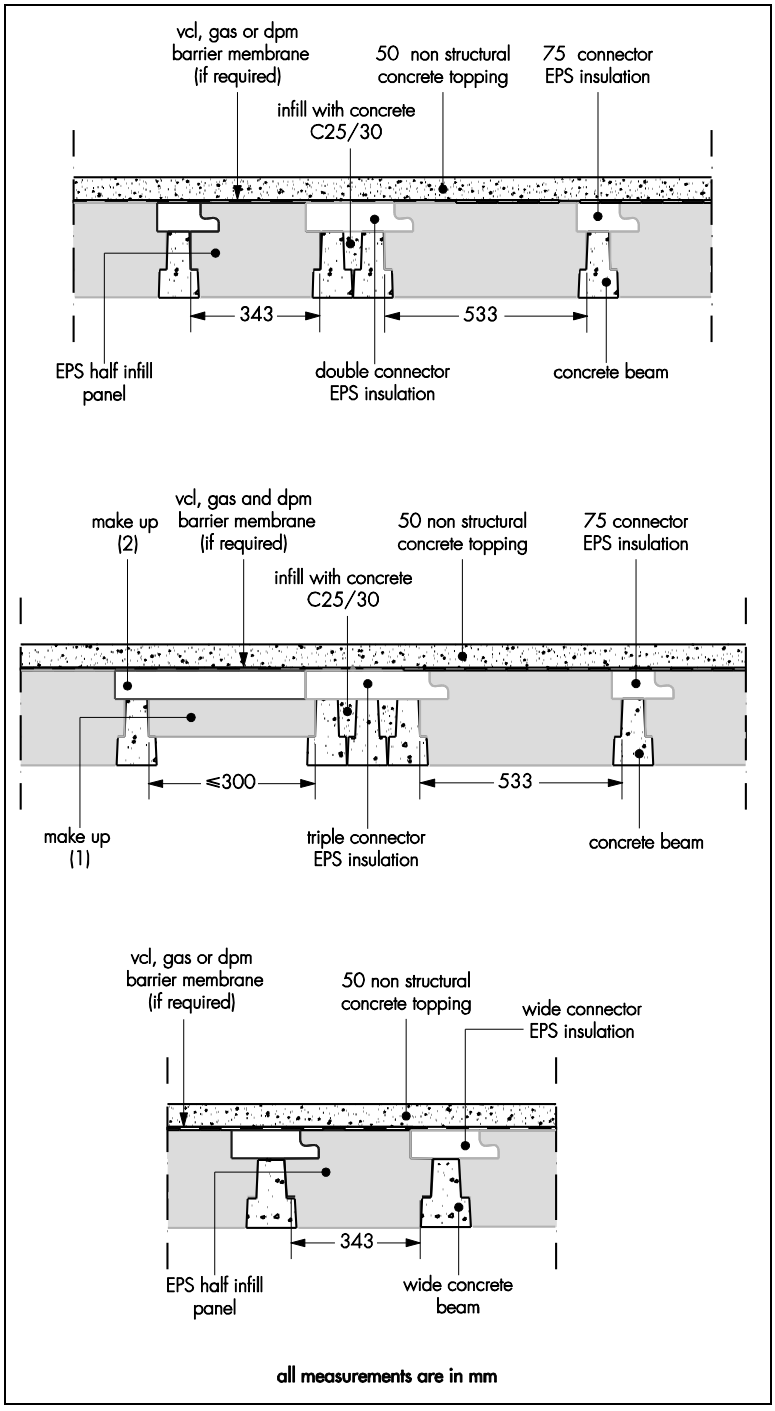
EPS material can be readily recycled if free from debris and contamination. The concrete and reinforcement steel can also be recycled.

Installation

12 General

Details of typical Jablite All-in-One Thermal Floor System NST (Non-Structural Topping) assemblies using precast concrete beams and Jablite All-in-One EPS products are shown in Figure 7.

Figure 7 Examples of beam and EPS block assemblies



13 Site preparation

13.1 The ground beneath the floor should be free of topsoil and vegetation. Oversite concrete or surface seals are not required, but material added to bring the solum to an even surface must be hard and dry.

13.2 Where clay soil of low-, medium- or high-volume change potentially exists, the final minimum void depth should be increased appropriately to prevent problems associated with heave (see section 4.4). The sub-floor void should have good natural drainage or land drains should be provided to prevent standing water within the sub-floor void when this is below ground level.

13.3 Damp-proofing and ventilation arrangements must be in accordance with normal good practice, for example, by the provision of damp-proof sleeves to ventilators and adequate drainage of the sub-floor.

13.4 A continuous damp-proof course (dpc) should be laid along the supporting wall below the beam and block bearings in accordance with BS 8102 : 2009.

13.5 The beams are laid in the positions shown on the floor plan. Each beam is tightly placed against the beam spacing blocks. Further installation details are given in section 14 of this Certificate.

14 Procedure

14.1 Normal precautions for handling EPS materials should be taken to avoid damaging the EPS products during offloading, storage, handling and installation. Any damaged blocks must be replaced before pouring the concrete.

14.2 A dpc should be laid on top of the bearing and end walls.

14.3 The pre-cast concrete beams are positioned at approximate locations and centres shown on the Jablite Ltd approved drawing.

14.4 Start Infill Panels are attached to the first beam. The beams and attached panels are then positioned tightly against the wall. The stainless steel clips are used to assist in supporting the Start and End Infill Panels. The clips should be installed horizontally and in the plane of the mortar joint across a cavity. For the number of clips, see section 6.8 of this Certificate.

14.5 The remaining beams must be accurately positioned in line, in accordance with the Jablite Ltd approved layout drawing using the spacer/closure blocks. The spacer/closure blocks are bedded in mortar.

14.6 The Jablite All-In-One EPS products are installed working from the Start Infill Panels and the first beam.

14.7 The Jablite All-In-One EPS products can be cut with a handsaw where required. Off cuts greater than 300 mm may be used elsewhere in the floor zone.

14.8 Make up Panels can be used to accommodate the gaps in non-standard beam spacings. These are cut to suit on site as per the approved drawing. Make up Infill Panels (between the beams) should not be more than 300 mm wide.

14.9 Finally, the End Infill Panels incorporating stainless steel clips are installed to complete the infill installation. For the number and installation of the clips, see section 6.8 of this Certificate.

14.10 A gas, VCL or dpm barrier membrane can be installed where required between the uppermost layer of insulation and the concrete topping.

14.11 If gas carcassing or underfloor heating pipes are specified, they can be secured to the uppermost layer of insulation material. If a gas barrier membrane, VCL or dpm is not required, this can be achieved using standard pipe clips secured directly to the insulation. If a gas, VCL or dpm membrane is required, pipes should be taped securely in position. Care must be taken not to puncture the gas, VCL or dpm membrane.

14.12 Perimeter edge insulation strips (thermal resistance $\geq 0.75\ m^2 \cdot K \cdot W^{-1}$) are installed against the perimeter wall.

14.13 If a steel mesh is specified, spacers should be positioned over spreader plates (minimum four per m^2 and minimum size 50 mm by 50 mm). They should be installed to position the steel mesh at the correct level.

14.14 The EPS panels are cut as appropriate to accommodate service penetrations, eg soil vent pipes, and the resulting gaps filled with expanding foam or other insulation to minimise local cold bridging and air infiltration.

14.15 Should any other cutting be required, the advice of the Certificate holder should be sought.

14.16 Although they can withstand temporary loads expected during the construction phrase (see section 6.2), care should still be taken not to walk unnecessarily over the installed EPS panels. If a temporary working platform is required, the panels should be covered with a suitably rigid board. To avoid damage to the panels, the concrete topping should be laid as soon as possible after the panels have been installed.

14.17 When using a concrete pump, truck or skip, concrete should not be discharged onto the polystyrene panels from heights greater than 500 mm and concrete heaps must not be formed over 300 mm high.

14.18 When wheelbarrows are used, planks must be placed to spread the wheel load to the precast concrete beams. Spot boards must be used when tipping and shovelling.

14.19 The concrete topping is placed and compacted. Provision should be made for a suitable concrete finish to be achieved, preferably by operatives not standing on the panels, eg by use of a self-levelling concrete topping.

14.20 Throughout the installation process, due consideration must be given to relevant health and safety regulations and the Certificate holder's product information sheets.

14.21 To prevent concrete ingress where a VCL, gas membrane or dpm is not placed above the Jablite All-In-One EPS products, the following procedures should be followed:

- the joints between the EPS should be taped with a minimum width of 75 mm and/or
- any gaps between Jablite All-In-One EPS products or around service openings, visible prior to installing the concrete, must either be filled with expanding foam or strips of insulation.

Technical Investigations

15 Tests

15.1 An assessment of test data was carried out to ensure that the short-term strain of the EPS 200 (Connectors and Make up Infill Panels) under the applied loads remains within the permitted elastic performance limit of 1.5%.

15.2 A test was carried out to assess the load bearing capacity and the number of clips against the applied ultimate bending moment and shear forces.

15.3 Tests were conducted on the Jablite All-in-One EPS products to determine the:

- resistance to construction loads
- thermal conductivity (λ_D *values*)
- dimensional accuracy.

16 Investigations

16.1 Assessment was made to determine the adequacy of the Jablite All-in-One EPS products as R2 blocks (full length and minimum cut, minimum bearing width) in terms of compressive strength and dimension against the applied imposed UDL or concentrated and dead loads at SLS and ULS conditions.

16.2 Assessment was made to ensure that the long-term thickness reduction of the EPS Connectors and Make up (2) Infill Panel as R2 blocks remains within the acceptable limit of 2% after 50 years when subjected to a permanent compressive stress of 0.3 σ_{10} (σ_{10} is the compressive stress of the EPS at 10 % deformation).

16.3 Floor deck U values were derived by modelling to BS EN ISO 10211 : 2007 and BS EN 15037-4 : 2010 Annex F, and example floor U values calculated to BS EN ISO 13370 : 2007.

16.4 The risk of condensation was determined in accordance with BS 5250 : 2011.

16.5 The durability, practicability of installation and detailing techniques of the system were assessed.

16.6 The manufacturing processes for the EPS panels were evaluated including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

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

BS 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*

BS 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 8500-1 : 2015 *Concrete — Complementary British Standard to BS EN 206-1 — Method of specifying and guidance for the specifier*
BS 8500-2 : 2015 *Concrete — Complementary British Standard to BS EN 206-1 — Specification for constituent materials and concrete*

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

BS EN 1990 : 2002 *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 *Design of concrete structures — General rules and rules for buildings*
NA to BS EN 1992-1-1 : 2004 *UK National Annex to Eurocode 2 : Design of concrete structures — General rules and rules for buildings*

BS EN 12620 : 2013 *Aggregates for concrete*

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

BS EN 14889-1: 2006 *Fibres for concrete — Steel fibres — Definitions, specifications and conformity*
BS EN 14889-2 : 2006 *Fibres for concrete — Polymer fibres — Definitions, specifications and conformity*

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 : 2008 *Quality management systems — Requirements*

BS EN ISO 10211 : 2007 *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

BS EN ISO 13370 : 2007 *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 (ISO 13788:2012)*

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

BRE Information Paper IP 01/06 *Assessing the effects of thermal bridging at junctions and around openings*

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*

17 Conditions

17.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

17.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

17.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

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

17.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

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

17.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.