Number BAF-17-059-S-A-UK **Replaces:** BAF 17-059/01/A		**Category** Insulated suspended concrete ground floors
Date May 2021		**Phase** Assessment
Project number 3 Year Renewal		**Subject** Thermal insulation systems
Validity www.kiwa.co.uk/bda		

BDA Agrément® BAF-17-059-S-A-UK

System

Gdeck R1 EPS Panel System

Agrément holder

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Description

Floor insulation system comprising a range of Type R1 expanded polystyrene (hereinafter 'EPS') infill panels and load-bearing rails (EPS 250) for use as thermal insulation for suspended ground floors (over a sub-floor void). To be used in conjunction with a structural (concrete) base slab (manufactured by others).

Scope (use)

Thermal insulation for use in suspended ground floors designed and constructed in accordance with the relevant clauses of this Agrément and the Agrément holder's requirements. See also Section 3 of this document for the full range of the Gdeck R1 EPS Panel System (hereinafter the 'System').

Objective

This document provides independent information to specifiers, building control personnel, contractors, installers and other construction industry professionals with regard to the fitness for the intended use of the System.

Summary of Agrément

This Agrément covers the following:

- Conditions of use;
- Sources, including codes of practice, test and calculation reports;
- Independently assessed System characteristics and other system information;
- Factory Production Control and annual verification procedure;
- Points of attention for the specifier and examples of details;
- Installation procedure;
- Compliance with national Building Regulations and non-Regulatory Standards.

Major points of assessment

Thermal performance (Sections 8.4, 8.5 and 8.6)
The EPS infill panels and load-bearing rails used in a correctly designed and installed System can enable a floor to meet the requirements of the national Building Regulations in respect of U-value performance.

Moisture control (Section 8.7)
The EPS infill panels and load-bearing rails used in a correctly designed and installed System can limit the risk of interstitial and surface condensation.

Strength (Section 8.8)
The System, when correctly designed and installed, will act as formwork for a cast in-situ structural (concrete) base slab that must transmit both dead and imposed floor loads.

Durability (Section 8.10)
The EPS infill panels and load-bearing rails are stable, rot-proof and durable and shall have a service life durability equivalent to that of the building into which they are incorporated.

Statement

It is the opinion of Kiwa Ltd. that the System is fit for the intended use, provided it is specified, installed and used in accordance with this Agrément.

Chris Vurley, CEng
Technical Manager, Building Products

Mark Crowther, M.A. (Oxon)
Technical Director

1 Conditions of use

1 Application
The assessment of the System relates to its use in domestic, residential and commercial buildings with correctly installed masonry external walls, designed and constructed in accordance with BS EN 1996-1-1 (with UK NA) and PD 6697 and correctly detailed ground floor systems, designed and constructed in accordance with BS 8103-1, BS 8215, BS EN 15037-1, BS EN 15037-4 and the Agrément holder's requirements.

2 Assessment
Kiwa Ltd. has assessed the thermal performance, design and installation of the System according to BS EN 15037-1, BS EN 15037-4 and BS EN 1996-1-1 in combination with the DoP and Technical Assessment and site visits. Also, the NHBC Standards have been taken into account. Factory Production Control has been assessed.

3 Installation
The quality of installation and workmanship must be controlled by a competent person who must be a qualified employee of the Agrément holder or a qualified employee of a consulting engineering body.

The System must be installed strictly in accordance with the instructions of the Agrément holder and the requirements of this Agrément.

4 Geographical scope
The validity of this document is limited to England, Wales, Scotland and Northern Ireland, with due regard to Section 11 of this Agrément.

5 Validity
The purpose of this BDA Agrément® is to provide for well-founded confidence to apply the System in the described applications and according to approved specifications. The validity of this Agrément is three years after the official date of issue, published on www.kiwa.co.uk/bda. After this the validity can be extended every three years after positive review. This Agrément is not valid in those cases where Kiwa Ltd. identifies that the design of a flooring system does not comply with article 8.2 (Permitted constructions) of this Agrément.

2 Sources

1 BS EN ISO 6946:2017 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method
2 BS EN ISO 10211:2017 Thermal bridges in building constructions. Calculation of heat flows and surface temperatures
3 BS EN ISO 13370:2017 Thermal performance of buildings. Heat transfer via the ground. Calculation methods
4 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
5 BS EN 13163:2012+A1:2016 Thermal insulation products for buildings. Factory made expanded polystyrene (EPS) products. Specification
6 BS EN 15037-4:2010+A1:2013 Precast concrete products. Beam-and-block floor systems. Expanded polystyrene blocks
7 BS 5250:2011+A1:2016 Code of practice for control of condensation in buildings
8 NHBC Standards 2020 Chapter 2.1 The Standards and Technical Requirements, Chapter 5.2 Suspended ground floors
9 BR 443:2006 Conventions for U-value calculations, BRE Scotland
10 BR 497:2010 Conventions for Calculating Linear thermal transmittance and Temperature Factors, BRE Trust
11 SAP 2012 Conventions, version 9.92, October 2013, BRE
12 Declaration of Performance, Type R1, Expanded Polystyrene G Deck Insulation Infill Panels & Load Bearing Rails, Moulded Foams, MF B185, 15 October 2019, Issue 1
13 Moulded Foams, Gdeck™ Installation Manual, 11/02/2020 Issue 6
14 Kiwa BDA report, No. 16-C-0247 (revision 3), Gdeck EPS Panel System - Calculations of the required beam width, issued 12.02.2018
15 EUMEPS, EPS White Book, version 19/10/16

3 Independently assessed System characteristics of components used for critical functions**)**

****)**The critical functions which apply to this section and Section 4 are Structure, Durability and Thermal insulation.

CE-marking of EPS load-bearing rails and infill panels
The Agrément holder has taken the responsibility of CE marking the EPS components used in the System in accordance with BS EN 15037-4. An asterisk (*) indicates values in this section are given in the manufacturer's Declaration of Performance (DoP).

3 Independently assessed System characteristics of components used for critical functions)** (continued)

EPS load-bearing rails and infill panels
Two variants of the white EPS rail can be provided. For use with multiple/grouped beams a 'multi-rail' is available to fill the void between the beams, eradicating the need for grouting and preventing a thermal bridge.

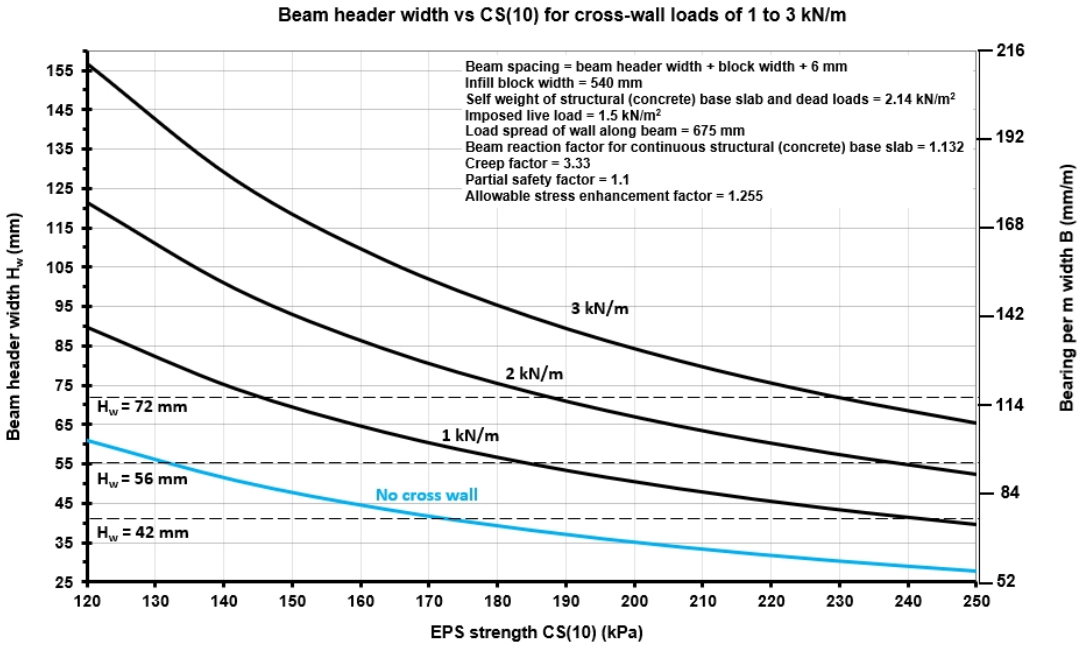
- Declared thermal conductivity λ_D (W/mK)
  - EPS load-bearing rails (EPS 250 white) : 0.032*
  - EPS infill panels (EPS 80 grey) : 0.030*
- Density (kg/m^3)
  - EPS load-bearing rails (EPS 250 white) : 30.5 - 34.3
  - EPS infill panels (EPS 80 grey) : 16.0 - 18.1
- Length (mm)
  - EPS load-bearing rails (EPS 250 white) : 1200
  - EPS load-bearing multi-rails (EPS 250 white) : 600
  - EPS infill panels (EPS 80 grey) : 1200
- Water vapour resistance factor (μ)
  - EPS load-bearing rails (EPS 250 white) : 40 - 100
  - EPS infill panels (EPS 80 grey) : 20 - 40
- Reaction to fire, class : F*
- Mechanical properties
  - EPS infill panels have, according to BS EN 15037-4, a characteristic resistance (P_{Rk}) to concentrated loads (kN) : > 1.5*
  - EPS load-bearing rails, line loads (kN/m) : ≤ 5.0
  - compressive strength at 1% strain according to the EPS White Book for EPS 250 (kPa) : ≥ 75

Note: a structural (concrete) base slab, self-bearing precast pre-stressed concrete beams (hereinafter 'pre-stressed concrete beams'), and concrete closure blocks do not form part of the System and are not manufactured by the Agrément holder.

Required beam header width
Beam headers are covered by EPS load-bearing rails. The minimum beam header width H_w depends on the level of compressive stress at 10 % deformation (CS(10)) and the line load. See Diagram 1 for partition walls exerting line loads from 1 kN/m to 3 kN/m (the inset shows the conditions assumed).

Note: the minimum length of EPS load-bearing rails shall not be less than 300 mm.

Diagram 1 - required beam header widths (H_w) for parallel and cross partition walls

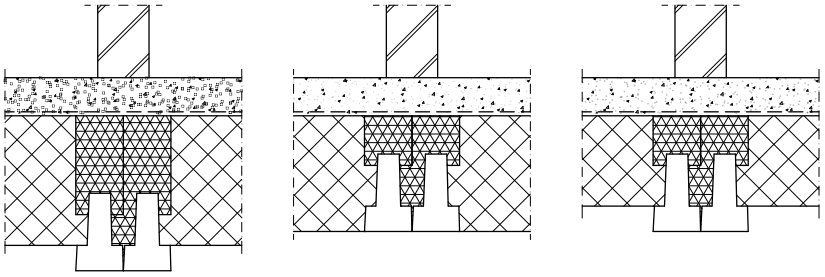


Remark: the difference in beam header width for parallel and cross walls is negligible up to a wall line load of 3 kN/m.

3 Independently assessed System characteristics of components used for critical functions)** (continued)

System range
The full System range is given in Diagrams 2a, 2b and 2c.

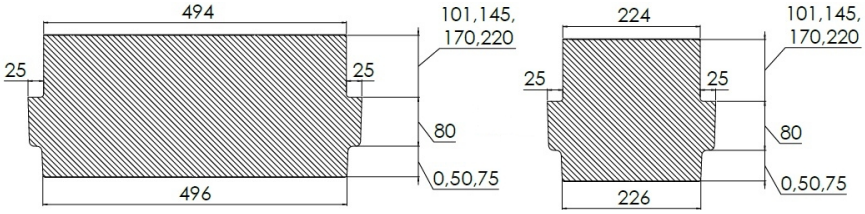
Diagram 2a - range of the Gdeck R1 EPS Panels



GT12 GT15 GT18

The EPS infill panels GT12, GT15 and GT18 have a thickness/height of 251 mm, 230 mm and 181 mm respectively.

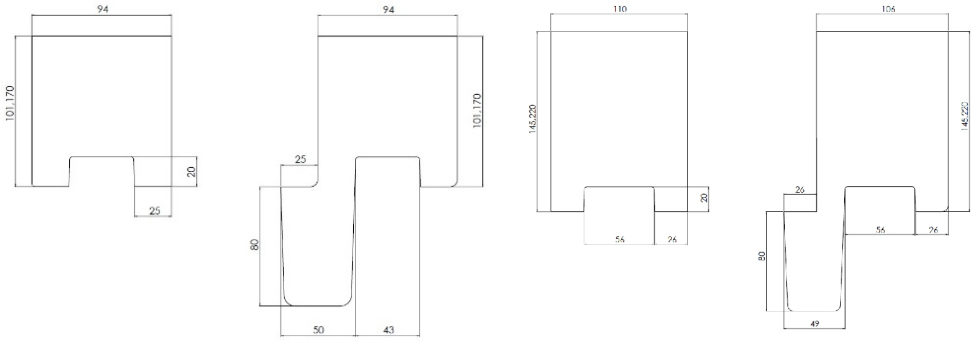
Diagram 2b - EPS infill panels



Full-size EPS infill panel Half-size EPS infill panel

Figures separated by commas indicate available size variations.

Diagram 2c - EPS load-bearing rails for 150 mm and 175 mm deep beams



The cross-sections on the right show EPS load-bearing rails for a 175 mm high precast concrete beam with a header width of 56 mm.

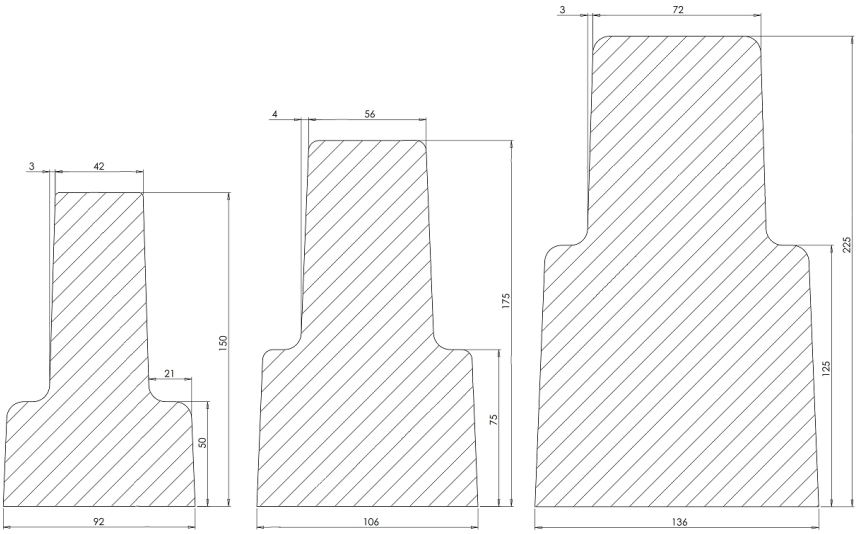
Note:
- for a 150 mm high beam, with a header width of 42 mm, the thickness of an EPS load-bearing rail is 101 mm OR 170 mm to match (common) brick courses.
- for a 175 mm high beam, with a header width of 56 mm, the thickness of an EPS load-bearing rail is 145 mm OR 220 mm to match (common) brick courses.

The EPS load-bearing rails are injection-moulded to suit beam profiles and to match the EPS infill panel height. Therefore, the header width (H_w) of a beam is not limited. The thickness of an EPS load-bearing rail is 101 mm minimum and 220 mm maximum (see Diagram 3 for examples of typical pre-stressed concrete beams).

4 Ancillary items used for critical functions)**

Typical pre-stressed concrete beams
Examples of typical pre-stressed concrete beams for the System are given in Diagram 3.

Diagram 3 - examples of typical prestressed concrete beams (where H_w = width of the beam header, all dimensions in mm)



In conjunction with the EPS load-bearing rails and infill panels, several ancillary items are used according to the following specifications (see also Section 9 of this Agrément).

Galvanised steel edge clips

- galvanised steel edge clips (hereinafter 'edge clips') provide a bearing for the EPS infill panels around the periphery of the build if required; a well cut panel will have suitable support, therefore edge clips are not mandatory and their use is solely down to personal preference of the specifier;
- edge clips are to be installed at the same bearing level as the floor beam; the 'V-shaped' unit will support the underside of the EPS infill panel to provide additional support; the typical usage is two edge clips per panel.

Concrete closure blocks

- concrete closure blocks:
  - are to be used in conjunction with the System, supplying a solid support thus allowing the continuation of the inner skin build;
  - are manufactured in accordance with BS EN 771-3;
  - have a compressive strength of 7.0 N/mm^2;
  - are to be installed between beam ends around the periphery of the floor, on to a mortar bed.
- full concrete closure blocks accommodate the spacing of full EPS infill panels; half concrete closure blocks suit the spacing of half EPS infill panels.

PsiStrip™

- PsiStrip™ is a strip of white or silver EPS, minimum thickness of 25 mm and height of 75 mm, fitted to the perimeter wall before applying the structural (concrete) base slab.

5 Factory Production Control (FPC)

Kiwa Ltd. has determined that CTS, with respect to the System, fulfills all provisions concerning the specifications described in this Agrément. The FPC audit conducted on 30 June 2016 demonstrated that CTS have a satisfactory Quality Management System and are committed to operating an effective Quality System throughout their activities.

6 Quality Management System

The Quality System covers the clauses required by the BDA Agrément®. CTS is committed to improving their FPC Quality System and related procedures. Document control and production line procedures were satisfactory with sufficient evidence provided in support of the requirements.
All processes in the factory were well organised and the factory can conduct all processes including storage of raw materials and packaging of final products. All area managers and employees are well trained and confident in executing their respective tasks.

7 Continuous surveillance

In order to demonstrate that the FPC is in conformity with the requirements of the technical specification described in this Agrément the continuous surveillance, assessment and approval of the FPC will be done in a frequency of not less than once per year by Kiwa Ltd.

8 Points of attention for the specifier

1 Delivery, transport and site handling

The EPS panels and rails are shrink-wrapped and bonded in cube packs but otherwise unprotected; therefore, care shall be taken during transit and storage to avoid damage; further measures are given in Section 10 of this Agrément.

2 Permitted constructions

Only constructions designed according to the specifications as given in this Agrément and as shown in Section 9 or similar are allowed under this Agrément; in each case the specifier will have to cooperate closely with the Agrément holder:

- all partition walls assume permanent blockwork walls; temporary/stud walls ≤ 1 kN/m can be placed in any orientation across the floor area;
- partition walls running parallel to beams shall be installed directly above beams;
- partition walls perpendicular to beams (cross walls) shall be supported by a minimum number of beams to match the header widths H_w as shown in Diagram 1;
- the exact position of partition walls will determine beam widths, configuration and strength of the base slab;
- the Agrément holder's guidelines are supplementary to the structural requirements of the structural (concrete) base slab and beams and shall be taken into consideration by the specifier of the floor.

3 Control of structural floor plan

CTS-approved System distributors draft floor plans to meet structural and thermal requirements. CTS has appointed Moulded Foams as the sole supplier of EPS components of the System within the UK:

- CTS only grants licences to beam suppliers who have obtained confirmation, from a structural engineer, that their beams comply with the requirements of BS EN 15037-1, BS EN 1991-1-1 and BS EN 1992-1-1;
- the distributor shall provide a structural floor plan showing the layout, bearing and profile of the beams, the location of all load-bearing and non-load bearing walls; the position and size of openings in the floor required for ducts and the position and magnitude of point and line loads;
- the distributor should provide cross-sections of the ground floor showing the floor system;
- Moulded Foams provides distributors with U-value performance tables specific to their beam profile; the perimeter/area ratio shall be calculated to determine which Gdeck thickness detail should be installed.

4 Building physics - general

- the hygrothermal behaviour of floors incorporating the System shall be verified as suitable by a competent specialist, who can be either a qualified employee of the Agrément holder or a qualified consultant;
- the Specialist will check the hygrothermal behaviour of the floor design and, if necessary, can offer advice in respect of improvements to achieve the final specification. It is recommended that the Specialist co-operates closely with the Agrément holder.

5 Thermal performance aspects

- for the purpose of U-value calculations and to determine if the provisions of the national Building Regulations (or other statutory requirements) are met, the thermal resistances of the constructions shall be calculated according to BS EN ISO 6946, BR 443, and BS EN ISO 10211 as appropriate. The recommendations of the Thermal Bridging Guide should also be observed;
- the Agrément holder can provide a service for 2D and 3D calculations for numerically modelled EPS panel and beam configurations, complying to BS EN ISO 13370, BS EN ISO 10211 and BR 497;
- the U-values of the building fabric elements shall not exceed the maximum values as given in guidance documents (e.g. Approved Document, Technical Handbook or Technical Booklet) and are to be calculated according to methods and conventions as given in those documents; see Section 11 of this Agrément.

6 Junction linear thermal transmittance (ψ) values

- the Agrément holder's service for numerical calculations also includes calculations for ψ-values such as those given in Section 9 of this Agrément including external walls, party walls, thresholds and temperature factors
- these ψ-values depend on several parameters such as System variants (Diagram 2); beam dimensions (Diagram 3), EPS infill panel and beam configurations, external wall configurations and foundation configurations;
- the Agrément holder provides a design service to enhance the benefit of the System in terms of improved ψ-values; including external walls, party walls, thresholds and temperature factors. Modelling undertaken according to BR 497 and the guidance in the documents supporting the national Building Regulations. Consult the Agrément holder for further details.

8 Points of attention for the specifier (continued)

Table 1 - default ψ-values (W/mK) according to Table K1 in SAP 2012

Junction	ψ-value
External wall (with ground floor, ref. E5)	0.32
Party wall (with ground floor, ref. P1)	0.16

7 Condensation risk

- external walls and ground floors incorporating the System will adequately limit the risk of interstitial condensation when designed in accordance with BS 5250; a condensation risk analysis shall be completed at design stage;
- to minimise the risk of interstitial condensation:
  - there shall be an underfloor void of at least 150 mm which incorporates ventilation openings in opposing external walls to facilitate cross ventilation. Ventilation openings should be a minimum of 1500 mm2 for every metre run of wall, or 500 mm2 for at least every square metre of floor area, depending which ratio results in the largest opening area;
  - wall insulation shall extend to at least 150 mm below the top of the EPS infill panels.
- to minimise the risk of condensation any gaps around service penetrations should be filled (e.g. with expanding foam) or sealed.

8 Construction of a floor

- the System requires a structural (concrete) base slab. A non-structural topping or screed can be applied to the structural (concrete) base slab to form grounds for the final flooring or to serve as flooring (wearing screed). **Note**: a screed is different from a base slab with regard to the load-bearing capacity; a screed primarily has to resist compression not bending and puncture;
- guidance regarding the method of construction of a floor, including recommendations for the concrete strength of slabs, can be provided by the Agrement holder and is given in BS 8204-1; for characteristic floor loads see Table 4;
- the design of a structural (concrete) base slab and specification of concrete shall be done by a specialist; specification of screed shall be by a designer while screed material proportions should be established by the contractor or supplier of the screed, in close co-operation with the designer;
- welded steel mesh, ribbed steel bars and/or steel or macro-polymer fibres can be used as reinforcement to cope with tensile stresses and shear stresses. TR34 (4th edition) of The Concrete Society provides guidance relating to a structural (concrete) base slab with fibres;
- the calculation of the ultimate moment capacity (M_u) of a base slab varies for fibre-only, fibre plus bar reinforcement where $A_s < 0.15\%$ and fibre plus bar reinforcement where $A_s \geq 0.15\%$. Due consideration should be given to NHBC Guidance in respect of the use of reinforcement to structural (concrete) base slabs above beam and block floors;
- the EPS infill panels and EPS load-bearing rails provide a permanent formwork for a structural (concrete) base slab; only the rails distribute loads to the self-bearing beams when the structural (concrete) base slab or screed has hardened;
- the EPS infill panels are designed to have a 20 mm bearing on prestressed concrete beams; an allowance of 5 mm is made for manufacturing tolerances in the beams and misalignment during installation; always maintain a minimum bearing of 15 mm;
- to reduce the risk of accidental penetration of the EPS infill panels during construction when steel mesh or bars are used as reinforcement, place reinforcement spacers (four per m^2 and with dimensions not less than 50 mm by 50 mm) over the EPS infill panels and load-bearing rails;
- general guidance and recommendations relating to the exchange of information and site work are given in sections 4 and 7 of BS 8204-1 respectively while basic workmanship is addressed in code of practice BS 8000-2.2; additional requirements for execution can be found in BS EN 13670 (a standard intended to be a link between design and execution, and to give guidance on documentation (Annex A)); employ qualified persons (e.g. a structural engineer) for design and specifications;
- examples of typical pre-stressed concrete beams are given in Diagram 3. Concrete beams shall be self-bearing and be CE marked.

8 Points of attention for the specifier (continued)

Table 2 - concrete specifications for single-family, self-contained dwelling with the characteristic imposed loads given in Table 4

Grade^	Maximum aggregate size (mm)	Type	Reinforcement type and specification
C25/30	20	Standard	Conventional reinforcement: • one-layer A142 steel mesh to BS 4483 with characteristic yield strength of (f_{yk}) 500 N/mm^2; nominal cover to reinforcement shall be 35 mm. Macro-fibre (Class II) reinforcement: • Durus S400 (4.0 kg/m^3), Novomesh B&BA (macro, 3.33 kg/m^3), Durus Easy Finish (3.00 kg/m^3). Steel fibre reinforcement: • Adfil SF86 (13.33 kg/m^3), Novomesh B&BA (15.00 kg/m^3).
C28/35	10	Self-compacting	

^ minimum concrete cover shall be 65 mm above services

Table 3 - concrete specifications for commercial buildings with the characteristic imposed loads given in Table 4

Grade^	Maximum aggregate size (mm)	Type	Reinforcement type and specification
C25/30	10	Self-levelling, self-compacting	Steel mesh
C28/35	20	Conventional	

^ minimum concrete cover shall be 65 mm above services

Table 4 - imposed loads for dwelling units, communal areas and commercial buildings

Description	Characteristic value of loads for…		
	Single-family dwellings	Communal areas in blocks of flats	Commercial buildings
Uniformly distributed load, q_k (kN/m^2)	1.5	3.0	2.0 to 7.5
Concentrated load, Q_k (kN)	2.0	4.5	1.5 to 7.0
Allowance for moveable partitions (kN/m^2) when self-weight ≤ 3.0 kN/m	0.5 to 1.2	N/A	0.5 to 1.2

Remarks:

- specific values for dwelling units and communal areas are given in the Tables NA.2, NA.3 and NA.6 in the UK National Annex to BS EN 1991-1-1;
- specific values for commercial buildings are given in Tables NA.2 and NA.3 in the UK National Annex to BS EN 1991-1-1 and/or PD 6688-1-1;
- do not combine distributed loads with point loads or with line loads (self-weight of partition walls);
- commercial buildings do not include areas for storage and industrial activities.

9 Maintenance and consulting service

- once installed strictly in accordance with the requirements of this Agrément and of the Agrément holder, the System components are within the floor structure, and therefore do not require maintenance;
- for specific calculation for robust details of wall and floor, the Agrément holder can provide a technical consulting service for calculations and installation advice.

10 Durability

- once correctly installed, the EPS components in the System are protected from the majority of agents likely to cause deterioration and will remain effective as insulation for the life of the building;
- EPS components may deteriorate when subjected to volatile organic compounds (VOCs) or other gases, and where such conditions apply an assessment should be made by a suitably qualified person to determine the compatibility of the EPS with any potential emissions;
- the suitability of reinforced or pre-stressed concrete with regard to durability depends on many aspects (e.g. compressive strength class and maximum w/c-ratio) and the working life; for concrete with a maximum aggregate size of 20 mm, durability recommendations are given in Tables A.4 and A.5 in standard BS 8500-1.

9 Examples of details

Diagram 5 - system variant GT12 (depth 250 mm) floor/wall junction

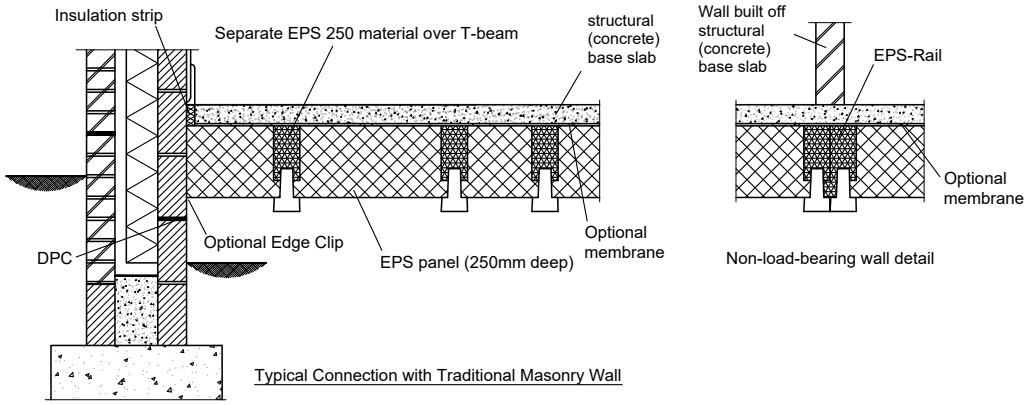


Diagram 6 - system variant GT15 (depth 230 mm) floor/wall junction

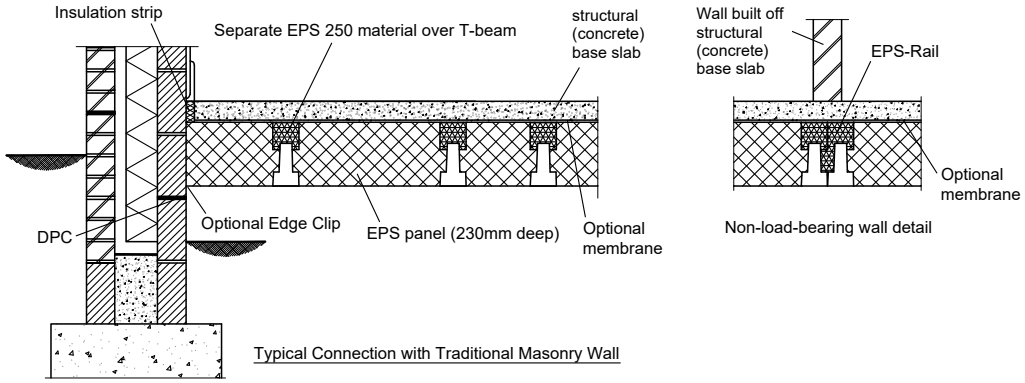
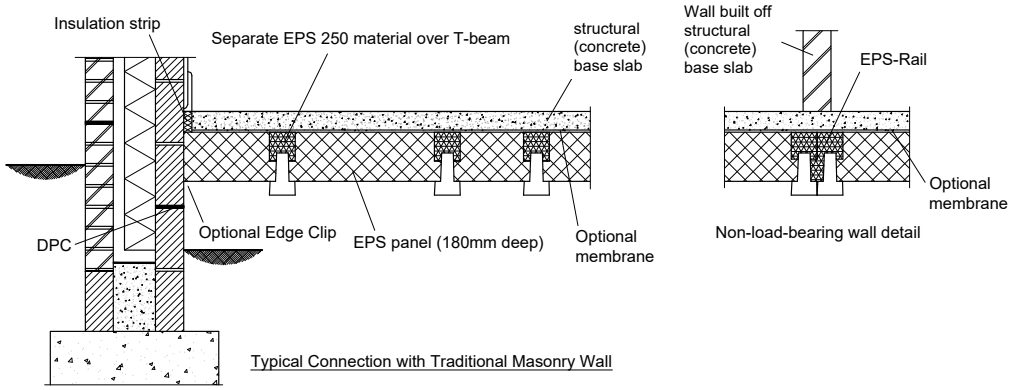


Diagram 7 - system variant GT18 (depth 180 mm) floor/wall junction



Remark: As part of the required technical consulting service (see Section 8.9 of this Agrément), the Agrément holder can provide for example (CAD) details, such as openings, floor and wall junctions.

10 Installation procedure

1 General

- installation of the System and ancillary items should be in accordance with the Agrément holder's requirements and current good building practice;
- during installation care must be taken to avoid damaging the EPS components; do not use damaged EPS components; any damaged EPS components shall be replaced before pouring the concrete.

10 Installation procedure (continued)

2 Delivery and site handling

- the EPS components:
  - are shrink-wrapped and bonded in cube packs but otherwise unprotected and should include component name, dimensions, the BDA identification mark, fitting requirements, the number of this Agrément and the CE-mark;
  - are unprotected; therefore, care shall be taken during transit and storage to avoid damage;
  - shall be stored in clean, dry conditions, stacked on a flat base, off the ground in order to avoid contamination, protected against prolonged direct sunlight and secured to avoid wind damage; care must be taken to avoid contact with organic solvents;
  - shall be protected from being dropped or crushed by objects; care shall be exercised when storing large quantities on site;
  - shall not be exposed to open flame or other ignition sources, and be stored away from flammable material such as paint and solvents;
  - shall be protected from contaminants after installation.

3 Site preparation

- the ground beneath the floor does not need to be raised to the external ground level if there is a good natural drainage or if site drains prevent water standing under the floor,
- under the ground floor a layer of oversite concrete or other surface seal is not required, however the ground shall be free of vegetation and topsoil. Any material used to level the ground must be hard and dry;
- typically a minimum void of 150 mm (300 mm in high heave soils) must be maintained between the underside of the polystyrene and the ground surface; see Table 7 in Chapter 4.2 of the NHBC Standards, this should be confirmed with local authority building control and/or NHBC inspector;
- along the strip/wall supporting the floor beams a continuous damp proof course (hereinafter 'DPC') shall be installed, at the level or below the bearing of the beams, in accordance with BS 8215 or code of practice PD 6697.

4 Installation - general

- ensure a ventilated airspace is provided beneath the infill panels of at least 150 mm; ventilators in the perimeter wall shall allow air to pass beneath the EPS infill panels;
- a DPC should be placed over all bearings prior to placing the beams for the ground floor; all bearings should be level and true, ensure a bearing of 90 mm is maintained;
- inverted 'T' pre-stressed concrete beams shall be placed in accordance with the relevant design drawings and guidelines supplied by the beam designer.

5 Installation of the pre-stressed concrete beams

- use concrete closure blocks or EPS infill panels as an aid to determine the spacing or centre distances between the pre-stressed concrete beams;
- inner leaf blockwork should be brought up to finished floor level where running parallel to the pre-stressed concrete beams; if not, use edge clips to support infill panels;
- to ease installation, the position of pre-stressed concrete beams can be adjusted to accurately fit male or female EPS infill panels after cutting.

6 Installation of the EPS infill panels

- to aid cutting, the EPS infill panels have imprinted guidelines; EPS infill panels will fill the space between the beams to the shoulder/ledge or the bottom of a beam (depends on the system variant that is being installed);
- ensure the EPS infill panels achieve a full 20 mm bearing on the beam; accommodate openings for service pipes;
- first row: if necessary, a cut row is formed along the perimeter, parallel with the beams, by cutting an EPS infill panel lengthwise; the male part is tightly placed between the beam and wall (if the inner leaf is built to the finished floor level) or is supported at the underside by edge clips; keep the female part for use in the last row;
- intermediate rows: place the EPS load-bearing rail over the top of a beam and check if the minimum length of a rail is not less than 300 mm; use multi-rails in case of multiple/grouped beams;
- at the end of a row, cut the EPS infill panels to fit and use the 'offcut' as a starter block for the next row; a panel cut to a length of 300 mm or less shall be placed at the edge of the floor, being cautious to avoid damage by foot traffic;
- last row: use the female part (the remaining part of the panel used for the first row); cut to width if necessary and place between the beam and wall with a tight fit or use edge clips.

Remark: the EPS infill panels and EPS load-bearing rails provide a platform for foot traffic and are formwork for the structural (concrete) base slab. However, the system is not intended as a working platform. The floor should be boarded if a working platform is required.

10 Installation procedure (continued)

7 Finishing

- concrete closure blocks (see Section 4 of this Agrément) are provided where the beams take bearing on the inside skin of a cavity wall;
- profiled EPS end blocks can be supplied by the Agrément holder, or alternatively they can be cut on site from a full or half panel; EPS end blocks shall not be more than 300 mm wide at the top;
- a gas barrier membrane can be installed where required and laid over the floor in accordance with the Agrément holder's requirements;
- after fitting service pipes through openings in the EPS infill panels, seal gaps around the pipes with foam insulation;
- in applications where underfloor heating is used with the System, this shall be clipped to a clamp track (stapling should be avoided as this may penetrate the membrane), and the tails brought up to the manifold.

8 Concrete work

- to avoid damage to the System, the structural (concrete) base slab shall be laid as soon as possible after the panels have been installed;
- PsiStrip™ is placed along the perimeter edge of the structural (concrete) base slab to reduce thermal bridging at the perimeter wall;
- concrete should not be poured on the panels and rails from heights greater than 500 mm and in concrete heaps over 300 mm high;
- the fibre content of delivered concrete shall be tested in accordance with BS EN 14488-7; for steel fibres use samples of fresh or hardened concrete; for polymer macro-fibres only use samples of fresh concrete.

11 Building Regulations

1 England - Requirements: The Building Regulations 2010 and subsequent amendments

- A1 Loading - the System requires a structural (concrete) base slab to sustain and transmit dead and imposed floor loads to the ground.
- C2(c) Resistance to moisture - to limit the risk of interstitial and surface condensation, use an adequately ventilated air space of at least 150 mm deep or use an appropriate damp proof membrane.
- L1(a)(i) Conservation of fuel and power - the panels and load-bearing rails will contribute to satisfying this Requirement.
- Regulation 7 Materials and workmanship - the System is manufactured from suitably safe and durable materials for its application and can be installed to give a satisfactory performance.
- Regulation 26 CO_2 emission rates for new buildings - the EPS infill panels and load-bearing rails will contribute to satisfying this Regulation.
- Regulation 26A Fabric energy efficiency rates for new dwellings - the EPS panels and load-bearing rails will contribute to satisfying this Regulation.

2 Wales - Requirements: The Building Regulations 2010 and subsequent amendments

- A1 Loading - the System requires a structural (concrete) base slab to sustain and transmit dead and imposed floor loads to the ground.
- C2(a)(c) Resistance to moisture - to limit the risk of (a) ground moisture and (c) surface and interstitial condensation, use an adequately ventilated void or use an appropriate damp proof membrane.
- L1(a)(i) Conservation of fuel and power - the panels and load-bearing rails will contribute to satisfying this Requirement.
- Regulation 7 Materials and workmanship - the System is manufactured from suitably safe and durable materials for its application and can be installed to give a satisfactory performance.
- Regulation 26 CO_2 emission rates for new buildings - the EPS infill panels and load-bearing rails will contribute to satisfying this Regulation.
- Regulation 26A Primary energy consumption rates for new buildings - the EPS infill panels and load-bearing rails will contribute to satisfying this Regulation.
- Regulation 26B Fabric performance values for new dwellings - the EPS infill panels and load-bearing rails will contribute to satisfying this Regulation.

11 Building Regulations (continued)

3 Scotland - Requirements: The Building (Scotland) Regulations 2004 and subsequent amendments

3.1 Regulations 8 (1)(2): Durability, workmanship and fitness of materials

- The System is manufactured from acceptable materials and is considered to be adequately resistant to deterioration and wear under normal service conditions, provided it is installed in accordance with the requirements of this Agrément.

3.2 Regulation 9: Building Standards - Construction

- 1.1(a)(b) Structure - the System requires a structural (concrete) base slab to sustain and transmit dead and imposed floor loads to the ground.
- 3.15 Condensation - to limit the risk of surface and interstitial condensation, apply permanent ventilation of the under floor space by means of ventilators in external walls on opposite sides of the building (open area in each wall is 1500 mm^2 for every metre run of wall, or 500 mm^2 for at least every square metre of floor area); the ventilated space must be 150 mm between solum and the underside of the floor.
- 6.1(b)/6.2 Energy - the EPS infill panels will contribute to reduce carbon dioxide emissions and heat loss.
- 7.1(a)(b) Statement of sustainability - the EPS infill panels 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 panels can contribute to a construction meeting a higher level of sustainability as defined in this Standard.

3.3 Regulation 12: Building Standards - Conversions

- All comments given under Regulation 9 also apply to this Regulation, with reference to Schedule 6 of The Building (Scotland) Regulations 2004 and subsequent amendments, and clause 0.12 of the Technical Handbook (Domestic).

4 Northern Ireland - Requirements: The Building Regulations (Northern Ireland) 2012 and subsequent amendments

- 23(a)(i)(iii)(b) Fitness of materials and workmanship - the System is manufactured from materials which are considered to be suitably safe and acceptable for use as thermal insulation.
- 28 Resistance to moisture and weather - the System can be constructed so as to prevent any harmful effect on the building or the health of the occupants caused by the passage of moisture to any part of the building from (a) the ground and (b) the weather;
- 29 Condensation - the EPS infill panels and load-bearing rails will contribute to limiting the risk of surface and interstitial condensation.
- 30 Stability - the System requires a structural (concrete) base slab to sustain and transmit dead and imposed floor loads to the ground.
- the System will contribute to satisfying the requirements 39(a)(i) - Conservation measures and 40(2) - Target carbon dioxide emission rate.

5 The Construction (Design and Management) Regulations 2015 and The Construction (Design and Management) Regulations (Northern Ireland) 2016

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

12 NHBC Acceptance

In the opinion of Kiwa Ltd., the System, if installed, used and maintained in accordance with this Agrément, can satisfy or contribute to satisfying the relevant requirements in relation to NHBC Standards, Chapter 5.2 Suspended Ground Floors.