




<b>Number</b> BAF 17-059/01/A  <b>Replaces:</b> -	   <p style="text-align: center;"><b>BDA Agrément® BAF 17-059/01/A</b></p>	<b>Category</b> Insulated suspended concrete ground floors
<b>Date</b> 2017-12-11		<b>Phase</b> Assessment
<b>Project number</b> 16-C-0247 / 2102		<b>Subject</b> Thermal insulation systems
<b>Validity</b> www.kiwa.co.uk/bda		
<b>System</b>  <b>Agrément holder</b>  <b>Description</b>  <b>Scope (use)</b>  <b>Objective</b>  <b>Summary of Agrément</b>  <b>Major points of assessment</b>    <b>Statement</b>	<p><b>Gdeck R1 EPS Panel System</b></p> <p>Combined Thermal Solutions (CTS) Hawtin Park Gellihaf, Blackwood Caerphilly, NP12 2EU, UK T.: +44 (0)1443 441 491 E.: enquiries@combinedthermalsolutions.co.uk W.: www.combinedthermalsolutions.co.uk</p>  <p>Flooring insulation system comprising a range of expanded polystyrene (EPS) infill blocks and load bearing rails for use as thermal insulation in conjunction with (but not manufactured by the Agrément holder) structural concrete toppings, precast concrete beams, masonry closure and coursing blocks in suspended concrete ground floors (over a sub floor void).</p> <p>Thermal insulation for use in the building envelope in domestic, residential and commercial buildings, 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.</p> <p>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.</p> <p>This Agrément covers the following:</p> <ul style="list-style-type: none"> <li>• Conditions of use;</li> <li>• Sources, including codes of practice, test and calculation reports;</li> <li>• Independently assessed system characteristics and other system information;</li> <li>• Factory Production Control and annual verification procedure;</li> <li>• Points of attention for the specifier and examples of details;</li> <li>• Installation procedure;</li> <li>• Compliance with Building Regulations and non-Regulatory Standards.</li> </ul> <p><b>Thermal performance aspects (sections 8.4, 8.5 &amp; 8.6)</b> The EPS infill blocks and load bearing rails can enable a floor to meet the design U values specified in the documents supporting the Building Regulations.</p> <p><b>Condensation and water (vapour) infiltration risk (section 8.7)</b> The EPS infill blocks and load bearing rails can contribute to minimising the risk of interstitial and surface condensation in floors.</p> <p><b>Structural performance (sections 8.8.1 to 8.8.4)</b> The System has adequate strength and stiffness to sustain and transmit dead and imposed floor loads in residential, domestic or commercial buildings.</p> <p><b>Durability (section 8.10)</b> The EPS infill blocks and load bearing rails are stable, rot-proof and durable and will remain for the life of the building in which it is installed.</p> <p>It is the opinion of the Kiwa BDA Expert Centre Building Envelope (ECBE) that the Gdeck R1 EPS Panel System is fit for its' intended use, provided it is specified, installed and used in accordance with this Agrément.</p> <p>Professor Nico Hendriks, MSc ECBE Chairman</p> <p>Authorisation: Chris van der Meijden, MSc Kiwa BDA Technical Director</p>	
<b>Version</b>  01	<p style="text-align: center;"><b>Kiwa BDA Expert Centre Building Envelope (ECBE)</b></p> <p><b>Kiwa BDA</b> Avelingen West 33 P.O. Box 389 4200 AJ Gorinchem The Netherlands +31 (0)183 66 96 90</p> <p><b>Kiwa Ltd.</b> Unit 5 Prime Park Way Prime Enterprise Park Derby, DE1 3QB United Kingdom +44 (0)7718 57 05 64</p> <p style="text-align: center;">Copyright© 2017 Kiwa BDA www.kiwa.co.uk/bda</p>	Page 1 of 10 pages

<p><b>1 Conditions of use</b></p>	<p><b>1 Application</b> The assessment of the Gdeck R1 EPS Panel System relates to the use of the System in domestic, residential and commercial buildings with correctly installed masonry external walls, which have been designed and constructed in accordance to BS EN 1996-1-1:2005+A1 and the UK NA to BS EN 1996-1-1:2005+A1<sup>17,18</sup> and correctly detailed ground floor systems, designed and constructed in accordance with BS 8102<sup>20</sup> and BS 8215<sup>21</sup> and with the Agrément holder's requirements.</p> <p><b>2 Assessment</b> Kiwa BDA Expert Centre Building Envelope (ECBE) has assessed the thermal performance, design and installation of the product according to BS EN 15037-1<sup>2</sup>, BS EN 15037-4<sup>3</sup> and BS EN 1996-1-1:2005+A1<sup>17</sup> and the UK NA to BS EN 1996-1-1:2005+A1<sup>18</sup> in combination with the DoP<sup>28</sup> and Technical Assessment and site visits. Also the NHBC Standards<sup>13</sup> have been taken into account. Factory Production Control has been assessed by Kiwa N.V., Technical Assessment Body, represented in the UK by Kiwa Ltd.<sup>27</sup></p> <p><b>3 Installation</b> It is recommended that the quality of installation and workmanship is controlled by (a) competent person(s). Such person(s) shall be either a qualified employee of the Agrément holder or a qualified employee of a consulting engineering body. The product shall be installed strictly in accordance with the requirements of the Agrément holder and the requirements of this Agrément.</p> <p><b>4 Geographical scope</b> The validity of this document is limited to England, Wales, Scotland and Northern Ireland, with due regard to section 11 Building Regulations.</p> <p><b>5 Validity</b> The purpose of this BDA Agrément<sup>®</sup> is to provide for well-founded confidence to apply the Gdeck R1 EPS Panel System in the described applications and according to approved specifications. According to the BDA Guideline – BDA Agrément<sup>®1</sup> the validity of this Agrément is therefore three years after the official date of issue, published on <a href="http://www.kiwa.co.uk/bda">www.kiwa.co.uk/bda</a>. After this the validity can be extended every three years after positive review. This Agrément is not valid in those cases where ECBE identifies that the design of a flooring system does not comply with article 8.2. Permitted constructions.</p>	
<p><b>2 Sources</b></p>	<ol style="list-style-type: none"> <li>1 BDA Guideline – BDA Agrément<sup>®</sup>, 30<sup>th</sup> June 2015</li> <li>2 BS EN 15037-1:2008 Precast concrete products. Beam-and-block floor systems. Beams</li> <li>3 BS EN 15037-4:2010+A1:2013 Precast concrete products. Beam-and-block floor systems. Expanded polystyrene blocks</li> <li>4 BS EN 14889-2:2006 Fibres for concrete. Polymer fibres. Definitions, specifications and conformity</li> <li>5 BS EN 1990:2002+A1:2005 - Eurocode. Basis of structural design</li> <li>6 UK National Annex to BS EN 1990-2002<sup>6</sup></li> <li>7 BS EN 1991-1-1:2002 - Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings</li> <li>8 BS EN 1992-1-1:2004+A1:2014 Eurocode 2: Design of concrete structures. General rules and rules for buildings</li> <li>9 UK National Annex to BS EN 1991-1-1:2002<sup>7</sup></li> <li>10 BS EN 206:2013 Concrete. Specification, performance, production and conformity</li> <li>11 BS 8500-1:2006+A1:2012 Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier</li> <li>12 BS 8500-2:2015 Concrete. Complementary British Standard to BS EN 206. Specification for constituent materials and concrete</li> <li>13 NHBC Standards 2017 Chapter 2.1 The Standards and Technical Requirements, Chapter 5.2 suspended ground floors</li> <li>14 Technical Report TR 65 : 2014 Guidance on the use of macro-synthetic-fibre-reinforced concrete</li> <li>15 BS EN 13163:2012+A1:2015 Thermal insulation products for buildings. Factory made expanded polystyrene (EPS) products. Specification</li> <li>16 Kiwa BDA Report 16-C-0247/2102 Gdeck EPS Panel System, Calculations of the required beam width, 27<sup>th</sup> October 2016</li> <li>17 BS EN 1996-1-1:2005+A1:2012 Eurocode 6. Design of masonry structures. General rules for reinforced and unreinforced masonry structures</li> <li>18 UK National Annex to BS EN 1996-1-1:2005+A1:2012</li> <li>19 BS 5250:2011 Code of practice for control of condensation in buildings</li> <li>20 BS 8102:1990 Code of practice for protection of buildings against water from the ground</li> <li>21 BS 8215:1991 Code of practice for design and installation of damp proof courses in masonry construction</li> </ol>	
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**2 Sources**  
(continued)

- 22 BS EN ISO 6946:2007 Building components and building elements. Thermal resistance and thermal transmittance. Calculation method
- 23 BR443: Conventions for U-value calculations, 2006 edition, BRE Scotland
- 24 BS EN ISO 10211:2007 Thermal bridges in building constructions. Calculation of heat flows and surface temperatures
- 25 BS EN ISO 13370:2007 Thermal performance of buildings. Heat transfer via the ground. Calculation methods
- 26 Thermal Bridging Guide – An introductory guide to thermal bridging in homes, Zero Carbon Hub, February 2016
- 27 Kiwa Ltd Report 2100/2102 Inspection of Factory and Factory Production Control, Moulded Foams Ltd. – Climabead and G Deck, 2016-07-15
- 28 Declaration of Performance Moulded Foams, Expanded Polystyrene G Deck Insulation Infill Panels & Load Bearing Rails, CPR 2011/04/04, 19<sup>th</sup> September 2016
- 29 CTS GT Flooring Technical Data Sheet
- 30 CTS GT Flooring – Installation Guidelines
- 31 Thermal Measurement Laboratory, University of Salford, UKAS Reports Serial No.'s 1473, 1474 (2016-06-30), 1475, 1476 (2016-07-02), 1605, 1606, 1607, 1608, 1609 and 1610 (2016-06-21)
- 32 SAP 2012 Conventions, BRE Standard Assessment Procedure, 20 October 2015 (v 6.0)
- 33 BR 497: 2010 Conventions for Calculating Linear thermal transmittance and Temperature Factors
- 34 BS 4483:2005 Steel fabric for the reinforcement of concrete. Specification
- 35 Thermal Measurement Laboratory, University of Salford, UKAS Reports Serial No.'s 1811, 1852, 1853 and 1854, 2017-09-08
- 36 Kiwa BDA Report 16-C-0247/17-0927 Comments on test 3 reported by 3<sup>rd</sup> party expert, 2017-10-05
- 37 Internal test report CTS lambda measurements grey EPS, 2017-06-10
- 38 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

**Remark:** in the text of this document reference is made to some of these sources by adding the relevant source number in superscript

**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 rails and blocks**

The Agrément holder has taken the responsibility of CE marking the EPS components of the system in accordance with BS EN 15037-4<sup>3</sup>, BS EN 13163<sup>15</sup> and Regulation (EU) No 305/2011 – Article 7. An asterisk (\*) indicates that the relevant data shown in this section is given in the manufacturer’s Declaration of Performance (DoP)<sup>28</sup>.

**EPS load bearing rails and infill blocks**

- Declared thermal conductivity  $\lambda_D$  ( $W \cdot m^{-1} \cdot K^{-1}$ )
  - EPS 250 rails (white) : 0.032\*
  - EPS 80 blocks (grey)<sup>35,37</sup> : 0.030
- Moisture diffusion coefficient  $\mu$  (-) • EPS 80 : 20 - 40
  - EPS 250 : 40 - 100
- Mechanical properties<sup>28</sup>
  - the EPS infill blocks, type R1, shall have adequate resistance to withstand loads applied during the construction phase, according to BS EN 15037-4<sup>3</sup> and a minimum cut-length and bearing width defined by the Agrément holder<sup>29</sup>
  - EPS infill blocks :  $\geq$  EPS 80\*
  - EPS load bearing rails, type R2, for line loads up to  $5 \text{ kN} \cdot \text{m}^{-1}$  :  $\geq$  EPS 250\*
  - compressive strength at 1% strain according to BS EN 15037-4<sup>3</sup> for EPS 250 (kPa) :  $\geq$  115

**Required beam width**

- Beams parallel under a partition wall
    - The required beam width for the EPS rails of EPS 250 is given in Figure 1<sup>16,36</sup>.
- Note 1:** The maximum span between the beams depends on the width of the beam header ( $H_w$ ). Departing from a maximum length of the closure block of 540 mm, a taper of 2 mm on each side and a fit tolerance of 2 mm, the maximum span  $S_m = H_w + 546$  mm. See also figure 4.

<p><b>3 Independently assessed system characteristics of components used for critical functions**)</b> (continued)</p>	<p><i>Figure 1 - Required total beam width parallel under partition wall, for EPS 250</i></p> <ul style="list-style-type: none"> <li>- The minimal required beam width (m) under a partition wall is given in Kiwa BDA Report 16-C-0247/2102<sup>16</sup> and Kiwa BDA Report 16-C-0247/17-0927<sup>36</sup>.</li> </ul> <ul style="list-style-type: none"> <li>• Beams perpendicular under partition walls (per m•m<sup>-1</sup>) <ul style="list-style-type: none"> <li>- The required beam width for the EPS rails of EPS 250 is given in Figure 2<sup>16,36</sup>.</li> </ul> <p><b>See also note 1</b></p> </li> </ul> <p><i>Figure 2 - Required total beam width per m•m<sup>-1</sup> perpendicular under partition walls, for EPS 250</i></p> <ul style="list-style-type: none"> <li>- The minimal required beam width per m•m<sup>-1</sup> under a partition wall is given in Kiwa BDA Report 16-C-0247<sup>16</sup> and Kiwa BDA Report 16-C-0247/17-0927<sup>36</sup>.</li> <li>- <b>Note 2:</b> Gapping/fit error in Gdeck Rails to be no more than 2 mm; minimum length of Rail not less than 300 mm.</li> </ul> <p><b>Guidance for the specifiers of T-beam supported suspended floors</b></p> <ul style="list-style-type: none"> <li>- all partition walls assume permanent blockwork walls; temporary/stud walls ≤ 1 kN.m<sup>-1</sup> can be placed in any orientation across the floor area;</li> <li>- partition walls running parallel to beams shall be installed directly above, or within a maximum distance from supporting beams;</li> <li>- partition walls perpendicular to beams shall be supported by a minimum number of beams according to the Agrément holder's requirements;</li> <li>- the exact position of partition walls will vary according to beam width and configuration;</li> <li>- the Agrément holder's guidelines are supplementary to the structural requirements of the beams themselves and shall be taken into consideration by the specifier of the floor.</li> </ul> <p><b>The Gdeck R1 EPS Panel System range</b> The full range of the Gdeck R1 EPS Panel System is given in Figure 3.</p> <p><i>Figure 3 – Range of the Gdeck R1 EPS Panel System</i></p> <p><b>Typical pre-cast concrete beams</b> Examples of typical pre-cast concrete beams for the Gdeck R1 EPS Panel System are given in Figure 4.</p> <p><i>Figure 4 – Examples of typical pre-cast concrete beams. H<sub>w</sub> = Width of the beam header. All dimensions in mm.</i></p>	
<p><b>4 Independently assessed ancillary items used for critical functions**)</b> **) see section 3</p>	<p>In conjunction with the EPS rails and blocks several ancillary items are used according to the following specifications (See also section 9 'Examples of details').</p> <ul style="list-style-type: none"> <li>• <b>Galvanised Steel Edge Clips</b> <ul style="list-style-type: none"> <li>- the Edge Clips provide a bearing for the EPS blocks around the periphery of the build if required; a well cut block will have suitable support, therefore the Edge Clips are not mandatory, this is solely down to personal preference of the specifier;</li> <li>- the 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 unit to provide additional support, the typical usage is 2 clips per panel.</li> </ul> </li> <li>• <b>Concrete Closure Blocks</b> <ul style="list-style-type: none"> <li>- the Closure Blocks are to be used in conjunction with the Gdeck R1 EPS Panel System, supplying a solid support thus allowing the continuation of the inner skin build;</li> <li>- the Closure Blocks have a crushing strength of 7.0 N•mm<sup>-2</sup>;</li> <li>- the Full Closure Block accommodates the spacing of a Full EPS Panel as well as the Small Closure Block suits the spacing of a Half EPS Panel. Closure Blocks are to be installed between beam ends around the periphery of the floor, onto a mortar bed.</li> </ul> </li> </ul>	
<p><b>5 Factory Production Control (FPC)</b></p>	<p>Kiwa N.V., Technical Assessment Body, represented by Kiwa Ltd. has determined that CTS, with respect to the Gdeck R1 EPS Panel System fulfills all provisions concerning the specifications described in this Agrément. The FPC audit conducted on the 30<sup>th</sup> June 2016<sup>27</sup> demonstrated that CTS have a satisfactory Quality Management System and are committed to operating an effective Quality System throughout their activities.</p> <p>Based on information provided during the audit / site inspection a positive recommendation is given to BDA as the 'new' system (existing T-Deck block + additional EPS rails) meets all aspects of the BDA Agrément® and relevant building regulations.</p>	
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<p><b>6 Quality Management System</b></p> <p><b>7 Continuous surveillance</b></p> <p><b>8 Points of attention for the specifier</b></p>	<p>The Quality System covers the clauses required by the BDA Agrément®. CTS are 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 BDA requirements. All processes in the factory were well organised and the factory has sufficient (but limited) space for conducting 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.</p> <p>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.</p> <p><b>1 Delivery, transport and site handling</b></p> <ul style="list-style-type: none"> <li>- the EPS blocks 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; particular attention is required for blocks with extended toe widths; further measures are given in section 10.</li> </ul> <p><b>2 Permitted constructions</b></p> <ul style="list-style-type: none"> <li>- 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.</li> </ul> <p><b>3 Control of Floor Design</b></p> <ul style="list-style-type: none"> <li>- CTS only grant licences to distribute Gdeck to beam suppliers who have obtained confirmation, from a suitably competent third party engineer, that beams they manufacture comply with the criteria specified in BS EN 15037-1<sup>2</sup>, BS EN 1991-1-1<sup>7</sup> and BS EN 1992-1-1<sup>8</sup>;</li> <li>- CTS approved distributors receive site plans from customers requiring detailed floor designs to meet structural and thermal performance; the distributor's technical departments design floor layouts, using beams made to BS EN 1991-1-1<sup>7</sup> and BS EN 1992-1-1<sup>8</sup> obeying maximum loading spans to create the most effective layouts for customer structural installation;</li> <li>- CTS have appointed Moulded Foams (manufacturer of the EPS components of the Gdeck R1 EPS Panel System) as the sole provider of Gdeck EPS parts within the UK; Moulded Foams provide Approved Gdeck distributors with Gdeck U-value performance tables specific to their beam profile;</li> <li>- once designers have created a suitable floor design, they calculate the perimeter/area ratio and use supplied Gdeck U-value Performance Tables to determine which Gdeck thickness detail is required to be installed.</li> </ul> <p><b>4 Building physics – general</b></p> <ul style="list-style-type: none"> <li>- the building physical behaviour of floors incorporating a Gdeck R1 EPS Panel System shall be verified as suitable by a specialist; the specialist can be either a qualified employee of the specifier or a qualified consultant;</li> <li>- the qualified person will check the building physical behaviour of the designed floor construction and if need be, advise about improvement to achieve the final specification; it is recommended that he would cooperate closely with the Agrément holder.</li> </ul> <p><b>5 Thermal performance aspects</b></p> <ul style="list-style-type: none"> <li>- for the purpose of U-value calculations and to determine if the requirements of the Building (or other statutory) Regulations are met, the thermal resistances of the constructions shall be calculated according to BS EN ISO 6946<sup>22</sup>, BR443<sup>23</sup>, and BS EN ISO 10211<sup>24</sup> as appropriate; also the recommendations in the Thermal Bridging Guide<sup>26</sup> should be observed;</li> <li>- the Agrément holder can provide a service to provide for 2D and 3D calculations for numerically modelled EPS block and beam configurations, complying to BS EN ISO 13370<sup>25</sup>, BS EN ISO 10211<sup>24</sup> and BR 497<sup>33</sup>;</li> <li>- the requirement for limiting the heat loss through the building fabric, including the effect of thermal bridging can be satisfied if the U-values of the building elements do not exceed the maximum values in the relevant Elemental Methods given in the national Building Regulations of England (Approved Document L), Wales (Approved Document L), Scotland (Technical Standards Regulations 9) and Northern Ireland (Technical Booklet F); further information on regulations is given in section 11 of this Agrément.</li> </ul> <p><b>6 Junction linear thermal transmittance (<math>\psi</math>) values</b></p> <ul style="list-style-type: none"> <li>- the Agrément holder's service for numerical calculations also includes calculations for <math>\psi</math>-values such as given in section 9 including external walls (perpendicular and parallel), party walls, thresholds and temperature factors;</li> </ul>	
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**8 Points of attention for the specifier**  
(continued)

- these  $\psi$ -values depend on several parameters such as system types (Figure 3) beam dimensions (Figure 4), EPS block and beam configurations, external wall configurations and foundation configurations;
- default system  $\psi$ -values are given in Table 1, other values can be modelled according to BR 497<sup>33</sup> 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 1 – Default  $\psi$ -values ( $W \cdot m^{-1} \cdot K^{-1}$ ), according to SAP 2012 Conventions<sup>32</sup>*

**7 Condensation risk**

- external walls and ground floors incorporating the systems will adequately limit the risk of interstitial condensation when designed in accordance with BS 5250<sup>19</sup>; a condensation risk analysis shall be completed at design stage;
- to help minimise the risk of interstitial condensation, the void space beneath the lowest point of the floor construction shall 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 shall be not less than 1500 mm<sup>2</sup>·m<sup>-1</sup> run of external wall or 500 mm<sup>2</sup>·m<sup>-2</sup> of floor area, whichever is the greater; where pipes are used to carry ventilating air, these shall be at least 100 mm in diameter;
- when designed and installed in accordance with this Agreement the systems will contribute to a convection-free envelope of high vapour resistance;
- to minimise the risk of interstitial condensation at junctions with external walls, specifiers shall ensure that wall insulation extends to at least 150 mm below the top of the EPS blocks;
- to minimise the risk of condensation at service penetrations, care should be taken to minimise gaps in the insulation layer, for example by filling with expanding foam insulation.

**8 Structural performance**

**8.1 General**

- structural screeds shall be designed by suitably qualified persons in accordance with BS EN 206<sup>10</sup> and its complementary British Standard BS 8500-2<sup>12</sup>. Reinforcement consisting of welded steel mesh should be in accordance with BS EN 15037-1<sup>2</sup>;
- the structural engineer must ensure that the concrete beams and structural topping are suitable for the intended use.

**8.2 EPS infill blocks and load bearing rails**

- the EPS infill blocks and load bearing rails provide a formwork to the structural concrete topping; only the load bearing rails make a further contribution to the long-term structural performance of the floor in the form of load spreading (see section 3), once the structural concrete topping has been placed and has obtained its full design strength;
- EPS blocks cut to less than 300 mm long, to accommodate varying beam lengths, shall be positioned at the floor edges; starter and end blocks should not be more than 300 mm wide at the top;
- 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;
- the EPS load bearing rails have adequate resistance to short-term and long-term creep compression (see section 3);
- to reduce the risk of accidental penetration of the EPS during the construction phase spacers (4 per m<sup>2</sup> and dimensions not less than 50 mm x 50 mm) for supporting mesh reinforcement should be located on spreader plates over the EPS infill blocks and load bearing rails.

**8.3 Structural concrete topping**

- the concrete topping thickness and reinforcement specification shall be determined in accordance with BS EN 1992-1-1<sup>8</sup> by a qualified structural engineer;
- the concrete topping shall be according to BS 8500-1<sup>11</sup>, BS 8500-2<sup>12</sup> and BS EN 206<sup>10</sup>, manufactured in plants covered by the QSRMC scheme (Quality Scheme for Ready Mixed Concrete) and laid by personnel with the appropriate skills and experience;
- the specifications in Table 2 are suitable for single-family self-contained dwelling units and communal areas in blocks of flats with the characteristic imposed loads defined in Table 4;
- the concrete specifications in Table 3 are suitable for commercial buildings with the characteristic imposed loads defined in Table 5.

*Table 2 - Concrete topping specifications for single-family self-contained dwelling with the characteristic imposed loads given in Table 4*

<p><b>8 Points of attention for the specifier</b> (continued)</p> <p><b>9 Examples of details</b></p> <p><b>10 Installation procedure</b></p>	<p><i>Table 3 - Concrete topping specifications for commercial buildings with the characteristic imposed loads given in Table 5</i></p> <p><i>Table 4 - Imposed and partition loads for concrete topping reinforced with macro-polymer fibres and steel mesh A142 (kPa)</i></p> <p><i>Table 5 - Imposed and partition loads for commercial buildings and concrete topping reinforced with steel mesh</i></p> <p><b>8.4 Pre-stressed concrete beams</b></p> <ul style="list-style-type: none"> <li>- examples of typical pre-stressed beams are given in section 3, Figure 4;</li> <li>- the self-bearing pre-stressed concrete beams provide for the final strength of the floor system independently of any other constituent part of the floor system;</li> <li>- the pre-stressed concrete beams must be designed in accordance with BS EN 1992-1-1 (Eurocode 2)<sup>8</sup> and its UK National Annex by a qualified and experienced individual to ensure that the beams are adequate to resist the applied loading;</li> <li>- the proposed pre-stressed concrete beam must be CE marked, and manufactured and designed according to BS EN 15037-1<sup>2</sup>;</li> <li>- the serviceability deflection limit of the proposed concrete beam must be in accordance with BS EN 1992-1-1<sup>8</sup>;</li> <li>- 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<sup>5</sup>;</li> <li>- where – e.g. under non-load-bearing walls - two or more concrete beams are placed side by side, the spaces between the beam webs should be in-filled with EPS 250 to provide unity of action.</li> </ul> <p><b>9 Maintenance and consulting service</b></p> <ul style="list-style-type: none"> <li>- once installed strictly in accordance with the requirements of this Agrément and of the Agrément holder, the system components are within the floor structure, therefore do not require maintenance;</li> <li>- for specific calculation for robust details of wall and floor the Agrément holder can provide a technical consulting service for calculations and installation advice.</li> </ul> <p><b>10 Durability</b></p> <ul style="list-style-type: none"> <li>- once installed the EPS components are protected in service from agents liable to cause deterioration and will be effective as insulation for the life of the building in which they are installed;</li> <li>- beneath a suspended ground floor over a ventilated void and soil the exposure condition is class XC1, in accordance with BS EN 1992-1-1<sup>8</sup>; the concrete beams will have adequate durability for this exposure condition;</li> <li>- the concrete topping reinforced with steel mesh or macro-polymer fibres will have adequate durability for exposure class XC1.</li> </ul> <p><i>Figure 5 – The Gdeck R1 EPS Panel System – GT detail 12 Floor/Wall Junction – depth 250 mm</i></p> <p><i>Figure 6 – The Gdeck R1 EPS Panel System – GT detail 15 Floor/Wall Junction – depth 230 mm</i></p> <p><i>Figure 7 – The Gdeck R1 EPS Panel System – GT detail 18 Floor/Wall Junction – depth 180 mm</i></p> <p><b>Remark:</b> As part of the required technical consulting service (see section 8.9) the Agrément holder can provide for example (CAD) details, for example around openings, floor- and wall junctions</p> <p><b>1 General</b></p> <ul style="list-style-type: none"> <li>- installation of the Gdeck R1 EPS Panel System and ancillary items should be in accordance with the Agrément holder's requirements<sup>30</sup> and current good building practice;</li> <li>- details of the components of the systems are given in sections 3 and 4 of this Agrément;</li> <li>- during installation care must be taken to avoid damaging the components; should damage occur the relevant component shall be repaired or replaced according to the Agrément holder's requirements<sup>30</sup>; any damaged EPS components shall be replaced before pouring the concrete.</li> </ul> <p><b>2 Delivery and site handling</b></p> <ul style="list-style-type: none"> <li>- the EPS components are shrink-wrapped and bonded in cube packs, but otherwise unprotected and should include product component name, dimensions, the BDA identification mark, fitting requirements, the number of this Agrément and the CE-label;</li> <li>- the EPS components are unprotected, therefore, care shall be taken during transit and storage to avoid damage;</li> </ul>	
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**10 Installation procedure**  
(continued)

- the EPS components shall be stored in clean, dry conditions, stacked on a flat base, clear of the ground (to avoid contamination), protected against prolonged direct sunlight and secured to avoid wind damage; care must be taken to avoid contact with organic solvents;
- the EPS components shall be protected from being dropped or crushed by objects; care shall be exercised when storing large quantities on site;
- the EPS components shall not be exposed to open flame or other ignition sources and be stored away from flammable material such as paint and solvents;
- to ensure maximum performance of the component when installed, on site precautions shall be taken to protect it from contaminants.

**3 Site preparation**

- the final minimum void depth shall be increased appropriately where clay soil of low medium- or high-volume change potential exists, to prevent problems associated with heave; the minimum void depth shall be in accordance with Table 7 of NHBC Standards Chapter 4.2<sup>13</sup>;
- where there is good natural drainage or site drains are provided to prevent water collecting and standing, the ground level beneath the floor does not need to be raised to the external ground level;
- the ground beneath the floor should 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;
- typically, a minimum void of 150 mm (225 mm in heavy clay soils) must be maintained between the underside of the polystyrene and the ground surface; this should be confirmed with local authority building control and/or NHBC inspector;
- a continuous damp-proof course should be laid along the support wall below the floor in accordance with BS 8102<sup>20</sup>.

**4 Installation - general**

- always ensure that a **minimum 150 mm ventilated airspace** is provided beneath the Gdeck R1 EPS Panel units; ventilators shall be positioned to allow air to pass beneath the units;
- a damp proof course should be placed over all bearings prior to laying the ground floor beams; all bearings should be level and true, care should be taken to ensure that a bearing on masonry and steelwork of 100 mm is maintained;
- precast concrete beams shall be laid out in accordance with the relevant drawings;
- where a block has to be cut down to length of 300 mm or less, it shall be located at the edge of the floor and extra care taken to avoid damage by foot traffic;
- the EPS blocks are to be cut as appropriate to accommodate service penetrations, e.g. soil vent pipes, and the resulting gaps filled with expanding foam or other insulation to minimize local thermal bridging and air infiltration.

**5 Installation of the beams**

- the beams should be placed vertically in accordance with the design drawings and guidelines supplied by the beam designer, centres of beams can also be determined by using the closure blocks on the inner skin;
- blockwork should be brought up to finished floor level where running parallel to the beams;
- installing one bay at a time and starting from the starting point on the drawing, a cut row is formed, by cutting along the length of the panel; this male cut row is cut from a full panel (the off cut to be retained – female end unit), the male cut panel (non-rail side) sits within the profile of the beam, either to the shoulder or the bottom (dependant on the GT system that is being installed);
- the beam is then pushed up tight to lock the first row of EPS in place between the wall (if the inner skin is built to the finished floor level) and the first beam;
- to ease installation, the beams can be splayed slightly; care must be taken to cut the EPS accurately to size and to push the beam upright to ensure that the EPS achieves its full 20 mm (min. 15 mm) bearing on the beam – this bearing and pressure on the outside wall provides a temporary pedestrian platform and temporary formwork for the structural topping;
- **Remark: This is not intended as a working platform, should this be the case the floor should be boarded out;**
- to aid cutting, the panels have imprinted guidelines.

**6 Installation of the EPS Panels**

- from this point, full or half panels are installed row by row; to install these panels the white EPS rail is placed over the top of the beam, the full or half panel will then fit into the void between the beams;
- **Note:** Gapping/fit error in Gdeck Rails to be no more than 2 mm; minimum length of Rail not less than 300 mm.
- at the end of the row, a panel will need to be cut to suit, the off cut of which will then be used as the start panel in the next row, a random pattern of panels will be seen after edge clips are installed;



<p><b>10 Installation procedure</b> (continued)</p>	<ul style="list-style-type: none"> <li>- at the end of the bay the last row will be created using the female end unit (the offcut of the male starter unit used on the first row), this panel should be cut to width and inserted to achieve a snug fit;</li> <li>- in the case of multiple beams, multi rails are provided to prevent a cold bridge, also eradicating the need for grouting the beams;</li> <li>- to accommodate any service pipes the panels can be cut with a hand saw, any awkward gaps around the services and the like are to be filled with expanding foam.</li> </ul> <p><b>7 Finishing</b></p> <ul style="list-style-type: none"> <li>- <b>concrete closure blocks</b> (see section 4) are provided where the beams take bearing on the inside skin of the cavity wall;</li> <li>- profiled EPS <b>end blocks</b> can be supplied by the Agrément holder, or alternatively they can be cut on site from a full or half block; the end block shall not be more than 300 mm wide at the top;</li> <li>- a <b>gas barrier</b> membrane can be installed where required and laid over the floor in accordance with the Agrément's holder's requirements<sup>30</sup>;</li> </ul> <p><b>8 Concrete topping</b></p> <ul style="list-style-type: none"> <li>- to avoid damage to EPS panels, the structural topping shall be laid as soon as possible after the blocks have been installed;</li> <li>- in the case of underfloor heating being used with the floor, this is clipped to a clamp track, stapling should be avoided as this may penetrate the membrane, and the tails brought up to the manifold</li> <li>- the required <b>perimeter edge insulation</b> strips (25 mm Silver or 30 mm White) are installed against the exposed perimeter wall;</li> <li>- the specified structural <b>concrete topping</b> (see section 8.8.3) shall be poured carefully and not dropped from a height greater than 500 mm, ensuring heaping is kept to a height of not greater than 300 mm.</li> </ul>	
<p><b>11 Building Regulations</b></p>	<p><b>1 Requirements: The Building Regulations 2010 and subsequent amendments</b></p> <ul style="list-style-type: none"> <li>- A1 Loading – The Gdeck R1 EPS Panel System can sustain and transmit dead and imposed floor loads to the ground; see sections 3 and 8.8.1 to 8.8.4 of this Agrément;</li> <li>- C2 Resistance to moisture – the blocks and load bearing rails will contribute to limiting the risk of (a) ground moisture and (c) surface and interstitial condensation if the floor is designed and constructed in accordance with Clause 8.4 of BS 5250<sup>19</sup> and BS EN ISO 13788<sup>38</sup>, see Approved Document C – C4(21) Floors;</li> <li>- L1(a)(i) Conservation of fuel and power - the blocks and load bearing rails will contribute to satisfying this Requirement; see sections 8.3 to 8.5 of this Agrément;</li> <li>- Regulation 7 Materials and workmanship – The Gdeck R1 EPS Panel System is manufactured from suitably safe and durable materials for its application and can be installed to give a satisfactory performance, see section 10 of this Agrément;</li> <li>- Regulation 26 - the blocks and load bearing rails will contribute to satisfying the requirements of (0) - CO<sub>2</sub> emission rates for new buildings and (A) - Fabric energy efficiency rates for new dwellings; see sections 8.4 and 8.5 of this Agrément.</li> </ul> <p><b>2 Requirements: The Building (Amendment) Regulations 2014 (Wales) and subsequent amendments</b></p> <ul style="list-style-type: none"> <li>- A1 Loading – The Gdeck R1 EPS Panel System can sustain and transmit dead and imposed floor loads to the ground; see sections 3 and 8.8.1 to 8.8.4 of this Agrément;</li> <li>- C2 Resistance to moisture – the blocks and load bearing rails will contribute to limiting the risk of (a) ground moisture and (c) surface and interstitial condensation if the floor is designed and constructed in accordance with Clause 8.4 of BS 5250<sup>19</sup> and BS EN ISO 13788<sup>38</sup>, see Approved Document C – C4(21) Floors;</li> <li>- L1(a)(i) Conservation of fuel and power - the blocks and load bearing rails will contribute to satisfying this Requirement; see sections 8.3 to 8.5 of this Agrément;</li> <li>- Regulation 7 Materials and workmanship – The Gdeck R1 EPS Panel System is manufactured from suitably safe and durable materials for its application and can be installed to give a satisfactory performance, see section 10 of this Agrément;</li> <li>- Regulation 26 - the blocks and load bearing rails will contribute to satisfying the requirements of (0) - CO<sub>2</sub> emission rates for new buildings and (A) - Fabric energy efficiency rates for new dwellings; see sections 8.4 and 8.5 of this Agrément.</li> </ul>	
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<p><b>11 Building Regulations</b> (continued)</p> <p><b>12 NHBC Standards</b></p>	<p><b>3 Requirements: The Building (Scotland) Regulations 2004 and subsequent amendments</b></p> <p><b>3.1 Regulations 8 (1)(2) Durability of materials and workmanship</b></p> <ul style="list-style-type: none"> <li>- The Gdeck R1 EPS Panel 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, see section 10 of this Agrément.</li> </ul> <p><b>3.2 Regulation 9 Building Standards-Construction</b></p> <ul style="list-style-type: none"> <li>- 1.1 (a)(b) Structure - The Gdeck R1 EPS Panel System can sustain and transmit dead and imposed floor loads to the ground; see sections 3 and 8.8.1 to 8.8.4 of this Agrément;</li> <li>- 3.15 - Condensation - the blocks and load bearing rails will contribute to limiting the risk of surface and interstitial condensation; see section 8.6 of this Agrément;</li> <li>- 6 Energy - the blocks and load bearing rails will contribute to satisfying the requirements of 6.1(b) - Carbon dioxide emissions and 6.2 - Building insulation envelope; see sections 8.4 and 8.5 of this Agrément;</li> <li>- 7.1(a)(b) - Statement of sustainability - the blocks 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 blocks can contribute to a construction meeting a higher level of sustainability as defined in this Standard; see sections 8.4 and 8.5 of this Agrément.</li> </ul> <p><b>3.3 Regulation 12 Building Standards-Conversions</b></p> <p>All comments given for Gdeck R1 EPS Panel System 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).</p> <p><b>4 Requirements: The Building Regulations 2012 (Northern Ireland) and subsequent amendments</b></p> <ul style="list-style-type: none"> <li>- 23(a)(i)(iii)(b) Fitness of materials and workmanship – The Gdeck R1 EPS Panel System is manufactured from materials which are considered to be suitably safe and acceptable for use as thermal insulation as described in sections 8 and 10 of this Agrément;</li> <li>- 28 Resistance to moisture and weather - The Gdeck R1 EPS Panel 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;</li> <li>- 29 Condensation – the blocks and load bearing rails will contribute to limiting the risk of surface and interstitial condensation; see section 8.6 of this Agrément.</li> <li>- 30 Stability - The Gdeck R1 EPS Panel System can sustain and transmit dead and imposed floor loads to the ground; see sections 3 and 8.8.1 to 8.8.4 of this Agrément;</li> <li>- the Gdeck R1 EPS Panel System will contribute to satisfying the requirements of 39(a)(i) – Conservation measures, and 40(2) – Target carbon dioxide emission rate see sections 8.4 and 8.5 of this Agrément.</li> </ul> <p>In the opinion of the Kiwa BDA Expert Centre Building Envelope (ECBE), the Gdeck R1 EPS Panel System, if installed, used and maintained in accordance with this Agrément (with the exception of the use of micro-fibre structural concrete toppings), can satisfy or contribute to satisfying the relevant requirements in relation to NHBC Standards, Chapter 5.2 Suspended Ground Floors<sup>13</sup>.</p>	
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Table 1 - Default  $\psi$ -values ( $W \cdot m^{-1} \cdot K^{-1}$ ), according to SAP 2012 Conventions<sup>32</sup>

Junction	$\psi$ -value
External wall	0,32
Party wall	0,16

Table 2 - Concrete topping specifications for single-family self-contained dwelling units with the characteristic imposed loads given in Table 4

Overall concrete thickness (mm) above services	Grade	Maximum aggregate size (mm)	Type	Reinforcement type*	Reinforcement Specification
65-75	C25/30	20	Standard	Conventional	1 layer A142 steel mesh to BS 4483 with characteristic yield strength of (fyk) 500 N.mm <sup>-2</sup> ; nominal cover to reinforcement shall be 35 mm
	C28/35	10	Self-compacting		
65-75	C25/30	20	Standard	Micro-fibre* (Class 1)	Fibrin XT Ultra (0.90 kg.m <sup>-3</sup> ), Fibrin 23 (0.90 kg.m <sup>-3</sup> ); or similar approved
	C28/35	10	Self-compacting		
65-75	C25/30	20	Standard	Macro-fibre (Class II)	Durus S400 (4.0 kg.m <sup>-3</sup> ), Novomesh B&BA (macro, 3.33 kg.m <sup>-3</sup> ), Durus Easy Finish (3.00 kg.m <sup>-3</sup> ); or similar approved
	C28/35	10	Self-compacting		
65-75	C25/30	20	Standard	Steel fibre	Adfil SF86 (13.33 kg.m <sup>-3</sup> ), Novomesh B&BA (steel, 15.00 kg.m <sup>-3</sup> ); or similar approved
	C28/35	10	Self-compacting		

\*Note: NHBC do not accept micro-fibre structural concrete toppings

Table 3 - Concrete topping specifications for commercial buildings with the characteristic imposed loads given in Table 5

Thickness (mm)	Grade	Maximum aggregate size (mm)	Type	Reinforcement
65-75	C25/30	10	Self-levelling self-compacting concrete	steel mesh <sup>1)</sup>
65-75	C28/35	20	Conventional	steel mesh <sup>1)</sup>

<sup>1)</sup> Structural mesh should be sized and designed according to BS EN 1990<sup>5</sup>, BS 1991-1-1<sup>7</sup> and BS EN 1992-1-1<sup>8</sup> and their UK National Annexes

Table 4 - Imposed and partition loads for concrete topping reinforced with macro-polymer fibres and steel mesh A142 (kPa)

Description	Characteristic value of loads for single-family dwellings	Characteristic value of loads for communal areas in blocks of flats
Imposed uniformly distributed load (kPa)	1,5	3,0
Imposed concentrated load (kN)	2,0	4,0
Line load partition, parallel and perpendicular to the beam (kN.m <sup>-1</sup> )	3,0	5,0
Allowance for moveable partition (kPa)	1,0	1,0

Table 5 - Imposed and partition loads for commercial buildings and concrete topping reinforced with steel mesh

Description	Characteristic values of loads
Imposed UDL (kPa)	5,0
Imposed concentrated load (kN)	4,5
Line load partition parallel and perpendicular to the beam (kN·m <sup>-1</sup> )	5,0
Allowance for moveable partition (kPa)	1,0

Figure 1 - Required total beam width parallel under partition wall, for EPS 250

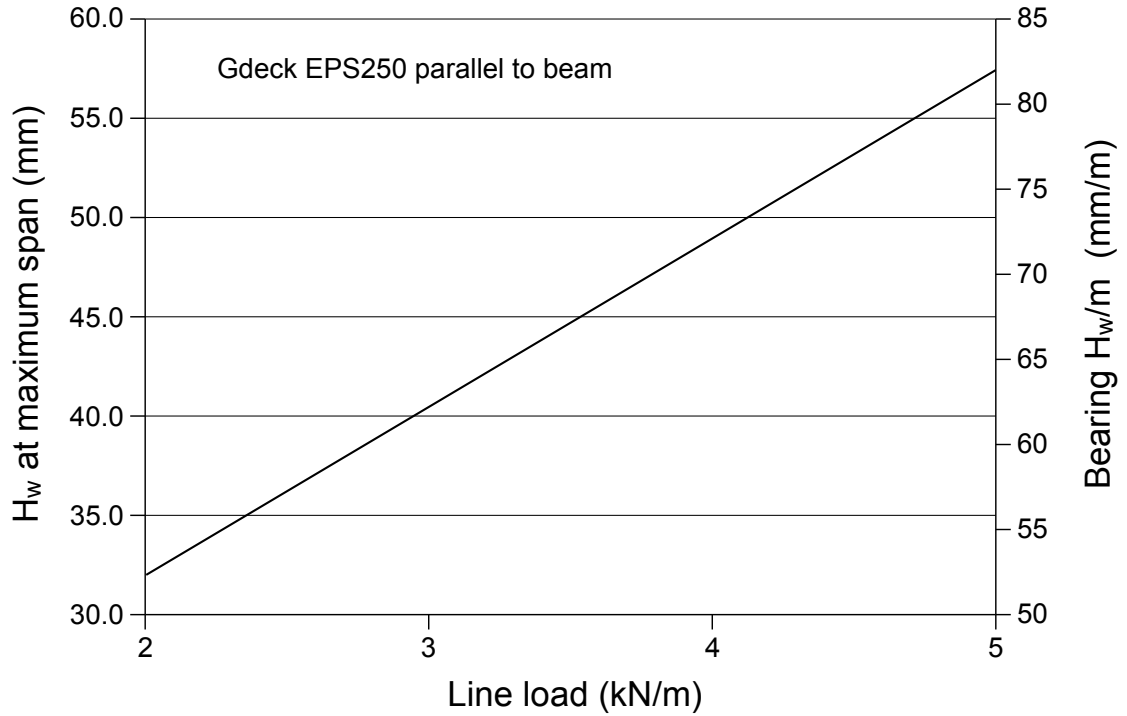


Figure 2 - Required total beam width per m<sup>1</sup> perpendicular under partition walls, for EPS 250

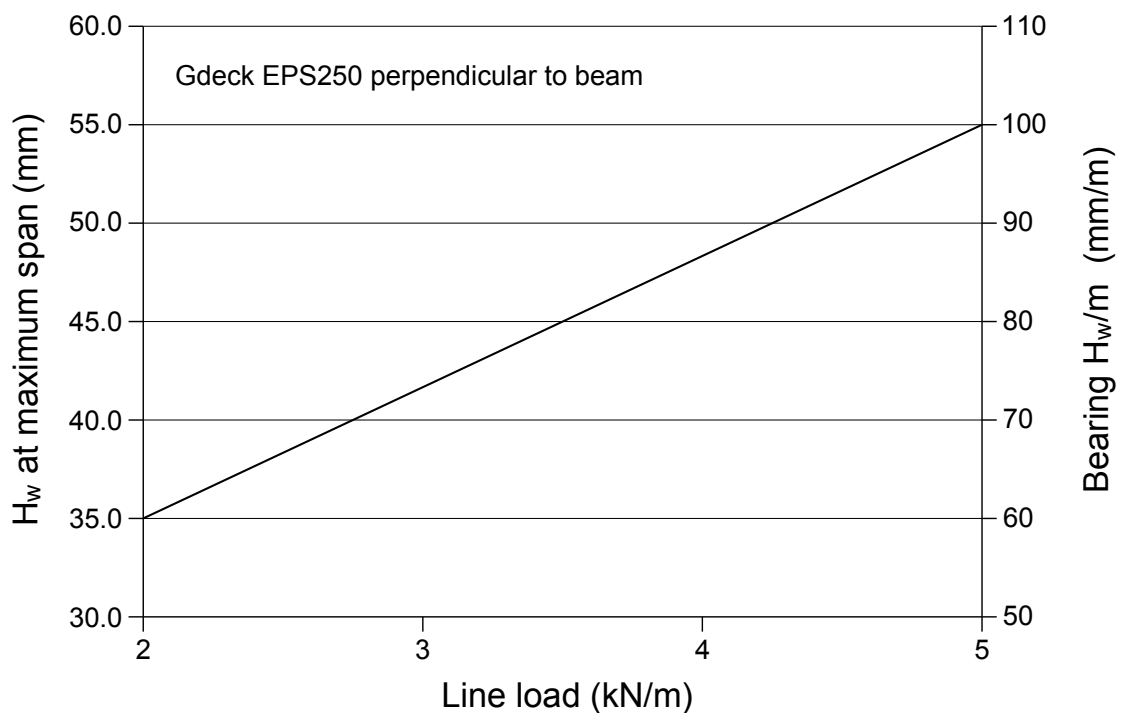


Figure 3 – Range of the Gdeck R1 EPS Panel System

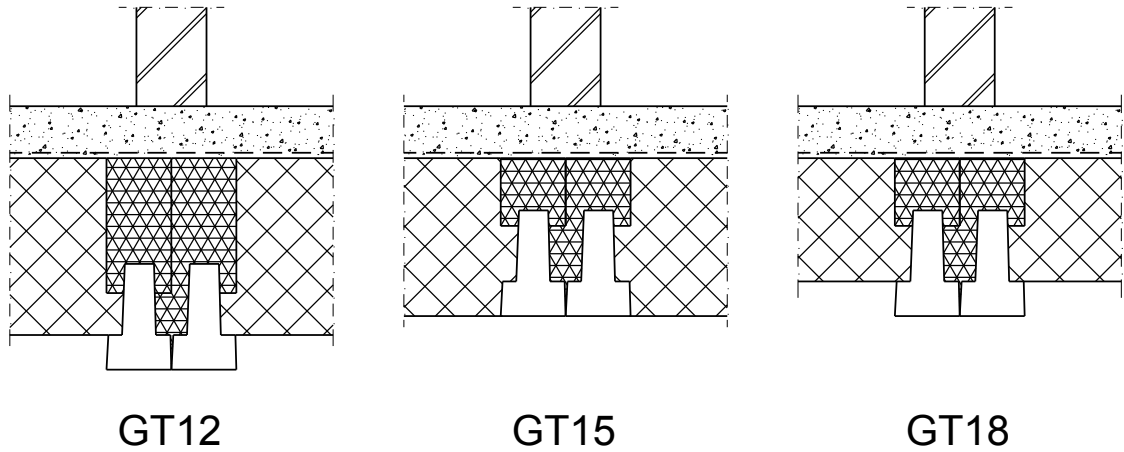


Figure 4 – Examples of typical pre-cast concrete beams.  $H_w$  = Width of the beam header. All dimensions in mm.

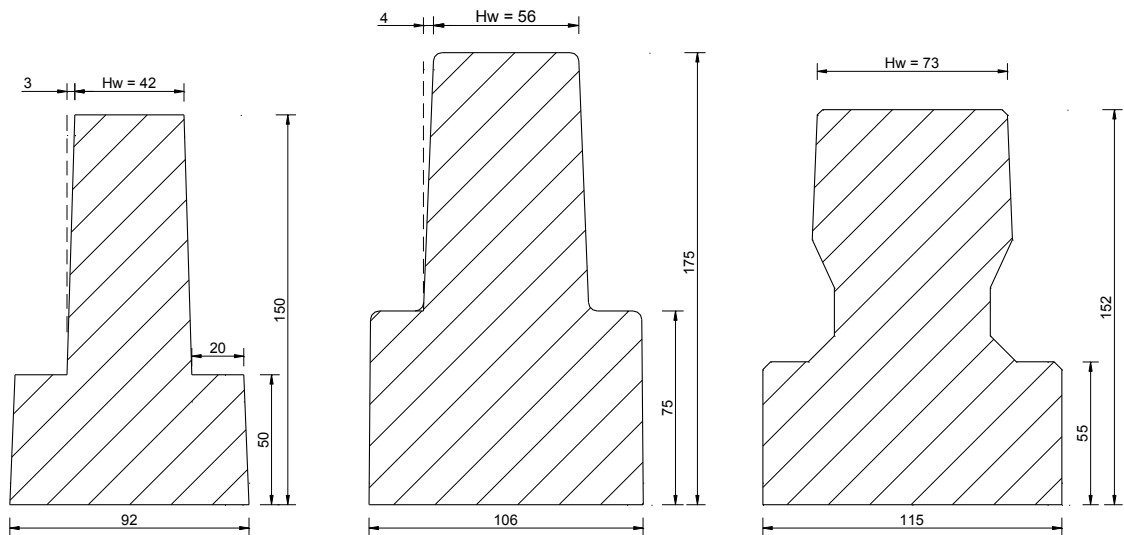


Figure 5 - The Gdeck R1 EPS Panel System – GT detail 12 Floor/Wall Junction – depth 250 mm

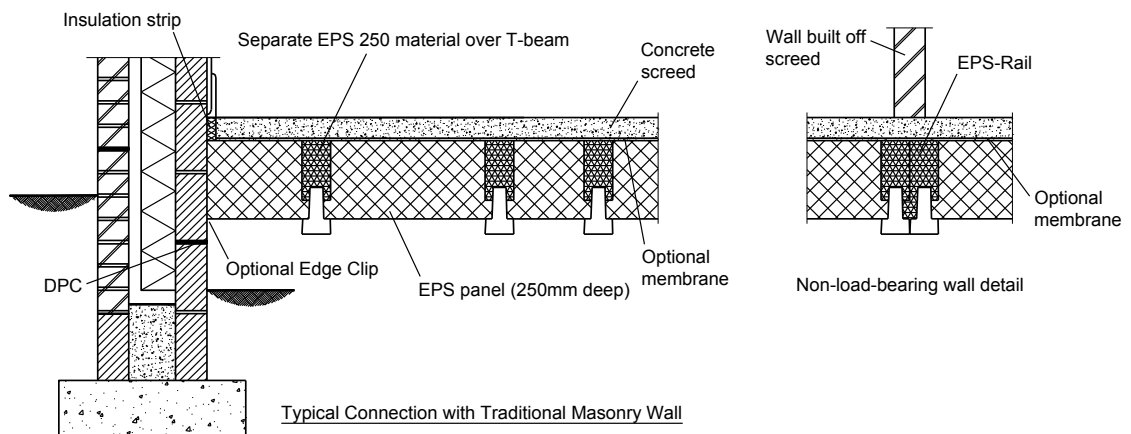


Figure 6 - The Gdeck R1 EPS Panel System – GT detail 15 Floor/Wall Junction – depth 230 mm

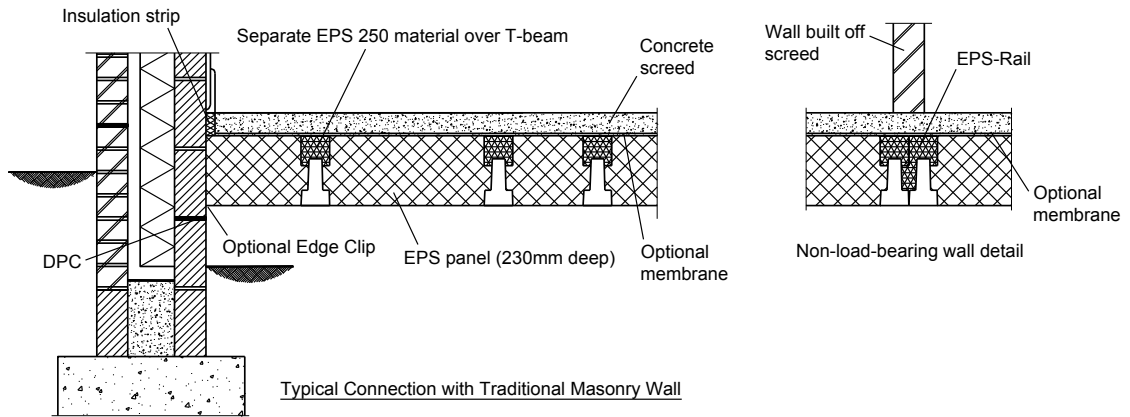


Figure 7 - The Gdeck R1 EPS Panel System – GT detail 18 Floor/Wall Junction – depth 180 mm

