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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Building System
Agrément Certificate
02/S029
Product Sheet 1

KINGSPAN STRUCTURAL INSULATED PANEL (SIP) SYSTEMS

KINGSPAN TEK BUILDING SYSTEM

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to Kingspan TEK Building System, a panelised method of construction using structural insulated panels manufactured from OSB/3 and rigid urethane insulation.

AGRÉMENT 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 walls have adequate strength to resist the loads associated with in-service loading (see section 5).

Thermal insulation — the system contributes to the overall thermal performance of the wall and roof construction (see section 6).

Condensation risk — walls, openings and junctions with other elements will adequately limit the risk of surface condensation (see section 8).

Behaviour in relation to fire — the structural external and separating walls formed from the system provide sufficient fire protection when assessed in accordance with BS 476-21 : 1987 (see section 9).

Resistance to airborne sound — separating walls, with additional plasterboard and soundproof linings and detailing shown in this Certificate, will provide sufficient sound resistance (see section 10).

Durability — the SIP wall and roof panels will have a minimum service life of 60 years provided that they are protected from damage by the external and internal finishes (see section 14).

The BBA has awarded this Agrément 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 Third issue: 21 March 2011
Originally certificated on 17 December 2002

Brian Chamberlain
Head of Approvals — Engineering

Greg Cooper
Chief Executive

Certificate amended on 2 November 2011 to correct Table number (page 10).

British Board of Agrément
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Regulations

In the opinion of the BBA, the Kingspan TEK Building System, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:

The Building Regulations 2010 (England and Wales)

Requirement:	A1	Loading
Comment:		Walls and roofs will have sufficient strength and stiffness when designed and constructed in accordance with sections 5.1 and 5.2 of this Certificate.
Requirement:	A3	Disproportionate collapse
Comment:		The system has sufficient strength and stiffness when designed in accordance with sections 5.1 and 5.2 of this Certificate.
Requirement:	B3(1)(2)	Internal fire spread (structure)
Comment:		Walls with the requisite lining can give a fire resistance in excess of 60 minutes. See sections 9.1 to 9.3 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		Walls can adequately limit the risk of surface condensation and contribute to minimising the risk of interstitial condensation. See sections 8.1 and 8.2 of this Certificate.
Requirement:	E1	Protection against sound from other parts of the building and adjoining buildings
Requirement:	E2	Protection against sound within a dwelling-house etc
Comment:		Walls can adequately meet these Requirements. See sections 10.1 to 10.3 of this Certificate.
Requirement:	L1	Conservation of fuel and power
Comment:		Walls can contribute to a building meeting the Target Emission Rate. See sections 6.4 and 6.6 of this Certificate. Walls can also adequately limit heat loss at junctions between walls, with other elements and around openings. See sections 6.1, 6.3, 6.4, 6.6 to 6.8, 7.1 and 7.2 of this Certificate.
Requirement:	Regulation 7	Materials and workmanship
Comment:		The system is acceptable. See section 14.1 and the *Installation* part of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The system panels can contribute to a construction meeting this Standard. See sections 13.1, 13.2 and 14.1 and the *Installation* part of this Certificate.
Regulation:	9	Building standards — construction
Standard:	1.1(a)	Structure
Comment:		Walls and roofs incorporating the system panels will have sufficient strength and stiffness when designed and constructed in accordance with sections 5.1 and 5.2 of this Certificate.
Standard:	2.2	Separation
Standard:	2.3	Structural protection
Comment:		Walls using the appropriate lining can achieve a period of fire resistance of 'medium' duration. See sections 9.4 and 9.5 of this Certificate.
Standard:	2.4	Cavities
Comment:		Walls using an appropriate cavity barrier can satisfy this Standard, with reference to clauses 2.4.1[1] to 2.4.7[1]. See section 9.2 of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		Walls using the appropriate lining can achieve a period of fire resistance of 'medium' duration, with reference to clauses 2.6.1[1] and 2.6.2[1] of this Standard. See sections 9.1 to 9.5 of this Certificate.
Standard:	3.15	Condensation
Comment:		Walls can adequately minimise the risk of surface condensation, with reference to clauses 3.15.1[1] and 3.15.3[1]. See section 8.1 of this Certificate. Walls can contribute to minimising the risk of interstitial condensation with reference to clauses 3.15.1[1] and 3.15.4[1]. See sections 8.1 and 8.2 of this Certificate.
Standard:	5.1	Resisting sound transmission to dwellings
Comment:		Separating walls satisfy this Standard, with reference to clauses 5.1.1[1], 5.1.2[1], 5.1.4[1] and 5.1.6[1]. See sections 10.1 to 10.3 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The system will enable, or contribute to enabling, a wall to meet these Standards, with reference to clauses 6.1.1[1][2], 6.1.4[1], 6.1.5[1], 6.2.1[1][2], 6.2.3[1], 6.2.4[1][2], 6.2.5[1][2], 6.2.6[2] and 6.2.7[2]. See sections 6.1, 6.3, 6.4, 6.6 to 6.8, 7.1 and 7.3 of this Certificate.

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2000 (as amended)

Regulation:	B2	Fitness of materials and workmanship
Comment:		The system is acceptable. See sections 14.1 and 14.2 and the *Installation* part of this Certificate.
Regulation:	B3(2)	Suitability of certain materials
Comment:		The system is acceptable. See sections 13.1 and 13.2 of this Certificate.
Regulation:	C4	Resistance to ground moisture and weather
Comment:		Walls can adequately limit the risk of moisture ingress from the ground. See sections 12.1 and 12.2 of this Certificate.
Regulation:	C5	Condensation
Comment:		Walls can contribute to minimising the risk of interstitial condensation. See sections 8.1 and 8.2 of this Certificate.
Regulation:	D1	Stability
Comment:		Walls will have adequate strength and stiffness to satisfy this Regulation. See sections 5.1 and 5.2 of this Certificate.
Regulation:	D2	Disproportionate collapse
Comment:		Walls, when suitably strengthened, will have adequate strength and stiffness to satisfy this Regulation. See sections 5.1 and 5.2 of this Certificate.
Regulation:	E4	Internal fire spread — Structure
Comment:		Walls can satisfy these Regulations. See sections 9.1 to 9.3 of this Certificate.
Regulation:	F2(a)(i)	Building fabric
Regulation:	F3(2)	Target carbon dioxide Emission Rate
Comment:		Walls can contribute to a building meeting the Target Emission Rate. See section 6.4 of this Certificate. Walls can also adequately limit heat loss of unwanted air infiltration and excessive additional heat loss at junctions between walls, with other elements and around openings. See sections 6.1, 6.3, 6.4, 6.6 to 6.8, 7.1 and 7.2 of this Certificate.
Regulation:	G2(1)	Separating walls and separating floors
Comment:		Separating walls can satisfy this Regulation. See sections 10.1 to 10.3 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* (1.1 and 1.2) and 15 *General* (15.1) of this Certificate.

Non-regulatory Information

NHBC Standards 2011

NHBC accepts the use of the Kingspan TEK Building System, when installed and used in accordance with this Certificate, in relation to *NHBC Standards*, Parts 6 and 7.

General

The system is for use in single- or multiple-occupancy constructions up to four storeys high as the loadbearing inner leaf of an external wall, a loadbearing internal wall, single or double leaf(s) of a separating wall or pitched roofing panels. The panels may also be used as infill panels (see Figure 8) to multi-storey framed buildings subject to design constraints on height and method of fixing to structural frames — the Certificate holder should be consulted for suitable details.

It is essential that the system is designed in accordance with the Certificate holder's recommendations with regard to structural analysis, design details and drawings, and installed using their trained and approved operatives.

Technical Specification

1 Description

1.1 Each panel of the Kingspan TEK Building System is nominally 142 mm thick overall and has two outer skins of 15 mm thick OSB/3 (oriented strand board type 3), separated by a core of 112 mm thick, zero rated Ozone-Depleting Potential rigid urethane insulation. Panel weight is approximately 25 $kg \cdot m^{-2}$.

1.2 The panels are available in widths ranging from 200 mm to a maximum of 1220 mm, and lengths up to 7500 mm. The panels are supplied in the appropriate shapes and sizes for each project together with any expanding urethane sealant, fixings and jointing pieces that may be required.

1.3 For each project, an inventory of components is manufactured from working drawings generated by the Certificate holder (or one of their appointed agents) in accordance with the client's approved design.

1.4 In addition to the panels, a number of other components are required to facilitate the assembly of the system:

- edge timbers — minimum 50 mm by 110 mm C16 or equivalent
- structural timber posts — minimum 100 mm by 110 mm C24 or equivalent
- cassette joints — two OSB/3 15 mm by 100 mm skins and rigid urethane insulation core (see Figure 2).

1.5 Associated ancillary items required (but not covered by this Certificate) are:

- other structural components such as engineered timber I-joists, beams, structural steel — detailed and specified as necessary
- damp-proof course (dpc) — complying with BS 5628-3 : 2005 or BS EN 1996-2 : 2006, BS 8000-3 : 2001 and BS 8215 : 1991 and of minimum thickness 1.2 mm and weight 1.5 $kg \cdot m^{-2}$
- levelling shims — high-density, polyethylene (>99%) of density >962 $kg \cdot m^{-3}$, available in 2 mm, 3 mm, 4 mm, 5 mm and 6 mm thicknesses
- sole plate grout — proprietary, injectable mortar grouting to exceed the properties of a Class 1 mortar as defined in BS 5628-3 : 2005 or BS EN 1996-2 : 2006
- silicone — one-part transparent silicone of density >1020 $kg \cdot m^{-3}$, permissible deformation >25%, UV and fungal resistant
- expanding urethane — gun-grade polyurethane based expanding one-part foam
- Sparrennagels — galvanized steel ring-shank nails, 6 mm diameter to DIN 1052-2 : 1988 (varying lengths)
- FastenMaster Headlok screws — epoxy coated carbon steel screws, 4.8 mm diameter by 73 mm to 254 mm long
- machine nails — galvanized/sherardized ringshank machine nails (in coils or strips) in accordance with DIN 1052-2 : 1988 and BS 5268-2 : 2002 or BS EN 1995-1-1 : 2004, sizes 2.8 mm by 63 mm and 3.1 mm by 90 mm
- standard nails — as per BS 5268-2 : 2002 or BS EN 1995-1-1 : 2004
- joist hangers — as specified for the project and manufactured by Cullen Ltd. All fixings to be in accordance with the manufacturer's instructions
- dry lining battens — minimum 50 mm wide by 10 mm deep softwood battens, or vertical metal rails
- floor decking — 22 mm TG4 OSB/3 or 22 mm P5 TG4 particle board (protected) – size of boards to suit joist centres
- sole plates — treated C24 to EN 338 : 2009, 140 mm by 38 mm (minimum), equivalent UK size 145 mm by 47 mm
- wall ties — Simpson Strong-Tie BTS-50 TEK wall-tie kits using ABC Spax stainless steel, flange-head, Pozi-drive screws 30 mm by 4 mm
- counter battens — treated softwood counter battens, minimum 50 mm wide by 25 mm deep
- tiling/slate battens — sizing as per BS 5534 : 2003
- vapour permeable underlay/membrane for roofing and walls (see section 8.3).

Quality controls

1.6 System components are bought in to agreed specifications or in accordance with British Standards or Agrément Certificates.

1.7 Quality checks are made during the manufacturing process and on the finished components.

2 Delivery and site handling

2.1 The panels are delivered in shrink-wrap, with edge protectors and banded packaging used for initial transit and temporary protection. They should be stored flat, no more than 16 panels high, over suitable stillage to a slight fall to allow rain run-off. Bearers should be at 600 mm (maximum) centres (end bearers no more than 150 mm from the edge of the panel), and aligned vertically between individual packs in accordance with the Certificate holder's guidelines.

2.2 The panels and all components should be stored inside, or in dry, sheltered conditions, at least 150 mm off the ground, and covered with opaque polythene sheeting or tarpaulin until the panels and components are to be used for erection.

2.3 The panels can withstand the normal loads associated with site handling and installation. Damaged panels should not be used.

2.4 Each panel bears the BBA identification mark incorporating the number of this Certificate.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Kingspan TEK Building System.

3 General

3.1 Kingspan TEK Building System panels are suitable for use as loadbearing partitions, separating walls, the inner leaf of external walls and pitched roofs in dwellings up to four storeys high, subject to the provision of solid timber spline joints at ground floor level (see Figures 1 and 2 and Table 1). The panels may also be used as infill panels in multi-storey framed buildings subject to design constraints on height and the method of fixing to structural frame. All fixings must be designed to allow movement within the structural frame due to expansion/contraction or differential movement. All designs should be undertaken by a suitably qualified Chartered Engineer familiar with the design and application of the system. All production drawings should be carried out by either the Certificate holder or one of their appointed agents according to the standard details for the system, the latest version of which can be found on the Kingspan TEK Building System website.

Figure 1 Typical wall and roof construction

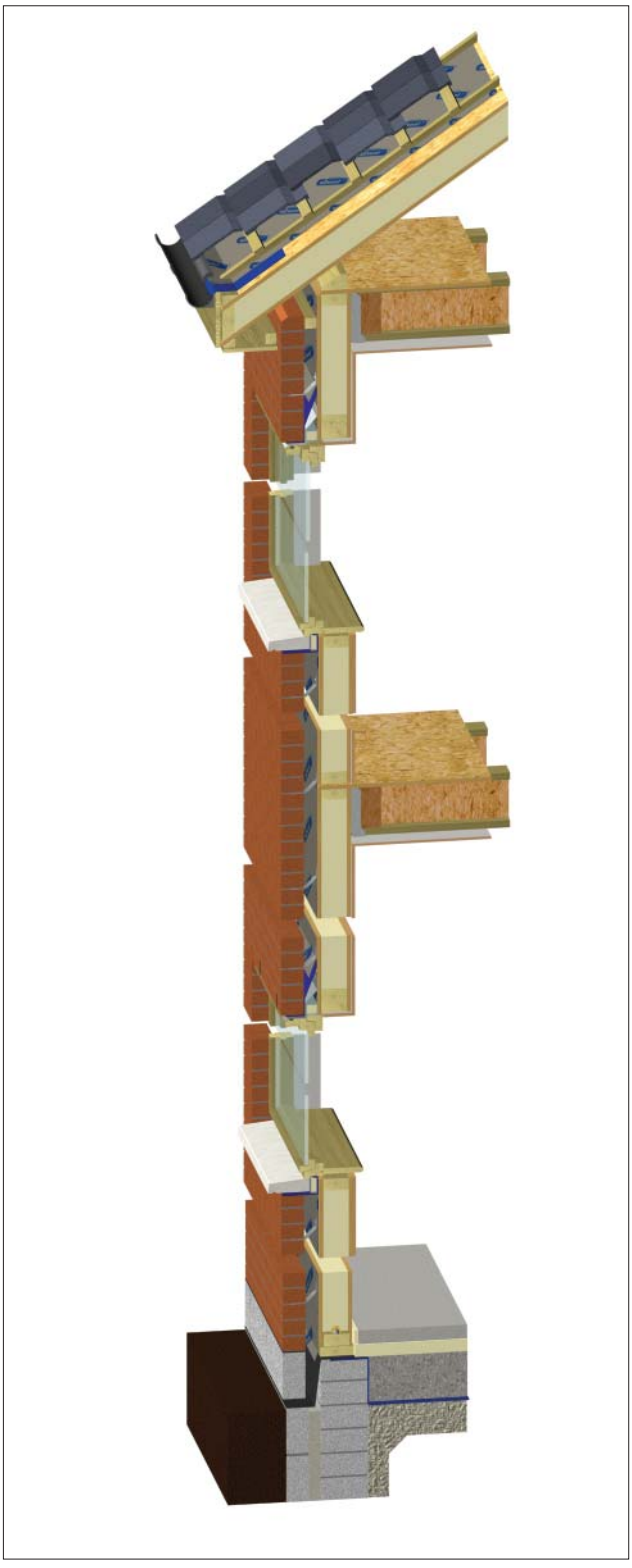


Figure 2 Cassette joint system

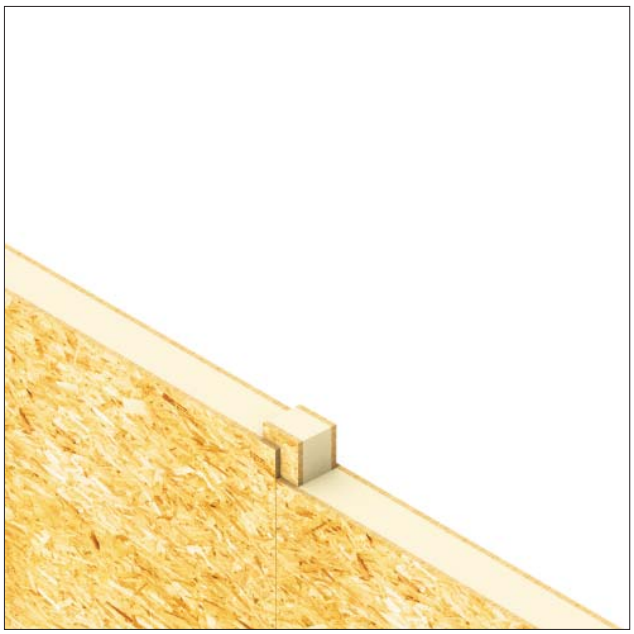


Table 1 Applications

Application	1 storey	2 storeys	3 storeys	4 storeys
Standard trussed rafters	✓	✓	✓	✓
Attic trusses	✓	✓	✓	X
TEK roof (non-habitable, minimum pitch 10°)	✓	✓	✓	✓
TEK room in the roof	✓	✓	✓	X

3.2 Masonry walls must be built in accordance with BS 5628-3 : 2005 or BS EN 1996-2 : 2006 and BS EN 1996-3 : 2006, and roof tiles and slates applied in accordance with BS 5534 : 2003.

3.3 Other wall and roof weatherproofing systems can be used, but are not covered by this Certificate.

3.4 Foundations (outside the scope of this Certificate) must be approved for use by the Certificate holder's technical staff and should be suitably level and square to accept the system.

3.5 Internal and separating floors form an integral part of the system. The components of the floor construction (see section 5) are outside the scope of this Certificate.

4 Practicability of installation

The system may be readily installed by contractors who have been trained and assessed to undertake this work. Any installation work should follow the details and information contained in the construction drawings, as prepared by the Certificate holder or their appointed agents.

5 Strength and stability

5.1 The system panels will have adequate strength and stiffness when used in accordance with the provisions of this Certificate.

5.2 The permissible design values to be used when evaluating the design resistance of the panels are given in Table 2.

5.3 The permissible vertical load resistance given in Table 2 is based upon the resultant load being applied at a maximum eccentricity of $d/6$ from the panel centre line. Where the resultant vertical load acts at a distance greater than $d/6$ from the panel centre line, this long-term effect should be taken into account in the design.

Table 2 Structural properties

Strength		Permissible value per metre length
Bending strength (M) (kN·m)		2.0
Shear strength (Q) (kN)		2.8
Axial strength[2] (N) (kN):		
wall height < 2450 mm		35.25
wall height 2450–2750 mm		30.67
wall height 2750–3000 mm		26.44
Racking strength (R)[3] (kN)		3.39
Stiffness		
EI_{inst} (N·mm^{-2})	wind load checks	4.26×10^{11}
EI_{perm} (N·mm^{-2}))	long-term deflection[2]	$EI_{inst}/(1 + 2.25)$
GA_{inst} (N·mm^{-2})	wind load checks	
GA_{perm} (N·mm^{-2})	long-term deflection[2]	5.73×10^{5} $GA_{inst}/(1 + 6.50)$

(1) When checking the permissible loads on a panel, the formula $N/N_{permissible} + M/c_m.M_{permissible} < 1.0$ should be evaluated, where:
$N_{permissible}$ is taken from Table 2
$M_{permissible}$ is taken from Table 2
c_m = 1.0 for long- or medium-term loads (including effects of load eccentricity — see below)
c_m = 1.25 for wind loadings (short- or very short-term).

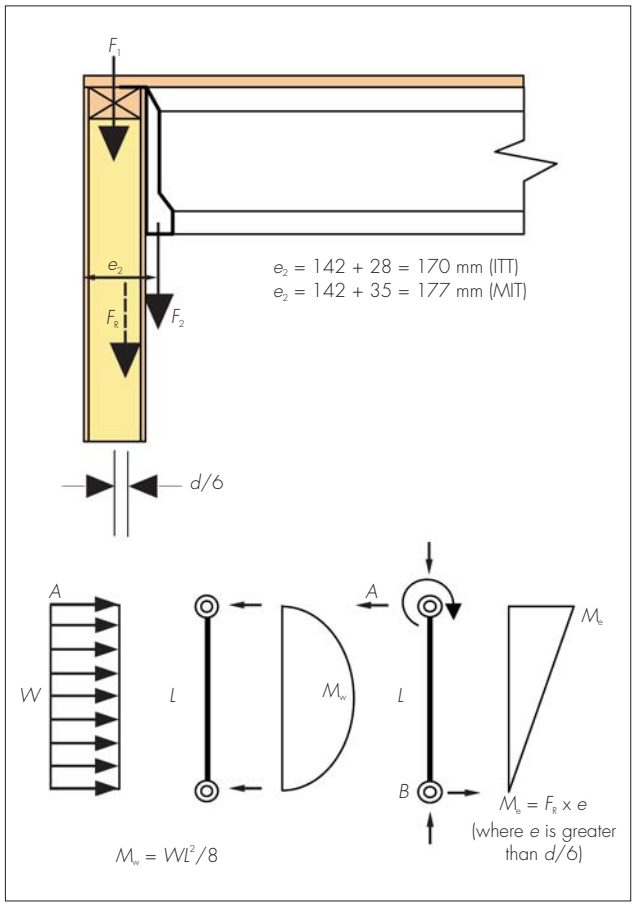
(2) Linear interpolation between values given above is permitted.

(3) Only modification factors K_{104}, K_{106} and K_{108} (taken from BS 5268-6.1 : 1996) may be used to modify the basic racking resistance value. Racking strength performance can be mobilised in addition to loads acting perpendicular to the plane of the panel. These modification factors are applied to the instantaneous stiffness moduli to take into account the potential effects of long-term creep.

5.4 The strength of all connection details which tie walls to other structural elements (such as walls, floors, roofs, solid timber splines) must be evaluated and provide adequate stability for the overall building design (see Figure 3). The specification and design for these items must be determined by a suitably qualified Chartered Engineer responsible for the stability of the building. Guidance on the design of connection details may be obtained from the Certificate holder.

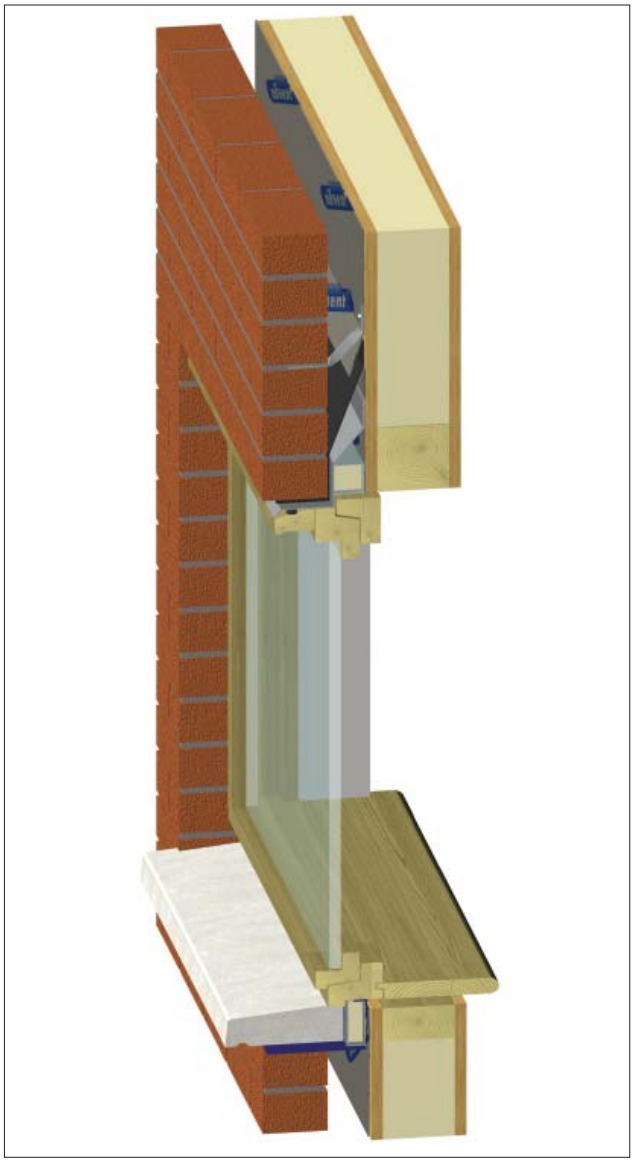
5.5 Lintels and framing around openings form an integral part of the loadbearing wall panels (see Figure 4). The sizing of lintels should be determined by the Chartered Engineer responsible for the design.

Figure 3 Basic panel design criteria[1]



(1) These calculations assess the performance of the TEK wall panel only. Ancillary timbers and posts are assessed separately and may be considered to enhance the overall performance of the panel.

Figure 4 External wall window detail including lintel



5.6 As part of the structural design, consideration should be given to the support of eccentric loads imparted by central heating systems or kitchen appliances.

5.7 Stainless steel wall ties (Simpson Strong-Tie BTS-50) can be directly attached to the OSB/3 face of the panel using stainless-steel screw fasteners (ABC Spax) 30 mm by 4 mm flange-head, Pozi-drive or as approved by the Certificate holder.

6 Thermal insulation

6.1 The thermal performance of each building incorporating the panels must be evaluated in accordance with the relevant national Building Regulations, and is the responsibility of the overall designer of the building.

6.2 Typical external wall constructions are made up (in sequence inside to outside) thus: 12.5 mm thick plasterboard, timber battens (between which services can be housed), Kingspan TEK Building System panels, vapour permeable underlay, 50 mm wide cavity and brick outer leaf. The U value is typically between 0.19 $W \cdot m^{-2} \cdot K^{-1}$ and 0.20 $W \cdot m^{-2} \cdot K^{-1}$ depending upon the percentage area of timber used[1] (from 0% to 4%).

(1) With extra insulation, U values as low as 0.10 $W \cdot m^{-2} K^{-1}$ are achievable. Further information can be obtained from the Certificate holder.

6.3 Calculations of the thermal transmittance (U value) of a specific wall construction should be carried out in accordance with BS EN ISO 6946 : 2007 and BRE report (BR 443 : 2006) *Conventions for U-value calculations*. The following thermal conductivities ($W \cdot m^{-1} \cdot K^{-1}$) may be used to conduct the calculation:

plasterboard	0.25
timber	0.13
plaster	0.18
PUR insulation	0.023
OSB (cassettes)	0.13.

6.4 Under the national Building Regulations, the system performs thus:

England and Wales and Northern Ireland

- walls are better than the U value specified for a wall in a 'notional' building in SAP 2009 *The Government's Standard Assessment Procedure for Energy Rating of Dwellings*, Appendix R, Table R1, or the Simplified Building Energy Model (SBEM). Therefore, the system can contribute to enabling a building to meet the Target CO_2 Emission Rate (TER) as specified in Approved Documents L1A and L2A and Technical Booklets F1 and F2 respectively (see Tables 3 and 4).

Scotland

- walls containing the system panels can satisfy the Limit U values specified in the Technical Handbooks, clause 6.2.1. Therefore, the system can contribute to enabling a building to meet its TER or it can meet the U values of the simplified approach given in the Technical Handbook (Domestic), clause 6.1.2 (see Table 5).

Table 3 Mean design wall U values — England and Wales(1)

Construction	U value ($W \cdot m^{-2} \cdot K^{-1}$)
Notional non-domestic building	0.26
Dwelling new-build limit	0.30
Notional dwelling	0.35
Non-domestic new-build limit	0.35

(1) Flexible approaches on existing buildings are given in the Approved Documents.

Table 4 Mean design wall U values — Northern Ireland(1)

Element	U value ($W \cdot m^{-2} \cdot K^{-1}$)
Existing building – new wall	0.30
Notional dwelling	0.35
Notional non-domestic building	0.35
Building new-build limit	0.35

(1) Flexible approaches on existing buildings are given in the Technical Booklets.

Table 5 Mean design wall U values — Scotland(1)

Construction	U value ($W \cdot m^{-2} \cdot K^{-1}$)
Notional dwelling	0.19
New dwelling simplified method	0.19
Extension to dwelling	0.19
Stand alone building < 50 m^2 to a dwelling	0.22
New non-dwellings limit for shell and fit-out	0.23
New dwelling limit	0.25
New non-domestic limit	0.27
Notional non-dwelling	0.30

(1) Flexible approaches on existing buildings are given in the Technical Handbooks.

6.5 Typical roof constructions are finished internally with 12.5 mm thick plasterboard, fixed either directly or on timber battens, plasterboard strips or boards between which services can be housed. Externally, a vapour permeable underlay/membrane is laid under treated softwood timber counter battens (minimum 25 mm deep by 50 mm wide), laid vertically down the roof pitch and tiling/slate battens sized in accordance with BS 5534 : 2003. The U value is typically 0.18 $W \cdot m^{-2} \cdot K^{-1}$ and 0.20 $W \cdot m^{-2} \cdot K^{-1}$ dependent on percentage area of timber used(1) (from 0% to 1%).

(1) With additional insulation, U values as low as 0.10 $W \cdot m^{-2} \cdot K^{-1}$ are achievable. Further information can be obtained from the Certificate holder.

6.6 The roof system contributes to meeting the requirements of the national Building Regulations, thus:

England and Wales

- roofs, with the construction described in section 6.5, can achieve:
  - 0.25 $W \cdot m^{-2} \cdot K^{-1}$ for a 'notional' building, other than a dwelling, in the Simplified Building Energy Model SBEM
  - 0.25 $W \cdot m^{-2} \cdot K^{-1}$ limit average value specified in Approved Documents L1A, Table 2, and L2A, Table 4
  - 0.35 $W \cdot m^{-2} \cdot K^{-1}$ limit value for an individual roof element specified in Approved Documents L1A, Table 2, and L2A, Table 4.
- unless additional insulation is provided, the roof construction described in section 6.5 cannot achieve(1):
  - 0.16 $W \cdot m^{-2} \cdot K^{-1}$ required for 'notional' dwellings in SAP 2005

(1) Where a proposed building roof cannot achieve the U value specified for the 'notional' building, additional energy saving measures will be required within the building envelope and/or services to achieve the required overall carbon dioxide emission rate reduction of about 20% for dwellings and 23 to 28% for buildings other than dwellings. Further information should be sought from the Certificate holder.

Scotland

- roofs, with the construction described in section 6.5, can achieve:
  - 0.20 $W \cdot m^{-2} \cdot K^{-1}$ maximum average specified in the Table to Mandatory Standard 6.2, clause 6.2.1[1]
  - 0.25 $W \cdot m^{-2} \cdot K^{-1}$ maximum average value specified in the Table to Mandatory Standard 6.2, clause 6.2.1[1][2]
  - 0.35 $W \cdot m^{-2} \cdot K^{-1}$ maximum value for an individual roof element specified in the Table to Mandatory Standard 6.2, clause 6.2.1[1][2].
- unless additional insulation is provided the roof construction described in section 6.5 cannot achieve[3]:
  - 0.16 $W \cdot m^{-2} \cdot K^{-1}$ for a 'notional' domestic roof with reference to Mandatory Standard 6.1, clause 6.1.6[1], and SAP 2005
  - 0.16 $W \cdot m^{-2} \cdot K^{-1}$ for a 'notional' non-domestic pitched roof (>10°) with reference to Mandatory Standard 6.1, clause 6.1.3[2], and when 'Scotland' is selected in SBEM.

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

(3) Where a proposed building roof cannot achieve the U value specified for the 'notional' building, additional energy saving measures will be required within the building envelope and/or services to achieve the required overall carbon dioxide emission rate reduction of about 18% to 25% for domestic buildings and 23% to 28% for non-domestic buildings. Further information should be sought from the Certificate holder.

Northern Ireland

- roofs, with the construction described in section 6.5, can achieve:

— 0.25 $W \cdot m^{-2} \cdot K^{-1}$ for a 'notional' building other than a dwelling specified in SBEM

— 0.25 $W \cdot m^{-2} \cdot K^{-1}$ limit average value specified in Technical Booklets F1, Table 2.2, and F2, Table 2.4

— 0.35 $W \cdot m^{-2} \cdot K^{-1}$ limit value for an individual roof element as specified in Technical Booklets F1, Table 2.2, and F2, Table 2.4.

- unless additional insulation is provided the roof construction described in section 6.5 cannot achieve[1]:

— 0.16 $W \cdot m^{-2} \cdot K^{-1}$ required for 'notional' dwellings in SAP 2005.

(1) Where a proposed building roof cannot achieve the U value specified for the 'notional' building, additional energy saving measures will be required within the building envelope and/or services to achieve the required overall carbon dioxide emission rate reduction of about 20% for dwellings and 23% to 28% for buildings other than dwellings. Further information should be sought from the Certificate holder.

6.7 The system panels can maintain, or contribute to maintaining, continuity of thermal insulation at junctions between elements and openings. For Accredited Construction details, the corresponding psi values given in BRE information Paper IP/06 *Assessing the effects of thermal bridging at junctions and around openings*, Table 3, may be used in carbon emission calculations in Scotland and Northern Ireland. Detailed guidance for other junctions and on limiting heat loss by air infiltration, can be found in:

England and Wales — Approved Documents to Part L and, for new thermal elements to existing buildings, Accredited Construction Details (version 1.0) (for new-build, see also SAP 2009, Appendix K, and the *iSBEM User Manual*).

Scotland — Accredited Construction Details (Scotland)

Northern Ireland — Accredited Construction Details (version 1.0).

6.8 The system panels can maintain, or contribute to maintaining, continuity of thermal insulation at junctions between walls and other building elements. The guidance given in BRE report (BR 262 : 2002) *Thermal insulation: avoiding risks is acceptable*.

7 Air leakage

7.1 Buildings can achieve adequate resistance to unwanted air infiltration provided there is effective sealing around junctions.

7.2 In England, Wales and Northern Ireland, completed buildings are subject to pre-completion testing for airtightness in accordance with the requirements of Approved Documents L1A and L2A (Regulation 20B), Technical Booklet F1 (sections 2.46 to 2.54), and Technical Booklet F2 (sections 2.57 to 2.61) respectively.

7.3 Completed buildings in Scotland are only subject to pre-completion airtightness testing if the target air permeability of the proposed building is less than 10 $m^3 \cdot h^{-1} \cdot m^{-2}$, or if the figure is between 10 $m^3 \cdot h^{-1} \cdot m^{-2}$ and 15 $m^3 \cdot h^{-1} \cdot m^{-2}$ and the designer does not wish to use the 15 $m^3 \cdot h^{-1} \cdot m^{-2}$ default figure in the proposed dwelling, in accordance with Mandatory Standard 6.2, clauses 6.2.4[1], 6.2.5[1], 6.2.6[2] and 6.2.7[2].

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

8 Condensation risk

8.1 Provided the panels are properly sealed together as detailed in section 12, the risk of surface and interstitial condensation under normal domestic use will be minimal. A mechanical ventilation system will help to alleviate moisture vapour within the construction (see section 7.1).

8.2 A condensation risk assessment was conducted in accordance with BS 5250 : 2002 on a typical wall and roof (given in sections 6.1 and 6.2). Any condensate will dissipate during the summer months. A vapour control layer (vcl) is not required in this instance.

8.3 For different constructions, a suitably-positioned vapour control layer should be used unless a condensation risk analysis in accordance with BS 5250 : 2002 shows it not to be necessary. In roofs, a vapour permeable membrane with a maximum vapour resistance of 0.25 MN·s·g^{-1}, eg Kingspan Nilvent.17 (BBA Certificate10/4757[1]) should be used and for the walls a maximum vapour resistance of 0.60 MN·s·g^{-1}, classified as HR membrane in BS 5250 : 2002.

(1) Users are advised to check the current validity of Certificates used with this system.

8.4 The risk of interstitial condensation in both the external walling and the roofing is greatest when the building is drying out after construction. Guidance on preventing condensation is given in BRE Digest 369 Interstitial condensation and fabric degradation and BRE report (BR 262 : 2002) *Thermal insulation: avoiding risks*.

9 Behaviour in relation to fire

9.1 When tested to BS 476-21 : 1987, the panel system achieved the results shown in Table 6.

Table 6 Fire performance

Performance	Axial load (kN·m^{-1})	Construction
FR30	13	12.5 mm plasterboard fixed over 50 mm x 10 mm battens
FR60	35	One layer of 12.5 mm fire-resistant plasterboard, plus one layer of 12.5 mm plasterboard on 50 mm x 10 mm battens

9.2 Assessment of test results and design details shows that panels are suitable for use in external walls not less than one metre[1] from a relevant boundary, and in separating walls that require fire resistance periods not less than:

- external walls 30 minutes[2] or 60 minutes[3] (from inside)
- separating walls 60 minutes[3] (from either side).

(1) In Scotland, the panels may be used in external walls not more than one metre from a boundary provided no storey height is more than 18 metres, the recommendations of clauses 2.6.1 and 2.6.2 of the Technical Handbook (Domestic) of the Building (Scotland) Regulations 2004 (as amended) are followed and the external wall cladding is constructed from non-combustible material.

(2) Short duration in Scotland.

(3) Medium duration in Scotland.

9.3 The OSB/3 panel linings have a Class 3[1] surface spread of flame designation.

(1) 'High risk' in Scotland.

9.4 Junctions between the panels in external and separating walls will adequately maintain the fire resistance of the separating wall.

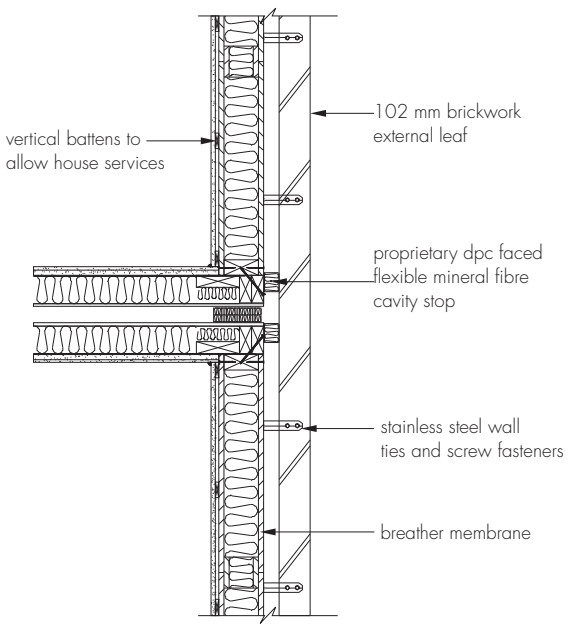
9.5 The panels can form part of a separating wall (single- or double-leaf construction — see Figure 5) between dwellings in Scotland in accordance with the exceptions permitted by the Technical Handbook (Domestic), clause 2.2.7.

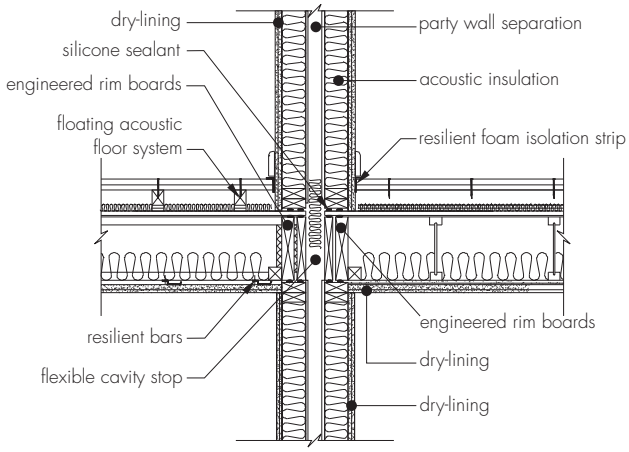
9.6 Constructions incorporating the system panels must include suitable provision for cavity barriers and for fire stopping at junctions with other elements in accordance with the requirements of national Building Regulations (see Figure 5).

9.7 Where any other form of wall construction incorporating the panels (including any service penetrations) is subject to fire resistance requirements, an appropriate assessment or test must be carried out by a UKAS (United Kingdom Accreditation Service) approved testing laboratory.

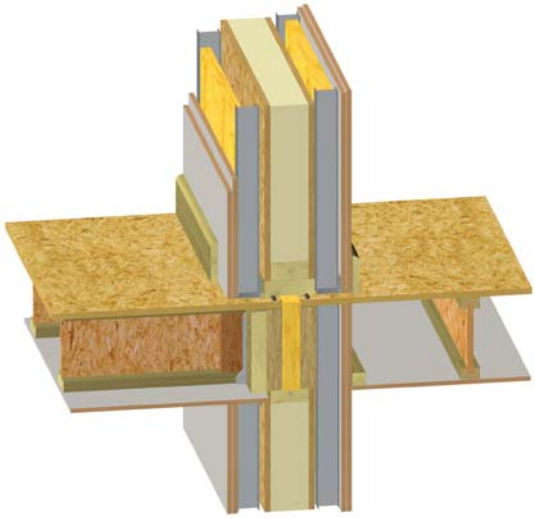
9.8 The external fire rating of any roof incorporating the system panels will depend on the specification of the roof covering used.

Figure 5 Separating wall details

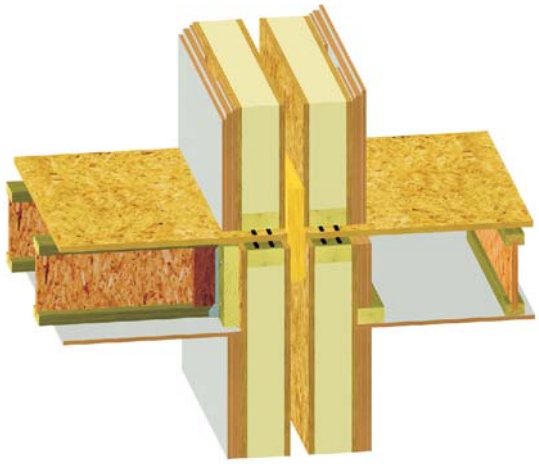




all joints/gaps to be sealed with tape or Gyproc acoustic sealant caulk



single-leaf



double-leaf SIP separating wall

10 Resistance to airborne sound

10.1 Testing to standards BS EN ISO 140-4 : 1998 (airborne) and BS EN ISO 140-7 : 1998 (impact) has indicated that the product will contribute to a wall or floor (see Figure 5) meeting the requirements for reducing flanking sound transmission in party walls and floors.

10.2 Separating walls with the Kingspan TEK Building System may be in the form of single TEK and double TEK party walls which would require pre-completion testing. Alternatively, the Kingspan TEK Building System has been listed with Robust Details and achieved a proprietary flanking condition using the TEK inner leaf in combination with timber separating walls E-WT-1 and E-WT-2 (see Robust Details, Appendix A2). Reference should also be made to the Certificate holder's Standard Details. It should be noted that separating floors would require pre-completion testing.

10.3 Good working practice should be adopted for sealing all joints with caulk or tape. Double or treble layers of plasterboard should be staggered. Relevant practices detailed within the Robust Details Part E *Resistance to the passage of sound* (as amended 2004) must be adopted.

11 Proximity of flues and appliances

When installing the product in close proximity to certain flue pipes and/or heat producing appliances provisions of the national Building Regulations are applicable:

England and Wales — Approved Document J

Scotland — Mandatory Standard 3.18, clauses 3.18.1(1) to 3.18.6(1)

(1) Technical Handbook (Domestic).

Northern Ireland — Technical Booklet L.

12 Damp-proofing and weathertightness

12.1 When the panels are used to form the inner leaf of an external cavity wall, the outer leaf must be designed and constructed in accordance with BS 5628-3 : 2001 incorporating damp-proof courses and cavity trays positioned in accordance with the latter Code. When used with other outer leaf construction, cladding or render systems the final weather resistance of the building is dependent upon the efficient positioning and sealing of all joints. The guidance given in BRE Digest 262, Section 3, should be followed with regard to rain penetration in that the designer selects a construction appropriate to the local wind-driven rain index, paying due regard to the design detailing, workmanship and materials to be used.

12.2 Roofing shall be in accordance with BS 5534 : 2003 detailed to ensure moisture is prevented from coming into contact with the panels.

12.3 The performance of windows and doors is not covered by this Certificate.

13 Maintenance and repair

13.1 Although maintenance is not envisaged for the system, regular checks should be carried out on the finishes to ensure that any damage is detected and repaired as soon as possible.

13.2 Minor repairs to the system can be carried out prior to erection in accordance with the Certificate holder's construction manual.

14 Durability

14.1 The panels will have comparable durability to that of OSB/3 to BS EN 300 : 1997, therefore, provided the installation remains weathertight, a life of at least 60 years may be expected.

14.2 Timber used in areas that could be at risk, eg sole plates, should be preservative-treated in accordance with the recommendations given in BS 1282 : 1999.

Installation

15 General

15.1 Erection of the system must comply with the details given in the Certificate holder's construction manual and the provisions of this Certificate.

15.2 When used as loadbearing construction, the main contractor must ensure that the accuracy of the foundation is in accordance with the Certificate holder's instructions. In particular, the following details must be within the tolerance of ± 5 mm:

- level of the foundation or other bearing support
- overall width and length of the building footprint
- diagonals used for checking the overall squareness of the building(1).

(1) Adjustment may be possible through the sole plates.

15.3 When used as an infill panel, the main contractor must ensure that the accuracy of the structural frame is in accordance with the Certificate holder's acceptable tolerances:

- panels to be held in place with proprietary brackets to the Chartered Engineer's specification
- a 5 mm gap should be left at the head of the infill panel to allow for expansion/differential movement. The gap should be filled with an expanding urethane foam or proprietary compressible foam.

15.4 Guidance to the procedure for installing the infill panels is limited due to the variations in the structural frame construction and detailing. Erection methods for lifting the infill panels into place, specification and design of brackets, fixings and tolerances will therefore need to be determined by the project engineer for each structure in which the infill panels are used. Further guidance can be obtained from the Certificate holder (see Figure 8).

16 Procedure (loadbearing construction)

Foundation construction

16.1 A suitable damp-proof course (dpc) must be used, laid on top of the foundation with silicone sealant applied to the top surface.

16.2 A combination sole plate/bottom plate (see Figure 5) is positioned over the dpc and fixed to the foundation using fixings as approved by the Certificate holder and the Chartered Engineer's requirements. Tolerances for sole plates can be adjusted as per Kingspan TEK Technical Bulletin No 5 or the Certificate holder's recommendations. Proprietary injectable mortar grouting is used to seal against air infiltration.

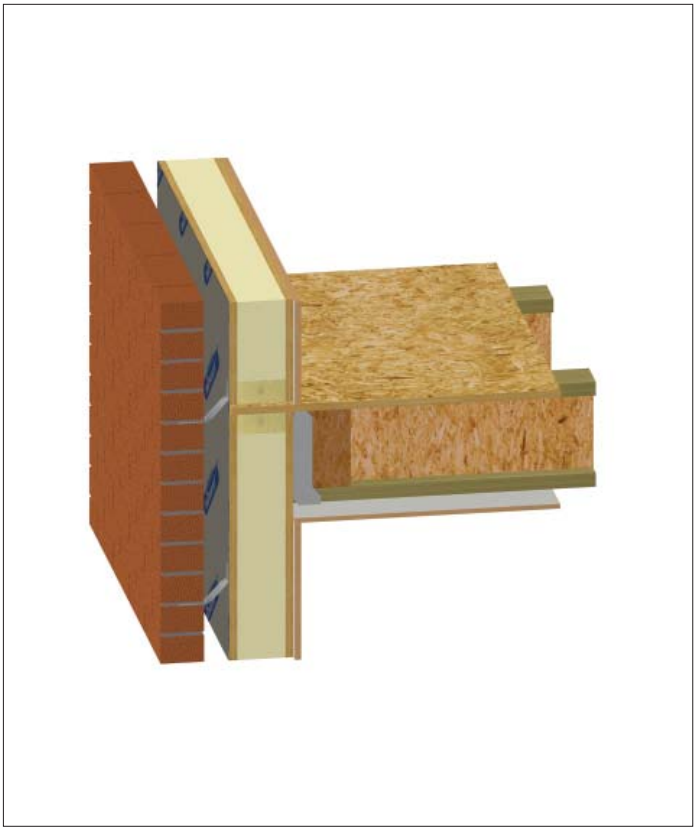
Ground-floor construction

16.3 A bead of expanding urethane sealant is applied to the top of combination sole plate/bottom plate or in the rout of the panel(s). When the panel is positioned correctly on the combination sole plate, the panel is fixed to the bottom plate section with nails/screws as approved by the Certificate holder. This forms the standard basis for connecting panel-to-panel runs, panel/intermediate floor joints or timber-to-timber at corner junctions. Panels are temporarily braced to maintain stability. Wall panels are generally assembled horizontally, using a cassette joint which is also sealed using expanding urethane. Joints of the panel are tightened. Timber lintels, where required, are fixed into position over openings. A continuous timber head plate is fitted into the rout at the top of panels. Generally, all timber to rigid urethane core connections to timber are sealed using expanding urethane. All timber-to-timber connections are sealed using two beads of silicone sealant.

Internal floor construction

16.4 Engineered floor joists can be supported on the panel by either adopting a rim board detail or secured using joist hangers (see Figure 6). OSB/3, 22 mm thick or P5 particle board floor decking is fixed over the I-joist and head plate/rim board as appropriate. The panel system is protected externally using a vapour permeable membrane (see section 8.3). A sole plate or bottom plate (as design requirements) is seated on silicone sealant and attached through the floor decking into the head plate/rim board. The process continues in the same manner as for the ground-floor construction.

Figure 6 Internal floor detail



Roof construction

16.5 The supporting walls are made fully rigid by application of nail/screw fixings as approved by the Certificate holder and use of intermediate/ridgebeams/purlins in accordance with the design requirements, which are incorporated within preformed pockets in the wall panel. A wall plate is fixed onto the top of the head plate, the top of which is angled to suit the pitch of the roof. Roof panels are mechanically handled into position, working from one gable wall to the other. Panels are joined by the same method used in the wall construction and fixed through to the structural supporting timber members using Sparrennagels or FastenMaster Headlok fasteners and to the Chartered Engineer's design requirements. The roof panel is overlaid with a vapour permeable membrane (see section 8.3). Treated softwood counter battens (minimum 25 mm deep by 50 mm wide) are fixed through to the roof panel using stainless steel screws as approved by the Certificate holder and at centres to the Chartered Engineer's design requirements. A variety of roof finishes (see section 1.5) can be adopted, subject to Certificate holder's approval (see Figure 7).

Figure 7 Typical roof detail

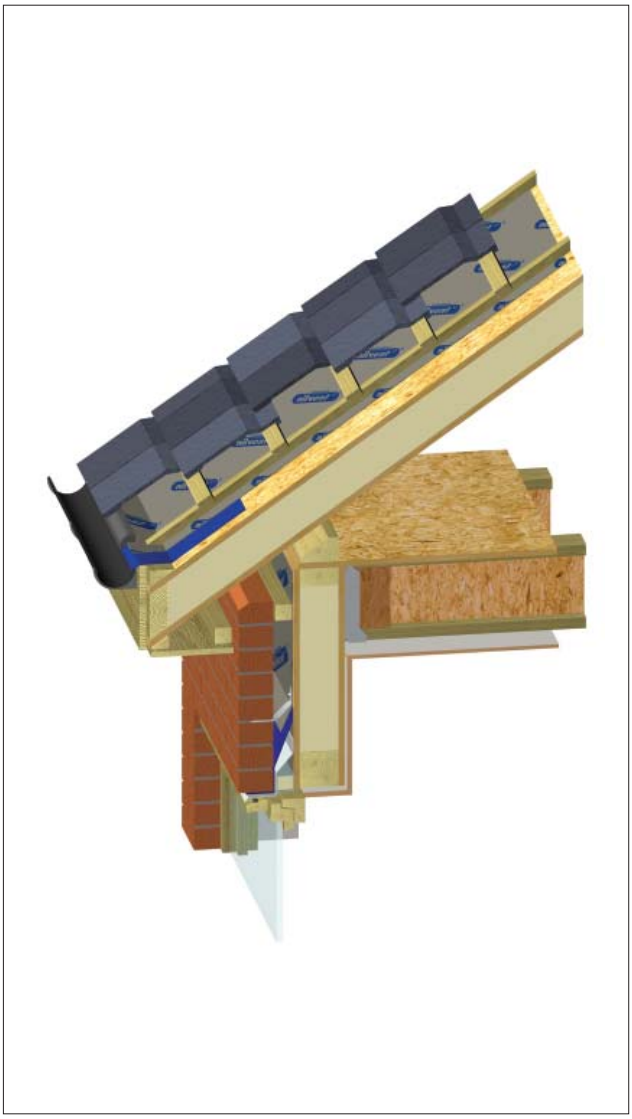
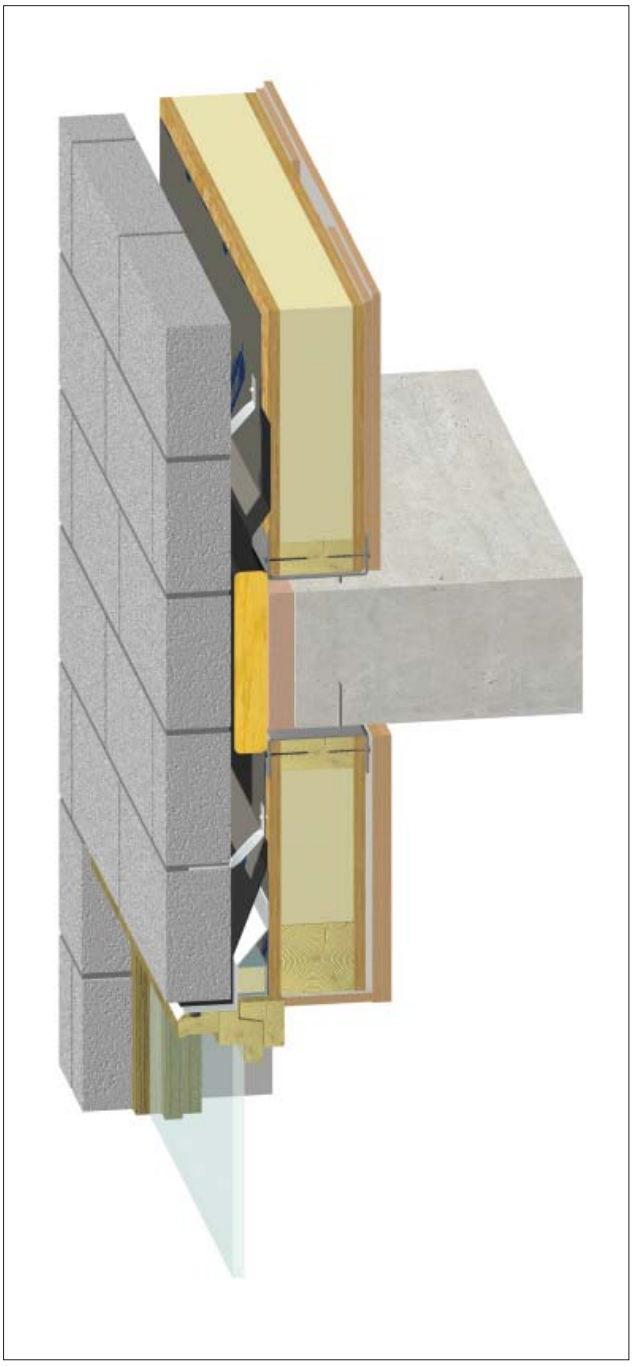


Figure 8 Infill panel



17 Tests

Tests were carried out to determine:

- racking resistance to BS 5268-6.1 : 1996
- vertical loading
- pull-out strength of wall ties based on BS DD 140-1 : 1986 and BS EN 846-6 : 2000
- fire-resistance to BS 476-21 : 1987.

18 Investigations

18.1 An examination was made of technical data relating to:

- structural properties and design calculations
- airborne sound insulation tests
- air leakage tests.

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

18.3 Visits were made to a number of sites in the UK to assess the installation processes.

18.4 A condensation risk assessment to BS 5250 : 2002 was undertaken for a typical wall and roof construction.

Bibliography

BS 476-21 : 1987 *Fire tests on building materials and structures — Methods for determination of the fire resistance of loadbearing elements of construction*

BS 1282 : 1999 *Wood preservatives — Guidance on choice, use and application*

BS 5250 : 2002 *Code of practice for control of condensation in buildings*

BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*
BS 5268-6.1 : 1996 *Structural use of timber — Code of practice for timber frame walls — Dwellings not exceeding four storeys*

BS 5534 : 2003 *Code of practice for slating and tiling (including shingles)*

BS 5628-3 : 2001 *Code of practice for use of masonry — Materials and components, design and workmanship*

BS 8000-3 : 2001 *Workmanship on building sites — Code of practice for masonry*

BS 8215 : 1991 *Code of practice for design and installation of damp-proof courses in masonry construction*

BS DD 140-1 : 1986 *Wall ties — Methods of test for mortar joint and timber frame connections*

BS EN 300 : 1997 *Oriented Strand Boards (OSB) — Definitions, classification and specifications*

BS EN 846-6 : 2000 *Methods of test for ancillary components for masonry — Determination of tensile and compressive load capacity and load displacement characteristics of wall ties (single end test)*

BS EN 1995-1-1 : 2004 *Eurocode 5 : Design of timber structures — General — Common rules and rules for buildings*

BS EN 1996-2 : 2006 *Eurocode 6 : Design of masonry structures — Design considerations, selection of materials and execution of masonry*
BS EN 1996-3 : 2006 *Eurocode 6 : Design of masonry structures : Simplified calculation methods for unreinforced masonry structures*

BS EN ISO 140-4 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of airborne sound insulation between rooms*
BS EN ISO 140-7 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of impact sound insulation of floors*

BS EN ISO 6946 : 1997 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

DIN 1052-2 : 1988 *Structural use of timber; mechanically fastened joints*

19 Conditions

19.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- 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.

19.2 Publications and documents referred to in this Certificate are those that the BBA deems to be relevant at the date of issue or re-issue of this Certificate and include any: Act of Parliament; Statutory Instrument; Directive; Regulation; British, European or International Standard; Code of Practice; manufacturers' instructions; or any other publication or document similar or related to the aforementioned.

19.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant 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.

19.4 In granting this Certificate, the BBA is not responsible for:

- 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
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

19.5 Any information relating to the manufacture, supply, installation, use and maintenance 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 and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date 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. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.

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