British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA
Tel: +44 (0) 1923 665300
e-mail: clientservices@bbacerts.co.uk
website: www.bbacerts.co.uk

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European Technical Assessment

ETA-11/0466 of 21/02/2018

Technical Assessment Body issuing the European Technical Assessment:	British Board of Agrément
Trade name of the construction product:	Kingspan TEK – Prefabricated Wood-based Loadbearing Stressed Skin Panels
Product family to which the construction product belongs:	Product area 14 – Wood-based panels and elements
Manufacturer:	Kingspan Insulation Ltd Pembridge Leominster Herefordshire HR6 9LA United Kingdom Tel: + 44 (0)1544 387 382 Fax: + 44 (0)1544 387 482 e-mail: technical@kingspantek.co.uk website: www.kingspantek.co.uk
Manufacturing plant(s):	Kingspan Insulation Ltd (Selby Plant) Sherburn Enterprise Park Enterprise Way Sherburn-in-Elmet Leeds North Yorkshire LS25 6NA United Kingdom
This European Technical Assessment contains:	19 pages including 3 Annexes, which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No. 305/2011 on the basis of:	The Guidelines for *European Technical Approval (ETAG) 019 — Edition Nov 2004, Prefabricated Wood-Based Loadbearing Stressed Skin Panels* used as the European Assessment Document (EAD)
This European Technical Assessment amends the	European Technical Approval 11/0466, valid from 04 January 2012 to 04 January 2017

1 Technical description of the product

Prefabricated Wood-based Loadbearing Stressed Skin Panels form a panelised method of construction. Panels are available with a nominal thickness of either 142 mm or 172 mm. Each panel has two outer skins of 15 mm thick OSB/3 (oriented strand board, type 3), separated by a core of 112 mm or 142 mm thick zero-rated Ozone-Depleting Potential, rigid polyurethane (PUR).

The panels are available in widths ranging from 200 mm to a maximum of 1220 mm, and lengths up to 7500 mm, and are supplied in the appropriate shapes and sizes for each project. Other components, such as sealant, fixings and jointing pieces, will be required to enable installation to be made in accordance with the ETA holder's recommendations.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

Kingspan TEK panels are 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; a single or double leaf of a separating wall; or pitched roofing panels, where Essential Requirements 1, 2, 3 and 6 *Mechanical resistance and stability, Safety in case of fire, Hygiene, health and environment* and *Energy economy and heat retention* respectively (CPR, Annex 1), apply.

The panels are for use in timber structures subject to the dry, internal conditions defined by service classes 1 and 2 of EN 1995-1-1 : 2004 and for members subject to static or quasi-static loading.

The panels may also be used in non-load bearing applications.

2.2 Assumed working life of the construction product

The provisions made in this ETA are based on an assumed intended working life for the panels of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2.3 Manufacturing of the panels

Detailed workshop drawings and assembly drawings are part of panel production. The process of production includes the control monitoring of the final dimensions of components and structural wood moisture. After the completion of the production of individual parts, a check is performed, during which the functionality of individual components needed for the manufacturing of the product is confirmed as acceptable.

2.4 Design

Production of panels is performed on the basis of the developed project and detailed workshop drawings.
The panels' design is a cassette joint system, which is also sealed using expanding urethane foam.
Construction work must be based on the applicable local building regulations for the anticipated construction in which the installation will be carried out.

2.5 **Packaging, transport and storage**

Loading at the manufacturer is performed by trained workers using mechanical means. The panels are delivered in shrink-wrap, with edge protectors, with banded packaging used for initial transit and temporary protection. Unloading at the construction site is performed with the use of machinery.

Panels must be protected from weather, mechanical damage during transport and possible damage during removal onto the prepared site. The panels and their 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. Panels must be stored and transported horizontally.

The manufacturer's instructions for packaging, transport and storage must always be observed and obeyed.

2.6 **Use, maintenance and repairs**

Before use, the panels are inspected visually for completeness and any signs of damage that might have occurred during transport or storage. For each delivery, the manufacturer ensures relevant information and instructions for use are present.

The assessment of the product is based on the assumption that during the estimated life expectancy no maintenance is required, though regular checks should be carried out on the finishes to ensure that any damage is detected and repaired as soon as possible.

In case of a repair, it is necessary to perform an assessment for mechanical resistance and stability. Minor repairs to the system can be carried out prior to erection in accordance with the construction manual for Kingspan TEK.

3 Performance of the product and references to the methods used for its assessment

3.1 **Mechanical resistance and stability (BWR 1)**

3.1.1 **Verification of structural capacity in general**

The mechanical properties, and design-load-carrying capacities for the wall and roof panels, are given in Annex 2, and have been derived in accordance with ETAG 019. They should be used for designs in accordance with EN 1995-1-1, EN 1991-1-1, EN 1991-1-2 and EN 1991-1-3 or the appropriate national regulation.

The load-carrying capacities have been derived by calculation, and calculation assisted by test. Additional strength of the panels can be achieved using structural engineering principles and via the introduction of structural members, such as ribs or posts within the panels.

In the calculations, the maximum vertical design loads for each roof span and pitch of panels for each load duration at Ultimate Limit State (ULS) are shown in Table 4.1 and 4.2, Annex B. However, the values do not include Serviceability Limit State (SLS) checks, such as deflection. It should be emphasized that deflection limits in Serviceability Limit State (SLS) must be checked for roof panels as per ETAG 019 and EN 1995-1-1, and considering the shear deformations.

The BBA has assessed a method of design analysis developed by the ETA holder. The method is based on TR019 in respect of the roof panels and sandwich theory in respect of the wall panels. The BBA holds the data on file.

As regards the resistance to earthquakes, no indication was assessed. Assessment for seismic load is considered in regions with high seismic activity. The assessment is carried out in accordance with standard and national regulations.

Any national provisions must be taken into consideration.

Calculation of stability of the building is performed for each concrete design of the building individually.

3.1.2 **Dimensional stability**

When considering the moisture of panels, the extension of moisture change leading to undesirable damage of product must not occur.

At installation, the panels must have a moisture content which will approximate the moisture content in the final application.

3.2 **Safety in case of fire (BWR 2)**

3.2.1 **Reaction to fire of components**

In relation to reaction to fire, the panel skins are classified as D-s2, d0, in accordance with EN 13501-1: 2007 by reference to EC Decision 2003/43/EC.

3.2.2 **Resistance to fire**

Performance of the panels in relation to fire resistance was determined after the panels were tested as a 'load-bearing wall construction', in accordance with EN 1365-1: 1999 test method. The test results were classified in accordance with EN 13501-2: 2007 as REI 60 based on the test, which consisted of a 142 mm Kingspan TEK panel, softwood timber battens (25 mm thick by 50 mm wide) vertically fixed and then over clad with a single layer of 15 mm thick gypsum plasterboard referenced "Firecheck board".

3.3 **Hygiene, health and environment (BWR 3)**

Content and / or release of dangerous substances

According to the manufacturer's declaration, the product specification has been assessed for dangerous substances, taking account of Directive 67/548/EEC, Regulation (EC) No 1272/2008 *Indicative list of dangerous substances*, Council Directive 76/769/EEC and the list on the database established on the EC construction website to verify that it does not contain such substances above the acceptable limits. The formaldehyde potential of the OSB skins is designated Class E1 in accordance with EN 13986: 2004. According to the manufacturer's declaration, the rigid urethane insulation core, when enclosed between the OSB skins, is suitable for use in interior spaces.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (eg transposed European legislation and national laws, regulations and administrative provisions). To meet the provisions of the EU Regulations, these requirements also need to be complied with, when and where they apply.

3.4 **Safety and accessibility in use (BWR4)**

Impact / shock resistance

The product is not assessed for impact / shock resistance. When used to construct walls and roofs, the panels will normally be protected by internal and external finishes. Therefore, *No Performance Determined* is stated.

3.5 **Protection against noise (BWR 5)**

3.5.1 **Airborne sound insulation**

Laboratory testing to BS EN ISO 140-3: 1995 (airborne) and field tests to BS EN ISO 140-4: 1998 indicate that the panels will contribute to reducing sound transmission in an internal/external wall and in a separating wall including flanking sound (see Annex A, Figure 3). The weighted sound reduction is calculated in accordance with the method given in BS EN ISO 717-1: 1997, namely the Weighted Standardised Level Difference ($D_{nT,w}$). (Annex A, Table 1.1)

3.5.2 **Impact sound insulation**

No performance assessed. The product does not contain interior or exterior finishings. Any impact sound insulation measurements are according to EN ISO 10140-3 : 2010.

3.5.3 Sound absorption

No performance is assessed.

3.6 **Energy economy and heat retention (BWR 6)**

3.6.1 **Thermal resistance**

Thermal resistance R [m^2.K/W] is also expressed by means of thermal transmittance U [W/m^2.K], which is calculated for particular constructions in accordance with BS EN ISO 6946, including consideration of EN ISO 10211. Details of thermal conductivities are given in Annex A, Table 1.1 and Annex C, Table 1.

3.6.2 **Air permeability**

No performance assessed.

3.6.3 **Thermal inertia**

Details are given in Annex A, Table 1.1.

3.7 **Sustainable use of natural resources (BWR 7)**

The panels can be used in service classes 1 and 2 as defined in EN 1995-1-1: 2004 and in Use Classes 1 and 2 as specified in EN 335: 2013. The products may be exposed directly to the weather for a short time during installation, depending on the weather conditions. However, they should be covered by a suitable breather membrane, as soon as possible, after they are erected.

3.8 **Aspects of serviceability**

The ability of the panels to resist loads without undue deflection (serviceability) is dealt with in section 3.1 [*Mechanical resistance and stability* (BWR1)].

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 2000/447/EC1 of the European Commission, the system of assessment and verification of constancy of performance [see Annex V to Regulation (EU) No 305/2011 and Commission delegated Regulation (EU) No 568/2014] given in the following.

System 1:

a) The manufacturer will carry out:
   1) Factory production control
   2) Further testing of samples taken at the manufacturing plant by the manufacturer, in accordance with the prescribed test plan

b) The notified product certification body will decide on the issuing, restriction, suspension or withdrawal of the certificate on constancy of performance of the construction product on the basis of the outcome of the following assessment and verifications carried about by that body:
   1) An assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation tabulated values or descriptive documentation of the product
   2) Initial inspection of the manufacturing plant and of factory production control
   3) Continuing surveillance, assessment and evaluation of factory production control.

5 Technical details necessary for the implementation of the AVCP system, as outlined in the applicable EAD

5.1 Tasks of the manufacturer

5.1.1 Factory production control

The manufacturer continues to operate a factory production control system. All elements, requirements and provisions adopted by the manufacturer are documented to ensure that product conforms to this ETA. The manufacturer will only use raw materials supplied with the relevant inspection documents, as laid down in the prescribed test plan(1).

(1) The prescribed test plan is deposited with the British Board of Agrément and is made available to the notified bodies involved in the conformity attestation process.

The raw materials will be subject to controls and tests by the manufacturer before acceptance. Checks on incoming materials will include control of the certificates of conformity presented by suppliers (comparison with nominal values) by verifying dimensions and determining material properties.

The manufactured panels are checked for:

- thermal conductivity (initial and aged)
- shear strength
- tensile strength
- compressive strength
- nominal density
- dimensional accuracy
- visual quality.

The frequency of controls and tests conducted during production and on the assembled panel is laid down in the prescribed test plan, taking account of the manufacturing process of the panel.

The results of factory production control are recorded and evaluated. The records include at least:

- designation of the product, basic material and components
- type of control or testing
- date of manufacture of the product and date of testing of the product or basic material and components
- result of control and testing and, if appropriate, comparison with requirements
- signature of person responsible for factory production control.

Records of inspections and tests must be stored, and submitted on request to the Notified Body. The records must also be presented to the inspection body involved in the continuous surveillance. Details of the extent, nature and frequency of testing and controls to be performed within the factory production control must correspond to the prescribed test plan included in the manufacturer's technical documentation relating to this European Technical Assessment.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. If all criteria are met for the assessment, validation and certification of constancy of performance, the manufacturer must issue a declaration of performance.

5.2 **Tasks of the notified body**

5.2.1 **Initial type-testing of the product**

The results of the initial type tests performed as part of the assessment for the European Technical Assessment must be used unless there are changes in the production line or plant. In such cases, the necessary initial type-testing must be agreed between the British Board of Agrément and the approved body involved.

5.2.2 **Initial inspection of factory and of factory production control**

The initial inspection consists of checking by the Notified Body whether all the prerequisites for the management of the manufacturer are fulfilled so that the product complies with the technical requirements of the ETA.

The Notified Body checks, and ascertains the fulfilment of, the prescribed test plans, including the inspection of personnel, equipment and the factory production control management system as specified in the ETA to ensure smooth and orderly manufacturing of the panels.

5.2.3 **Continuous surveillance**

The Notified Body will visit the factory at least twice per year for routine inspections. It must be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the prescribed test plan.

The results of product certification and continuous surveillance must be made available on demand by the certification body to the British Board of Agrément. Where the provisions of the European Technical Assessment and the prescribed test plan are no longer fulfilled, the certificate of constancy of performance will be withdrawn by the certification body.

5.3 **CE marking**

CE marking for prefabricated wood-based loadbearing stressed skin panels must contain the following information:

- Identification number of the Notified Body
- Name/address of the manufacturer of the bearing sandwich wood-based panel
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance
- ETA number.

On behalf of the British Board of Agrément

Paul Valentine
Technical Excellence Director

Claire Curtis-Thomas
Chief Executive

Date of Second issue: 21 February 2018

ANNEX A PRODUCT DETAILS

This annex applies to the Kingspan TEK panels / Prefabricated Wood-based Loadbearing Stressed Skin Panels described in the main body of the European Technical Assessment.

BASIC REQUIREMENTS

Table 1.1 – Description of the basic requirements

Basic works requirements BWR / Essential characteristics	Verification Procedure	Class / Use category / Numerical value
Basic Works Requirement 1 (BRW 1): Mechanical resistance and stability		
Mechanical resistance and stability		
Wall design load of 142 mm and 172 mm thickness	EN 1995-1-1	See Annex B
Roof design load of 142 mm and 172 mm	EN 1995-1-1	See Annex B
Connecting means	EN 1995-1-1	
Dimensional stability		
During operation, change in the moisture content must not occur in order to avoid undesirable deformations		
Basic Works Requirement 2 (BRW 2): Safety in case of fire		
Reaction to fire		
OSB board Grade 3	2003/43/EC (1)	D-s2, d0
Rigid urethane insulation core	EN ISO 11925-2 and classified to EN 13501-1	E
Wooden structural element	2003/43/EC (1)	D-s2, d0
Explanation: (1) As amended by Commission decision 2003/593/EC,2006/673/EC and 2007/348/EC		
Fire resistance		
142 mm	Tested to EN 1365-1 and classified to EN 13501-2	REI 60
Fire resistance test construction: - 15 mm fire check plasterboard - 25 x 25 mm timber batten - Kingspan TEK panel		
Basic Works Requirement 3 (BWR 3): Hygiene, health and environment		
Vapour permeability and moisture resistance		
OSB board (ρ = 650 kg/m^3)	EN ISO 10456	μ = 30-50 (-)
Thermal insulation, PU (ρ = 32-35 kg/m^3)	EN ISO 12572	μ = 70-100 (-)
Wooden structural element (ρ = 500 kg/m^3)	EN ISO 10456	μ = 20-50 (-)
Watertightness – external envelope	No performance assessed Product does not comprise exterior cladding	
Watertightness – internal surface	No performance assessed Product does not comprise interior cladding	
Content and/or release of dangerous substances	No performance assessed	
Formaldehyde from OSB boards	EN 13986+A1	Class E1
Pentachlorophenol PCP from OSB boards	EN 13986+A1	PCP≤ 5ppm or PCP≥ 5ppm
Basic Works Requirement 4 (BRW 4): Safety and accessibility in use		
Slipperiness of floor finishes	No performance assessed Product does not comprise floor finishing	
Impact resistance	No performance assessed Product does not comprise floor finishing	

Table 1.1 – Description of the basic requirements cont.

Basic works requirements BWR / Essential characteristics	**Verification Procedure**	**Class / Use category / Numerical value**
Basic Works Requirement 5 (BRW 5): Protection against noise		
Airborne sound insulation		
OSB Board (15 mm thickness)	EN ISO 717-1 Measurement Procedure in accordance with EN ISO 140-3	Weighted sound reduction: $R_w(C;C_{tr})$=31 (-2;-5)dB
Insulation core PU (112 mm thickness)		
OSB Board (15 mm thickness)		
Basic Works Requirement 5 (BRW 5): Protection against noise		
Impact sound insulation	No performance assessed Product does not include interior and exterior surface finishing	
Sound absorption	No performance assessed	
Basic Works Requirement 6 (BRW 6): Energy economy and heat retention		
Thermal resistance		
Input parameters for calculating thermal resistance according to BS EN ISO 6946 and EN ISO 10211		
Thermal conductivity		
OSB boards	EN 13986	λ = 0.13 W/(m.K)
Thermal insulation rigid urethane core	EN 13165	λ_D = 0.024 W/(m.K)
Wooden structural element	EN ISO 10456	λ = 0.13 W/(m.K)
Air permeability	No performance assessed	
Thermal inertia		
Characteristic density		
OSB board	EN 13986	ρ > 650 kg/m^3
Thermal insulation, PU core	EN 13165	ρ = 32-35 kg/m^3
Spruce, fir wood (C24 and C16)	EN 338	ρ = 350-420 kg/m^3
Specific thermal capacity		
OSB boards (ρ = 650 kg/m^3)	EN ISO 10456	C_p = 1700 J/(kg.K)
Thermal insulation, PU core (ρ = 10-50 kg/m^3)	EN ISO 10456	C_p = 1400 J/(kg.K)
Wooden structural element (ρ = 500 kg/m^3)	EN ISO 10456	C_p = 1600 J/(kg.K)
Basic Works Requirement 7 (BRW 7): Sustainable use of natural resources		
No performance assessed		

Table 1.2 — Connection of panels

	Kingspan TEK 142 mm	**Kingspan TEK 172 mm**
Panel to spline	2.8 x 63 mm galvanized ring shank nails	2.8 x 63 mm galvanized ring shank nails
Panel to timber post/end timbers	Expanding urethane foam, when connecting panel to panel 2 beads of silicone sealant	Expanding urethane foam, when connecting panel to panel 2 beads of silicone sealant
	2.8 x 63 mm galvanized ring shank nails	2.8 x 63 mm galvanized ring shank nails
For further information please see Kingspan TEK construction manual		

Figure 1 Cassette joint system

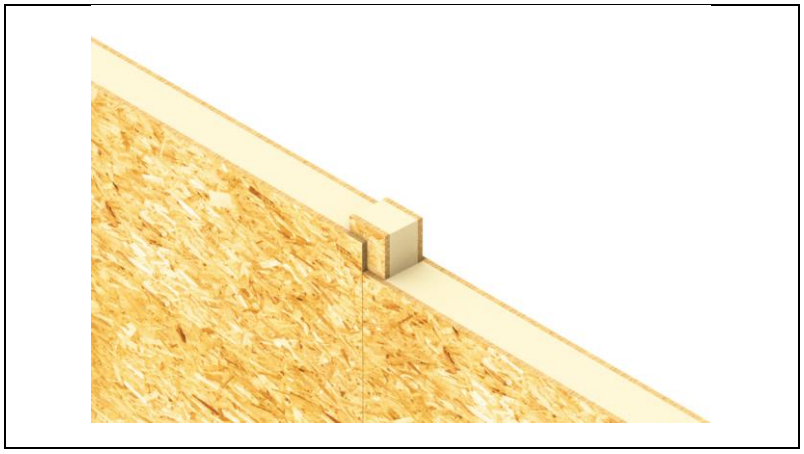


Figure 2 Connection through timber spline

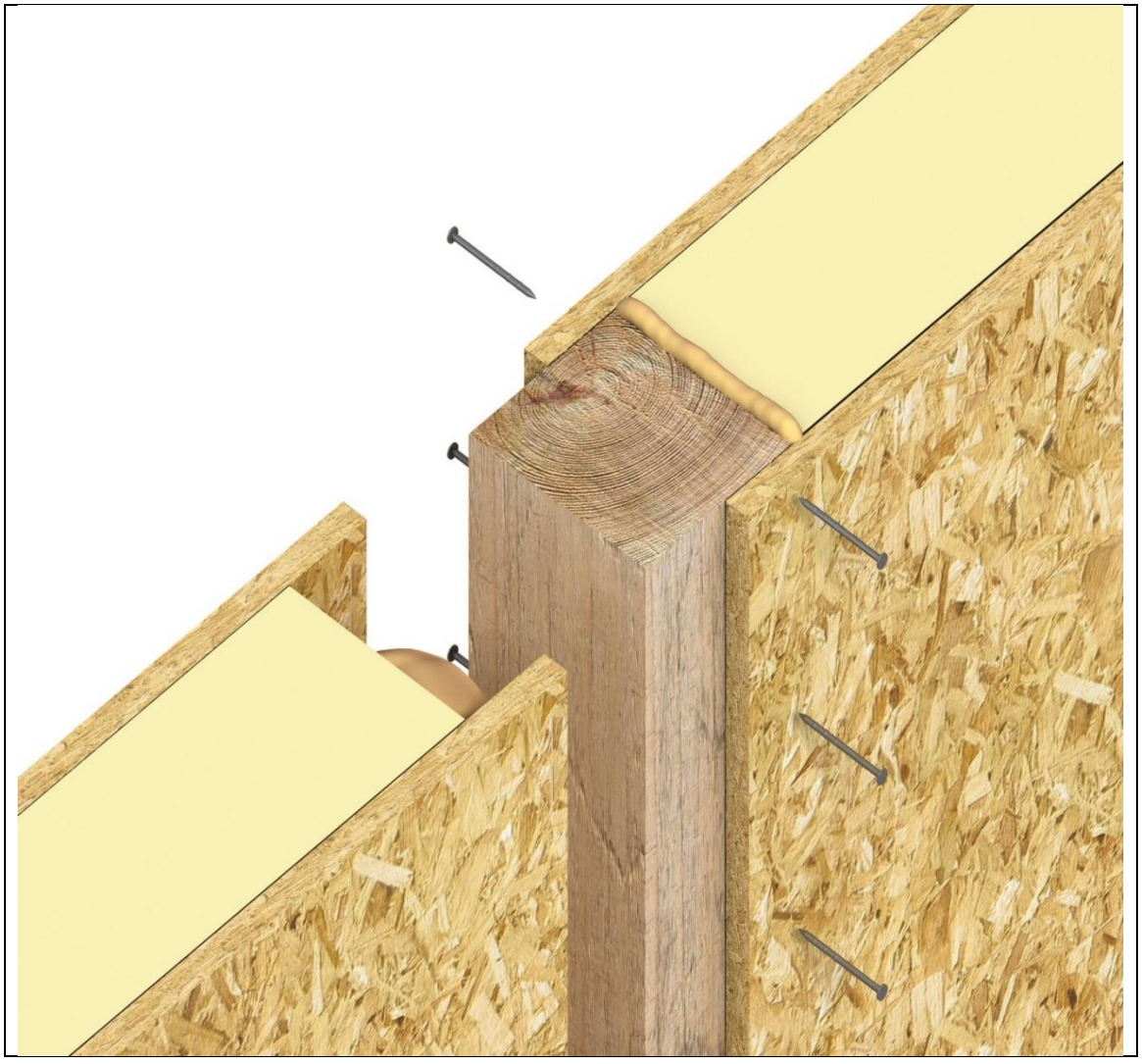
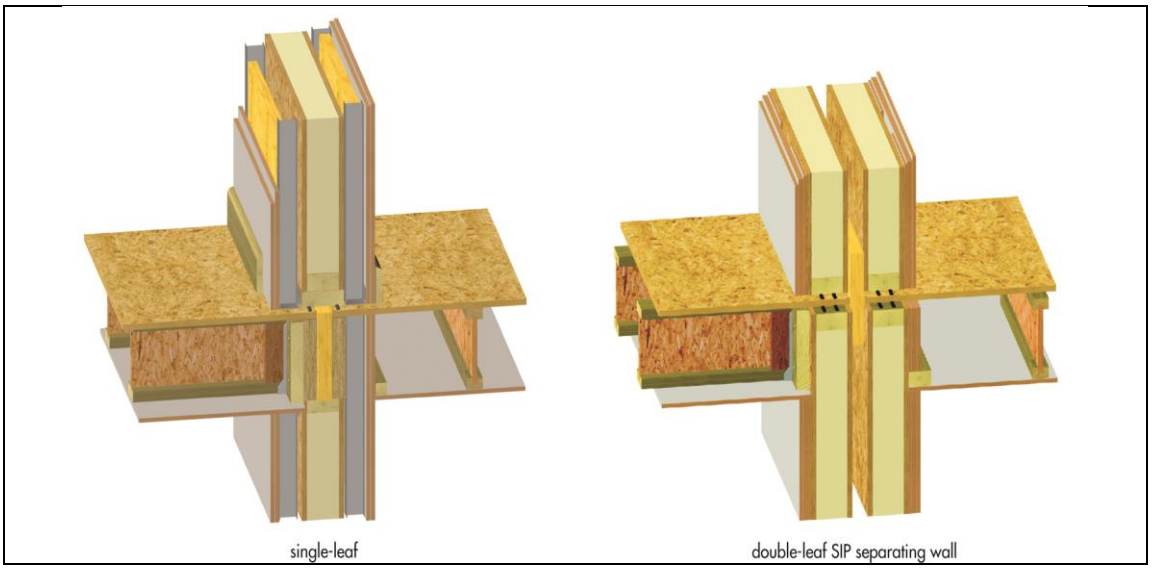


Figure 3 Separating wall details



ANNEX B DESIGN LOAD TABLES FOR KINGSPAN TEK 142 AND TEK 172 WALL AND ROOF PANELS

Table 1.1 Wall — design vertical load(1) – Kingspan TEK 142 mm

Wall Height *H*		**Vertical load(2)(3)(4) (kN·m^{-1})**				
		Load duration				
(m)		Permanent	Long-term	Medium-term	Short-term	Instantaneous
< 2.4		38.5	50.8	57.9	64.7	78.1
< 2.7		33.4	44.4	57.9	64.7	78.1
< 3.0		29.0	38.8	57.9	64.7	78.1
< 3.5		23.3	31.4	47.6	64.7	78.1
< 4.0		18.9	25.7	39.3	64.7	78.1
< 4.8		14.0	19.2	29.6	50.4	62.6

(1) Vertical load without any horizontal load
(2) Maximum design vertical load for the heights of the wall for each load duration per metre run
(3) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS)
(4) The eccentricity of vertical load on the panel should be no more than the panel thickness divided by 6.

Table 1.2 Wall — Design vertical load(1) – Kingspan TEK 172 mm

Wall Height *H*		**Vertical load(2)(3)(4) (kN·m^{-1})**				
		Load duration				
(m)		Permanent	Long-term	Medium-term	Short-term	Instantaneous
< 2.4		43.4	51.2	57.9	64.7	78.1
< 2.7		43.4	51.2	57.9	64.7	78.1
< 3.0		40.0	51.2	57.9	64.7	78.1
< 3.5		32.7	43.8	57.9	64.7	78.1
< 4.0		27.0	36.4	55.2	64.7	78.1
< 4.8		20.4	27.7	42.4	64.7	78.1

(1) Vertical load without any horizontal load
(2) Maximum design vertical load for the heights of the wall for each load duration per meter run
(3) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS)
(4) The eccentricity of vertical load on the panel should be no more than the panel thickness divided by 6.

Table 2.1 Wall — design horizontal load(1) – Kingspan TEK 142 mm

Wall Height *H*		**Horizontal load(2)(3) (kN·m^{-2})**	
		Load duration	
(m)		Short-term	Instantaneous
< 2.4		4.66	4.66
< 2.7		3.72	3.72
< 3.0		3.01	3.01
< 3.5		2.16	2.16
< 4.0		1.59	1.59
< 4.8		1.02	1.02

(1) Horizontal load only without vertical load, ie as an infill wall
(2) Maximum design wind load resistance for each wall height
(3) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS).

Table 2.2 Wall — design horizontal load(1) – Kingspan TEK 172 mm

Wall Height *H*		**Horizontal load(2)(3) (kN·m^{-2})**	
		Load duration	
(m)		Short-term	Instantaneous
< 2.4		6.19	6.19
< 2.7		5.01	5.01
< 3.0		4.10	4.10
< 3.5		2.99	2.99
< 4.0		2.24	2.24
< 4.8		1.47	1.47

(1) Horizontal load only without vertical load, ie as an infill wall
(2) Maximum design wind load resistance for each wall height
(3) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS).

Table 3.1 Wall — combined design horizontal and vertical load – Kingspan TEK 142 mm

Wall Height *H*		**Horizontal load[(1)] (kN·m^{-2})**	**Vertical load[(2)(3)(4)] (kN·m^{-1})**	
			Duration of horizontal load	
(m)		**Instantaneous**	**Short-term**	**Instantaneous**
< 2.4		1.125	64.7	78.1
< 2.4		1.500	64.7	78.1
< 2.4		2.250	64.7	78.1
< 2.7		1.125	64.7	78.1
< 2.7		1.500	64.7	78.1
< 2.7		2.250	64.7	78.1
< 3.0		1.125	64.7	78.1
< 3.0		1.500	64.7	78.1
< 3.0		2.250	64.7	78.1
< 3.5		1.125	64.7	78.1
< 3.5		1.500	64.7	78.1
< 3.5		2.250	64.7	78.1
< 4.0		1.125	64.7	78.1
< 4.0		1.500	33.7	33.7
< 4.0		2.250	N/A	N/A
< 4.8		1.125	N/A	N/A
< 4.8		1.500	N/A	N/A
< 4.8		2.250	N/A	N/A

(1) The applied horizontal load is the design wind load
(2) Maximum design vertical load for each height of the wall panel and wind load of given magnitude for each load duration
(3) The eccentricity of vertical load on the panel should be no more than the panel thickness divided by 6
(4) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS).

Table 3.2 Wall — combined design horizontal and vertical load – Kingspan TEK 172 mm

Wall Height *H*		**Horizontal load(1) (kN·m^{-2})**	**Vertical load(2)(3)(4) (kN·m^{-1})**	
			Duration of horizontal load	
(m)		**Instantaneous**	**Short-term**	**Instantaneous**
< 2.4		1.125	64.7	78.1
< 2.4		1.500	64.7	78.1
< 2.4		2.250	64.7	78.1
< 2.7		1.125	64.7	78.1
< 2.7		1.500	64.7	78.1
< 2.7		2.250	64.7	78.1
< 3.0		1.125	64.7	78.1
< 3.0		1.500	64.7	78.1
< 3.0		2.250	64.7	78.1
< 3.5		1.125	64.7	78.1
< 3.5		1.500	64.7	78.1
< 3.5		2.250	64.7	78.1
< 4.0		1.125	64.7	78.1
< 4.0		1.500	64.7	78.1
< 4.0		2.250	N/A	N/A
< 4.8		1.125	64.7	78.1
< 4.8		1.500	N/A	N/A
< 4.8		2.250	N/A	N/A

(1) The applied horizontal load is the design wind load

(2) Maximum design vertical load for each height of the wall panel and wind load of given magnitude for each load duration

(3) The eccentricity of vertical load on the panel should be no more than the panel thickness divided by 6

(4) These values should be compared to the most severe combination of actions at Ultimate Limit State (ULS).

Table 4.1 Roof — design vertical load capacity (single span) – Kingspan TEK 142 mm

Span on slope	Horizontal span	Pitch		Vertical load[1][2] (kN·m^{-1})			
				Duration			
(m)	(m)	(º)		Permanent[3]	Long-term[3]	Medium-term[3]	Short-term[4]/ instantaneous
1.50	1.50	2		4.06	8.12	12.18	16.24
1.50	1.48	10		4.12	8.24	12.37	16.24
1.50	1.30	30		4.69	9.37	14.06	16.24
1.50	1.06	45		5.74	11.48	17.22	16.24
2.00	2.00	2		3.05	6.09	9.14	12.18
2.00	1.97	10		3.09	6.18	9.27	12.18
2.00	1.73	30		3.52	7.03	10.55	12.18
2.00	1.41	45		4.31	8.61	12.92	12.18
2.50	2.50	2		2.44	4.87	7.31	9.74
2.50	2.46	10		2.47	4.95	7.42	9.74
2.50	2.17	30		2.81	5.62	8.44	9.74
2.50	1.77	45		3.44	6.89	10.33	9.74
3.00	3.00	2		2.03	4.06	6.09	8.12
3.00	2.95	10		2.06	4.12	6.18	8.12
3.00	2.60	30		2.34	4.69	7.03	8.12
3.00	2.12	45		2.87	5.74	8.61	8.12
3.50	3.50	2		1.74	3.48	5.22	6.96
3.50	3.45	10		1.77	3.53	5.30	6.96
3.50	3.03	30		2.01	4.02	6.03	6.96
3.50	2.47	45		2.46	4.92	7.38	6.96
4.00	4.00	2		1.52	3.05	4.57	6.09
4.00	3.94	10		1.55	3.09	4.64	6.09
4.00	3.46	30		1.76	3.52	5.27	6.09
4.00	2.83	45		2.15	4.31	6.46	6.09

(1) Maximum vertical design loads for each roof span and pitch of panels for each load duration at Ultimate Limit State (ULS). The values do not include Serviceability Limit State (SLS) checks such as deflection
(2) Serviceability Limit State (SLS) frequently governs the design of roof panels and should be checked separately, using the stiffness parameters shown in Table 5.1 of this Annex.
(3) Permanent, long-term and medium-term loads are applied vertically along the full slope length
(4) Short-term and Instantaneous loads are applied perpendicular to the panel along the full slope.

Table 4.2 Roof — design vertical load – Kingspan TEK 172 mm

Span on slope	Horizontal span	Pitch		Vertical load[1][2] (kN·m^{-1})			
				Duration			
(m)	(m)	(º)		Permanent[3]	Long-term[3]	Medium-term[3]	Short-term[4]/ instantaneous
1.50	1.50	2		5.02	10.04	15.06	20.07
1.50	1.48	10		5.09	10.19	15.29	20.07
1.50	1.30	30		5.79	11.59	17.38	20.07
1.50	1.06	45		7.10	14.19	21.29	20.07
2.00	2.00	2		3.77	7.53	11.30	15.05
2.00	1.97	10		3.82	7.64	11.46	15.05
2.00	1.73	30		4.35	8.69	13.04	15.05
2.00	1.41	45		5.32	10.64	15.97	15.05
2.50	2.50	2		3.01	6.03	9.04	12.04
2.50	2.46	10		3.06	6.11	9.17	12.04
2.50	2.17	30		3.48	6.95	10.43	12.04
2.50	1.77	45		4.26	8.52	12.77	12.04
3.00	3.00	2		2.51	5.02	7.53	10.03
3.00	2.95	10		2.55	5.10	7.64	10.03
3.00	2.60	30		2.90	5.79	8.69	10.03
3.00	2.12	45		3.55	7.10	10.64	10.03
3.50	3.50	2		2.15	4.30	6.46	8.60
3.50	3.45	10		2.18	4.37	6.55	8.60
3.50	3.003	30		2.48	4.97	7.45	8.60
3.50	2.47	45		3.04	6.08	9.12	8.60
4.00	4.00	2		1.88	3.77	5.65	7.53
4.00	3.94	10		1.91	3.82	5.73	7.53
4.00	3.46	30		2.17	4.34	6.52	7.53
4.00	2.83	45		2.66	5.32	7.98	7.53

(1) Maximum vertical design loads for each roof span and pitch of panels for each load duration at Ultimate Limit State (ULS). The values do not include Serviceability Limit State (SLS) checks such as deflection
(2) Serviceability Limit State (SLS) frequently governs the design of roof panels and should be checked separately, using the stiffness parameters shown in Table 5.2 of this Annex.
(3) Permanent, long-term and medium-term loads are applied vertically along the full slope length
(4) Short-term and Instantaneous loads are applied perpendicular to the panel along the full slope.

Table 5.1 Wall and roof – panel properties — stiffness – Kingspan TEK 142 mm[1]

Flexural deflection			Shear deflection	
Rigidity *EI* (Nmm^2)	Deflection factor $k_{def,(EI)}$		Rigidity *GA* (N)	Deflection factor $k_{def,(GA)}$
4.60E+11	1.87		5.70E+05	6.45

(1) The stiffness values and deflection factors must be used to calculate the instantaneous and final deflection according to EN 1995-1-1:2004 + A2 : 2014 (2.2.3)

Notes:
An appropriate deflection limit should be defined for each project on a case by case basis. For further guidance, see EN 1995-1-1:2004 + A2 : 2014 (7.2). The deflection due to shear must be taken into account.

Table 5.2 Wall and roof – panel characteristics — stiffness – Kingspan TEK 172 mm(1)

Flexural deflection			**Shear deflection**	
Rigidity *EI* (Nmm^2)	**Deflection factor $k_{def,(EI)}$**		**Rigidity *GA* (N)**	**Deflection factor $k_{def,(GA)}$**
7.02E+11	1.87		6.89E+05	6.45

(1) The stiffness values and deflection factors must be used to calculate the instantaneous and final deflection according to section 2.2.3 in EN 1995-1-1 : 2004 + A2 : 2014

Notes:
An appropriate deflection limit should be defined for each project on a case by case basis. For further guidance, refer to section 7.2 of EN 1995-1-1 : 2004 + A2 : 2014. The deflection due to shear must be taken into account.

Table 6.1 Wall – racking resistance(1) *— nail spacing 75 mm and 150 mm – Kingspan TEK 142 mm*

Wall Height *H*	**Fixing nail**(2)(3)		**Racking load**(4) **($kN \cdot m^{-1}$)**		**Stiffness**(5)
			Load duration		
(m)	**Diameter (mm)**	**Spacing (mm)**	**Short-term**	**Instantaneous**	**($kN \cdot m^{-1}$)**
< 2.4	2.8	75	8.89	10.86	1055.40
< 2.7	2.8	75	8.89	10.86	896.67
< 3.0	2.8	75	8.89	10.86	770.67
< 3.5	2.8	75	8.89	10.86	612.03
< 4.0	2.8	75	8.89	10.86	497.32
< 4.8	2.8	75	8.89	10.86	370.62
< 2.4	2.8	150	5.58	6.82	747.83
< 2.7	2.8	150	5.58	6.82	650.52
< 3.0	2.8	150	5.58	6.82	570.82
< 3.5	2.8	150	5.58	6.82	466.85
< 4.0	2.8	150	5.58	6.82	388.69
< 4.8	2.8	150	5.58	6.82	298.84

(1) Racking resistance is influenced by the spacing of fixing nails at the perimeter (minimum 50 mm, maximum 150 mm). The racking resistance for other nail spacing can be calculated — the Certificate holder's advice should be sought.

(2) The fixing spacing factor (k_s) is included, but the wall shape factor (k_d) and the load factor (ki,q) must be applied to the resistance values.

(3) Dimensions given relate to machine-driven nails with tensile strength of 600 $N \cdot mm^{-2}$. The capacity of other fixings can be calculated in accordance with BS EN 1995-1-1: 2004+A2:2014, Method B.

(4) Maximum racking load for the height of the wall — without vertical load.

(5) Values per metre width of the panel and based on a panel 1200 mm wide.

Table 6.2 Wall – racking resistance(1) — nail spacing 75 mm and 150 mm – Kingspan TEK 172 mm

Wall Height *H*	**Fixing nail(2)(3)**		**Racking load(4) (kN·m^{-1})**		**Stiffness(5)**
			Load duration		
(m)	**Diameter (mm)**	**Spacing (mm)**	**Short-term**	**Instantaneous**	**(kN·m^{-1})**
< 2.4	2.8	75	8.89	10.86	1055.40
< 2.7	2.8	75	8.89	10.86	896.67
< 3.0	2.8	75	8.89	10.86	770.67
< 3.5	2.8	75	8.89	10.86	612.03
< 4.0	2.8	75	8.89	10.86	497.32
< 4.8	2.8	75	8.89	10.86	370.62
< 2.4	2.8	150	5.58	6.82	747.83
< 2.7	2.8	150	5.58	6.82	650.52
< 3.0	2.8	150	5.58	6.82	570.82
< 3.5	2.8	150	5.58	6.82	466.85
< 4.0	2.8	150	5.58	6.82	388.69
< 4.8	2.8	150	5.58	6.82	298.84

(1) Racking resistance is influenced by the spacing of fixing nails at the perimeter (minimum 50 mm, maximum 150 mm). The racking resistance for other nail spacing can be calculated — the Certificate holder's advice should be sought.

(2) The fixing spacing factor (k_s) is included, but the wall shape factor (k_d) and the load factor (ki,q) must be applied to the resistance values.

(3) Dimensions given relate to machine-driven nails with tensile strength of 600 N·mm^{-2}. The capacity of other fixings can be calculated in accordance with BS EN 1995-1-1: 2004 + A2 : 2014, Method B.

(4) Maximum racking load for the height of the wall — without vertical load.

(5) Values per metre width of the panel and based on a panel 1200 mm wide.

ANNEX C THERMAL DATA

The thermal conductivities (λ value) given in Table 1 may be used to conduct thermal transmittance (U value) calculations in accordance with EN ISO 6946: 2007.

Table 1 Thermal conductivity of associated materials

Material	**λ value (W·m^{-1}·K^{-1})**
Plasterboard	0.25
Timber	0.13
PUR insulation(1)	0.024(2)
OSB/3	0.13

(1) Rigid urethane insulation.
(2) This value is determined in accordance with EN 12667 : 2001 and declared in accordance with EN 13165 : 2008.