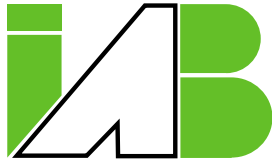


**IRISH
AGRÉMENT
BOARD**



BUILDING PRODUCT CERTIFICATION

CERTIFICATE No. 02/0158

Kingspan Insulation Ltd.,
Bree Industrial Estate, Castleblayney, Co. Monaghan
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KINGSPAN TEK HAUS BUILDING SYSTEM

The Irish Agrément Board is designated by Government to issue European Technical Approvals.

Irish Agrément Board Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2002**.

The Irish Agrément Board operates in association with the **National Standards Authority of Ireland (NSAI)** as the National Member of UEAtc.



Photo courtesy: J. Hill, Architect, Limerick



PRODUCT DESCRIPTION

This certificate relates to the Kingspan TEK Haus Building System for the manufacture and erection of structural insulated panel buildings. The system can be used for domestic housing up to two and a half storeys in height with habitable space within the roof and can accommodate a wide range of custom designs covering detached, semi-detached or terraced house types.

USE

The Kingspan TEK Haus Building System is based on structural insulated panels and is designed for use with a brick, concrete block or other approved external finish. The system can accommodate a wide range of traditional roofing finishes. The Kingspan TEK Haus Building System offers a fast efficient construction solution that is factory manufactured and easily erected on site. The system provides a high level of thermal insulation incorporating a proprietary airtight jointing system, both of which ensures a high level of energy efficiency.

MARKETING

The building system is marketed by :

**Kingspan Insulation Limited,
Bree Industrial Estate,
Castleblayney, Co. Monaghan, Ireland.**

DESIGN AND MANUFACTURE

The design of the building system for each particular building is the responsibility of:

**Kingspan Insulation Limited,
Bree Industrial Estate,
Castleblayney, Co. Monaghan, Ireland,**

and is certified by their chartered structural engineering consultants in accordance with the design constraints and procedures set out in DIBT Certificate Z-9.1-315.

All structural insulated panels are manufactured by Kingspan TEK Haus GmbH, Klosterfelde, Beusterstrasse 1a , D-16348, Germany.

1.1 ASSESSMENT

In the opinion of the Irish Agrément Board (IAB), the Kingspan TEK Haus Building System when used as specified in this Irish Agrément Certificate is satisfactory for the purpose defined above, and meets the requirements of the Building Regulations 1997 - 2002 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2002

REQUIREMENTS

PART D - Materials and Workmanship

D3 - The Kingspan TEK Haus Building System, as certified in this Irish Agrément Board Certificate, is comprised of proper materials fit for their intended use. (See Parts 2, 3, 4 of this Certificate).

D1 - The Kingspan TEK Haus Building System, used in accordance with this Irish Agrément Board Certificate, meets the requirements for workmanship.

PART A – Structure

A1 – Loading

The Kingspan TEK Haus Building System, as certified in this Agrément Board Certificate, has adequate strength and stability. (See Parts 3 and 4 of this Irish Agrément Board Certificate).

A2 – Ground Movement

The ground floor is typically formed with a 150mm thick reinforced concrete slab with a floated finish and meets the requirement.

PART B - Fire Safety

B1 – Means of Escape in Case of Fire

Windows in ground or higher floors may be used as a means of escape in the case of fire.

Where a window is required to provide an alternative means of escape, it must provide an unobstructed opening of not less than 850mm high by 500mm wide. The window should be positioned as required by BS 5588: *Fire precautions in the design, construction and use of buildings*: Part 1: 1990 *Code of practice for Residential Buildings*, Part 2: 1997, *Code of practice for Shops, Offices, Industrial, Storage and other similar Buildings*, and in accordance with Part B1 of the Building Regulations 1997 to 2002.

Any restrictor fitted must be easy to operate.

B2 – Internal Fire Spread (linings)

The plasterboard side of walls and ceilings is designated Class 0. It may therefore be used on the internal surfaces of buildings of every purpose group without restriction.

B3 – Internal Fire Spread (Structure)

(i) For domestic houses up to two storeys in height with habitable space within the roof, the separating wall specification shown in Figs. 5 and 6 will give a minimum of 60 minutes fire resistance and can meet the requirements of B3 for fire resistance. The floor

specification shown in Fig. 6 gives a minimum fire resistance of 30 minutes from both sides with one layer of 15mm plasterboard applied to the joists, or panels where used for ceiling construction, at ceiling level.

(ii) The loadbearing elements specified in Table 2, section 4.1.1 of this Irish Agrément Certificate, provide for 30 and 60 minutes fire resistance from either side for a range of specifications.

(iii) Cavity barriers and fire stops can be provided to meet the requirements of B3 as set out in Sections 3.3 and 3.4 of Technical Guidance Document to Part B of the Building Regulations 1997 to 2002.

B4 – External Fire Spread

The external masonry walls have a Class 0 surface spread of flame rating and when constructed and used in the context of this certificate, can satisfy the relevant requirements of this Regulation as indicated in section 4.1 of this certificate.

Part C – Site Preparation and Resistance to Moisture

C3 – Dangerous Substances

Every ground floor must include a radon sump and be provided with a facility for extracting Radon.

Where it is shown that protection from dangerous substances e.g. Radon, is required, an approved gas resistant membrane and gas handling system must be provided under the ground floor. The Kingspan TEK Haus Building System permits the easy incorporation of the appropriate membrane, sump and gas handling system.

C4 – Resistance to Weather and Ground Moisture

The Kingspan TEK Haus Building System has adequate damp-proof courses and membranes to resist the passage of moisture from the ground, see Figure 2.

Roof and wall coverings will have adequate weather resistance in all exposures as specified in section 4.6 of this certificate.

Part E – Sound

E1 – Airborne Sound (walls)

Compartment walls (i.e. Party walls) are constructed to meet the airborne sound requirements of this Regulation. (See also section 4.4.1 and Figs. 4 and 5 of this Agrément Certificate).

E2 and E3 – Airborne and Impact Sound (floors)

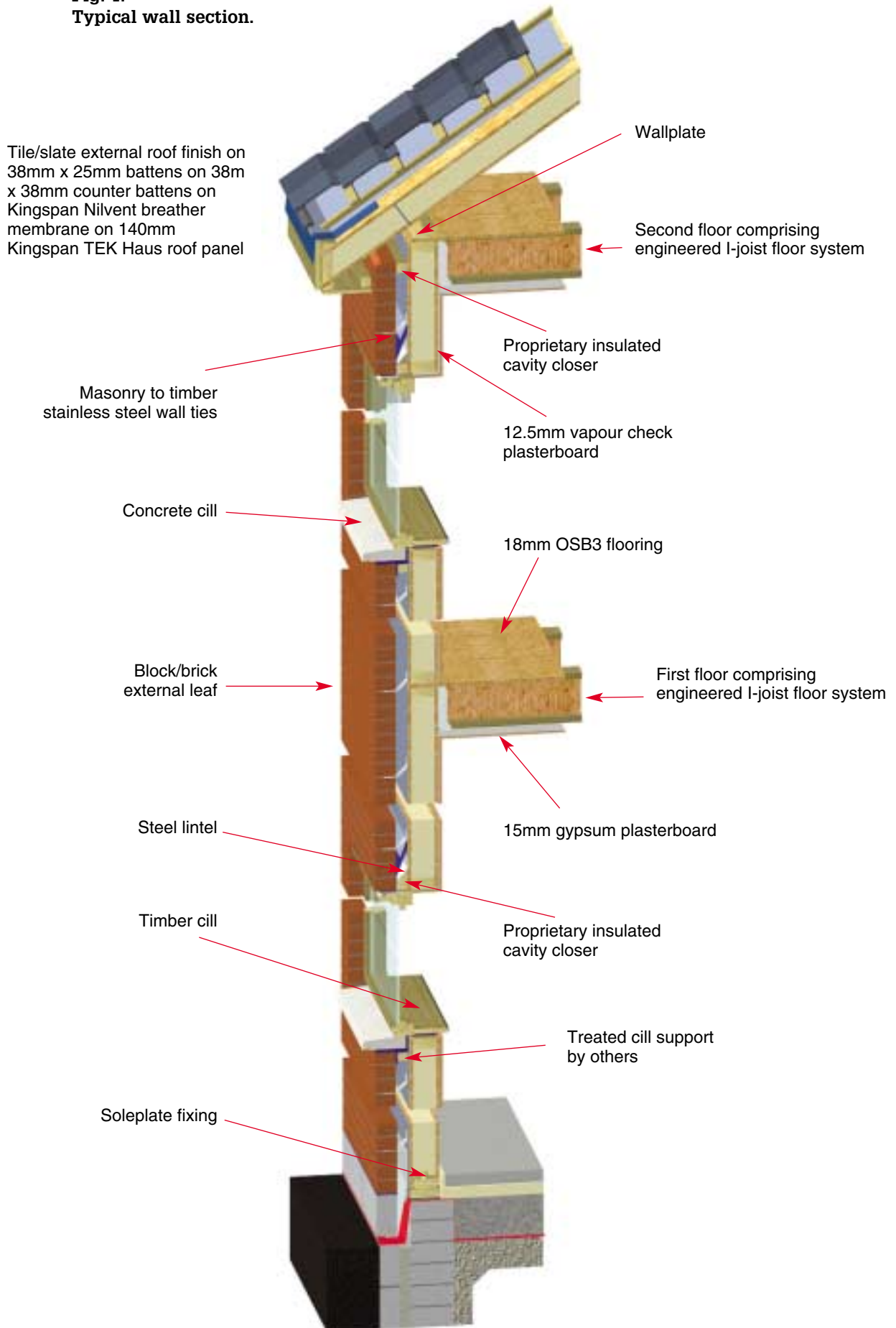
Intermediate and separating floors can be constructed to meet the airborne sound requirements of this regulation.

Part F – Ventilation

F1 – Means of Ventilation

Adequate ventilation openings can be provided in external and internal walls and in roofs to meet this requirement.

Fig. 1.
Typical wall section.



F2 – Condensation in Roofs

Adequate ventilation is provided in roofs to meet this requirement in respect of the prevention of condensation. (See section 4.3.2 of this Agrément certificate).

Part J – Heat Producing Appliances

J3 – Protection of Building

When used as set out in 4.1.3 of this certificate, wall lining insulation and separation distances can meet the regulation requirements.

Part L – Conservation of Fuel and Energy

L1 – Conservation of Fuel and Energy

The walls and roof of the Kingspan TEK Haus Building System can readily incorporate the required thickness of insulation to meet the new U value requirements as set

out in Part 4 of this certificate. The system can be detailed to accommodate a wide variety of plan forms; the design can take account of plan form in the calculation of thermal performance so that building regulation requirements can be complied with at all times.

Part M – Access for People with Disabilities

M1 – Access and Use

Buildings can be designed to meet the access, circulation and facilities requirements of this regulation. (See Section 4.5.1 of this Agrément certificate).

M2 – Sanitary Conveniences

Buildings can be designed to meet the installation requirements for sanitary conveniences for people with disabilities. (See section 4.5.2 of this Agrément certificate).

PART

2

TECHNICAL SPECIFICATION AND CONTROL DATA

2.1 DESCRIPTION

2.1.1 General

This Certificate relates to the Kingspan TEK Haus Building System for the manufacture and erection of structural insulated panel buildings. The system can be used for domestic housing of single storey, two storey and two storey with attic, and can accommodate a wide range of architectural designs covering detached, semi-detached or terraced house types. The structural insulated panels are manufactured by Kingspan TEK Haus GmbH in accordance with the panel specifications determined by Kingspan Insulation Limited and their engineering consultants. This determination is based on the design process set out in DIBT certificate No. Z-9.1-315 and conforms to the requirements of DIN 1052 Part 1: 1998, 'Structural use of timber: Design and construction'. Kingspan Insulation Limited is responsible for the structural design of wall, roof and floor components and the certification by a chartered structural engineer of completed buildings constructed using the system. To ensure accurate adherence to the design all structural panels, beams and columns are clearly identified in the project drawings and construction specifications. Particular site requirements, including Irish loadings and wind exposure conditions are taken into account in design calculations. Kingspan TEK Haus Building System panels are designed and specified to ensure that the completed building will meet the requirements of the Building Regulations 1997 to 2002, including structural safety, structural fire safety and thermal performance requirements. A suitably qualified structural engineer will underwrite the structural adequacy of every building. Site erection is carried out by approved contractors, or by specialist sub-contractors under the supervision of Kingspan Insulation Limited. Initial site development and completion of building works after the panel structure has been erected are the responsibility of the main contractor.

2.1.2 Structural Insulated Panel System

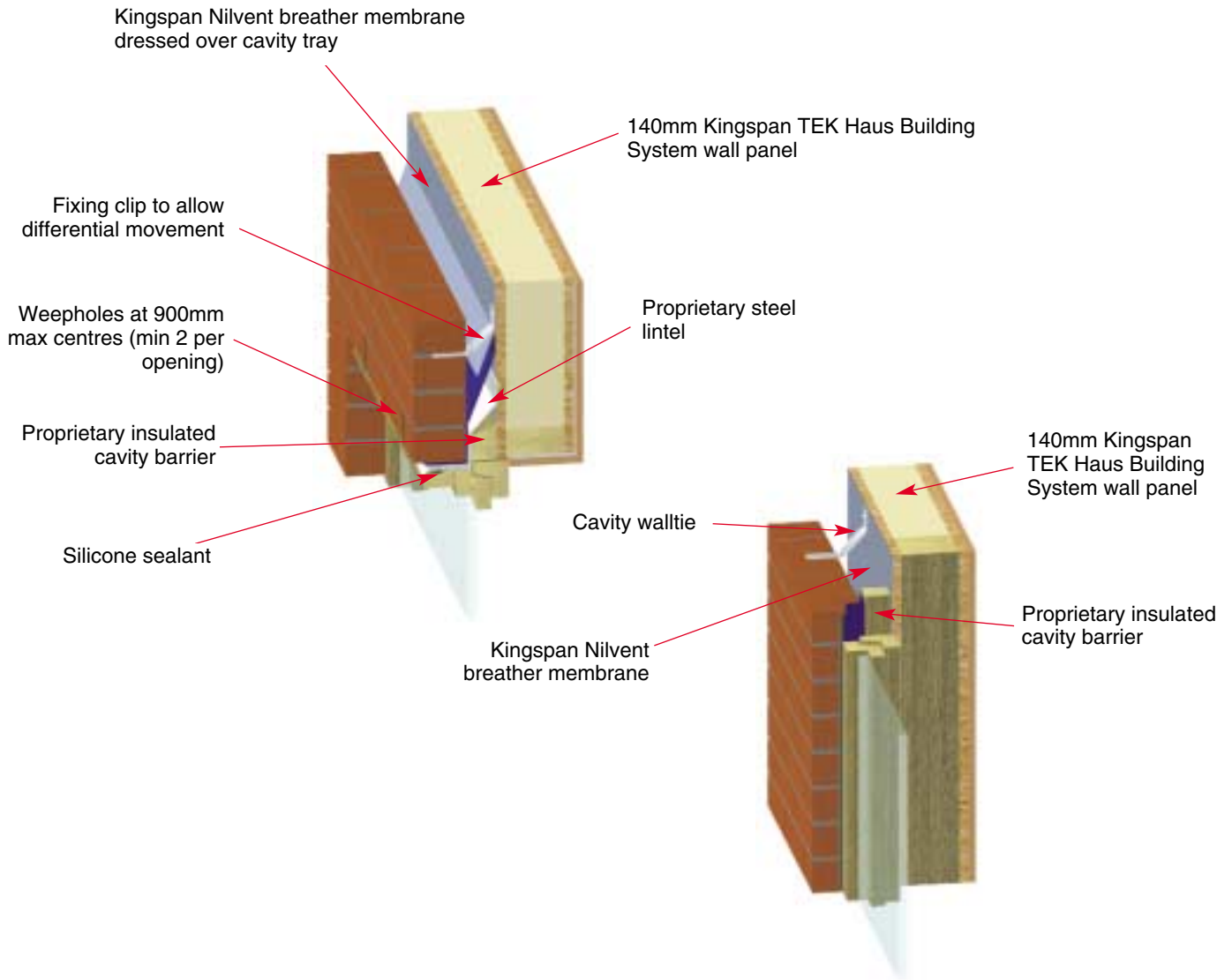
The structural insulated panels are made up of two 15mm thick OSB 3 (Oriented Strand Board) boards with a zero Ozone Depletion Potential (zero ODP) 110mm thick rigid Urethane insulation core. The OSB boards are autohesively bonded to the rigid insulation core during manufacture resulting in superior shear and tensile strength in the bond between the core and the OSB 3 boards. The autohesive bonding process and the use of OSB 3 facing boards with a rigid Urethane core give proven and reliable structural performance to the panels.

The Kingspan TEK Haus Building System uses a proprietary sealed panel-jointing technique, which provides a secure structural joint between adjacent panels. This feature also provides an airtight panel-to-panel joint with a significant improvement in thermal performance and a reduction in both relative movement and sound bridging in the finished building. Joined in this way the panels can be used to create the internal leaf of external walls, loadbearing and non-loadbearing internal walls and the roof of a building.

Panels are designed to take the vertical dead and imposed loads together with any surface loading. The necessary load capacity can be provided in external walls (internal leaf) and load bearing internal walls where required. Where further structural support is required timber posts can be incorporated in the relevant panel joint.

Resistance to horizontal loading (racking) is provided by the horizontal diaphragm action of the floor and roof in conjunction with the vertical diaphragm action of the Kingspan TEK Haus Building System wall panels of the building structure.

Fig. 3. Typical window detail showing brickwork external leaf.



Haus Building System structural insulated panels form the inner leaf of the external walls and a fire-resistant plasterboard lining is fixed to the internal room face of the panels. Generally the internal leaf of an external wall in the Kingspan TEK Haus Building System will be loadbearing. Ground floor panels are anchored by means of lateral galvanised nail fixings through the structural OSB sheeting on the panels into a pre-fixed continuous timber (110mm x 50mm section) bottom plate. Ground floor panels are manufactured with a continuous groove along the lower edge and this groove fits tightly over the bottom plate. The bottom plate is first fixed over a continuous sole plate which is the same thickness as the panel and is fixed over a heavy duty damp proof course; sole plate and bottom plate are compositely fixed to the concrete ground structure by means of stainless steel M10 anchor bolts with washers to DIN 440. Anchor bolt centres are as determined in the design but will be not more than 1 metre. Depending on design, anchor bolts will be of expanding type or chemical anchors depending on the type of substrate to which the anchors are fixed. Only IAB approved anchor bolts should be used.

Where it is required for the design of the building, stainless steel strap anchors can be installed to tie the Kingspan TEK Haus Building System Panels back to the ground floor slab. Generally these straps are at not more than 1800mm apart, and at either side of openings. At least two straps should also be provided as close as practical to external corners.

As the system will generally give an elemental U-value considerably better than 0.27 W/m²K there will be no additional insulation required in the wall structure. However, if a superior U-value is desired this can be achieved using Kingspan TW52 insulated plasterboard slab fixed to the room side of the Kingspan TEK Haus Building System wall panel.

For domestic dwellings, the external leaf of the external walls is generally of traditional brick/block masonry or other IAB approved claddings. In commercial buildings steel cladding or other approved IAB cladding may be considered. The masonry is tied to the inner leaf with purpose made stainless steel wall ties, screw fixed to the Kingspan TEK Haus Building System panels. The wall incorporates a 40mm wide clear cavity between

the Kingspan TEK Haus Building System panels and the masonry outer leaf. Kingspan Nilvent Breather membrane is stapled to the external face of the Kingspan TEK Haus Building System wall panel inner leaf.

Figure 3 shows a typical window detail.

The steel tie is attached to the Kingspan TEK Haus Building System panel by the block layer or bricklayer during construction of the external masonry outer leaf. The ties are spaced vertically at 450mm centres generally, and at 225mm centres vertically within

150mm of any opening. Maximum horizontal spacing of wall ties will not exceed 700mm. Wall ties comply with I.S. 268: 1986 *Metal Wall ties for masonry walls*, or equivalent recognised standard.

During construction it is critical that the Kingspan TEK Haus Building System is protected from the weather and kept dry until the building is complete.

2.2.4 Compartment Wall (party wall)

Compartment walls (party walls) in semi-detached or terraced houses are constructed using two independent Kingspan TEK Haus Building System wall panels with

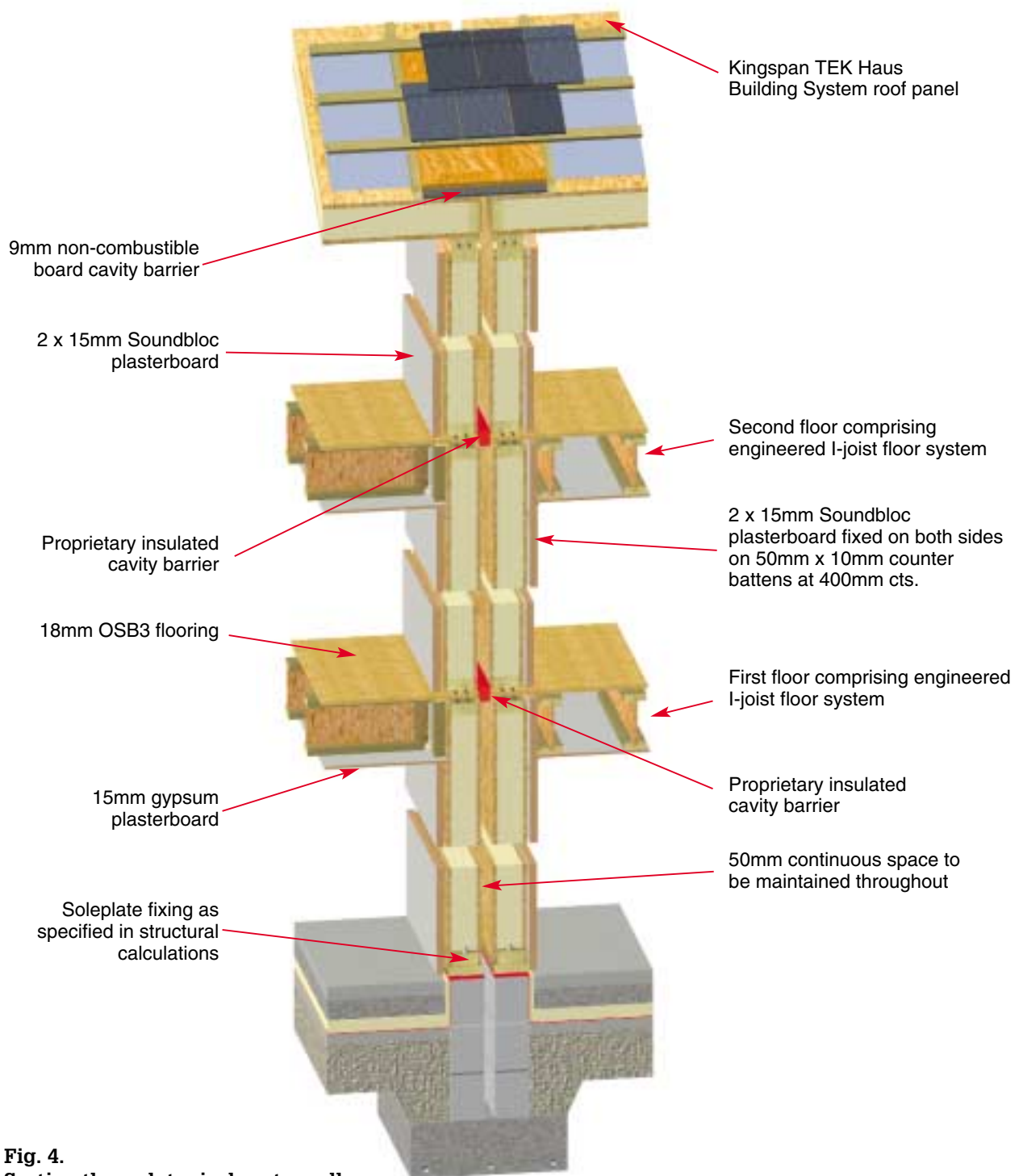


Fig. 4.
Section through typical party wall.

an additional fire protective lining to each house, comprising two layers of 15mm sand resistant plasterboard. Cavity barriers and fire stops will be required in accordance with Part B of the Building Regulations 1997 to 2002. This will include the provision of fire stops/cavity barriers at all junctions between the compartment wall and other elements of structure.

Figures 5, 6 and 7 show a typical detail for a compartment wall, highlighting fire stopping and acoustic details.

2.2.5 Internal Walls

Load bearing and non-load bearing internal walls are formed from the Kingspan TEK Haus Building System structural insulated panels in a similar way to that for the internal leaf of the external walls, but with linings of 12.5mm plasterboard on both sides giving a class 0 spread of flame on all internal wall surfaces. The plasterboard can be mechanically fixed directly to the wall panel or on battens at 400mm centres, which are fixed to the Kingspan TEK Haus Building System panel. Where the internal wall is load bearing, the 12.5mm plasterboard must be fire resistant.

Where individual wall panels are required to provide horizontal shear strength and rigidity to the building, ground anchorage and panel-to-panel joints will have increased fixings in accordance with the structural design requirements. Closer nailing patterns will normally be required in the head and sole plate areas whether racking panels are to be fixed in internal or external walls.

2.2.6 First Floor

The structural design of the first floor, as with all Kingspan TEK Haus Building System elements, is designed to meet the Irish Building Regulations.

There are two typical specifications for the first floor of a domestic house:

- (i) The engineered timber floor system is supported directly by bearing onto the Kingspan TEK Haus Building System wall panel and attached to an engineered timber rim beam. The floor is then decked with 18mm T&G OSB3, which is nailed to the joists. Joists are fixed at 400mm centres.
- (ii) Engineered timber floor joists are supported on joist hangers, which are fixed to the wall plate on the top of the Kingspan TEK Haus Building System wall panels. The floor is then decked with 18mm T&G OSB3, which is nailed to the joists. Joists are fixed at 400mm centres.

Proprietary joist and floor decking systems may be used provided they are approved by IAB for use with the Kingspan TEK Haus Building System.

2.2.7 Second Floor

Where it is proposed to use the attic area for living accommodation in a two-storey house, the design and construction of the floor will be along the same lines as for the first floor. Adequate anchorage for the roof panels against movement will require to be provided for in the design of the floor.

2.2.8 Ceilings

Ceilings are constructed by screwing 15mm plasterboard lining to the bottom of the floor or ceiling joists with approved drive screws at not more than 200mm centres.

On the attic storey, ceiling battens are fixed to the underside of the Kingspan TEK Haus Building System roof panels and 15mm fire-check plasterboard lining is fixed to the battens with drive screws at not more than 200mm centres.

2.2.9 Roof

Roofs are constructed using Kingspan TEK Haus Building System structural insulated roof panels in conjunction with Glulam or other approved engineered timber beams, appropriately sized by Kingspan Insulation Limited or their structural engineering consultants. Timber beams can be installed in the joints between the roof panels to add to their structural strength and rigidity. Proprietary laminated joist systems may be used provided they are approved by IAB for use with the Kingspan TEK Haus Building System. The Kingspan TEK Haus Building System structural insulated panels are highly insulated but where additional insulation is required, this can be readily incorporated onto the internal side of the panel using Kingspan TW52 insulated plasterboard slabs. The external finish to the roof is comprised of an approved vapour permeable underlay, lapped and sealed, and fixed over the entire roof area, with counter battens down slope and tiling battens across slope and nail fixed through the vapour permeable underlay and counter battens. Slating or tiling then follows traditional practice. The roof cladding will be the responsibility of the main contractor. The use of timber roof truss design is allowed in the system, but must be approved by Kingspan TEK GmbH.

Figure 6 and Figure 7 show typical details of upper floor and roof construction in party wall construction.

2.2.10 Chimney construction

The Kingspan TEK Haus Building System can incorporate both traditional block/brick chimney construction or an IAB approved prefabricated chimney block system in accordance with the IAB Agrément certificate and the relevant codes of practice and the Building Regulations 1997 to 2002.

2.2.11 Cavity Barriers and Fire Stops

To meet the requirements for complying with the Building Regulations 1997 to 2002, cavity barriers should be provided in the construction of Kingspan TEK Haus Building System walls and roof as follows:

- Cavity barriers should be installed around all openings such as doors, windows, vents, openings for extractor fans and meter cupboards.
- Cavity barriers should also be installed at eaves and gable verges including for detached houses
- In semi-detached and terraced units both cavity barriers and fire stops should be fitted at the junction of compartment (party) walls and external walls and in the roof at and over party wall location.

Figure 8 shows typical window cill detail

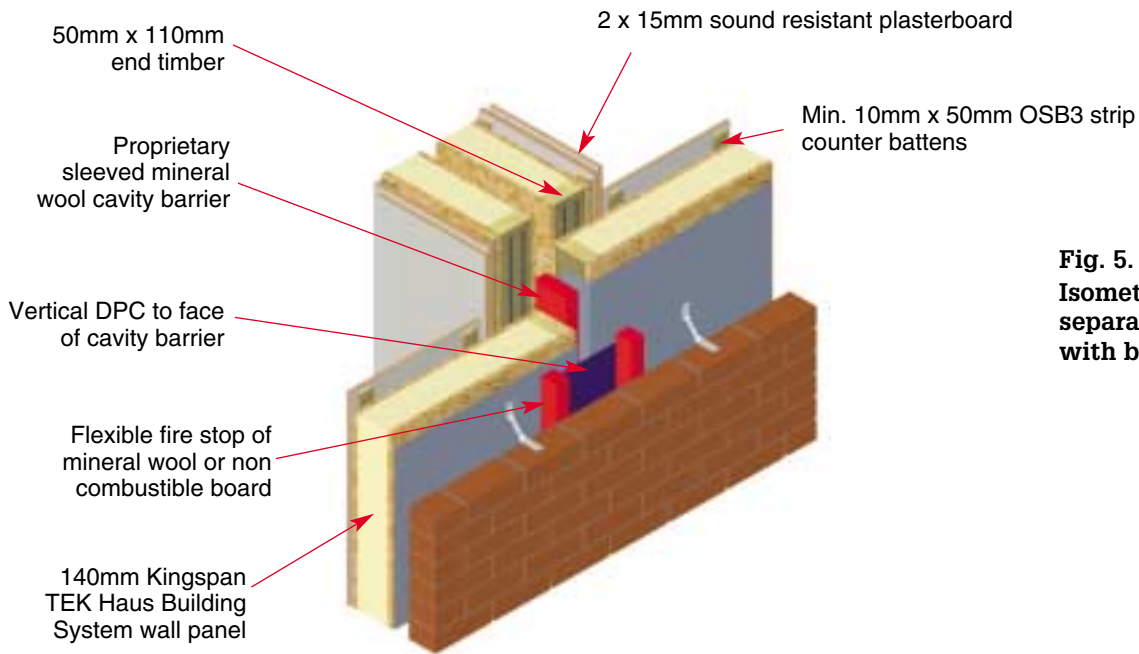


Fig. 5.
Isometric view showing separating wall detail with brick clad finish.

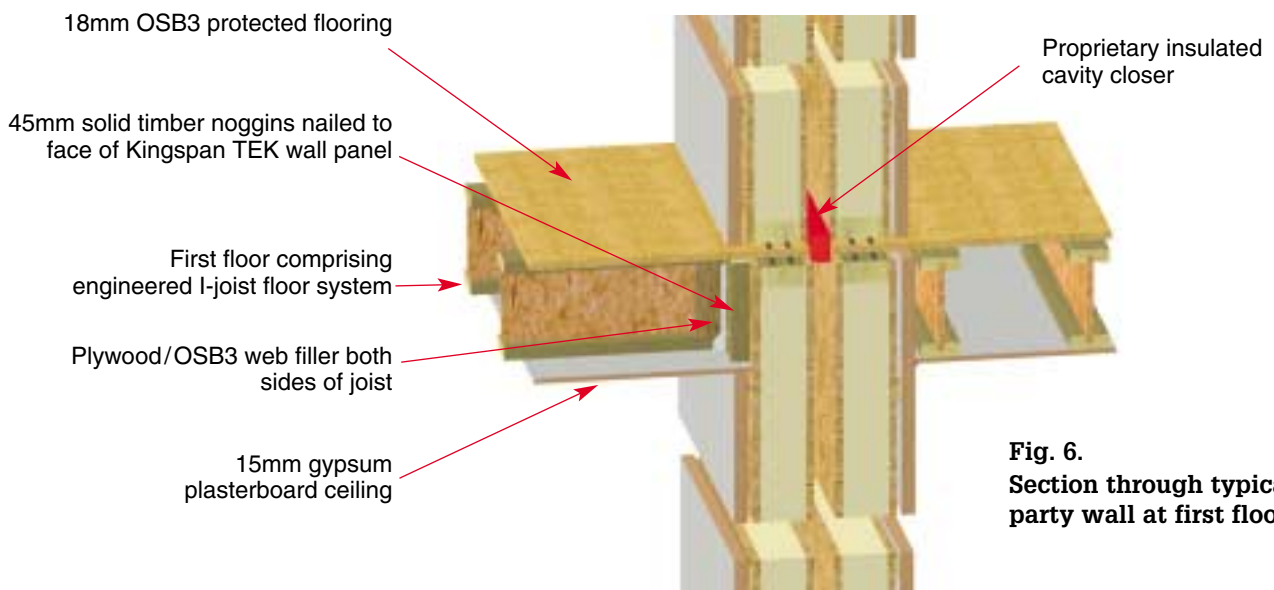


Fig. 6.
Section through typical party wall at first floor level.

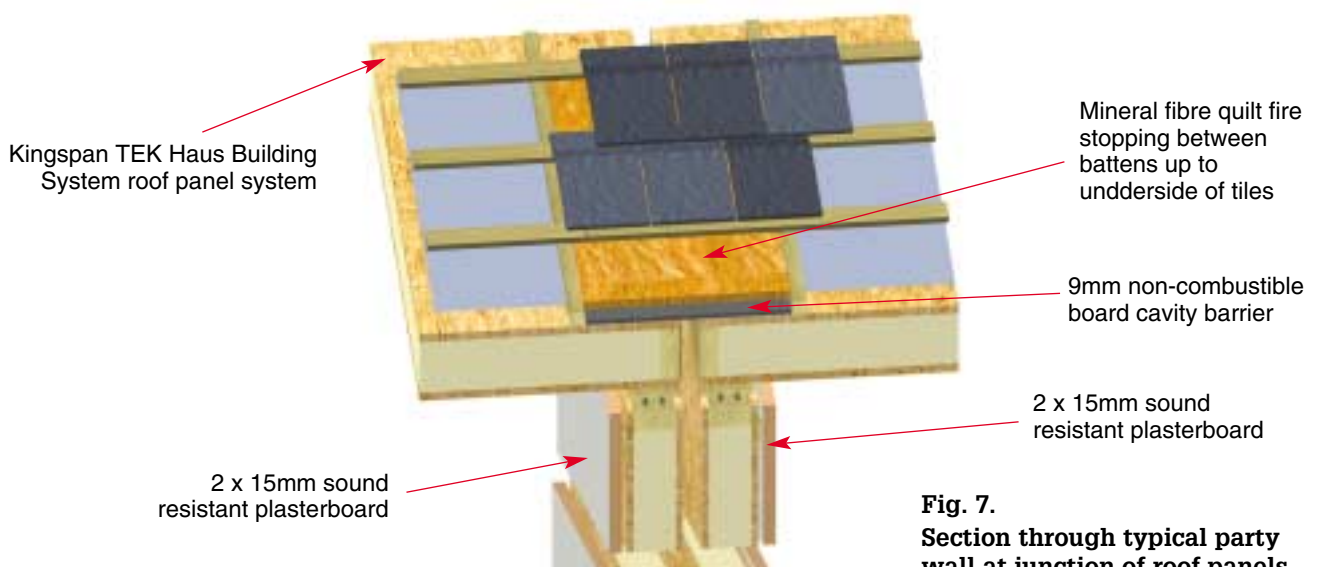


Fig. 7.
Section through typical party wall at junction of roof panels.

Table 1: Typical List of Erection Items

Timbers	Specification
Soleplate	140 mm x 40 mm pre-treated with preservative
End timber, head plate, bottom plate, rebated edge timber	50 mm x 110 mm timber C24 grade
Timber post	100 mm x 110 mm timber C24 grade (unless stated otherwise)
OSB3 spline	100 mm x 15 mm OSB3
Beams	Specification
I-beam	As specified by structural engineer
Floor beam	As specified by structural engineer
Purlin	As specified by structural engineer
Ridge beam	As specified by structural engineer
Panel Fasteners	Size
Galvanised rink shank nails (Paslode)	2.8 mm x 63 mm, 3.1 mm x 90 mm,
Galvanised twist shank nails	3.75 mm x 32 mm
Round Wire Nails	3.35 mm x 65 mm
Sparrennagel	6.0 mm x 210 mm, 6.0 mm x 225 mm,
6.0 mm x 250 mm	
Skew Nails	3.75 mm x 75 mm
Building Fixings	Specification
Joist hangers	As specified by structural engineer
Scabs	As specified by structural engineer
Sealants	
Expanding urethane sealant	
Silicone sealant	
Other ancillary items	Specification
Rim board	As specified by structural engineer
Shims	2 mm, 3 mm, 4 mm, 5 mm, 6 mm

2.2.12 Internal linings, finishes, windows and doors

Linings to walls and ceilings are of 12.5mm plasterboard (fire rated where required) manufactured to BS 1230: Part 1: 1985 (1994), *Specification for plasterboard excluding materials submitted to secondary operations*. The plasterboard is attached to the Kingspan TEK Haus Building System structural insulated panels by means of self-drill, self-tap screws at a fixing rate of at least 4 screws per square metre. Joints in plasterboard wall linings can be taped and filled for direct decoration. Joints in ceilings can be similarly treated. Alternatively skim coat plaster can be applied. Where services require to be accommodated, they can be located in conduits within a cavity created by fixing timber battens to the Kingspan TEK Haus Building System panels and then fixing the plasterboard to the battens.

The Kingspan TEK Haus Building System can readily accommodate the full range of window and door sizes because of the ease with which door or window openings can be cut into the panels at panel production stage. The requirements in respect of door widths for Part M of the Building Regulations 1997 to 2002 can be specified and provided for at design stage. The Kingspan TEK Haus Building System design programme selects panel proportions so the structural integrity is

optimised and adequate strength is retained in spandrel panels, load-bearing posts and panels around openings.

2.3 DESIGN AND MANUFACTURE

2.3.1 Design

The Kingspan TEK Haus Building System presents good scope for individual architectural design. The principal structural features of the system are the solid core structural insulated panels and the flexibility with which they can be combined to give a structural solution for any architectural proposition. Kingspan Insulation Limited, who are responsible for the marketing of the system, take full responsibility for the design of the complete panel structure with the main contractor taking responsibility for ground works, external cladding to walls and roof, windows/doors and all finishing other than the assembled panel structure. Erection of the Kingspan TEK Haus Building System is the responsibility of the approved contractor or specialist sub-contractor. On receipt of architectural plans prepared by others, Kingspan Insulation Limited, or their engineering consultants, will engineer a Kingspan TEK Haus Building System scheme to match that design. This scheme will set out in detail the way in which the

Kingspan TEK Haus Building System structural insulated panels will be joined on site to create that building. Throughout this design process there will be consultation on all aspects of design and a full-itemised quotation will be provided with the final scheme proposal. The design will ensure that the requirements of the Building Regulations 1997 to 2002 are met in respect of the finished building. Furthermore, the structural design of the Kingspan TEK Haus Building System structural insulated panel system proposed for any development project, will be certified in respect of structural safety, by the Kingspan Insulation Limited or their approved consulting engineers.

As a support to their design process, Kingspan Insulation Limited can undertake additional performance assessments on a proposed scheme. Typically these might include an Energy Rating of the whole building scheme or Condensation Risk Analysis.

Assembly and erection of the individual panels and related components on site is undertaken by a Kingspan Insulation Limited approved contractor or specialist sub-contractor. Before this is undertaken the main contractor will already have completed the ground works and left the sub-structure ready for panel erection. Panel erection follows a predetermined procedure to achieve quality and reliability for all

workmanship involved in site installation of the Kingspan TEK Haus Building System panels. Kingspan Insulation Limited use an itemised identification mark on each individual element of their scheme and this facilitates speedy and accurate assembly and erection.

2.3.2 Manufacture

(a) Kingspan TEK Haus Building System Structural Insulated Panels

The Kingspan TEK Haus Building System structural insulated panels are continuous core sandwich panels composed of 15mm OSB 3 board, 110mm Rigid Urethane Insulation and a second 15mm OSB 3 board. Ideally panels are manufactured 1220mm wide and up to 9m in length; generally wall panels will be manufactured in single storey heights while roof panels will be longer. The panels are manufactured using a continuous lamination process where the Rigid Urethane foam autohesively bonds to the OSB 3 facing boards. The closed cell nature of the insulation minimises the risk of condensation within the Kingspan TEK Haus Building System wall or roof panels. Manufacturing is carried out under fully controlled environmental conditions.

Quality control carried out during manufacture includes checks on the quality of the raw materials, OSB 3 boards and the chemicals for the rigid Urethane foam. The dimensions, squareness and planarity of finished panels and the mechanical properties of the foam core are also checked for quality and consistency. Manufactured product is dimensionally checked within the following tolerances:

- length +0 mm, -5 mm
- position of opening +2mm, -2mm
- size of opening +2mm, -0mm
- frame squareness +2mm, -2mm

Structural timbers to be used with the system will require to be stress graded (with quality certification) and to be fit for purpose with the system.

(b) Fixings, fasteners, anchor bolts, joist hangers, wall ties, strap ties, bolts and screws

All fixings and fasteners used in the Kingspan TEK Haus Building System need to be adequately protected against corrosion i.e. galvanizing/zinc coating and made from a 'suitable metal' in order to ensure the 60 year design life of the system. IAB has assessed and approved all fasteners included in the Kingspan TEK Haus Building System. Kingspan Insulation Limited must approve all fasteners and nails used in the construction of the Kingspan TEK Haus Building System.

Only fixings, anchors bolts, joist hangers, wall ties and screws which have been approved by IAB for use with the Kingspan TEK Haus Building System will be used in construction. All components in this category will require to be manufactured under an appropriate quality system.

(c) Proprietary Floor Systems

Proprietary floor systems may only be used provided they are Agrément certified by IAB or approved by IAB for use with the Kingspan TEK Haus Building System. The manufacture of these floor systems must be to an approved quality system.

(d) Membranes

Radon resisting membranes, damp-proof membranes, DPCs, vapour check membranes, breathable membranes house wrap and vapour permeable underlay must be Agrément certified by IAB or be otherwise approved for use with the Kingspan TEK Haus Building System by IAB.

(e) Materials used by main contractor

All traditional materials used by the main contractor in sub-structure or in completion of claddings, masonry, slates, concrete tiles, additional linings, finishes and services, will be required to be fit for purpose and to meet the requirements of the appropriate standards, or be approved by IAB for use with the Kingspan TEK Haus Building System.

The external wall leaf is constructed using traditional brick or block construction or IAB approved cladding panels mechanically fixed to the external face of the Kingspan TEK Haus Building System wall panel. Internal walls are lined with plasterboard screwed to the Kingspan TEK Haus Building System wall panel directly or fixed through timber battens.

2.4 DELIVERY AND SITE HANDLING

2.4.1 Protection of materials

Delivery of the Kingspan TEK Haus Building System to site will be arranged by Kingspan Insulation Ltd. to suit the erection programme and to keep on-site storage time to a minimum. Panels and all timber elements are wrapped with polythene to protect them from rain and weather.

The Kingspan TEK Haus Building System Panels and ancillary timbers and fixings should be stored indoors or under cover on a dry, clean, level base and must not be dropped or allowed to rest on projecting objects. Care is needed to ensure that panels are stored so that there is no risk of warping or moisture absorption.

2.4.2 Typical list of Kingspan TEK Haus Building System materials delivered to each site

With each delivery of a Kingspan TEK Haus Building System to site, a comprehensive bill of materials is supplied. This bill of materials gives a detailed list of all components delivered. All materials are clearly labelled and numbered as required. All components are individually numbered during production and these numbers correspond with the erection drawings supplied with the bill of materials. A typical bill of materials would include items listed in Table 1.

2.4.3 Main contractor

The main contractor is responsible for supply and installation of all materials necessary for the completion of the building with the exception of those items included in the Kingspan Insulation Ltd. bill of materials for the specific project. This responsibility includes proper construction of the foundations and floor slab within the tolerances specified by Kingspan Insulation Limited.

When the main contractor has constructed the foundations and floor slab accurately and correctly, Kingspan TEK Haus Building System approved

erectors/installers can commence the erection of the Kingspan TEK Haus Building System. When the structure is completely erected, brick and block-laying trades can commence. The main contractor on site is responsible for providing scaffolding to roof level and all crane facilities necessary for the safe erection of the structure. When the Kingspan TEK Haus Building System roof structure is completed, the approved erector/installer fixes Nilvent breather membrane to the roof structure. Fixing of doors and windows is then undertaken. All internal trades can then start with electrical and plumbing first fix followed by installation of any additional insulation required, plasterboard and finishes. The main contractor is also responsible for providing and installing stainless steel wall-ties, fire stops and cavity barriers.

2.5 INSTALLATION

2.5.1 General

Erection is carried out in accordance with the Kingspan TEK Haus Building System Construction Manual, a copy of which must be available on each site. Site erection will only be carried out by Kingspan Insulation Limited registered installer/erector, or by a specialist sub-contractor under the supervision of Kingspan Insulation Limited.

2.5.2 Erection

The Kingspan TEK Haus Building System panels are delivered to site in packs that can be off-loaded by forklift truck or by hand. Lifting equipment should be selected taking into account the weight and dimensions and the distance of lift required and should conform to the requirements of the Safety, Health and Welfare at Work Act 1989. The manufacturer's instructions should be followed at all times. The individual Kingspan TEK Haus Building System wall panels can normally be positioned without the use of lifting equipment. Care must be taken to ensure that no water is trapped at panel joints or within wood based elements.

The erection procedure is conventional and similar to that for buildings of frame design. Site erection will be carried out by the approved installer/erector under the supervision of Kingspan Insulation Limited in accordance with the Kingspan TEK Haus Building System construction manual.

2.5.3 Supervision

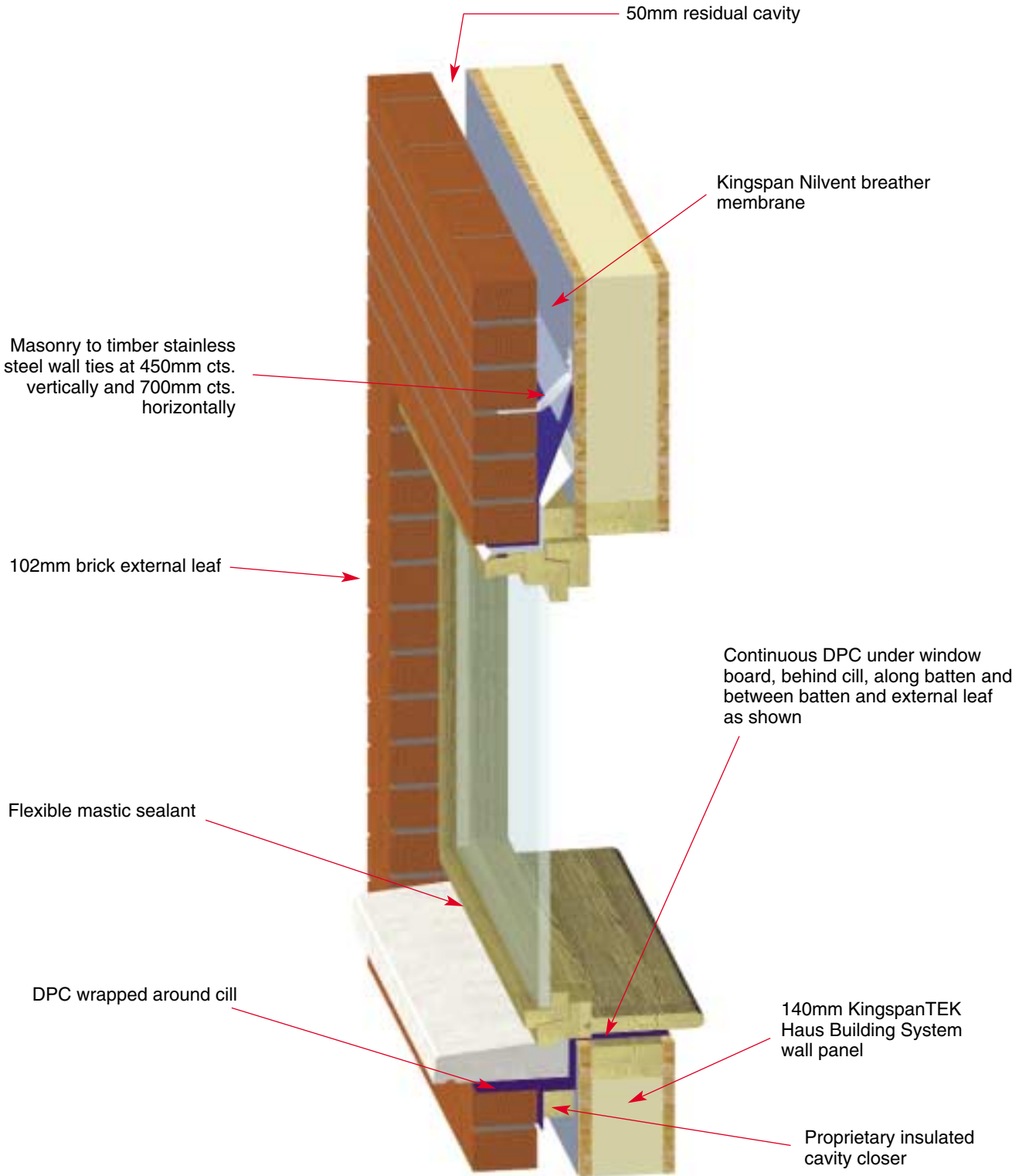
Approved contractors or specialist sub-contractors are subject to supervision by Kingspan Insulation Limited. Supervision of erection have been assessed by IAB and found to be satisfactory. For the installer/erector supervision of erection should include particular checks at the junctions of the panel elements to ensure optimum structural strength and rigidity of the assembled building. For the main contractor particular attention needs to be given to the installation of cavity barriers/fire stops/sealants at compartment walls, door and window openings, and as scheduled by Kingspan Insulation Limited in their design brief to the main contractor; the locations of these will be determined in the Kingspan TEK Haus Building System design process.

2.5.4 Procedure

In respect of the Kingspan TEK Haus Building System, to comply with this certificate, the requirements, which have to be met, include the following:

- All components delivered to site should comply with the 'Bill of Materials' for the project
 - Components must not be damaged and must be properly pre-marked for erection
 - Acceptance of the concrete ground slab should be based on a full check of the dimensions, squareness and planarity
 - Due to the high accuracy of the structural insulated panels erection should not take place unless any irregularities /inaccuracies in the concrete slab have been corrected; this check should also include proper installation of Radon barriers and DPC's on rising walls or under ground slabs
 - Panels must be in line and plumb and in accordance with the Kingspan TEK Haus Building System panel layout.
 - Rooms must be checked for squareness
 - The sole plate must be anchored to the slab or rising wall with either mechanical or chemical anchors, and stainless steel tie-down straps where necessary
 - All panels must be fixed and sealed using the methods outlined in the Kingspan TEK Haus Building System construction manual.
 - Where required by structural design, panels must be anchored laterally with additional stainless steel strap anchors
 - Floor joists and floor decking must be installed in accordance with the Kingspan TEK Haus Building System design layout
 - Cavity barriers and Fire Stops must be installed at doors, windows, wall/roof junctions and compartment wall junctions
 - Roof panels and support systems, including any necessary bracing, must be installed in accordance with the Kingspan TEK Haus Building System design layout and the Kingspan TEK Haus Building System construction manual
 - Wall ties must be correctly positioned and installed
 - All fasteners, screws, nails, strap anchors (where necessary), and wall ties must be approved by Kingspan Insulation Limited.
 - No modification should be made to the designed system arrangement without authorisation from Kingspan Insulation Limited.
-

Fig. 8
Typical section of window cill showing external brickwork.



3.1 STRENGTH AND STABILITY

3.1.1 Certificate of Structural Compliance

The structural design of every building to be constructed with the Kingspan TEK Haus Building System is undertaken by Kingspan Insulation Limited in conjunction with their engineering consultants. Every building constructed with the Kingspan TEK Haus Building System will be certified by a chartered structural engineer in respect of conformance with the requirements of Part A of the Building Regulations 1997 to 2002. Dwellings designed and constructed in accordance with this Agrément certificate will have adequate strength and stability.

3.1.2 Design Loads

Designs for typical dwellings which have been completed for Kingspan Insulation Limited by their engineering consultants, B. Tork, Consulting Engineer, Wiesbaden, Germany, have been examined by IAB and confirmed to provide an equivalent level of safety and suitability to that required under Irish Building Regulation requirements. The design process conforms to the requirements of DIN 1052 Part 1: 1998, '*Structural use of timber: Design and Construction*'. Other standards used in the design process include DIN EN 300: 1997 – 6: 'OSB Board', DIN 1052-1: 1998 '*Structural use of timber, Design and Construction*', DIN 18 164-1: 1992 – 08 '*Plastic Foams as insulating material for the construction industry & insulating materials for thermal insulation*', DIN 68 800-2 & -3: 1996 – 05 '*Wood preservatives in building construction*', DIN 1055-3; 1971-06 '*Design loads for buildings*'.

Based on the wind exposure map provided in the Technical Guidance Document to Part A of the Building Regulations 1997 to 2002, the Kingspan TEK Haus Building System design programme will determine the structural proportions necessary for any site in Ireland. For very exposed sites on hills above the general level of the surrounding terrain, the system can be specifically designed to withstand the unusually high wind loading. This is likely to involve the provision of

additional diaphragm and lateral bracing panels coupled with greater ground anchorage. These can be readily incorporated into the system using the same techniques. At development stage, selective features of the Kingspan TEK Haus Building System were subjected to structural testing to check design reliability.

Typical design loads included in the calculations are:

- 1.5 kN/m² for domestic floors plus an allowance of 1.0 kN/m² for internal partitions
- 0.75 kN/m² roof imposed loads (including for snow) with an allowance of 0.75 kN/m² for use of loft for storage.

Diagrams 14 and 15, Technical Guidance Document to Part A, Building Regulations 1997 to 2002, give the design snow and wind loading for Ireland.

3.1.3 Foundation Design

Foundation design should be in accordance with BS 8004: 1986: *Code of practice for foundations*, or other appropriate approved procedure.

3.1.4 Coastal Salt Spray

The Kingspan TEK Haus Building System is well protected from weather and coastal salt spray through the use of traditional durable materials for external cladding. However where a building is to be constructed within one kilometre of the coastline it would be prudent to specify only stainless steel for all fixings, anchors, wall ties, nails and screws.

3.1.5 Impact Resistance

As the external walls are finished on the outside with a 100mm thick masonry leaf, there is little risk of external impact damage to the structure. With regard to internal impacts, the continuous solid insulation core, bonded continuously to OSB 3 board, is also very resilient and capable of withstanding any likely impact shock to the internal wall surfaces. Also, any exceptional impact to internal surfaces is unlikely to be sufficient to create significant damage.

4.1 BEHAVIOUR IN RELATION TO FIRE

4.1.1 Fire Resistance

Assessment of fire test results show that the Kingspan TEK Haus Building System can meet the building regulation requirements for fire resistance as shown in Table 2. Fire tests on wall and floor panels were carried out at Warrington Fire Research Centre, UK Building Test Centre and the MPA Materials Testing Institute, Dresden.

Table 2: Fire Resistance of Walls

Element	Test Standard	Results
Loadbearing wall assembly – One layer 12.5mm standard plasterboard on 10mm deep battens on 140mm TEK Haus panel.	BS 476:Part 21: 1987	54 minutes
Loadbearing wall assembly – One layer 12.5mm fire resistant plasterboard on 10mm deep battens on 140mm TEK Haus panel.	BS 476:Part 21: 1987	73 minutes

4.1.2 Surface Spread of Flame

The exposed surfaces of the various wall, roof and ceiling cladding materials are assessed as having surface spread of flame characteristics as shown in Table 3. The Classes are defined in accordance with BS 476: Part 7: *Method of test to determine the classification of surface spread of flame of products*.

Table 3: Surface Spread of Flame Characteristics

Brickwork/blockwork	Class 0
Timber Boarding	Class 3
OSB 3 Board	Class 3
Plasterboard internal lining	Class 0
Slates/tiles	Class 0

4.1.3 Protection of Building

Combustible material, e.g. insulation and timber, should be separated from the flue of a masonry chimney by at least 200mm, or by at least 40mm from the outer surface of the chimney. Particular details are given in section 2 and diagrams 2 to 6 of the Technical Guidance Document to Part J of the Building Regulations 1997 to 2002. The required separation distance from a heating appliance to combustible wall insulation material should be as set out in Clause 2.2.2 and diagram 8 of the Technical Guidance Document to Part J of the Building Regulations 1997 to 2002. For chimneys covered by BS 4543 Part 1: 1990 (1996) *'Factory-made Insulated Chimneys'*, separation between this product and the external surface of the chimney is determined in accordance with clause 2.17 of the Technical Guidance Document to Part J of the Building Regulations 1997 to 2002.

Combustible material in proximity of a constructional hearth must be protected by 250mm of solid concrete or as detailed in Diagram 4 of the Technical Guidance Document to Part J of the Building Regulations 1997 to 2002.

4.1.4 Roof Designation

The tiled or slated roof is designated AA in accordance with *'Table A5: Notional designation of roof coverings'* of the Technical Guidance Document to Part B of the Building Regulations 1997 to 2002.

4.1.5 Cavity Barriers

The Kingspan TEK Haus Building System design incorporates suitable cavity barriers and fire stops in compliance with the requirements of the Building Regulations 1997 to 2002 and as shown in Figures 4 to 9 and section 2.3.10 of the Technical Guidance Document to Part B of the Building Regulations 1997 to 2002.

4.2 THERMAL INSULATION

4.2.1 U-Values

The U-values (thermal transmittance measured in W/m²K) of the system elements are shown in Table 4, calculated in accordance with Part L of the Building Regulations 1997 to 2002. The U-value of the Kingspan TEK Haus Building System structural insulated panel is considerably better than the elemental value of 0.27 W/m²K set in Part L of the Building Regulations 2002.

4.3 CONDENSATION

4.3.1 External Walls

Calculations in accordance with BS 5250: (2002) *'Code of practice for control of condensation in buildings'*, show that the level of insulation in the Kingspan TEK Haus Building System panels and the totally uniform distribution of the insulation, prevent the occurrence of surface or interstitial condensation in all normal environments in dwellings. As with all cavity wall construction, care must be taken when installing the DPC below windows to ensure that any condensation occurring on the window is drained outwards away from the cavity. Under extreme conditions of temperature and humidity, condensation may occur on the lintel supporting the outer leaf of masonry but this will not adversely affect the lintel and proper detailing will ensure that condensed water will generally be drained outwards.

4.3.2 Roof Ventilation

Adequate provision must be made by means of continuous fascia ventilation along the eaves, and tile/slate ventilators on the roof slopes, as high towards the ridge as is practical. Roof ventilation should be carried out in accordance with BS 5250: 1989 (1995) *'Code of practice for control of condensation in buildings'*. The diagrams in section 2.1.1 of the Technical Guidance Document to Part F of the Building Regulations 1997 to 2002 illustrate the appropriate way to provide ventilation in the roof. Only approved tile/slate underlay should be used. Figure 9 shows typical eaves detail in Section.

Table 4: Typical U-Value of Roof and Wall Construction

External wall construction	Internal leaf of Kingspan TEK Haus Building System panels finished with 12.5 mm plasterboard on timber battens and a brick outer leaf with a 50 mm vented cavity	U - value of 0.22 W/m ² K
Roof Construction	Kingspan TEK Haus Building System roof panel lined internally with 12.5 mm plasterboard on battens and externally with vapour permeable membrane, counter battens, tiling battens and tiles or slates.	U - value of 0.20 W/m ² K

4.4 SOUND

4.4.1 Party Wall

The party wall (i.e. compartment wall between adjacent dwellings) specified for the Kingspan TEK Haus Building System is made up of two independent walls with a clear gap of 50mm between them, a typical specification of each wall is as follows:

- 15mm Soundcheck plasterboard
- 15mm Soundcheck plasterboard
- 140mm Kingspan TEK Haus Building System Wall Panel
- 50mm Clear Cavity
- 140mm Kingspan TEK Haus Building System Wall Panel
- 15mm Soundcheck plasterboard
- 15mm Soundcheck plasterboard

The acoustic performance of this party wall specification has been assessed analytically on the basis of the material specifications. NCRL (Noise Control and Research Laboratories) have predicted that a party wall constructed to this specification will meet the requirements of the Building Regulations. To certify compliance with the requirements of Part E of the Building Regulations 1997 to 2002 it is essential to complete field tests on an authentic party wall between two dwellings. Tests should be carried out in accordance with IS EN ISO 140-3: 1995 '*Laboratory measurements of airborne sound insulation of building elements*' and IS EN ISO 717-1: 1997 '*Airborne sound insulation*'.

4.4.2 On Site Testing

On site airborne sound insulation tests were carried out on a party wall constructed to the proposed party wall specification. Testing was in accordance with IS EN ISO 140-4: 1998 '*Field measurements of airborne sound insulation between rooms*'.

For the twin leaf party wall shown in Figure 4 the measured sound insulation met the requirements of Part E of the Building Regulations 1997 to 2002. This performance was achieved through the following:

- each wall is independent due to the 50mm gap
- dense wall linings with two layers of 15mm soundcheck plasterboard on both faces of the panels with the joints between the plasterboard layers staggered, taped and filled
- the continuity of the panel core material

4.4.3 External walls and walls between rooms

Other aspects of sound insulation were also assessed. This included an analytical study of the likely sound insulation performance of room partitions and external walls of dwellings constructed with the Kingspan TEK Haus Building System.

The estimated average sound reduction to the unglazed part of the external walls is 40 dB for brick or rendered concrete block external leaf construction. For the internal Kingspan TEK Haus Building System structural insulated panel wall acting alone a value of 33 dB is achievable. Estimates are based on BS 8233: 1997, '*Code of practice for sound insulation and noise reduction for buildings*'.

4.5 ACCESS FOR PEOPLE WITH DISABILITIES

4.5.1 Access and use

Building designs are required to provide minimum opening widths for doors and corridors, and minimum dimensions for rooms and circulation spaces to provide access for people with disabilities. These minimum dimensions are set out in Diagrams 5 to 12 of Technical Guidance Document to Part M, '*Access for People with Disabilities*', of the Building Regulations 1997 to 2002. The Kingspan TEK Haus Building System can meet these requirements.

4.5.2 Sanitary convenience

Buildings based on the Kingspan TEK Haus Building System can meet all necessary installation requirements for special sanitary conveniences, including access space requirements, to meet the requirements of Part M of the Building Regulations 1997 to 2002.

4.6 WEATHERTIGHTNESS AND DAMP-PROOFING

4.6.1 DPCs, DPM

The system has adequate damp-proof courses and membranes to resist the passage of moisture from the ground.

4.6.2 Roof and Rainwater goods

Roof coverings and rainwater systems are of traditional materials and will provide adequate weather resistance and run-off when completed in accordance with this Agrément certificate and the manufacturer's instructions.

4.6.3 External Walls

The external walls with traditional masonry outer leaf and a 50mm clear vertical cavity, will, when properly constructed, prevent the passage of rainwater to the cavity face of the inner leaf of the wall. Wind-driven rain, which may cross the cavity in very severe weather conditions, will be effectively deflected away from the inner leaf by the Kingspan Nilvent breather membrane. The joints between adjacent panels are weatherproofed and any penetrations for services are sealed.

Where it is proposed to use alternative claddings for limited infill panels, then an additional approved water barrier is fixed to the external face of the Kingspan TEK Haus Building System panel, approved vertical battens are fixed at not more than 400mm centres and an IAB approved cladding is fixed to the battens as an exterior cladding. With this arrangement it is essential to ensure vertical drainage away from the internal leaf of the wall and to allow some ventilation behind the exterior cladding.

Detail sheet two of this Agrément certificate details the use of the Kingspan TEK Haus Building System for use as an infill panel in residential and commercial buildings up to four storeys in height. Kingspan Insulation Ltd. is responsible for the structural design and specifications of the wall infill panels using only chartered structural engineers. The infill panels must be designed within the design, constraints and procedures set out in DIBT Certificate Z-9-1-315. This infill panel system is designed for use with a brick, concrete block, or other masonry external wall finish.

4.6.4 Windows and Doors

The performances of windows and doors are not covered by this certificate. However, the detailing at window and door openings has been assessed and is considered adequate to ensure that water penetration will not occur at these locations assuming properly designed and installed windows and door sets are used.

4.7 ELECTRICAL AND PLUMBING SERVICES

Provision of electrical and plumbing services is outside the scope of this certificate. However, in designing and installing these services it is essential to take all precautions to avoid damaging the panels, membranes, claddings or finishes. Ideally, the cutting of holes through the Kingspan TEK Haus Building System panels should be done in the factory so that there will be minimum loss of valuable insulation. The enclosure of cold water pipe work within the panels should be avoided wherever possible because of the risk of local condensation. Also, electrical cables should not be run in the insulation to avoid over heating of the cables.

4.8 DURABILITY

Buildings constructed using the Kingspan TEK Haus Building System will, when constructed in accordance with the Kingspan TEK Haus Building System design process and construction manual and the requirements of this certificate and all relevant codes of practice, will have a minimum design life of at least 60 years in accordance with BS 7543: 1992, *'Guide to Durability of Building Elements, products and components'*. Buildings based on the system, provided they are properly erected and that construction is carried out properly and accurately, should give good performance under all relevant headings throughout their working life. Particular features of the system which contribute to this performance include:

- panel specification and manufacture are accurate and controlled so that the risks of cold bridges or structural weakness are negligible
- panel conformation and joint design minimise the risk of air leakage
- predictable project completion times reduce weather related defects in construction
- accurate scheduling of components in advance reduces site waste
- reduced energy usage due to significantly superior thermal insulation levels
- CFC/HCFC-free insulation with zero Ozone Depletion potential
- for correctly designed and built walls and roofs based on the Kingspan TEK Haus Building System there should be no risk of interstitial or surface condensation thereby supporting longer service life for the buildings
- design and provision of DPCs, DPMs and Breather Membranes minimises the risk of damaging moisture gain in timber based materials
- externally exposed cladding materials are conventional durable materials with proven long life endurance.

4.9 MAINTENANCE

Maintenance will be required at a level comparable to that for buildings of conventional construction. The elimination of wet trades in the construction of the inner leaf of the external walls reduces drying time and can reduce the incidence of shrinkage cracking in the early life of the building.

Repainting should be carried out in accordance with the relevant recommendations of BS 6150: 1991 *'Code of practice for painting of buildings'*. Timber boarding, fascia, soffit and other exposed timber elements should be treated with an appropriate paint system or translucent stain and should be maintained by periodic re-coating using a paint or stain suitable for external applications, applied in accordance with the manufacturers instructions.

4.10 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING

- structural strength and stability
- behaviour in fire
- resistance to airborne and impact sound transmission
- thermal transmittance value and condensation risks for walls and roof.

4.11 OTHER INVESTIGATIONS

Existing data was examined to assess:

- adequacy of structural design
- weather tightness of buildings constructed using the Kingspan TEK Haus Building System
- durability of the system
- maintenance requirements for the system.

Production audits were carried out at the design unit and production facility of Kingspan Insulation Limited and Kingspan TEK Haus GmbH, to examine the process of structural design and the adequacy of quality control.

Construction sites were examined when construction was in progress to assess the practicability of construction and the adequacy of site supervision arrangements.

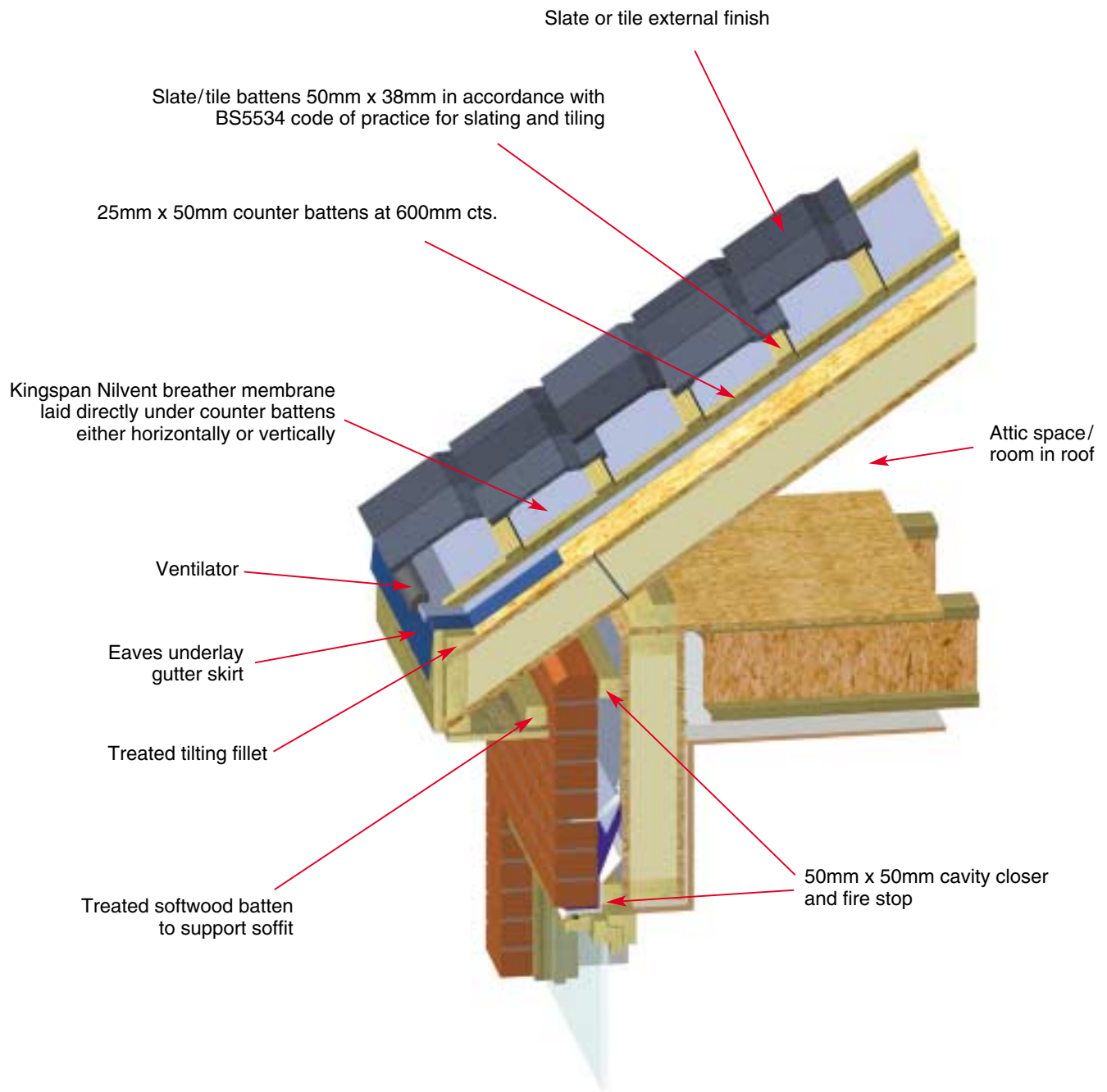


Fig. 9. Typical eaves detail vertical section.

5.1 CONDITIONS OF CERTIFICATION

The National Standards Authority of Ireland (“NSAI”) following consultation with the Irish Agrément Board (“IAB”) has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this certificate and in accordance with the manufacturer’s instructions and usual trade practice. This certificate shall remain valid so long as:

- (a) the specification of the product is unchanged;
- (b) the Building Regulations, 1997 to 2002 and any other regulation or standard applicable to the product/process, its use or installation remain unchanged;
- (c) the product continues to be assessed for the quality of its manufacture and marking by NSAI;
- (d) no new information becomes available, which in the opinion of the NSAI would preclude the granting of the certificate;
- (e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

5.2 The IAB mark and certification number may only be used on or in relation to products/processes in respect of which a valid certificate exists. If the certificate becomes invalid, the certificate holder must not use the IAB mark and certification number and must remove them from products already marked.

5.3 In granting this certificate, the NSAI makes no representation as to:

- (a) the presence or absence of patent rights subsisting in the product/process; or
- (b) the legal right of the certificate holder to market, install or maintain the product/process; or
- (c) whether individual products have been manufactured or installed by the certificate holder in accordance with the descriptions and specifications set out in this certificate.

5.4 This certificate does not comprise installation instructions and does not replace the manufacturer’s directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this certificate relating to the safe use of the certified product or process are preconditions to the validity of the certificate. However, the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act, 1989 or of any other current or future statute or current or future common law duty of care owed by the manufacturer or by the certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage, including personal injury, arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this certificate to any Act of the Oireachtas, regulation made thereunder, statutory instrument, code of practice, national standards, manufacturer’s instructions or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this certification.

THE IRISH AGRÉMENT BOARD

This Certificate No. 02/0158 is accordingly granted by NSAI to Kingspan TEK GmbH on behalf of The Irish Agrément Board.

Date of Issue: May 2002

Signed: _____



Chief Executive, NSAI

Readers may check that the status of this Certificate has not changed by contacting the

Irish Agrément Board,
NSAI, Glasnevin, Dublin 9. Ireland.

Telephone: (01) 8073800.
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BUILDING PRODUCT CERTIFICATION

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