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CERTIFICATE NO. 04/0198

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Kingspan Century Medium Rise Timber Frame Construction System

Systémes pour constructions Bausystem

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 2006**.

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



PRODUCT DESCRIPTION:

This certificate relates to the Kingspan Century Medium Rise Timber Frame Construction System for the construction of buildings up to 4 storeys in height and of purpose groups 1(a), 1(b), 1(c), 2(b), 3, 4(a) and 5 as defined in Technical Guidance Document B of the Building Regulations 1997 to 2006. Buildings are manufactured in Kingspan Century factories at Monaghan, Longford and Dungarvan. The system can be used for domestic housing, including apartment blocks, and can accommodate a wide range of custom designs covering detached, semi-detached or terraced house types. The design of the Kingspan Century system is based on conformance with the approved material standards and procedures for timber framed construction. Kingspan Century are responsible for the structural design of wall, roof and floor components and the certification by a chartered structural engineer of buildings constructed using the system. System design meets the required level of safety and suitability for Building Regulation requirements. External wall design is based on cavity construction with the inner load-bearing leaf of timber-frame construction with a 50mm cavity and a traditional masonry external leaf or an IAB approved cladding.



Kingspan Century, or their approved agents, are responsible for site erection of all timber-frame components. Initial site development and completion of building works after the panel structure has been erected are the responsibility of the main contractor. This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2006.

USE:

The Kingspan Century building system is based on structural timber panels and is designed for use with a brick; concrete block, masonry or other IAB approved external cladding systems. Due to the design and manufacturing flexibility afforded by timber frame construction, the system can be used for a very wide range of architectural designs and building types. The system can accommodate a range of slate, concrete tile roof finishes and other IAB approved or similar roofing materials, and offers a fast efficient construction solution based on a high level of factory manufacture and ease of erection on site. It should be noted that the stairwell, stairs and entrance lobby for apartments are not in timber frame (concrete block) and are not supplied as part of the system by Kingspan Century. The system provides a high level of thermal insulation and can achieve good energy efficiency.



MARKETING: The product is marketed by:

Kingspan Century, Clones Road, Monaghan, Ireland. Tel: +353 (0)47 81270 Fax: +353 (0)47 84397 Email: <u>salesdesk@century.ie</u> Website: <u>www.century.ie</u>

Part One / Certification

DESIGN AND MANUFACTURE OF SYSTEM:

The design of the system for each particular building is undertaken by Kingspan Century on the basis of the project design being prepared by the developer's architectural consultants; their chartered structural engineering consultants certify all designs. All timber frame components are manufactured and erected by Kingspan Century or their approved contractors or developers. All materials used in the manufacture of timber frame components are purchased from approved qualified manufacturers or suppliers.



In the opinion of the Irish Agrément Board (IAB), the Kingspan Century Medium Rise Timber Frame Construction 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 - 2006 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2006

REQUIREMENT:

Part D – Materials and Workmanship

D3 – The Kingspan Century Medium Rise Timber Frame Construction System, as certified in this Certificate, is comprised of proper materials fit for their intended use (see Parts 2, 3, and 4 of this Certificate).

D1 – The Kingspan Century Medium Rise Timber Frame Construction System, used in accordance with this Certificate, meets the requirements for workmanship.

Part A – Structure

A1 – Loading

The Kingspan Century Medium Rise Timber Frame Construction System, as certified in this Certificate, has adequate strength and stability (see Parts 3 and 4 of this Certificate).

A2 – Ground Movement

An appropriately designed ground floor can safely sustain the combined dead imposed and wind loads of the system into the foundation structure without causing undue deflection to any part of the Building.

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 in residential dwellings up to 4.5m in height. Where a window is required to provide an alternative means of escape, it must provide an unobstructed opening of not less than 850 mm high by 500 mm 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 2006.

Any restrictor fitted must be easy to operate.

B2 – Internal Fire Spread (Linings)

The plasterboard lining to walls and ceilings is designated Class 0. It may therefore be used on the internal surfaces of buildings to meet this requirement for every purpose group without restriction.

B3 – Internal Fire Spread (Structure)

(i) Fire Resistance Test Performance Requirements for Compartment Walls:

For domestic houses or apartments up to 10 metres in height the separating wall specification shown in Figures 4(a) and 6 will give a minimum of 60 minutes fire resistance and meets the requirements of B3 for fire test performance.

Resistance Test Performance (ii) Fire Requirements for Elements of Structure: The Kingspan Century Medium Rise Timber Frame construction system when used as described above, can achieve a minimum period of fire resistance as set out in Table 2 of this Certificate. For the Purpose Groups listed above, this is the maximum requirement for fire resistance of elements of structure, including structural frames, beams, columns, load bearing walls, external walls, floors and roof. Typical fire resistant elements of structure are shown in Figures 4(a), 4(b) and 4(c). Table 2 gives the fire resistances that are achieved by components of the Kingspan Century Medium Rise Construction System.





(iii) Fire Resistance Test Performance Requirements for Compartment Floors:

The floor specification shown in Figure 5 gives a minimum fire resistance of 60 minutes. For the Kingspan Century Medium Rise Timber Frame construction system, used for the Purpose groups and building heights set out above, this floor specification meets the requirements.

(iv) Cavity Barriers and Fire Stops:

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 2006.

B4 – External Fire Spread

The external masonry walls and traditional roof cladding have Class 0 surface spread of flame ratings and when 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 Century Medium Rise Timber Frame construction system permits the easy incorporation of the appropriate membrane, sump and gas handling system.

C4 – Resistance to Weather and Ground Moisture

The Kingspan Century Medium Rise Timber Frame construction system has adequate dampproof courses and membranes to resist the passage of moisture from the ground (see Figures 1 and 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/Separating walls are constructed to meet the airborne sound requirements of this Regulation (see also Section 4.4.1 and Figure 4(a) of this Certificate). It is not permitted to install services in Compartment/Separating walls or run them through Compartment/Separating walls.

E2 and E3 – Airborne and Impact Sound (Floors)

Intermediate and separating floors meet and exceed the airborne sound requirements of this regulation (see Figure 5 of this Certificate).

Part F – Ventilation

F1 – Means of Ventilation

Adequate means of ventilation must be provided for people in buildings, including adequate provision for the removal of water vapour from kitchens, bathrooms and other areas where water vapour is generated. It is also necessary to provide sufficient ventilation for fireplaces. The design must include provisions for these requirements. The system allows the installation of ventilation openings for mechanical and natural ventilation in the areas required.

F2 – Condensation in Roofs

Adequate ventilation must be provided to prevent excessive condensation in the roof or roof void above insulated ceilings. The system allows the provision of all necessary ventilation paths to meet the requirements of Regulation F2 (see section 4.3.2 of this 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 Century Medium Rise Timber Frame construction system can readily incorporate the required thickness of insulation to meet and exceed the current 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 whole building thermal performance so that building regulation requirements can be met or exceeded.

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 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 Certificate).



Part Two / Technical Specification and Control Data

2.1 PRODUCT DESCRIPTION

2.1.1 General

This Certificate relates to the Kingspan Century Medium Rise Timber Frame Construction System for the construction of highly insulated buildings up to 10 metres in height and of purpose groups 1(a), 1(b), 1(c), 2(b), 3, 4(a) and 5 as defined in Technical Guidance Document B of The Building Regulations 1997 to 2006; the system is suitable for use with traditional slate, concrete roof tiles or IAB approved roof cladding, and can be used for domestic housing, including four storey apartment blocks. External cladding may be brick/masonry or external cladding systems as approved by the IAB. It can accommodate a wide range of architect's designs covering detached, semi-detached or terraced house types.

2.1.2 System Design

Kingspan Century are 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. Structural and serviceability designs are based on conformance with the approved material standards and procedures for timber framed construction and meet the required levels of safety and suitability under Building Regulations. For each project, Kingspan Century develop the timber frame structure in consultation with the project architect to ensure maximum architectural choice with the system.

The complete specifications and drawings for the materials and components of the Kingspan Century Medium Rise Timber Frame construction system covered by this Certificate have been examined and are retained by the IAB.

2.2 STRUCTURE

2.2.1 Foundations

The Kingspan Century Medium Rise Timber Frame construction system may be used with a range of foundation types, depending on the ground conditions encountered on site.

The foundations and ground floor slab are the responsibility of the main contractor, and should be designed and constructed correctly to the project developer's engineering specifications. The foundation and ground floor slab must be constructed accurately, i.e. correct dimensions, square and level so that the Kingspan Century Medium Rise Timber Frame construction system, with its accurate manufacturing dimensions, can be assembled and erected properly and within the required tolerances.

Figure 2 shows a typical foundation anchorage detail. The Kingspan Century timber frame panel

is anchored with a stainless steel strap anchor to the concrete block work in the outer leaf of a properly constructed traditional rising wall on a foundation. Anchorage strength is strip subsequently enhanced by the weight of the masonry outer leaf of the external wall. Anchors are fixed through the plywood sheeting into each full height vertical stud. Where the masonry rising wall has to provide the anchorage without a masonry outer leaf at higher level, chemical anchors should be used to tie the strap anchor to the rising wall. This is to ensure that a sufficiently secure anchorage can be achieved and to avoid edge bursting of the masonry. Stainless steel nails are shot fixed through the sole plate into the concrete slab to ensure that the panels are kept rigidly in position.

2.2.2 Ground Floor

The main contractor is responsible for the construction of the ground floor. A suspended floor may be used with the Kingspan Century Medium Rise Timber Frame construction system. The structural design of the floor and substructure should be in accordance with Part 3 of this certificate. A suspended concrete or timber joist ground floor may be supported with dwarf walls or an approved joist hanger system. Details of the installation of DPC and Radon resisting membrane are shown in Figure 2.

2.2.3 External Walls

External walls of residential buildings are generally of cavity construction with the external leaf constructed with traditional masonry for which the main contractor is responsible. The masonry leaf should be constructed to IS 325 Use of Masonry or equivalent standards. In accordance with IS 325 a residual cavity of not less than 50mm should be retained. The Kingspan Century timber frame 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 will be load bearing. Kingspan Century, or their approved agents, are responsible for site erection of all timber-frame components. Initial site development and completion of building works after the panel structure has been erected are the responsibility of the main contractor. The timber frame inner leaf is positioned on the DPC, over the inner leaf of the foundation rising wall, and fixed accurately in its design location; generally the floor DPM will be returned upwards at the edge of the ground floor slab and returned outwards under the DPC. Timber frame panels will have studs at centres not exceeding 600mm with trimmers under and over all openings and noggins where necessary for structural design requirements. Where design loading requires it, studs will be at closer centres





and may be located directly under floor joists. Lintels over openings will be supported with additional short studs fixed to adjacent full height studs and supported laterally with noggins. Panels are sheeted with breather membrane over 9mm plywood or OSB 3 board on the cavity face and plasterboard, over vapour check membrane on the room side. Vertical and horizontal DPCs and cavity barriers are fixed around all openings in the external walls. Ground floor panels are anchored to the external masonry leaf with stainless steel anchor strap-ties nailed to the vertical studs through the plywood sheeting, and built into the masonry leaf at one masonry course over ground level.

The stainless steel anchor ties are specifically designed for the system and are nailed to the studs. The external leaf of brick or concrete block is tied to the timber frame inner leaf with stainless steel angle ties at not more than 600mm horizontally and 450mm vertically.

Wall ties should be spaced at 225mm vertically around external openings and at movement joints and corners. Wall ties should be fixed at stud locations in the timber frame leaf using stainless steel annular ring nails or approved drive screws, securely anchored into the studs. Specific details of the construction of external walls are shown in Figures 2 and 3.

Where adequate anchorage is not possible due to building fenestration and where it is required by structural design requirements, stainless steel strap anchors can be installed to tie the external wall panels to the ground floor slab. Generally these straps will be provided in accordance with the specific design requirements. The system can give an elemental U value within the range 0.27 W/m^2K to 0.21 W/m^2K as per schedule shown in Table 1.

Material	Conductivity (W/mK)	Thickness (mm)	U Value (W/m ² K)
Mineral Wool	0.036	140	0.27
PIR	0.023	80	0.27
PIR	0.023	90	0.25
PIR	0.023	120	0.21

Table 1: Typical U Values

The external finish may be of a proprietary cladding system. Such claddings must be approved by IAB for use with the system and a minimum cavity of 25mm must be retained between the cladding and the timber inner leaf.

2.2.4 Internal Walls

Load bearing and non-load bearing internal walls are formed from the Kingspan Century timber frame panels in a similar way to that for the internal leaf of the external walls. Panel strength and load bearing capacity will be in accordance with the particular specific structural design specifications. Vertical studs will be at closer centres where greater loading occurs. The panels for the internal walls, including load-bearing walls are sheeted.

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

2.2.5 Compartment/Separating Walls

Compartment / Separating walls are constructed using two independent timber framed leaves with a lining to each house comprised of two layers of plasterboard with staggered joints and the exposed joints filled and taped. One of the leaves of the wall is fitted with 100mm (minimum) rock mineral wool insulation within the stud frame.

At intermediate floors, where the floor joists run parallel to the compartment wall / Separating Wall, a solid continuous timber rim board must be fitted within the floor structure between lower and upper storey frames. Where the floor joists run perpendicular to the Compartment / Separating Wall a continuous header joist must be fitted. A continuous layer of wire reinforced rock mineral wool firestop is inserted to tight fit between the leaves of the wall, as shown in Figure 4(a).

At roof and ceiling level, special construction details must also be followed to ensure that the integrity of fire resistance and sound insulation are maintained. In general these follow the traditional principles of constructing a twin-leaf Compartment / Separating Wall from ceiling level up to roof profile with the slates or tiles running over it and the ceiling sheeted in accordance the plasterboard shown in Table 2. The attic portion of the compartment wall is constructed directly on top of the head plates of the lower storey panels with special spandrel panels, triangular in shape. An approved cavity barrier, (such as polythene wrapped compressed rock mineral wool cavity barrier or timber cavity barrier), is fixed between the two leaves at the level of the head plate of the topmost storey wall panels. To ensure that the passage of fire is retarded in the gap between the top of the roof structure and the soffit of the slates or roof tiles, rock mineral wool is packed between battens and tiles for the full width of the compartment wall so that the risk of fire creeping across the Compartment/Separating wall is significantly reduced. As an alternative detail for this section of the building an approved proprietary roof divides system can be installed.

As a further alternative the compartment /separating wall may be extended above the line of the external roof space to form a parapet wall.

Polythene wrapped compressed mineral wool cavity barriers are installed in the cavity of the



external walls where the compartment wall meets the external wall.

Details of the construction of a compartment wall are shown in Figures 4(a) and 6.

2.2.6 Compartment Floor, First Floor and Intermediate Floors

First and subsequent floors are constructed with prefabricated floor panels consisting of I-beams, LVL and Solid Timber, are designed with joists spanning onto load bearing timber framed walls, internal or external as the design dictates. Joist sizes and fixings are determined through structural design. Floor panels are detailed to allow on-site stitching of deck sheeting between adjacent panels where they meet; edge joists of the panels, which are close together, are also site nailed together with the appropriate thickness of packer between them. Figure 7 shows details of secure panel-to-panel joints. Ceiling sheeting is fixed after the floor structure has been constructed.

Compartment floors for the Kingspan Century Medium Rise Timber Frame construction system are installed along similar lines, but with a further construction layer on the deck and additional fire resistance in the ceiling. Typical construction details are shown in Figure 5.

2.2.7 Roof

Roofs are clad with slates, concrete tiles or IAB approved roof-cladding systems, and cladding is in accordance with ICP 2 Code of Practice for Slating and Tiling. The roof structure is comprised of Kingspan Century factory manufactured timber roof trusses or roof panels designed specifically for each building, assembled on site and both nail fixed and truss clipped to a continuous timber wall plate securely anchored to the internal leaf of the top storey external wall. Truss design, erection and bracing should conform with BS 5268:Part 2, 1996 Structural use of timber -Code of practice for permissible stress design, materials and workmanship, and BS 5268:Part 3, 1998 Code of practice for trussed rafter roofs. Gables are constructed with a fully sheeted spandrel truss panel and gable ladders, extending over the spandrel panel to form verge overhang. Typical roof construction details are shown in Figure 8.

2.2.8 Cavity Barriers and Fire Stops

To meet the requirements for complying with the Building Regulations 1997 to 2006, cavity barriers should be provided in walls and roof of the Kingspan Century Medium Rise timber Frame construction system as follows:

- Cavity barriers should be installed around all openings such as doors, windows, vents, openings for extractor fans, meter cupboards, etc.
- 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 / separating walls and external walls and in the roof at and over Compartment/Separating wall location; cavity barriers and fire stops should also be provided at the junctions between timber joist floors (both intermediate floors and compartment floors) and load bearing walls.

2.2.9 Ceilings, Internal Linings and Finishes

Linings to walls and ceilings are of plasterboard as outlined in Table 2 (fire rated where required for increased fire resistance) manufactured to BS 1230: Part 1: 1985 (1994) Specification for plasterboard excluding materials submitted to secondary operations. The plasterboard is attached to timber frame wall panels and the floor joists by means of self-drill screws in accordance with Gyproc recommendations to achieve the required fire rating. Joints in plasterboard wall linings and ceilings can be taped and filled for direct decoration. Alternatively skim coat plaster can be applied. Services can be accommodated frame, within the stud except f∩r Compartment/Separating walls, provided they do not hinder the provision of insulation or detract from panel performance and function. Where necessary, services can be located in conduits within a cavity created by fixing timber battens to sheeted panels and fixing a further layer of plasterboard or moisture resistant wallboard to the battens to conceal the services. For either solution it is essential that cavity barriers and fire stops are fully preserved.

2.3 COMPONENT MANUFACTURE AND QUALITY

Before a Kingspan Century timber frame building can be manufactured the structural design, including the specifications of all materials and elements for the individual components of the building, must be completed. With the inherent flexibility of timber frame manufacture and construction, the system presents good scope to match a range of panel types with individual architectural design. The architectural drawings of the project, prepared for the developer, are received and translated into a structural computer The CAD system aided design model. automatically calculates all framing requirements for walls, floors and roof trusses, and allows for all openings such as doors and windows. The design process will detail the panels and there will be consultation with the developer's architects on all aspects of design with a fullitemised quotation provided with the final scheme proposal. As a support to their design process, Kingspan Century will also undertake additional performance assessments on a proposed scheme. To facilitate efficient and accurate panel manufacture, each individual frame element is allocated a unique identification number and has its dimensions and characteristics set out. Before a drawing is transferred to production, it is checked and signed off by a structural engineer to ensure that full compliance with the Building Regulations 1997 to 2006 are achieved by the



design, including structural safety, structural fire safety and thermal efficiency requirements of the whole building.

Quality checks on finished panels include an overall visual check against the design specification with measured checks of dimensions, square-ness and planarity of panels. Manufactured product is dimensionally checked within the following tolerances:

- Length +0mm, -5mm
- Position of opening +2mm, -2mm
- Size of opening +2mm, -0mm
- Frame squareness +2mm, -2mm

Spot checks are carried out on the mechanical properties of manufactured panels.

All fixings and fasteners used with the system including ties, strap ties, bolts, screws, fasteners, etc, must be of stainless steel or otherwise adequately protected against corrosion. IAB has assessed and approved all fasteners included in the system. Only fixings, anchors bolts, joist hangers, wall ties and screws which have been approved by IAB for use with the system will be used in construction. All components in this category will require to be manufactured under an appropriate quality system.

All traditional materials used by the main contractor in sub-structure or in completion of claddings, i.e. masonry, slates, concrete tiles, additional linings, finishes, services, etc., 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 system.

2.4 DELIVERY AND SITE HANDLING

Delivery of building elements to site is arranged by Kingspan Century to suit the erection programme and reduce site storage to a minimum. Panels should be stored covered on a dry, clean, level base and must not be dropped or allowed to rest on projecting objects. Components should be handled carefully on site so that panel elements are not subjected to excessive warping or bending strains. A detailed list of all components is included with each delivery. Individual components are identified by a number that corresponds with the relevant erection drawing.

2.5 INSTALLATION PROCEDURE

2.5.1 Panel Erection

Kingspan Century, who are responsible for the marketing of the system, take full responsibility for the design and supervision of the erection of the complete panel structure with the site contractor acting as erector or subcontracting an erector, while also taking responsibility for ground works, external cladding to walls and roof, windows/doors and all finishing other than the assembled panel structure.

Kingspan Century or their appointed agent acting under their control undertakes assembly and erection of the individual panels and related

Element	Plasterboard Specification	Fire Resistance	Reference
External Walls – Non Combustible	1No. layer 12.5mm Gyproc Wallboard internally	30 minutes	BS 476 BS 5268 BRE Report 128
External Walls – Loadbearing	2No. layers 12.5mm Gyproc Wallboard internally	60 minutes	BS 476 BS 5268 BRE Report 128
Internal Non- Load Bearing Walls	1No. layer of 12.5mm Gyproc Wallboard to both sides	30 minutes	BS 476 BS 5268 BRE Report 128
Internal Load Bearing Walls	2No. layers of 12.5mm Gyproc Wallboard to both sides	60 minutes	BS 476 BS 5268 BRE Report 128
Compartment Walls	2No. independent leafs, with 19mm Gyproc Plank Board and 12.5mm Gyproc Wallboard to inner face	60 minutes	BS 476 BS 5268 BRE Report 128
Separating Walls	2No. independent leafs, with 19mm Gyproc Plank Board and 12.5mm Gyproc Wallboard to inner face	60 minutes	BS 476 BS 5268 BRE Report 128
Intermediate Floors	1No. layer of 15mm Gyproc Board to underside	30 minutes	BS 476 BS 5268 BRE Report 128
Compartment Floors	1No. 19mm Gyproc Plank Board and 1No. 12.5mm Gyproc Wallboard to underside	60 minutes	BS 476 BS 5268 BRE Report 128
Uppermost Ceiling	1No. layer of 12.5mm Gyproc Fire Line Board to underside	30 minutes	BS 476 BS 5268 BRE Report 128

Table 2: Schedule of Linings

components on site. 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, accuracy and reliability for all workmanship involved in the site installation of the system.



2.5.2 Supervision

Installers and erectors registered or authorised by Kingspan Century to complete the construction of the panel system on site, are subject to supervision. The arrangements for supervision have been assessed by IAB and found to be satisfactory. For the installer/erector supervision of erection includes 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 must be given to the installation of cavity barriers and fire stops at compartment walls, door and window openings, and as scheduled by Kingspan Century in their design brief to the main contractor.

In accordance with their 'Method Statement', Kingspan Century carry out a detailed examination of the system when the erection process is completed. In this examination the quality of workmanship is audited through a checklist and, where necessary, corrective actions are undertaken.

2.5.3 Procedure

To comply with this certificate it is necessary to observe the following procedures:

- All components delivered to site should comply with the Kingspan Century schedule for the project.
- Components must not be damaged and must be properly pre-marked for erection.
- All materials should be Quality Assurance marked, or otherwise accredited.
- The timber framed panels should not be erected 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 Century panel layout.
- Rooms must be checked for squareness.
- Stainless steel foundation anchor straps are fixed as specified by Kingspan Century and must be properly anchored to the rising wall or ground slab and the vertical studs of the ground storey panels. Timber sole plates must be shot fixed where specified. Where required by structural design, panels must be anchored laterally to the concrete substructure with additional stainless steel strap anchors.
- Floor joists and floor decking must be installed in according with the Kingspan Century design layout.
- Cavity barriers and Fire Stops must be installed at doors, windows, wall/roof junctions, compartment wall junctions and where design requires them.
- Roof trusses, including any necessary bracing, must be installed in accordance with the Kingspan Century design layout and construction manual.
- Wall ties must be of the correct material and correctly positioned and installed.
- All fasteners, screws, nails, strap anchors and wall ties must be approved by Kingspan Century.
- Modification should not be made to the designed system without authorisation from Kingspan Century.

Only trained erectors are used for the system. Kingspan Century train new erectors and supervise and inspect construction.





Figure 1(b): Foundation level





Figure 2: Foundation anchorage detail



Figure 3: Window detail









- 1. Tiling/slating batten to run over head of compartment wall and fixed to external runners at head of wall and also fixed to head pieces internally on wall as shown.
- 2. Saw cut battens at external faces of wall as shown taking care not to damage roofing felt.
- 3. Fill all gaps above and below roofing felt/membrane with suitable non-combustible fire stopping material over full width of wall.

Enlarged detail at head of Compartment Wall





Figure 4(b): 60 min Fire resistant load bearing internal wall section





One layer of 12.5mm plasterboard on one layer 19mm plank plasterboard with 100mm glass fibre insulation 10-33 kg/m³

Resilient Channel

Two layers of plasterboard to all structural walls supporting compartment floors to provide 1hr fire resistance

Figure 5(a): 60 min RSD Compartment floor





Figure 6: Compartment/Separating wall intersection with an external wall











Part Three / Design Data

3.1 STRENGTH AND STABILITY

3.1.1 Certificate of Structural Compliance

Kingspan Century undertake the structural design of every building constructed with the Kingspan Century Medium Rise Timber Frame construction system. Every building constructed with the 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 2006. Buildings designed and constructed in accordance with this Certificate will have adequate strength and stability with due account taken of site location and characteristics.

3.1.2 Design Standards

IAB has examined designs for typical buildings which have been completed by Kingspan Century and their structural engineers; these designs have been confirmed to be in conformance with the requirements of the Building Regulation 1997 to 2006. The design process conforms to the requirements of the following standards and guidance documents relating to the component design areas:

- IS 444: 1998 The use of structural timber in buildings – Structural elements
- BS 5268 *Structural use of timber,* Part 6 Wall panels, floor panels
- IS 193: 1986 *Timber trussed rafters for roofs* - Roof trusses
- BS 8004: 1986 Code of practice for foundations – Foundation design
- TRADA/DETR Design Guide on Multi-storey Timber Frame Buildings – Design
- BS 6399, Part 1: 1996 Code of practice for dead and imposed loads – Loading
- BS 6399, Part 2: 1997 Code of practice for wind loads – Loading
- BS 6399, Part 3: 1996 Code of practice for dead and imposed roof loads – Loading
- BS 8200:1985 Code of practice for the design of non-load bearing external vertical enclosures of buildings
- BS 5268, Section 6.1 Code of practice for timber frame walls – Dwellings not exceeding four storeys
- OSB 3 boards covered by IAB certification

Diagrams 14 and 15 in the TGD D to Part A of the Building Regulations 1997 to 2006, give the design snow and wind loading maps for Ireland. Based on these maps and the standards included above, the Kingspan Century design programme will determine the structural proportions of all elements necessary for a building located in 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 and these can be readily incorporated into the system.

3.1.3 **Provision for Differential Movement**

Differential movement arises where timber framed construction is used with masonry claddings. Over a short period of time timber framework contracts while brickwork expands. BS 5268 requires that wall ties should accommodate 6mm differential movement per storey. Due to differential movement, particular attention should be paid to sealing around windows. To preserve the seals under such conditions, the Kingspan Century system uses specially developed building details, including the installation of proprietary expanding/compressible sealing tapes at the joints between windows and masonry. Good practice with the system includes use material with moisture content lower than 18% in floor joists, use of 'I' beam floor joists and preloading the roof with slate or tile claddings before building the masonry cladding.

3.2 STRUCTURAL FIRE SAFETY

Structural fire safety requirements of Part B of the Building Regulations 1997 to 2006 are included in the Kingspan Century design process. Fire resistance and flame spread requirements can be met for up to four storey buildings with the Kingspan Century system by the use of plasterboard, cavity barriers and fire stops.

3.3 PROTECTION AGAINST COASTAL SALT SPRAY

The Kingspan Century construction system is protected from weather and coastal salt spray through the use of brick / masonry external cladding or IAB approved external cladding system. All metal fixings within the cavity of external walls are manufactured from stainless steel and are adequately protected from coastal salt spray.

3.4 IMPACT RESISTANCE

As the external walls are finished on the outside with a 100mm thick masonry leaf, or approved IAB external cladding systems there is no risk of external impact damage to the structure. The internal lining specified for walls is adequate to resist normal impacts; where severe impacts are likely, such as in production plant areas or storage buildings, timber frame panels can be sheeted internally with heavier grade plasterboard or plywood or other timber based sheeting, and plasterboard. Any exceptional impact to internal surfaces is unlikely to be sufficient to create significant damage.





Part Four / Technical Investigations

4.1 BEHAVIOUR IN FIRE

4.1.1 Fire Resistance

Assessment of fire test results shows that the Kingspan Century Medium Rise Timber Frame construction system can meet the Building Regulation requirements for fire resistance as shown in Table 2. Fire tests and assessments on Compartment/Separating walls and compartment floors show that they can meet the 60 minute requirement for Compartment/Separating walls and compartment floors in buildings up to four storeys for Purpose Groups 1(a), 1(b), 1(c), 2(b), 3, 4(a) and 5.

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 listed below. 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.*

Brick work/block work	Class 0
Slates/tiles	Class 0
Plasterboard internal lining	Class 0
OSB 3 board	Class 3
Timber boarding	Class 3

In general internal and external wall surfaces and ceilings will have a Class 0 flame spread rating.

4.1.3 Protection of Building

Combustible material should be separated from the flue of a chimney in accordance with details provided by Kingspan Century. Particular details are given in section 2 and diagrams 2 to 6 of the TGD to Part J of the Building Regulations 1997 to 2006. The required separation distance from a heating appliance to combustible material should be as set out in Clause 2.2.2 and diagram 8 of the TGD to Part J of the Building Regulations 1997 to 2006.

Combustible material in proximity of a constructional hearth must be protected by 250 mm of solid concrete or as detailed in Diagram 4 of the TGD to Part J of the Building Regulations 1997 to 2006.

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 TGD to Part B of the Building Regulations 1997 to 2006.

4.1.5 Cavity Barriers and Fire Stops

The Kingspan Century design incorporates suitable cavity barriers and fire stops in compliance with the requirements of the Building Regulations 1997 to 2006 and as shown in Figures 4(a), 4(b), 4(c), 5, and section 2.3.10 of the TGD to Part B of the Building Regulations 1997 to 2006.

4.2 THERMAL INSULATION

4.2.1 U-Values

The U-values (thermal transmittance measured in W/m²K) of the system elements are calculated in accordance with Part L of the Building Regulations 1997 to 2006. The U-value of the standard external wall specification, using 140mm of fibreglass insulation within the timber panels and a rendered concrete block work external leaf, is 0.27 W/m²K. This is the elemental 'U' value required in Part L of the Building Regulations 1997 to 2006. Using insulation materials with λ value of 0.023 W/mK, U values as low as 0.18 W/m²K can be achieved.

4.3 CONDENSATION

4.3.1 External Walls

The insulation levels in the external walls and the provision of vapour check layers and good building detailing indicate that there should not be a problem with surface or interstitial condensation in 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.

4.3.2 Roof Ventilation

Adequate provision must be made by means of continuous soffit 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 TGD to Part F of the Building Regulations 1997 to 2006 illustrate the appropriate way to provide ventilation in the roof. Only approved tile/slate underlay should be used.

4.4 SOUND

4.4.1 Compartment/Separating Wall

The Compartment/Separating wall specified for the Kingspan Century Medium Rise construction system is made up of two independent walls with a clear gap of 50mm between them; the specification of each wall is as follows:

- 19mm sound check board fixed horizontally to room side of timber frame
- 12.5mm plasterboard fixed vertically over plank plasterboard, with staggered joints between both plasterboard layers
- 100mm rock mineral wool acoustic insulation packed into the cavity between the studs





A continuous wire reinforced rock mineral wool Firestop is tightly fixed between the two independent leaves of the Compartment/Separating wall at intermediate floors and compartment floors. A cavity barrier is fixed between the two leaves of the Compartment/Separating wall at ceiling and roof levels. At ground level the gap between the two leaves of the Compartment/Separating wall is extended at least 215mm below floor finish level. Double sole plates and head plates are fixed at intermediate floor levels and roof level and floor joists are; where a trimmer of less than 50mm in thickness is used, solid bridging with 42 or 50mm joist sections must be used so that sound bridging is avoided.

4.4.2 On-Site Testing

On site airborne sound insulation tests were carried out on a Compartment/Separating wall constructed to the proposed Compartment/Separating 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 Compartment / Separating wall shown in Figure 4(a) the measured sound insulation exceeded the requirements of Part E of the Building Regulations 1997 to 2006.

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 TGD to Part M of the Building Regulations 1997 to 2006. The Kingspan Century system can meet these requirements.

4.5.2 Sanitary Convenience

Buildings based on the Kingspan Century 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 2006.

4.6 WEATHER TIGHTNESS AND DAMP-PROOFING

4.6.1 DPCs, DPMs

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 Certificate and the manufacturer's instructions.

4.6.3 External Walls

The external walls with traditional masonry outer leaf and a 50 mm clear vertical cavity, will, when properly constructed, prevent the passage of rainwater to the cavity face of the inner leaf of the wall. The joints between adjacent panels are weatherproofed and any penetrations for services are sealed. IAB approved cladding systems may be specified as an alternative.

4.6.4 Windows and Doors

This Certificate does not cover the performances of windows and doors. 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 avoid damaging the panels, membranes, claddings or finishes. The cutting of holes through the panels should be done in accordance with Kingspan Century details, so that there will be minimum loss of insulation or reduction in weather tightness. To avoid the risk of local condensation, the enclosure of cold-water pipework should be on the warm side of the insulation. Also, electrical cables should not be run within the insulation to avoid over heating of the cables.

4.8 DURABILITY

Buildings constructed using the Kingspan Century system, when properly constructed in accordance with the design process, the erection manual and the requirements of this Certificate and all relevant codes of practice, should 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 superior thermal insulation levels
- CFC/HCFC-free insulation with zero Ozone depletion potential



- For correctly designed and built walls and roofs based on the 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 minimise the risk of moisture gain in timber based materials
- Externally exposed cladding materials are conventional durable materials with proven long life endurance or IAB approved external cladding systems.

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.

Periodic examination of the seals around windows and doors should be carried out.

4.10 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING:

- Structural strength and stability:
- Behaviour in fire;

Part Five / Conditions of Certification

- 5.1 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 accordance with the manufacturer's in instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue so long as:
 - (a) the specification of the product is unchanged.
 - (b) the Building Regulations 1997 to 2006 and any other regulation or standard applicable to the product/process, its use or installation remains 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.

- Resistance to airborne and impact sound transmission;
- Thermal transmittance evaluation and condensation risks analysis for walls and roof;
- Examination of four-storey building subjected to severe loading and environmental testing and assessment of the results of an extensive test programme on a prototype building design aimed at exceeding Building Regulation requirements.

4.11 OTHER INVESTIGATIONS

Existing data was examined to assess:

- Adequacy of structural design;
- Weather-tightness of buildings constructed using the Kingspan Century system;
- Durability of the system;
- Maintenance requirements of the system.

Production audits were carried out at the design unit and production facility of Kingspan Century 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.



- (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.
- (f) the registration and/or surveillance fees due to IAB are paid.
- **5.2** The IAB mark and certification number may only be used on or in relation to product/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 the products already marked.
 - **5.3** In granting Certification, the NSAI makes no representation as to;
 - (a) the absence or presence 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/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 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. **04/0198** is accordingly granted by the NSAI to **Kingspan Century Ltd.** on behalf of The Irish Agrément Board.

Date of Issue: February 2004

Signed

Seán Balfe Director, Irish Agrément Board

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) 807 3800. Fax: (01) 807 3842. www.nsai.ie

Revisions: January 2007

• General revisions.