IRISH AGRÉMENT BOARD
CERTIFICATE NO. 20/0415
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Altherm Insulating Concrete Formwork System

NSAI Agrément (Irish Agrément Board) is designated by Government to issue European Technical Assessments.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with TGD Part D of the second schedule to the **Building Regulations 1997 to 2024**.

PRODUCT DESCRIPTION:

This Certificate relates to the Altherm Insulating Concrete Formwork (ICF) System, which consists of modular interlocking expanded polystyrene (EPS) building blocks (graphite enhanced) for permanent formwork for the construction of in-situ concrete walls. Each block (form) is based on two EPS panels separated by 150 or 200mm with embedded polypropylene connectors bridging the gap. The overall block thickness ranges from 300 to 400mm, depending on the required EPS and concrete core thickness. An NSAI certified external render system which meets the requirements of this certificate is applied to the external polystyrene insulation of the ICF System as the external finish. Plasterboard slabs are screw-fixed to the polypropylene connectors as an internal finish. In the opinion of NSAI, the Altherm ICF System as described in this Certificate, complies with the requirements of the Building Regulations 1997 to 2024, hereafter referred to as the Building Regulations.

USE:

The Altherm ICF System is certified for use in the construction of buildings of up to 15m in height, as defined in Technical Guidance Document (TGD) Volume 2 to Part B of the Building Regulations 1997 to 2024 for purpose groups 1(a), 1(b) and 1(d). The system can also be used up to 15m in height, with specific requirements set out in TGD Volume 1 to Part B of the Building Regulations 1997 to 2024, for purpose groups 1(c), 2(a), 2(b), 3, 4(a), 5(a) and 5(b). The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings.

MANUFACTURE AND MARKETING:

The product is manufactured and marketed by:

Altherm ICF Ltd.,
Unit F Airport Business Campus,
Santry,
Dublin 9.

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Altherm ICF System if used in accordance with this Certificate can meet the requirements of the Building Regulations 1997 to 2024, as referenced in Section 1.2 of this Irish Agrément Certificate. Guidance was adopted from the EAD 340309-00-0305 Non-Load-bearing Permanent Shuttering Kits/Systems Based on Hollow Blocks or Panels of Insulating Materials and Sometimes Concrete[1], where appropriate in the assessment.

1.2 BUILDING REGULATIONS 1997 to 2024

REQUIREMENTS:

Part D – Materials and Workmanship

D3 – The Altherm ICF System, as certified in this Certificate, is comprised of 'proper materials' fit for their intended use (see Parts 3 and 4 of this Certificate).

D1 – The Altherm ICF System, used in accordance with this Certificate, meets the requirements of the building regulations for workmanship.

Part A - Structure

The Altherm ICF System, as certified in this Certificate, has adequate strength and stability to comply with Part A of the Building Regulations (see Parts 3 and 4 of this Certificate).

A1 – Loading
A2 – Ground Movement
A3 – Disproportionate Collapse

Part B – Fire Safety
Part B Vol 2- Fire Safety

B1 & B6 – Means of Escape in Case of Fire

The Altherm ICF System can be designed to meet the requirements in respect of means of escape in case of fire.

B2 & B7 – Internal Fire Spread (Linings)

The plasterboard slabs used on the internal finish shall meet or exceed class A2-s1,d0. The reaction to fire classification of the finished construction will be determined by the class of the lining materials used.

B3 & B8 – Internal Fire Spread (Structure)

The Altherm ICF System, used in accordance with this Certificate, meets this requirement.

B4 & B9 – External Fire Spread

The NSAI certified external render selected for use with the Altherm ICF System, per Section 2.1.12 below, must have a spread of flame rating equivalent to Class B-s1,d0.

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 gas. Where it is shown that protection from dangerous substances such as Radon is required, an approved gas resistant membrane and gas handling system must be provided under the ground floor, in accordance with TGD to Part C of the Building Regulations. The Altherm ICF System permits the incorporation of the appropriate membrane, sump and gas handling system.

C4 – Resistance to Weather and Ground Moisture

The Altherm ICF System, used in accordance with Part 3 of this Certificate, will have adequate weather resistance in all exposures, will resist the passage of moisture to the inside of the building and will prevent surface or interstitial condensation.

Part E – Sound

E1 & E2 – Airborne and Impact Sound

Separating walls can be designed and constructed to meet the airborne sound level performance outlined in Table 1 of TGD E of the Building Regulations. Separating floors can be designed, detailed and constructed to meet the airborne and impact sound level performance outlined in Table 1 of TGD E provided good workmanship is adhered to onsite.

Part F – Ventilation

F1 – Means of Ventilation

Adequate building ventilation openings can be provided in walls constructed with the Altherm ICF System. It is essential that ventilation ducts through such walls are fully sealed within the walls or from contact with the cut edges of adjacent materials. Alternatively, a mechanical ventilation system can be installed into the thermal airtight envelope which the Altherm ICF System provides. Penetrations in fire rated walls and floors must be appropriately fire stopped, see section 2.4.8.

F2 – Condensation in Roofs

Adequate ventilation can be provided in roofs to meet this requirement in respect of the prevention of condensation.

Part J – Heat Producing Appliances

J1 – Air Supply
J3 – Protection of Building

When the Altherm ICF System is used in accordance with Clause 4.1 of this Certificate, wall lining, insulation and separation distances meet the Regulation requirements.

Part L – Conservation of Fuel and Energy
L1, L5 & L6 – Conservation of Fuel and Energy
The Altherm ICF System will contribute to enabling a building to meet this requirement. U-value and Psi value calculations may be based on a λ value = 0.030W/mK for graphite-enhanced EPS and 0.034W/mK for standard (white) EPS. U-values for the product range are presented in Table 1. Consult TGD Part L for maximum elemental U-values.

Part M – Access for People with Disabilities
M1 – Access and Use
Buildings based on the Altherm ICF System can be designed to meet the access, circulation and facilities requirements of this Regulation.

Part Two / Technical Specification and Control Data 2

2.1 PRODUCT DESCRIPTION
This Certificate contains illustrations to explain the various elements of the Altherm ICF System. These illustrations are not intended to be used as construction drawings. The terms Project Engineer or Architect, as used in this Certificate, defines the competent person responsible for co-ordinating individuals or companies providing specific expertise. The Client's Structural Engineer, who may also be the Project Engineer, in conjunction with the design team on a project, will produce a set of project specific details on a project-by-project basis. All drawings should be compliant with the relevant codes of practice and relevant standards, along with current Building Regulations.

2.1.1 General
The Altherm ICF blocks are comprised of two EPS panels which are connected by polypropylene webs that maintain a core thickness of either 150mm or 200mm between the EPS panels. Table 1 lists the panel/core configurations. The hollow blocks are stacked in courses in a stretcher bond pattern to form a permanent shuttering kit for walls. The forms are closed at openings by insertion of Altherm ICF closers, which are factory moulded EPS sections that slide in between the ICF panels. After placement of the forms the cavity between the panels is filled with concrete to produce the wall.

Once the concrete has set, a monolithic concrete wall is formed. The poured wall then retains the Altherm formwork insulation. The ICF therefore forms an essential part of the thermal insulation of the wall and the supporting layer for internal and external wall finishes for the life of the building.

Altherm ICF blocks come in straight and 90° plan sections. The thickness of the concrete core is either 150mm or 200mm. The blocks are 400mm high and 1200mm in length, with an EPS thickness of 75mm or 100mm. The panels are manufactured from fire retardant grade EPS in accordance with I.S. EN 13163[2], without the use of HCFC's. The minimum density is 24kg/m^3.

The panels have castellated top and bottom edges to enable the forms to interlock together. Vertical edges are grooved to form a flush fit when joined together. Forms are interlocked with staggered vertical joints.

The polypropylene web flanges are embedded at least 15mm within the outer surface of the EPS panels during manufacture. These embedded flanges can be used as furring strips to provide a fixing for bracing during construction and attachment of the interior plasterboard slab wall finish. The location of the web flanges is indicated on external surfaces of the panels through recessed grooves in the panel surface at 200mm vertical centres. The top edges of the inner span of the webs have clips for placing of horizontal steel reinforcing bars where required. Vertical steel reinforcement is also placed at intervals as required.

2.1.2 Structure
The concrete specification to I.S. EN 206[3] including:

- Minimum concrete strength: C20/25 for exposure class XC1[3].
- Maximum aggregate size: 10mm
- Concrete slump: S3 (110-140mm)
- Concrete supplier certified to I.S. EN 206[3].

Notwithstanding minimum specification above, project specific concrete specification is to be determined in accordance with approved Project Engineer's Specification document.

2.1.3 Steel Reinforcement
The steel reinforcement to be used should be 12mm diameter round or deformed bars, high tensile to BS 4449[4], BS 4483[5], I.S. EN 10020[6], and I.S. EN 1992-1-1[8], and have a maximum yield strength of 500N/mm^2.

2.1.4 Foundations
The foundations are not part of the Altherm ICF System and are not covered by this Certificate. Foundation design must comply with TGD to Part A of the Building Regulations. Altherm ICF will provide loading information for foundations.

2.1.5 External Walls

The different elements of the external wall are as follows, from external surface to internal:

- External render system per 2.1.12 below.
- 75mm or 100mm EPS board.
- 150mm or 200mm reinforced concrete core width with embedded Altherm polypropylene webs.
- 75mm or 100mm EPS board.
- 12.5mm plasterboard slabs screw fixed to the Altherm polypropylene webs.
- 4mm gypsum skim coat plaster applied over the taped plasterboard joints or on the overall wall.

The external renders certified for use onto EPS are outlined in section 2.1.12 and detailed in their own NSAI Agrément Certificates.

2.1.6 Compartment Walls

The compartment wall consists of the following:

- 4mm gypsum skim coat plaster applied over the taped plasterboard joints or on the overall wall.
- 12.5mm plasterboard slabs with reaction to fire classification of A2-s1,d0 screw fixed to the polypropylene webs.
- 75mm or 100mm EPS board.
- Altherm ICF form with 150 or 200mm reinforced concrete core width.
- 75mm or 100mm EPS board.
- 12.5mm plasterboard slabs with reaction to fire classification of A2-s1,d0 screw fixed to the polypropylene webs.
- 4mm gypsum skim coat plaster applied over the taped plasterboard joints or on the overall wall.

With regard to sound transmission, the Altherm ICF 200mm concrete core has a mass in excess of 480kg/m^2 and this meets the requirements of Diagram 4 of TGD to Part E of the Building Regulations. The 150mm concrete core wall, constructed as described above, has been tested and can meet the requirements of TGD E.

With regard to reaction to fire, Class A2-s1,d0 12.5mm gypsum plasterboard slabs are screwed to the webs of the polypropylene connectors resulting in internal wall linings that are acceptable for all areas according to the TGDs to Part B of the Building Regulations. Section 4.1.1 of this certificate references the requirements of TGD B Volume 1 in respect of compartment wall fire performance for specific purpose groups and permitted heights.

Plasterboard lining may be omitted in the attic (loft) space of two storey housing, provided the space is a non-habitable area without permanent access. Hazardous items should not be stored and a risk assessment must be carried out if the attic space is used to house mechanical or electrical equipment. The publication 'Loft Conversion Guidelines'[34] should be consulted regarding compliance with the Building Regulations, in the event of future conversion from non-habitable use.

2.1.7 Internal Walls

Load bearing internal walls are constructed using the 300mm or 350mm form for a 150mm core with an alternative 350mm or 400mm form for a 200mm core, see Table 1 for form types. Internal walls are finished as per compartment walls, see section 2.1.6. Traditional masonry block internal walls and timber or metal stud internal walls can also be used with the system.

2.1.8 Floors

Generally ground floors will be floating concrete slabs with insulation below or above the slab, with the upper floors in timber or hollowcore. All compartment floors must be constructed using hollowcore slabs.

Form Type	Form Thickness (mm)	Insulation Panel 1 (mm)	Concrete Core (mm)	Insulation Panel 2 (mm)	U-value (W/m^{2}K)	U-value (W/m^{2}K)
					Grey	White
300/75	300	75	150	75	0.20	N/A
350/100	350	100	150	100	0.15	0.17
350/75	350	75	200	75	0.20	N/A
400/100	400	100	200	100	0.15	0.17

Table 1. Form configurations with corresponding U-values.

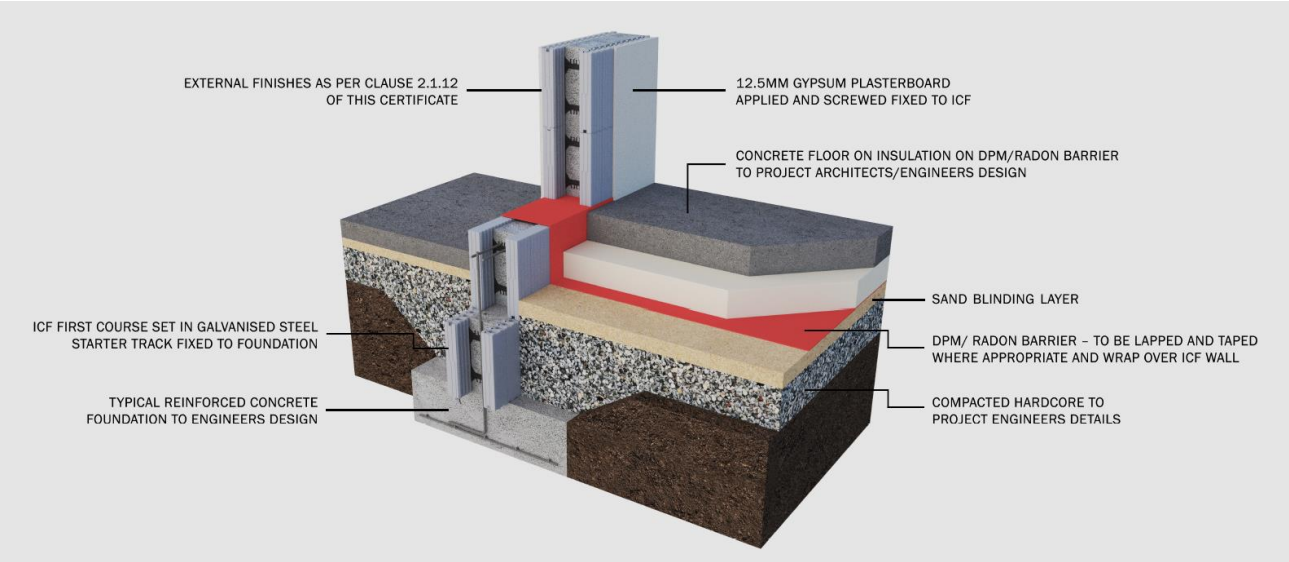

Figure 1: Foundation Detail

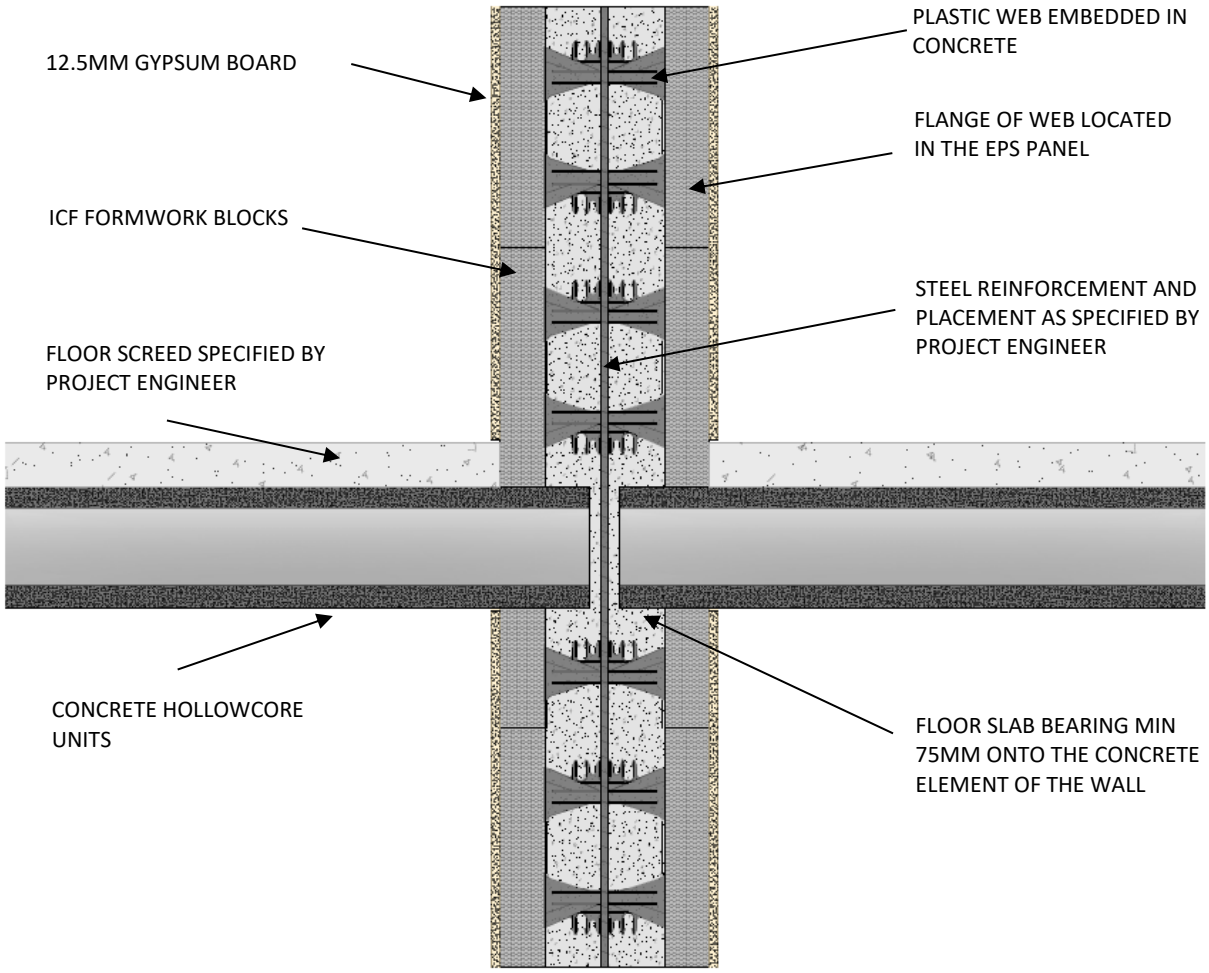

Figure 2: Precast Hollowcore Floor on Interior Compartment Wall

2.1.8.1 Suspended Ground Floor Slabs

When the depth of fill under the ground floor slab exceeds 900mm it will normally be necessary to suspend the ground floor slab, either using an in-situ reinforced concrete slab or a precast system.

2.1.8.2 Precast Floor/External Wall Connection

The bearing surface should be nominally 100mm, minimum 75mm, as specified in I.S. EN 1992-1-1[8]. The slabs are bedded in 1:3 mortar placed on top of the wall. The minimum cover to the vertical reinforcing steel must be at least 30mm, as specified. The form straddling the transition between the walls and the floor is cut as required to allow the smooth transition between the floors. This form is filled with concrete of the same specification as the rest of the wall. The floor/wall dowels may be bent as shown or alternatively connection bars can be hooked around the vertical bars to secure the structure.

2.1.8.3 Timber Floors

In two storey construction, first floors are assumed to be formed using solid or open web timber floor joists fixed to the load bearing walls using a ledger board secured to the concrete using the Altherm concrete pocket detail in Figure 8 or a proprietary hanger system approved by the project engineer.
Where intermediate floors have open void space for the provision of services, either by the use of Engineered Joists, as per Supplementary Guidance to TGD B Volume 2 2017, or counter battens below traditional solid joists, then the risk of fire spread within the floor void is greatly increased. Where required, interior fire barriers must be installed as described in section 4.1.1 of this certificate.

2.1.9 Roof

The Altherm ICF System allows for the supply by others of a conventional timber or trussed roof with slating or tiling in accordance with SR 82[10].

2.1.10 Stairs

Stairs are not part of the Altherm ICF System and are not covered by this Certificate.

2.1.11 Chimney

Chimneys are not part of the Altherm ICF System and are not covered by this Certificate. The requirements of Clause 2.15 of TGD to Part J of the Building Regulations require that combustible material such as polystyrene insulation have at least the following separation distance:

a) 200mm from a flue, or
b) 40mm from the outer surface of a brick or blockwork chimney or fireplace recess.

2.1.12 External Finish

An external render system certified by NSAI Agrément for use onto EPS which meets the requirements of Section 3 and 4 of this Certificate is applied to the external polystyrene insulation of the Altherm ICF System. A typical external render system consists of the following:

- Basecoat consisting of high polymer modified cement product
- Reinforcing mesh consisting of alkali resistant glass fibre mesh, 160g/m2
- Second basecoat consisting of high polymer modified cement-based product.
- Topcoat primer.
- Render Topcoat finish consisting of silicone/acrylic.
- topcoat, available in a variety of colours and grain sizes, as certified.
- Ancillary items such as PVC beads, fixings and approved fire stops.

Only a complete render system (finish coat, primer, base coat and mesh) which is part of a current NSAI certified Agrément Certificate may be used with the ICF system. The render must also be approved by the relevant ETICs Certificate holder and Altherm before application to the ICF.

Installers of the render must be currently registered on the NSAI External Thermal Insulating Composite Systems (ETICS) Installer Scheme for the Certificate containing the chosen render. Before this can proceed, the fire barriers must be fitted opposite all separating walls and floors (see Section 4.1.1). For impact resistance of external walls, see Section 3.1.5.

2.1.13 Ancillary Items

- Anchor bolts;
- Proprietary timber ledger/joist connection system to engineers specification;
- Brickwork/stonework ties;
- PVC pipe sleeves for penetrations;
- Waterproofing membrane;
- Course thread drywall screws;
- Corner rods – hollow polypropylene rods;
- ICF push/pull braces (see section 2.4.6 below);
- Fire stops.

The ancillary products listed are outside the scope of this certificate and each product remains under the respective manufacturer's responsibility.

Property	Test Method	Value
Declared Thermal Conductivity (50mm)	I.S. EN 12667	0.030 W/mK (Grey EPS) or 0.034 W/mK (White EPS)
Compressive Strength at 10% Deformation	I.S. EN 826	129 kPa
Bending Strength	I.S. EN 12089	329.65 kPa
EPS Density	I.S. EN 1602	Min 24kg/m^3
Reaction to Fire	I.S. EN ISO 11925-2, I.S. EN 13501-1	Euroclass E
Water Vapour Permeability	I.S. EN 12086	0.7208 mg/l.h.Pa
Water Absorption by Partial Immersion	I.S. EN 12087	0.23kg/m^2
Water Absorption by Total Immersion	I.S. EN 12087	2.1%

Table 2: Properties of EPS used in Altherm ICF System

2.2 MANUFACTURE

The EPS building blocks are manufactured by Altherm ICF. The modular units are moulded with the interlocks and with markings on the block face showing the locations of the polypropylene connectors. Each EPS building block is manufactured with its integral polypropylene connectors. Production is controlled at different stages through inspections and quality control checks per the Altherm ICF Quality Manual and Inspection Schedule.

2.3 DELIVERY, STORAGE AND MARKING

Forms are delivered to site in suitable protective packaging. All packaged components are clearly labelled with product type and production date allowing full traceability of supply.

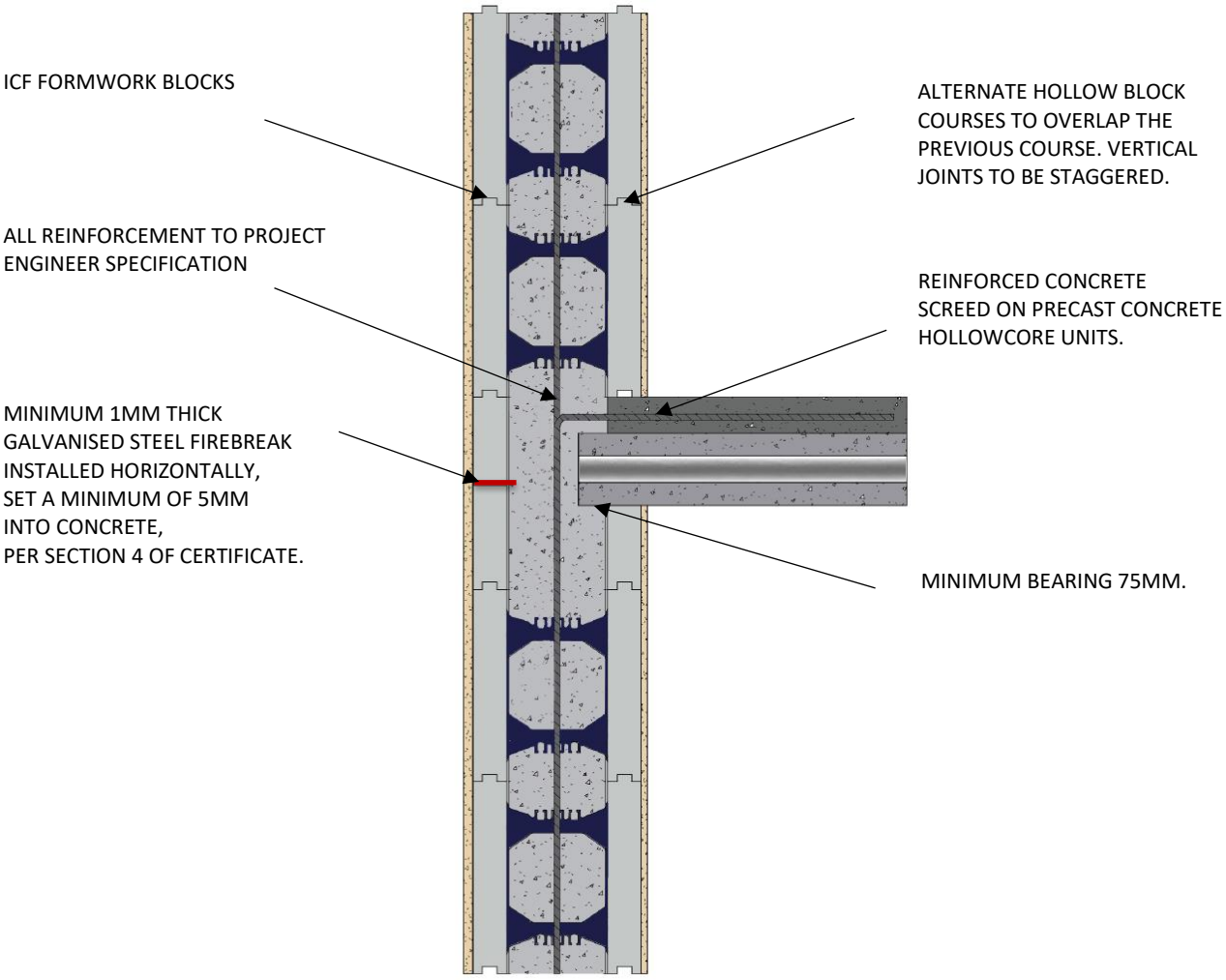

Figure 3: Altherm External wall - Bearing Detail for Precast Floor

Altherm ICF System components should not deteriorate in normal storage conditions so long as they remain in their packaging protected from the environment prior to use. Storage must be on firm, level and dry ground, and if the components are to be stored outside, they may be further protected from the weather by a secured covering. Altherm ICF System materials should be protected from prolonged exposure to direct sunlight and must not be exposed to plastic materials containing plasticizers or to volatile aggressive solvents. The polystyrene must not come into contact with aggressive chemicals or deleterious agents, e.g. diesel oil, petrol, various cleaning solvents, hydrocarbons, membranes containing coal tar pitches or building products containing solvents.

The forms are easily handed on site and may be readily cut or trimmed with a knife or fine toothed saw. Reasonable care must be taken however to prevent damage to forms before, during and after installation. The forms must not be punctured, split, deformed or unduly compressed before use.

2.4 INSTALLATION

2.4.1 General

Altherm ICF undertakes responsibility for the design and manufacture of the system. An approved Altherm Design Guideline for Housing is available (see Section 3). Site construction is undertaken using approved installers in accordance with the Altherm Installation Manual. A pre-rendering checklist report shall be completed before rendering commences, which shall include checking that all fire barriers are correctly installed. The external render system shall be applied by NSAI Agrément registered installers of render onto ICF systems in accordance with the render specification.

Concrete working best practice should be followed in both hot and cold conditions. The concrete may be placed when the air temperature is between 5°C and 30°C.

This Certificate does not contain a complete set of installation instructions, but an overview of the procedures involved. For a full list of these instructions, refer to the Certificate holder's manuals. Should a conflict arise between this Certificate and the Certificate holder's manuals, this Certificate shall take precedence.

2.4.2 Foundations

Foundations are not covered by this Certificate. However, foundations and substructures must comply with the relevant clauses of BS 8004[11], I.S. EN 1992-3[12] and BS 8102[13], as appropriate, and must provide a flat and level footing for the first course of ICF blocks Any reinforcing bars cast into the substructure must be positioned such that they allow for compaction and located in the system with adequate concrete cover for protection. The foundation base from which the Altherm ICF System is to be built must be checked to ensure it is clean, flat and level.

2.4.3 Damp Proof Course (DPC)

Forms with appropriate materials and workmanship can produce adequately damp proof structures by using a layer of water resisting concrete, a minimum of 150mm above external ground level, in accordance with Type B structures defined in BS 8102[13]. Alternatively install a DPC, e.g. brush applied liquid membrane. The external detail must be such that protection is provided up to a minimum of 150mm above the external ground level (see Figure 1) The system also permits the easy incorporation of an NSAI Agrément approved radon membrane where required, and also a sump and gas handling system.

2.4.4 Wall Assembly

When setting out the first course, it is recommended to start at the corners and work inwards towards the centre of the wall. It is important to run the forms through the window and door openings initially (the forms can be cut out later). This ensures proper spacing so that the forms will interlock correctly above the door/window openings.

On reaching the centre of the wall, cut the final form to the required size. After the first course is completely in place, start the second course working in from the corners again as per the first course. Vertical joints between forms should never coincide with those of the course below, so remember to reverse the corner block which will stagger the vertical joints in a stretcher bond pattern. It should always be checked that the polypropylene webs inside the forms align vertically for every course.

Once the second course is in place, the interlocking design of the Altherm form will create a "self-levelling" effect. At this stage, all corner walls are checked for straightness. The forms should be secured to the footing or slab using low expansion foam. After the forms are secured, measure and mark the centre of each door and window opening. If necessary, place the first horizontal reinforcing steel as per the engineer's specifications. Segments cut from standard forms are used to make up wall lengths and should ideally be placed adjacent to large openings. Cuts should be made along the grooves on the face of the forms so that successive courses will interlock correctly. All cuts and weak spots must be reinforced or glued.

Internal wall formwork is jointed into external formwork by removal of a vertical slice.

Where the specified elevation height is not a multiple of the standard form, units may be trimmed using woodworking tools. See section 2.4.7 for formation of door and window openings.

2.4.5 Reinforcement Placement

Horizontal reinforcement can be placed in different locations across the concrete fill void using the form tie/spacer toothed slots. Horizontal reinforcing bars for lintels must be located within the lintel as specified in the structural design, the minimum length of bar will be specified by the chartered structural engineer to ensure that adequate anchorage has been allowed for either side of an ope. Vertical reinforcement can then be secured to horizontal reinforcement at required centres using standard fixing methods. Bar lapping lengths as per I.S. EN 1992-1-1[8] should be adopted. The system requires that in plain walls horizontal reinforcement be provided in top and bottom courses of every wall lift. The reinforcement is checked to ensure there is adequate concrete cover for protection and that compaction can take place. The horizontal and vertical reinforcement shall be specified by the chartered structural engineer (see Section 3.1.1).

2.4.6 Bracing

The bracing system is installed following installation of the third or fourth course of forms. Temporary bracing and propping during construction is essential to maintain alignment and adequate lateral stability during concrete filling. The installer is responsible for ensuring the adequacy of all temporary bracing. As a minimum, the full height of the assembled formwork system must be supported 700mm from corners and along the length of each wall at maximum horizontal centres of 1.8m.

All lintels must be adequately supported until the concrete has attained its minimum working strength. On exposed sites or in adverse weather conditions further support may be necessary. Typically, the bracing and alignment systems are placed on one side of the formwork (usually the inside face) during construction, however for very long or walls greater than one storey height, bracing on two sides is recommended. Altherm recommend push/pull bracing systems that do not include working platforms. Where combined bracing/platform systems are used, please consult the HSA 2018 Code of Practice for Access and Working Scaffolds[32].

2.4.7 Openings

The rigidity of the formwork is reduced by window and door openings but is increased by the incidence of corner and crosswall details. Openings are formed during construction of the formwork. Altherm ICF EPS cavity closers are used to close openings created for door and window openings. Openings are cut allowing tolerance for on-site adjustments when installing windows and doors. Timber framing and bracing must be installed for temporary support during the concrete pour.
Where joists are installed, they are fixed directly into the concrete core, as shown in Figure 8. Refer to Clause 2.1.8.

2.4.8 Services

Wall openings or ducts for service penetrations can be positioned within the formwork prior to concrete pouring. At all service entry points, care must be taken to effect a properly sealed joint to prevent the ingress of vermin or moisture. Gaps in the insulation may be made good by filling and sealing with a self-expanding polyurethane foam. Service entry points to basement walls should be avoided.

Where services are to penetrate the wall, a duct or sleeve through the Altherm ICF System should be inserted prior to placing the concrete. Electrical cables should be ducted (to avoid plasticizer migration). At a minimum, the cables must be placed in PVC conduit and must be sized to minimise heat build-up with resulting fire risk, in accordance with I.S. 10101[14]. Electrical sockets and switches shall be installed in PVC or metal boxing.

2.4.9 Pre-Pour Checks

Once the bracing and propping is erected, adjustments are made for plumb, alignment and level by use of the push/pull screws. Reinforcement should be checked for correct cover distance and rigidity. Before the initial pour and between concrete pours, care must be taken to remove any debris from inside the formwork. All reinforcement must be checked by registered installer.

2.4.10 Concrete Placement

Adequate supervision and care by the installer is needed when placing concrete. Concrete can be placed using line pump or overhead boom from a concrete pump lorry. Small volumes of concrete can be placed by hand, e.g. to make up small deficiencies at the end of each pour or to the sill of window openings. The concrete should be directed into the central cavity away from corners and not directly against the polystyrene units in 1.2m lift height allowing concrete to free-flow into corners and below window openings. The first lift is allowed to stiffen before placing the second lift of concrete. Typically, storey heights should be placed in two storey lifts. When forming construction joints between concrete pours, these should be located within 100mm of the top of the Altherm ICF System for ease of access and visual checking. Construction joints should be horizontal rather than vertical.

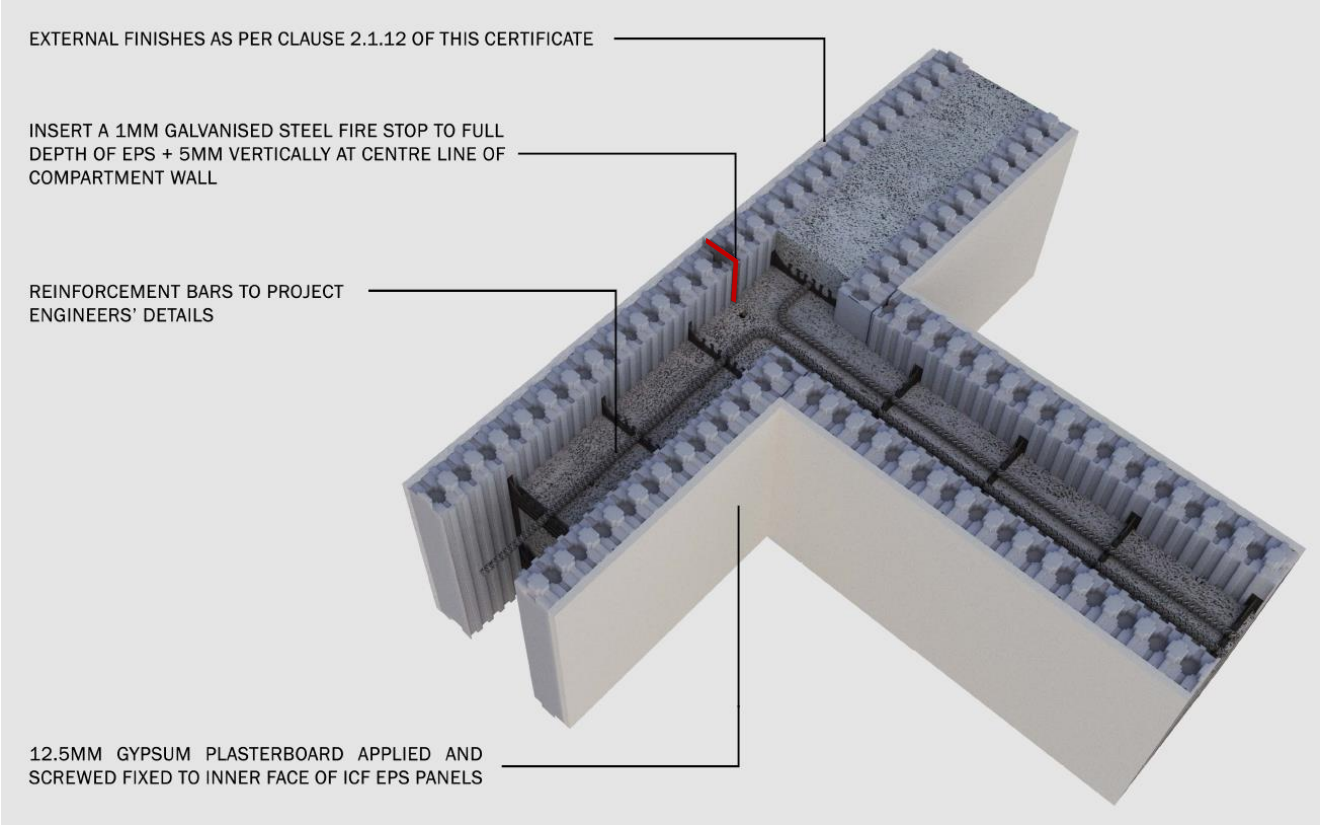

Figure 4: 300mm 'T' Junction Detail

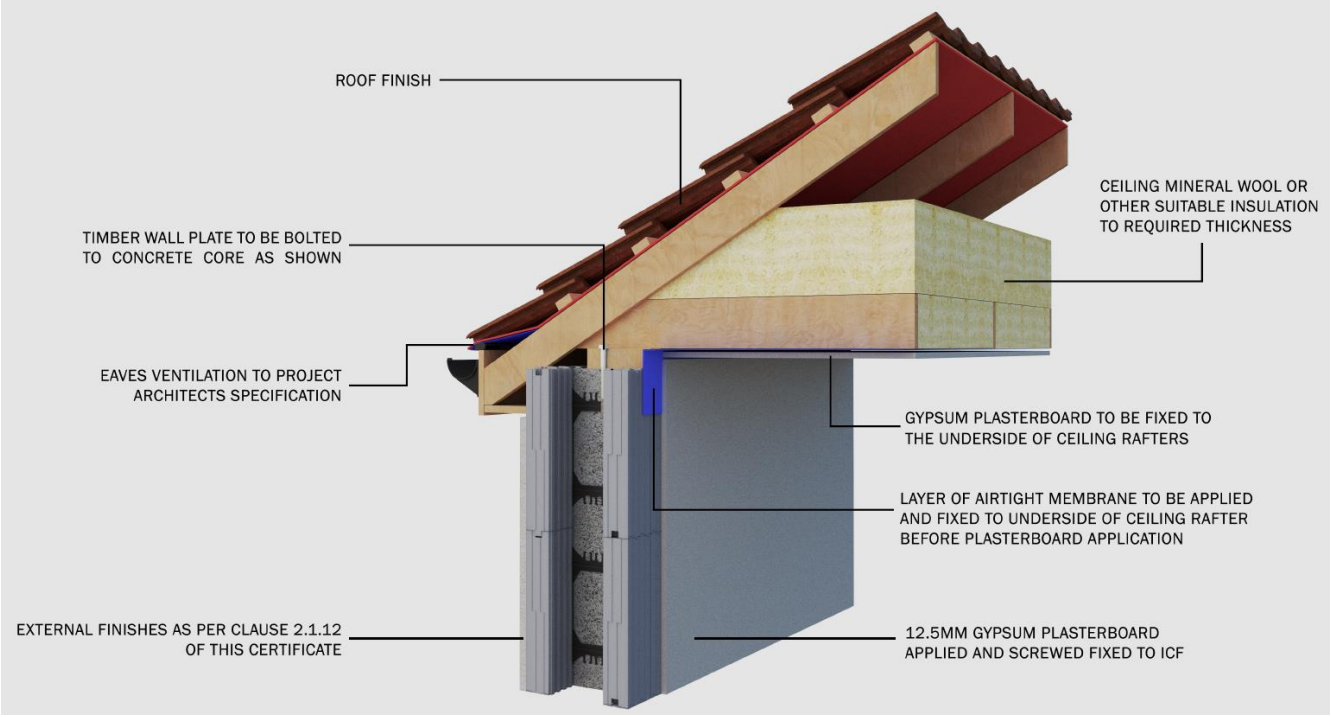

Figure 5: Altherm Typical Eaves Detail

Lintels must be filled with concrete in a single operation, ensuring that the concrete integrates fully with the concrete in the walls at both ends. Particular attention should be paid at opening/lintel reinforcement as the steel can impede the flow of concrete around these sections. To prevent damage to the system, the use of poker vibrators above 25mm diameter is not recommended.

In very hot or freezing conditions, the top of the Altherm ICF System must be covered to protect the concrete from adverse curing conditions.

The recommended concrete pour rate is 1000 to 1200mm/hr with a maximum of 1500mm/hr in warm temperatures. The formwork system is filled and compacted progressively in layers not exceeding 1.3m lifts with a total daily concrete pour height not exceeding 3m (i.e. one storey height). This is to ensure adequate compaction is achievable and to avoid possible displacement of any reinforcement and excessive pressure being exerted on the Altherm ICF System.

2.4.11 Concrete Compaction

Adequate consolidation/compaction of the concrete in line with I.S. EN 1992-1-1[8] is essential and the concrete must be placed so that it completely fills the Altherm ICF System without creating any voids. A 25mm vibrating poker should be used with care and kept back from the corners by approximately 1m.

Particular attention should be given to basement walls and areas around openings. Particular attention should also be paid to the window and door openings where the steel reinforcement can impede the flow of concrete beneath these sections. Concrete in lintels must be mechanically tamped or vibrated to ensure proper compaction around any steel reinforcement.

Where reinforcement is present for structural purposes, mechanical vibration is essential with internal poker vibrators smaller than 25mm diameter. Special care is required to avoid touching the formwork when using this equipment. Where internal poker vibrators are used, these should be confined to the central concrete core between reinforcement layers and used in accordance with the Certificate holder's instructions.

The formation of construction joints between concrete pours should be located as close to the top of the form wherever possible for the formwork wall to enable visual checking and ease of access for the formation of these joints. The construction joints formed should be horizontal rather than vertical.

The completeness of filling of the formwork can be easily confirmed by tapping its surface (with the palm of the hand or a wooden mallet) – any voids will be detected by a distinctive hollow sound. This should be done as the concrete is placed so that any voids detected can be easily corrected. The compaction of the concrete can be confirmed by tapping the surface as described up to 2.8m high walls. For load bearing walls above this height, the EPS can be removed to inspect the concrete core or alternatively, normal concrete cores can be taken as required.

2.4.12 Post-Pour Tasks

After pouring is complete, immediately check the walls are straight and vertical adjusting the bracing support as required.

Any damage to the forms should be repaired immediately and any concrete spillage or leakage of grout may be removed by hosing down the exposed face of the system before it sets.

The concrete in the Altherm ICF System must be left to cure until it has achieved a specified minimum strength, usually after two or three days, for construction to continue. Structural fixings should not be loaded until the concrete has achieved a sufficient strength, and supports should be left in place as long as required.

Where lateral bracing walls and other structures are intended to act in concert with the concrete filled forms, the polystyrene face must be removed to allow the required structural connection between the concrete core and the supplementary structure.

Backfilling around bottom layers of formwork to the ground floor walls should not take place until the concrete has reached sufficient design strength, i.e. a minimum period of seven days.

Any damage to the faces of the Altherm ICF System must be made good prior to the application of the internal and external finishes.

3.1 STRENGTH & STABILITY

3.1.1 General

The Altherm ICF System is intended for use where Architect's drawings are available and satisfy the Building Regulations. The Architect, Engineer or competent design team of the developer are responsible for the architectural drawings and overall building design to comply with the Building Regulations.

Buildings constructed using the Altherm ICF System shall be certified by a competent, chartered civil or structural engineer, with experience in design of buildings and structures incorporating the Altherm ICF System, as being in accordance with Part A of the Building Regulations.

The Altherm ICF Design Guide [30] addresses residential buildings up to 5 storeys in height.

3.1.2 Loading

The loading is calculated based on I.S. EN 1990[7] and I.S. EN 1991-1-1[16]. The loading depends on usage of the building, client requirements and other project specific requirements to be included in the project specific design by a chartered structural engineer.

The vertical dead loads should be calculated based on the self-weight of materials to be used in construction, and reference should be made to I.S. EN 1991-1-1[16] in this regard. The following self-weights apply to the Altherm ICF wall thicknesses:

- 150mm core wall: 3.7kN/m^2
- 200mm core wall: 4.9kN/m^2

Designs for typical dwellings which have been completed have been examined by NSAI Agrément and comply with the following standards:

- I.S. EN 1991-1-1[16]
- I.S. EN 1991-1-7[17]
- I.S. EN 1991-1-4[18]

Reinforcement for lintel load spans and spacings of anchor bolts for the Ledger fixing System must be as per the Altherm ICF Design Guide for Housing[30].

Design snow and wind loads must be based on guidance given in TGD to Part A of the Building Regulations. The maximum characteristic wind loading pressure for the Altherm ICF System has been calculated as 1.2kN/m^2, in accordance with I.S. EN 1991-1-7[17].

Where timber elements are used they are designed in accordance with I.S. EN 1995-1-1[19], I.S. EN 1995-1-2[20].

Panel designs are based on the wind exposure map provided in the TGD to Part A of the Building Regulations. 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 ground anchorage and increased lateral bracing, both of which can be readily provided in the system.

3.1.3 Retained Earth

Differences in the final level of ground or floor slabs between one side of a wall and the other should not exceed four times the wall thickness.

3.1.4 Stability

Because of the homogeneous and boxed nature of the form of construction, domestic structures built using the Altherm ICF System will be stable in themselves. Normally the elements requiring particular care are the tying-in of floors and roofs into walls and the bracing of any free standing or unbutressed sections of wall.

3.1.5 Impact Resistance

The Altherm ICF System can provide a robust system that has a high resistance to hard and soft body impacts likely to be associated with normal use situations. The rendered wall is acceptable for all normal situations and subject to the appropriate selection of render, per 2.1.12, can achieve Category I, which is described in EAD 040083-00-0404[22] as a zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use. The Certificate Holder can provide tougher compatible solutions depending on the level of impact resistance required.

3.2 STRUCTURAL FIRE SAFETY

3.2.1 Internal Fire Spread (Linings)

The plasterboard slabs used on the internal finish are non-combustible and have a Class A2-s1,d0 reaction to fire rating. Surface spread of flame rating of the finished construction will be determined by the surface spread of flame rating of the lining materials used.

3.2.2 Internal Fire Spread (Structure)

When the building has been designed and installed in accordance with the requirements of this Certificate, the walls are capable of withstanding the effects of fire for 60 minutes without loss of stability. Further structural fire resistance can be achieved by the incorporation of additional reinforcing steel in accordance with IS EN 1992-1-2[9]. See section 4 for fire behaviour of the constructed system.

3.2.3 External Fire Spread

The NSAI Agrément certified render approved for use onto EPS must have a reaction to fire rating of B-s1, d0 to I.S. EN 13501-1[24]. Fire barriers must be installed per section 4.1.1 of this certificate. Render systems must be installed in conformance with the render certificate, including a fixing design taking account of the extra duty required under fire conditions.

3.3 WEATHERTIGHTNESS

Externally the walls are protected by an approved render. A DPC/radon barrier is installed at ground level to prevent rising damp. A DPC is also used around window sills, and a double seal is used at window reveals. In the case of aluminium window sills, an upstand is required on the back of the sill with stop ends with welded corners on both ends with wraparound DPC. In the case of concrete sills, they shall either be stooled or be 75mm wider than the window opening and be provided with the wraparound DPC.

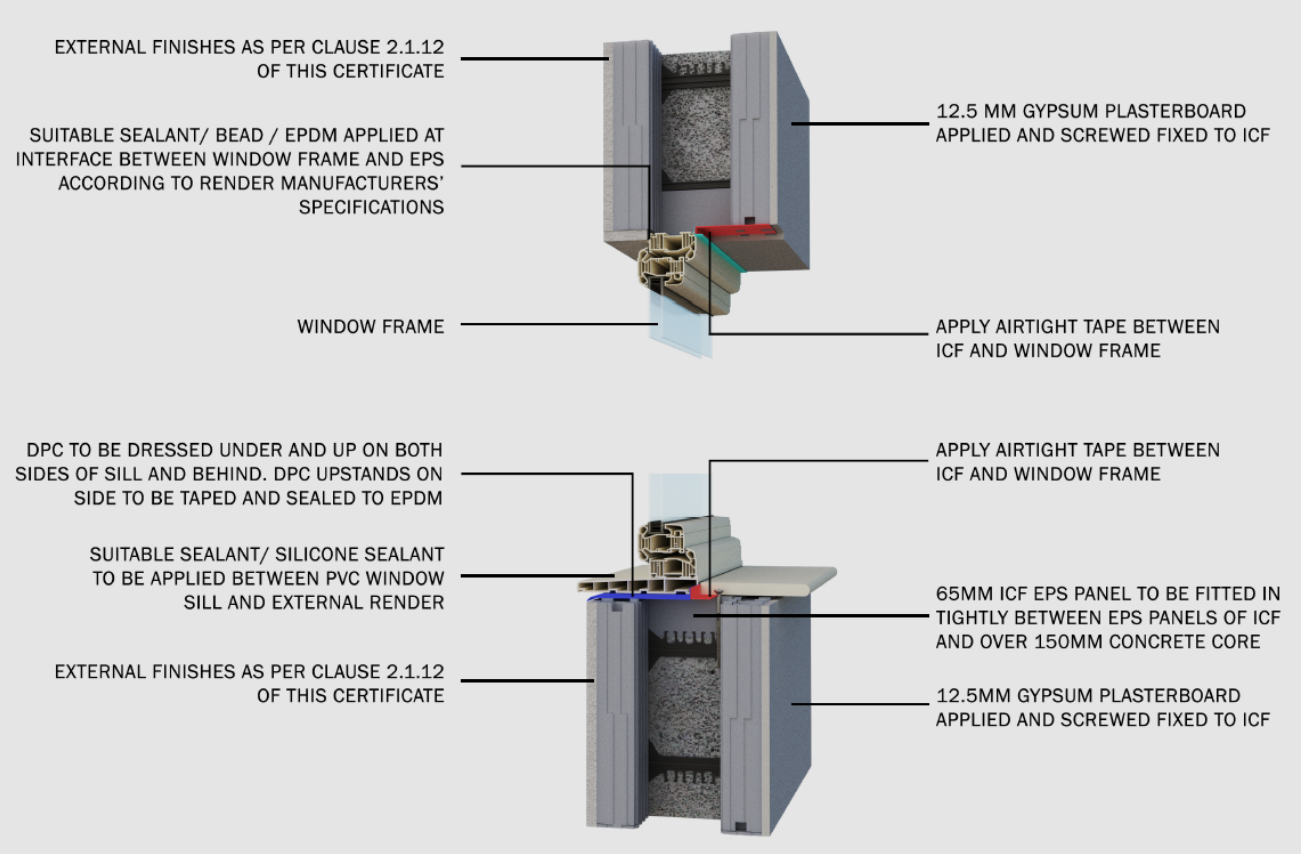

Figure 6: Typical Window Head and Sill Detail

4.1 BEHAVIOUR IN FIRE

This section 4.1 must be read completely with other documents as referenced for further detail. The fire performance requirements for purpose groups 1a, 1b and 1d (Dwelling House) are addressed in TGD B Vol. 2 (2017).
Consult TGD B Vol. 1 (2024) for the fire performance requirements of other purpose groups, including specific provisions for compartment walls in buildings with a topmost floor height exceeding 11m. Escape stairway enclosures constructed using the Altherm ICF System must be lined in accordance with the provisions of the relevant TGD to Part B. The Altherm ICF system is certified for use in buildings up to 5 storeys, subject to design in compliance with the TGDs to the building regulations.

Where the design complies with section 3.1 above and IS EN 1992-1-2[9], an Altherm ICF wall with a 150mm concrete core has over 60 minutes fire performance[1]. Minimum cover to reinforcement is 30mm (for durability), which exceeds the required cover of 25mm for fire protection. The concrete in the walls has A1 classification and is non-combustible per TGDs to Part B of the Building Regulations. The polystyrene used in the wall and floor panels is flame retardant and Class E in accordance with I.S. EN 13501-1[24]. The combination of Altherm ICF load bearing wall, separating wall and concrete floor elements achieves a 60 minute fire resistance when constructed in accordance with this certificate.

The NSAI certified external render system must achieve a minimum B-s1,d0 per I.S. EN 13501-1[24]. In the case of the internal wall, 12.5mm gypsum plasterboard slabs, class A-s1,d0 per I.S. EN 13501-1, are screwed to the webs of the polypropylene connectors. This exceeds the requirements stated in section 2.2 of TGD Volume 1 to Part B of the Building Regulations, and Clause 2.4 of TGD Volume 2 to Part B of the Building Regulations.

4.1.1 Fire Barriers

An Altherm ICF wall contains polystyrene but does not typically contain a cavity. The system must be fire stopped externally opposite every compartment wall and compartment floor, with horizontal and vertical barriers shown in figures 3 and 4 respectively. The external render must be applied as specified in its own NSAI Agrément certificate and specific manufacturer instructions. Typically, a strip of mesh reinforcement is placed along the length of the fire stop before a second layer of mesh reinforcement is placed in the render basecoat along the length of the entire wall. The external render acts as a fire barrier at the insulation around the window and door openings.

The location of fire breaks should be specified by the Architect or Fire consultant on a project specific basis. Fire barriers shall be continuous and unbroken. Fire barriers are typically created by placing strips of galvanised or stainless steel 1mm thick (weight 2.68kg/m2) to the full depth of the expanded polystyrene and extending a minimum of 5 mm into the concrete per section 4.1.2 below, or fire barriers are provided in accordance with the applicable TGD to Part B of the Building Regulations. Fire stopping can be provided by timber battens (min. 38mm thick), mineral wool or galvanised metal strip (minimum 1mm thick), combined or not with the use of insulation in the floor void which has a classification of A2 or better for buildings under 10m in height. A section of the inner ICF panel can be removed allowing the fire stop to be directly fixed back to the concrete core.

Plasterboard is screw fixed to the Altherm ICF internal wall with intervals aligning to the plastic connectors. Where an additional layer of timber battens and plasterboard is installed to create a service void, fire stopping shall be provided at the top of the void at floor level.

4.1.2 External Wall/Floor Junction – internal fire break

Compartment floors require fire stopping externally and internally in accordance with TGDs to Part B, Vol. 1 (2024) and Vol. 2 (2017) of the Building Regulations.

Where intermediate floors have open void space for the provision of services, either by the use of engineered open web joists, or counter battens below traditional solid joists, the Altherm system includes an additional measure of a galvanised steel internal horizontal fire break, set a minimum of 5mm in the concrete. The 1mm steel strip must be placed before concrete is poured and is inserted horizontally through the inner EPS panel at a level aligned to the bottom of the ledger board/top of the internal ceiling plasterboard as shown in Figure 8.

Timber intermediate floors with open web joists require a minimum of 15mm plasterboard, class A-s1,d0 on the ground floor ceiling, to achieve a 30 minute fire resistance in accordance with the Supplementary Guidance to the TGD Vol 2 to Part B[33] of the Building Regulations, which also addresses penetrations. Penetrations through the ceiling plasterboard, such as down-lighters, soil vent pipes or ventilation duct heads must be fire stopped by the use of fire collars, fire hoods or fire rated products, in accordance with TGDs to Part B of the Building regulations.

4.1.3 Separating Wall/ Roof Junction –fire break

The separating wall/roof detail shown in Figure 7 represents a section through a pitched roof. The eave must be fire stopped over the soffit with a cavity barrier fitted in line with the party wall. 25mm thick battens may run continuously across a party wall, subject to appropriate fire stopping between each of those battens such that no void exists along the length of the separating wall and the roof structure, as detailed in TGDs to Part B of the Building Regulations.

4.1.4 Toxicity

The system is non-toxic in normal conditions. In fire conditions, the polystyrene will begin to soften, to contract, and final melt above 100°C. Ignition occurs between 350°C and 450°C. The mass of material present is low and hence the amount of heat released is low.

When burning, EPS behaves like other hydrocarbons such as wood and paper. The products of combustion are basically carbon monoxide and styrene; during a fire, the styrene may be further decomposed, giving off oxides of carbon, water and a certain amount of smoke. The polystyrene used in the Altherm ICF System is flame retarded.

4.2 THERMAL INSULATION AND U-VALUES

The thermal conductivity, λ, value of the Altherm ICF form is 0.030W/mK for graphite enhanced EPS, with allowance made for the cold bridging effect of the polypropylene connector. Where the calculated U-value does not meet the relevant requirement of the Building Regulations, additional energy improvement measures such as internal drylining board may be used to meet the backstop elemental U-values outlined in TGD to Part L of the Building Regulations.

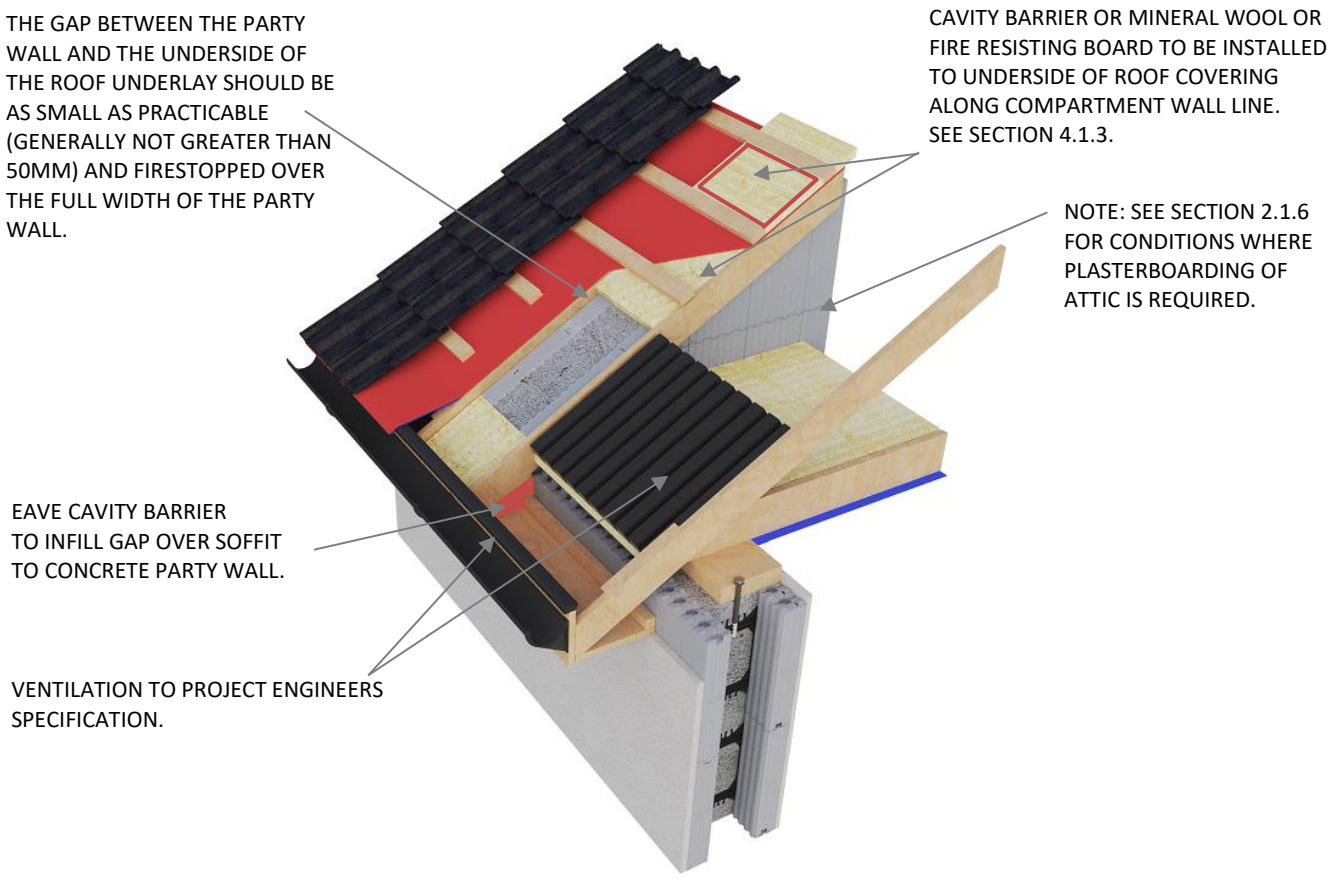

Figure 7: Top of Compartment Wall Detail

4.3 LIMITING THERMAL BRIDGING

The linear thermal transmittance (ψ) or Psi describes the heat loss associated with junctions and around openings. The Altherm ICF System has been assessed and when detailed in accordance with this Certificate, these thermally bridged junctions can be compared with the requirements of Table D2 of Appendix D of TGD to Part L of the Building Regulations. 'ψ' values for bridged junctions as outlined in Table 3 can be used for calculating the 'y' factor for a dwelling.

'ψ' values for other junctions outside the scope of this Certificate should be assessed in accordance with BRE IP1/06[25] and BRE BR 497[26] in accordance with Appendix D of TGD to Part L of the Building Regulations.

4.4 CONDENSATION

The system was subjected to an interstitial condensation risk analysis, which concluded that the risk of condensation is minimal and that no vapour barrier is required.

4.5 SOUND

The separating wall requirement is met by the wall thickness of the Altherm 200mm core wall which gives 490kg/m2. This satisfies the requirement of 415kg/m2 of Diagram 4 of TGD to Part E of the Building Regulations. The 150mm core wall can also be used as this has been tested to meet the 53dBa requirement. With regard to compartment floors in apartments, the minimum required mass for hollowcore type floors with a screed and soft covering is 365kg/m^2 as per Diagram 32 of TGD to Part E of the Building Regulations.

4.6 DURABILITY

The structural core of buildings constructed with the Altherm ICF system should have a service life of at least 60 years, provided it is designed in accordance with Part A of Irish Building Regulations and this Certificate. The EPS formwork will have a similar service life provided it is protected from damage by the external and internal finishes of the certified wall construction.Note for further information on indicative design life refer to BS 7543:2015 Guide to durability of buildings and building elements, products and components[27].

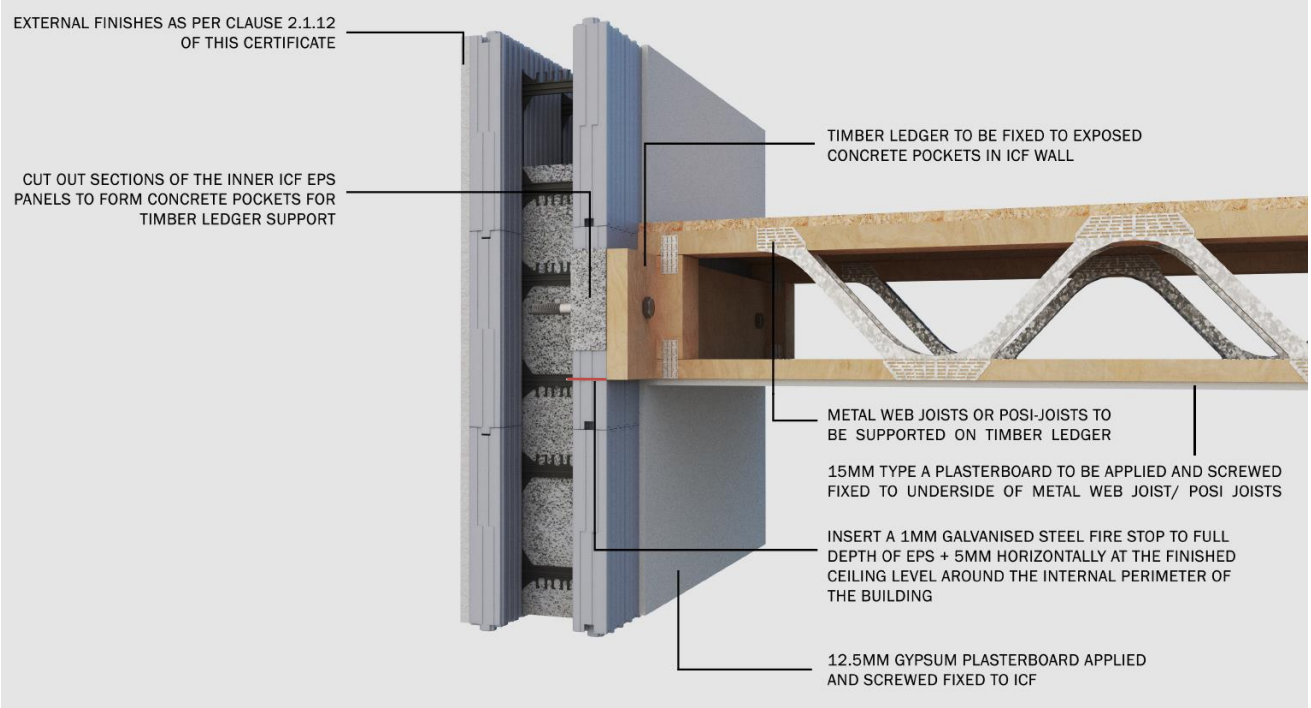

Figure 8: Floor Detail – Floor Joists Perpendicular to Wall

It is important to note that the durability of the render system is entirely dependent on the correct installation of the product in accordance with its NSAI Agrément Certificate, the manufacturer's instructions, I.S. EN 13914-1[28] and ongoing care and maintenance as described in Section 4 of their NSAI Agrément Certificates. Critical details include rendering at window sills, raised features, junctions with eaves and verges, and the use of suitably designed overhangs and flashings. Reference should be made to I.S. EN 13914-1[28] for general advice on design, in particular on the use of angle, stop and movement joint beads.

The render manufacturer is responsible for the design of the render to meet the durability requirements and exposure conditions. Render shall meet durability and exposure conditions as per S.R. 325[23]. Any damage to the surface finish shall be repaired immediately and regular maintenance shall be undertaken as outlined in render manufacturer's specification.

4.7 MAINTENANCE

The rendering/concrete in the wall panels is maintenance free. However, the coloured rendering may discolour with time. It is considered that periodic re-coating of the silicone top coat may be necessary every 18 to 20 years to improve the appearance. The external sealants around window and door frames should be inspected periodically and replaced when necessary.

• Visually inspect the render and architectural details for signs of damage or water ingress (at least annually).

• Necessary repairs must be carried out immediately and must be in accordance with the Certificate holder's instructions to prevent deterioration or damage, and to protect the integrity of the system.

• Sealants should be inspected and replaced as required with full replacement every 18 to 20 years to maintain performance.

• Care should be taken to ensure that the synthetic finish used is compatible with the original system and that the water vapour transmission or fire characteristics are not adversely affected.

4.8 PRACTICABILITY

A Design Guide and Installation Manual incorporating Health & Safety guidelines are provided by Altherm ICF for each project, for review and acceptance by the Project Engineer. Erection of the Altherm ICF System must be by approved trained installers.

4.9 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 values
- Impact resistance for external walls
- Site erection controls

4.10 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity, environmental impact and the effect on mechanical strength/stability and durability were assessed.

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

(iii) Site visits were conducted to assess the practicability of installation and the history of performance in use of the product.

(iv) Bought-in components were assessed for suitability in use.

(v) No failures of the product in use have been reported to NSAI Agrément.

Target linear thermal transmittance (ψ) for different types of junctions	**Target U-value** Wall: 0.18W/m²K with mineral wool or PIR internal insulation Roof: 0.09W/m²K Ground Floor: 0.15W/m²K	**Target U-value** Wall: 0.15W/m²K with PIR internal insulation Roof: 0.09W/m²K Ground Floor: 0.15W/m²K
Description	(W/mK)	(W/mK)
External wall corner in plan	0.031	0.031
Inverse external wall corner in plan	-0.091	-0.076
Compartment wall between dwellings in plan	0.150	0.166
Partition within dwelling	0.083	0.110
Ground floor (standard)/external wall perimeter	0.047	0.043
Ground floor (suspended)/external wall perimeter	0.265	0.270
Compartment wall standard (non-suspended, ground bearing)	0.086	0.086
Compartment wall suspended (continuous slab)	0.135	0.135
Intermediate floor (hollowcore slab)/external wall detail)	0.170	0.204
Typical head detail	0.004	0.009
Typical jamb detail	0.006	0.009
Typical sill	0.012	0.018
Intermediate floor (I-joists parallel to wall)	0.008	0.020
Intermediate floor – rim joist/hanger carrier parallel to wall with concrete pad fixings	0.055	0.062
Typical eaves detail	0.035	0.032
Compartment wall head at ceiling line	0.257	0.257
Gable – attic insulated at ceiling line	0.070	0.058

ψ-values for additional and improved junctions are available from the Certificate holder.
Installation details and thermal modelling calculations for these junctions are available from the Certificate holder.
Please note: The Part L Acceptable Construction Detail (ACD) for external insulation on solid masonry/hollow block walls permits variation in the Target U-Values such that the Psi values remain valid when the aggregate percentage change from the respective target U-values in the table does not exceed 20%. Therefore the U-values in the rightmost column above, for a target U-value of 0.15W/m²K, can be applied to the 350/150 and 400/200 forms block, where the overall wall U-value is achieved by 2x100mm EPS panels, as opposed to 75mm EPS panels with additional PIR internal insulation. This assumes the junction constructions remain as modelled, aside from the substitution of thicker EPS panels.

Table 3: Linear thermal transmittance (Ψ)

5.0 CONDITIONS OF CERTIFICATION

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément 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 for five years from date of issue or revision date so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2024 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.

(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 NSAI Agrément are paid.

5.2 The NSAI Agrément 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 NSAI Agrément 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 2005, 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.

NSAI Agrément

This Certificate No. **20/0415** is accordingly granted by the NSAI to **Altherm Build Ltd.** on behalf of NSAI Agrément.

Date of Issue: **10 June 2020** (original certificate)

Signed

Martin Searson
Head of MMC

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément , NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. www.nsai.ie

Revisions:
6th Oct 2025: Update references to Building Regulations and bibliography. Addition of 100mm EPS panel, see Table 1.

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