NSAI Agrément

CERTIFICATE NO. 10/0349

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Thermo House Roofing System

Système pour construction
Bausystem

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

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 the **Building Regulations 1997 to 2009**

PRODUCT DESCRIPTION:
This Certificate relates to the Thermo House Roofing System, which consists of a composite steel cold-formed c-channel and interlocking expanded polystyrene (EPS) panels. The composite panels provide insulation and structural support to conventional slate and tiled roofing systems. The internal finishes to the composite panels can either take the form of a NSAI Agrément approved internal plaster for use with ICF (Insulating Concrete Formwork) systems or plasterboard slabs nail or screw fixed to timber battens which, in turn, are fixed to the bottom flange of the c-channels. This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2009.

USE:
The Thermo House Roofing System is certified for use in both domestic and commercial buildings for all roof pitches between 17.5° to 60° pitches. Manufacture's guidance should be sought for roof pitches outside of this range.

The system has been assessed for use as load bearing roofing panels which are simply supported on wall plates, ridge beams or intermittent purlins. The panels can be single or continuously spanning.

The roof panels are used as conventional roof rafters for traditional cut roof constructions supported on the primary support elements such as purlins and steel beams. The primary roof structure must cater for all wind uplift forces in addition to providing adequate triangulation and diagonal bracing. The Thermo House roof panel has not been assessed for use as an integral member in either trussed or framed roof designs.

MANUFACTURE AND MARKETING
The product is manufactured and marketed by:

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Part One / Certification 1

1.1 ASSESSMENT
In the opinion of the NSAI Agrément, the Thermo House Roofing 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 - 2009 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2009

REQUIREMENT:

Part D - Materials and Workmanship
D3 – The Thermo House Roofing 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 Thermo House Roofing System, used in accordance with this Certificate, meets the requirements for workmanship.

Part A – Structure
A1 – Loading
The Thermo House Roofing System, as certified in this Certificate, has adequate strength and stability to meet the requirements of this regulation (see Parts 3 and 4 of this Certificate).

Part B – Fire Safety
B1 – Means of Escape In Case of Fire
The Thermo House Roofing System can be designed to meet the requirements in respect of means of escape in case of fire.

B2 – Internal Fire Spread (linings)
The NSAI Agrément approved internal plaster finish for ICF systems and plasterboard slabs used on the internal finish of the Thermo House Roofing System are non-combustible and have a Class 0 'spread of flame' 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.

B3 - Internal Fire Spread (structure)
Cavity barriers may be required, as indicated in Section 3.3 of *Building Regulations 1997 Technical Guidance Document Part B Fire Safety* (TGD Part B). (See Part 4 of this Certificate.)

B4 - External Fire Spread
The designation of the roof with respect to external fire spread is dependent on the roof covering used.

Part C – Site Preparation and Resistance to Moisture
C4 – Resistance to Weather and Ground Moisture
The Thermo House Roofing System, used in accordance with Part 3 of this Certificate, will have adequate weather resistance in all exposures, will resist the passage of moisture from whatever source and will prevent surface or interstitial condensation.

Part E – Sound
E1 – Airborne Sound (Walls)
Compartment walls and roof junctions (i.e. party walls) are designed and constructed to meet the airborne sound requirements of this Regulation.

Part F – Ventilation
F1 – Means of Ventilation
Adequate ventilation openings are provided in roofs to meet this requirement. Roofs used in the system can be designed and constructed so as to prevent any harmful effect from interstitial or inner surface condensation to comply with the requirements of BS 5250:2002 *Code of practice for the control of condensation in buildings.*

F2 – Condensation in Roofs
Adequate ventilation is provided in roofs to meet this requirement in respect of the prevention of condensation.

Part J – Heat Producing Appliances
J3 - Protection of Building
The panels must be protected from heat sources in accordance with the requirement. (See Part 4 of this Certificate.)

Part L – Conservation of Fuel and Energy

L1 – Conservation of Fuel and Energy

The Thermo House Roofing System will contribute to enabling a building to meet this requirement. U value and Psi value calculations may be based on a declared thermal conductivity (λ value) of expanded polystyrene (EPS) of 0.031 W/mK. The calculated U-value for the standard Thermo House Roofing System is 0.15W/m^2K which surpasses the requirements of Part L of Building Regulations 1997 - 2009.

Thermally bridged junctions, when detailed in accordance with this certificate will satisfy the target linear thermal transmittance values (Psi value) as outlined in Table D1 of Appendix D of Part L of the Building Regulations 2009. As a result the Thermo House Roofing System when detailed in accordance with this certificate has adequate provision to safe guard against the risk of mould growth and surface condensation.

The Thermo House Roofing System, when detailed in accordance with this certificate meets the requirements within Part L of Building Regulations 1997 - 2009 with respect to the avoidance of mould growth and surface condensation.

2.1 PRODUCT DESCRIPTION

2.1.1 General

The Thermo House Roofing System consists of two steel cold formed sections encased in moulded panels of expanded polystyrene (EPS). The panels are interlocking due to their tongued and grooved profiles. The vertical joints are taped and sealed. Each individual panel is fixed down through the cold formed sections to timber wall plates, purlins and ridge beams.

The Thermo House panels are manufactured from fire retardant grade of EPS in accordance with IS EN 13163:2001 *Thermal insulation products for buildings – Factory made products of expanded polystyrene – Specification*, without the use of HCFC's. The minimum density is 26kg/m^3.

2.1.2 Structure

The structural integrity of the roofing panel is based solely on the load carrying capacity of the cold formed sections. The only structural benefit attributed to the EPS is that the EPS will provide lateral restraint to the cold formed section.

Section properties for the cold formed sections are calculated using design core thickness of steel (excluding coatings) in accordance to I.S. EN 1993-1-3:2006 *Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting* and I.S. EN 1993-1-5:2006 *Eurocode 3. Design of steel structures. Plated structural elements*.

The structural design of the member is in accordance with BS 5950-5:1998 *Structural use of steelwork in building. Code of practice for design of cold formed thin gauge sections* or designed to IS EN 1993-1-3:2006 *Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting.*

2.1.3 Dimensional Tolerances

The Thermo House Roofing System panels are available in a variety of lengths. Panel lengths are produced to meet the requirements of each specific project. Typically the roof panels shall be one continuous panel from ridge to eves. The practice of butt jointing panels or splicing panels along their length should be avoided. Each panel has an overall depth of 250mm and a width of 510mm. Dimensional tolerances for manufactured panel are outlined in Table 1. Important physical properties for the EPS are outlined in Table 2. The Roof panels are mitred to suit the angle at the eves and ridge. The integrity of corrosion resistance for all cut cold formed section is reinstated as outlined in section 2.1.7.

Dimensional Tolerances	
Length	±0.6% or ±3mm
Width	± 2 mm
Height	± 2 mm

Table 1: Dimensional Tolerances

2.1.4 Roof Pitch

The Thermo House Roofing System has been assessed for use in pitched roof in the range or 17.5° to 60°. Designers and specifies should be mindful that the Thermo House Roofing panel may not be the governing criteria when establishing a suitable roof pitch and all additional component part of the overall roof assemble should be considered when specifying a suitable roof pitch.

2.1.5 External Finishes

The Thermo House Roofing System is suitable for use in conjunction with conventional concrete tile and slate tile build ups. Once the panels have been securely fixed down to wall plates, purlins and ridge beams, a continuous strip of sealant tape is place at all joints between panels. It is also acceptable to install the sealant tape on the roof side of the roofing panels. The voids formed through the EPS during the installation of the holding down bolts are then sealed using expanding foam.

The roofing panels are then battened out with timber battens which both coincide and run parallel with each cold formed section encased in the moulded EPS panels. This ensures that roof loads and wind loads are evenly distributed to the load bearing cold formed sections. The first layer of timber battens are fixed down to the top flange of the cold formed section with self tapping Ruspert® corrosion resistant fixing or similar. Further information on all fixing used can be found in table 9 of this certificate.

An unsupported vapour permeable underlay as described in I.C.P. 2:2002 *Irish Code of Practice for Slating and Tiling* is draped over the timber battens and the underlay is then counter battened to facilitate roof tiles or slates. Roof tiles or slates are then fixed to the counter battens as outlined in I.C.P. 2:2002 *Irish Code of Practice for Slating and Tiling.*

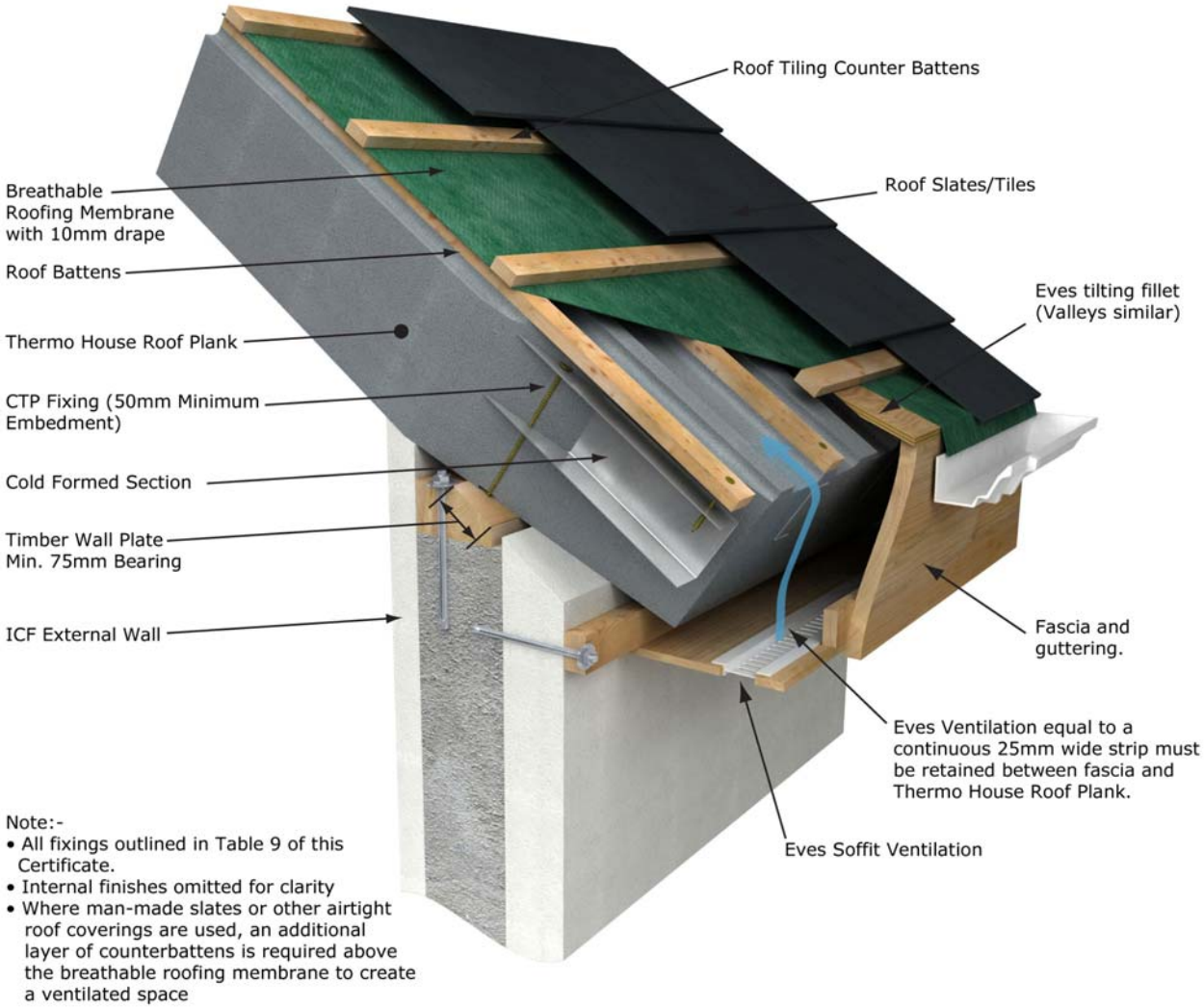


Figure 1: Eves Detail with ICF Wall

2.1.6 Internal Finishes

The internal roof finishes consists of the following:

- 4mm gypsum skim coat plaster
- 12.5mm plasterboard slabs nail or screw fixed to timber battens, or 15mm thick NSAI Agrément approved internal plaster finish for use with ICF systems. Internal plaster finishes are only suitable for use when there are no rooflights and/or inline timber trimmers.
- Vapour control layer (on warm side of timber trimmers only).
- Sealant tape is generally placed internally at all joints between panels. It is also acceptable to install the sealant tape on the external side of the roof panel. Installing sealant tape, in part, both internally and externally should be avoided as this can compromise the airtightness integrity of the system .
- Timber battens are fixed to the bottom flange of the cold formed section with self tapping Ruspert® corrosion resistant fixing.

When using ICF internal plaster finishes, all sealing tape must be fitted to the external side of the Thermo house roofing panel system. Inline timber trimmers for either chimney penetrations or rooflights are not suitable for use in conjunction with ICF internal plaster finishes as both details require a vapour control layer to which the plaster would not adhere to.

2.1.7 Cold formed sections

Cold formed sections are manufactured from coils of hot-dipped galvanised steel grade DX51D. The steel coils supplied to Thermo House comply with

I.S. EN 10346:2009 *Continuously hot-dip coated steel flat products - Technical delivery conditions* and I.S. EN 10143:1993 *Continuously hot-dip coated steel sheet and strip – Tolerances on dimensions and shape*. Steel grade DX51D as defined in I.S. EN 10346:2009 is suitable for cold forming bending and profiling quality.

The surface finish is a Zinc coating having a designation of Z275. This relates to 275 g/m^2 of Zinc coating over both top and bottom surfaces of the hot-dipped galvanised steel coils. This ensures a minimum thickness of 15µm (microns) of zinc-coating on each side of the cold formed section.

When the corrosion resistance of a cold formed section is compromised at mitred or cut ends the corrosion resistance must be reinstated using a Zinc rich protective paint.

The structural design aspects of the manufactured cold-formed sections are discussed under section 3 of this certificate.

2.1.8 EPS Polystyrene

The Thermo House Roofing panel is manufactured from fire retardant grade expanded polystyrene in accordance with IS EN 13163:2001 *Thermal insulation products for buildings – Factory made products of expanded polystyrene – Specification*, without the use of HCFC's. The minimum density is 24kg/m^3.

The EPS classification is EPS-EN 13163-T1-L1-W2-S1-P4-BS200-CS(10)150-DS(N)2-DS(70,-)1-TR200-WL(T)3. Further information on both dimensional tolerances and critical physical properties of the EPS used in the Thermo House Roofing System panels are given in Table 2.

Property	Test Method	Value
Declared Thermal Conductivity	IS EN 12667	0.031 W/mK
Compressive Strength at 10% Deformation	IS EN 826	150 kN/m^2
Bending Strength	IS EN 12089	250 kN/m^2
EPS Density	IS EN 1602	Min 24kg/m^3
Reaction to Fire	DIN 4102	B1
Water Vapour diffusion resistance factor.	IS EN 12086	µ = 51.4 sd = 2m

Table 2: Properties of Expanded Polystyrene

2.1.9 Wall plates and support locations

The Thermo House Roofing panel can only be supported on timber wall plates or into the Thermo House proprietary eves shoe. All other forms of support such as masonry wall or steel beam must have a timber wall plate with a minimum width of 75mm securely fixed prior to installation of the roofing panels. All timber wall plates and 'eves shoe' must be adequately fixed down such that they can accommodate the design loads as outlined in section A of Building Regulations 1997 - 2009.

The timber wall plate must have sufficient depth to allow for full 50mm embedment of the CTP holding down fixings. Timber wall plates need to be chamfered to provide a minimum bearing width of 75mm in order to limit the compressive forces on the EPS material to within acceptable tolerances. Bearing widths can be reduced when the design bearing stress associated with smaller spans exist however designers should seek guidance from the certificate holder in this regard.

Support at gable ends many often require special t-fixings as shown in Figure 4.

In all cases wall plate must be suitably anchored or strapped down prior to installation of the Thermo house roofing panels.

2.1.10 Holding down bolts.

To provide resistance to wind uplift, each individual Thermo House Roofing panel must be anchored down to a timber wall plate at each support point. Holding down bolts or fixing is provided through both cold formed sections in each panel. Roofing panels are positioned and, once the installer is satisfied with the line and level of the panel, the installer will pre-drill directly through the cold formed sections and secure the assembly with a CTP 6.0x280 long fixing. The CTP fixings must have a minimum embedment length of 50mm.

2.1.11 Timber batten fixing

The first layer of timber battens which run parallel with the roofing panels on top and perpendicular on the soffit of the assembly shall be fixed using self tapping Ruspert® corrosion resistant fixing.

Counter battens shall be fixed to roof battens with universal woodscrew in accordance with the requirements of ICP2:2002.

A full list of suitable roof fixing is listed in Table 9 of this certificate.

2.1.12 Eves Shoe

Holding down bolts for the Thermo Houses proprietary 'Eves Shoe' must be mechanically anchored at eve's level. The eves shoe is predominately use in conjunction with ICF type constructions but can be modified for conventional masonry construction.

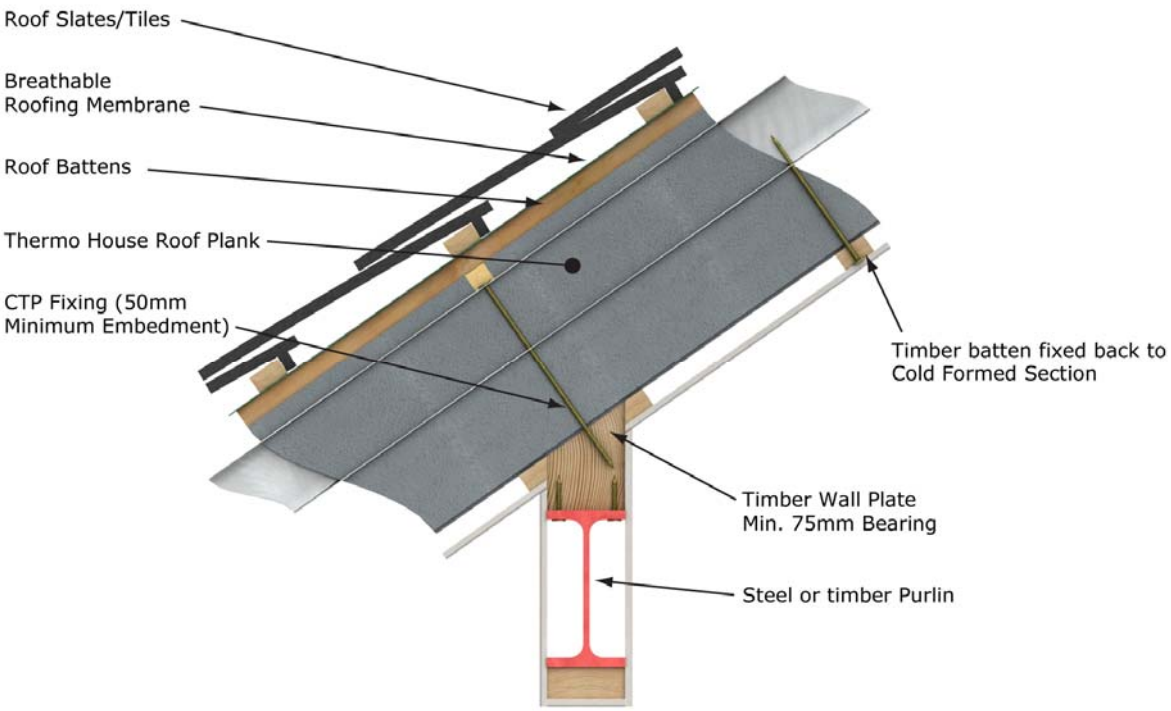


Figure 2: Typical Steel Purlin connection

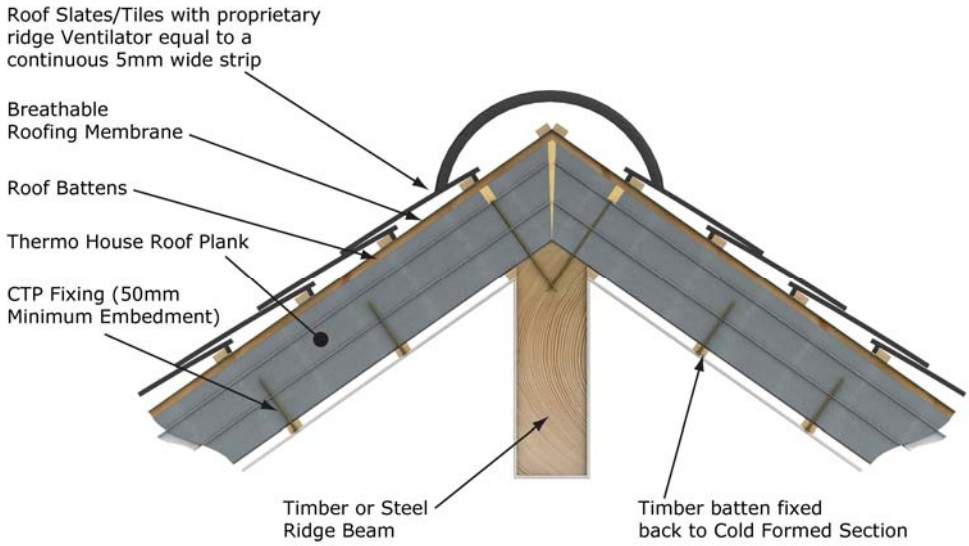


Figure 3: Typical Timber Ridge connections

2.1.13 Jointing/Sealant Tape

The jointing/sealant tape used is a slightly expansible plastic air tight laminated with an acrylate adhesive. The acrylate adhesive used does not contain resin or other additives that can cause the adhesive film to become brittle and is resistant to aging. The sealant tape is available in a variety of widths from 50mm to 150mm however the most commonly used width is 80mm wide.

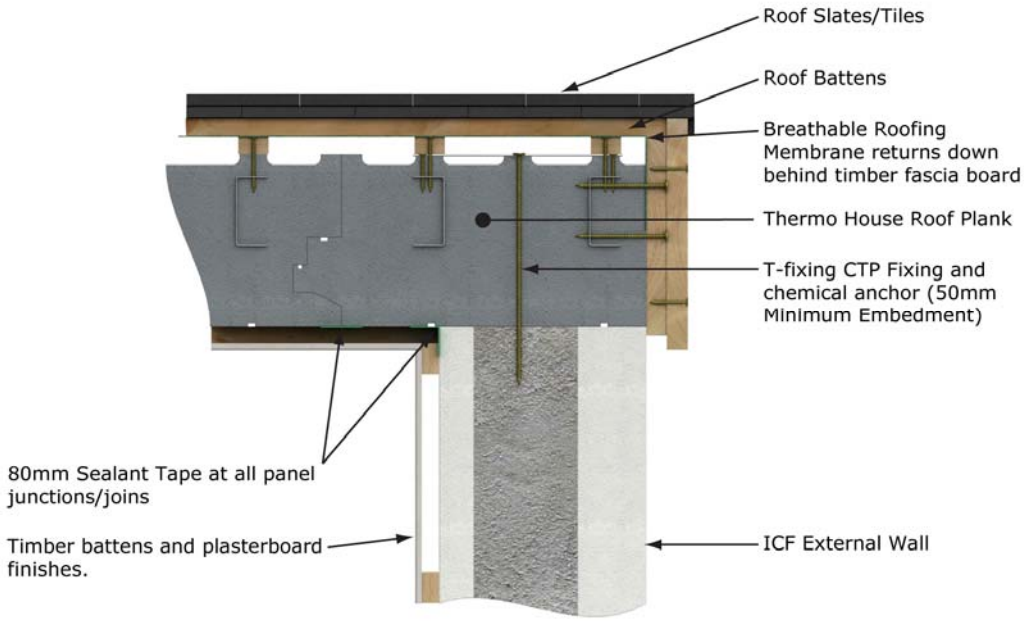


Figure 4: Typical Gable End Detail Option A - Psi = 0.03 W/m.K

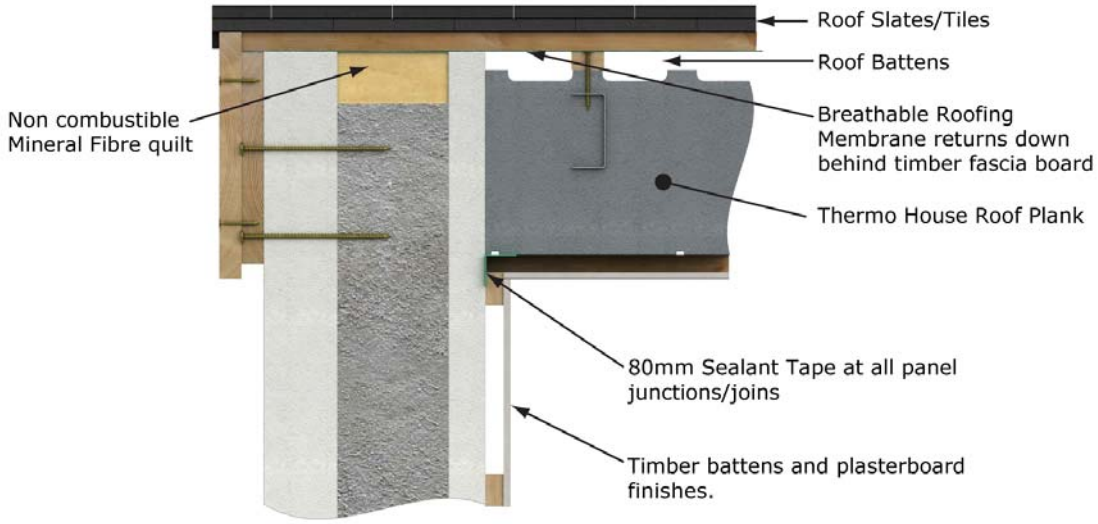


Figure 5: Typical Gable End Detail Option B - Psi = 0.07 W/m.K

2.1.14 Ridge/Apex Straps

Ridge straps are available however are seldom required. Ridge straps shall be formed from steel complying with the requirements of BS 1449: Part 1, hot dipped galvanized after cutting, formed and holing or stainless steel complying with the requirements of BS 1554 grades 302, 304, 315, 316, 321 or 347.

2.1.15 Chimney

Chimneys are not part of the Thermo House Roofing System and are not covered by this Certificate. However, the system can incorporate an NSAI Agrément approved pre-fabricated chimney system or a conventional masonry chimney. The requirements of Clause 2.15 of TGD to Part J of the Building Regulations 1997 to 2009 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.

All penetration such as chimney flues must be trimmed out by providing additional purlin or primary structural support members. (See figure 8).

2.1.16 Ancillary Items

- Low expanding foam adhesive.
- Hot knife.
- Weathering tape.
- Fixing at battens, wallplates/purlins.
- Ridge/Apex straps.
- Timber battens.
- Ceiling render.
- Anchor bolts
- PVC pipe sleeves for penetrations
- Fire stops.
- Vapour control layer.
- Breathable vapour barrier.

2.2 MANUFACTURE

Both the cold formed sections and the EPS Thermo House Roofing panels are manufactured by Thermo House Ltd. Production is controlled at different stages through inspections and quality control checks.

2.3 DELIVERY, STORAGE AND MARKING

Panels are delivered to site strapped in bales. All components are clearly labelled with product type and production date allowing full traceability of supply.

Thermo House Roof 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 should be protected from the weather by a secured covering.

Thermo House Roof 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 panels are easily handled on site and the EPS may be readily cut or trimmed with a knife or fine toothed saw through the EPS. The cold formed sections are cut with a 'Large blade circular saw' or 'Reciprocating saw'. Corrosion protection is reinstated to the cut ends of all cold formed section. 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

Thermo House Ltd. undertakes responsibility for the design and manufacture of the system. An approved Technical Manual is available (see Section 3). Site construction is undertaken using approved trained installers in accordance with the Thermo House Roof Installation Manual. Fire stopping, when required, shall be installed in accordance with the Thermohouse Installation manual.

2.4.2 Main Contractor

The main contractor is responsible for the proper construction of wall plates and purlins within the tolerances specified by Thermo House. Wall plates and purlins are mitred to the required angle to receive the roof panels. All strapping, holding down fixings, DPC's and bracing elements must be secured prior to installation of the Thermo House Roofing System.

The alignment and fixing of the Thermo proprietary eves shoe is the responsibility of the installer.

The main contractor on site is responsible for providing scaffolding to wall plate level and all access necessary for the safe erection of the structure. Thermo House also provide the main contractor with project specific building details on the construction of their Thermo House Roof System.

2.4.3 Underlay, Slating and Tiling

A breathable roof underlay must be used in conjunction with the Thermo House Roofing System. The installation of the breathable roof underlay must be as outlined in Figure 1. The underlay is supported between the roof support battens and the roof tiling battens.

Roof ventilation should be carried out in accordance with Part F of the Building Regulations 1997 to 2009 and the recommendations of BS 5250:2002, *Code of practice for control of condensation in buildings*. When man-made slates or other airtight roof coverings are used, an additional layer of counter battens is required above the breathable roofing membrane to create a ventilated space. In addition eves vent tiles are provided to supply adequate ventilation to this unobstructed free air space between the roof tile and the breathable roofing membrane.

The slating or tiling should be in accordance with I.S. ICP 2: 2002 *Irish Code of Practice for Slating and Tiling*. Workmanship must be in accordance with BS 8000-6:1990 *Workmanship on building sites. Code of practice for slating and tiling of roofs and claddings.*

2.4.4 General provisions

- The Thermo House Roofing panel must be adequately separated from any heat source such as chimneys and flues.
- All Thermo House Roof installations may be made airtight through the correct use of jointing tape and the provision of isolated vapour barriers. Gaps between the roofing planes and gable walls should be avoided. When gaps are unavoidable, these should be filled with expanding foam of a similar thermal resistance as the EPS used in the roofing panels. Jointing tape should then be installed over the complete junction to ensure air tightness.
- Service penetrations can be accommodated within the zones between cold formed sections of the Thermo House Roofing panel. All gaps around service penetrations must be filled and the air tightness integrity must be reinstated.
- If it is necessary to form larger opes that would clash with the cold formed sections within the thermo house roofing panels, then these larger opes must be trimmed out as indicated in Figure 8, 10 and 11.
- Prior to installation of roof underlay, all jointing tapes, cavity barriers and fire stops must be provided.
- Thermo House Roofing panel must be fixed through both cold formed sections of each individual panel. Fixing must be provided at all support points.
- The practice of butt jointing panels or splicing panels along their length should be avoided.

2.4.5 Openings/Services

Service penetrations for extracts or vent pipes should be installed between the cold formed sections of a panel and not at the rebated join between two panels. If the ope for a service penetration is large enough to clash with a cold formed section then inline timber trimmers must be use to frame out similar to chimney and rooflight opes. Expanding foam and sealing tapes must be used to reinstate full air tightness once service ducts or penetrations are installed.

Electrical cables should be ducted (to avoid plasticizer migration). The cables must be placed in PVC conduit and must be sized to minimise heat build-up with resulting fire risk, in accordance with ETCI requirements (Electro-Technical Council of Ireland documents, ET 101:2000 *National rules for electrical installations*, and ET 207:2003 *Guide to the national rules for electrical installations as applicable to domestic and similar situations*).

Electrical services can be fixed within the void created by the timber battens on the soffit of the roofing panels. Where chases are made in the polystyrene they should be kept to a minimum and need to be located at appropriate distances from separating walls. The Thermo House Roofing system is not suitable for recessed lighting.

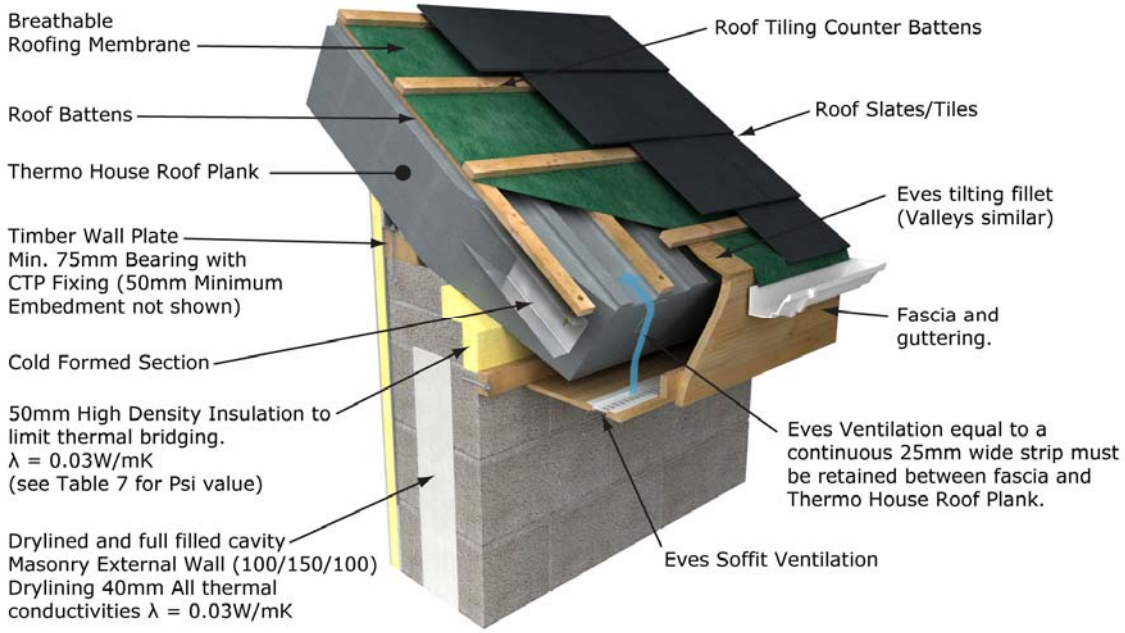


Figure 6: Eves Detail to typical cavity Wall.

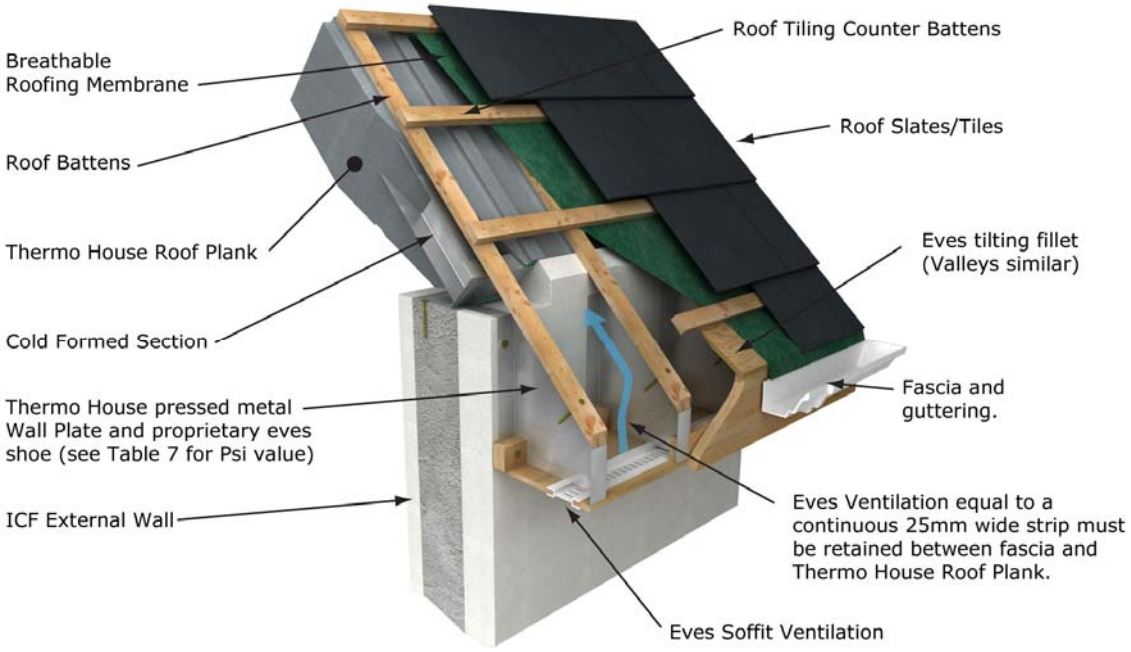


Figure 7: Eves Detail to ICF with 'Eves Shoe'

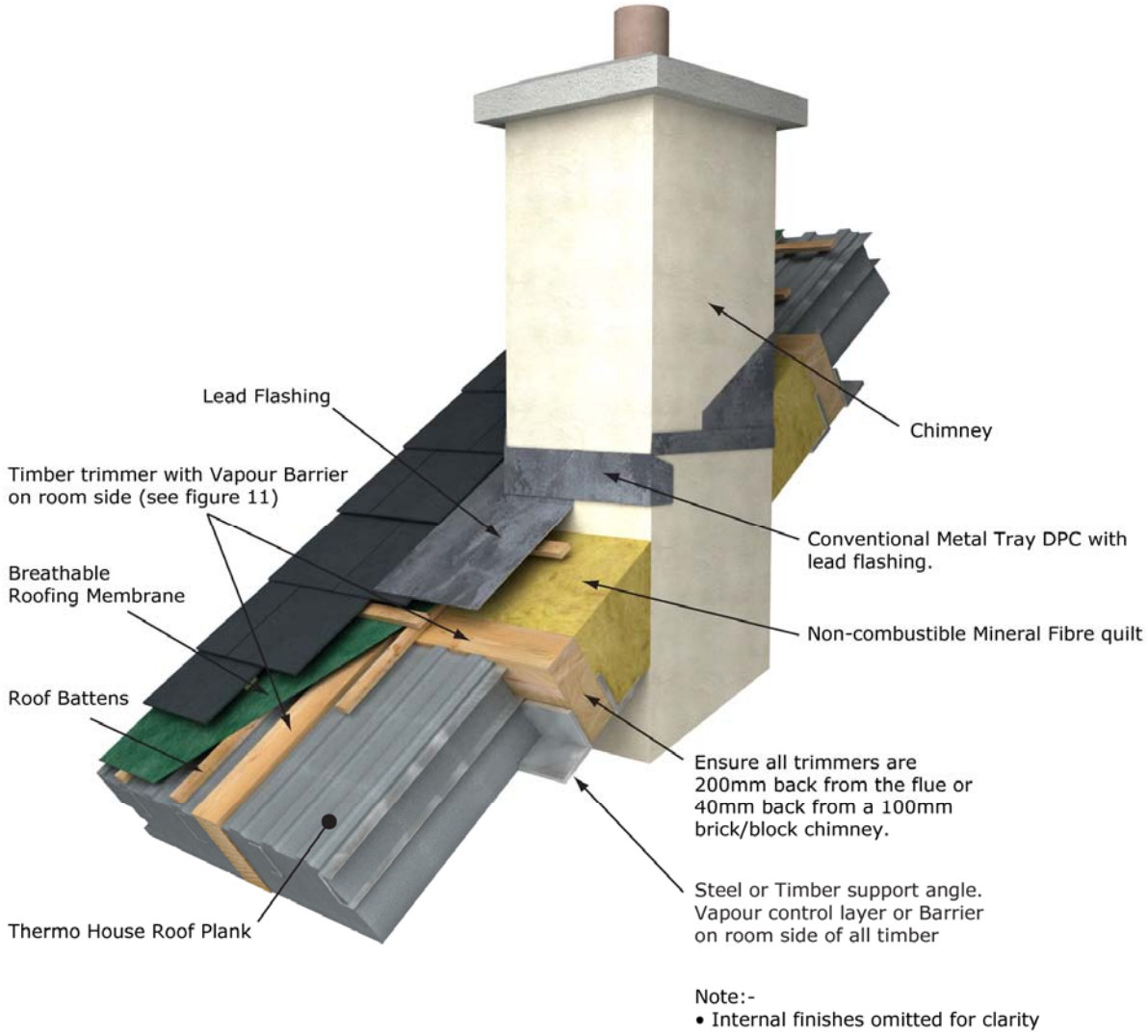


Figure 8: Chimney penetration Details

3.1 STRENGTH & STABILITY

3.1.1 General

The Thermo House Roofing panel is intended for use where Architect's drawings are available and satisfy the Building Regulations 1997 to 2009 – the Architect and Engineer design team of the developer are responsible for the architectural drawings and overall building design to comply with the Building Regulations. Thermo House Ltd., through the use of an experienced Chartered Structural Engineer, are responsible for the structural design of the Thermo House Roofing panel.

A range of prescriptive designs are outlined in table 4 by Chartered Structural Consulting Engineers which addresses the structural requirements for the Thermo House Roofing panel for houses meeting the criteria given in table 6. For all other cases outside the scope of table 4 and 6, Thermo House Ltd., if requested, will provide a structural design and issue a certificate of compliance at the completion of the project. If requested, Thermo House Ltd. will liaises with the engineer for the developer and provides the necessary loading information for the design of wall plates, purlins and ridge supports.

3.1.2 Loading

The vertical imposed loads should not exceed the following:

Element	Loading	
Roof	Distributed Load	0.75kN/m^2
Floor	Distributed Load	1.50kN/m^2
Ceiling	Distributed Load	0.75kN/m^2

Table 3: Vertical Imposed Loads

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 BS 648:1964 *Schedule of weights of building materials* in this regard.

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

- Eurocode 1 - *Actions on structures*
- Eurocode 3 - *Design of steel structures*
- BS 6399-1:1996 *Loading for buildings – Code of practice for dead and imposed loads*
- BS 6399-2:1997 *Loading for buildings – Code of practice for wind loads*

Fixings and frequency of anchor bolts must be as per the Thermo House Technical Manual.

Design snow and wind loads must be based on Diagram 14 and 15 of TGD to Part A of the Building Regulations 1997 to 2009. The maximum characteristic wind loading pressure for the Thermo House Roofing panel are detailed in table 4 of this certificate for a number of different exposure categories, in accordance with BS 6399-2:1997.

Where timber elements are used they are designed in accordance with IS 444:1998 *The use of structural timber in buildings*, and Eurocode 5 - *Design of timber structures*.

Panel designs are based on the wind exposure map provided in the TGD to Part A of the Building Regulations 1997 to 2009. 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 a reduction of allowable single and double span values as outlined in table 4 and in effect will result in a greater frequency of primary support.

3.1.3 Stability

The roof panels are used as conventional roof rafters for traditional cut roof constructions supported on the primary support elements such as purlins, wall plates and steel beams.

The primary roof structure must be capable of accommodating all lateral and wind uplift forces. The primary supports must be adequately sized to accommodate lateral forces which arise due to lack of triangulation of a cut roof.

Thermo House Ltd can provide site by site specific data on maximum loads both vertical and horizontal, however it is the responsibility of the client/developers engineer to ensure that the primary structure in the form of wall plates, purlins and ridge beams are adequately sized to accommodate all design loads.

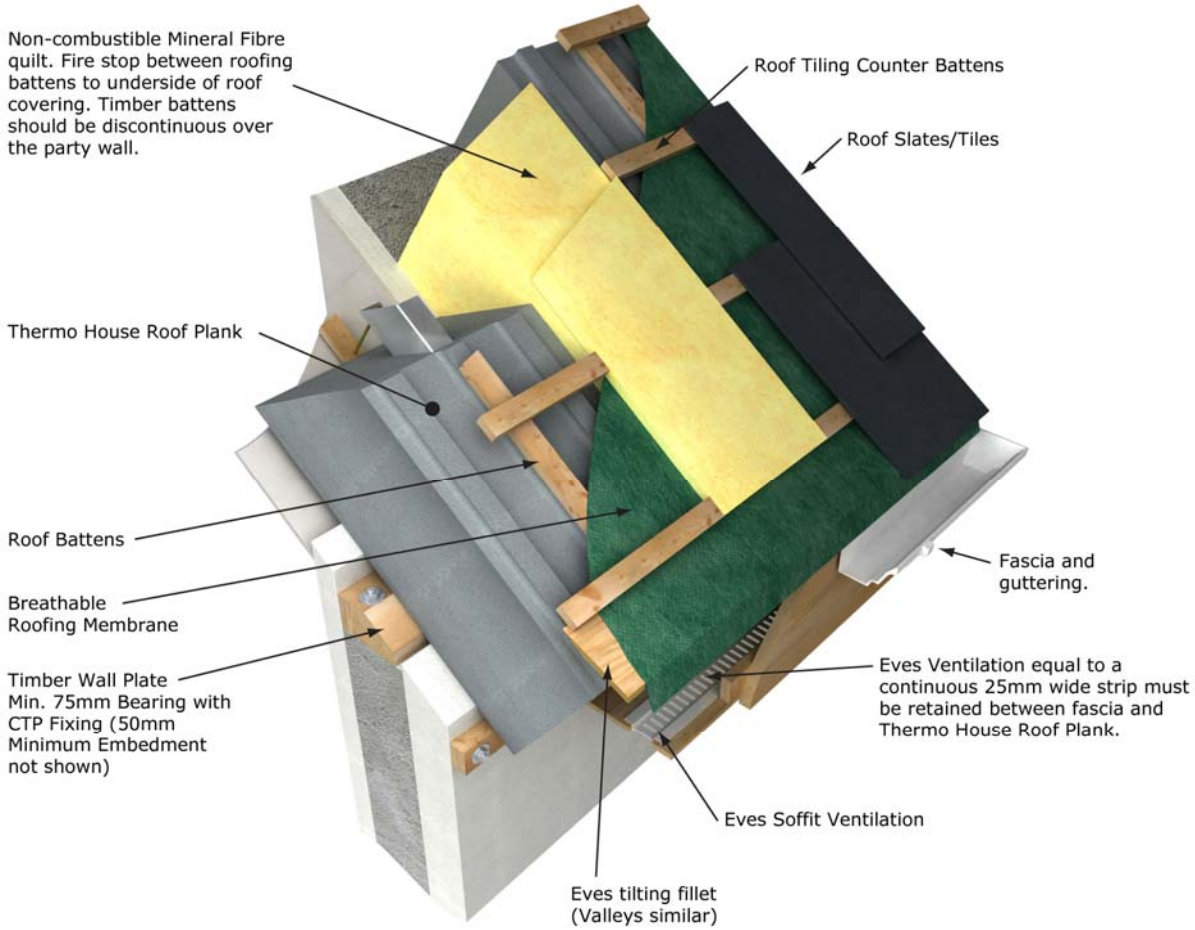


Figure 9: Fire Stopping at Party Wall

3.2 STRUCTURAL FIRE SAFETY

3.2.1 Internal Fire Spread (Linings)

The NSAI Agrément approved internal plaster finish for ICF systems and plasterboard slabs used on the internal finish are non-combustible and have a Class 0 'spread of flame' 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)

Primary structural support elements must be installed in accordance with the requirements of Technical guidance document to Part B of Building Regulations 1997 to 2009.

3.2.3 Containment of fire

The plasterboard internal lining for use with the thermo House Roofing Systems have a spread of flame rating equivalent to Class 0. In accordance with the requirements of Appendix A Table A1 of TGD to part B of the Building Regulations 1997 to 2009 there is no requirement for a roof element to contain a fire.

At the boundary or party wall junction between two adjacent dwelling the integrity of the dividing wall must extend up thought the roof structure as indicated in Figure 9.

Table of Maximum Spans for Single Span Roof							
Roof Finish	Wind Load Type	Roof Slope					
		10°	20°	30°	40°	50°	60°
		Span (m)					
Slate Roof	Exposure 1	3.63	3.45	3.36	3.34	3.32	3.42
	Exposure 2	3.46	3.36	3.25	3.22	3.17	3.26
	Exposure 3	3.26	3.30	3.17	3.13	3.08	3.15
Tiled Roof	Exposure 1	3.48	3.33	3.26	3.25	3.24	3.36
	Exposure 2	3.43	3.25	3.16	3.14	3.11	3.20
	Exposure 3	3.36	3.19	3.09	3.07	3.02	3.11
Table of Maximum Spans for Double Span Roof							
Roof Finish	Wind Load Type	Roof Slope					
		10°	20°	30°	40°	50°	60°
		Span (m)					
Slate Roof	Exposure 1	4.06	3.85	3.75	3.73	3.70	3.82
	Exposure 2	3.86	3.75	3.63	3.59	3.54	3.64
	Exposure 3	3.64	3.68	3.54	3.50	3.44	3.52
Tiled Roof	Exposure 1	3.89	3.71	3.64	3.64	3.62	3.75
	Exposure 2	3.84	3.63	3.53	3.51	3.47	3.58
	Exposure 3	3.75	3.57	3.45	3.42	3.38	3.47
Notes	1. Relevant only to structures less than 250 m OD Malin Head						
	2. Wind Load	exposure 1 -refers to basic wind speed of 23 m/s or less					
		exposure 2 -refers to basic wind speed of 23 -24 m/s					
		exposure 3 -refers to basic wind speed of greater than 24 m/s					
	3. The span is measured along the slope of the roof						

Table 4 – Load Span Tables

Thermo House Panel properties	
Max Moment Capacity	5.45 KNm/m
Max Moment of Inertia	108.31 cm^4/m

Table 5 – Panel properties

Loadings			
Slated Roof Dead Loading	kN/m^2	Tiled Roof Dead Loading	kN/m^2
Roof Slates(15mm avg tk, $30kN/m^3$)	0.45	Roof Slates (35mm avg tk,$20kN/m^3$)	0.70
Thermo Panel	0.12	Thermo Panel	0.12
Battens & Felt	0.05	Battens & Felt	0.05
Ceiling and services	0.25	Ceiling and services	0.25
Total Dead	0.87	Total Dead	1.12
Wind Loading		Live Loads	
Exposure 1	1.33	Live Loading	0.60
Exposure 2	1.65	Snow Loading	0.60
Exposure 3	1.89	Max Live Loading	0.60
Note:- For load conditions outside the scope of this table, designer should contact the certificate holder			

Table 6 – Panel Loading

3.3 WEATHERTIGHTNESS

The weathertightness of the building relies upon the correct installation of the breathable vapour barrier as outlined in both this certificate and I.C.P. 2 2002 - *Irish Code of Practice for Slating and Tiling.* Service penetrations through the breathable vapour barrier should reinstate the full integrity of this layer thought the use of preparatory roofing skirts and double sided sealing tape.

Rooflights can be accommodated and incorporated into the Thermo House roofing system and designers should provide details of their selected rooflight to the certificate holder as not all rooflights on the market are suitable for the Thermo House roofing system. See Figure 11.

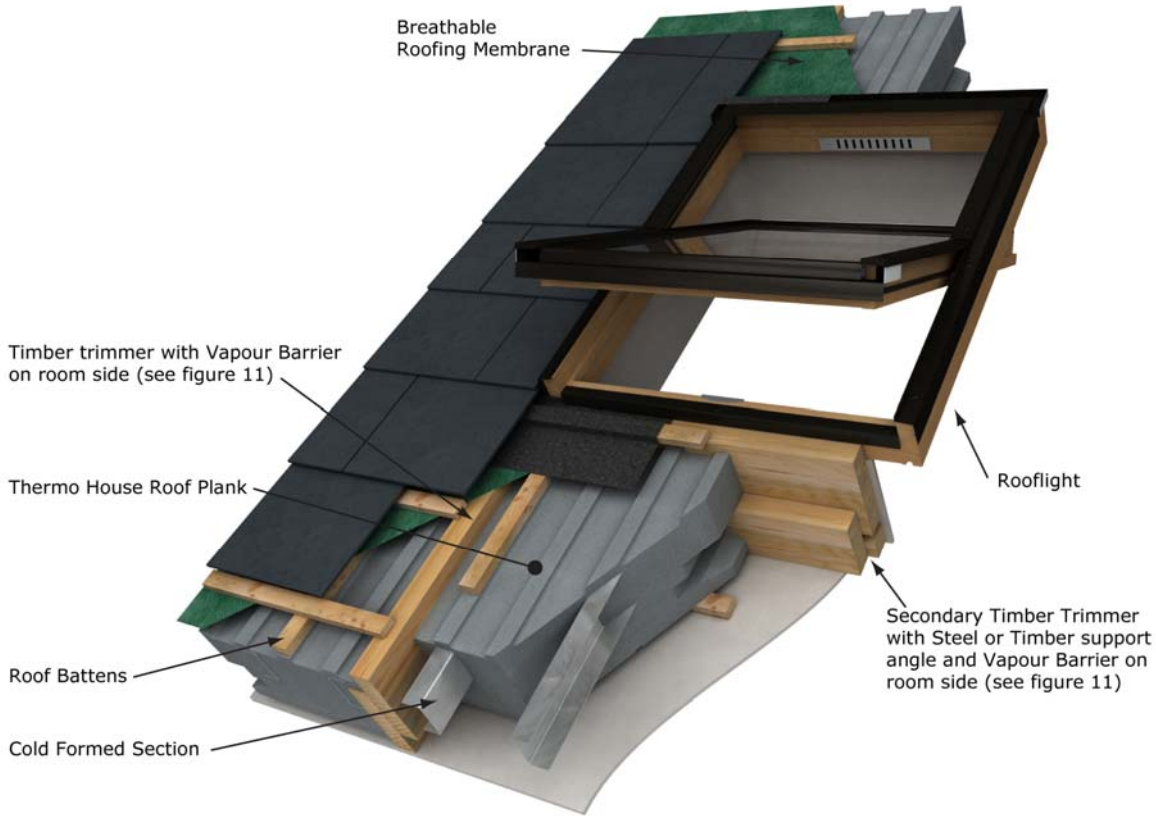


Figure 10: Rooflight

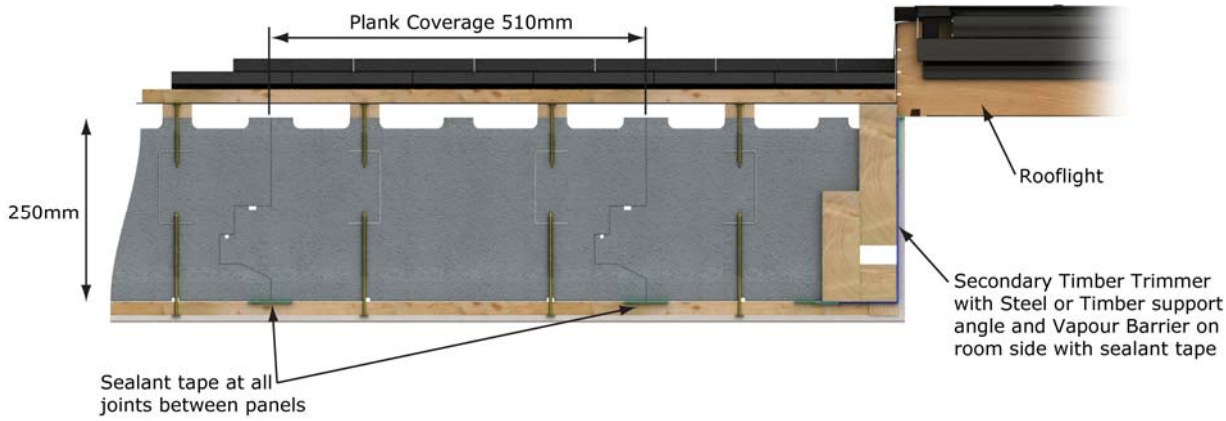


Figure 11: Rooflight Details

Typical requirements for rooflights are detailed in the thermo house installation manual.

As mentioned in section 2.4.4 of this certificate the practice of butt jointing panels or splicing panels along their length should be avoided. If butt jointing panels is unavoidable additional sealant tape must be use as per Thermo House instructions.

4.1 BEHAVIOUR IN RELATION TO FIRE

Combustibility - Although the Thermo House Roofing panel is a product of limited combustibility, when used in the context of this Certificate the increase in fire load in the building consequent to its use, is negligible.

The use of the Thermo House Roofing panel will not affect the fire rating obtained by the tiled/slated roof when assessed or tested to BS 476:Part 3:2004 *Fire tests on building materials and structures – Classification and method of test for external fire exposure to roofs*.

Thermo House Roofing panel is manufactured without the use of CFC's and HCFC's, there is no release of such gas on burning.

4.1.1 Fire Barriers

At the junction of compartment walls and party walls, The compartment wall, should be carried up to the underside of the *roof deck and be fire stopped with resilient non-combustible fire stopping material over the full* width of the wall (see Figure 9).

If a fire penetrates a roof near a compartment wall there is a risk that it will spread over the roof to the adjoining compartment. To reduce that risk, the junction between a compartment wall and a roof should be constructed in accordance with the following:

A zone of the roof at 1.5 m wide on both sides of the wall should have a covering of class BROOF(t4) (European class) or AA, AB or AC (National class) (see table A5 to Appendix A) on a non-combustible (see table A8 to Appendix A) sub-strate or deck.

4.1.2 Toxicity

The system is non-toxic in normal conditions. In fire conditions, the polystyrene will begin to soften, to contract and finally 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 Thermo House Roofing System is flame retarded.

4.2 THERMAL INSULATION

The Thermo House Roofing panels are a form of hybrid construction where insulation is included between the steel cold formed sections and further insulation is placed on the outside and inside of the steel cold formed sections to reduce thermal bridging through the steel.

Following an assessment of the elemental u-value of Thermo House Roofing system in accordance with the requirements of I.S EN ISO 6946:2007 *Building components and building elements - Thermal resistance and thermal transmittance - Calculation method*, the Thermo House Roofing system meets and exceeds the U-Value requirements of TGD to Part L of the Building Regulations 1997 to 2009. Elemental u-values and thermal conductivity values are outlined in table 8 of this certificate.

4.2.1 Limiting Thermal Bridging

The linear thermal transmittance (ψ) or Psi describes the heat loss associated with junctions and around openings. The Thermo House Roofing System has been assessed and when detailed in accordance with this certificate, these thermally bridged junctions comply with the requirements of Table D1 of appendix D of TGD to Part L of the Building Regulations 1997 to 2009. 'Ψ' values for bridged junctions as outlined in table 7 can be used in calculating the 'y' factor for a dwelling.

When all 'Ψ' values for an entire dwelling are equal to or better that the values outlined in Table D1 of Appendix D of TGD to Part L then an improved 'y' factor for a dwelling can be entered into the DEAP Building Energy Rating (BER) software package. This is as a result of lower heat loss from thermal bridging.

In addition to the junctions outline in Table D1 of Appendix D of TGD to Part L, further assessment of thermal bridged junctions has been carried out. These additional junctions are listed in table 7 along with their 'Ψ' values and 'f_{Rsi}' temperature factor (see section 4.2.3).

'Ψ' values for other junction outside the scope of this certificate should be assessed in accordance with the BRE IP1/06 "Assessing the effects of thermal bridging at junctions and around openings" and BRE Report BR 497 "Conventions for calculating linear thermal transmittance and temperature factors" in accordance with appendix D of TGD to Part L of the Building Regulations 1997 to 2009.

4.2.2 Air Infiltration

Air permeability pressure testing is now a mandatory requirement under TGD L 2009 and as result default values can no longer be solely

used. Air pressure testing was carried out on a number of dwellings and the results were better than the default values applied under DEAP (Dwelling Energy Assessment Project).

The Thermo House Roofing system will therefore significantly contribute to the reduction of air permeability from a building. To ensure the full thermal benefit and to avoid excessive heat losses it is necessary to install peripheral seals around windows, doors, services, floors, roof and all building junctions which penetrate the envelop of the building in accordance with clause 1.3.4 Building Envelope Air Permeability of Part L of the Building Regulations 1997 to 2009.

4.2.3 Mould Growth and Surface Condensation

The key factor used in assessing the risk of mould growth or internal surface condensation in the vicinity of thermal bridges is the temperature factor (fRsi). The Thermo House Roofing system has been assessed and when detailed in accordance with this certificate, these thermally bridged junctions comply with the requirements of Section D2 of appendix D of TGD to Part L of the Building Regulations 1997 to 2009. fRsi values are given in table 7 and these values surpass the 0.75 requirement as outlined in TGD to Part L. As a result the risk of internal surface condensation and mould growth in the vicinity of thermal bridges is minimal.

4.3 CONDENSATION

In order to eliminate the risk of interstitial condensation jointing tapes and vapour control barriers must be provided as outlined in section 4.3.1 of this certificate. Aadequate roof ventilation must be provided to the cold side of the insulation in order to meet the requirements of TGD to Part F of the Building Regulations 1997 to 2009.

4.3.1 Interstitial Condensation Roof

Due to the relatively high water vapour diffusion resistance factor (see table 2) of the EPS it is unlikely that moist humid air from within the living space will condense within the Thermo House roofing panel.

At the location where timber trimmers bridge the insulation layer, and frame out for chimney or roof light penetrations, a vapour control membrane must be provided on the warm side of the timbers to prevent humid air from passing from the living space into these timbers trimmers. As a result of this requirement is not possible to accommodate roof lights and chimney penetrations when using the NSAI Agrément approved Internal Plaster System unless calculations under the guidance of BS 5250:2002 predict no interstitial condensation within the roof construction and pass the risk criteria in IS EN ISO 13788 *Hygrothermal performance of building materials and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods.*

4.3.2 Condensation in Roof

A breathable vapour control layer should be used over the whole roof area. Adequate provision for roof ventilation must be made. Roof ventilation should be carried out in accordance with Part F of the Building Regulations 1997 to 2009 and the recommendations of BS 5250:2002, *Code of practice for control of condensation in buildings* and slates/tiles should be installed in accordance with ICP 2:2002. It is important to ensure that the ventilation is not obstructed by roof insulation and that the recommendations of TGD Part F, diagram 6 are observed and adhered to (i.e. 50mm unobstructed free air space between the roof deck and the insulation. Only NSAI Agrément approved roof tile/slate under-lays should be used in a roof with the system.

4.3.3 Means of Ventilation

Adequate means of natural or mechanical ventilation must be provided in order to regulate the moisture content or relative humidity of the air within the living space. The Thermo House Roofing systems can accommodate natural ventilation roof penetrations. Ducting associated with mechanical ventilation systems, should be concealed within service ducts. Under no circumstances should ducting or services be recessed into the EPS of the Thermo House Roofing system.

4.4 WEATHERTIGHTNESS

In all situations timber battens are fitted directly over the steel cold formed sections of the roofing panels. These timber battens can be considered to be the top edge of either a conventional timber or prefabricated roof truss and as a result all subsequent roof membranes, tiling battens, valley boards, counter flashings, slates and tiles should be installed as outlined in ICP 2:2002 *Irish Code of Practice for Slating and Tiling.*

4.5 DURABILITY

Roofs based on the Thermo House Roofing panel system, subject to maintenance, when constructed in accordance with the manufacturer's instructions and this Certificate will have a minimum design life of at least 60 years in accordance with BS 7543: 1992 *Guide to Durability of Building Elements, products and components*.

4.6 PRACTICABILITY

A Technical Manual, Installation Manual incorporating Health & Safety guidelines are provided by Thermo House Ltd. Erection of the Thermo House Roofing panel System must be by approved trained installers.

4.7 SOUND TRANSMISSION

When detailed in accordance with this certificate, the Thermo House Roofing System will meet the requirements of TGD to Part E of the Building Regulations 1997 to 2009 with respect to limiting the flanking transmission of sound at the party wall roof junction between two attached dwellings.

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

- Structural strength and stability
- Behaviour in fire
- Resistance to airborne sound transmission
- Elemental U-Value calculations
- Thermal transmittance values
- Condensation risk analysis
- Air tightness testing.
- Site erection controls

OTHER INVESTIGATIONS

- 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.
- Site visits were conducted to assess the practicability of installation.
- Bought-in components were assessed for suitability for use.
- Structural load testing of Thermo House Roofing Panels.
- Assessment of the effects of creep on the expanded polystyrene and wall plate interface.
- No failures of the product in use have been reported to the NSAI Agrément.

Target linear thermal transmittance (ψ) for different types of junctions.		Temperature Factor f_{Rsi}	TGP L Default Ψ-value	Thermo House Roof Ψ-value
Figure †	Junction detail in external wall	Min = 0.75	(W/m.K)	(W/m.K)
1	Eaves with wall-plate and ICF external wall	0.97	0.04	0.02
7	Eaves with shoe and ICF external wall	0.96	0.04	0.09
6	Eaves with cavity wall	0.96	0.04	0.14
THR-010a	Roof ridge with Steel beam	0.97	-	0.03
3	Roof ridge with Timber beam	0.97	-	0.03
THR-010c	Roof ridge with Ridge/Apex Strap	0.97	-	0.04
THR-012	Junction of extension roof and ICF wall	0.98	-	-0.04
10,11	Rooflight window	0.87	-	0.07
THR-014	Lean-to roof	0.98	-	-0.04
4	Gable, Option A: Roof insulation over wall	0.96	0.04	0.03
5	Gable, Option B: Roof insulation abuts wall	0.95	0.04	0.07
THR-016a	Flat Roof-Main Wall	0.98	-	-0.02
THR-016b	Flat Roof- External Wall	0.96	0.06	0.04
9	Roof / Party wall *	0.98	-	0.04

* For these junctions half of the Ψ-value is assigned to the dwelling on each side.
† Junctions refer to figures within this certificate or to Thermo Houses technical illustrations manual

Table 7: Linear thermal transmittance (ψ) and Temperature Factor

Building element	Required Elemental U-value (W/m^2K)	Calculated **U-value** (W/m^2K)
Pitched Roof - insulation on slope	0.20	0.15
Thermal conductivity, $\lambda_{90/90,}$ of EPS	0.031 W/mK	

Table 8: Elemental U-Values and Thermal Conductivity

Fixing Requirements For Typical (single) Roof Panel					
Ref	Description	Size	Location	Quantity	Reference
A	Supplied With Roof HSS Drill Bit	Dia. 6.5 x 200	Pre-Drill Roof Panel	1	THR-004
B	Supplied With Roof CTP 280 Screw	Dia. 6.0 x 280	Roof Panel Fixing	6	THR-004 THR-008b THR-010
C	Supplied on Request Wing Drill Tek Screw	Dia. 5.5 x Length Calculated	External Batton fixing	7 per m^2	THR-005
D	Supplied on Request Wing Drill Tek Screw	Dia. 5.5 x Length Calculated	Internal Batton fixing	7 per m^2	THR-009a
E	Supplied on Request Tek Stitching Screw	Dia. 6.3 x 22	Galv. Shoe to Panel	2	THR-008a
F	Supplied on Request Tek Stitching Screw	Dia. 6.3 x 22	Facia/Soffit Bracket To Galv. Shoe	2	THR-008a
G	Supplied on Request Frame Anchor	Dia. 8.0 x 60	Galv.Shoe to Wall	2	THR-008a
H	Supplied on Request Frame Anchor	Dia. 8.0 x 140	Facia Bracket to Wall	2	THR-008a
I	Supplied With Roof Dichtkontakt Klebeband Air Stop Tape	50mm x 25M (Roll)	Panel - Panel(External)	2 Ln m /m^2	THR-006

Table 9: Schedule of approved fixings.

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 in accordance with the manufacturer's 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 2009 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 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 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.

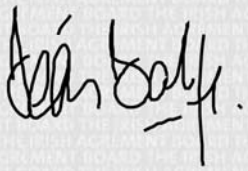
5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **10/0349** is accordingly granted by the NSAI to **Thermo House Ltd.** on behalf of The Irish Agrément Board.

Date of Issue: **September 2010**

Signed



Seán Balfe
Director of NSAI Agrément

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie