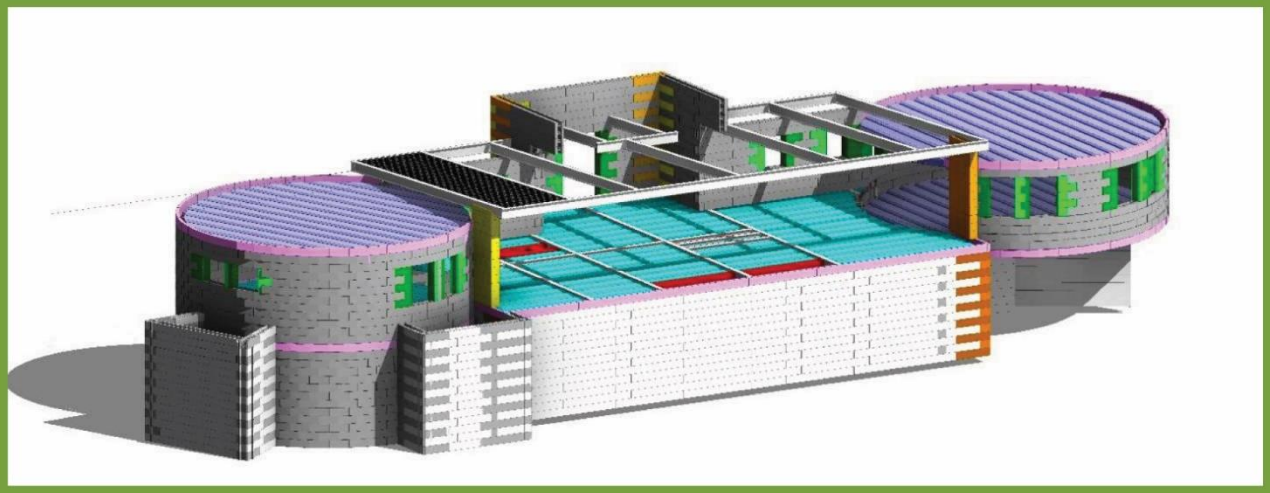
thermohouse

the complete low energy building system



Technical Manual

2018

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1.0 INTRODUCTION

What is the Thermohouse Complete System?

The Thermohouse modular building system consists of the following components;

- Insulating Concrete Formwork – ICF Walls
- Energy efficient floor system
- Energy efficient roof system
- Energy efficient ground floor insulation

The Thermohouse complete low energy building system, certified for construction up to 6 storeys, is manufactured to the highest standard available on the market today. The system has been providing quality homes throughout Europe since 2008 and is fully certified by European Organisation for Technical Approval (EOTA), Irish Agremént Board (IAB) and Local Authority Building Control (LABC) UK

The Thermohouse complete low energy building system is manufactured in a state of the art factory in Killarney, Co Kerry, Ireland, guaranteeing speedy delivery, service and customer support throughout Europe. Our technical team is ready to respond to any query with practical advice on the quick and efficient installation of the system. Thermohouse shall be responsible for the design and supply of the system. Installation shall be carried out directly by Thermohouse or by approved installers. Further technical details can be obtained from the following certifications;

- ETA – 07/0018, IAB 08-0310, IAB 10-0349, LABC RD178,
  - ThermoRoof Load Test
  - ThermoRoof & Wall Thermal Testing
  - ThermoFloor Thermal Testing
  - Flat Roof & Suspended Floor Thermal Testing
  - Flat Roof Interstitial Condensation Risk Analysis
  - Acoustic Testing – Airborne & Impact

NOTE:

The advice in this publication is based on the most authoritative information available. Users should ensure that it is relevant to the specific circumstances to which they seek to employ it.

Professional advice should always be sought.

All certification referred to in this publication were current at the time of printing.

For clarification on any detail within this manual or for further technical support please contact +353 (0)64 6631307.

1.1 SITE SAFETY

Under the ***Safety, Health and Welfare at Work Regulations*** it is the site manager's responsibility to ensure all relevant health and safety regulations are complied with during the build process. These include, but are not limited to:

- Working with concrete, protective clothing and eye wear, to protect from cement burns and dust inhalation.
- Working with power tools will require personal protective equipment such as hard hats, gloves, ear defenders, eye protection etc.
- In any situation where work takes place off the ground, particularly on the scaffolding used in conjunction with the alignment/propping frames of the Thermohouse system, the relevant regulations must be considered.
- Manual handling – care should be taken when moving blocks, flooring and roofing panels around the site.
- Fire safety – Thermohouse components are made from flame-retardant polystyrene, but they will melt when exposed to a flame or solvents.

The roof and flooring panels contain galvanized steel "C" sections within the forms and the appropriate PPE must be worn to avoid injury.

Toxicity

The system is non-toxic in normal conditions. In fire conditions, the polystyrene will begin to soften, then contract and finally melt above 100^{o}C. Ignition occurs between 350^{o}C and 450^{o}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 Thermohouse Roofing System is flame retarded.

Waste Disposal

The wall forms, roofing and flooring panels are manufactured from high density expanded polystyrene (EPS). Please ensure full compliance to the local authority regulations when disposing of any waste material.

*********A HSDS data sheet is available on request*********

These notes are a guide only to some of the issues that can affect site safety. They should not be seen as an exhaustive list. For further information please contact the appropriate **Health and Safety Authority.**

1.2 EXPANDED POLYSTYRENE (EPS)

Expanded Polystyrene (EPS) is made up of 98% air and 2% polystyrene and has a minimum lifespan 60years. EPS uses less than 0.1% of global oil as a feedstock, allowing it to save up to 200 times its own resource in thermal energy savings. The energy payback of EPS thermal insulation is highly renowned. In the case of thermal renovation of a house with EPS insulation, the total primary energy for production of the EPS used is saved in just 2 to 4 months. For commercial construction, EPS applications get the highest possible A-plus summary rating in the BRE Global Green Guide to specification. In addition to the A-plus summary rating, EPS gains 'A' ratings across the majority of the critical environmental performance matrices including:

Water Extraction	A+
Mineral Resource	A+
Stratospheric Ozone Depletion	A+
Human Toxicity	A+
Ecotoxicity	A+
Nuclear Waste	A+
Waste Disposal	A+
Fossil Fuel Depletion	A
Eutrophication	A+
Acidification	A

The lightweight, low impact qualities of EPS combined with its immense energy saving insulation properties has the potential to significantly reduce CO2 emissions. Approximately 85% of the environmental impact of a building is related to energy consumption in the building's occupation phase, mainly from the heating and cooling needs of the building user. Therefore, one of the most important environmental aspects of any insulation material is its thermal performance throughout the lifetime of the building and the design to ensure the longevity of this thermal performance. It is important that optimum insulation dominate properties which allow for the long-term performance, such as:

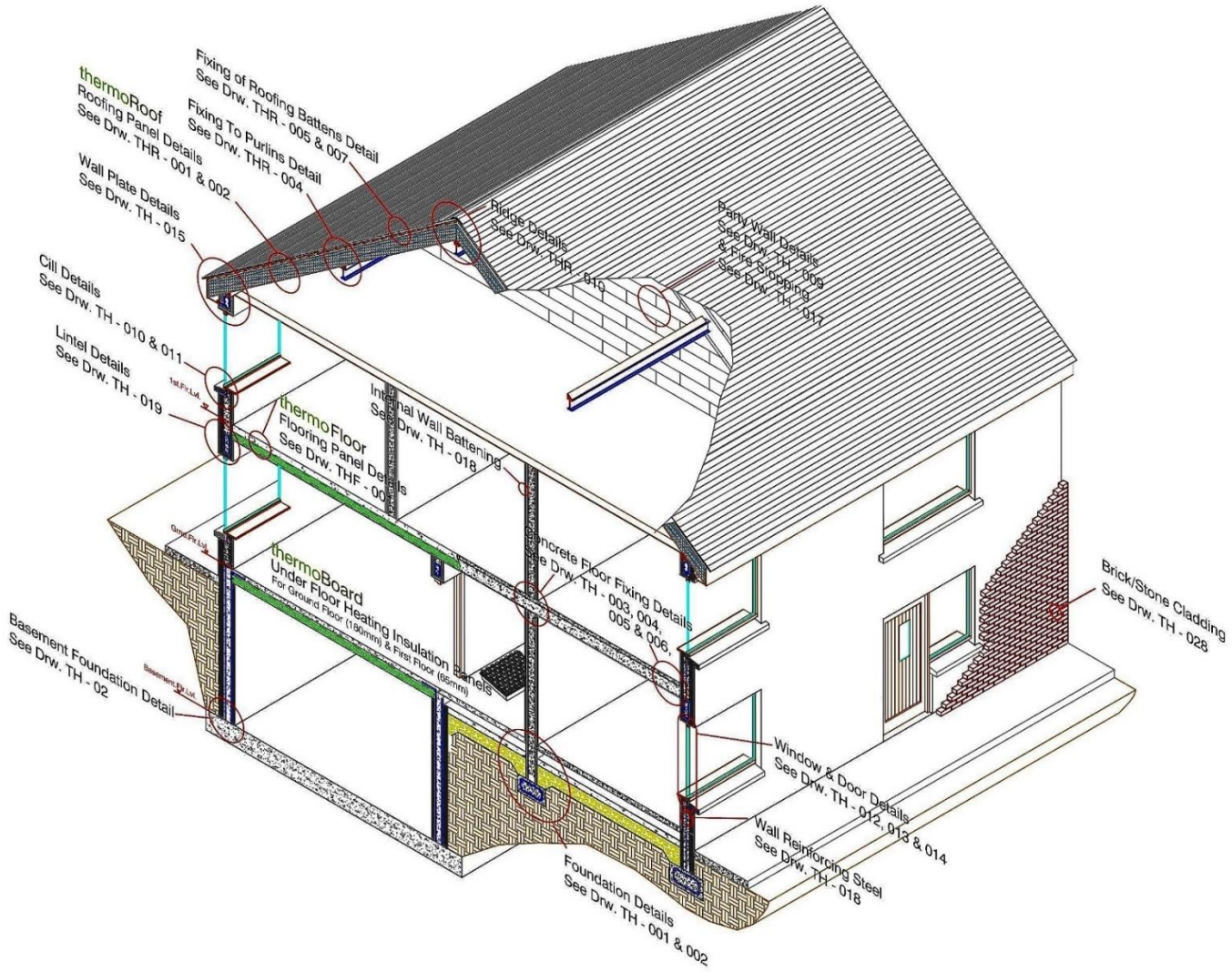
- Constant Thermal Insulation Value
- Low Moisture
- Mechanical Strength (to offset user wear & tear throughout life span of building)
- Resistance to Rot, Mould & Decay
- Resistance to Rodent Decay

Please be aware that care must be taken to avoid UV damage to the EPS products

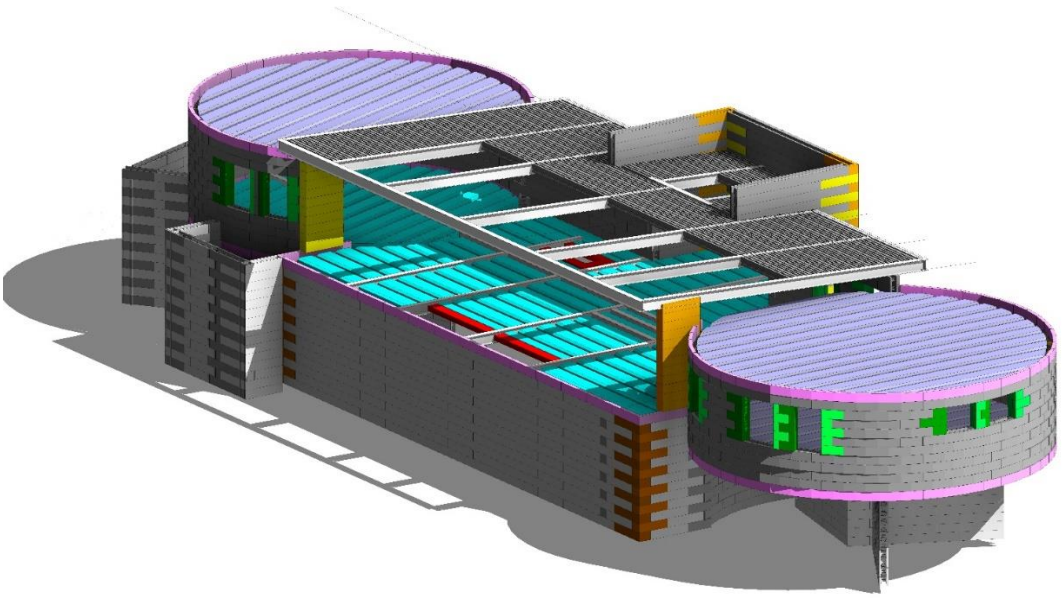
1.3 TOOLS, MATERIALS & ACCESSORY REQUIREMENTS

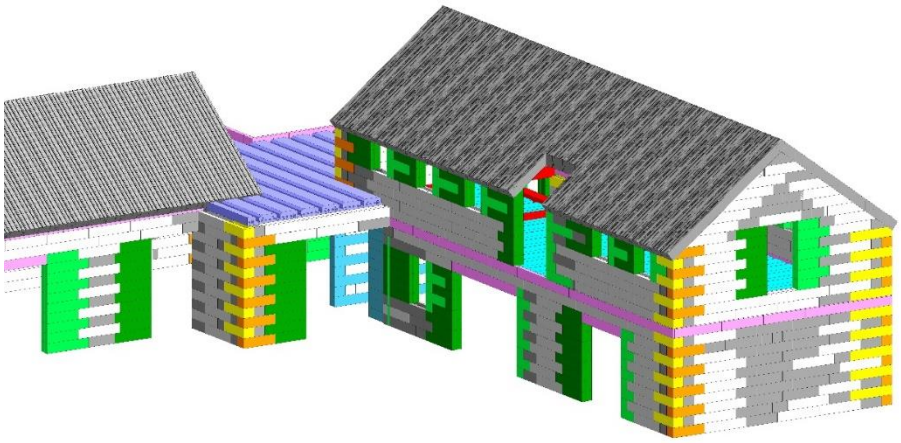
- Wall alignment / bracing system
- Scaffold planks
- Safety Rails
- Hand saw
- Tape measure
- Cordless drill
- Hammer drill
- Impact drill
- Hammer
- Spirit Level
- Plumb bob
- String line
- Foam gun
- Concrete vibrator poker (25mm)
- Hot knife

1.4 Thermohouse - Details Index



1.5 Revit Models





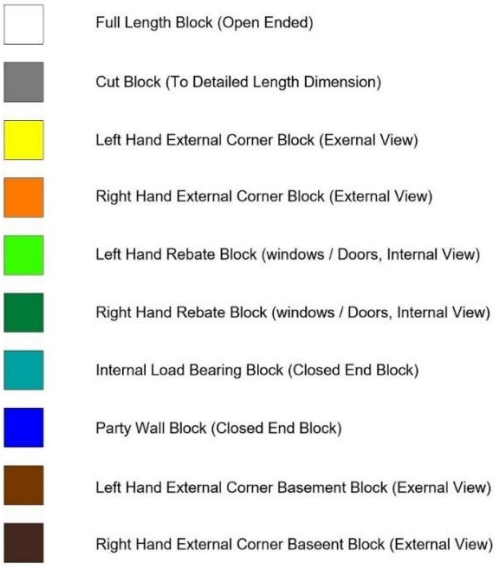
Typical Thermohouse 3-D Revit Layout Model

Thermohouse provide a 3-D colour coded layout model for each specific project. This model highlights where each different block type is located within the construction of the building and indicates where the off-cuts can be placed to minimise the waste factor.

Thermohouse manufacture a variety of families of external wall elements providing a range of U values from 0.2 to 0.1W/m2K. The colour coding of the blocks remains the same across all of the different block ranges, 250mm, 300mm, 350mm, 400mm and 450mm.

For example;
Basement/Retaining Walls;
TH-46 - Open ended block (full length), White
TH-47L - Left hand corner – (viewed from outside) Light Brown
TH-47R - Right hand corner - (viewed from outside) Dark Brown
TH-47RL - Left hand reveals to openings - (viewed from inside) Light Green
TH-47RR - Right hand reveals to openings - (viewed from inside) Dark Green
All off-cuts, from all block types, now being open blocks of various lengths – Grey
TH-58 – 200mm Lintel insert – Light Brown

External Walls; 300/400/450
Open ended block (full length), White
Left hand corner - (viewed from outside) Orange
Right hand corner - (viewed from outside) Yellow
Left hand reveals to openings - (viewed from inside) Light Green
Right hand reveals to openings - (viewed from inside) Dark Green
All off-cuts, from all block types, now being open blocks of various lengths – Grey
Riser to external insulation to floor edge and window heads– Deep Pink
50mm riser internal insulation to floor edge and window heads– light Pink
TH-57 – 150mm Lintel insert – Light Brown



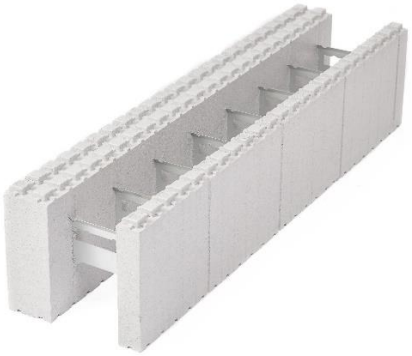
2.0 WALL SYSTEMS

Thermohouse provides a range of external wall systems to satisfy all requirements, with U-values ranging from 0.2 to 0.1W/m^{2}K.
Thermohouse also provides an external retaining wall system suitable for basement construction, internal load bearing walls and party walls.

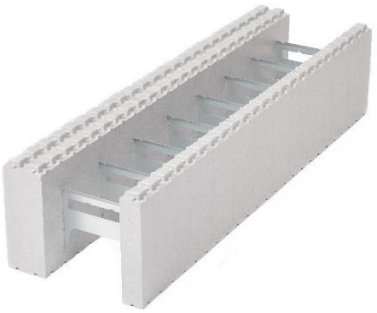
Walls designed using the Thermohouse ICF system can sustain and transmit loads to the ground to satisfy disproportionate collapse.

Internal Load Bearing – 250mm

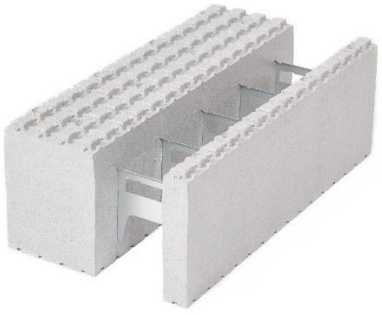
Internal Party Wall – 300mm



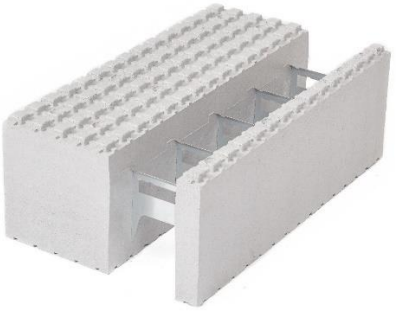
External – 300mm (U=0.20)



External (Retaining) – 350mm (U=0.20)



External – 400mm (U=0.12)

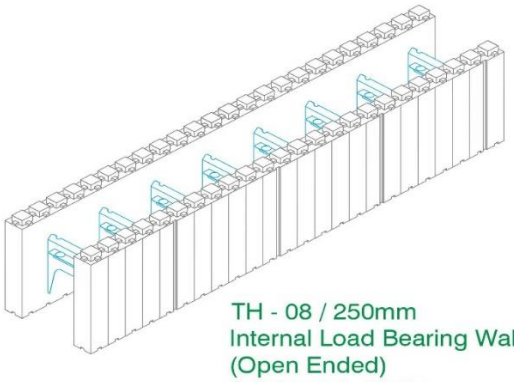


External – 450mm (U=0.10)

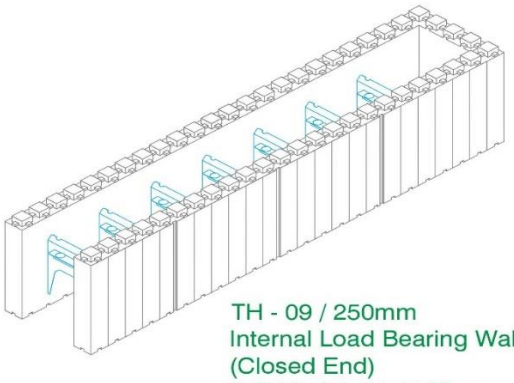
ThermoWall - Block Range Details

250mm Internal Load Bearing Block

(50-150-50)



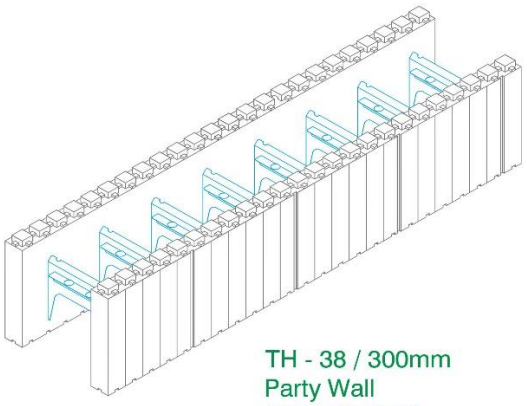
TH - 08 / 250mm
Internal Load Bearing Wall
(Open Ended)
3-D Model - White



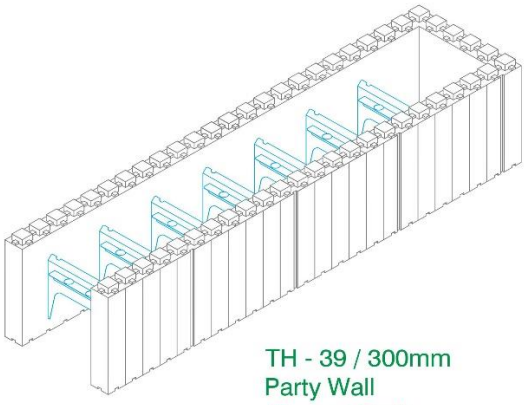
TH - 09 / 250mm
Internal Load Bearing Wall
(Closed End)
3-D Model - Light Blue

300mm Party Wall Block

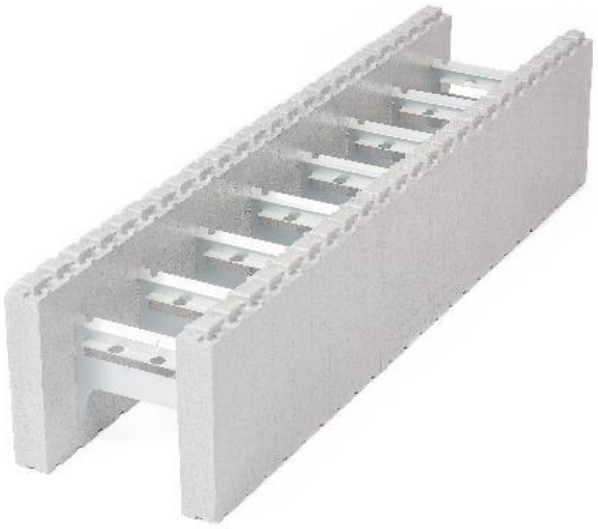
(50-200-50)



TH - 38 / 300mm
Party Wall
(Open Ended)
3-D Model - White



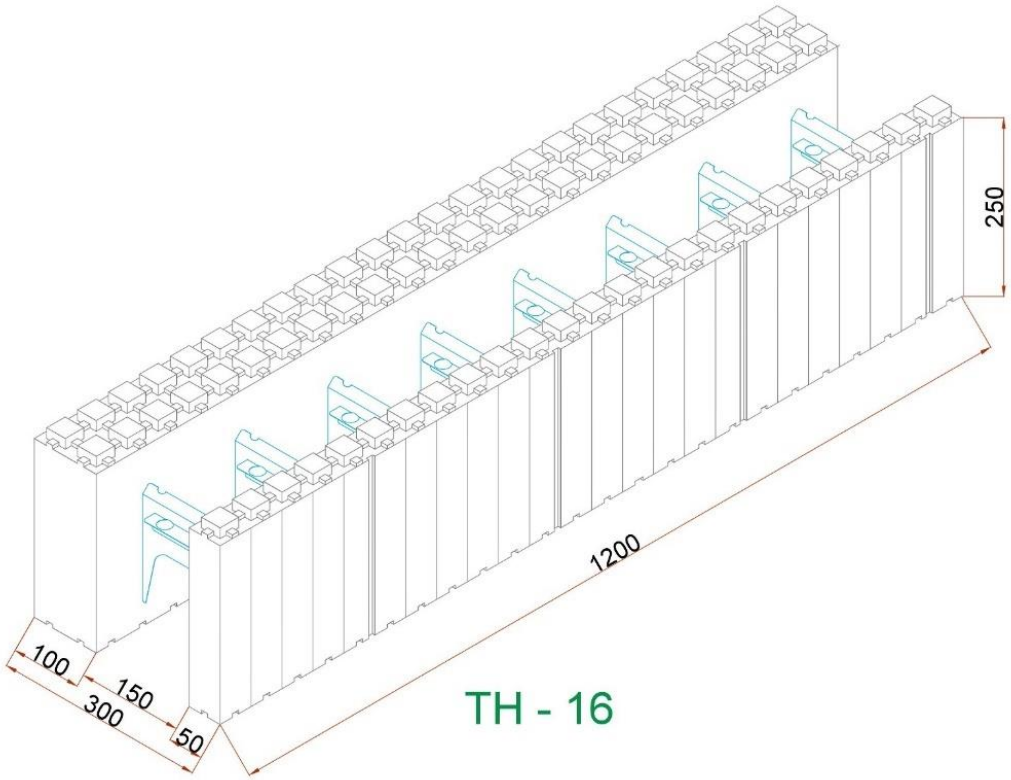
TH - 39 / 300mm
Party Wall
(Closed End)
3-D Model - Dark Blue

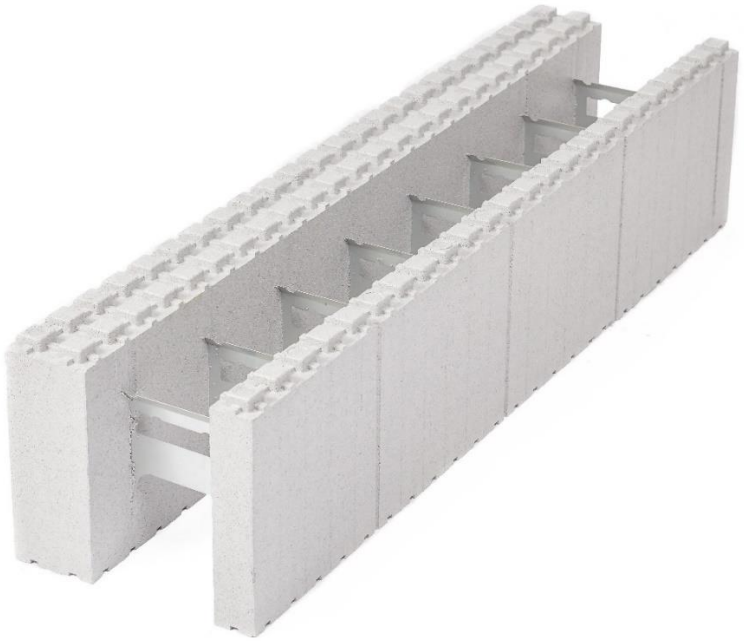


300mm External Block

U- value of 0.20

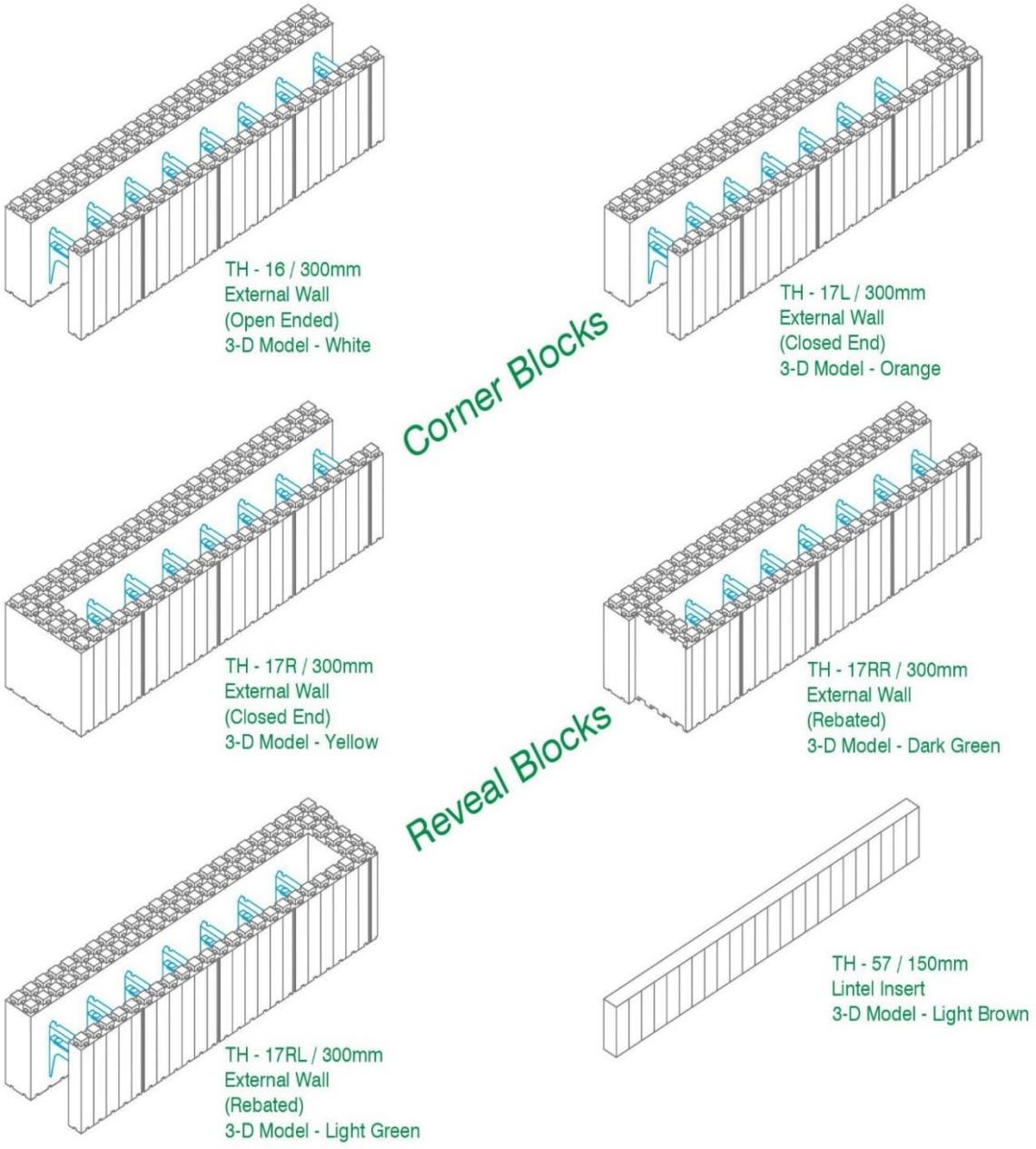
(100-150-50)





300mm External Block Family

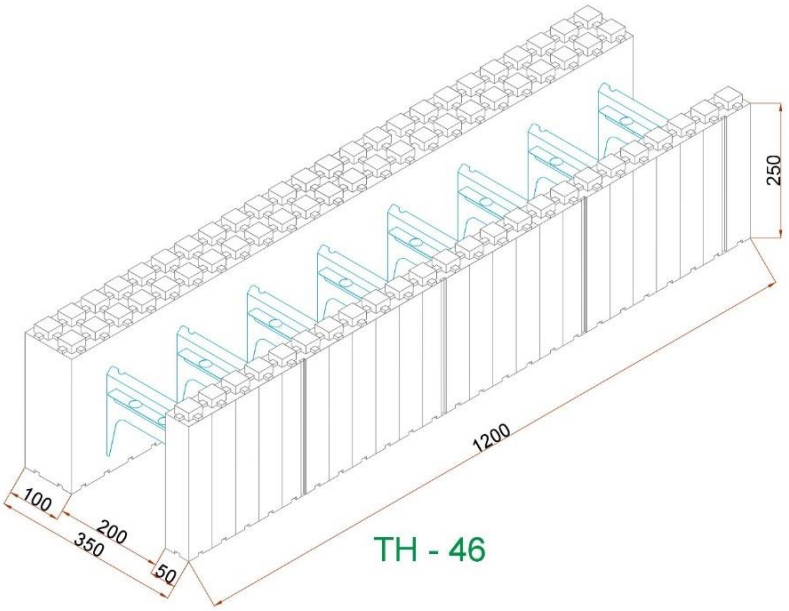
U-value of 0.20

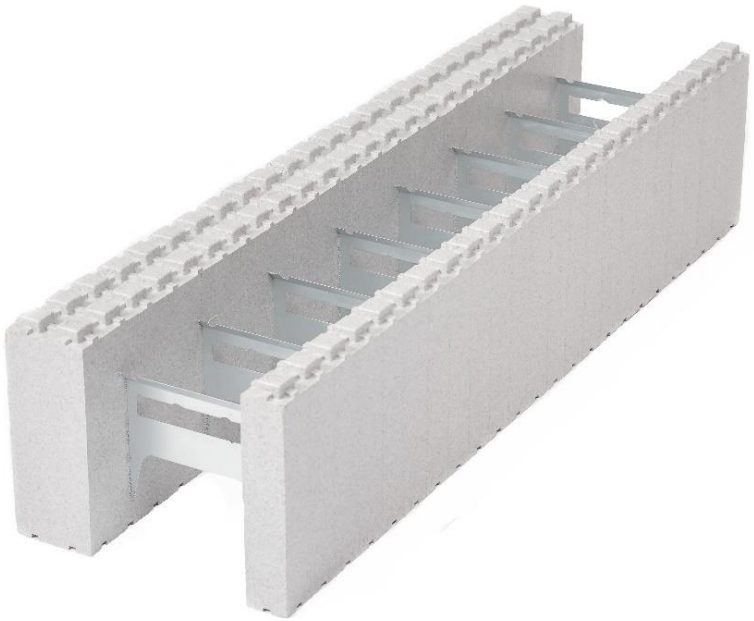


350mm Basement Block

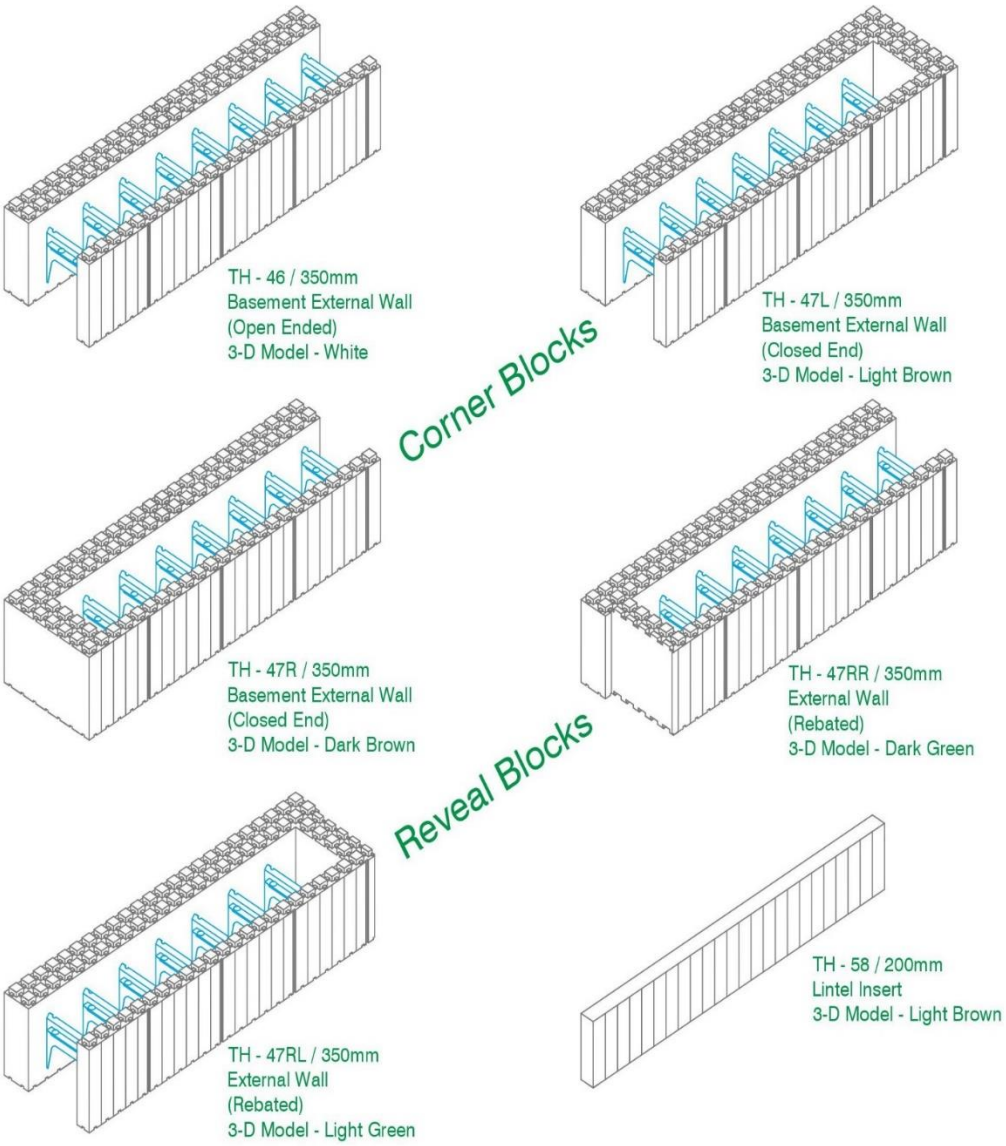
U-value of 0.20

(100-200-50)





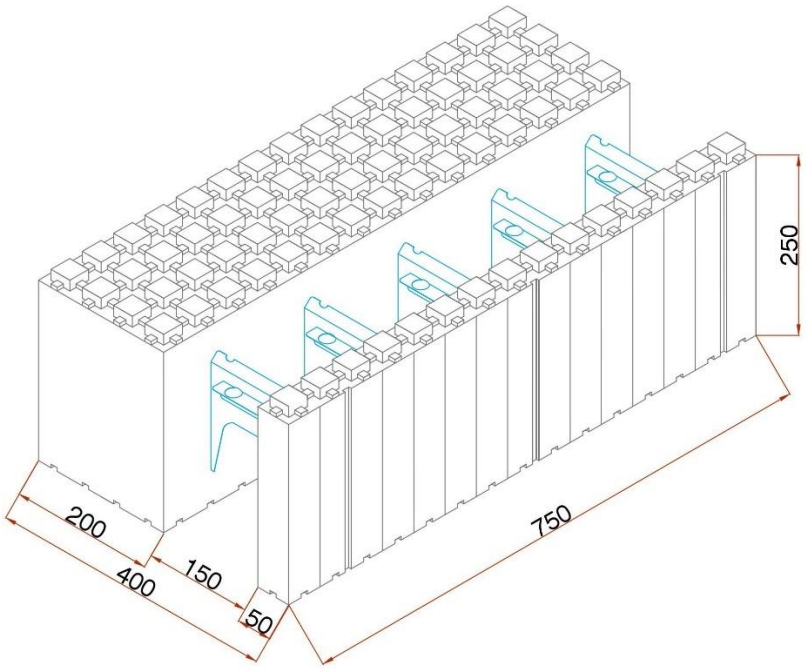
350mm (Retaining Wall)
Basement Block Family
U-value of 0.20

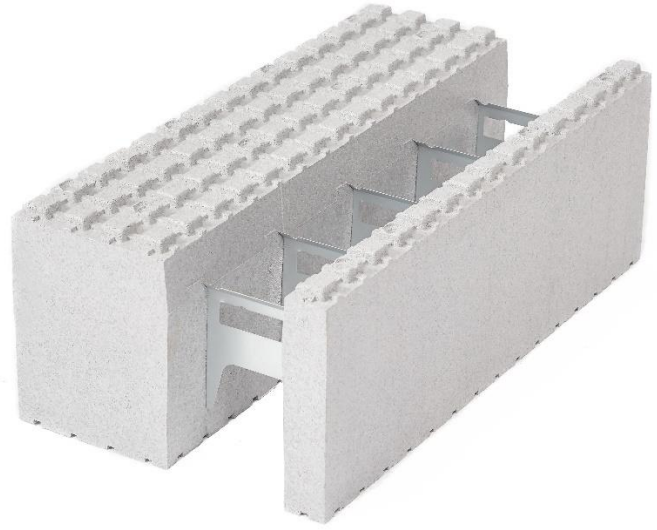


400mm External Block

U- value of 0.12

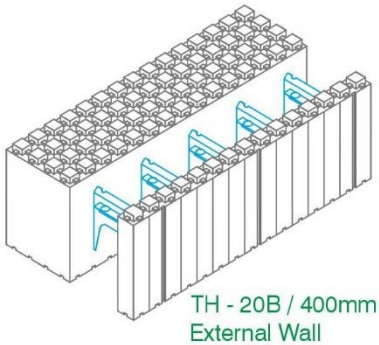
(200-150-50)





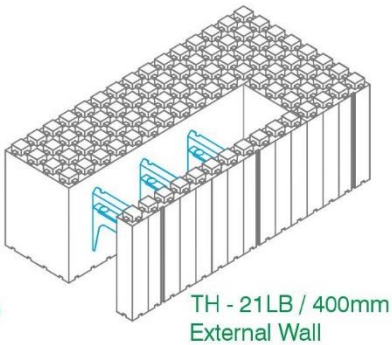
400mm External Block Family

U- value of 0.12

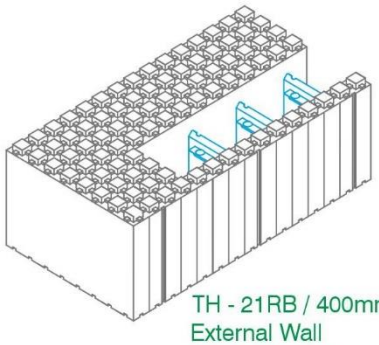


TH - 20B / 400mm
External Wall
Passive Block
(Open Ended)
3-D Model - White

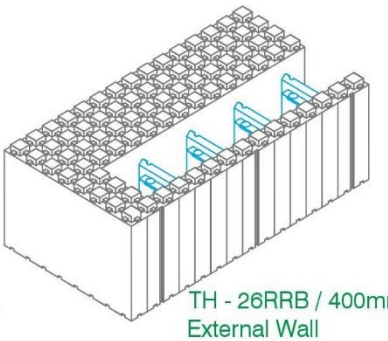
Corner Blocks



TH - 21LB / 400mm
External Wall
Passive Block
(Closed End)
3-D Model - Orange

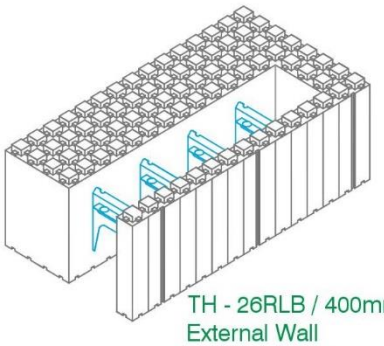


TH - 21RB / 400mm
External Wall
Passive Block
(Closed End)
3-D Model - Yellow

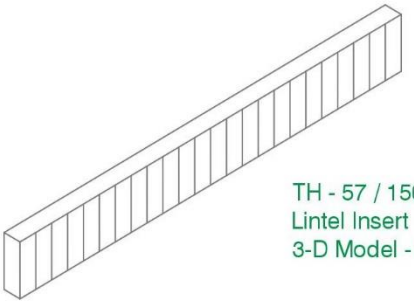


TH - 26RRB / 400mm
External Wall
Passive Block
(Closed End)
3-D Model - Dark Green

Reveal Blocks



TH - 26RLB / 400mm
External Wall
Passive Block
(Closed End)
3-D Model - Light Green

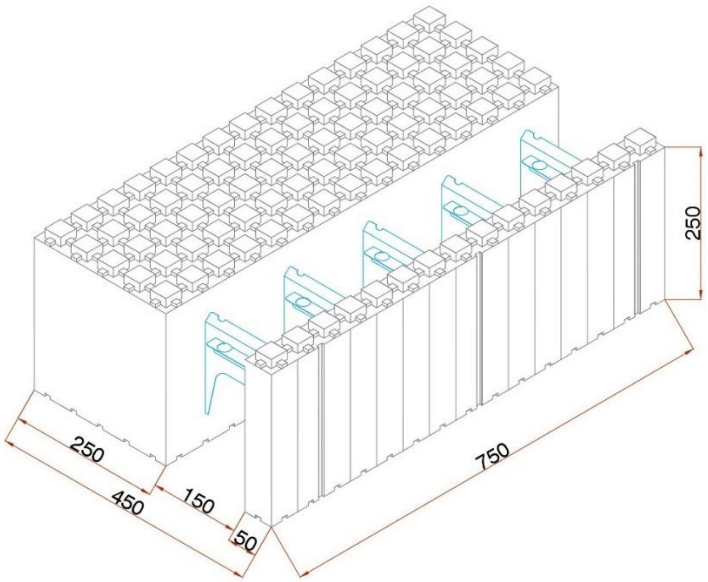


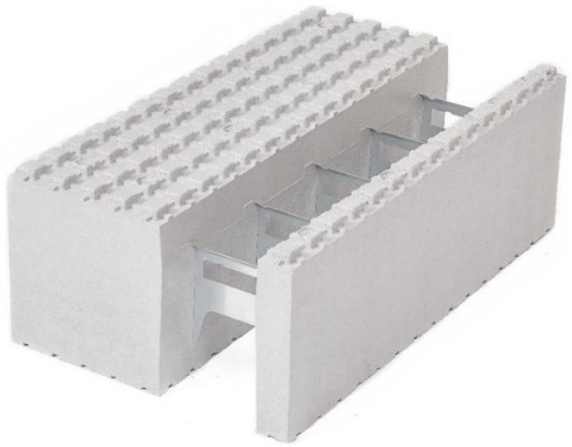
TH - 57 / 150mm
Lintel Insert
3-D Model - Light Brown

450mm External Block

U- value of 0.10

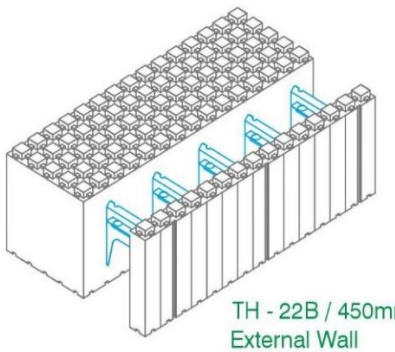
(250-150-50)



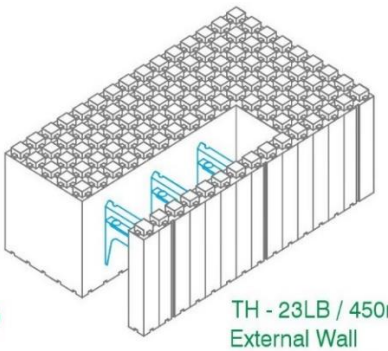


450mm External Block Family

U- value of 0.10

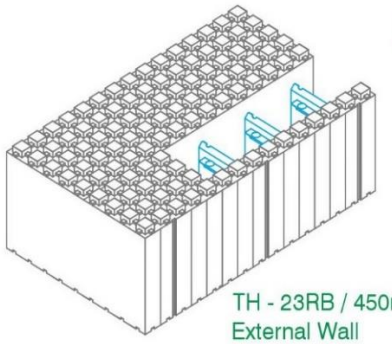


TH - 22B / 450mm
External Wall
Passive Block
(Open Ended)
3-D Model - White

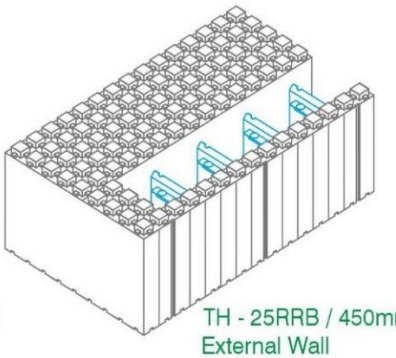


TH - 23LB / 450mm
External Wall
Passive Block
(Closed End)
3-D Model - Orange

Corner Blocks

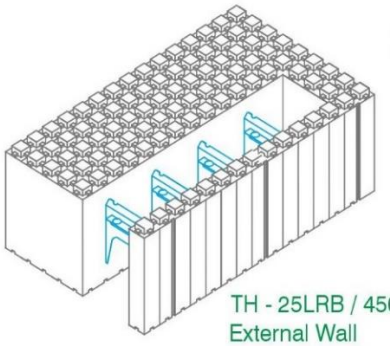


TH - 23RB / 450mm
External Wall
Passive Block
(Closed End)
3-D Model - Yellow

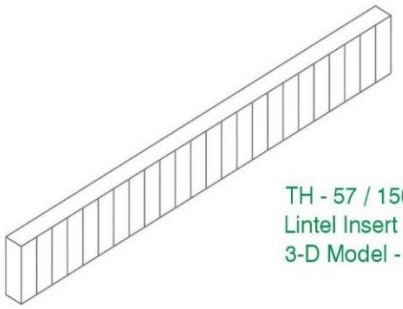


TH - 25RRB / 450mm
External Wall
Passive Block
(Closed End)
3-D Model - Dark Green

Reveal Blocks

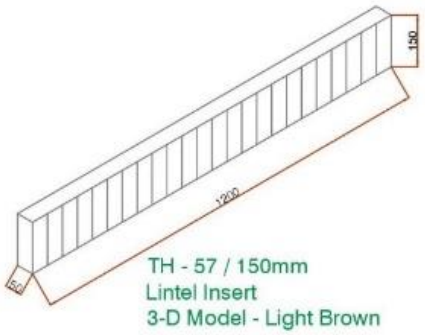


TH - 25LRB / 450mm
External Wall
Passive Block
(Closed End)
3-D Model - Light Green

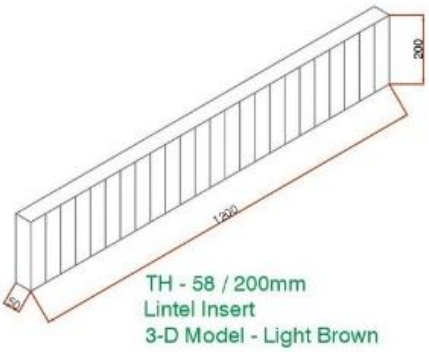


TH - 57 / 150mm
Lintel Insert
3-D Model - Light Brown

Independent Components

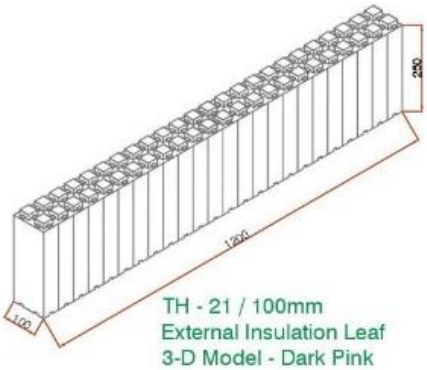


TH - 57 / 150mm
Lintel Insert
3-D Model - Light Brown

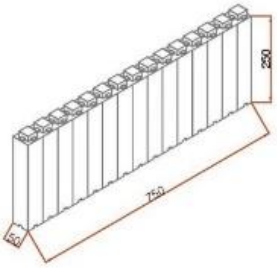


TH - 58 / 200mm
Lintel Insert
3-D Model - Light Brown

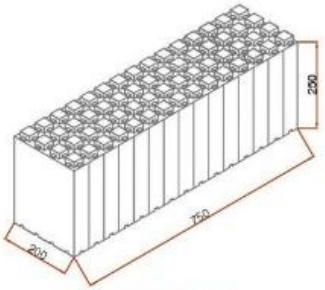
TH - 20 / 50mm
Internal Insulation Leaf
3-D Model - Light Pink



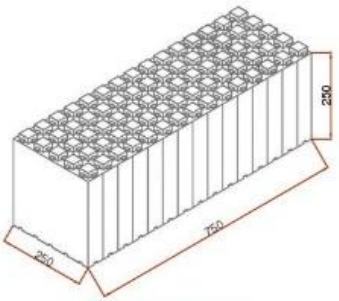
TH - 21 / 100mm
External Insulation Leaf
3-D Model - Dark Pink



TH - 19a / 50mm
Internal Insulation Leaf
3-D Model - Light Pink



TH - 19 / 200mm
External Insulation Leaf
3-D Model - Dark Pink

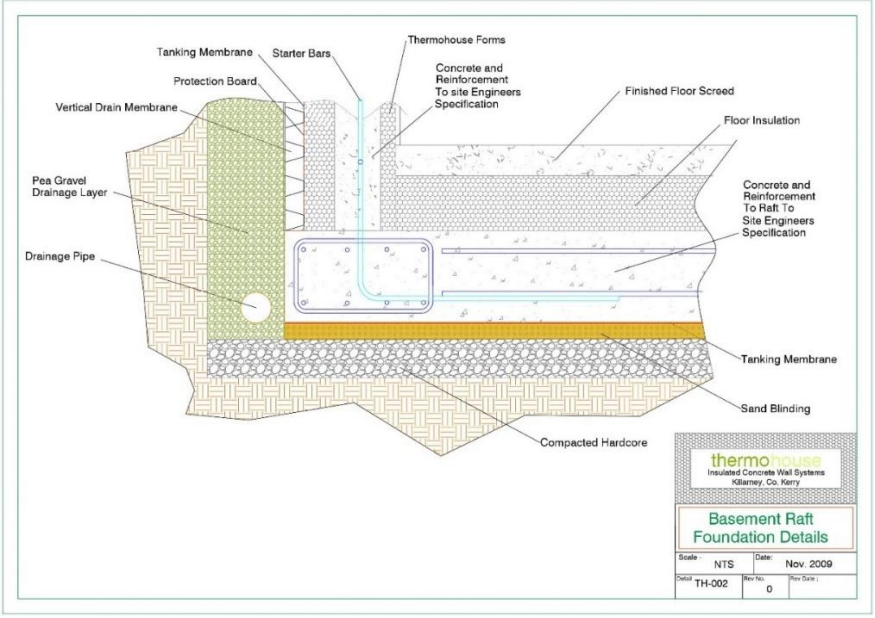


TH - 24 / 250mm
External Insulation Leaf
3-D Model - Dark Pink

2.1 BASEMENT CONSTRUCTION

Thermohouse 350mm wall elements facilitate the construction of basements. Our standard basement form has a 200mm concrete core which can be engineered with retaining wall values (these blocks can also be used in other locations of the build if required for engineering purposes). The elements are 350mm wide with a 100mm external and 50mm internal insulation. The construction/building method of the basement form work is the same as the method outlined in the next section on ***Wall Construction*** for the standard 300mm form work, with the exception that there has to be starter bars (as specified by Supervising Engineer) from the foundation/raft to the wall to combat the ground shear forces.

All ICF (Insulated Concrete Formwork) basements MUST be tanked externally as a primary line of defense, there may also be a requirement for a second line of defense. In standard construction, water proof concrete may suffice, however this is NOT acceptable in ICF construction, the alternative is to install an internal tanking system as the second line of defense. There are various methods and systems to achieve this and many specialists in this area that can be consulted. Multi storey basement construction can also be achieved, photographic examples are shown on the following pages for a two storey basement which has a 650mm double wall on the lower level to combat ground shear forces and this reduces to a 350mm wall for the upper basement level. The Thermohouse building system allows for variations in design criteria.



Basement Raft Foundation
Single Storey Basements

Basement Construction

A Tanking Detail with Drainage Stone to Basement Wall

Multi-Storey Basements

Construction of Two Storey Basement

First Storey Basement Wall (650mm Double Wall)

The second storey was erected with a single basement 350mm wall.

Lower Basement Incorporating Swimming Pool

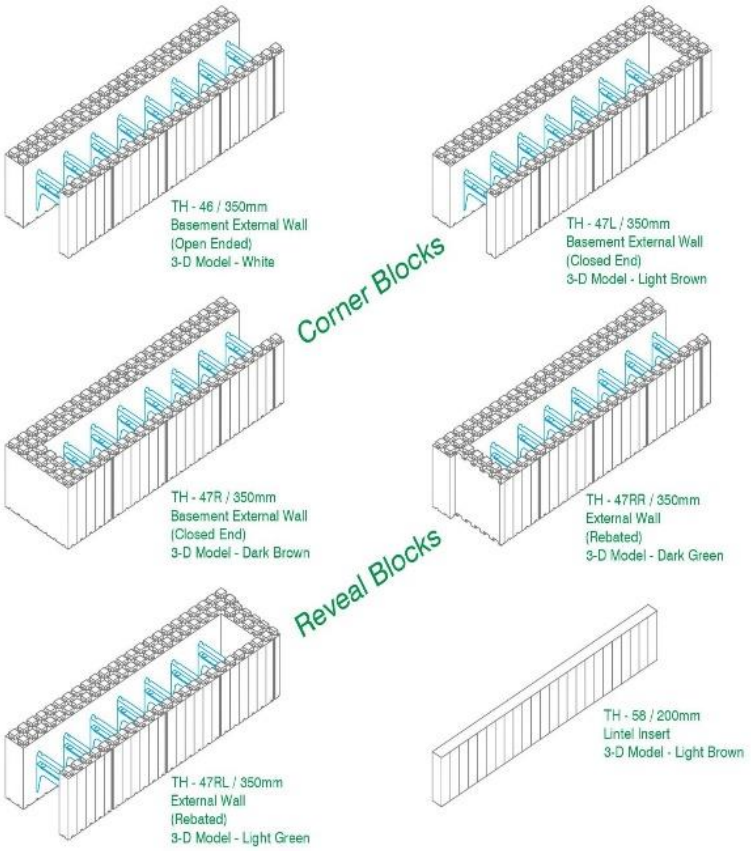
Lower Basement Showing Initial Tanking Layer

Typical Tanking Membrane Detail

2.2

2.3 BASEMENT WALL CONSTRUCTION

350mm Blocks



An accurate wall layout is critical to ensure a satisfactory Thermohouse project. Before you begin setting out a wall layout check the plans to confirm the proper foundation layout and dimensions. An EDM (Electric Distance Measure) is considered best practice to mark the wall layout on the footings, a string line may also be sufficient.

- Verify that the wall layout is in accordance with the plans.
- Make sure that outside face of the elements line up with the overall building dimensions.
- Make sure that all 90-degree corners are properly squared and plumb.
- Wall Layout dimensions must be in increments of 50mm to allow the blocks to lock into each other, ideally this should be 150mm to minimise waste, ensure insert alignment and facilitate the installation of vertical reinforcing bars.

Prior to laying the first course of elements, determine the exact wall height required for the project. Thermohouse elements are 250mm high. If your storey is not divisible by 250mm you have the option to cut the first or last course of block elements horizontally to suit.

Cutting the first course is recommended since the cut edge will be seated on the footing and will not affect the interlocking of subsequent courses.

- Prior to laying the first course of blocks it is recommended that the layout is rechecked for accuracy and that it is set out in measurements with increments of ~150mm. Double check the Thermohouse set-out for the project.
- Always place blocks with protruding interlock facing up.
- Always begin at a corner and use the same handed block around each course.

In basement construction please ensure that all EPS which bridges the cavity in the corners is completely removed as and when the corner blocks (TH-47R/47L) are located and positioned in place. Alternatively, form the corner using a stepped TH - 46 joint as shown in Figure 1, alternating direction between courses, this will enable the free flow of concrete throughout the cavity of the formwork while ensuring interlocking between courses.

In either case, provide adequate support and shuttering to the corner construction for the installation of concrete.

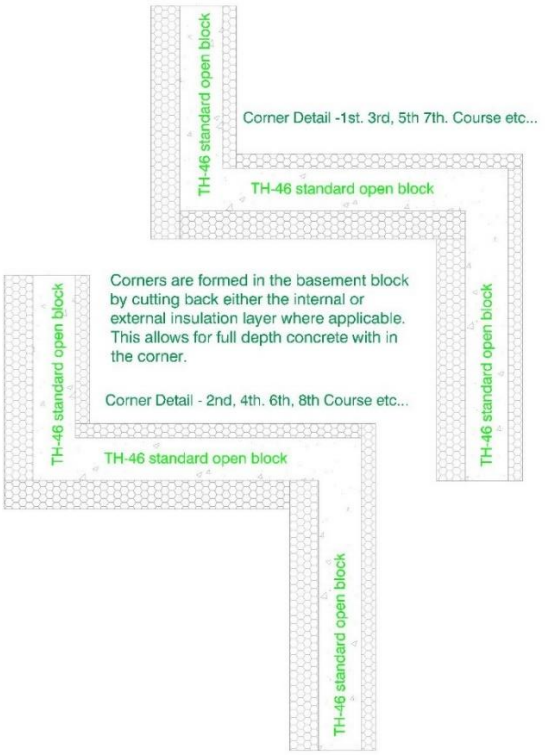


Figure 1 – Basement Wall - Corner Assembly

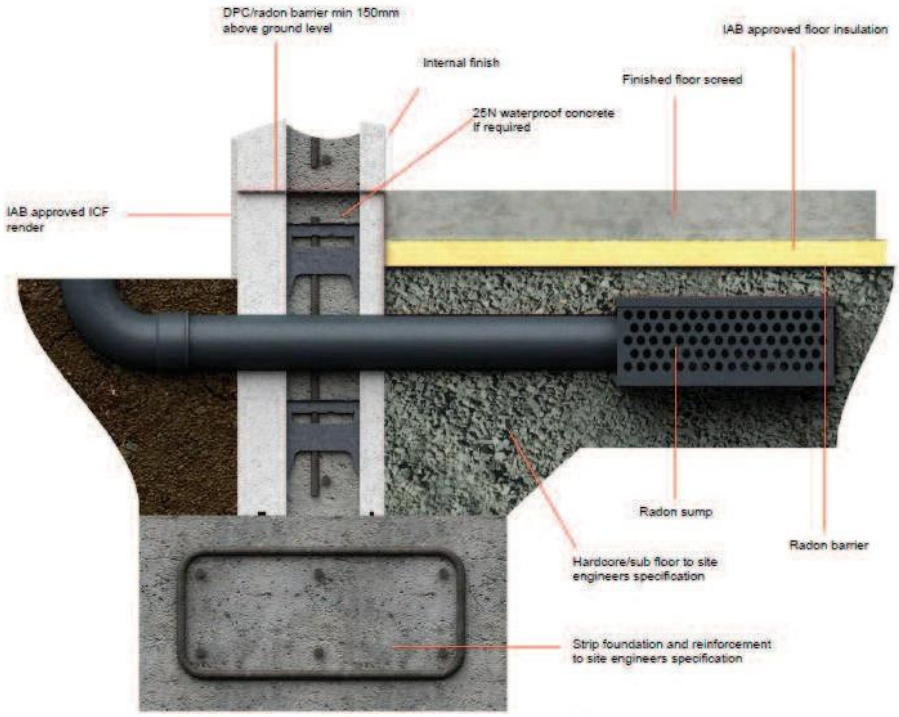
This build system can be used when erecting the corner with all open-ended blocks

2.4 ACCURATE FOOTINGS & SLABS

The Thermohouse building system can be started from all types of standard foundations. It can also be started from ground floor level, permitting construction to DPC (damp proof course) level to be completed in traditional concrete block on.

The first step to a successful Thermohouse installation is an accurate Strip or raft foundation. It is important that the finished surface of the concrete is level to within +/- 5mm. The level can be checked using a laser level. A level footing will make the installation of the courses significantly easier.

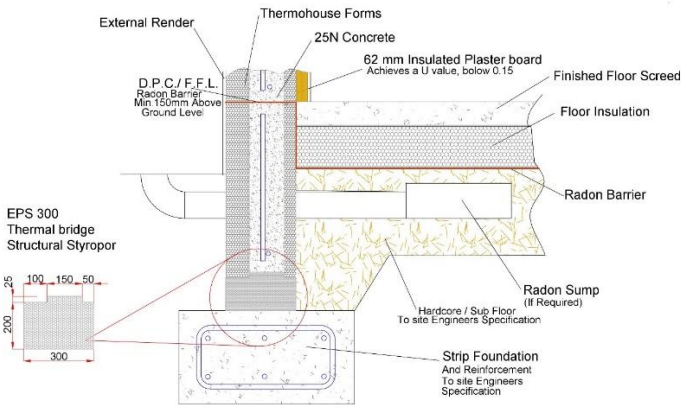
The ideal increment for stepped foundation is 250mm. However different height steps can be accommodated by cutting Thermohouse elements horizontally and installing these elements in the first row.



Strip Foundation

Passive foundations can be achieved by using a structural EPS 300 Styropor insert as shown above to provide a cold bridge barrier to Passive standard between the foundation and the wall structure. This system would have to be approved by the project Engineer

Raft Foundation



Passive Foundation

Passive foundations can be achieved by using a structural EPS 300 Styropor insert as shown above to provide a cold bridge barrier to Passive standard between the foundation and the wall structure. This system would have to be approved by the project Engineer.

2.4 STANDARD WALL CONSTRUCTION OVERVIEW

This is a short overview of the wall construction, all details and diagrams are contained later on in this publication.

Step 1

Plan the outline of the building to the proper set-out dimensions which are calculated to suit the Thermohouse formwork increments (designed project specific). Rise the footings to DPC level using the TH-16 (open block-white) and the TH-17L/TH-17R (corner blocks-light & dark brown) as indicated on the REVIT model. Place the corner blocks using all the same handed blocks on alternate courses, TH-17L (light brown) for courses 1,3,5,7 etc. and a TH-17R (dark brown), for the intermittent courses 2,4,6,8 etc.

Form the outside corners, then lay the straight blocks towards the centre of each wall section, cut/shorten a TH-16 to complete this section, keep the off cut handy, it will be used elsewhere.

For the construction of inside corners, cut the TH-16's to form the corner in an overlapping format enclosing the cavity of the formwork. Check that all walls are straight and level, shim or trim where necessary, this will be more prominent where care has not been taken with the foundations which ideally should be +/- 5mm. Prop and shutter corners etc.…where necessary, install horizontal steel reinforcement, where required, by placing it on top of the internal webs within the block cavity and prepare for concrete. Remove all the locking stubs from the top of the forms and provide a level surface for the DPC membrane at ground floor level. Ensure all service penetrations are in place before the concrete pour to avoid core boring at a later date.

Step 2.

Restarting on the ground floor level, insert DPC/DPM (this DPC will also be required at ground floor level above a basement construction) and raise formwork in the same manner as before continuing with the next course of corner forms

TH-17L/R and include for rebated forms TH-17RL/RR (yellow & orange) to door or window openings/reveals.

Start by raising the wall with the most window and door openings, this wall will require the largest number of cuts and produce the most off cuts which can be used in many other areas or the walls with the larger build areas. Install the rebate blocks to form the closure at the location of each door. Complete the installation of first course with straight blocks, using a previous waste off cut or by cutting to length where required.

Install the second course of blocks so that this course is offset from the first, in a running bond pattern of 300mm or more (occasionally, infill pieces of 150mm can be accommodated where required). A horizontal straining wire can be placed along the course work (lower, centre & upper courses) from corner to corner and through to the external openings as additional support to stop any horizontal movement

during the concrete pour. At this point check for level across all of the blocks. If the courses are not level, use shims or trim the block as required.

Construct up to 5 or 6 courses and continue in this fashion constructing the next wall with the most openings finally working towards the walls with the largest build area or least number of openings. Use the waste cuts from forming corners and window openings as you go and use as many as possible on the walls with the largest build area.

Install horizontal steel reinforcement where required as you go, by placing it on top of the internal webs within the block cavity.

Step 3

Ensuring all laid courses are leveled, **i**nstall the alignment bracing around the entire internal face of the structure at 1.0 to 1.2m centers max., it is advisable at this stage to set the braces slightly off plumb, leaning in by approx. 20mm over the full height of the wall this will allow the prop to push out against the weight of the concrete ensuring that the walls are straight and plumb during/after the pour. The bracing also serves the dual purpose of providing a secure and safe framework to facilitate the pouring of the concrete.

Window heads should be constructed using a TH-57 (50mm) horizontal insert to avoid any cold bridging across the lintel, this should be inserted flush with the lower edge of the internal insulation TH-20 (50mm), the external insulation TH-21 (100mm) should be 25mm lower to provide a 25mm rebate for the fitting of joinery frames. If cutting a standard form TH-16 to construct the lintel, the metal inserts should be cut where required to allow the insertion of the TH-57.

Step 4

Place the blocks to full wall height for single storey construction. Cut the vertical reinforcing steel to length and install it from top of the wall.

Step 5

Pour the concrete into the walls using a concrete pump. Start the pour at the centre of one wall and fill initially to approximately 1m in height. Continue pouring in one direction and return to first point. Repeat the process for each subsequent meter. Use a slender concrete vibrator (maximum 25mm poker) to vibrate the concrete, to remove all air pockets and avoid any honeycombing within the wall and to obtain full compaction of the concrete.

Step 6

Screed off the concrete until it is even with the top block and install anchor bolts if necessary. These bolts can be used to install the wall plate, if required.

Step 7 Remove the bracing after the concrete has cured and proceed with further stages of the construction.

2.5 WALL LAYOUT

Once again, prior to laying the first course of elements, determine the exact wall height required for the project. Thermohouse elements are 250mm high. If your storey is not divisible by 250mm you have the option to cut the first or last course of elements horizontally.
Cutting the first course is recommended since the cut edge will be fixed to the footing and will not affect the interlocking of subsequent courses.

- Prior to laying the first course of blocks it is recommended that the layout is rechecked for accuracy and that it is set out in increments of ~150mm.
- Always place blocks with protruding interlock facing up.
- Always begin at a corner:

Base Rail

Rising Walls

Radon Barrier

Service Penetrations

- Above ground floor level use end/corner blocks TH – 17L / 17R as shown in Figure 2a.
- Where applicable ALWAYS start first course using TH – 17L for all corners working in a clockwise direction and continue using TH17L for

- courses 3, 5, 7, 9 etc…
- Where applicable ALWAYS start second course using TH – 17R for all corners working in an anti-clockwise direction and continue using TH – 17R for courses 4, 6, 8, 10 etc …
- Cut out end sections of block as shown in Figure 2a & 2b. This will enable the free flow of concrete from adjoining elements.
- Internal corners should have the inner end wall of the form reduced to 50mm where it is located in the cavity to allow for full penetration of concrete into the corner whilst maintaining the consistency of structural concrete depth.
- Alternatively, the internal corners can be constructed from TH-16's in a similar fashion to that shown in fig.1 for the TH-46 basement forms.

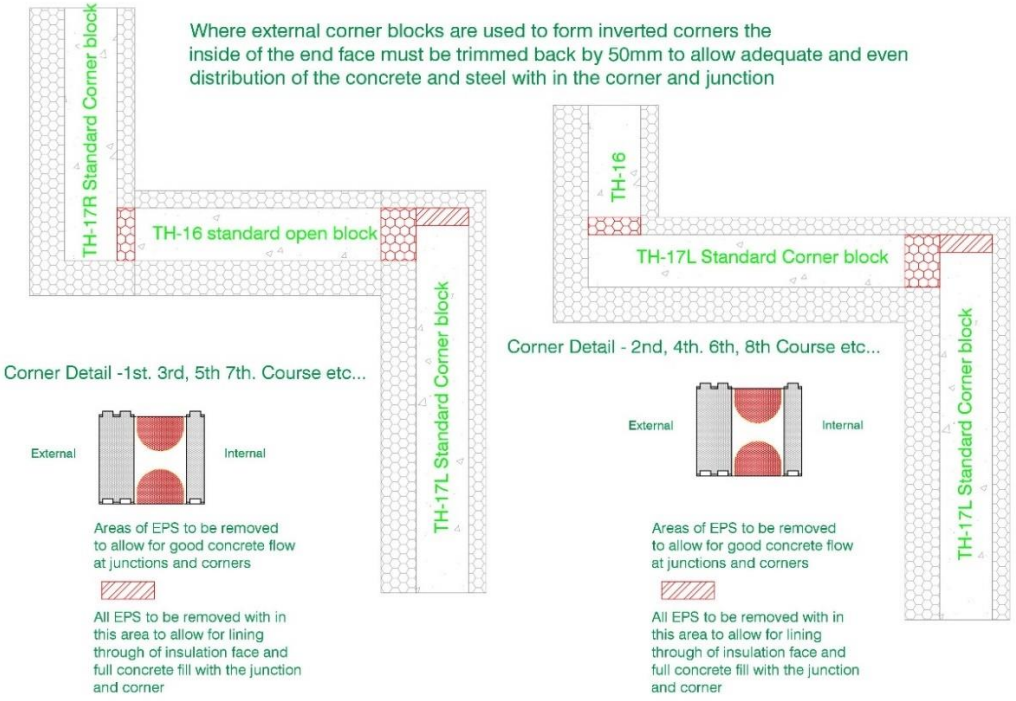


Figure 2a - End Block Corner Assembly & Cut-Out Example

2.6 WALL ALIGNMENT SYSTEM/PROP

A wall alignment system is used to keep the wall straight and plumb during concrete placement. Typically, the wall alignment system is installed on the inner side of the Thermohouse system. Each alignment unit consists of a vertical steel upright, a turnbuckle arm and a scaffold bracket. Details and certification of the alignment system are shown in Annex 2.

After installing 3 to 6 courses of Thermohouse blocks and ensuring that the courses are perfectly level, place the alignment system along the walls to prepare for fixing, install the alignment bracing around the entire internal face of the structure no more than 600mm from each corner or end wall and at 1.0 to 1.2m centers max., it is advisable at this stage to set the braces slightly off plumb, leaning in by approx. 20mm over the full height of the wall this will allow the prop to push out against the weight of the concrete ensuring that the walls are straight and plumb during/after the pour.

Alignment units should also be placed on either side of every door and window opening and along the lintels of large openings.

Again, ensuring that the courses are level, fix the alignment units securely to the floor with 10/12mm concrete screws or expanding metal anchor bolts.

Only after the units are fixed to the floor should you attach the uprights to the blocks by use of screws into the metal flange or alternatively a plywood block placed inside the cavity of the formwork.

If the alignment system is to be used as a working platform, place the appropriate scaffolding planks, guards and rails to provide a safe working platform according to current safety regulations.

Ensure blocks/walls are level, straight, plumb and properly aligned along each wall length.

If necessary provide support against wind and other lateral loads until concrete is poured and gains enough strength.

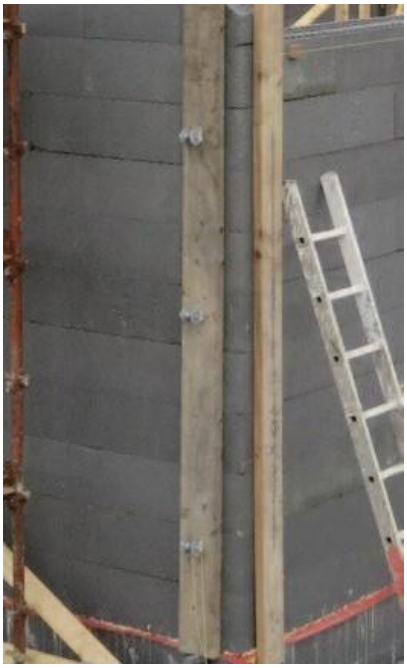
Heads and reveals, of the window and door openings, will require support during the pouring of the concrete.

Before, during and after concrete placement, the diagonal turnbuckle arm is used to adjust wall straightness and assure that all walls remain plumb.

Overall tolerances for the building must comply with BS 5606 Guide to accuracy in building.

6m Full Height Propping

Layout of Bracing/Propping System

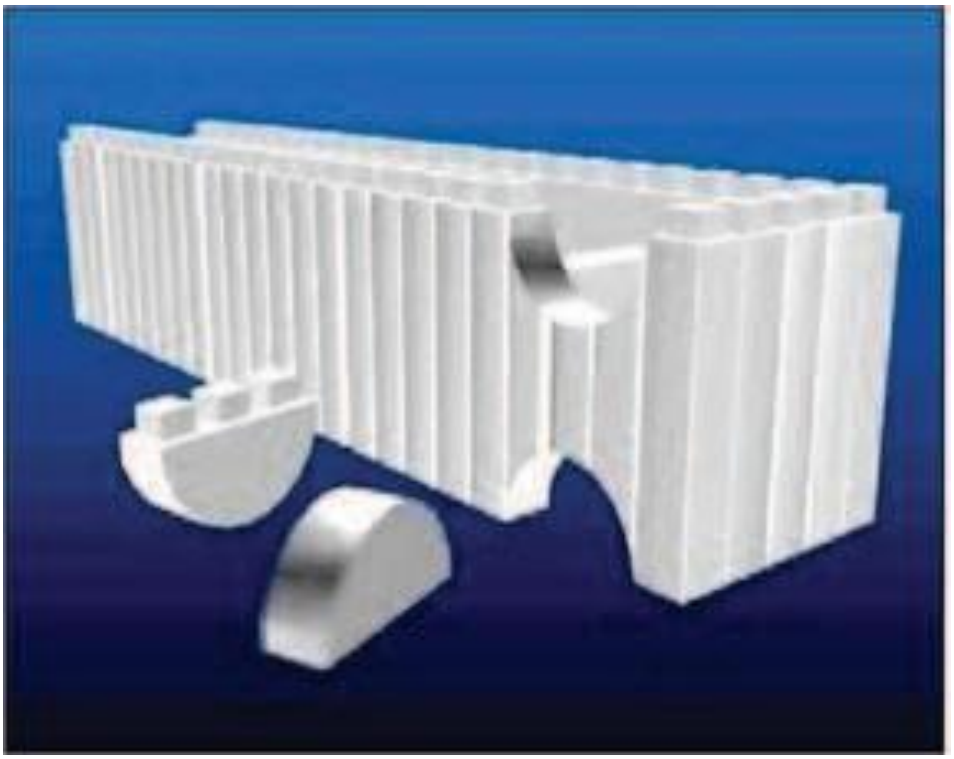


Straining wire proposal at corner

Note:

All braces/props and retaining shutters should remain in place for a minimum of 24 hours after pouring wall.

Typical Window Bracing Detail



Typical Cut-Out in Corners

In basement construction, the EPS crossing the cavity, "MUST" be completely removed

Typical Corner Detail

Showing the installation of a double layer of reinforcing

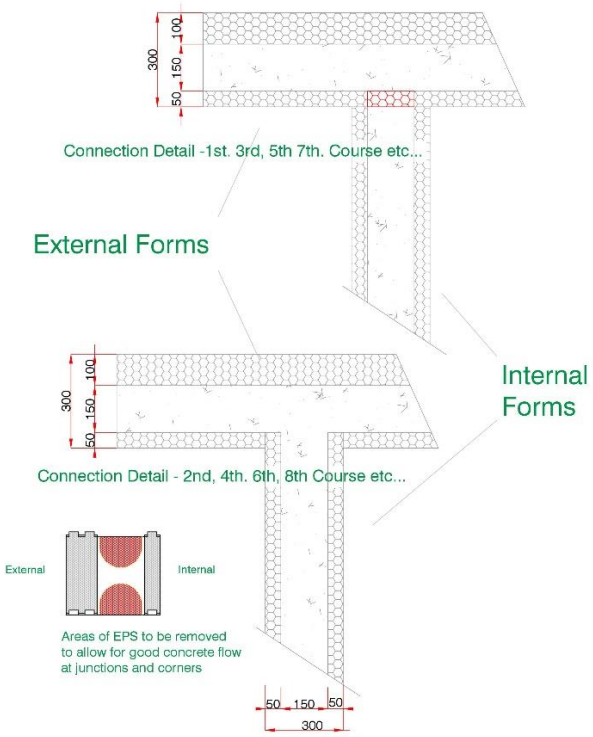


Figure 2b

Typical Detail Showing Internal Wall Abutting External Wall

- Continue placing straight blocks along wall length.
- When the blocks are within 1200mm of a door or window opening, place a rebate block at the opening as shown below in Figure 3 and apply an airtight seal on horizontal seams between the rebate and hollow concrete void.

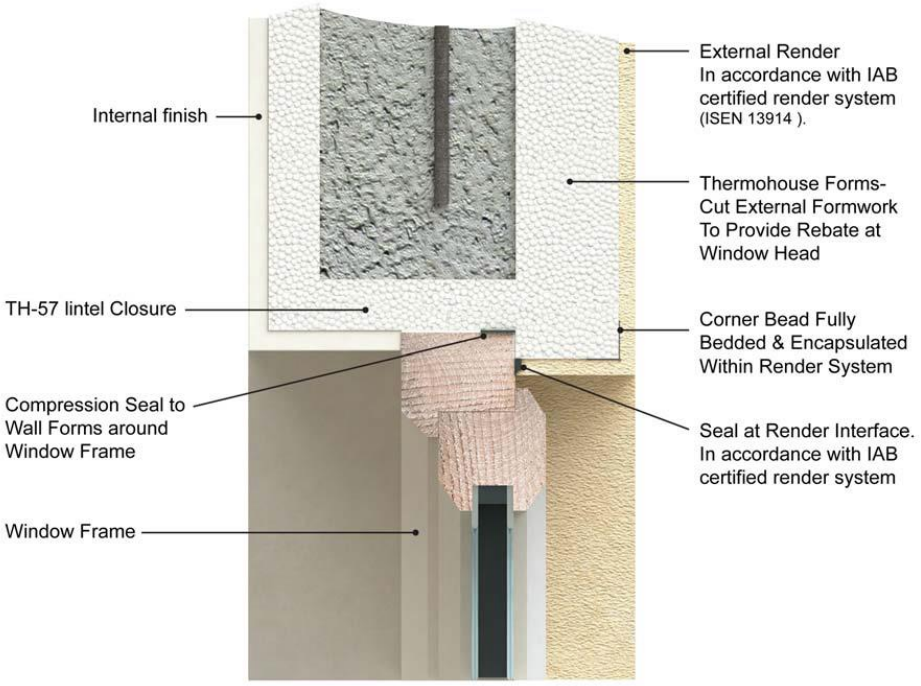


Figure 2c-Window Head

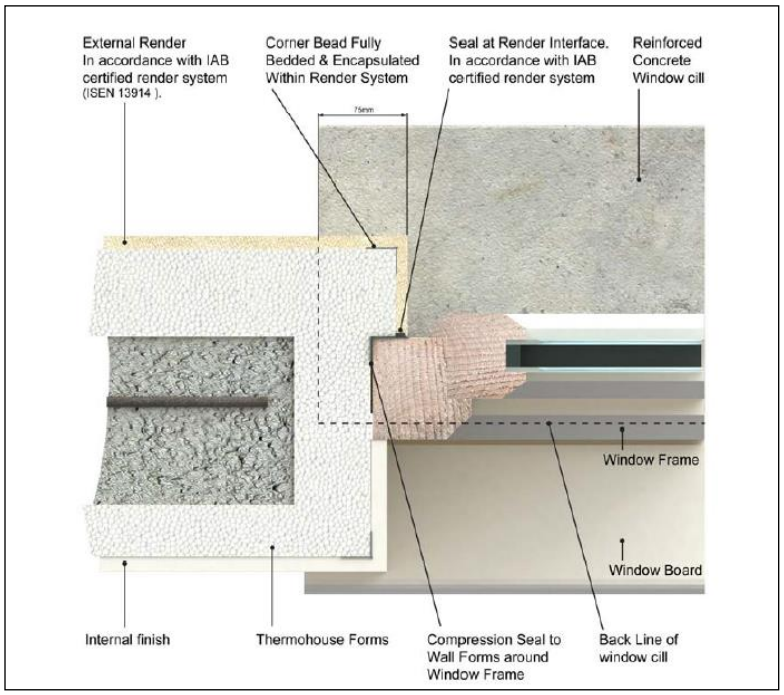


Figure 3 (Plan view)- Rebate block at window/door opening

- Cut a standard open block TH - 16 to fit the space between the end block and the previous block.
- Continue around the wall in this manner until the first course is complete and dimensions are verified.
- Place the necessary horizontal reinforcement in the first course as required by the Supervising Engineer.
- Begin installation of the second course again using a TH – 17R end block in the corner. Cut out sections as shown in Figure 2.
- Press the open block firmly against the first end block so that there is no gap. Alternating the corner block type between courses will create a 300mm running bond between the two courses.
- Continue along the second course in a similar manner to the first course, ensuring that the 300mm running bond is maintained between the courses.
- Once approximately 6 full courses and the ground floor window / header course has been laid, check each wall and corner are plum and level.
- Attach support frames to walls at maximum 1200mm centers
  if there is a discrepancy in the wall level of more than +/- 5mm then it will be necessary to either shim low spots or trim high spots.
- Check that all blocks are level and in line, in accordance that the overall layout. Use low expansion foam adhesive to glue the edge of the first course to the concrete footing along the length of the wall while filling any gaps created during leveling process. Allow adequate setting time.
- Alternatively, a 50mm C channel may be used in conjunction with construction foam to fill gaps. Ensure the channel is securely fixed to the concrete footing along the inside line of the building and the blocks placed in the channel.
- The installation of subsequent courses of block is the same as for the second course of block. The following rules must always be followed.
    1. Start at the corner of a wall and work in one direction along the external line of the building.
    2. Maintain running bond pattern between each alternative course
    3. Place horizontal steel reinforcement as required by the Supervising Engineer.

External Curved Wall Construction

Dormer Window – Arch Window

Long Span Window

Wrapping a structural column

Commercial Building – Showing Previous Structural Column Encased in Wall

Single Concrete Pour To Full Wall Height - Floor To Ridge Level At 6.0m

Typical Concrete Pour

Design showing the versatility of the system

Designs showing the versatility of the system

2.7 REINFORCEMENT

The exact details of how much reinforcement and where it should be placed must be confirmed by the Supervising Engineer. ***Minimum necessary steel is shown in Annex 3.*** If reinforcement is deemed necessary for crack control rather than for structural reasons, the use of fibre reinforced concrete with the correct slump may be considered.

Reinforcing steel strengthens concrete walls to help minimise cracking and buckling under load due to backfill, wind and other loadings. Reinforcement also helps control cracking due to temperature swings and shrinkage.

A non-contact splice is typically the splice of choice for vertical reinforcement in Thermohouse walls except in heavily reinforced walls. The minimum cover usually required for reinforcement is 30mm but it is advisable to check with the Supervising Engineer.

It is the responsibility of the installer to verify the specifications of the reinforcement required to comply with current building regulations.

It is advised to place the reinforcement, when required, in accordance with the following method;

1. Build the wall as already described, placing the horizontal reinforcement in a staggered pattern (horizontal reinforcement, sized as required, should be placed in the wall as the required course is installed). The Thermohouse webs are designed to hold the reinforcement in place in a staggered pattern, so that a bar is offset slightly from the bars above and below.
2. Maintain the proper overlap splice length of 50d or 300mm whichever is the greater (d=bar diameter), or as otherwise specified by the Supervising Engineer when placing horizontal reinforcement.
3. Once all blocks are in position and erected to pour height, the vertical reinforcement can be added. The vertical bars are lowered into place from the top of the wall, the bars are slotted through the steel bridges located on each block.
4. Using a plastic or steel tie secure each vertical bar to the top row of horizontal reinforcement.

Lintel Steel Reinforcement

(Incorporating Flooring Mesh)

Steel Reinforcement in forms

2.8 WINDOWS & DOORS

Step 1 Plan the outline of the building, and the location of the door and window openings, on a conventional footing or slab that is level, straight and square.

Step 2 Place the end blocks on each corner, then lay the straight blocks towards the centre of each wall segment. Install rebate blocks to form the opening at the location of each door. Complete installation of first course with straight blocks, cutting to length where required. Install horizontal steel reinforcement, as specified, by placing it on top of the internal webs within the block cavity.

Step 3 Install the second course of blocks so that the second course is offset from the first, in a running bond pattern. At this point check for level across all of the blocks. If the courses are not level, use shims or trim the block as required.

Step 4 Continue installing third and subsequent courses until window sill level is achieved. Form window opes in a similar manner to the formation of the door opes through installation of rebate blocks TH17RL/17RR. Check exact location of each window before installing the blocks and apply airtight seal between concrete cavity and rebate to frame (see Fig. 3). The window ope installation of the lintel blocks should look like Figure 4 & 4a.

Figure 4 – Typical Window Opening

Figure 4a – Typical Window Opening

Step 5 TH57's or TH58's (dependent on cavity size) are to be installed in the base of the window head and propped prior to concrete pouring, as shown in fig. 5.

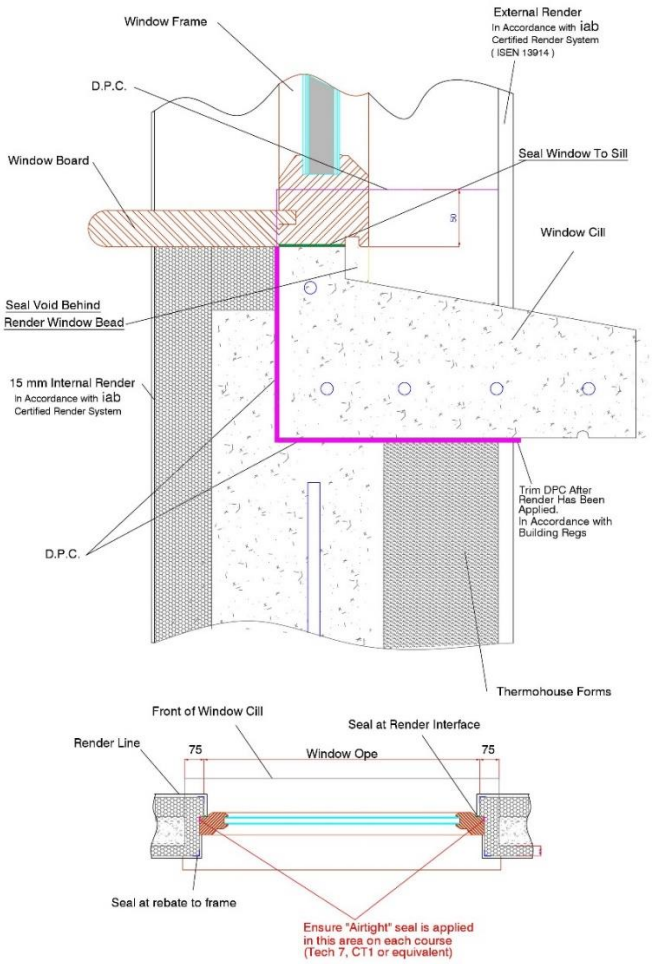
Step 6 Appropriate lintel reinforcement should be placed in the window head blocks to carry loads over the window and door openings. Check to make sure that the bottom lintel steel has enough clearance. All reinforcement is to be verified by the Structural Engineer.

A general layout of the wall reinforcement is shown in Annex 3.

2.9 WINDOW AND WINDOW CILL INSTALLATION

The installation of DPC around the window cill is <u>extremely important</u>

It is critical to ensure that the DPC element around the ends of the window cill extend upwards, a minimum of 50mm above the base junction of where the window frame sits on the window cill, also ensure that the DPC under the sill extends beyond the finished render line and is not trimmed until after the finished render is applied, this will allow for any ingress of moisture to escape.



Section Through Cill

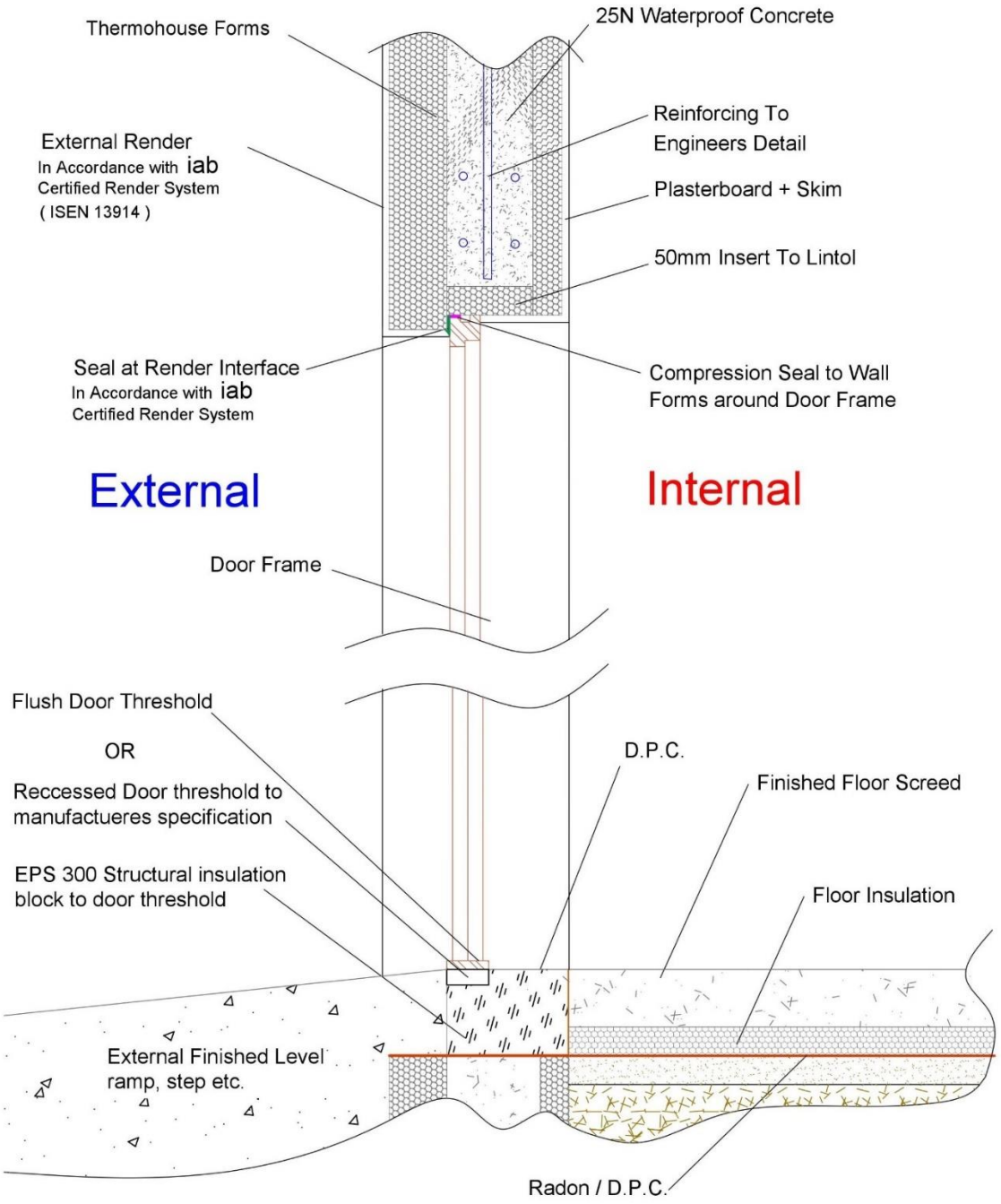
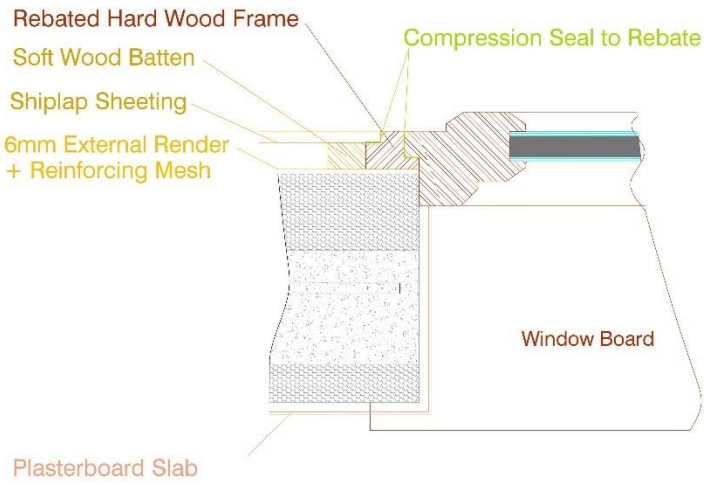


Figure 5
Insulated Door Threshold Detail

Flush Mounted Windows

This will comprise of a rebated hardwood frame fixed externally with the window frame sealed into the rebate as shown below.



Reveal Section – Surface/Flush Mounted Window

Guideline and Procedure for Window Cill DPC

Window Ope Before Preparation

Cutting & Removal of Plug After Marking

Cut out an EPS plug 50mm higher than the window seat on the cill and flush with the back line of the cill in
its seated position. This should be removed back to the line of the concrete (100mm) inside the reveal as shown.

Preparation showing plug and locking lugs on top of forms removed
Double check clearance and alignment before insertsion of DPC

Insertion of DPC

Insert DPC to full height of apperature (cut out) and allow for a min. 30mm overhang of the DPC outside the wall forms. Fold the DPC to allow it to wrap around the ends and back of the cill.

Cut the EPS plug to fill void on reveal above cill and insert into position.
Double check all is ok before finalising procedure.

Cut vertical line of DPC flush with forms and seal with TEC 7 or similar.
Seal EPS plug to window cill and seal top joint all around with TEC 7
Ensure DPC has a min. overhang of at least 30mm underneath the cill.
Seal the underside of the DPC to the EPS forms (DO NOT SEAL THE DPC TO CILL)
This DPC overhang MUST be maintained untill after the render has been applied and finished
Only at this stage (after render application) can the DPC be trimmed.

2.10 SERVICE PENETRATIONS

Identify and size all service and utility penetrations. Install all appropriate and properly sized sleeves where required remembering that lightweight sleeves can be crushed during concrete placement. PVC sewer pipes are considered sufficient. Large penetrations may require the advice of the structural engineer, depending on size and location.

List of possible penetrations:

- Dryer vent
- Water
- Sewer
- Electrical mains service
- Gas
- Boiler vent
- Air exchange/HVR
- Bathroom vent
- Kitchen vent
- Fireplace vent
- Air vents
- Telephone service

2.11 CONCRETE PLACEMENT

The Thermohouse system, when assembled to the guidelines in this manual, is designed to withstand the pressure exerted by placement and consolidation of the concrete. However, it is worth noting that each block will hold approximately 90 Kg's of wet concrete and that even the smallest concrete pump can supply over 1 tonne of concrete per minute.

The Placement of the concrete and the installation of the reinforcement should be completed in accordance with BS8110 (structural use of concrete) & Eurocode 2 (design of concrete structures). Adequate compaction of the concrete is essential and the concrete must be placed so that it completely fills the Thermohouse system without creating any voids or honey combing. A 19mm / 25mm vibrating poker should be used with care.

Where a large amount of reinforcing steel is specified in the wall forms there may be a requirement for the design of a higher slump factor in the concrete mix to avoid any honeycombing occurring during the pour. *Extra care and attention should be taken in this circumstance.*

When placing concrete, plan for all possible contingencies, double check the following pre-pour check list before placing concrete.

Pre-pour Checklist

Date _____

Supervisor _____

Job Reference _____

Prior to placing concrete in the Thermohouse insulated forms, be certain to mark off each item on the following checklist;

- **String line in place around the top of entire perimeter?**
- **Walls straight and plumb (not leaning out)?**
- **Additional form support on all corners?**
- **Additional form support on all window and door openings?**
- **All fastening screws securely fixed to blocks?**
- **Alignment system securely fixed to floor?**
- **All hand rail and toe boards installed? (in accordance with current building regulations)**
- **All door and window lintels supported?**
- **All horizontal and vertical reinforcement in place?**
- **All lintel reinforcement in place?**
- **All floor embedment's in place?**
- **Cavity wall checked and all foreign matter removed?**
- **Properly sized concrete pump (Max. Size 75 / 100mm) ordered?**
- **Correct concrete mix, volume and slump classification are ordered?**
- **Concrete vibrator (Max. Size 25mm) on site and in working order?**

PLEASE NOTE: If this check list is not complete DO NOT POUR concrete

The most important stage of a successful Thermohouse project is the concrete placement. Extra workers at this stage are important, to be certain have sufficient numbers on hand during the pour to safely handle placement, to ensure consolidation, to ensure alignment and clean-up. Concrete placement should be considered, as a minimum, a four-person job, one on the nozzle, two on the poker and another co-ordinating between nozzle and pump. It is strongly recommended to have a crew of 5-6 available during concrete placement.

Ensure straight walls by placing a straight line at the top course set off 20mm from the wall using spacers at each corner. Adjust the turnbuckles if necessary to keep the wall straight during placement.

Concrete shall be supplied from an approved concrete supplier.

The minimum compressive concrete strength for walls shall be C25/30.

The workability of the concrete shall be S3 (Slump 100mm to 150mm).

The actual requirement will vary from site to site and should always be confirmed by the Project Engineer. The maximum size of aggregate to be used in the Thermohouse forms is 10mm.It is

important to ensure that the concrete placed in the forms matches that specified for the project. Testing the concrete during placement and keeping a record of the results is much easier and cheaper than testing the concrete in-situ at a later stage.

Check that the delivery ticket matches the concrete mix ordered.

Concrete slump test. The slump for each delivery of concrete should be taken and recorded prior to pouring.

A pump truck with 75mm or 100mm reducer attached to a rubber extension works best to control the rate of the concrete pour. The slower the flow of concrete, the easier the placement and proper consolidation will be.

Proper consolidation of the concrete, by mechanical internal vibration, is critical to obtaining the full strength of the wall. Thermohouse forms are designed to withstand internal vibrator compaction. Using a vibrator with a head size of 19 mm / 25mm.

Sequence of the concrete placement:

Step 1 Complete the preplacement check list.

Step 2 Begin pouring at the centre of one wall. Pouring the concrete to 1m in the height and continue in one direction around the house until you return to the starting point.

Step 3 Ensure proper concrete consolidation at all times.

Step 4 Repeat step 2 pouring the next subsequent metre.

Step 5 Fill both sides of window and door openings at the same time by moving the pump nozzle back and forth.

Step 6 Fill all lintels in one continuous pour.

Step 7 Continue placing concrete around the full length of the external wall and internal load bearing walls. Proper consolidation of the concrete in the walls is vital.

Step 8 As the concrete is being placed, ensure consolidation is taking place to remove air voids and ensure structural integrity.

Step 9 As the concrete is being placed, continually check wall alignment using string line. Adjust the wall accordingly to maintain straight and plumb using the adjustable turnbuckle.

Post Placement Checklist

Date _____

Supervisor _____

Job Reference _____

After placing concrete in the Thermohouse forms be certain to mark off each item on the following list:

1 Has concrete consolidation been completed?

2 Are walls straightened to string line?

3 Have any/all anchors and embedment's been installed?

4 Has spilled concrete been disposed of?

5 Have final checks for straight and plumb been carried out?

6 To enable proper instalment of the next course, have all concrete spills been

cleaned from the ICF locking lugs on top of the TH-21?

2.12 WALL PLATE CONNECTIONS

Wall Plate Preparation– ThermoRoof system

This method of wall plate attachment is one of the most energy efficient. The Thermohouse insulation on either side provides an excellent thermal barrier.

Trowel the concrete to provide a level surface for seating the wall plate
Install anchor bolts into concrete if required (or use expansion bolts at later date)
When concrete has gained adequate strength, drill the wall plate and fix securely to the anchor bolts.

Cut external insulation to match angle cut on wall plate. (See fig. 14a & 14b)

Figure 14a –Installation/ Fixing Chamfered Wall Plate

Figure 14b – EPS Chamfer For Seal To ThermoRoof Panel

Top mounted wall plate – Traditional Timber Cut Roof System (See fig 15)

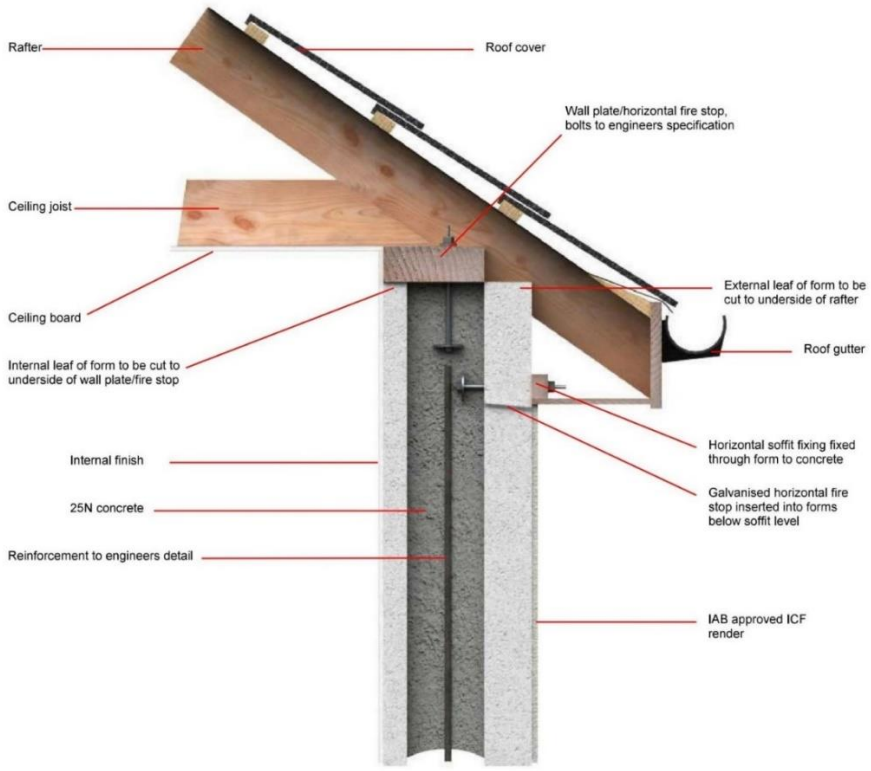


Figure 15 – Timber Cut Roof Top Mounted Wall Plate

Prepare concrete seating as described before

2.13 ELECTRICAL INSTALLATIONS

Electrical and plumbing installations are typically installed after concrete placement. The exception to this rule is the placement of conduits that penetrate the wall, which should be installed if possible, before concrete placement to avoid core boring afterwards.

Installing electrical wiring and boxes is accomplished by fixing on the surface or chasing into the EPS foam. Placing it on the surface within a service void reduces the thermal effects on the wiring but requires the plasterboard to be fixed to battens which in turn are fixed to the wall.
When installed on Thermohouse walls directly against the concrete, electrical boxes will extend 13mm beyond the EPS foam to match the thickness of the plasterboard.

Note: The use of pvc-pvc cable must be placed into conduit to avoid reaction with EPS. Therefore, ensure that all PVC cables are NOT in contact with the EPS.

Various tools can be used to create the channels and spaces for wiring and boxes.

2.12.1 Hot knife

2.12.2 Various hand saws or router

Note: All electrical wiring must comply with relevant electrical regulations/standards.

Hot Knife Conduit Chasing

Installation of Large Conduit

2.14 PLUMBING INSTALLATIONS

In most cases buildings are designed so plumbing pipes are not carried through Thermohouse walls, except for utility entry and exit points.
However, in some cases it may be required to embed pipes in the EPS. For example, a kitchen vent tube may need to be installed vertically in the EPS foam. Pipes embedded in the foam cannot exceed 40mm in diameter.

An external tap will require the installation of a hose sleeve through the wall prior to concrete placement. This will permit replacement of the tap or pipe should it ever be necessary.

If connecting to an existing sewer line, establish the location of the required opening and ensure clearances since this is difficult to change at a later stage.

Recessed Pipe or Conduit

2.15 THERMOWALL – RANGE OF FINISHES

ThermoWall Interior Finishes

The most common type of interior finish material that will meet the thermal barrier requirements is the 12.5mm gypsum board, improved U values can be achieved by using an insulated plasterboard.

The ideal method of installing plasterboard in a Thermohouse is using metal or nylon plasterboard fixings, commonly known as mushroom fixings. It is also considered adequate to glue and screw the plasterboard to the metal flanges (located at 150mm centres) of the block using drywall screws.

Plasterboard - with metal fixings

Screw fixing flange

The walls can also be battened to provide a service void and/or a fixing for cladding/sheeting etc.

ThermoWall - Exterior Finishes

Exterior

Exterior finishes for the Thermohouse system must be EOTA (European Organisation for Technical Assessment) approved or supplied by an approved supplier as certified by the Irish Agrement Board as suitable for use on ICF walls. Installation must be in accordance with manufacturers details and be carried out by an approved installer.

When finishing the outside with timber cladding, stone, or brick etc., it is recommended to install a flashing/drip tray and weep holes to allow the escape of any moisture ingress.

When a building is being brick faced, care should be taken in the layout of external openings, wall heights and wall lengths to ensure the suitability of the horizontal and vertical brick coursing.

Maxit Insulating Concrete Formwork Render System has been approved for use by the Irish Agrement Board as suitable for use on ICF walls. There are also many other suitable certified systems on the market.

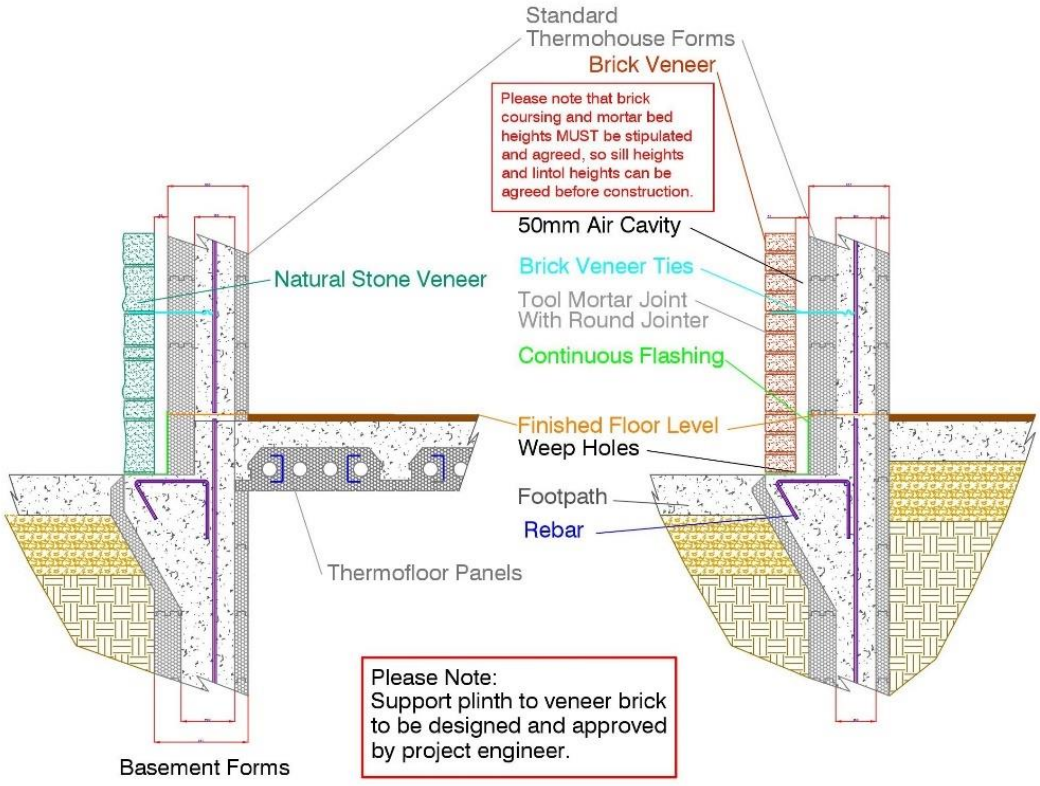
Render finish

The external light weight render is classified as a 4 coat system,

1st coat 7mm base coat with 4mm grid glass fibre reinforcing mesh.
2nd coat 5mm base coat levelling course.
(For high impact areas and fire breaks another layer of mesh can be installed into the second coat)
3rd coat primer.
4th coat client specified, coloured top coat which is either acrylic / silicon based with various chip sizes for desired finish (Smooth / Rough).

Natural stone and Brick Finish Details

Natural stone and standard brick finishes are easily achieved and are tied back into the ICF structure using wavy tail brick ties. These ties are inserted through the EPS into the cavity of the cavity of the form work to suit coursing measures before the concrete is poured. The wall ties should be sized to maintain a minimum cavity. (See detail below).



Section - Window Reveal

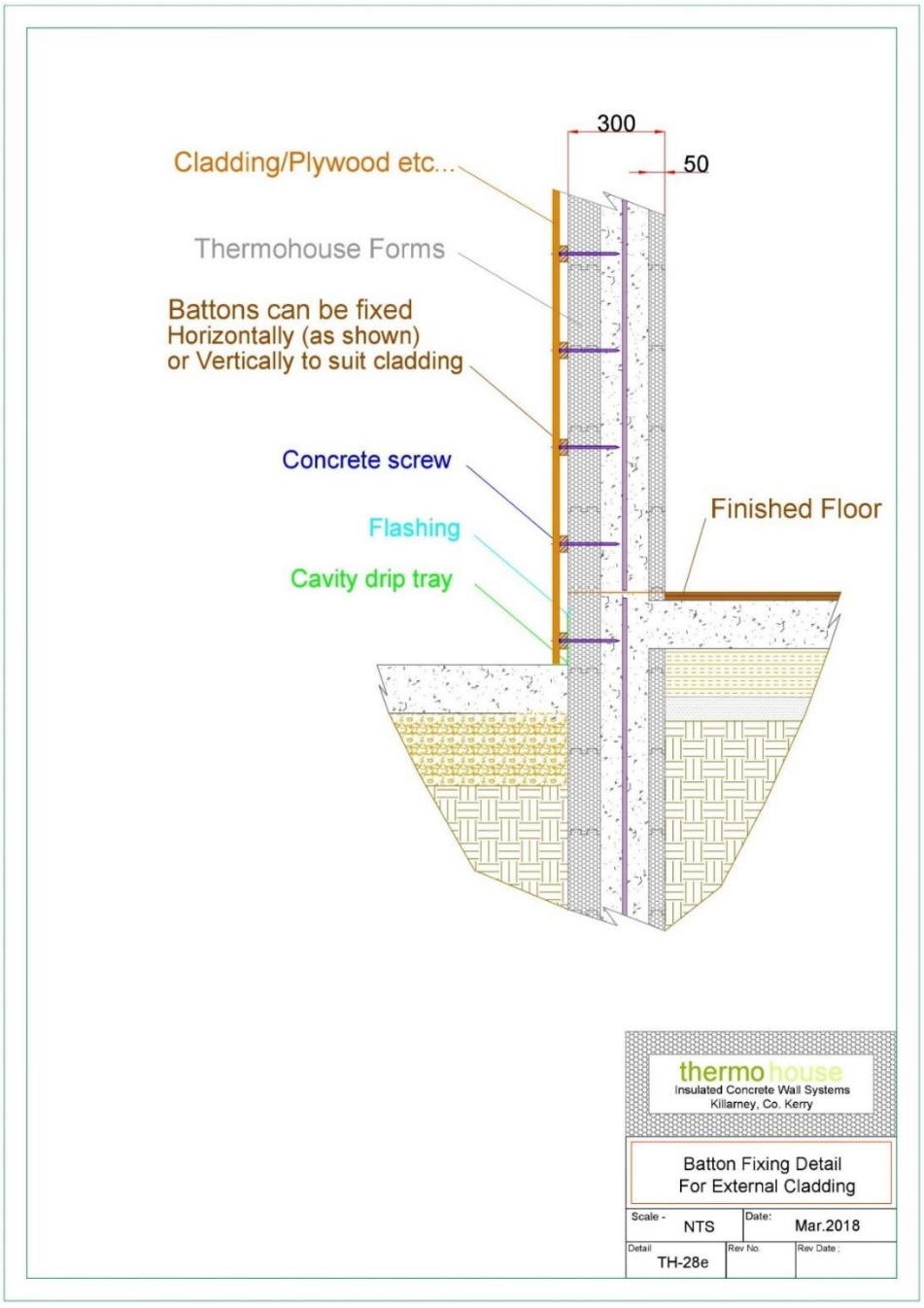
Stone and Render finish

Natural Brick Finish

External Baton Detail

External battons can be fixed through the EPS to the concrete core by means of

concrete screws or speed nails, these or any other fixings must be adequately sized and fit for purpose. If a membrane is required behind the finished cladding a second batton can be applied. Battons should be fixed in the appropriate direction to suit the finished cladding.

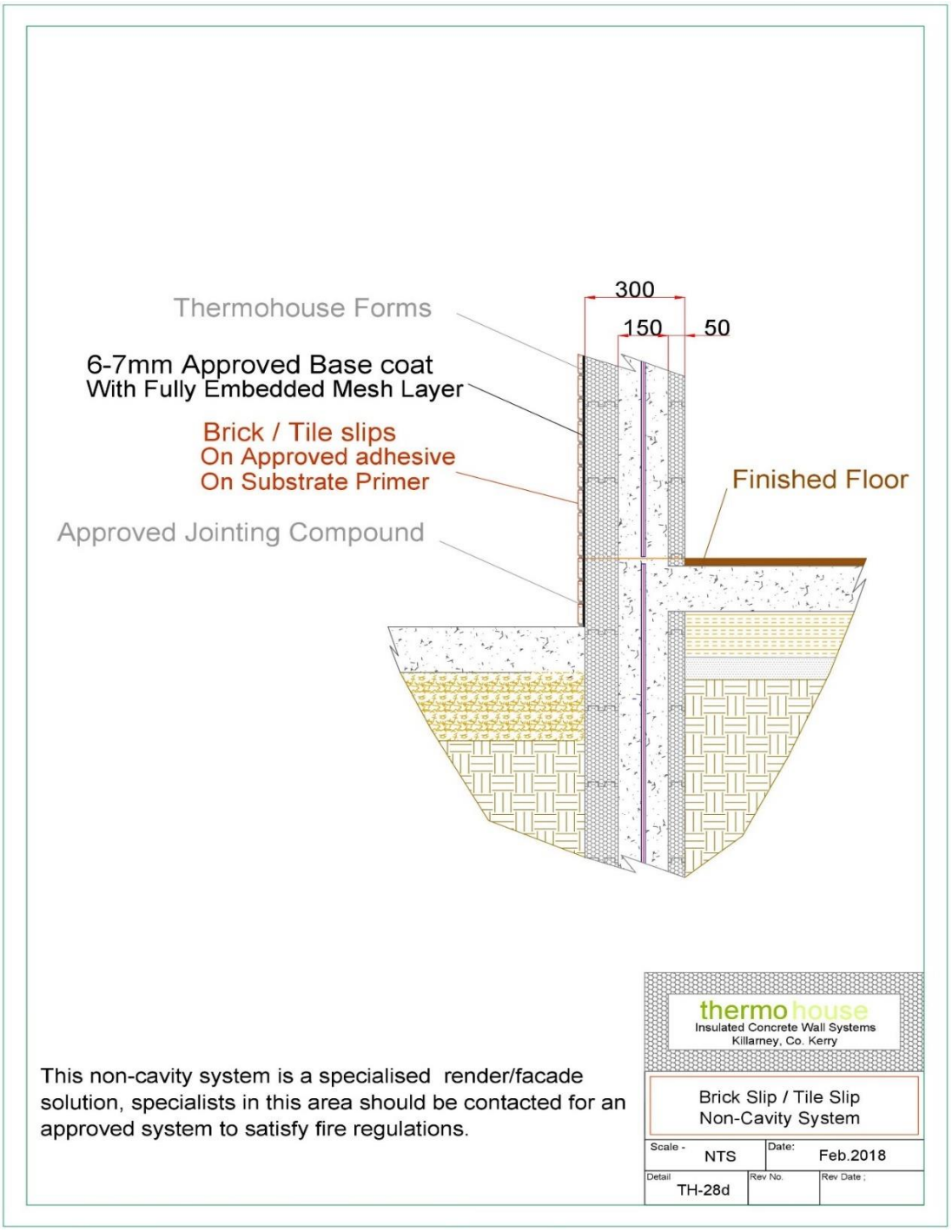


Timber cladding

A timber cladding finish can be achieved by fixing onto a batten on a breathable vapour membrane on a primary batten fixed through the EPS into the concrete core

Brick Slip/Tile Finish Detail

Brick slips or tiles are easily attached to the EPS and there are many systems available on the market some of which can specify sheltered, moderate and severe exposure zones. Severe exposure will need to comply with high exposure and coastal location specification.



Brick Slip Finish Detail

Brick Slip & Render Finish Detail

3.0 FLOORING SYSTEMS

CONCRETE FLOORING SYSTEMS

Building with Thermohouse will allow you to explore many concrete floor system options. Our walls are stronger and can support additional weight that timber or steel frame buildings may not. Concrete floor systems are usually standard in multi-residential buildings where the transmission of sound and fire are a concern and are growing in popularity in single-family residential applications.

3.1 THERMOFLOOR

Floors designed in conjunction with the Thermohouse ICF system can sustain and transmit loads to the ground to satisfy disproportionate collapse.

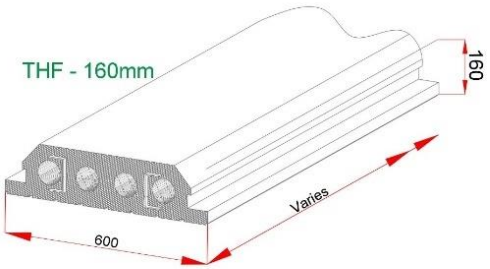
The ThermoFloor offers all the advantages of the pre-cast concrete floor and due to faster installation (without the necessity for cranage), the overall build program will be considerably reduced.

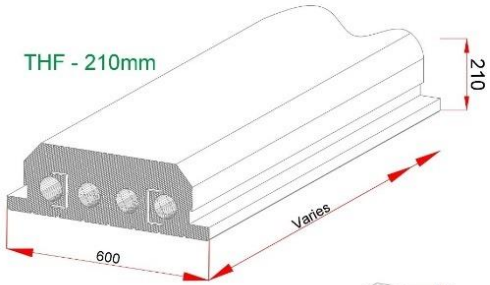
ThermoFloor is a lightweight nonstructural permanent shutter flooring solution for intermediate floors providing excellent thermal, noise reduction and air tightness benefits.

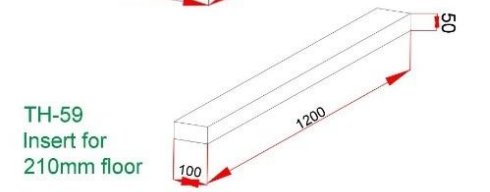
ThermoFloor can also be used as a suspended floor at ground level and for insulated concrete flat roofs. The U values achievable are relative to the perimeter to area ratio, these should be verified by the Project Engineer. Minimal additional insulation will be required on top of the flat roof concrete screed to eliminate any risk of interstitial condensation.
As a suspended floor ground conditions must be checked in this instance that they provide adequate support to the propping of the panels, all supports must be double checked as being fit for purpose before continuing to work on the ThermoFloor panels, inserting the reinforcing steel and pouring the concrete.

The finished ThermoFloor can support different loads depending on the reinforcing steel in place.
Typical examples of the ThermoFloor system in place are shown below in Figure 6a suspended ground floor, 6b intermediate floor and section 3.4 Thermofloor 210 as a flat roof.

ThermoFloor Elements







Thermofloor Locations

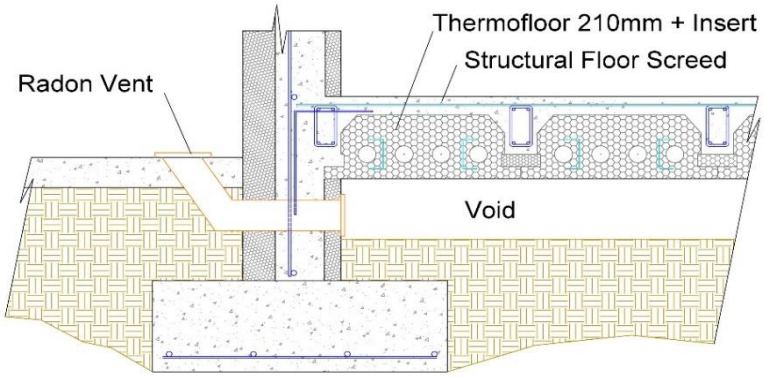


Figure 6a – Suspended Ground Floor (U = 0.16)

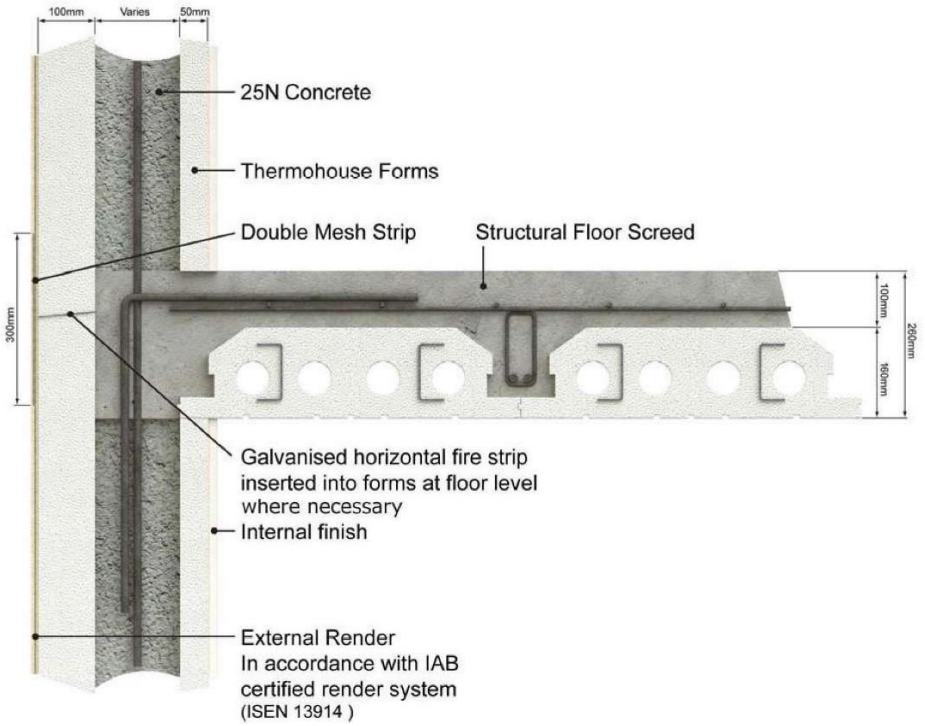


Figure 6b– Intermediate Floor

The process involved in installing the ThermoFloor panels are similar to that of a hollow core slab. The ThermoFloor elements are placed in position and propped before walking on and before installation of steel to ensure safety, as shown in

Figures 7, 8 and propping photo. The specified reinforcing steel is laid in position as shown in Figure 9, a course of TH 21's are laid around the floor edge and adequately supported for the concrete installation. The specified concrete screed is poured to complete the structure. Examples of the reinforcement detail are shown in Annex 8, these must be verified by the Supervising Engineer.

Typical ThermoFloor layout

Edge support to TH21 course at floor edge

In-Situ Load Bearing Floor Beam

Showing wall connection bars ready for bending into floor screed

In-Situ Load Bearing (Engineered) Floor Beams

Typical propping Support to ThermoFloor Panels

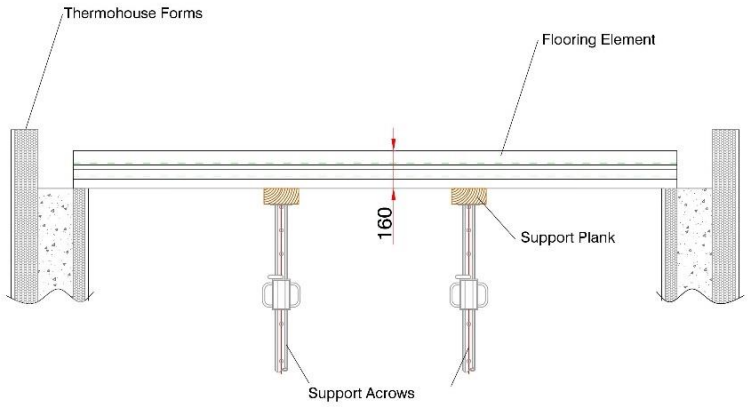


Figure 7 - Flooring Element Placement and Propping

It is recommended that the support planks are a minimum of 150mm x 75mm and the support acrows are placed at a maximum of 2m Centre's. It is necessary to have the support system verified by the Supervising Engineer before placement of reinforcing steel and concrete.

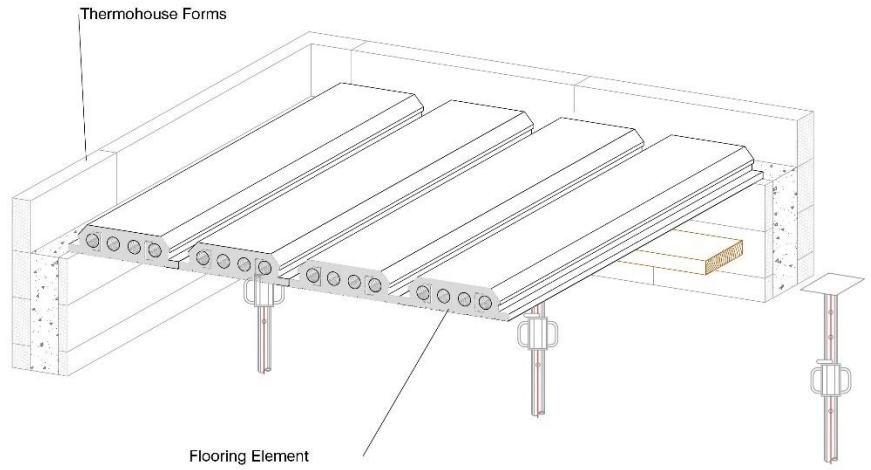


Figure 8 - Flooring Element Laying

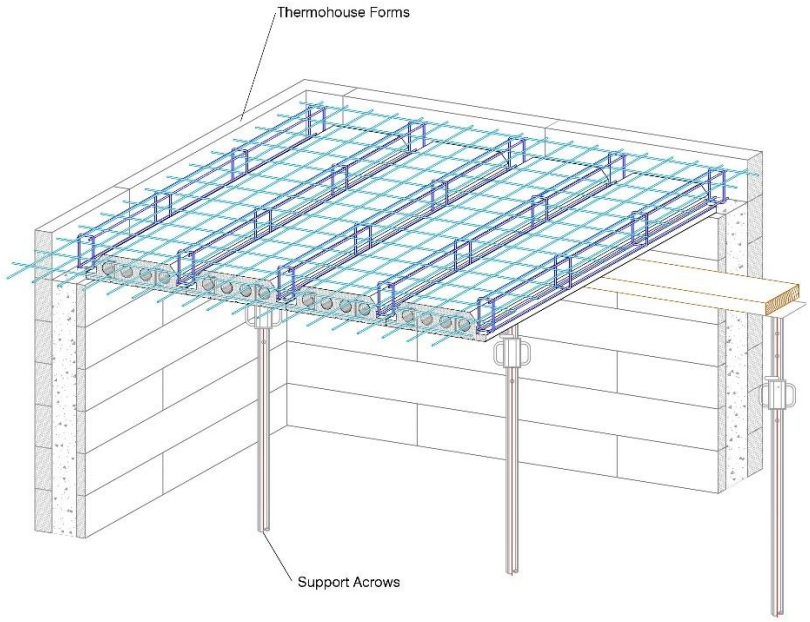


Figure 9 - ThermoFloor Reinforcement

Figure 9 demonstrates the reinforcement layout for a ThermoFloor installation.

The ThermoFloor panels can span up to 8m and support different loads, the reinforcement and screed depth adjusts accordingly to the engineering requirements for the particular span. Typical reinforcement details are outlined in Annex 8, however it is necessary to have ALL reinforcement verified by the Supervising Engineer.

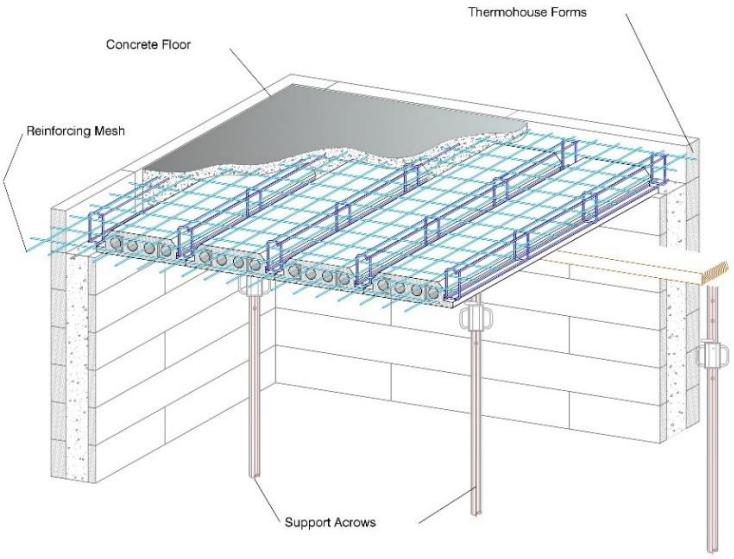


Figure 10 - ThermoFloor Complete

Where concrete flooring is being installed it will be necessary to lay a course of TH-21 blocks on the top course of block work on the outer insulation layer, this TH-21 on the top course of block will require special attention to propping/casing since it is not locked to an internal face.

Suspended floor installations at ground floor level are discussed in detail at a later stage. It is recommended that the top of outer insulation of the Thermohouse block at ceiling level is taped or covered for protection from concrete spillage when pouring the wall structure as this will protect the external extrusions for connection of the TH-21's rising to the floor level pour. This exercise should be repeated on the top of the TH-21 when pouring the floor to allow the connection of the first course to the next level.

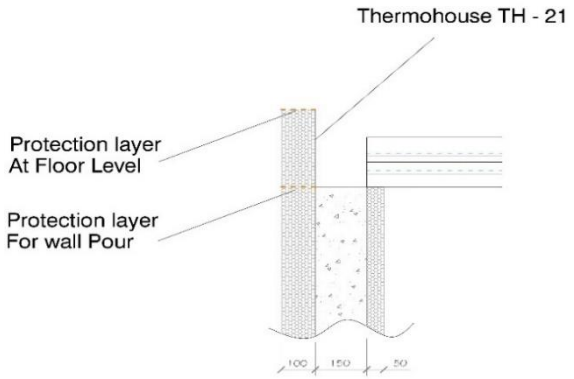
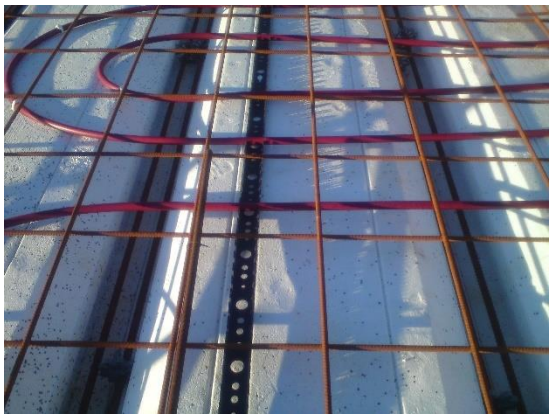
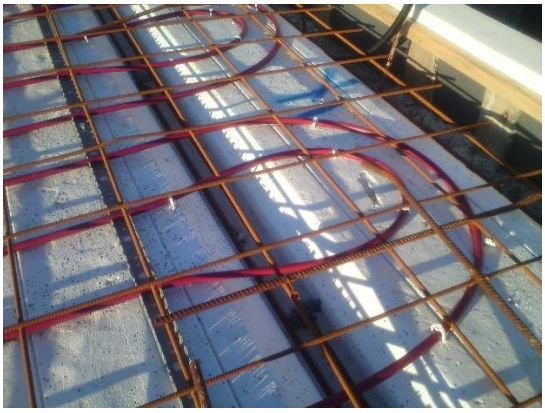


Figure 11 - Typical Floor Edge Detail

Underfloor heating can be installed on the Thermofloor panels before the concrete pour if required. The heating pipes can be pinned to the panels or tied to the reinforcement mesh. (see example below).





Underfloor Heating Pipes on ThermoFloor Panels

If required and once the concrete has cured it is possible to remove some of the EPS to the underside of the Thermofloor panel to provide a service void.

3.2 PRE-CAST FLOORS

Pre-cast flooring systems are cast at the factory, shipped to site and then craned in place. They are usually pre-tensioned with steel cables cast in the concrete to provide maximum strength. Pre-cast floors are fast and can have long clear spans. Typically, the Thermohouse wall is constructed to the desired height and the pre-cast floors sit directly on the cured concrete wall shown in figure 12.

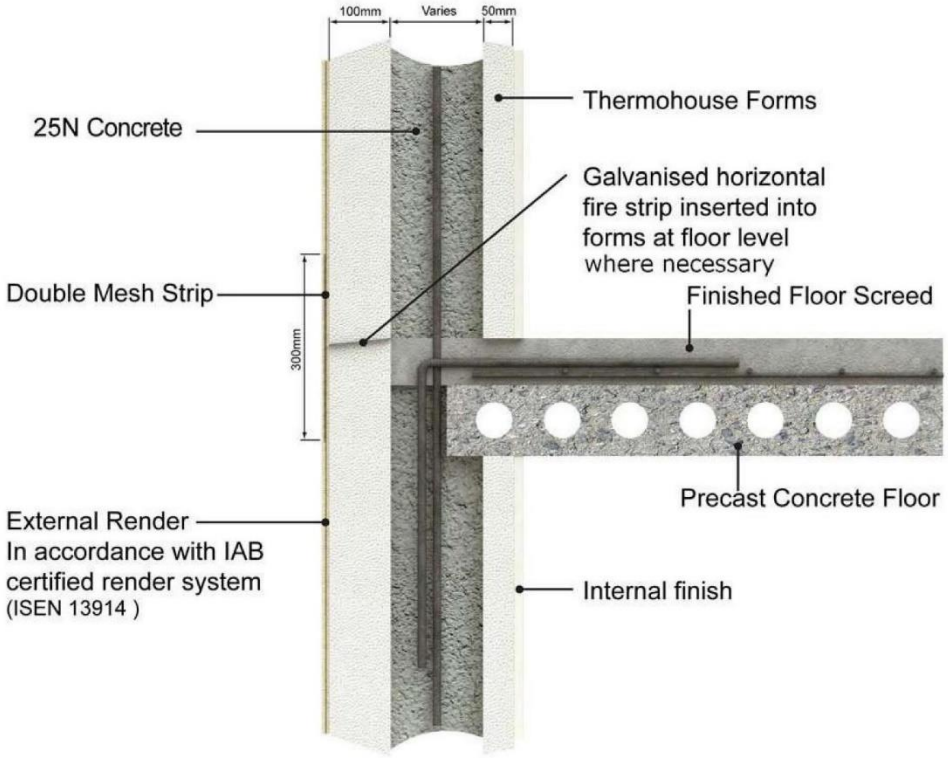


Figure 12 – Hollow Core Floor Detail

3.3 SUSPENDED TIMBER FLOORS

Timber floor systems are most commonly suspended from rim joists or ledgers that are securely attached to the concrete wall with anchor bolts. Anchor bolt sizing and spacing must be specified by the Structural Engineer.

Thermohouse blocks must be installed to a height allowing 50mm minimum cover over the floor embedment.

Mark the top and bottom of the rim joist on the inner face of the blocks using chalk lines.

Cut 100mm dia. openings between the chalk lines to accommodate anchor bolts.

Make certain that cuts are flared/tapered to facilitate concrete placement.

Cut 200mm x 200mm pieces of plywood and drill a hole in the center to accommodate the anchor bolt fixings. Install the anchor bolt and hold in place using double nuts.

Place the plywood and anchor bolts into the holes and attach with 4 screws to the block.

Allow the concrete to gain adequate strength before removing the plywood, usually 3 days.

Install the ledger by fixing to the anchor blocks. It may be necessary to drill holes slightly larger than the anchor bolts.

Use standard joist hangers to attach floor joists.

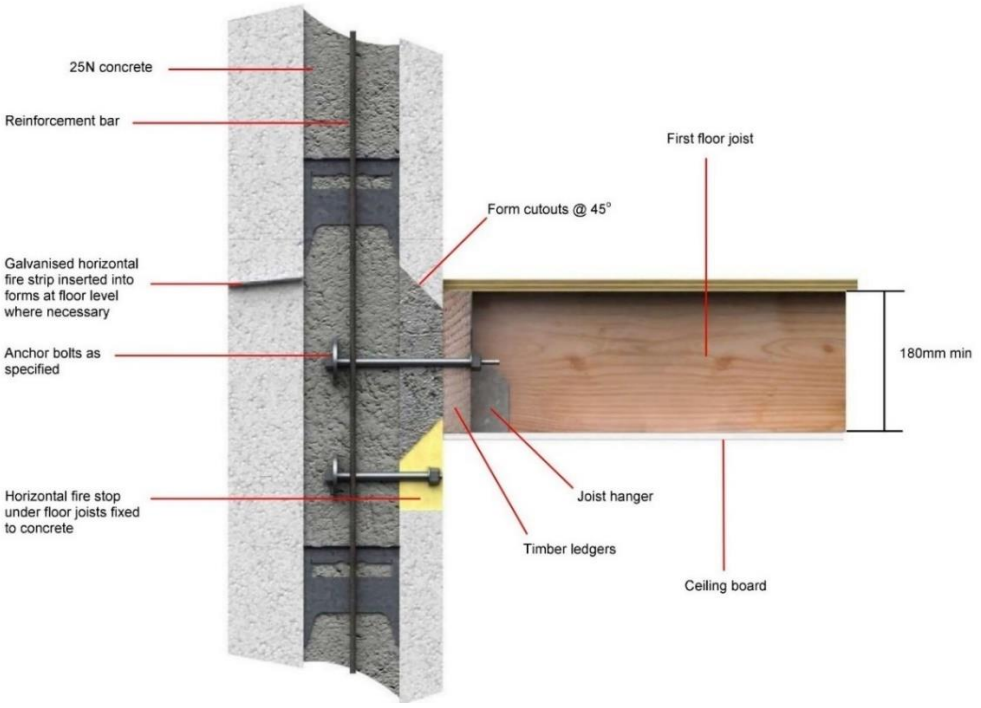
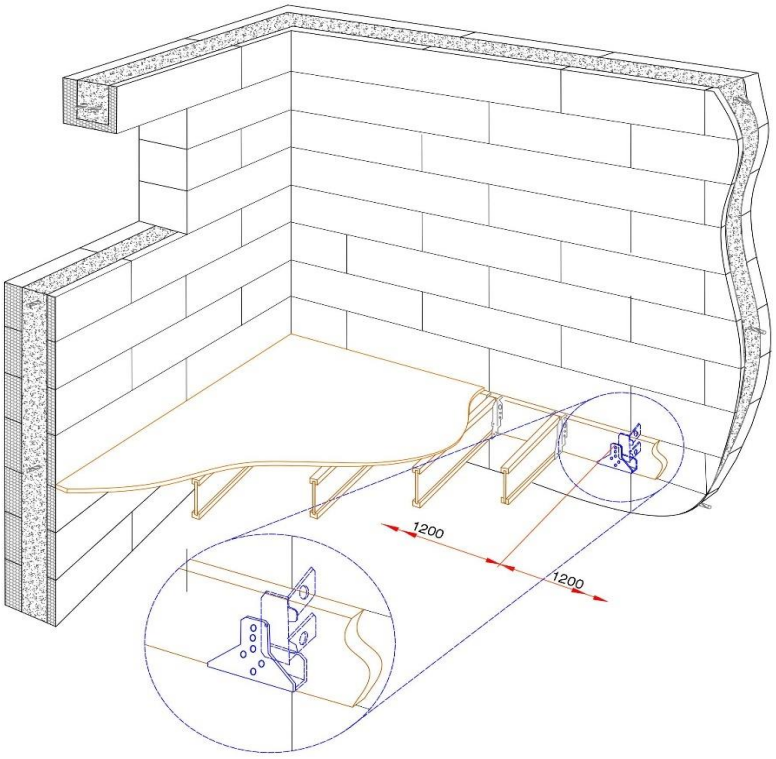


Figure 13 - Typical Suspended Floor Detail

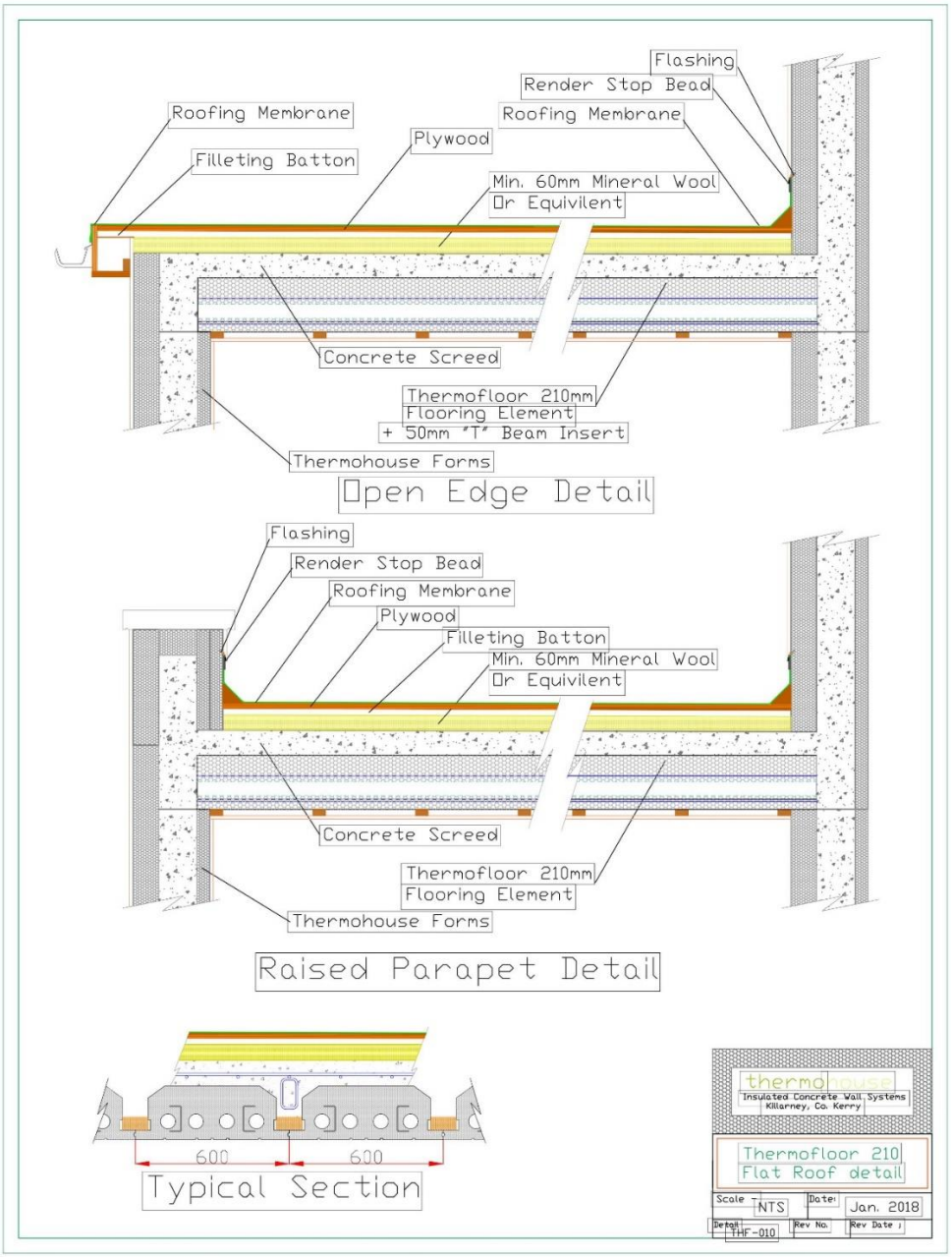
Proprietary joist hangers, such as the McMillan Joist Hanger or the Simpson Strong-Tie or any other approved system, are designed to support wood floor joists to ICF walls and are usually easier and quicker to install. All proprietary joist hangers must be installed in accordance with the manufacturer's instructions.



Simpson Strong Tie

3.4 THERMOFLOOR – AS A FLAT ROOF

ThermoFloor 210mm in conjunction with TH – 59 “T” beam insert can be used as a flat roof system, it is important to note, as shown in the figures below that the equivalent of 60mm (minimum) mineral wool (thermal conductivity 0.040) insulation must be placed under the surface finish (by others) to prevent interstitial condensation forming on the internal surface. Depth of “T” beam and slab will be dependent on spans and loadings based on the final use of roof.



Flat Roof Construction Showing “T” Beam Inserts & Reinforcement

Thermofloor 210mm External Balcony

3.5 ELECTRICAL INSTALLATIONS

Electrical installations are typically installed after concrete placement. The exception to this rule is the placement of conduits that penetrate through the floor, if required these should be installed or sleeved if possible, before concrete placement to avoid core boring afterwards. Tracks and conduits can be screw fixed to the "C" sections within the Thermofloor panels which sits above a longitudinal groove on the underside of the panel to highlight the screw line.

Note: The use of pvc-pvc cable must be placed into conduit to avoid reaction with EPS. Therefore, ensure that all PVC cables are NOT in contact with the EPS.

Various tools can be used to create the channels and spaces for wiring and boxes.

Hot knife

Various hand saws or router

Note: All electrical wiring must comply with relevant electrical regulations/standards.

False Ceiling Showing Service Void

3.6 PLUMBING INSTALLATIONS

In most cases buildings are designed so plumbing pipes are not carried through the ThermoFloor panels except for utility entry and exit points or engineered openings designed for purpose.

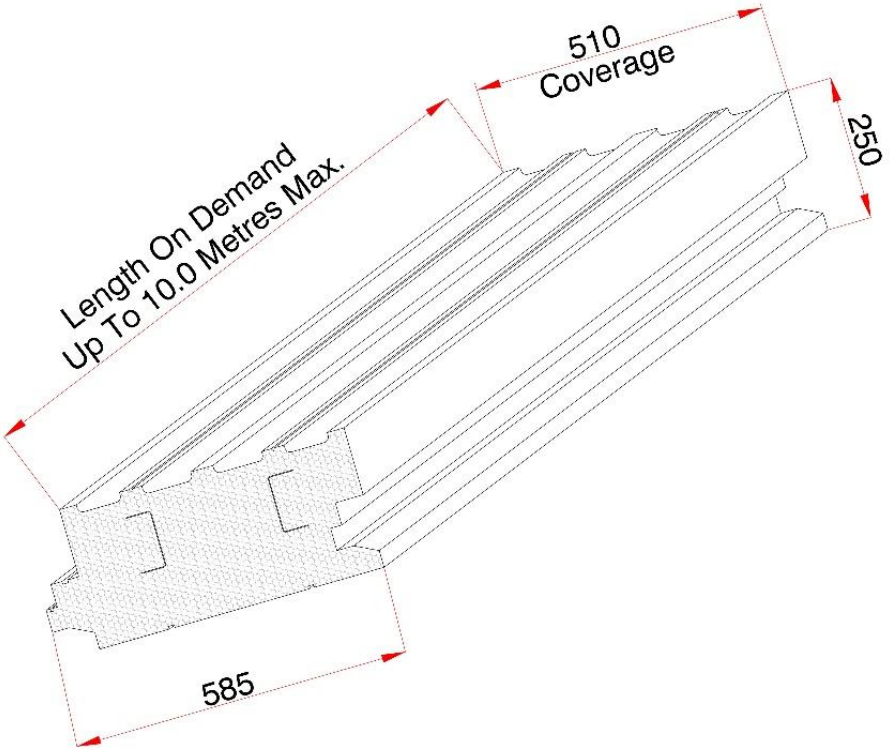
Most pipes are located in the service void between the floor panel and the ceiling, if extra space is required it is possible to remove the EPS in between the “C” sections after the structural concrete floor above has cured.

False Ceiling Showing Service Void

4.0 THERMOROOF - ROOFING SYSTEM

ThermoRoof Element

U-value of 0.15



4.1 APPLICATION

The Thermohouse Roofing System is certified for use in both domestic and commercial buildings for all roof pitches. The system can be used for Traditional, flat roof and curved roof applications. The system has been assessed for use as load bearing roofing panels which are simply supported on wall plates, ridge beams and intermittent purlins. The panels can be single or multi spanning. The roof panels are used as conventional roof rafters for traditional 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.
All designs to be confirmed by the Supervising Engineer.

4.2 DESIGN

The Thermohouse Roofing System consists of two steel cold formed "C" sections encased in moulded panels of expanded polystyrene (EPS). The panels are interlocking due to their tongued and grooved profiles. The vertical T&G joints are adhered with low expansion adhesive foam and sealed. Each individual panel is fixed down through the two cold formed "C" sections to timber wall plates, purlins (or knee walls) and ridge beams.

The Thermohouse Roofing System panels are produced to meet the customer's pitch and length requirements for 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 unless they are joined on a support beam. Each panel has an overall depth of 250mm and a cover width of 510mm. Dimensional tolerances for manufactured panel are outlined below. The roof panels can be mitred to suit the angle at the eves and ridge providing a plumb cut.

Dimensional Tolerances

- Length ±0.6%
- Width ± 2 mm
- Height ± 2 mm

4.3 TOOLS, MATERIALS and ACCESSORY REQUIREMENTS

- 8mm x 275mm Panel Screw
- 6mm x 180mm Panel Screw
  Ensure that the fixing screws are driven through the "V" grooves on the panels which highlight the location of the "C" sections embedded within the panel. Screws should be inserted perpendicular (at $90^{0)}$ to the panel to ensure a 50mm embedment into the timber supports. If the screw requires to be driven
  at an angle other than 90^{0} a longer screw will be required to achieve the proper embedment.
- Low Expanding Adhesive Foam
- Expansion Foam
- Foam Gun
- Hot Knife
- Weathering / Airtight Tape
- Fixings for Battens, Wall plates, Purlins
- Ridge/Apex Straps
- Timber Battens
- Anchor Bolts
- PVC Pipe Sleeves for Penetrations
- Fire Stops
- Vapour Control Layer
- Breathable Vapour Barrier

Roof With Dormer Windows

Multi-Facetted Roof Designed With Large Overhangs

ThermoRoof – Versatile Roofing System

Under Construction **Completed**

Large Overhangs

Barrel Roof

Traditional Roof

Curved Roof

4.4 DELIVERY, STORAGE AND MARKING

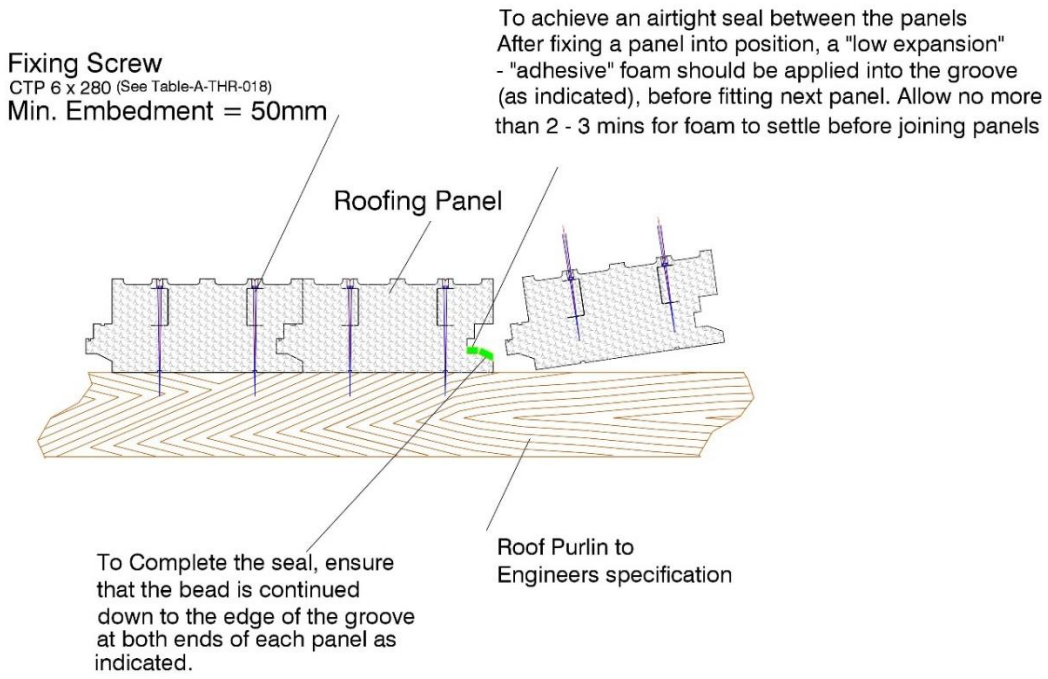
Panels are delivered to site strapped in bales. All components are clearly marked as to their size and location in the build. Thermohouse Roof System components should not deteriorate in normal storage conditions so long as they remain protected from the environment prior to use. Storage must be on firm, level and dry ground, and if the components are to be stored outside, they should be protected from the weather by a secured covering. Thermohouse 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 any 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 lightweight 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 must be reinstated to the cut ends of all cold formed section. Reasonable care must be taken to prevent damage to the forms before, during and after installation. The forms must not be punctured, split, deformed or unduly compressed before use. The surface finish is a Zinc coating having a designation of Z275 (This relates to 275 g/m2 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

4.5 AIRTIGHTNESS & SEALING

At the point of installation, a full-length bead of 20mm in diameter of low expansion adhesive foam should be applied to the lower side of the female section of the tongue & groove joint on each panel. Any voids or damage to the panels caused during the installation such as gaps at the wall plate / ridge and /or the drill holes created for the holding down screws must now be sealed using expanding foam,

For ThermoRoof details, please see annex 8 to annex 14.

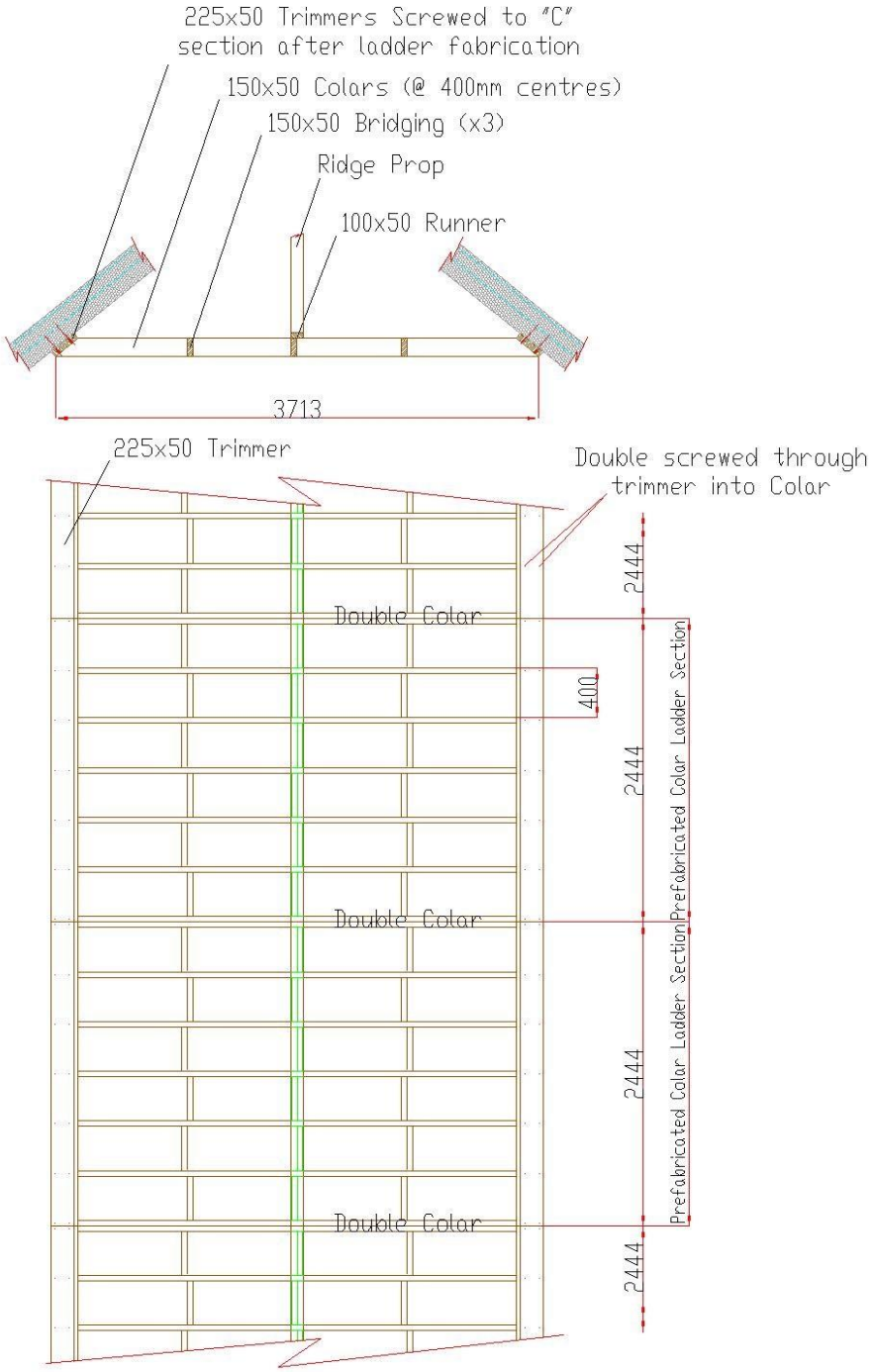


4.6 COLLAR LADDER BRACING

Collar ladders are used to triangulate the roof where a flat ceiling line is required, or more importantly there are NO loadbearing walls to support the ridge beam.
In this instance, the ridge is temporarily propped for the installation and fixing of the Thermoroof panels. Once this procedure is completed the collar ladders can be pre-fabricated in sections, offered up to the underside of the roofing panels and fixed through to the reinforcing “C” sections molded into the Thermoroof panels, when the collars are in place, a prop/hanger can be installed from the location of the double collar to the ridge beam if required. All designs are to be carried out by the Supervising Structural Engineer.

Pre-Fabricated Colar Ladder

In-Situ Collar Ladder



Fabrication of Collar Ladder

4.7 WALL PLATES & SUPORT LOCATIONS

The Thermohouse Roofing panel can only be supported on timber wall plates (or into the Thermohouse proprietary eve shoes), ridge beams and intermediate purlins. All other forms of support such as masonry wall or steel beam must have a timber fixing beam with a minimum bearing width of 75mm securely fixed prior to installation of the roofing panels. All timber wall plates and 'eve shoes' must be adequately fixed down such that they can accommodate the specific regulatory design loads. The timber wall plates, purlins and ridge beams must have sufficient depth to allow for a full 50mm embedment of the holding down screws. All timber support beams need to be chamfered to the roof pitch and 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 may often require special t-fixings as shown in ***Annex 10***. In all cases the wall plate must be suitably anchored or strapped down prior to installation of the Thermohouse roofing panels.

Detail- Showing ridge and valley beams + Panel Fixing Beam

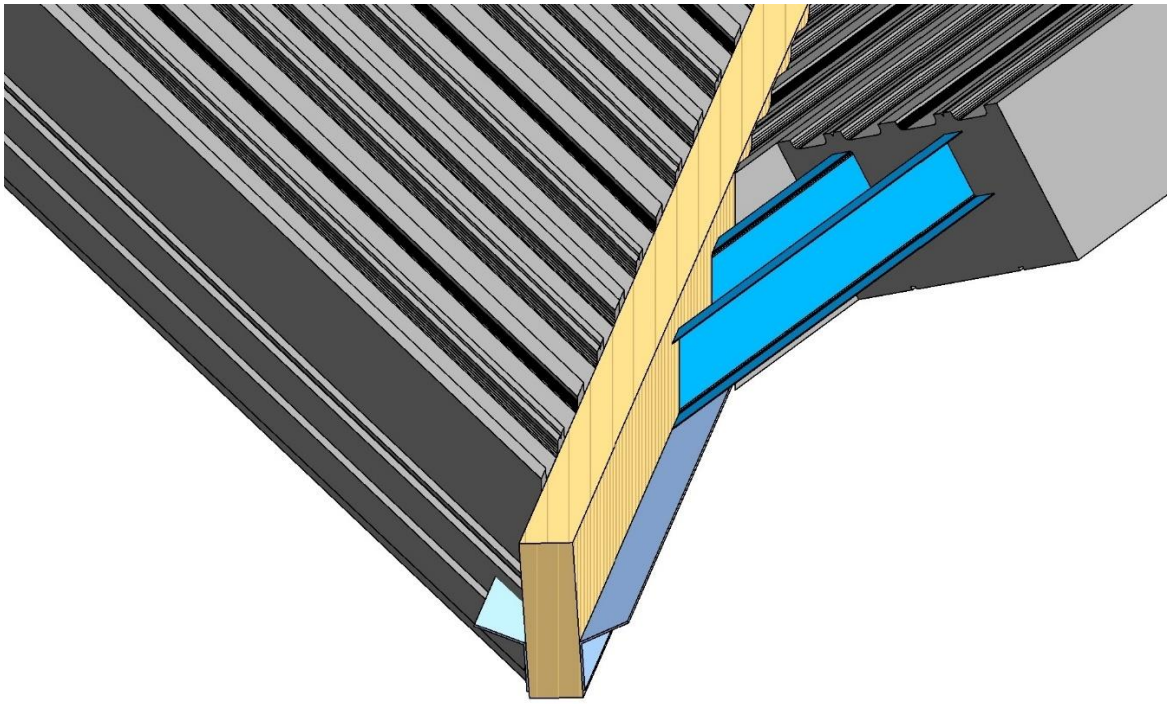
Detail - showing knee wall as Intermediate support and double internal battening for slabbing with a service void

4.8 PANEL FIXING SCREWS

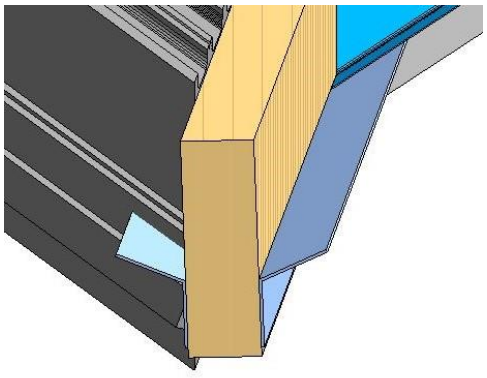
Once located, to secure the panels in place and to provide resistance to wind uplift, each individual Thermohouse Roofing panel must be anchored down to a timber wall plate, purlin or ridge beam at each support point. Holding down screws are fixed through both cold formed sections in each panel. Roofing panels are positioned and once the installer is satisfied with the line and level of the panel, the installer will secure the assembly with a dia. 8.0 x 275 long fixing screw. The roof fixing screws must have a minimum embedment length of 50mm, ***see Annex 11.***

4.9 HIP & VALLEY CONNECTION PLATE

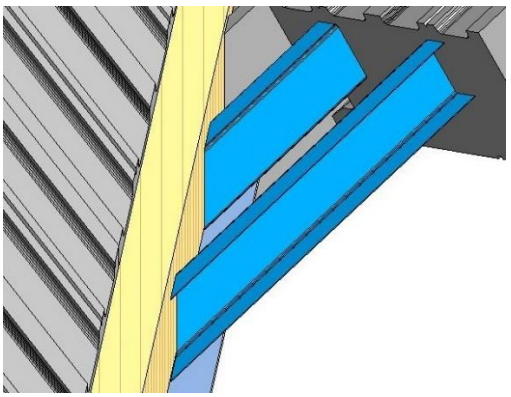
As an alternative option to the timber fixing beams on the valley/hip beams (see **4.7**) Thermohouse can provide on request, a 3mm galvanized folded plate fit for purpose, that is fixed to the to the hip or valley beam, strategically located to support the "C" sections on the compound cut of the Thermoroof panel allowing the roof panels to sit flush with (as shown) or encompass the vallev beam.



Galvanised Valley & Hip Support/Fixing Plate



Folded Plate to Beam



Panel steels to Folded Plate

4.10 EAVE SHOES

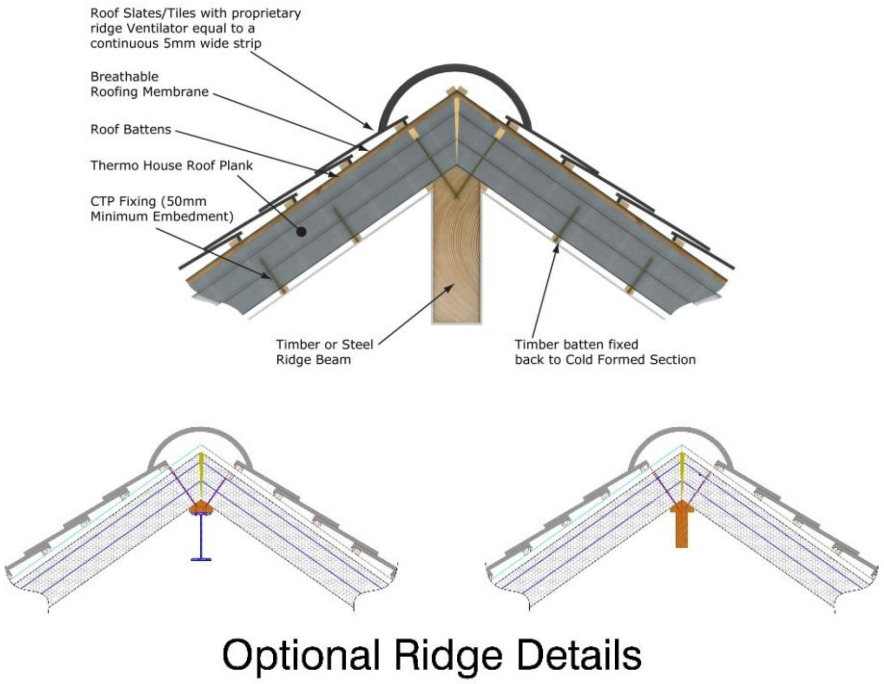
Where applicable, holding down bolts for the Thermohouse proprietary 'Eave Shoes' must be mechanically anchored at the eave's level. The eave shoe is predominately used in conjunction with ICF type constructions but can be modified for conventional masonry construction, ***see Annex 12.***

4.11 EXTERNAL ROOF FINISHES

Once the panels have been securely fixed down to wall plates, purlins & ridge beams the Thermohouse Roofing System is now ready for installation of the primary battens, membrane and counter battens suitable for use in conjunction with conventional concrete tile or slate build ups or any other roof finish.

4.12 RIDGE / APEX STRAPS

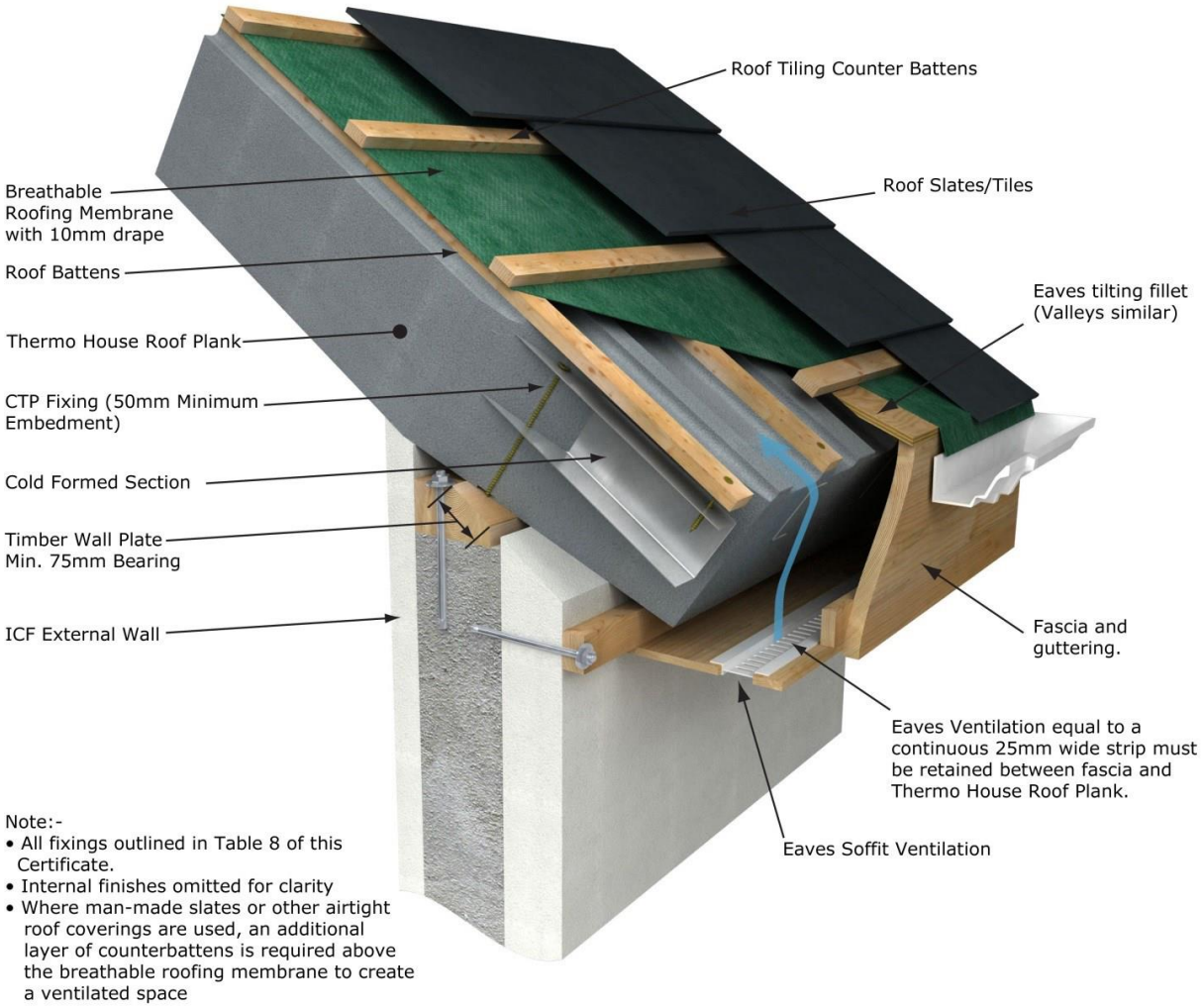
Ridge straps can be used, however are seldom required. If required, ridge straps shall be formed from steel complying with the requirements of BS 1449: Part 1, hot dipped galvanized after cutting, formed and holing or stainless-steel complying with the requirements of BS 1554 (specification for stainless & heat resisting steel) grades 302, 304, 315, 316, 321 or 347.



Optional Ridge Details

4.13 BATTENS & VAPOUR MEMBRANE

The roofing panels can now be battened out with primary timber battens. Primary battens should be fixed 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 "C" sections. The first layer of timber battens is fixed down to the top flange of the cold formed "C" section (which is marked on the panel with a "V" groove) with self-tapping Ruspert corrosion resistant fixing or similar. Further information on all fixing used can be found in table 9 of our IAB certificate. A suitable vapour permeable underlay is to be draped over the primary timber battens and the underlay is then counter battened to facilitate roof tiles or slates. Roof tiles or slates can then be fixed to the counter battens, ***see Annex 11.***



4.14 UNDERLAY, SLATING & TILING

A breathable roof underlay must be used in conjunction with the Thermohouse Roofing System. The installation of the breathable roof underlay must be as outlined in ***Annex 10 to 14.*** The underlay is supported between the roof primary support battens and the roof tiling battens. Roof ventilation should be carried out in accordance with the appropriate building regulations and the recommendations of BS 5250, *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, eave vent tiles can be fitted to supply adequate ventilation to this unobstructed free air space between the roof tile and the breathable roofing membrane.

Slating or tiling should be in accordance with the appropriate regulation and the workmanship must be in accordance with BS 8000-6 - *Workmanship on building sites / Code of practice for slating and tiling of roofs and claddings.*

4.15 CONTAINMENT OF FIRE / PARTY WALL

The plasterboard internal lining for use with the Thermohouse Roofing Systems must have a spread of flame rating equivalent to Class 0. In accordance with the Irish regulatory requirements (Appendix A Table A1 of part B of the Irish Building Regulations fire safety) there is no requirement for a roof element to contain a fire. However, at the boundary or party wall junction between two adjacent dwellings the integrity of the dividing wall must extend up through the roof structure as indicated in, ***Annex 11.*** And as shown in photo below.
Regulations in other Countries may vary and these regulations need to be considered when finalising all design details.

Fire Break in ThermoRoof panels

4.16 CHIMNEY

Chimneys are not part of the Thermohouse Roofing System and are not covered by our certification. However, the system can incorporate an approved pre-fabricated chimney system or a conventional masonry chimney. The requirements of Part J of the Irish Building Regulations heat producing appliances 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 block-work chimney or fireplace recess.

All penetration such as chimney flues must be trimmed out by providing additional purlin or primary structural support members, ***see Annex 12.***

4.17 ROOF WINDOWS

Roof windows can be accommodated and incorporated into the Thermohouse roofing system and designers should provide details of their selected roof window to the certificate holder. ***see Annex 13.***

Typical window framing in ThermoRoof Panels

4.18 INTERNAL FINISHES

The internal roof finishes consist of the following options:

- Internal plaster finishes are only suitable for use when there are no roof lights and/or inline timber trimmers.
- Vapour control layer (on warm side of timber trimmers only).
- Timber battens are fixed to the bottom flange of the cold formed section with self-tapping Ruspert corrosion resistant fixing.

Service Void Battens

Finished Ceiling

Internal Finishes 1

Internal Finishes 2

4.19 OPENINGS / SERVICES

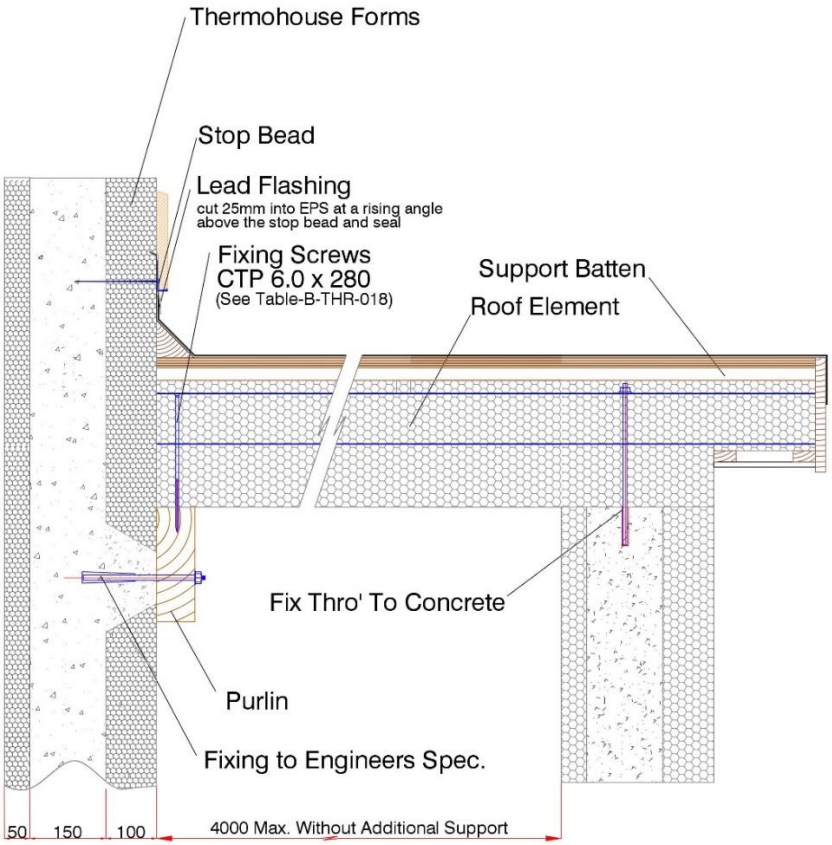
- Service penetrations for extracts or vent pipes should be installed between the cold formed sections of a panel and not at the rebated join between two panels. If the ope for a service penetration is large enough to clash with a cold formed "C" section then inline timber trimmers must be used to frame out similar to chimney and roof-light openings.
- 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 Thermohouse 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 Thermohouse Roofing system.
- Expanding foam and sealing tapes must be used to reinstate full air tightness once service ducts or penetrations are installed.
- Electrical cables should have been manufactured using a migration resistant plasticizer where in direct contact with the EPS insulation or they **MUST** be placed with in a duct/conduit to avoid plasticizer migration and cable degradation. The cables must be sized to minimize heat build-up with resulting fire risk, in accordance with the appropriate regulation.
- 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 Thermohouse Roofing system is not suitable for recessed lighting unless suitable precautions are taken to avoid heat build-up in the EPS.

4.20 GENERAL PROVISIONS

- The Thermohouse Roofing panel must be adequately separated from any heat source such as chimneys and flues.
- All Thermohouse Roof installations can be made airtight through the correct use of jointing tape, adhesive foam, 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 ($0.030W/m^2K$) 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 Thermohouse 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 openings that would clash with the cold formed sections within the Thermohouse roofing panels, then these larger openings must be trimmed out in accordance with the guidelines of figures 8, 10 and 11 and the Supervising Engineer's requirements.
- Prior to installation of roof underlay, all jointing tapes, cavity barriers and fire stops must be provided.
- Thermohouse Roofing panels 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 unless there is adequate support provided.

4.21 THERMOROOF AS A FLAT ROOF

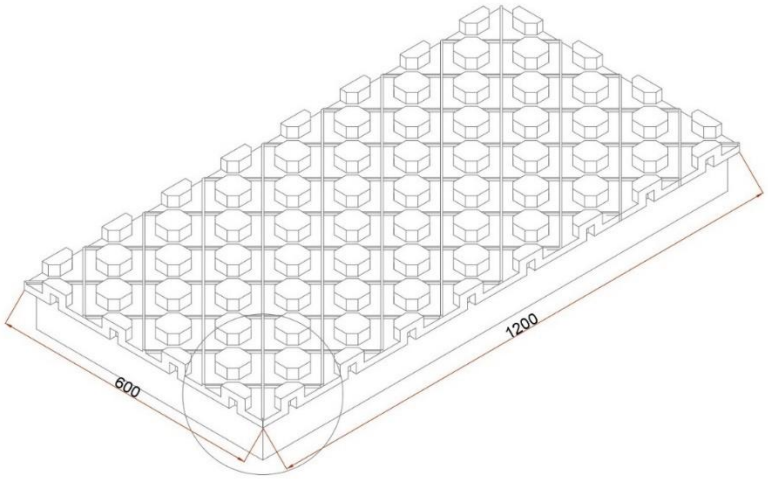
The ThermoRoof system can be used as a flat roof / 0-degree system to achieve / continue a passive grade envelope. It is important that loadings, access and area use are carefully considered and signed off on by the Supervising Engineer.

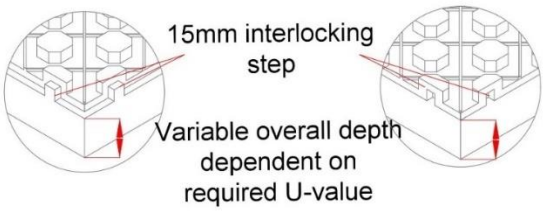


Unsupported span length can vary dependent on the loadings and has to be approved by the Supervising Engineer

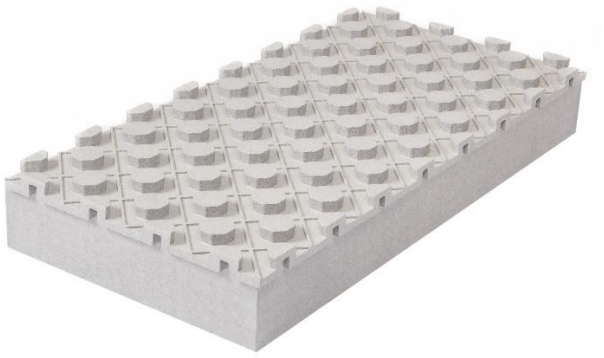
The support purlins and wall plates can also be rebated in 125mm as a support for the "C" sections within the panels

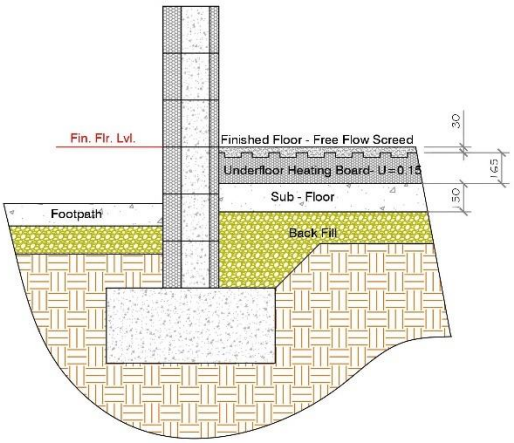
5.0 THERMOBOARD



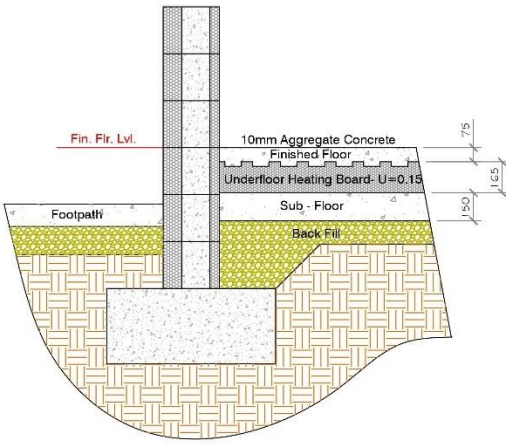


Insulated, lapped & locking boards for under-floor heating pipes





30mm Free Flow screed



75mm Free Flow screed

The ThermoBoard panel dimensions are 1200mm x 600mm and are available in various thicknesses that can meet and exceed building regulations with U-values to 0.12 as indicated below.

Thermal Conductivity	0.030 W/mk
Maximum Compression	Compression 10%
U-values	0.12 for 225mm Board 0.15 for 180mm Board 0.33 for 100mm Board 0.45 for 80mm Board 0.68 for 60mm Board
Panel Thickness Increment	5mm from 60mm to 225mm
Panel Size	1200mm x 6mm = 0.72sqmtrs

Typical Thermoboard – Dimensions 1,200mm x 600mm

The Thermoboard can support a two-tier installation system providing the facility to segregate, where required, the return cool-flow from the outgoing heated supply.

THERMOBOARD - INSTALLATION INSTRUCTIONS

- *Sub-floors must be clean and level to ensure the boards interlock correctly and sit tighly into room corners.*
- *Start the installation in one corner of the room and work towards the opposite corner.*
- *Boards that are placed against the edge walls must have the interlocking overlap removed with a blade to allow them to sit flush against the edge walls / edge insulation strip. Edge insulation strip is not required where the rising walls are built with the Thermohouse Wall System.*
- *All boards must be interlocked and fitted together tightly leaving no gaps to ensure the integrity of the finished screed.*
- *Where practicable, use the off cuts from one room to commence the installation in the next room.*
- *The retaining "Mushrooms" / "Upstands" can be removed from the boards by manually twisting them off. This may be required to increase the strength of the outer edges of the screed and also where pipes may need to run closer together e.g near the manifold etc.*
- *Piping should be laid in a "Reverse Spirral" format for ease of instalation and the optimum heat distibution of the underfloor heating.*
- *Due to the unique design of the interlocking overlap facilty on the Thermoboard, there is no additional requirements for plastic sheeting, taping of joins, guide tracks or rails.*

16mm Pipe at 150mm Centres

20mm Pipe at 200 / 300mm Centres

Annex 1 - 1

Thermohouse
External Wall, Floor & Roof Elements

U – value selection
By Element

U-value	Product
External Walls Systems	
0.2 W/m^{2}K	300mm Standard External Wall Block
0.2 W/m^{2}K	350mm Basement External Wall Block
0.12 W/m^{2}K	400mm Passive Gold External Wall Block
0.1 W/m^{2}K	450mm Passive Platinum External Wall Block
Roof Systems	
0.25 W/m^{2}K	ThermoFloor 210mm with TH-59 Inserts
0.15 W/m^{2}K	ThermoRoof Element 250mm

Annex 1 - 2

PSI VALUES

To External Envelope

Based on

300mm Wall = 0.20W/m2K – 250mm Roof = 0.15W/m2K

thermohouse
the low energy building system

Summary of certified psi-values for use in SAP/DEAP/Y-factor calculations. All calculations carried out in accordance with IS EN ISO 10211:2007 and BR497:2016.For more detailed information on application and relevant ranges of applicable U-values, see footnotes at the end of this table.

NSAI Agrément
Andrew Lundberg
Passivate
Registration Number IAB/TM/02
NSAI Approved Thermal Modeller

Date of issue:	23/01/2018
Revision no.:	1

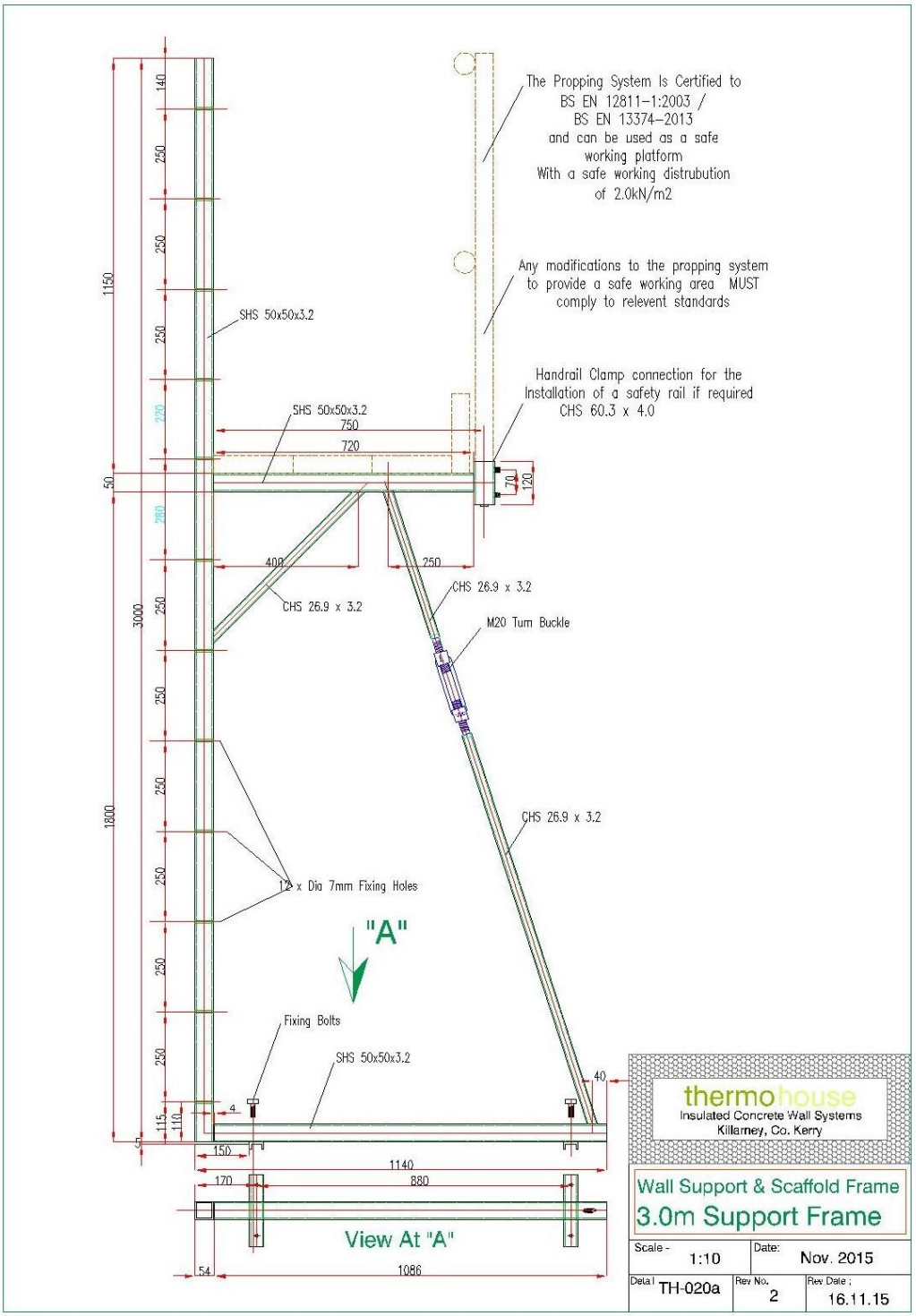
Target U-value: 0.19W/m^{2}K

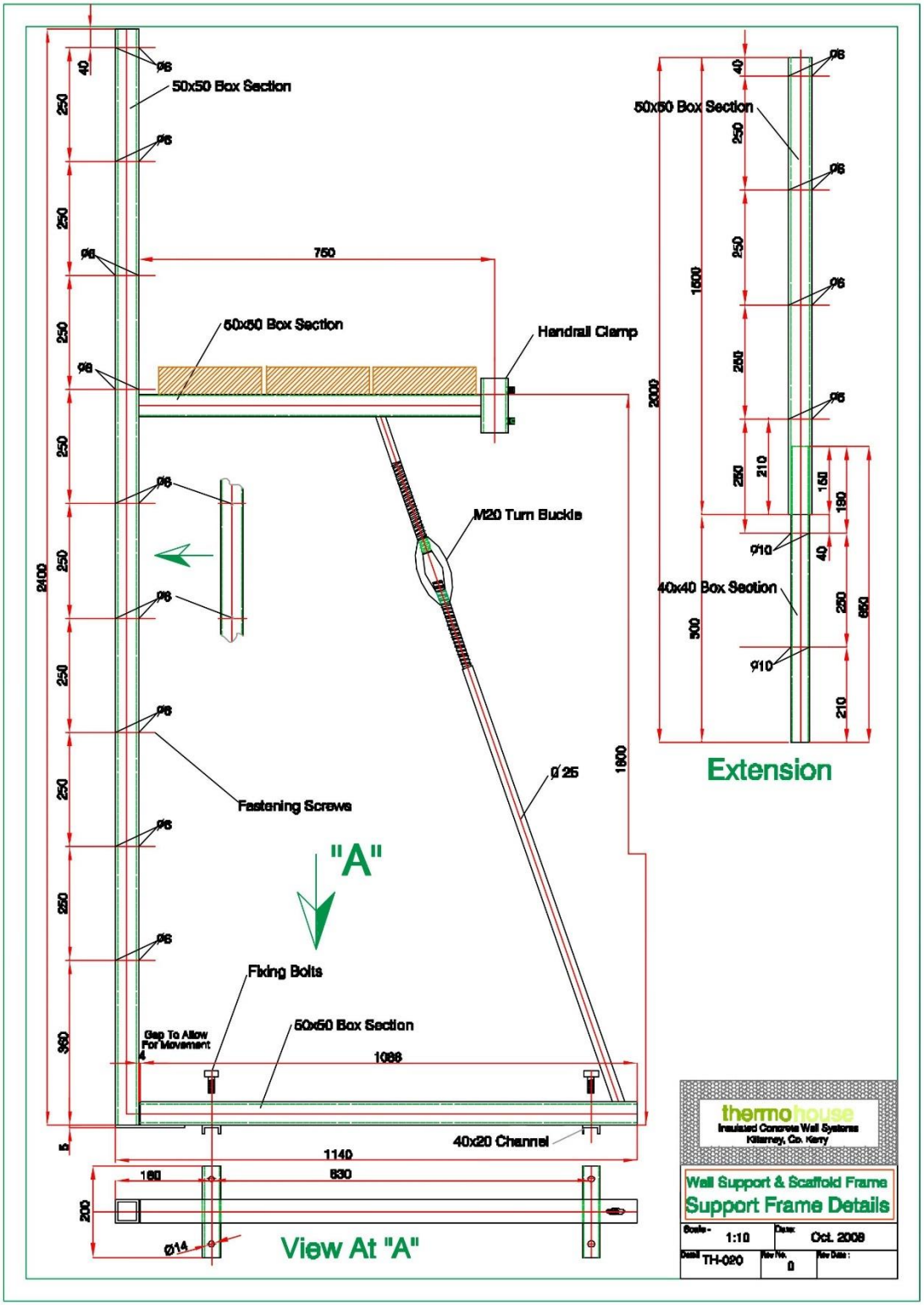
Detail number	Description	Psi value	fRsi value	Comment
1.01	Strip foundation to external wall	0.084	0.92	
1.01A	Raft foundation to external wall	0.160	0.87	
1.02	Party wall in plan	0.049	0.94	Assign this psi value per dwelling in a DEAP/SAP/y-factor calculation
1.02A	Party wall in plan with SS fire break	0.078	0.93	Assign this psi value per dwelling in a DEAP/SAP/y-factor calculation
1.03	Internal partition in plan	0.035	0.94	
1.04A	Hollowcore intermediate floor within a dwelling	0.071	0.87	
1.04B	Timber intermediate floor within a dwelling	0.040	0.9	
1.04C	Thermofloor intermediate floor within a dwelling	0.055	0.83	
1.05	External wall corner	0.051	0.91	
1.06	Roof eaves standard roof on thermowall	0.034	0.91	
1.08	Window head	0.002	0.95	
1.09	Window jamb	0.002	0.95	
1.1	Window sill (concrete)	0.186	0.82	
1.11	Thermoroof wall eaves	0.005	0.94	
1.12	Thermoroof on cavity wall eaves	0.092	0.94	
1.12A	Thermoroof on cavity wall with Quinnlite B7 cavity closer	0.029	0.94	
1.13	Roof ridge	0.017	0.94	
1.14	Main wall to extension roof	0.095	0.95	
1.15	Main wall to lean-to roof	0.124	0.92	
1.16	Roof verge	0.030	0.91	
1.17	Main wall to flat roof	0.094	0.94	
1.18	Party wall roof head	0.026	0.96	Assign this psi value per dwelling in a DEAP/SAP/y-factor calculation
1.19	Door threshold	0.133	0.84	
1.2	Door head	-0.001	0.95	
1.21	Door jamb	-0.001	0.95	

Notes: The target U-value for the wall is 0.19W/m^{2}K. The target values for the roof and floor are 0.15W/m^{2}K and 0.14W/m^{2}K respectively. The psi-values are applicable for walls with U-values in the range of 0.15 - 0.21W/m^{2}K. Where two elements have one U-value above its target while another is below its target U-value, the aggregate percentage change from the respective target U-values in the table should not exceed 20% for the psi-value to be valid. For example, if the wall U-value were 0.21W/m2K, which is 10% above the target value, the roof could not be below 0.135W/m^{2}K or the floor below 0.126W/m^{2}K in order for the psi-values to remain valid. Otherwise the aggregate difference about the target values would be greater than 20%. Where this is the case, the advice of the certificate holder should be sought, with project specific psi-values to be calculated.

Annex 2 – 1

Thermohouse Propping System And Details




50x50 Box Section
750
60x60 Box Section
Handrail Clamp
M20 Turn Buckle
Fastening Screws
"A"
Fixing Bolts
Gap To Allow For Movement
60x60 Box Section
40x20 Channel
1140
630
View At "A"
50x50 Box Section
40x40 Box Section
Extension
thermohouse
Insulated Concrete Wall Systems
Killarney, Co. Kerry
Wall Support & Scaffold Frame
Support Frame Details
Scale - 1:10
Date: Oct. 2008
Detail TH-020
Rev No. 0
Rev Date :

Annex 2 – 2

S-MECH LTD
Suite 9 – Railway House – Railway Road – Chorley – PR6 0HW • 01257 367580 • info@s-mech.co.uk • www.s-mech.co.uk •

Structural Certificate

October 13, 2016

Component: Thermohouse Prop/Platform System.

Test: Tested by an independent test house to a specification provided by S-Mech Ltd, against the distributed load and edge protection requirements of requirements of BS EN 12811-1:2003, and the Class A Edge Protection loading requirement of BS EN 13374:2013

Results: The component is compliant with the requirements of the above Codes, with a safe working distributed load capacity of 2.0 kN/m^2.

Certified By:

Ian R Hale. BSc (Hons) MSc CEng MIStructE
for S-Mech Ltd.

Registered Office: 4 Babylon Lane, Chorley, Lancashire, PR6 9NN. Registration No. 06025673

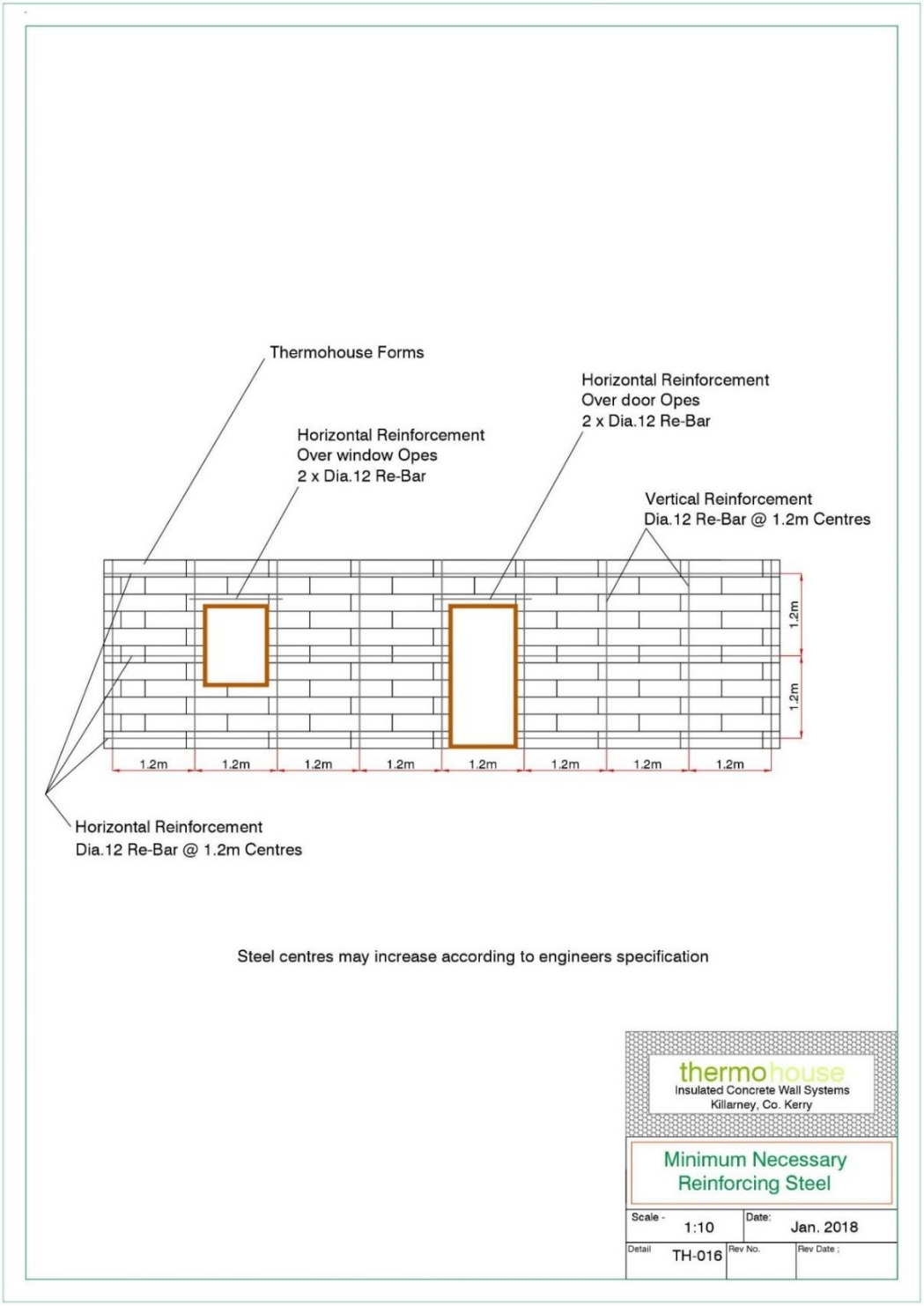
Test Reference: #1598-R1

Annex 2 –3

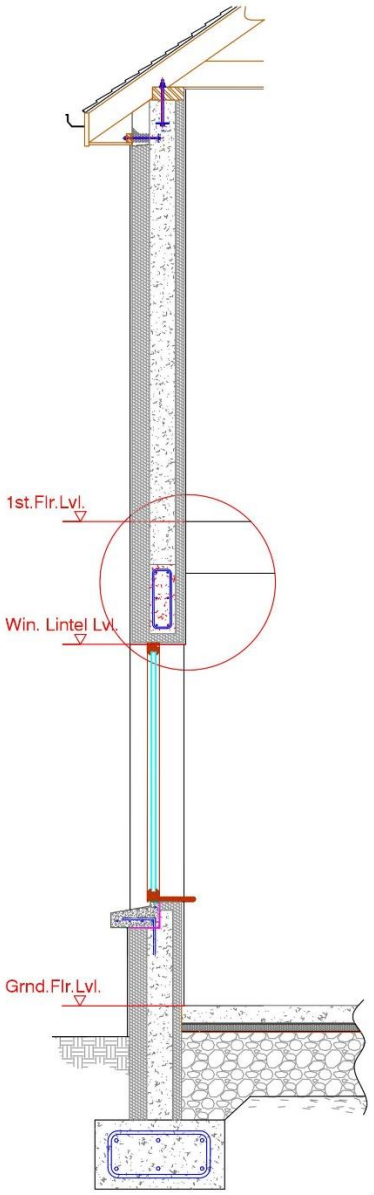
Temporary propping installed for wall support during concrete pour Max. 1.2m Centre’s

Annex 3

Minimum Necessary Steel Reinforcement



Annex 4
Lintel Reinforcement



Option 1 - External Wall Supporting Thermofloor Concrete Internal Floors

Design Assumptions:

Permanent Loading;
Thermofloor TH21 Flooring with a Minimum Concrete Depth of 100mm Spanning 5m
Roof with Maximum Span of 8m

Variable Loading;
First Floor - 2.5kN/m²
Roof - 0.6 kN/m²

Concrete;
Concrete Mix Design to be C25/30

Option 1.	250mm Concrete Floor			
Clear Span	1.0m	2.0m	3.0m	4.0m
Member Size	200mm Deep x150mm Wide	400mm Deep x150mm Wide	400mm Deep x150mm Wide	400mm Deep x150mm Wide
Tension Reinf. Required	2 no. 12mm	2 no. 12mm	2 no. 16mm	4 no. 16mm
Shear Links	6mm @ 100 Centres	8mm @ 200 Centres	8mm @ 200 Centres	8mm @ 200 Centres

Option 2 - External Wall Supporting Timber Internal Floors

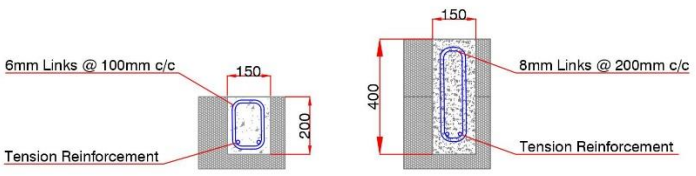
Design Assumptions:

Permanent Loading;
Timber Flooring Spanning 5m
Roof with Maximum Span of 8m

Variable Loading;
First Floor - 2.5kN/m²
Roof - 0.6 kN/m²

Concrete;
Concrete Mix Design to be C25/30

Option 2.	Timber Floor			
Clear Span	1.0m	2.0m	3.0m	4.0m
Member Size	200mm Deep x150mm Wide	400mm Deep x150mm Wide	400mm Deep x150mm Wide	400mm Deep x150mm Wide
Tension Reinf. Required	2 no. 12mm	2 no. 12mm	2 no. 16mm	4 no. 16mm
Shear Links	6mm @ 100 Centres	8mm @ 200 Centres	8mm @ 200 Centres	8mm @ 200 Centres



200mm Deep Typical Section

400mm Deep Typical Section

TITLE:

Typical Concrete Lintel Specifications to IS EN 1992-1-1

Coolcaslagh
Killarney
Co. Kerry
Ireland

Tel: 064 66 31307
Email: info@thermohouse.ie
Web: www.thermohouse.ie

This drawing to be read in conjunction with all other CMCE drawings and any other relevant information.

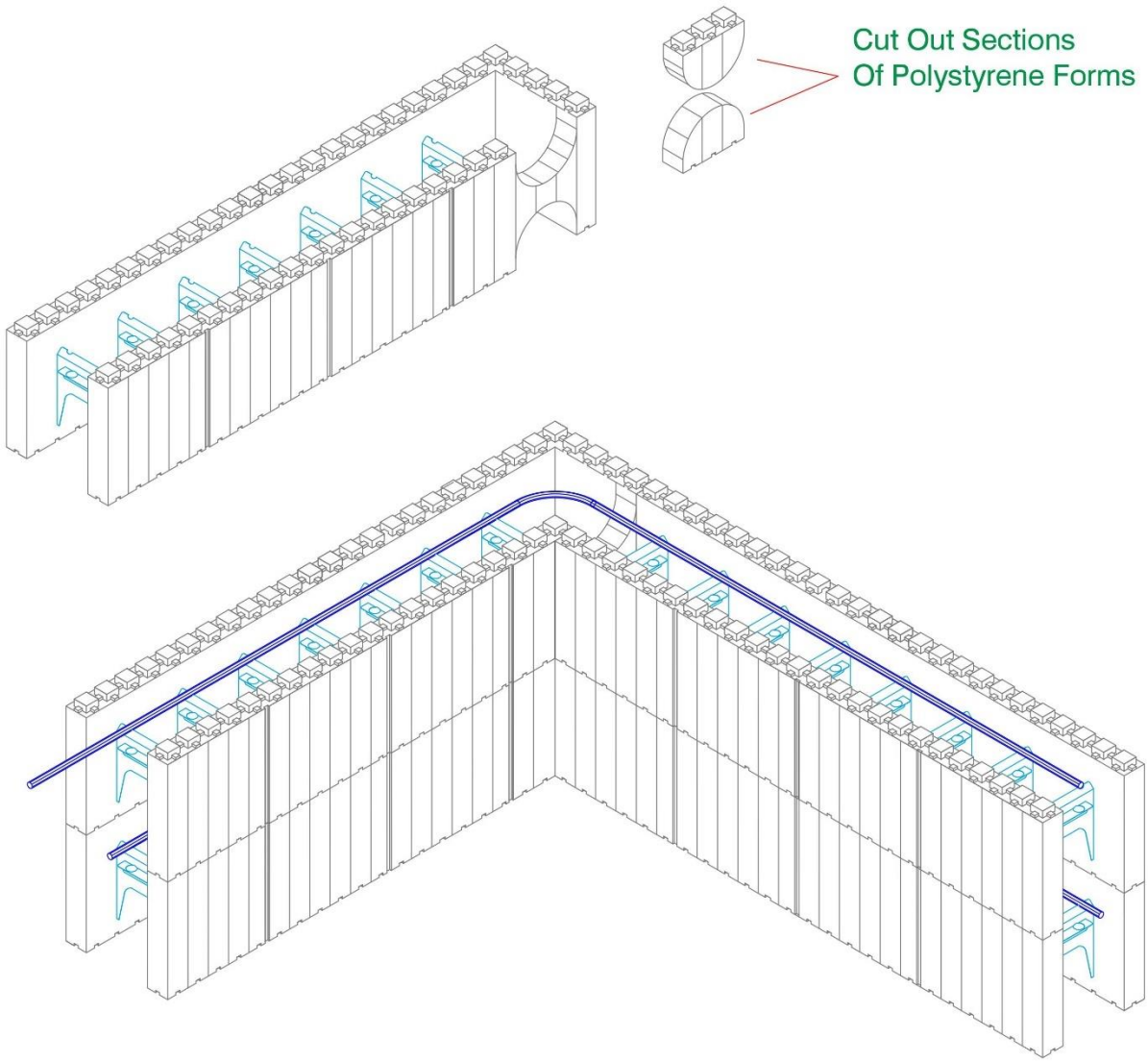
No dimensions are to be scaled from this drawing.

Unless noted otherwise, all dimensions are in millimeters and all levels are in meters from the noted datum.

DATE: 23 April 2015
DRG. NO. LD/1
REV. A
SCALES: Not to Scale
ENGINEER: D. Tarrant

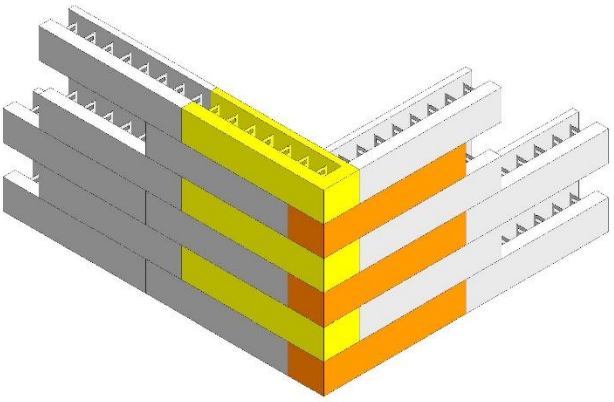
Annex 5

5.1 Construction of 90^0 Internal Wall Corners

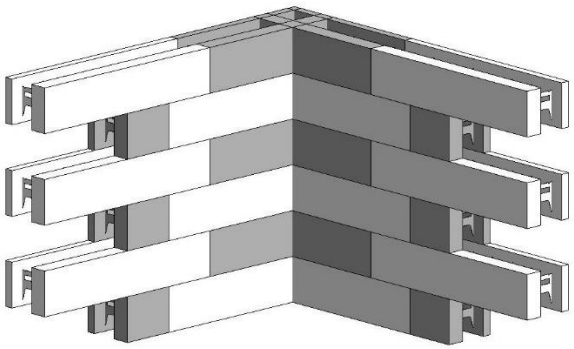


Internal Wall Corner Assembly
Alternate end block on every second course

5.2 Construction of 90^0 External Wall Corners



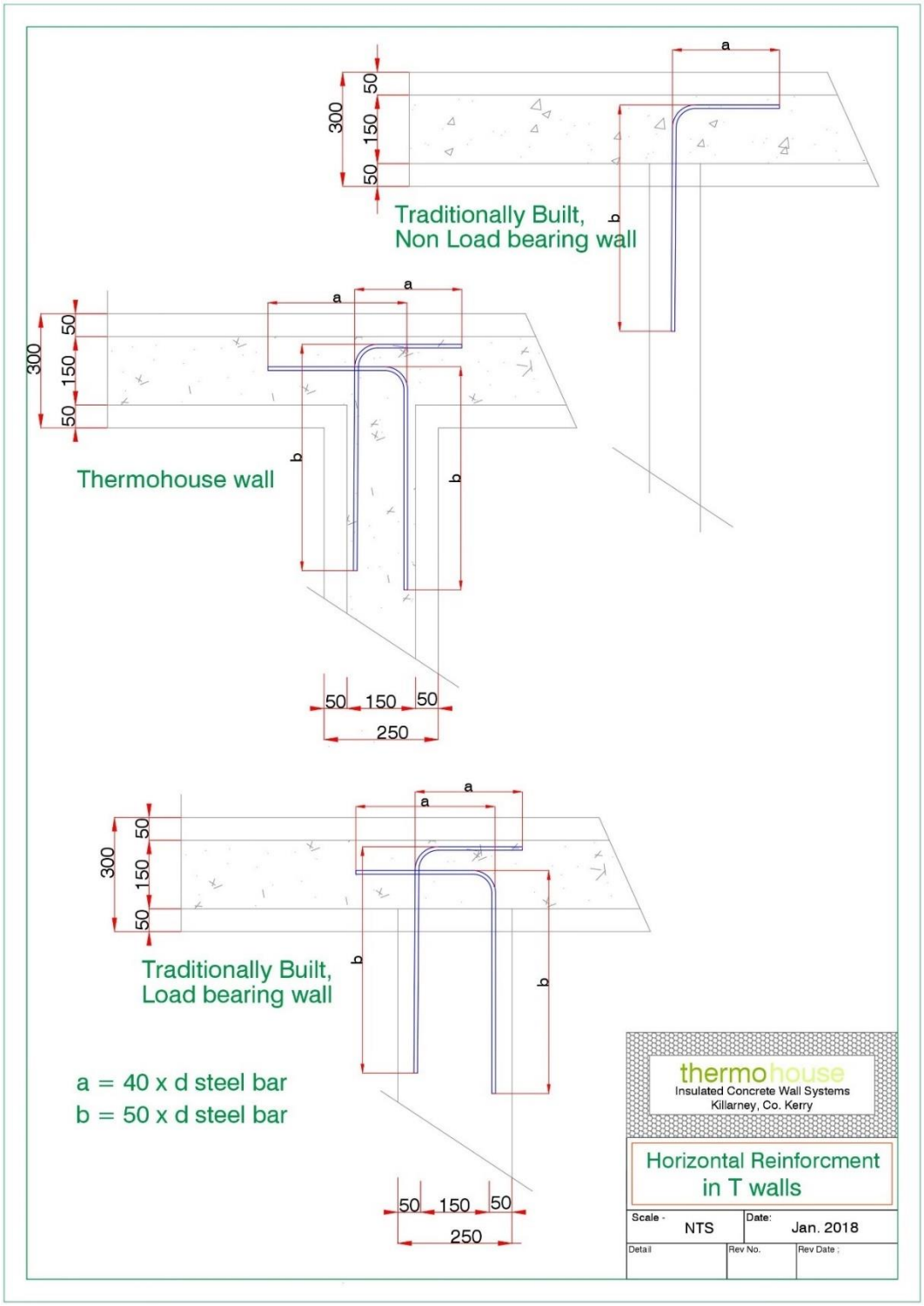
Outside Corner Construction
Example – Front Wall Connection To Gable Wall



Inside Corner Construction
Example – Entrance Porch Connection To Front Wall

Annex 6

Horizontal Reinforcement in Wall “T” Junction



Annex – 7 - 1

ThermoFloor Design Details

MMOS
MURPHY · MATSON · O'SULLIVAN
CONSULTING CIVIL & STRUCTURAL ENGINEERS

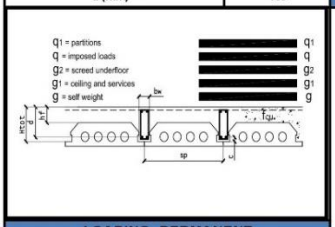
MURPHY MATSON O'SULLIVAN
Cork Address:
Lane Business Park, Monaghan Road, Cork, T12 VK2Y
Dublin Address:
Unit 200, Greenogue Business Park, Rathcoole, Co. Dublin

THERMOFLOOR SLAB CALCULATIONS

Design according to EN1992-1-1:2004 incorporating Corrigenda January 2008 and the Irish National Annex

NOTES:			
1.	Input values in blue cells	PROJECT #:	00000
2.	This spreadsheet covers simply supported beams only.	BEAM NAME:	TYPICAL
3.	User to input blue cells only.	CALCS BY:	GMD
4.	Maximum allowable span is 9.0m.	CHECKED BY:	GMD
		DATE:	2017-11-09

GEOMETRIC DATA	
Element Type =	H160
hf (mm)=	100
bw (mm) =	100
sp (mm) =	600
c (mm) =	15
H tot (mm) =	220
beff, 1-2 (mm)	250
bf (mm) =	600
Bar DIA (mm) =	20
Link DIA (mm) =	6
d (mm) =	189



LOADING: PERMANENT	
SDL (kN/m²) =	0.50
Screed w = [mm]	0
Beam SW (kN/m) =	1.73
SDL (kN/m) =	0.30
Screed SW (kN/m) =	0.00
Total Permanent Load (kN/m) =	2.03

LOADING: IMPOSED	
Imposed (kN/m²) =	1.50
Partitions (kN/m²) =	1.00
Imposed (kN/m) =	0.90
Partitions (kN/m) =	0.60
Total Imposed Load (kN/m) =	1.50

LOADING: TOTAL	
Total Serviceability UDL (kN/m) =	3.53
Total Ultimate UDL (kN/m) =	4.99

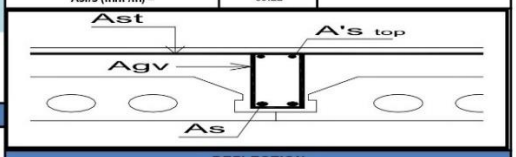
MATERIAL STRENGTHS	
fcu (MPa) =	C35/45
fyk (MPa) =	500

STRUCTURAL ANALYSIS	
Span (m) =	6.10
Check at 'x' from support (m):	0.20
M@x (kNm) =	2.94
V@x (kN) =	14.22
Mmax @ midspan (kNm) =	23.20
Vmax @ support (kN) =	15.21

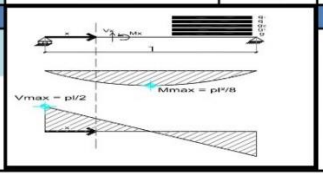
SECTION ANALYSIS: BENDING		
K =	0.0309	
z (mm) =	180	
x (mm) =	23.6	OKAY
As,req'd (mm²) =	298	
As,min (mm²) =	31.5	
As,max (mm²) =	880.0	
Select reinforcing =	2-20Φ	
As,prov'd (mm²) =	628	OKAY
Clear bar spac., if applicable (mm) =	18	
Minimum bar spac. (mm) =	25	NOT OKAY

SECTION ANALYSIS: SHEAR		
Ved (kN) =	15.21	
ved (Mpa) =	0.80	
Angle of Strut (°) =	21.80	
Asv,reqd (mm²/m) =	74.0	
Asv,min (mm²/m) =	94.7	
Select reinforcing =	2-6Φ	
Select spacing =	300	
Asv, provd (mm²/m) =	188	OKAY
Max. long. spacing (mm) =	141.8	NOT OKAY
Vrd,c (kN) =	18.7	
Vrd,s (kN) =	36.8	
Vrd,max (kN) =	74.5	

SECTION ANALYSIS: TRANSVERSE SHEAR		
Theta	26.5	
Max. Strut Comp. Stress (Mpa) =	4.09	
k*fctd (MPa) =	0.60	
v,ed (MPa) =	0.34	NO TRANSVERSE REINF. REQ'D
Asf/s (mm²/m) =	39.22	



DEFLECTION		
Kb	1	**NOTE: PROPS AT 1/3 REQ'D**
L/D,allowable =	40.00	
L/D,actual =	32.28	OKAY



SUMMARY
Beam Size:
100wide x 220deep
Bottom Reinforcement:
2-20Φ
Links:
2-6Φ @300

Annex 7 - 2

ThermoFloor Handling Guide Lines

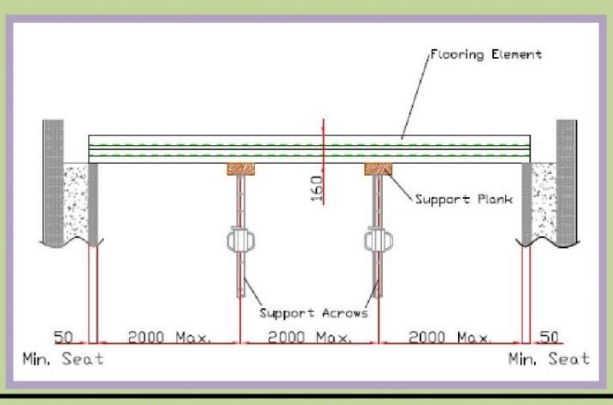
THERMOFLOOR – HANDLING & INSTALLATION

HANDLING:

This is the incorrect method for the handling of the floor panels as it will result in the snapping off of the side "wings".

This is the correct method for the handling of the floor panels.

INSTALLATION:

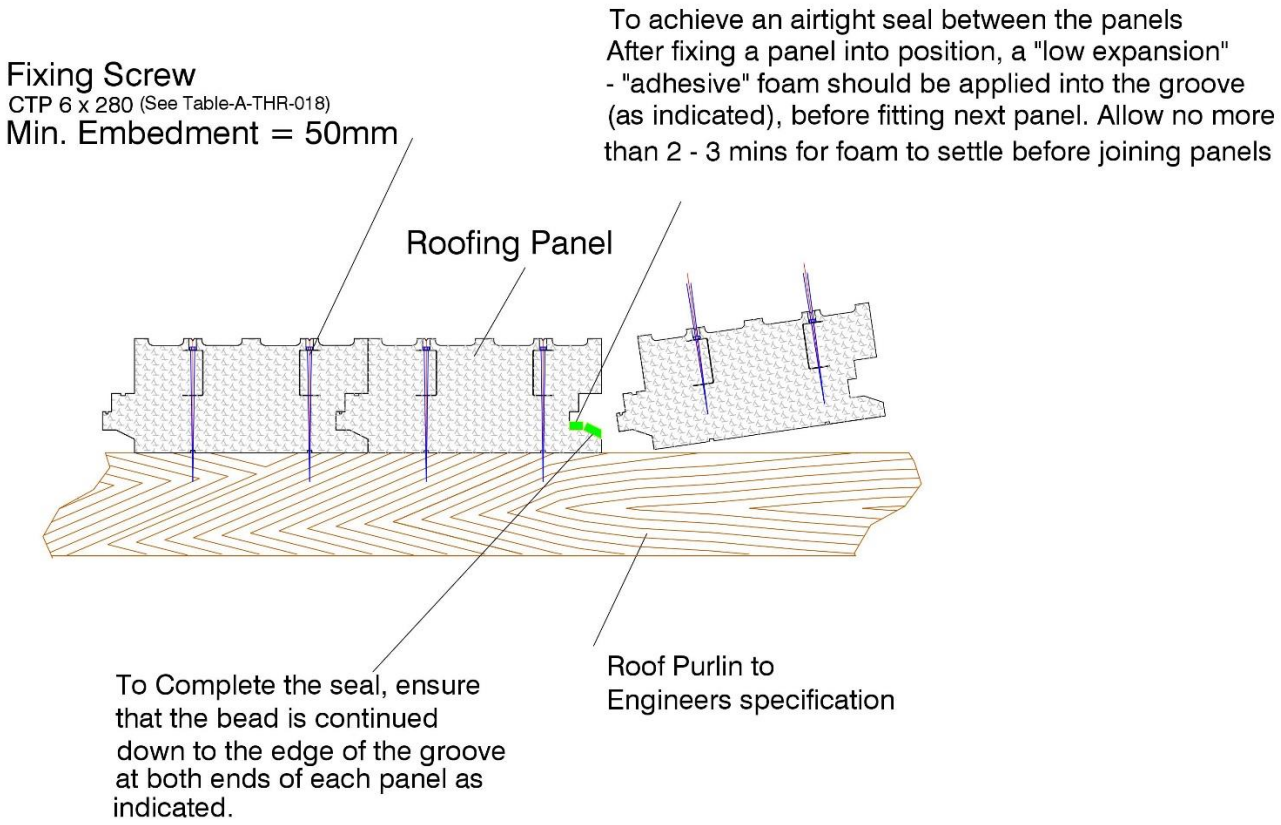


- Ensure a minimum of 50mm seating on both ends of the panels.
- Ensure a maximum spacing of 2 meters is maintained between the support acrows.

Once installed insert the red plastic plugs provided which will ensure that the concrete does not enter the service ducts.

Annex 8

ThermoRoof – Installation Details



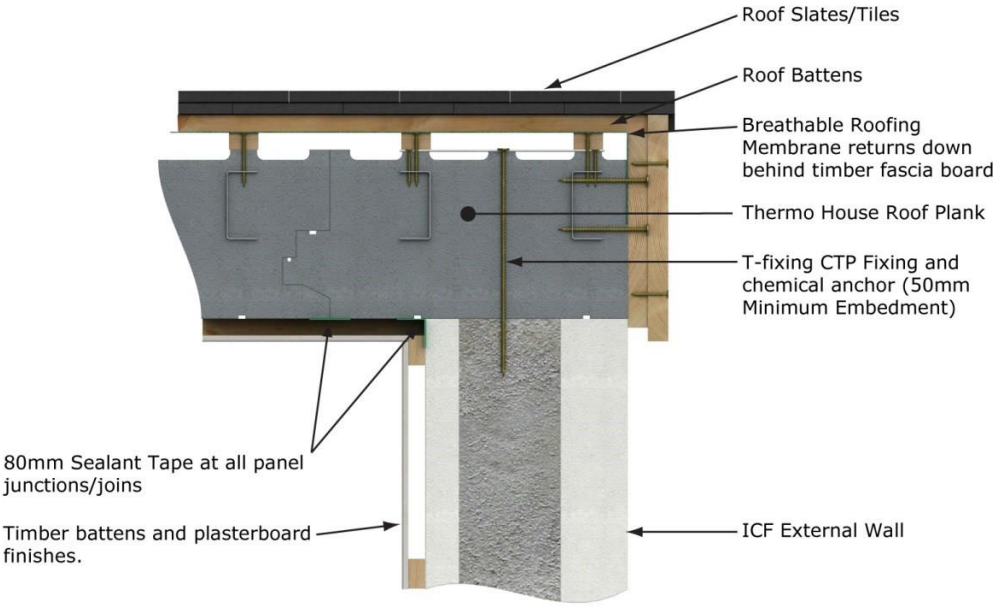
Thermohouse – Airtight / Sealing foam Application

Annex 9 - 1

Thermohouse - Gable End Details

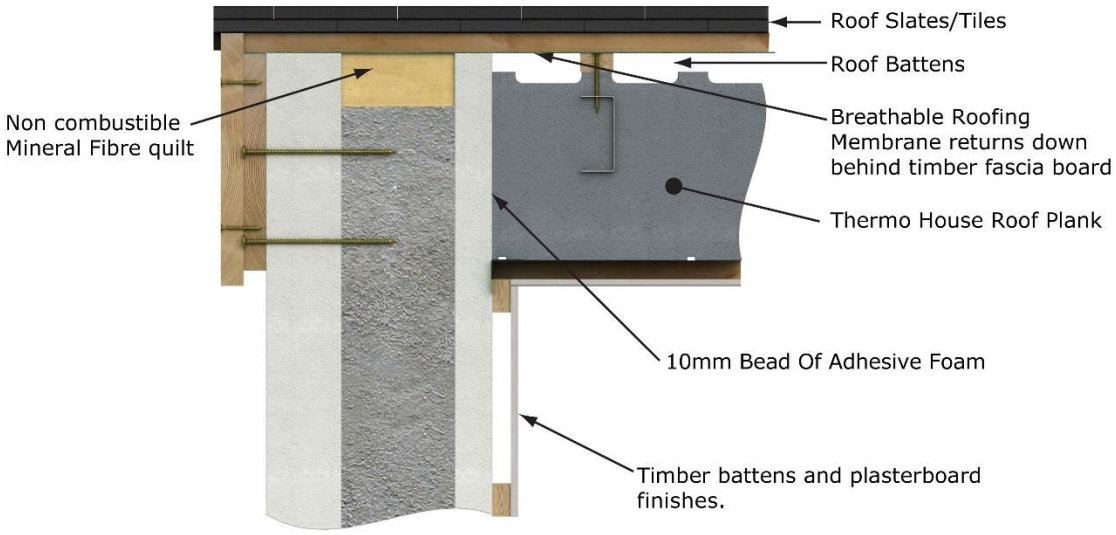
Option A

Annex 9 – 2
Flush With Gable



Option B

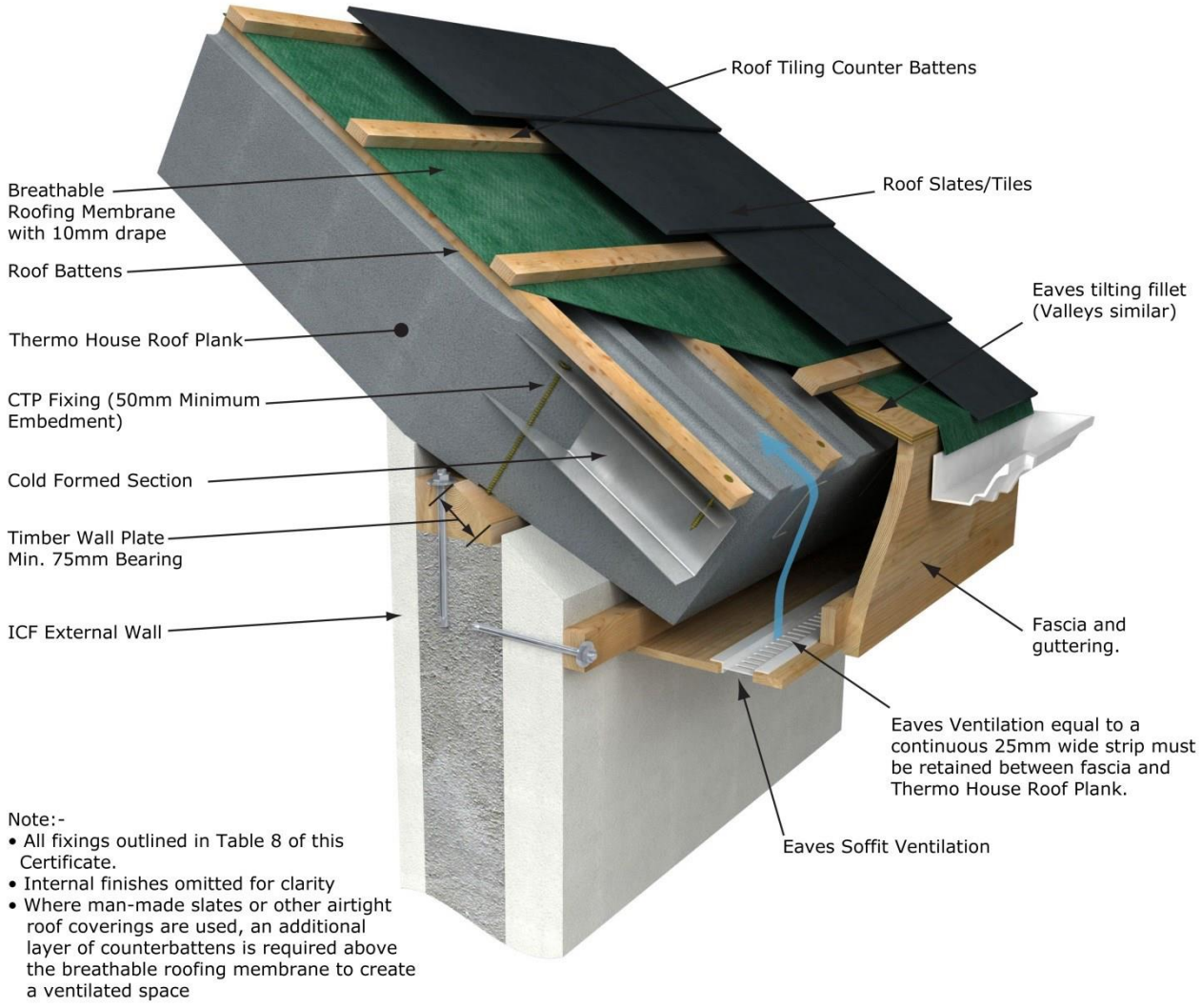
Annex 9 – 3
Abbutting Gable Wall



Option C

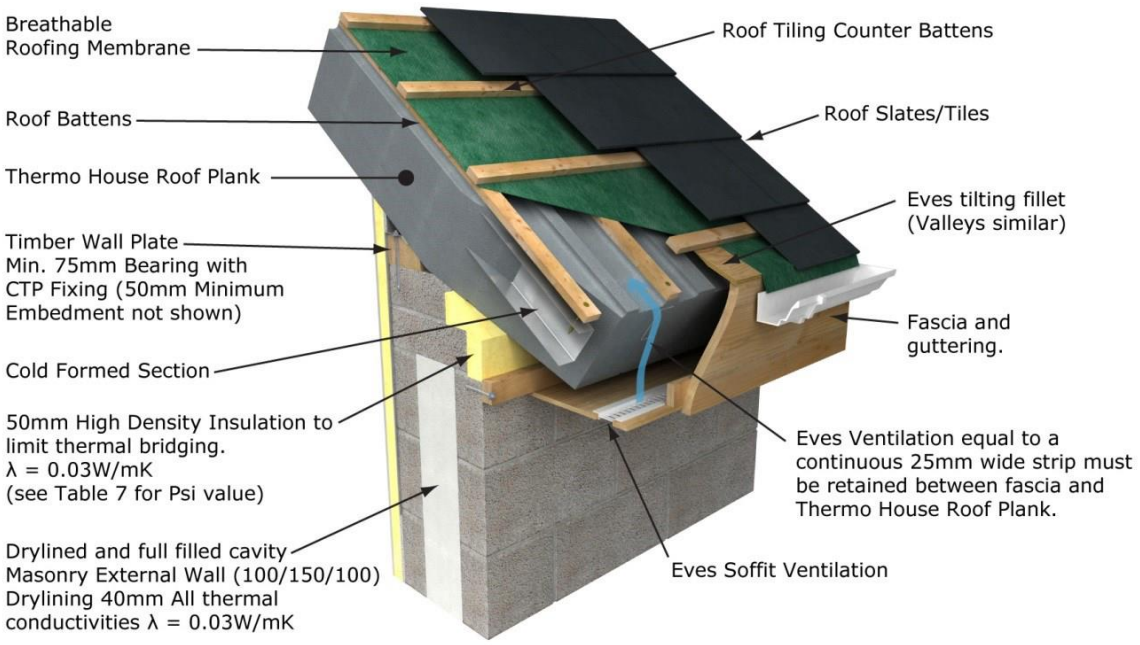
Annex 10 - 1

Thermohouse ICF– Roof Eves Detail – Standard



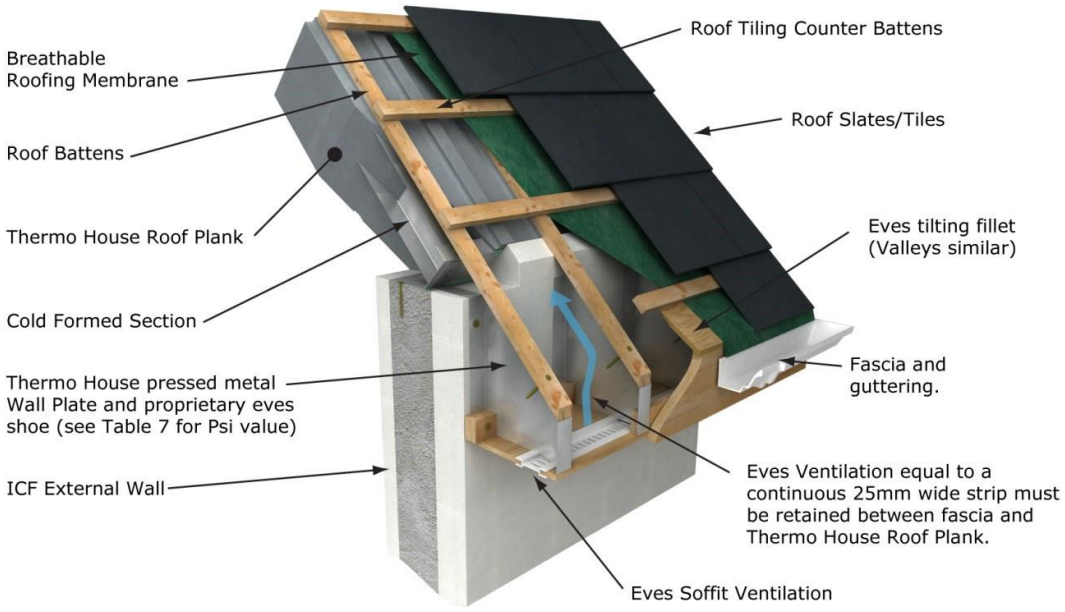
Annex 10 - 2

Traditional Construction - Eaves Detail



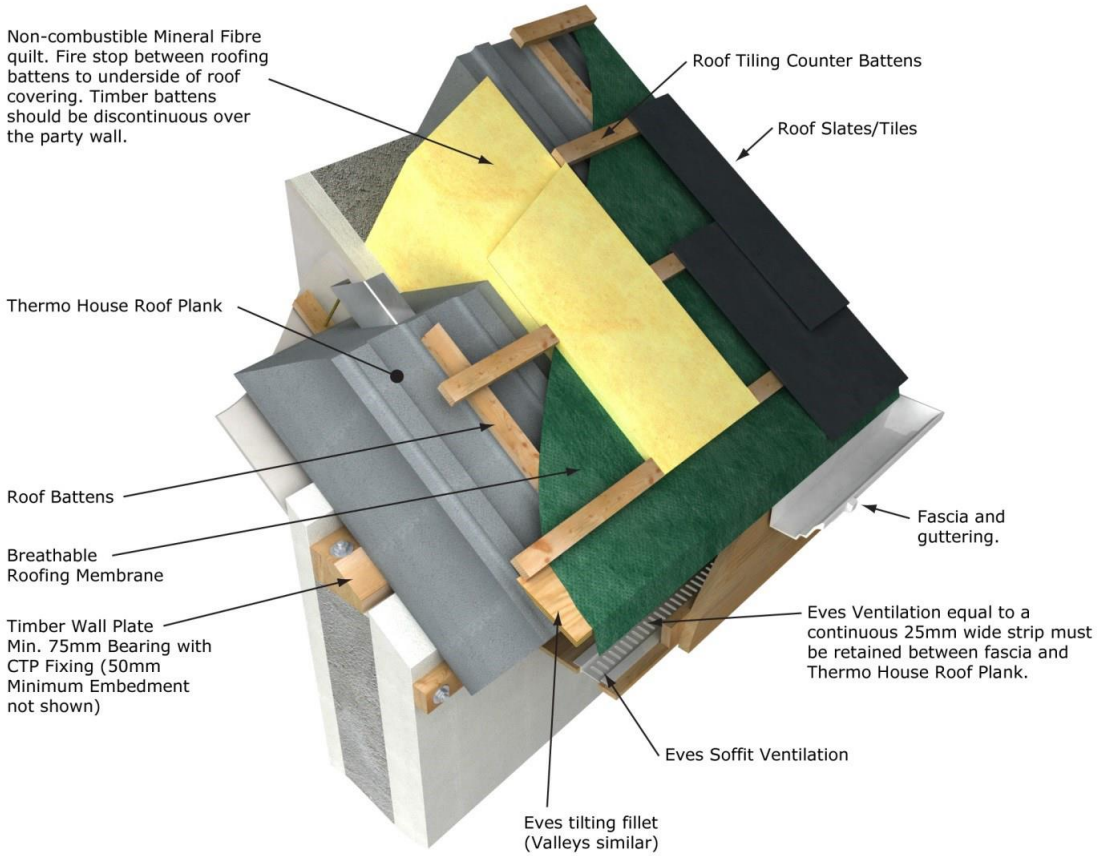
Annex 10 - 3

Alternative ICF Eaves Detail with Galvanised "Eves Shoe"

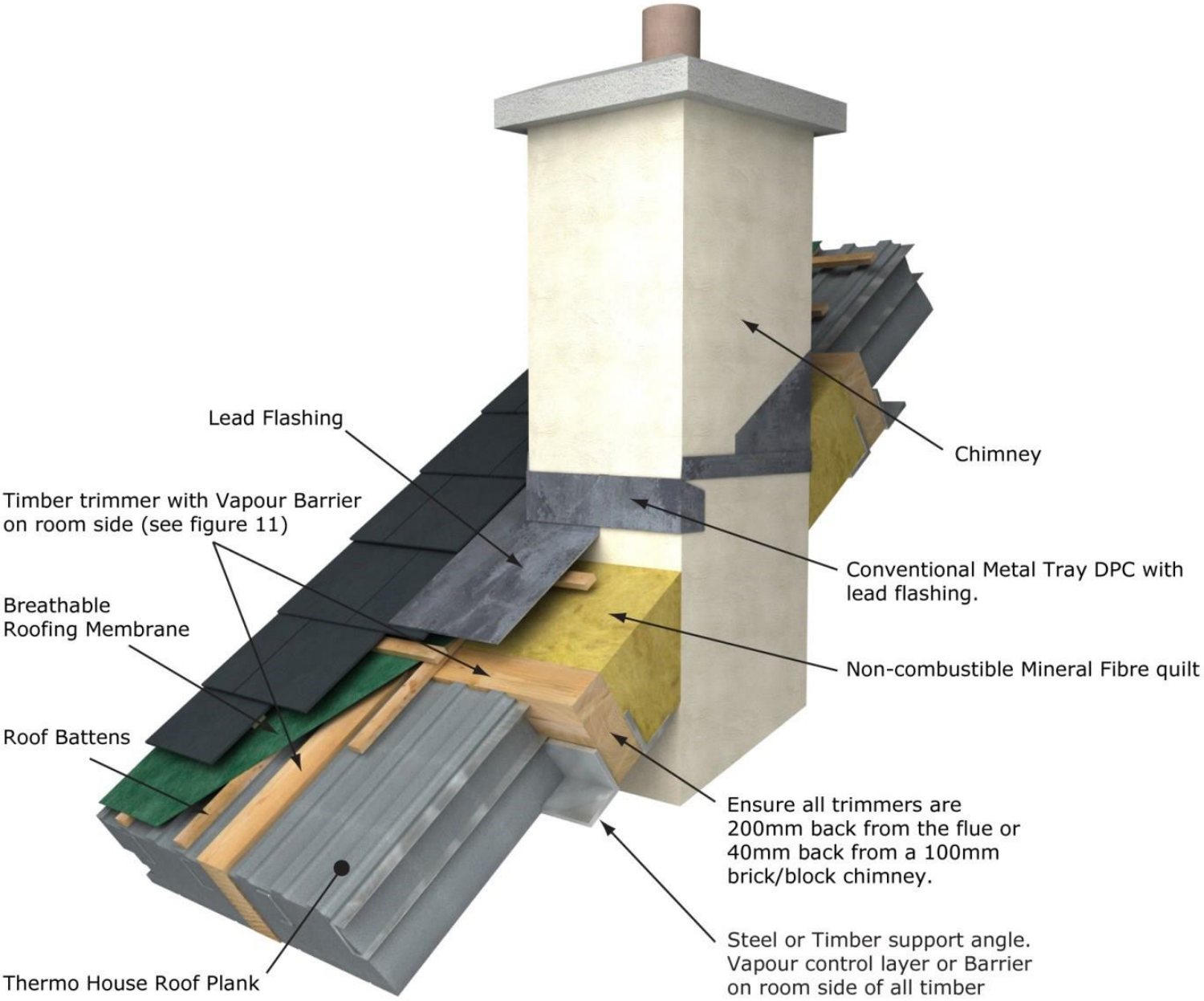


Annex 11

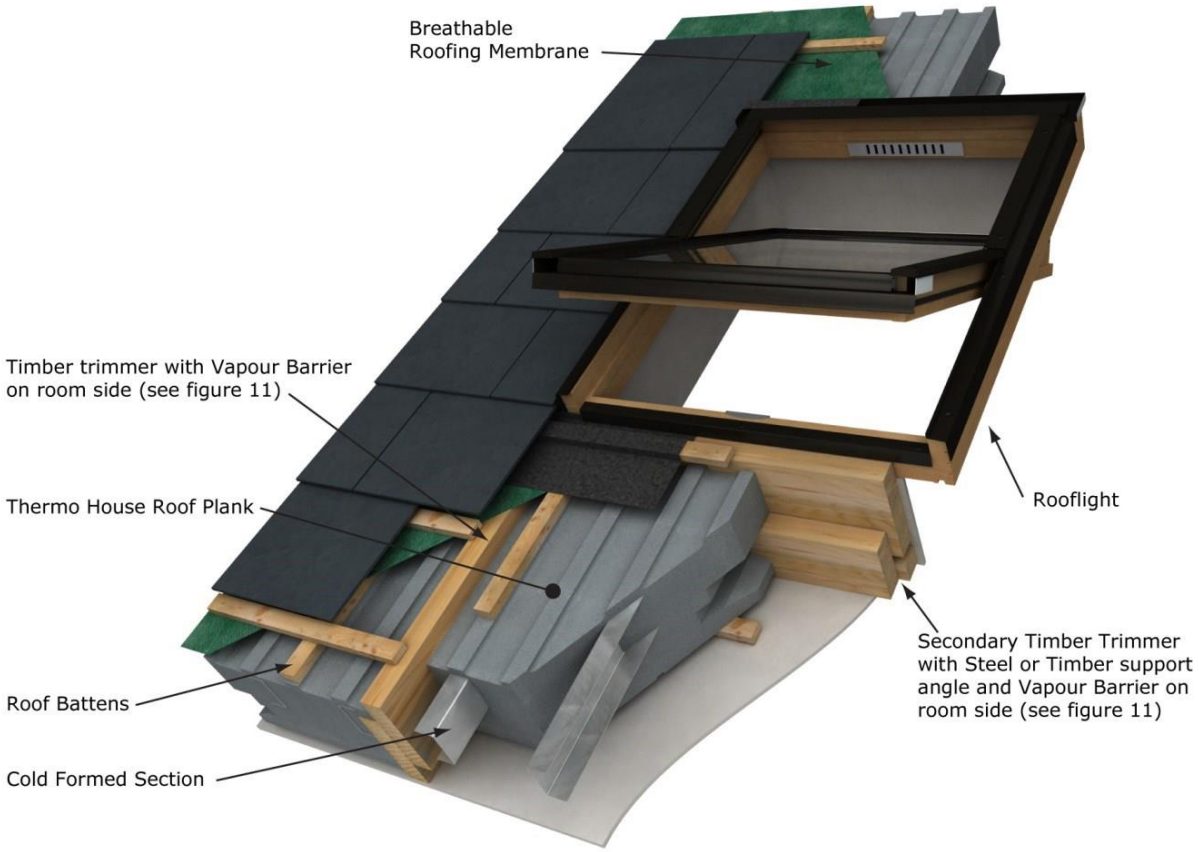
Fire Stopping a Party Wall Roof Junction



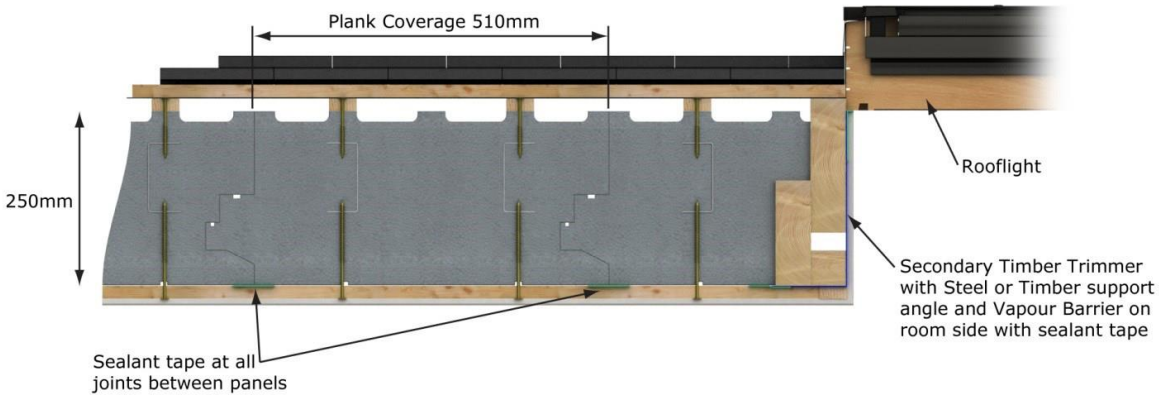
Annex 12
Chimney Penetration Detail



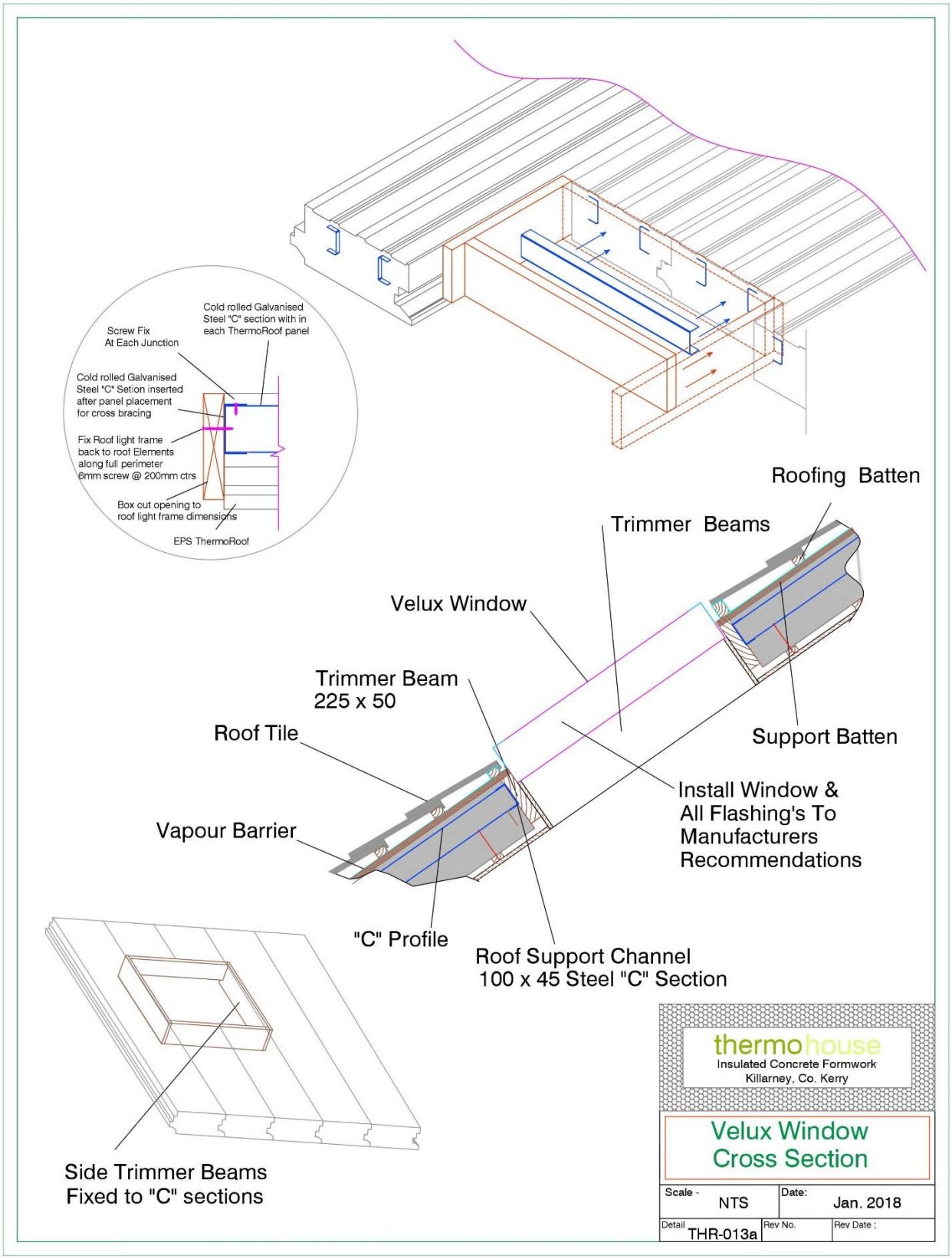
Annex 13 – 1
ThermoRoof
Roof Light Penetration Details



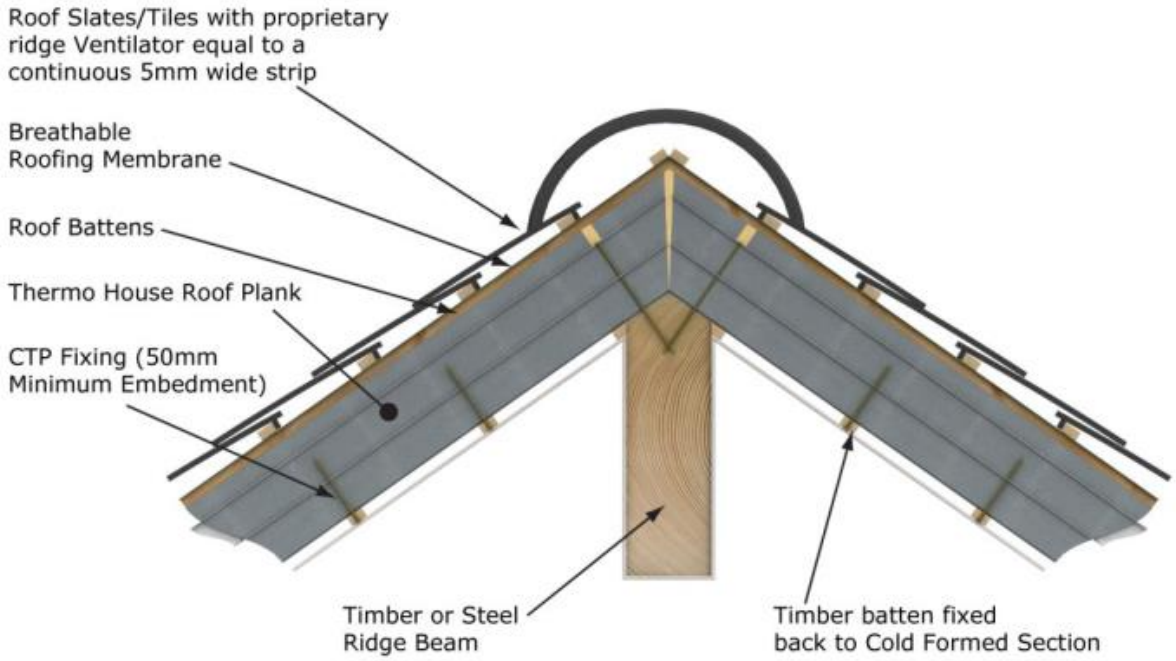
Annex 13 – 2



Annex 13 – 3
Steel Trimmer Detail

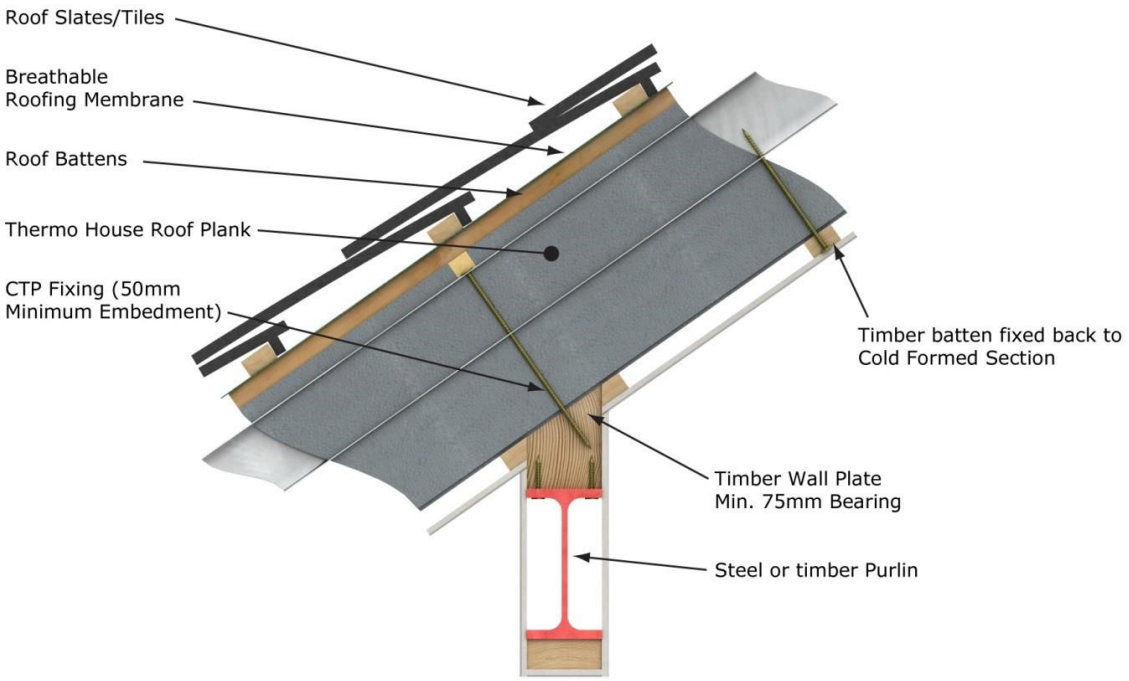


Annex 14 - 1
ThermoRoof Ridge Detail



If there is an engineering requirement for the ridge to be an RSJ, it will require a timber capping to provide a min. 75mm seat on the chamfered face for the seating of the ThermoRoof panel and allow for a 50mm embedment of the fixing screw, similar but double sided in relation to the purlin support below, which in turn could also be a timber beam if the engineering allows.

Annex 14 - 2
Intermediate Purlin Detail



Annex 15
Multi-Storey & Town Houses

Apartment Block Under Construction

Apartment Block Completed

Apartment Block + Town Houses

Apartment Block

Town Houses

Annex 16-1
Housing Estates

Annex 16-2
Nursing Home

Annex 16-3
Hostel Extension

Annex 16-4

Private Dwellings

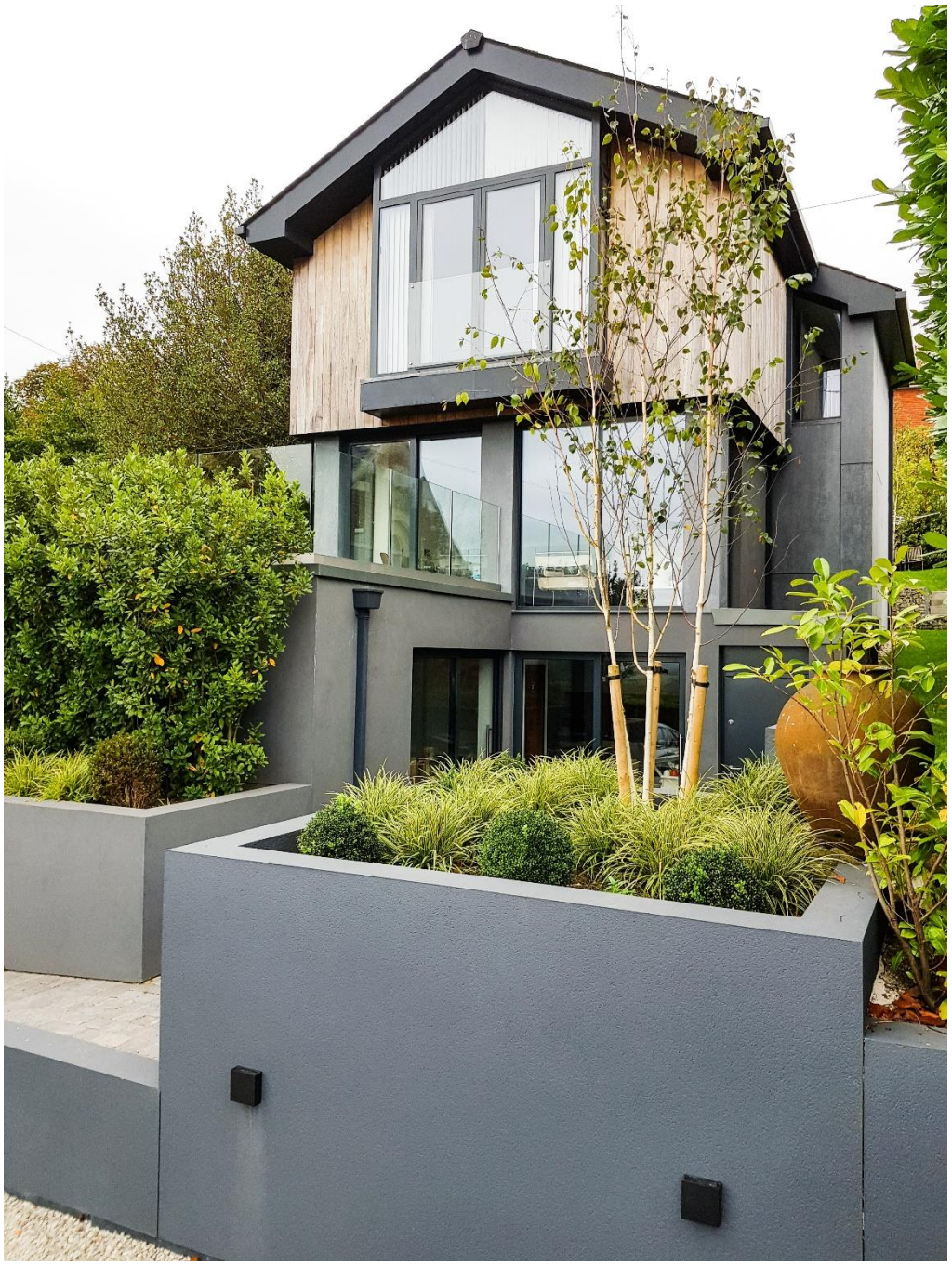
Traditional Design

View From Outside

Single Storey Dwelling Over Basement

View From Inside

Impressive Vaulted Ceilings In The Music Room



Contemporary Design

Two Storey Over Basement

Contemporary - Curved Build – Rear Elevation

Contemporary - Curved Build – Front Elevation

Single Storey, Split Level Over Partial Basement

Contemporary Open Plan Design

A Re-Design & Replacement of Old Water Towers Comprising a Single Storey Dwelling Over Basement

Natural Stone Finish and Vaulted Ceilings

Single Storey Dwelling Clad in Natural Green/Blue Sand Stone

Annex 16-5
Tourism Visitor Centre Tralee

Having Timber Cladded Walls and a Curved Roof, The Thermohouse Complete Low Energy Building System Provided the Ideal Solution for The Airtight Thermal Envelope of the Structural Shell of This Energy Efficient Visitor Centre.

Annex 17 -1

INSTYTUT TECHNIKI BUDOWLANEJ
PL 00-611 WARSZAWA
ul. Filtrowa 1
tel.: (+48 22) 825-04-71
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www.itb.pl

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

Member of EOTA
www.eota.eu

European Technical Assessment ETA-07/0018 of 13/06/2017

General Part

Technical Assessment Body issuing the European Technical Assessment	Instytut Techniki Budowlanej
Trade name of the construction product	ICF SYSTEM
Product family to which the construction product belongs	Non load-bearing permanent shuttering kit based on elements of EPS
Manufacturer	Thermohouse Ltd Coolcaslagh, Killarney Co Kerry, Ireland
Manufacturing plant	Thermohouse Ltd Coolcaslagh, Killarney Co Kerry, Ireland
This European Technical Assessment contains	41 pages including 2 Annexes which form an integral part of this Assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	Guideline for European Technical Approval ETAG 009, Edition June 2002 "Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete", used as European Assessment Document (EAD)
This version replaces	ETA-07/0018 issued on 02/05/2012

Annex 17 - 2

Cl/SfB (21.9) (Hn7)

NSAI Agrément

CERTIFICATE NO. 08/0310

Thermohouse Ltd., Coolcaslagh,
Killarney, Co. Kerry.
Tel: 064 6631307
Fax: 064 6632394
Email: info@thermohouse.ie
Website: www.thermohouse.ie

Thermohouse ICF System

Système pour construction
Bausystem

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

Irish Agrément Board Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2011**.

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

PRODUCT DESCRIPTION:
This Certificate relates to the Thermohouse ICF (Insulating Concrete Formwork) System, which consists of modular interlocking expanded polystyrene (EPS) building blocks (standard white and grey) for permanent formwork for the construction of in-situ concrete walls. An external render system approved by NSAI Agrément for use with ICF systems is applied to the external polystyrene insulation of the Thermohouse ICF system as the external finish. Alternative finishes may be used in accordance with the Thermohouse ICF installation manual. Internally, the plasterboard is fixed directly through the EPS into the concrete core with plastic insulated anchors, or alternatively screwed to timber battens. An NSAI Agrément approved internal plaster may also be used as an alternative finish. This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2011.

USE:
The Thermohouse ICF System is certified for use in the construction of buildings up to six storeys in height.

The system has been assessed for use as load bearing and non-load bearing walls in the construction of specifically designed buildings. Fire and sound rated walls may also be constructed using the system.

MANUFACTURE AND MARKETING
The product is manufactured and marketed by:

Thermohouse Ltd.,
Coolcaslagh,
Killarney,
Co. Kerry.
Tel: 064 6631307
Fax: 064 6632394
Email: info@thermohouse.ie
Website: www.thermohouse.ie

Readers are advised to check that this Certificate has not been withdrawn or superseded by a later issue by contacting NSAI Agrément, NSAI, Santry, Dublin 9 or online at http://www.nsai.ie/modules/certificates/uploads/pdf/IAB080310.pdf

Annex 17 - 3

CI/SfB (21.9) (Hn7)

NSAI Agrément

CERTIFICATE NO. 10/0349

Thermo House Ltd., Coolcaslagh,
Killarney, Co. Kerry.
Tel: 064 6631307
Fax: 064 6632394
Email: info@thermohouse.ie
Website: www.thermohouse.ie

Thermo House Roofing System

Système pour construction
Bausystem

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out 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 2017.**

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 2017.

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.

Annex 17 - 4

Registered Details FACT SHEET

RD Certificate Number: EW178

Thermohouse Ltd Insulated Concrete Formwork Building System

Description

Thermohouse Ltd Insulated Concrete Formwork Building System is an Insulating Concrete Formwork Building System consisting of the Thermohouse wall elements (above and below ground), floor and roof panels. The wall elements and floor panels are applied as formwork for plain or reinforced cast in-situ concrete.

Scope of Registration

The Thermo House Roofing and Floor System, consists of a composite steel cold-formed c-channel and interlocking expanded polystyrene (EPS) panels. The composite panels provide insulation and structural support for 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.

Validity

This system has been checked for compliance in accordance with English and Welsh Building Regulations.

Registration was first issued on 09/02/12 and is valid until 09/02/18 providing there are no amendments to applicable regulations.

Issue dated 09/03/2015

Further Information

For more detailed information including access to the full certificate and supporting documents please use this link http://www.labc.co.uk/our-services/registered-details/ew178-thermohouse-ltd-insulated-concrete-formwork-building-system

Thermohouse Ltd
8 Concord Business Park
London
W3 0TR
Tel: 0208 752 8013
Email: sales@thermohouse.co.uk
Website: www.thermohouse.co.uk

LABC | 66 South Lambeth Rd | London | SW8 1RL | T: 0207 0916865 | www.labc.uk.com/registereddetails

Annex 17 – 5

بلدية مدينة أبو ظبي
MUNICIPALITY OF ABU DHABI CITY

الرقم : ق ت م/ ت ب/ ٤٤٥٥
التاريخ : ٨/ ٥/ ٢٠١١م

السادة / شركة ثيرموهاوس(Thermohouse)للمقاولات العامة المحترمين
ابوظبي ص . ب ٤٦٥٤٩
فاكس : ٦٣٣٦٥٥٢ - ٠٢ ت : ٦٣٣٧٧١٦ - ٠٢

تحية طيبة وبعد ،،،

الموضـوع : طلـب اعتمـاد نظـام ثيرموهاوس لإنشاء المباني
Thermo House ICF System

بالإشارة لخطابكم الوارد إلينا بتاريخ ٢٠١١/٣/١٦ بخصوص الموضوع أعلاه فقد تم مراجعة المواصفات الفنية المقدمة من قبلكم بخصوص نظام الإنشاء المذكور أعلاه وقد تبين أن هذا النظام عبارة عن قوالب دعم دائمة (Permanent Formwork) مصنوعة من البولستيرين الممدد (expanded polystyrene) تستخدم في المنشآت الخرسانية وتبقى في مكانها بعد صب الخرسانة ولا يتم إزالتها بعد تصلب الخرسانة وتعتبر جزء من العنصر الإنشائي المستخدمة به وتستخدم هذه القوالب عادة في الأسقف والحوائط الحاملة والغير حاملة ، المسلحة والغير مسلحة.

وحيث أنه تم اعتماد هذا النظام من قبل المنظمة الأوروبية للاعتمادات الفنية (European Organization for Technical approvals)(EOTA) حسب الوثيقة الصادرة عنه برقم (ETA – 09/0083) بتاريخ ٢٠٠٩/٣/٢ فلا مانع لدينا من استخدام هذا النظام على أن يتم مراعاة الشروط الآتية :

١. الالتزام بجميع متطلبات وشروط الاستخدام الواردة في الوثيقة المذكورة أعلاه.
٢. أن يتم الحصول على موافقة الدفاع المدني في ابوظبي .
٣. أن يتم تقديم كل مشروع على حده من خلال مكتب استشاري مرخص ومعتمد في ابوظبي.
٤. أن يتم تقديم حسابات التصميم الإنشائي والرسومات والتفاصيل من قبل مهندس مؤهل ومعتمد وذلك حسب كود البناء الدولي (IBC 2009).

وتقبلـوا التحيـة ،،،

بلدية أبو ظبي
قطاع تخطيط المدن
إدارة تراخيص البناء

المهندس / خلفان سلطان النعيمي
مديـــر إدارة تراخيص البنـــاء
قطـــاع تخطيط المـــــدن

ص.ب: ٢٦٣، أبوظبي، الإمارات العربية المتحدة P.O. Box: 263, Abu Dhabi, United Arab Emirates, Tel: 02 6788888, Fax: 02 6774919
www.adm.gov.ae | 80022220

Annex 17 - 6

Seismic Certification

جمهوری اسلامی ایران
وزارت مسکن و شهرسازی
مرکز تحقیقات ساختمان و مسکن

بسم الله الرحمن الرحیم

شماره: ۱۰/۱-۵۳۸
تاریخ: ۱۳۸۶/۱۲/۲۲

تأییدیه فنی

به استناد ماده ۲ وظایف قانونی مرکز تحقیقات ساختمان و مسکن، جزء ۲-۶ بند «د» تبصره ۶ قانون بودجه سال ۱۳۸۶ کل کشور و دستورالعمل‌های مربوط، بر اساس بررسی‌های انجام شده و با شرط رعایت الزامات ذیل:

۱.سیستم سازه‌ای حاصل از این روش اجرا، به عنوان سیستم سازه‌ای دیوار باربر با دیوارهای برشی بتن مسلح محسوب می‌شود، در صورتی که ضوابط شکل‌پذیری بر اساس آئین‌نامه ۲۸۰۰ و مبحث نهم مقررات ملی ایران رعایت نشود، با استناد به بند ۹-۲۰-۲-۵-۲۰ مبحث نهم مقررات ملی ایران، کاربرد این سیستم صرفاً در مناطق با خطر نسبی کم و متوسط و برای ساختمان‌های دارای اهمیت کم و متوسط تا حداکثر ارتفاع ۱۰ متر مجاز می‌باشد. بدیهی است در صورتی که ضوابط شکل‌پذیری رعایت شود، ضمن رعایت ضوابط مقاومت در برابر حریق، حداکثر ارتفاع ساختمان براساس ضوابط آئین‌نامه ۲۸۰۰ ایران، ۵۰ متر از تراز پایه می‌باشد.

۲.بارگذاری ثقلی و نیروهای سیستم سازه‌ای حاصل از این روش، باید به ترتیب بر اساس آخرین ویرایش‌های مبحث ششم مقررات ملی ساختمان و استاندارد ۲۸۰۰ ایران صورت گیرد.

۳.طرح سازه‌ای سیستم حاصل از این روش، باید بر اساس مبحث نهم مقررات ملی ساختمان یا آئین‌نامه ACI ۳۱۸-۰۵ و ویرایش‌های بعد از آن صورت گیرد.

۴. ضخامت مفید دیواره‌های بتنی نباید از ۱۵ سانتی‌متر کمتر باشد.

۵.بتن مصرفی باید از نوع بتن سازه‌ای و با حداقل مقاومت ۲۰MPa و حداکثر اندازه اسمی سنگدانه مصرفی، ۲۰ میلی متر باشد.

۶. مشخصات کلیه مصالح مصرفی مربوط به اجزاء قالب‌بندی ماندگار، باید مطابق با استانداردهای بین‌المللی معتبر و اسناد ارائه شده باشد. مشخصات سایر مصالح مصرفی نیز باید مطابق استانداردها و آئین‌نامه‌های ملی یا معتبر بین‌المللی باشد.

۷.مقاومت سیستم در برابر آتش (که وابسته به نوع و جزئیات دیوار است)، باید مطابق با الزامات مبحث سوم مقررات ملی ساختمان و آیین‌نامه ۴۴۴ مرکز تأمین شود. مدرک ارائه شده توسط متقاضی معرف سیستمی با مقاومت ۹۰ دقیقه در برابر آتش است که برای ساختمان‌های بلند کافی نیست. برای مقاومت‌های بالاتر به ضخامت‌های بیشتر دیوار بتنی نیاز می‌باشد.

۸.پلی‌استایرن باید از نوع کندسوز (خود خاموش‌شو) باشد (توجه: اصولاً استفاده از پلی‌استایرن منبسط‌شده معمولی در ساختمان مجاز نیست و حتماً همیشه فقط باید از نوع خود خاموش‌شو استفاده شود).

۹.پلی استایرن مورد استفاده باید مطابق با استانداردهای معتبر بین‌المللی و دارای گواهینامه فنی از مرکز تحقیقات ساختمان و مسکن باشد.

۱۰. محافظت از بلوک پلی‌استایرن باید به وسیله پوشش و مانع حرارتی مناسب صورت گیرد. به عنوان مثال، می‌توان از یک اندود با تخته گچی حدود ۱۲ میلی‌متر یا سایر مصالح که از نظر مقاومت در برابر دمای بالا، معادل آن باشند، استفاده نمود. پوشش محافظت‌کننده باید دارای اتصال مکانیکی به سازه باشد و چسباندن آن به پلی‌استایرن به تنهایی قابل قبول نیست. (توجه: در مدرک Thermohaus / ۰۸/۰۳۱۰ IAB به پوشش‌های تائید شده برای این کار اشاره شده است که متقاضی می‌تواند مشخصات آنها را از تولیدکننده اصلی تهیه نماید).

۱۱. توجه به نکات فنی ذکر شده در مدارک ETA-۰۵/۰۱۷۰ و Thermohaus / ۰۸/۰۳۱۰ IAB که توسط متقاضی پیوست شده است، ضروری است.

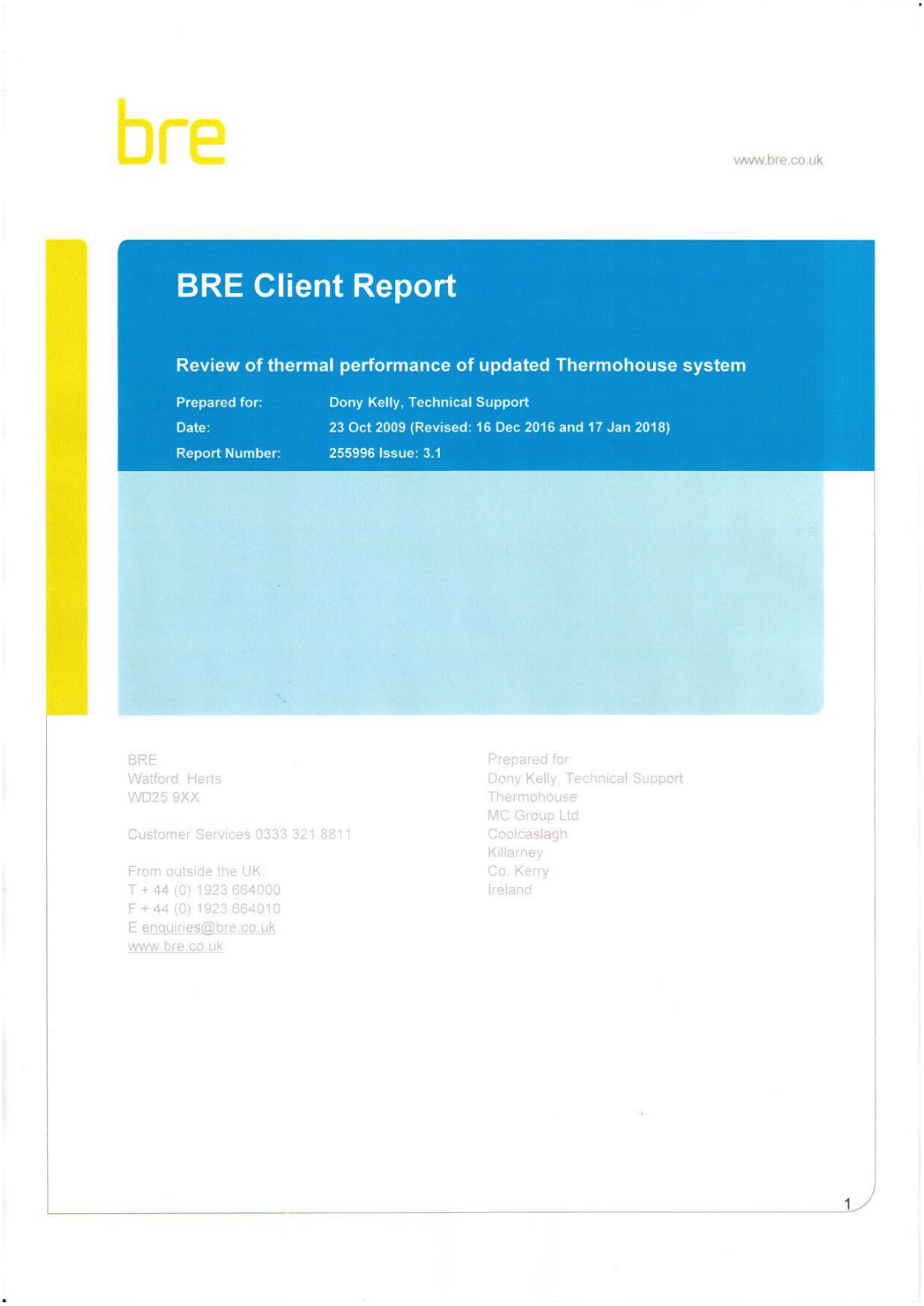
۱۲. لایه پلی‌استایرن بین واحدهای مستقل، نباید امتداد داشته باشد و حتماً باید به وسیله مصالح غیر قابل سوختن با مقاومت کافی در برابر آتش قطع شود.

Annex 18 - 1

BRE-ThermoRoof Load Testing

Annex 18 - 2

BRE-Walls & Roof – Thermal Testing



bre

www.bre.co.uk

BRE Client Report

Review of thermal performance of updated Thermohouse system

Prepared for:	Dony Kelly, Technical Support
Date:	23 Oct 2009 (Revised: 16 Dec 2016 and 17 Jan 2018)
Report Number:	255996 Issue: 3.1

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Prepared for:
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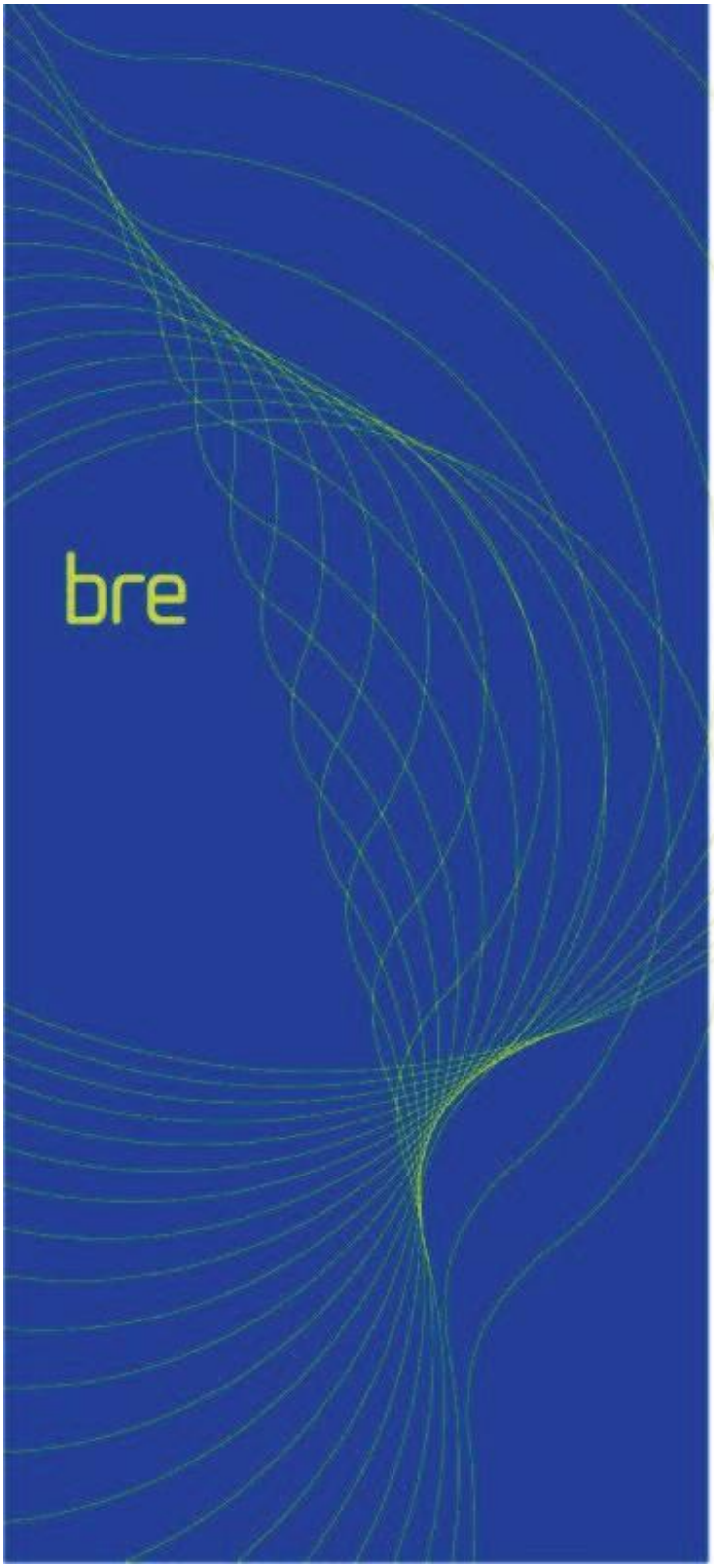
Thermohouse
MC Group Ltd
Coolcaslagh
Killarney
Co. Kerry
Ireland

1

Annex 18 - 3

BRE-ThermoFloor – Thermal Testing



Thermohouse Flooring Element – Thermal Performance

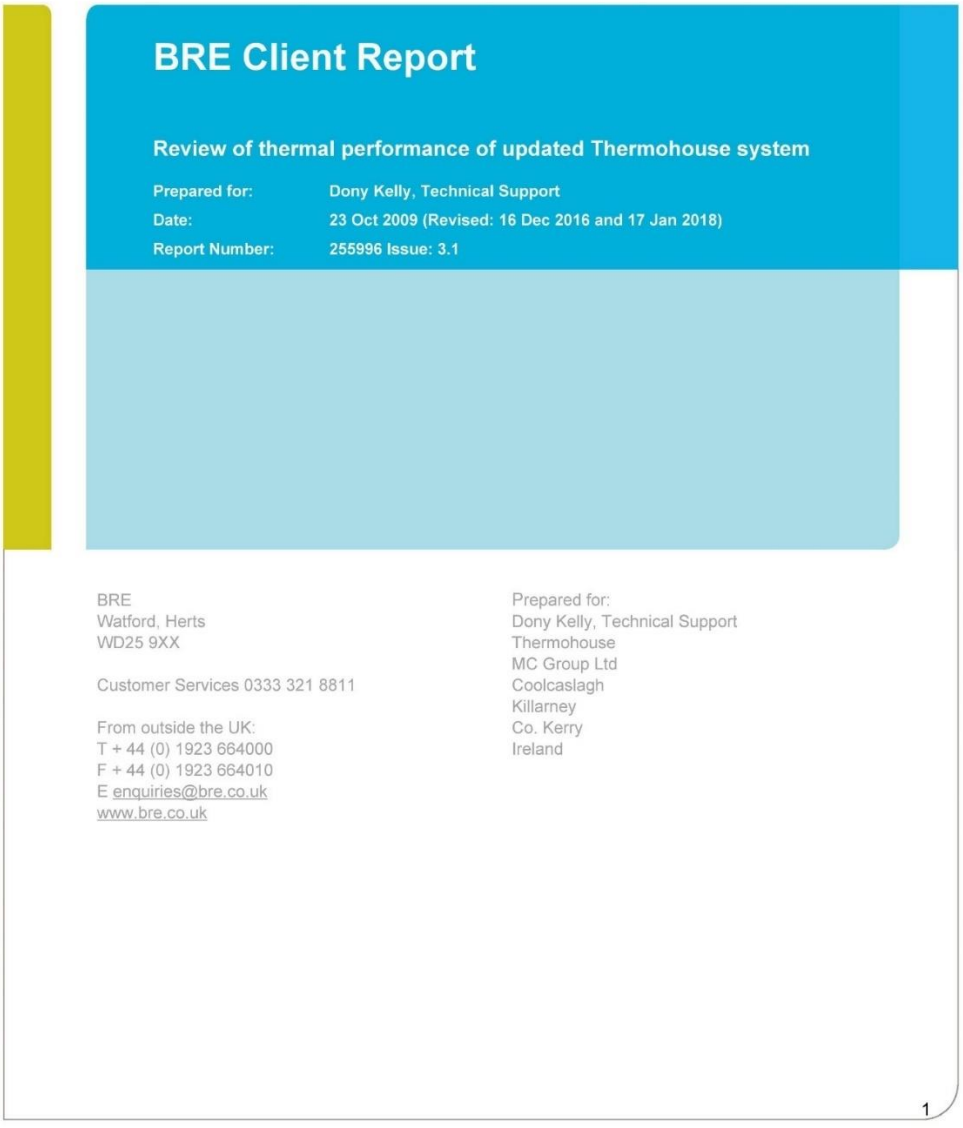
Prepared for: Dony Kelly, Thermohouse

28 May 2014

Client report number 295-782

Annex 18 - 4

ThermoFloor - Suspended Floor & Flat Roof – Thermal Testing



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BRE Client Report

Review of thermal performance of updated Thermohouse system

Prepared for: Dony Kelly, Technical Support
Date: 23 Oct 2009 (Revised: 16 Dec 2016 and 17 Jan 2018)
Report Number: 255996 Issue: 3.1

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Annex 18 - 5

ThermoFloor as a Flat Roof – Interstitial Condensation Report

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Dony Kelly
Technical Support
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Co. Kerry

22/01/2016
Your Ref. Thermohouse – Condensation risk analysis
Our Ref. P103405

Dear Dony,

Please find results for the Thermohouse Roof element interstitial condensation risk analysis project below.

Background

Two types of condensation can affect building details – condensation at an inside surface and interstitial condensation within a structure. Both types of condensation occur when the temperature falls too low in relation to vapour pressure.

- Surface condensation is a deposition of liquid water from a vapour, occurring on visible surfaces within the building. It can cause moulds to grow which pose a health hazard to occupants.

  Surface condensation is assessed against the requirements set down in IP 1/06 and an assessment is carried out using the method in BS EN ISO 10211 and the conventions in BR 497.

- Interstitial condensation is deposition of liquid water from a vapour, occurring within or between the layers of the building envelope. It can cause damage to the structure and reduce the thermal performance of insulation.

  It is assessed using the method in BS EN ISO 13788, using guidance in BS 5250, and involves a simplified calculation procedure, but it does require detailed information about any vapour control layer or ventilation within the structure – BRE has in-house software for assessing interstitial condensation.

Previous 3D thermal modelling had been undertaken for the Thermohouse roof element (Thermofloor used as a flat roof element), and no risk of surface condensation was identified.

BRE has been commissioned by Thermohouse to assess the interstitial condensation risk of the Thermohouse roof element, and determine if any additional insulation is required.

Annex 18 – 6 - 1

BRE-Acoustic Testing - Airborne

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BRE Client Report

Field Sound Insulation Acoustic Testing at 1 Watford Road, Canning Town to BS EN ISO 140-4 , BS EN ISO 140-7 and BS EN ISO 140-5

Prepared for: Thermohouse
Date: 7th June 2016
Report Number: P104618-1001 Issue: 1

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0578

Annex 18 – 6 - 2

BRE-Acoustic Testing – Impact

www.bre.co.uk

BRE Client Report

Field Sound Insulation Acoustic Testing at 1 Watford Road, Canning Town to BS EN ISO 140-4 , BS EN ISO 140-7 and BS EN ISO 140-5

Prepared for: Thermohouse
Date: 23rd June 2016
Report Number: P104618-1002 Issue: 1

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Annex 19

Pre-pour Checklist

Date _____

Supervisor _____

Job Reference _____

Prior to placing concrete in the Thermohouse insulated forms, be certain to mark off each item on the following checklist;

- **String line in place around the top of entire perimeter?**
- **Walls straight and plumb (not leaning out)?**
- **Additional form support on all corners?**
- **Additional form support on all window and door openings?**
- **All fastening screws securely fixed to blocks?**
- **Alignment system securely fixed to floor?**
- **All hand rail and toe boards installed? (in accordance with current building regulations)**
- **All door and window lintels supported?**
- **All horizontal and vertical reinforcement in place?**
- **All lintel reinforcement in place?**
- **All floor embedment's in place?**
- **Cavity wall checked and all foreign matter removed?**
- **Properly sized concrete pump (Max. Size 75 / 100mm) ordered?**
- **Correct concrete mix, volume and slump classification are ordered?**
- **Concrete vibrator (Max. Size 25mm) on site and in working order?**

PLEASE NOTE: If this check list is not complete DO NOT POUR concrete

Post Placement Checklist

Date _____

Supervisor _____

Job Reference _____

After placing concrete in the Thermohouse forms be certain to mark off each item on the following list:

1 Has concrete consolidation been completed?

2 Are walls straightened to string line?

3 Have any/all anchors and embedment's been installed?

4 Has spilled concrete been disposed of?

5 Have final checks for straight and plumb been carried out?

6 To enable proper instalment of the next course, have all concrete spills been cleaned from the ICF locking lugs on top of the TH-21?

thermohouse

the complete low energy building system

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