

THERMOMUR®

ICF building system



Construction Training Programme

- **A Four Step Approach**

1. One days formal training
2. On site training on Day 1 before assembly begins
3. On site training
4. On site training on the day of pour

- Successful completion of the above leads to Approved Installer status

Contents

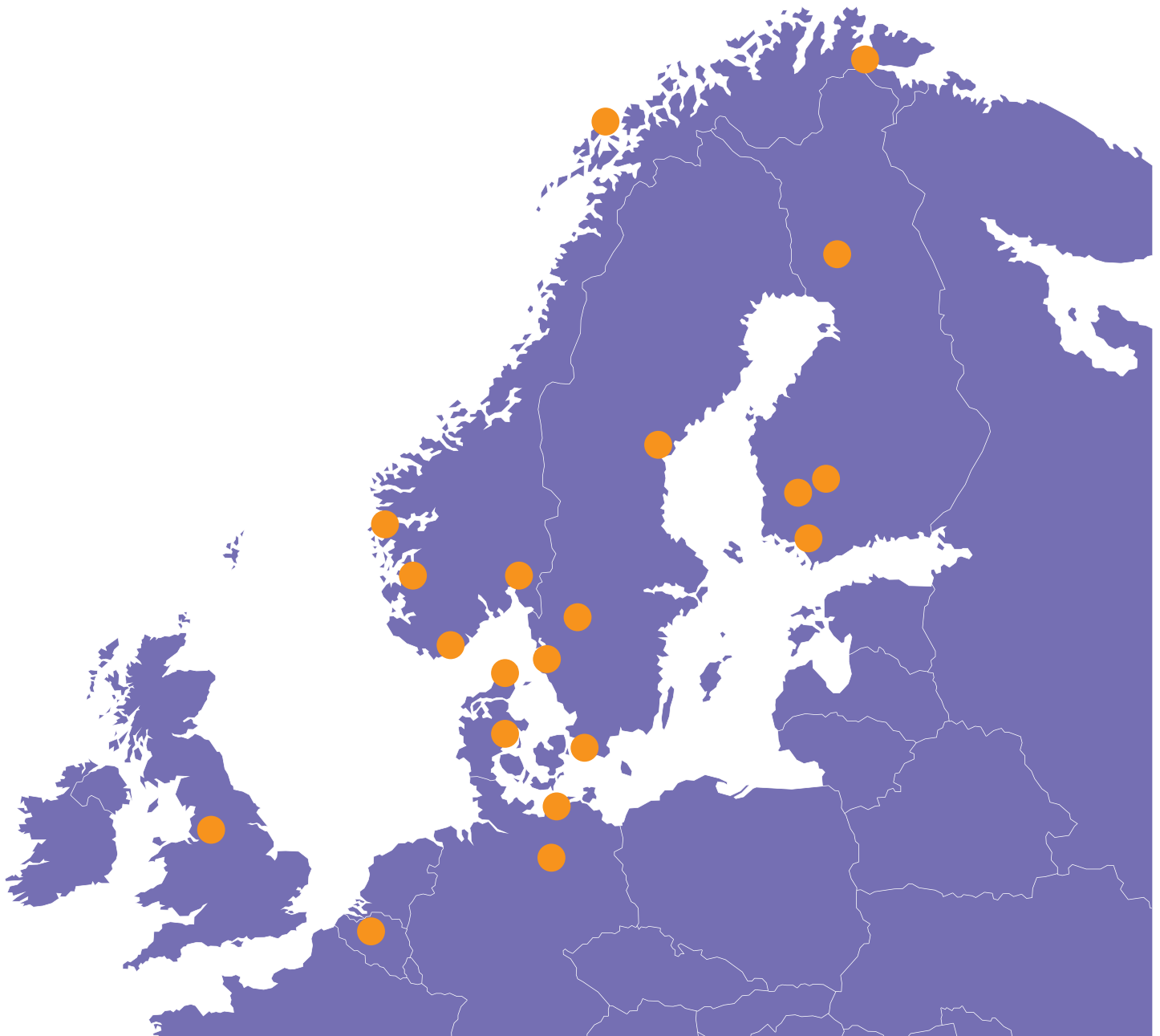
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The JACKON Group - Facts & Figures

We are a family-owned company established in Fredrikstad, Norway, in 1956

We are one of Europe's leading manufacturers of XPS (extruded polystyrene foam) and EPS (expanded polystyrene)

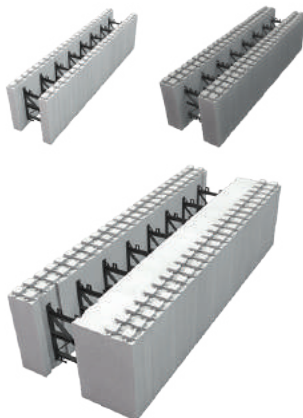
Today, we have 800 employees in 8 countries, 22 factories and 7 sales locations. Negotiations are ongoing for a factory to be built in the UK by the end of 2020.



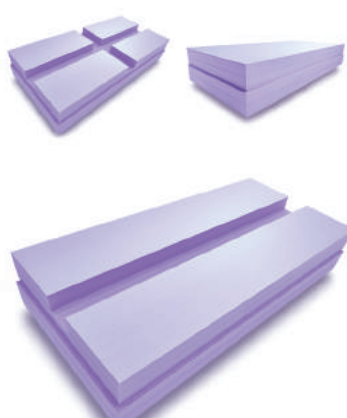
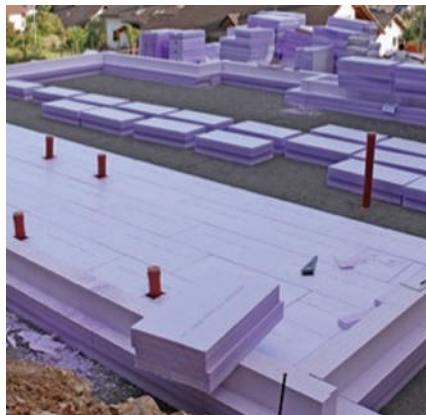
The JACKON Group - Facts & Figures

- We distribute our products mainly to European countries
- Segments/product lines
 - building solutions
 - construction boards
 - insulation applications
 - industrial applications
 - EPS raw material/beads
- We are a market and customer driven company, constantly striving to:
 - Improve and develop new products - in close cooperation with our customers
 - Optimize service quality and customer satisfaction

THERMOMUR®



JACKODUR® Atlas



JACKOBOARD®



The benefits of ICF

Integrated insulation and formwork

- The insulation acts as the formwork to a robust concrete structure
- No waste materials or time required to remove the formwork
- Rapid construction time

High levels of insulation and reduced thermal bridges

- Excellent u-values
- Systems shown to reduce annual energy costs by 70%
- Elimination of thermal bridges designed into the system

Significant sound elimination

- Continuous concrete core eliminates noise transmission

Air tightness built in

- Continuous concrete core seals the structure, no requirement for tapes and membranes
- Air tightness readings as low as 0.03m³/m²/hr have been recorded

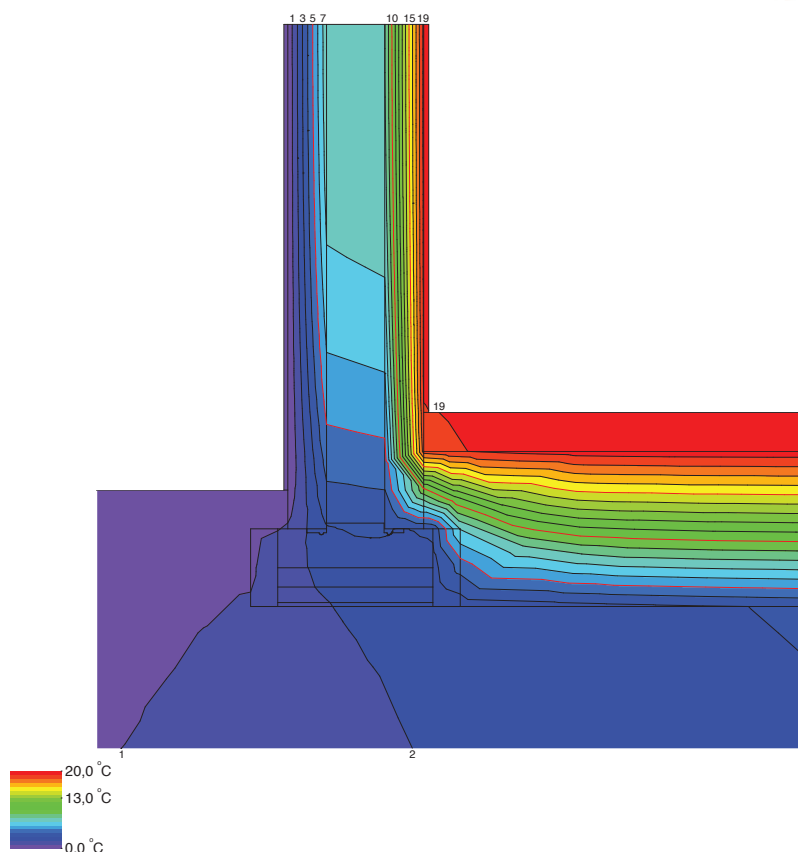
Long life cycle

- An insulated concrete structure built to last
- No timber elements that can be affected by moisture or rot

The benefits of THERMOMUR ICF

- Over 30 years of continuous development and experience
- The leading brand in the demanding Scandanavian environment
- High density EPS manufactured in our premises with Jackon's own PS bead
- A robust preformed block requiring no on-site assembly or adjustment with a patented interlocking blocks
- No internal metal components, eliminating risk of corrosion and increasing speed of build
- Continuous internal and external insulation layers to eliminate thermal bridging and excellent Ψ values
- A metric system with fixing webs at 150mm intervals, Curved internal corners reduce the pressure during pour and improve concrete distribution.
- Various block dimensions to meet different u-value requirements without the need for additional insulation
- Complete European technical and environmental approvals

Thermal Performance and Technical Competence



- Construction with ICF can eliminate Thermal Bridges
- The effectiveness of the insulation at these junctions is measured by its PSI value
- The Thermomur range can produce market leading PSI values
- The Jackon Technical Department carries out thermal analysis for all standard junctions and for any bespoke designs

For your SAP Assessor to calculate the expected performance of the property they need to understand the thermal performance of the individual structural elements, e.g. wall, floor, windows etc. This Thermal Performance of the elements is usually declared by its u-value, which is actually its thermal conductivity, so the lower the u-value the better performing the insulation.

The Thermomur range has a wide variation in thermal performance, from $u = 0.31$ for the '250 range', often used for internal walls or garages, to the industry leading '450 range' with a u-value of 0.11.

Our '350 Super' range is proving most popular in the UK. it has a u-value of 0.15, when combined with the other features of Thermomur can help you achieve Passive House standards.

The SAP Assessor also needs to know the thermal efficiency of the various junctions, or interfaces, where the elements meet. These 'thermal bridges' can be the source of significant heat loss. From thermal finite element analysis, we can predict the performance of the various junctions, generating a PSI value which is used by the assessor.

The Jackon Technical Department can produce their own thermal analysis, specific to our products, for all standard junctions and any new designs as they occur.

The third factor that determines thermal performance of the property is the air tightness of the structure. Many alternative methods of construction, for example, timber frame properties rely on the accurate application of foil membranes and adhesive tapes, to create an airtight structure. Thermomur with its solid, continuous concrete core is inherently airtight.

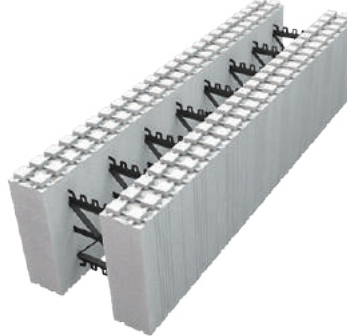
The THERMOMUR Range

	length	height	height	insulation thickness	core thickness	u value
250X	1200	300	350	2 x 50	150	0.31
350X	1200	300	350	2 x 100	150	0.17
350HD	1200	300	350	2 x 75	200	0.22
350 Super	1200	300	350	2 x 100	150	0.15
450	1200	300	350	100 + 200	150	0.11

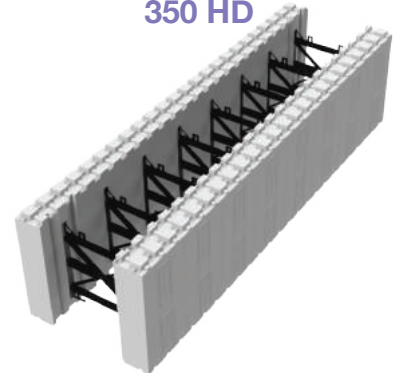
JACKON THERMOMUR®
250X



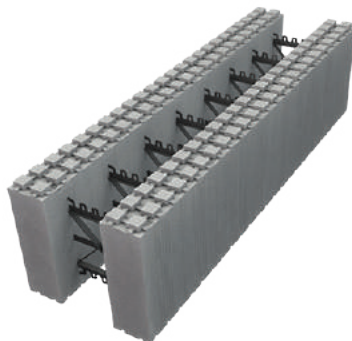
JACKON THERMOMUR®
350



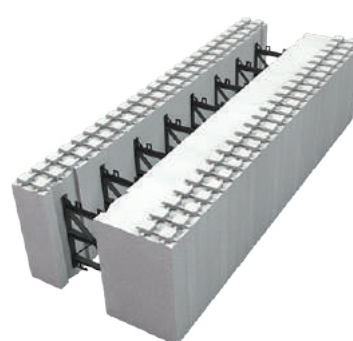
JACKON THERMOMUR®
350 HD



JACKON THERMOMUR®
350 SUPER

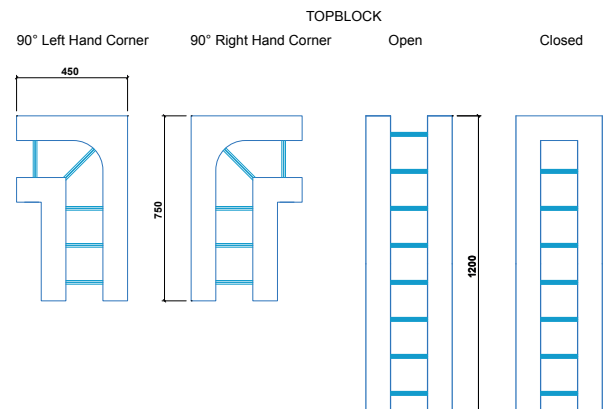
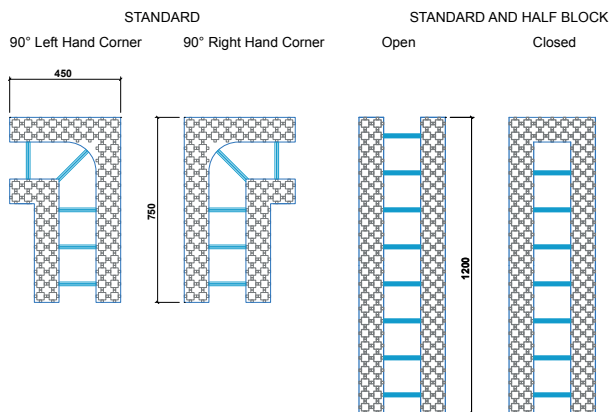
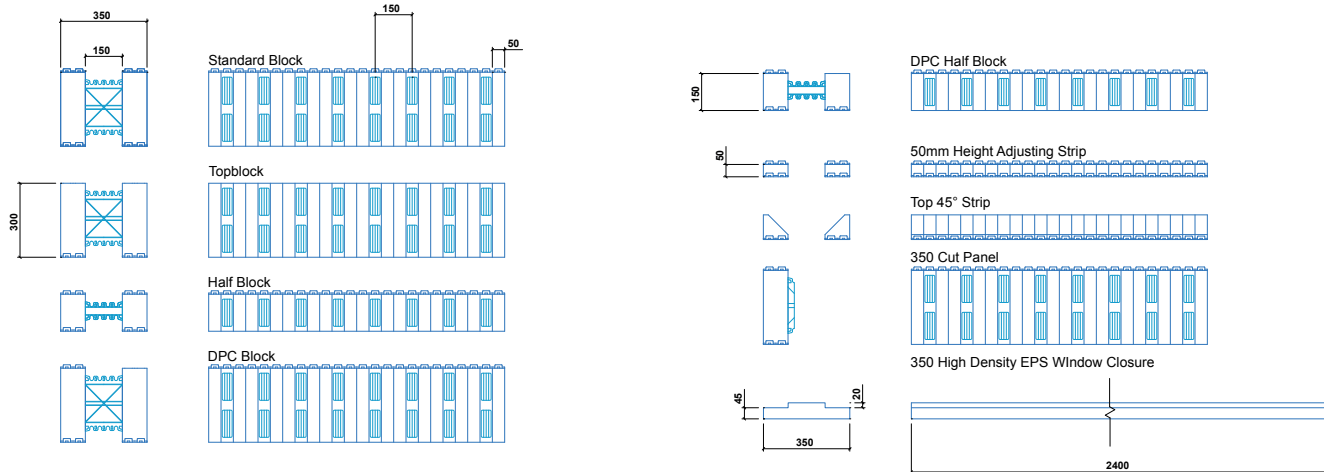


JACKON THERMOMUR®
450 HD

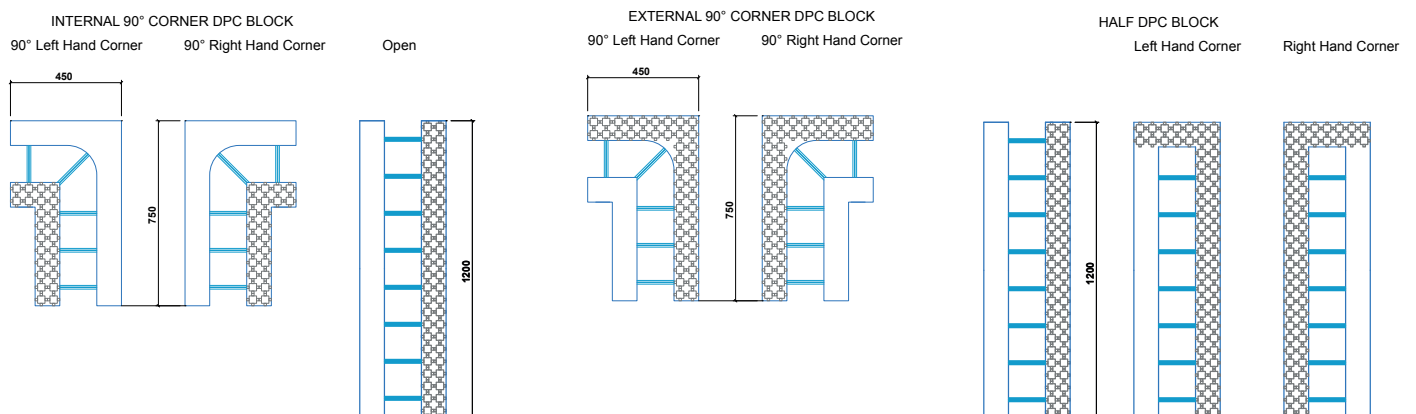


In addition to the excellent u-values of the Thermomur range, building with Thermomur eliminates thermal bridges. All standard junction details have been analysed to generate a complete set of psi values for use by SAP Assessors in determining the overall thermal performance of the property.

The THERMOMUR Range



DPC BLOCK



Module 1: Preparation

The project so far:

- Purchase of the site
- Design and planning
- Site ground investigation
- Finding a Structural Engineer
- Building Control and Structural Warranties
- The construction teams

Establishing the site:

- Site strip and level
- Datum point and peg
- Building area
- Storage area
- Welfare
- Waste control
- Security
- Safety

Tools Required

- PPE for all and Welfare Facilities
 - Hard hats, boots, wet weather gear, hi viz, gloves, eye protection
- Specialist items
 - Large and small format hot wire cutters
 - Slump tester
 - Long tailed 25mm concrete vibrators, 2 units required
 - Bracing system
 - Rebar bender and cutter or pre-formed rebar links are available from Jackon
 - Hose pipe connection for equipment cleaning
- General Builders tools
 - Laser level
 - Pruning saw and cross cut saw
 - Rubber mallet, retractable knife
 - Foam gun
 - Battery powered screw driver, 50mm min length wood screws
 - 5m and 25m tape, string lines, marker pens, laser level
 - Wheel barrows, shovels and brushes
 - Timber bracing and plywood sheets

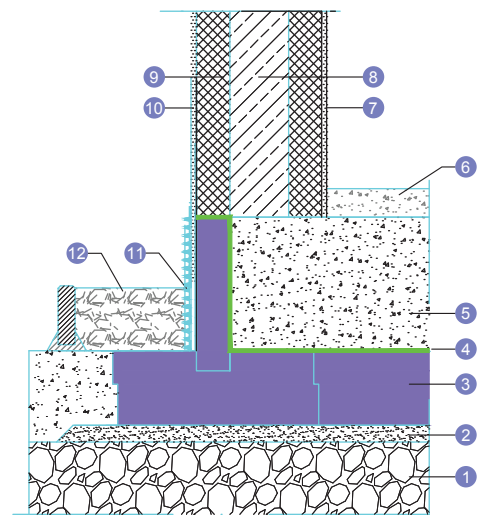
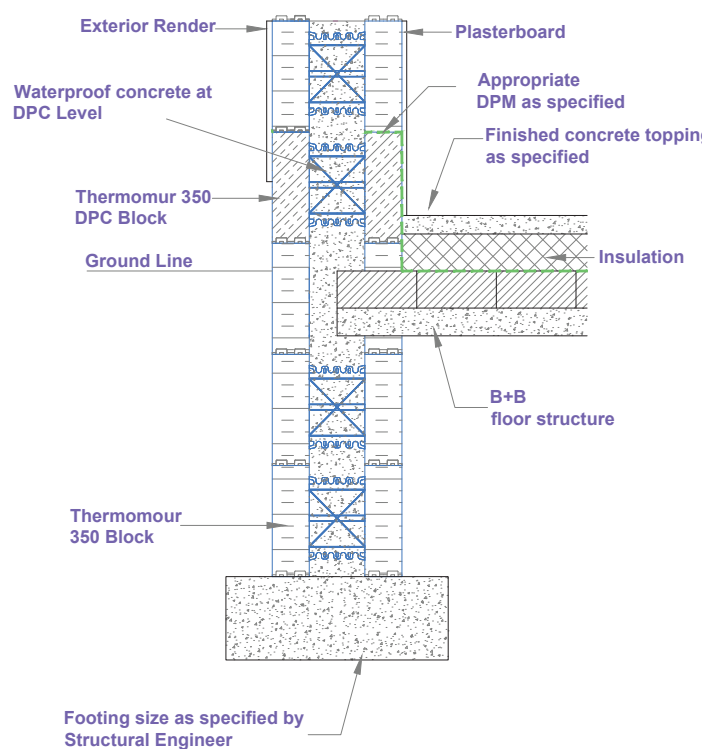
Module 1: Preparation - Foundations

- Target level +/- 5mm
- Rebar Starter Bars if specified by Engineer
- Foundations determined by Engineer
- Foundations should be set in conjunction with site 'Datum Point'
- Ideally steps in footings to be at 150mm or 300mm to coincide with half/full blocks



Practical: laser level operation, 3:4:5 setting out

Foundations Details



- 1 MOT Type 1
- 2 Sand blinding
- 3 JACKODUR® Atlas
- 4 DPC
- 5 Foundation slab
- 6 Screed

- 7 Plasterboard
- 8 Concrete core
- 9 THERMOMUR (ICF)
- 10 Exterior Render
- 11 Cement-based waterproof coating and dimple sheet
- 12 Filter gravel 16/32 mm

Module 2: Starting the build

- Set up 'datum point' at ground floor finish height
- Set up string lines for perimeter of building
 - Square corners
 - Parallel sides
 - Check diagonals
 - Check wall lengths
- Only after final check load the site with ICF and tools
- Start at a corner (alternating Thermomur Left/Right Hand Corner on each course to avoid Stack Joints while building) and work towards middle avoid cutting a corner block
- Cut formwork at 50mm cut lines, avoid cutting a web
- If necessary to cut off the cut line, choose a door opening if possible
- A cut off the cut line is a 'stack cut' which will need additional timber reinforcement internally and externally
- Build two full courses do not remove any 'openings'
- Fit horizontal rebar on top of first course, leave gaps in rebar for openings
- With two courses complete check the walls for line, squareness then level. Adjust as necessary
- Mark the position of any openings on the formwork
- Add a second layer of rebar if required and be prepared to add any vertical rebar
- Consider the addition of a DPC
- When building off a strip footing, now is the time to fill the formwork up to DPC level. Bear in mind protection of the top inter-locking lugs, DPC placement, wall alignment, starter bars.



Discuss: Waste management, loading the site



Module 3: Rebar



- Building Control will require calculations from a Structural Engineer
- The quantity, specification and location is determined by the Structural Engineer. Their specification must be adhered to.
- Lintels will also be defined by the Engineer
- Prepare any rebar and links beforehand

Rebar is added to give the concrete additional tensile strength. It stops shrinkage cracking, improves load performance and minimises deflections.

The quantity, specification and location of rebar will be defined by the Structural Engineer. Their specification must be adhered to in order to satisfy Building Control. The Structural Engineer will also design the rebar required to construct lintels within the concrete structure.

Rebar can either be ordered from a specialist supplier to the schedule calculated by the engineer or it can be ordered in bulk straight lengths and be cut and bent onsite provided we have the required tools. Some lintel link sizes are also available from Jackson designed to fit the concrete core.

If we choose the bulk option, we have to take the following into consideration:

- Prepare any required corner bars and links beforehand. Links can be purchased them directly from Jackson. Horizontal rebar will be located in the plastic webs within the Thermomur. Clips are available to locate any vertical rebar.
- When joining two pieces of rebar the overlap must be 40 times the diameter of the rebar. In order to help the flow of concrete keep overlapped bars on top of each other.
- 'No Contact' laps should be no further than 150mm apart and wet placement of the rebar is acceptable provide the x40 rule is obeyed (e.g. 10mm diameter rebar has to be overlapped by a minimum of 400 mm)
- To maintain continuity of the reinforcement in the vertical walls the rebar should protrude by at least the minimum lap length above each pour level. To minimise the risk of accidents protective 'mushroom' caps should be placed on top of each piece of protruding rebar.



Practical: locating rebar in Thermomur

Module 4: Continuing the Build



- Fit the second layer of rebar if required, allow for any openings
- Consider the position of the DPC layer using the DPC Blocks as necessary.
- Mark all openings on the top of the second course.
- Add the third and fourth courses of formwork but leave out any formwork to form openings
- Make sure all binders line up vertically
- Continue building up to the 4th course then brace, continue building up to lintel level. Then remove the openings from the first two courses as required.
- Assemble rebar reinforcement and links as defined by the structural engineer.
- Check the height of any window cills and mark the position of any windows on the fourth course
- Fit the wall bracing between 1200mm and 1800mm spacing
- Fit bracing within 300mm at either side of each opening
- Fix to the wall and the ground and set the wall plumb.
- Create sleeved service penetrations, e.g. foul water, services, air exchange pipes.



Discuss: DPC layers, wet placement of rebar, off slab build, radius topped openings, service penetrations



Practical: Brace assembly, window bucks, stack joint support and 'T' joints, vertical and horizontal support within openings

Module 4: Continuing the Build - Openings

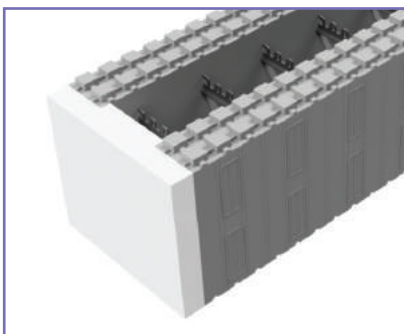
- Determine opening sizes when using the Thermomur cavity closure
- Build up walls to lintel level
- Consider any additional insulation and/or screed on the slab when setting lintel heights
- Fit the head closure first then both vertical closures to support the head closure
- Cut but do not fit the sill closure. This will not be fitted until the void beneath the sill has been filled.
- Additional temporary timber supports will be required vertically and horizontally to resist the pressure of the concrete



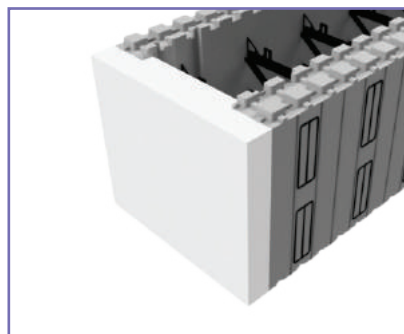
Thermomur New 'Cavity Closure'

- Fix Window/Door Frames mechanically directly into the High-Density EPS closure at the desired position

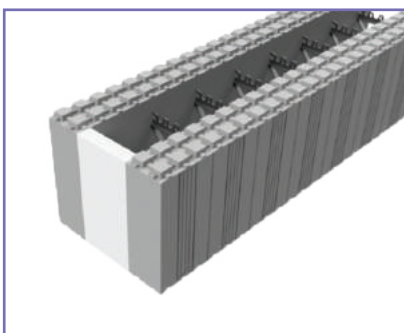
350/150



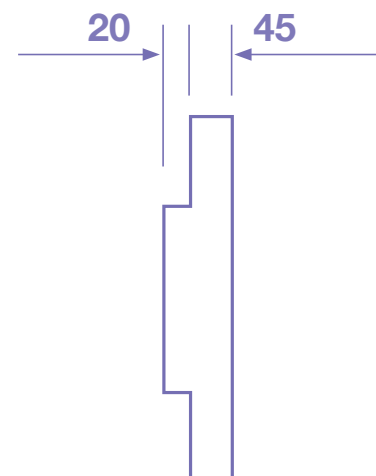
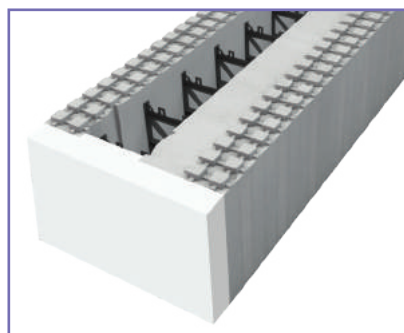
350/200



150m core

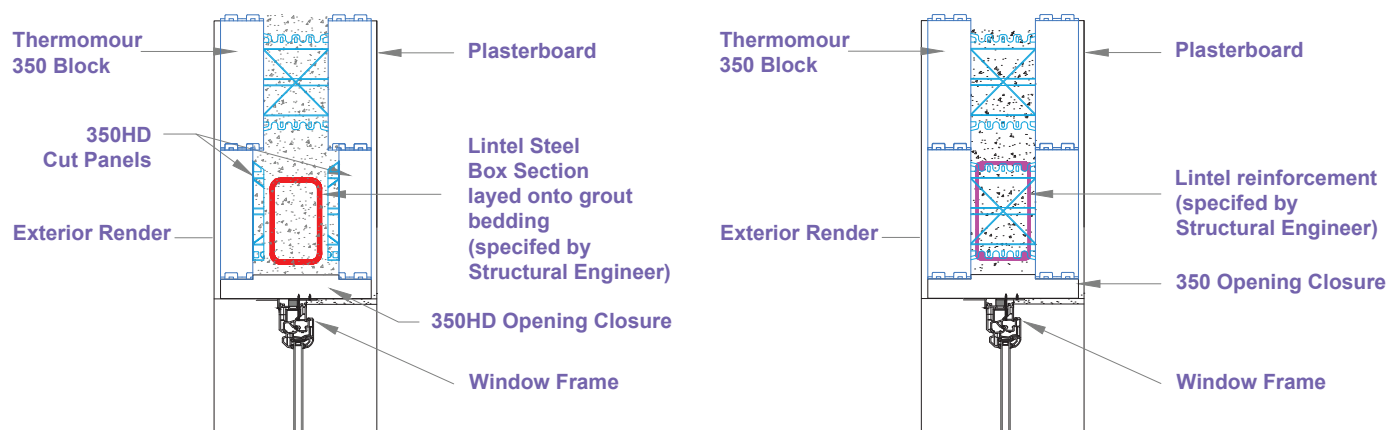


450/150



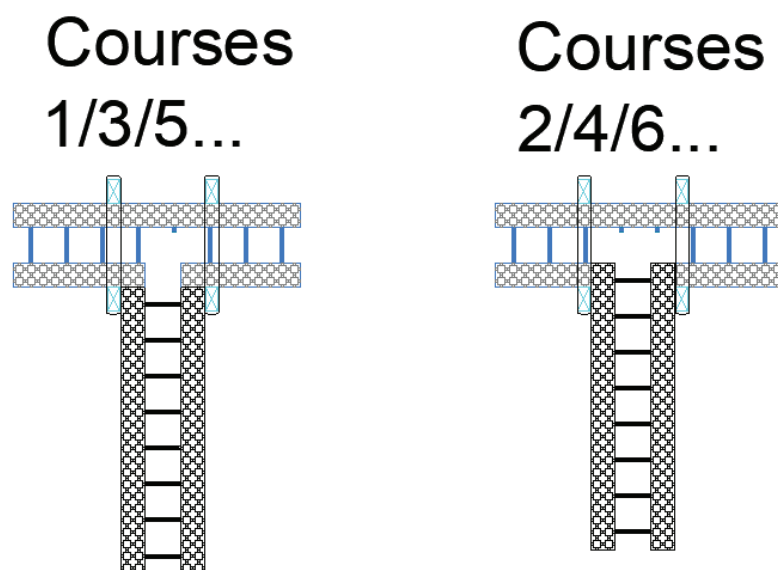
Module 4: Continuing the Build - Lintel Design

- Always consult a Structural Engineer
- All openings must be fully supported with timber struts and wedges both vertically and horizontally

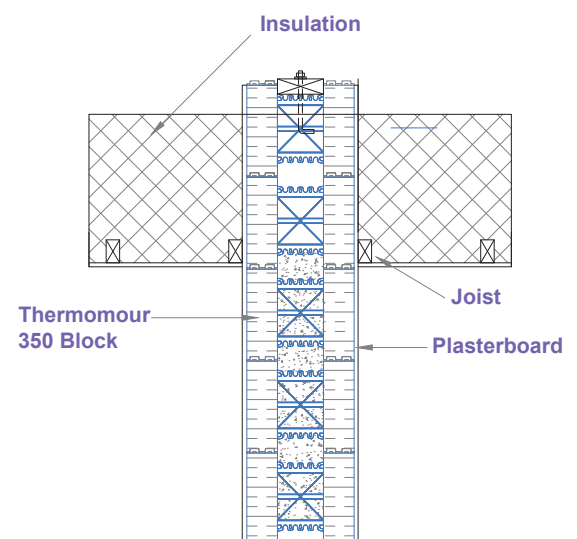
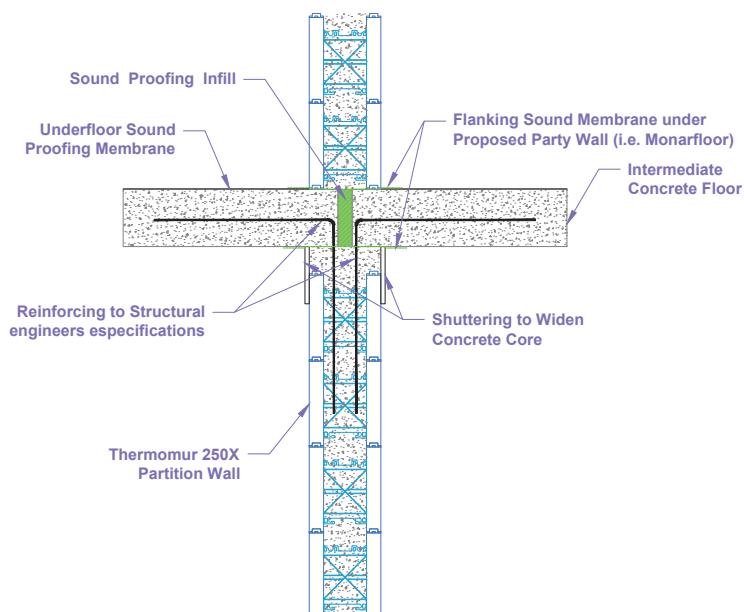
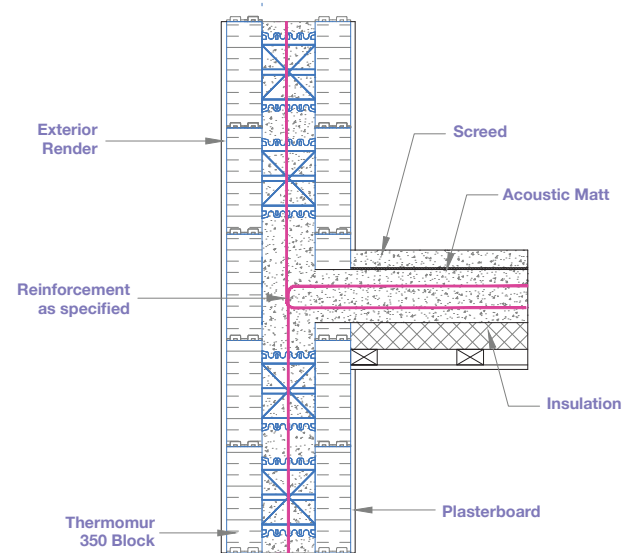
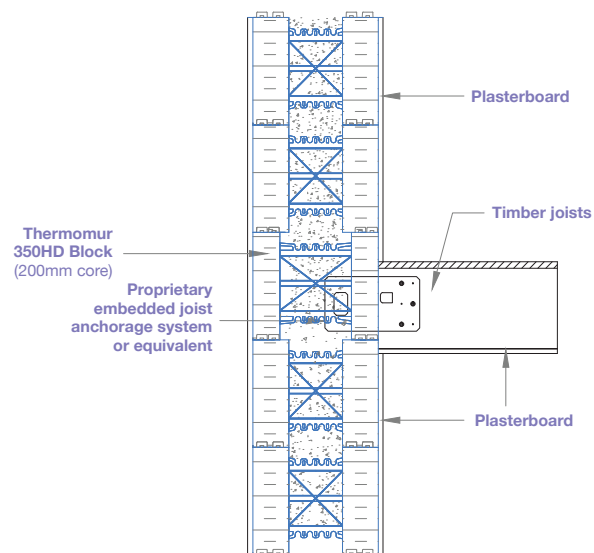


Module 4: Continuing the Build - T Junctions

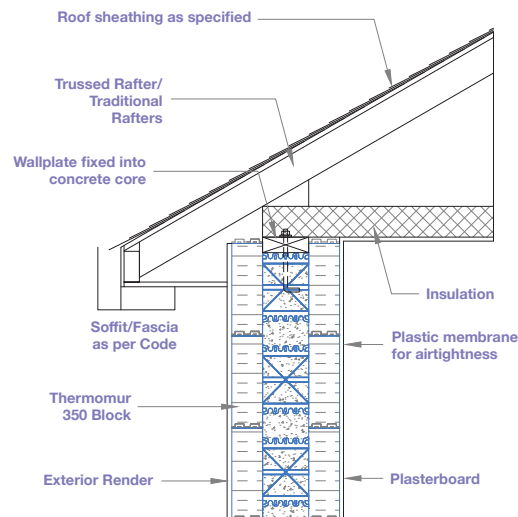
- Additional timber reinforcement will be required prior to pour at T-junctions using timber studs braced with wire loops
- Wire loops must be placed on every course at the T Junction position



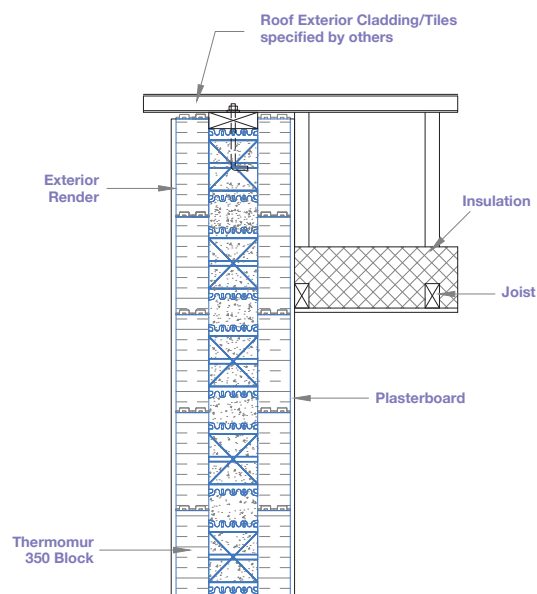
Module 5: Floor and roof connections



Module 5: Roof connections



- Pre-cut the timber wall plate, 100mm x 50mm
- Drill along the length of the wall plate, staggered format
- Once the concrete has been levelled bed the wall plate onto the wet concrete
- Embed fixings through the wall plate into the concrete
- Level the wall plate
- Alternatively embed fixings into the wet concrete and use to fix the wall plate once the concrete has set
- If either opportunity is missed drill and epoxy fixings into place once the concrete has set, at least 7 days later
- The process is the same regardless of the roof structure; trussed, SIPs, steel or cut.



Module 6: Concrete

- Use the Pre Pour Checklist
- Recheck the quantity required
- Strength: C25 – C30
- Aggregate :
 - 10mm for 100mm and 150mm core walls
 - If 10 mm is not available 20 mm can be used for 150mm with minimal rebar and 200mm core walls
- Slump: 180mm-200mm
- Discuss rejection of load if too high!
- Will the pump reach?
- Frequency of trucks
- Pumps are the best
- Get a pump with just enough reach
- 150mm diameter hose must be reduced to 100mm
- Reduce the flow further with a 'swan neck'
- Thin wall flexible hose gives better control
- Placement should not exceed 1.2m height per hour so layer the pour with 1.2m high laps around the building
- Slump test each load
- To prevent voids and honeycombing the concrete needs to be vibrated
- Avoid external vibration
- Use a maximum diameter poker of 30mm with a long tail
- Battery operated pokers are easier
- Work the poker directly behind the pump nozzle
- Quick in – slow out
- Use the Post Pour Checklist

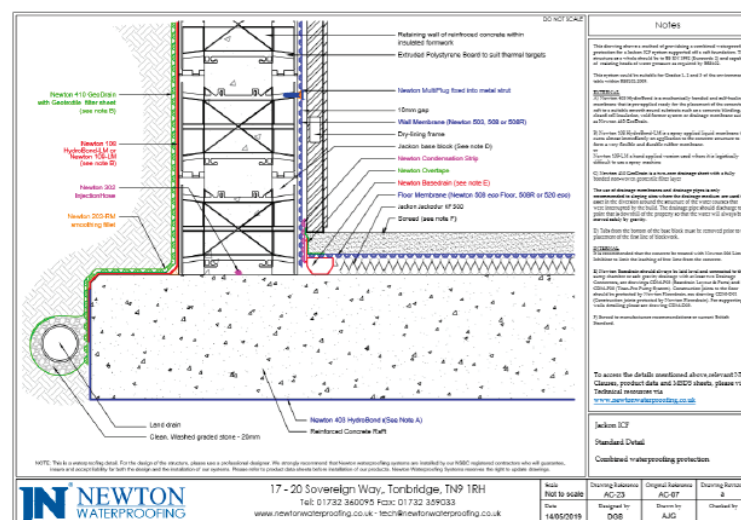


Module 6: Concrete - Gable Ends

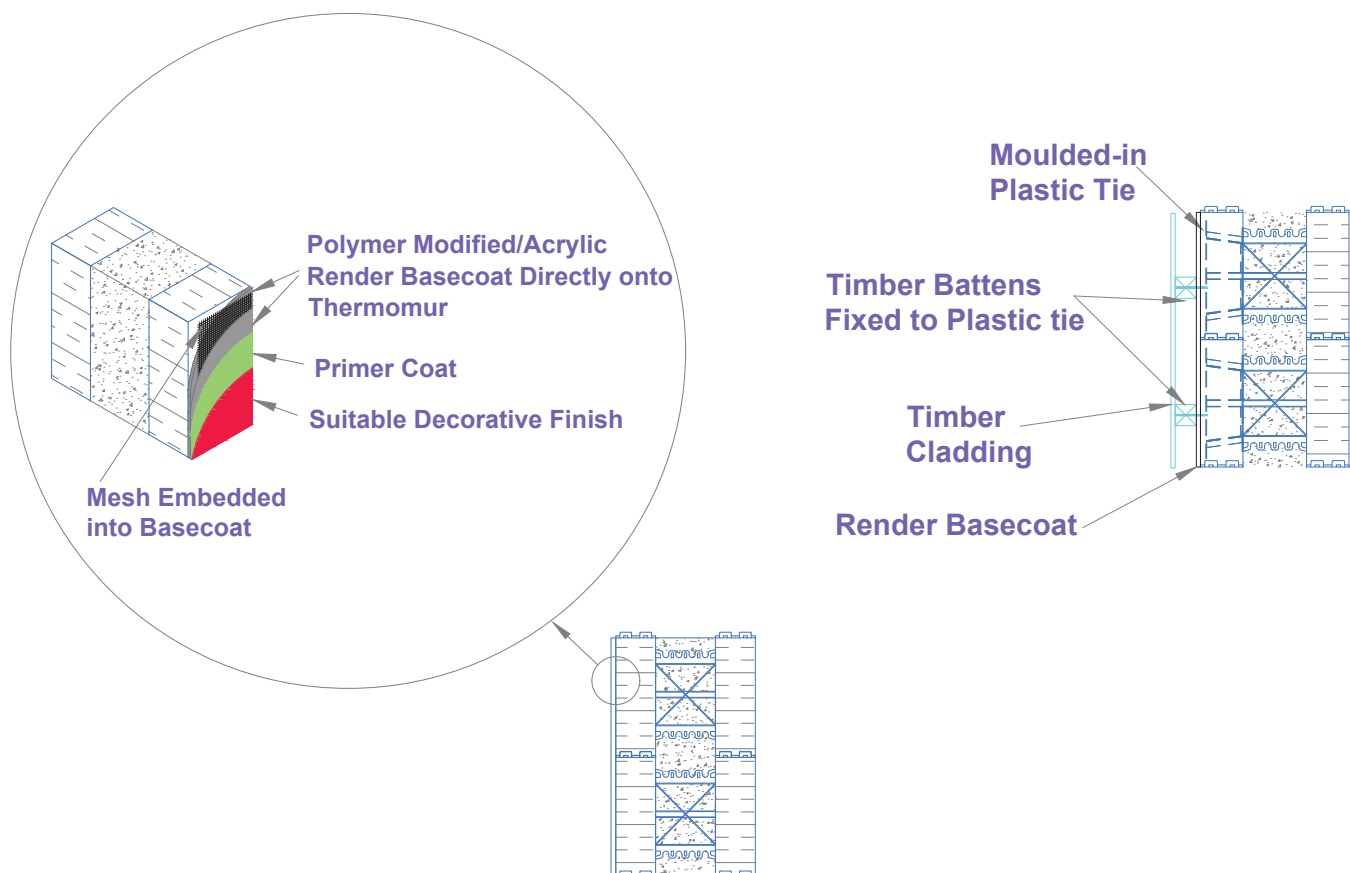
- Cut the forms to the designated angle or wait until the roof structure has been fitted so that the gables can be built to the roof line quickly, easily and accurately.
- Placing the concrete requires a reduced slump. Use the poker with caution.
- Fix the designated anchors into the wet concrete.
- Trowel the top concrete flat to the line of the roof and protect from rain run off and frost.
- Check the walls are plumb, adjust if necessary.

- For a straight forward DPC, just add a “pore blocker” type additive to the concrete that covers DPC height.
- Tanking is a specialist job and must be done by Approved Installers.
- Basements must comply with BS8102 2009 standards. Two layers of protection are required to reach BS8102. Any combination between A,B,C depending on the risk assessment.
- Type A is external
- Type B is within the concrete core
- Type C is internal

BEWARE! Failure to comply to BS8102 will be detrimental when applying for a mortgage. Rectification will be extremely expensive. Do not be tempted to dabble.



Module 7: External Finishes



Module 8: Internal Services

• Electrical and Plumbing Installation.

- Must always be done by a qualified electrician.
- Either always use conduit, or non-migratory TPS cable. (Thermo Plastic Sheathing)
- Use a hot wire cutter to put chases in the wall quickly, cleanly and very professionally.
- Insert any ducts through the walls prior to concreting.

• Interior Fixings.

- For heavy or high load items imbed a sheet of ply into the wall.
- Plasterboards: fix directly with 45mm drywall screws.
- Skirting boards: Mark the floor before skimming the walls so all web positions are known.

Summary

- Fast construction process when good building practices are followed
- Support during predesign, design and construction process
- In-Built Air Tightness, fire safety, noise reduction and U-Values during construction process without after fixings.
- Thermomur allows you to build net zero homes, quickly and accurately. With a robust concrete core, inherent fire safety. These structures will last for hundreds of years.
- With over 30 years' experience THERMOMUR is the leading ICF system in Scandinavia.
- We are in total control of our manufacturing, from the manufacture of the polystyrene bead through to the delivery on site.
- Our range can achieve market leading u values and Ψ values without the need for additional insulation.
- Even from Norway we can deliver at competitive pricing with lead-times of less than two weeks.

Appendices

- 1 - Pre Pour Check List**
- 2 - Post Pour Check List**
- 3 - Thermomur Brochure**
- 4 - Tool List**

JACKON THERMOMUR - Pre-Pour Checklist

1	Is it built to plan?	
2	Has the bracing been fitted correctly?	
3	Is there adequate/safe access to the top of the wall?	
4	Has the rebar been installed as per instructions, with top protection?	
5	Are all openings the right size and in the right position, and fully braced?	
6	Do all the "Stack Joints" have additional support?	
7	Are "T" sections connected properly inside, and supported externally?	
8	Are there any beam pockets required, if so, are they in the correct position?	
9	Have the walls been plumbed for the pour, with all string lines fitted? Use a 1.8m level, to avoid bulges and hollows.	
10	Are there two long tailed concrete vibrators on site? (A spare for breakdowns)	
11	Have the intermediate floor connections been considered or fitted?	
12	In case of blowouts, is there the necessary kit on site to deal with that scenario? E.g. plywood, saws, screws, screwdrivers, shovels, wheelbarrows, buckets.	
13	Have all the formwork tops been protected with 4" tape?	
14	Has the concrete been ordered to the correct specification?	
15	Is there a bag of OPC to prime the pump on site?	
16	Has the pump operator been on site checking access/overhead cables etc?	
17	Is road access OK for large vehicles, e.g. low bridges, weight restrictions etc?	
18	Does the pump carry the right kit eg. Swan necks, reducers, thin wall pipe?	
19	Is there a good water supply and washing out area for the pump and mixers?	
20	Does the washing out area allow catchment and usage for the waste concrete?	
21	Has there been dialogue between site and the batching plant re: the slump/mix?	
22	Is there a slump tester on site, with an operative that knows how to use it?	
23	Is the correct PPE on site? E.g. Hard hats, safety boots, gloves, glasses etc.	
24	Is there a First Aid Box on site filled with plasters, bandages, eye wash?	
25	Is the access equipment safe, no trap ends, loose ladders, loose cables or other potential trips, basically is the site tidy and ready?	
26	Do all the operatives on site know their job? Are there enough operatives on site? Is there a designated one contact operative to communicate with the pump driver? More than one can cause confusion. Discuss communication signals beforehand.	
27	Safety toolbox talk prior to the concrete pump arriving: Theme of the talk to be "What to do if there is a serious blockage in the pump during the filling operation". The answer must be to clear all operatives a safe distance from the pump whilst the operator clears the blockage by increasing the line pressure. The nozzle must be away from the wall during this operation, preferably over the pump cleaning/washing out area.	
28	Has the empty formwork been cleaned? If not use a blower/ hoover.	

JACKON THERMOMUR - Post-Pour Checklist

1	Are the walls straight and true?	
2	Are all the openings plumb, have they been checked?	
3	Is the consolidation complete?	
4	Has the top been levelled?	
5	Have all the anchors, wall plates, Joist hangers etc, been fitted?	
6	If the wall is to be continued, are the rebar laps protruding to the right length?	
7	Has all the kit been thoroughly cleaned including the bracing?	
8	Have the walls been cleaned, is the bracing clean?	
9	In cold weather, has the top of the wall been protected from frost penetration?	
10	Remove the protective tape from the top of the formwork.	
11	Have all the concrete spills, inside and out been cleaned up?	

NOTES

Solutions for construction.
Simple but **effective**.

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