Installation Manual using ECO-Block ICF

Index

Section 1

INTRODUCTION AND DISCLAIMER

Disclaimer

1. This version of the manual (NZ 2023:1) was published in March 2023 and there may be changes that occur without warning which we reserve the right to make. Please make sure you are using the latest version of the manual. By contacting info@arkform.co.nz

2. It is the and the Builders responsibility to always use the most current and up to date version of the manual when installing Eco-Block Insulating Concrete Forms.

3. This manual is designed to be used as a useful reference guide and educational tool only. Many buildings require and PS1 and PS4 from an engineer registered with your local authority for the actual design work. The associated Engineer and Architect Design Manual is a very adequate tool for initial design BUT you need to check what the local authority requires in way of certificates for completion of the job before you start. Note that some requirements may vary from area to area and authority to authority depending on earthquake and wind zones. Additionally, this manual is not a substitute for using trained installers. ARKFORM who proudly sell and distribute ECO-Block NZ, have trained and certified installers to do the work. We also run courses to certify builders. ARKFORM Ltd states that all the information and details in this manual is for educational and information purposes only. It is not intended as a substitute for professional advice.

4. ARKFORM assumes no responsibility regarding the use of our products, or any other third-party products referred to in the manual. The user's total commitment is to comply with all applicable standards codes and regulations for the authority who has oversight in the area in which you are building. While we give guidance in this manual and with our onsite training it is the builder's responsibility to comply with all the health and safety regulations and we point out that every builder is required to have their own health and safety manual, training in safety and orientation to site.

Why Choose ICF

There are lots of reasons for choosing an ICF structure but four of the key things to consider are:

Durability.

Concrete, steel, and polystyrene last a very long time.

Insulation and acoustic properties.

Great insulation values far exceeding NZ building standards for insulation. A house in this block featured in the picture below runs 2 electric cars as well as the 3-bedroom house and just got a note from the power company asking if they should move to the 'low consumption' pricing plan. And sound proofing for intertenancy that really performs.

Environment:

Because its high performing insulation energy costs are dramatically reduced and a small environmental footprint. We use 'low energy concrete too'. When the building is replaced, everything can be recycled - including the polystyrene – and there are no toxic chemicals released – unlike timber that has to be replaced much more quickly.

Cost effective.

ICFs are quick to construct and highly competitive with everything from timber to concrete block to tilt slab.

But Why Choose ECO-Block. Why does ARKFORM promote ECO-Block

Good question! Here are just a few reasons….

- It is a brilliant and flexible product used internationally for 30 years.
- It is manufactured in NZ so reducing transport costs and energy footprint and it's been made here for 20 years.
- Paul Jones who owns it has creative expertise and is solution orientated.
- You will get exceptional sales and service backup from the ARKCON team.
- We personally deliver nationwide and provide supervision to make sure you get it right first time.

Compliance

ARKFORM proudly sells ECO-Block which as the following rated approvals. Documentation for this is in the Appendices of the product manual but includes.

BRANZ appraisal for fire rating

Acoustic testing

Pull testing on vertical rails.

Section 1: Introduction

Where can ECO-Block be used?

- Residential construction for single dwellings
- Intertenancy walls for town houses and terraced houses
- High rise buildings
- Hospitals and Institutional buildings requiring extra strength.
- Basements
- Buildings requiring retaining as part of the structure.
- Retaining walls
- In ground tanks
- Swimming pools
- Curved walls
- Insulated foundations and concrete footings.

Because ARKCON's ECO-Block is an all-in-one system when rapidly install it you find already have:

- All the bracing structures required – and more.
- Preinstalled insulation
- A vapour barrier
- A sound barrier
- A fire wall.

Everything you need for fixing any external façade – plaster, iron, weatherboard, shiplap. The 200 spaced vertical rails embedded in the polystyrene and concrete can carry very high wind loadings for any exterior covering specified.

Installing

We love our product and are very proud of it. We want to help you achieve the cost effectiveness we know ECO-Block can provide for you. To achieve optimum efficiency when building with ECO-Block, an ideal and experienced trained crew consists of a minimum of three and a maximum of 4. One skilled person (who understands level, plumb and square) and one or two laborers (Carpenters, block layer, formwork) and a gopher. We can provide a crew like this or provide hands on supervision to train your team in the use of ECO-Block. We won't just drop the blocks and run. We want to help you get started right, to get it right the structure right from the ground up – from before when the slab is poured – and we hire all the gear to make it easy for you.

We are always willing to provide estimates for quantities for your projects; these will also offer a guide to Materials Supplied by others, i.e., concrete volume, steel, and an indicative labour rate based on your projects' specific detail, i.e., corners, t- joints, door and window openings. Just ask.

Product Description and Specification

All product details and specifications are in the Product manual and are not repeated here. Some diagrams around detailed constructions are included here but you are encouraged to download the product manual for all block details, appraisals, and certificates.

CONSTRUCTION FEATURES:

ECO-Block panels are modular sized to provide a net 400mm high by 1200mm long form from each set of two connected panels. Webs are spaced at 200mm on center and are recessed 6mm from the exterior surface of the EPS panel to allow a uniform surface for finish application. Web features include a 25mm wide x 3.5mm thick outer flange, six points for connector attachment on the inside and connections through the EPS. A clearly marked groove over the recessed web outer flange makes it easy to locate the finish attachment point. Attachment to the web flange is made with drywall screws.

Connection to floor joists, roof trusses, concrete block walls and wood walls are easily made using industry standard hardware and methods. Brick ledge forms and 90-degree corner forms are catalog items. Panels can be applied to the ECO-Block with woodworking tools.

Horizontal reinforcing bars are placed in notches in the panel connectors. These notches precisely locate the bars for predictable structural function and allow concrete to fully surround the bars. Horizontal bars should be staggered side to side for structural considerations and to allow the vertical bars to be confined near the center of the wall. Prescriptive reinforcing design is available for sample structures. Local design engineers must be used for complicated and high load designs to assure that local codes and special design requirements are met.

Chases for electrical cable or plumbing can be cut into the EPS using a router or a hot knife. A 60mm deep electrical box against the concrete provides a workable flush installation with 10 or 13mm gypsum board.

Lintels over door and window openings can be integral with the wall by adding required rebar to provide additional strength. Point loads from beams or girder trusses can be supported by locally increasing wall width but usually require engineering detail.

ECO-Block forms must be installed plumb and straight. A form alignment system approved by ECO-Block is available. This alignment system is adjustable for uneven floors and provides scaffolding a platform from which to easily place concrete. Concrete and concrete placement shall conform to NZS 3104, NZS 3108 and NZS 3109 and local codes. The EPS forms provide the ideal concrete curing environment by retaining

moisture and by insulating the concrete during cold weather placement. Curing inside the form assures that laboratory-cured test cylinders represent the strength of the building concrete. Up to 50% of concrete strength can be lost by improper curing but curing in an ECO-Block wall adds to the MPA of the finished product.

ECO-Block structures can be designed to safety withstand seismic and wind loads.

The 230 Series is good for low retaining walls and single and double storied buildings.

The 280 series will happily work with retaining walls to 2.5 metres and in 3 storied town houses and terraced houses.

The 330 Series (and above) has application for heavy duty retaining walls and multistoried commercial and apartment blocks. The unique connecting system easily allows for walls with 600mm solid concrete core.

Meeting the NZ Building code:

To ensure that ECO-Block, as sold by ARKFORM, meets the NZ building code you should ensure that all work adheres to the following NZ standards. Additionally, the local council may require engineer inspection before concrete is poured by either the Council or one of their registered engineers.

NZS 3104, NZS 3108 and NZS 3109 for all concrete related matters. ARKCON's ECO-Block construction is mostly covered in the masonry code.

NZS 4671: 2001 which defines the general standard for steel bars for concrete reinforcing.

NZ 3604, the standard document for residential construction containing most of the requirements about insulation, acoustics, fire ratings, waterproofing etc.

Some summary issues in construction:

Consolidating Concrete:

Two acceptable ways of consolidating concrete are with a mechanical vibrator or a length of rebar with a small rectangle of steel welded to the base. ARKFORM recommends that each 'lift' in concrete be no more than 1 metre and this allows the concrete poured in the first round to settle and take some pressure off the lowest courses of the ICF block when the rest is poured. To comply with the code, we recommend a minimum 25MPA concrete with a slump of 140 - 160 but engineers can vary this. Make sure concrete delivery dockets are kept to for Council inspectors or engineers to view. Tests may be required by the sign off authority.

Steel:

The specifications for steel are covered by NZS 4671: 2001 "Steel Bars for the Reinforcement of Concrete" so make sure you use steel required in the engineer's specifications. Reinforcement should be bent and cut as per the specific drawings or the attached drawings in this and the product manual (if there are no specific details) and will confirm NZS 3109:1997. Use tie wires as specified.

Often the lapping of bars is specified but where not detailed staggering of joins is required practice where possible. Bars should be lapped only where detailed, except that bars in foundation and slab edge beams may be lapped to suit standard lengths providing that laps be kept to a minimum and staggered where possible.

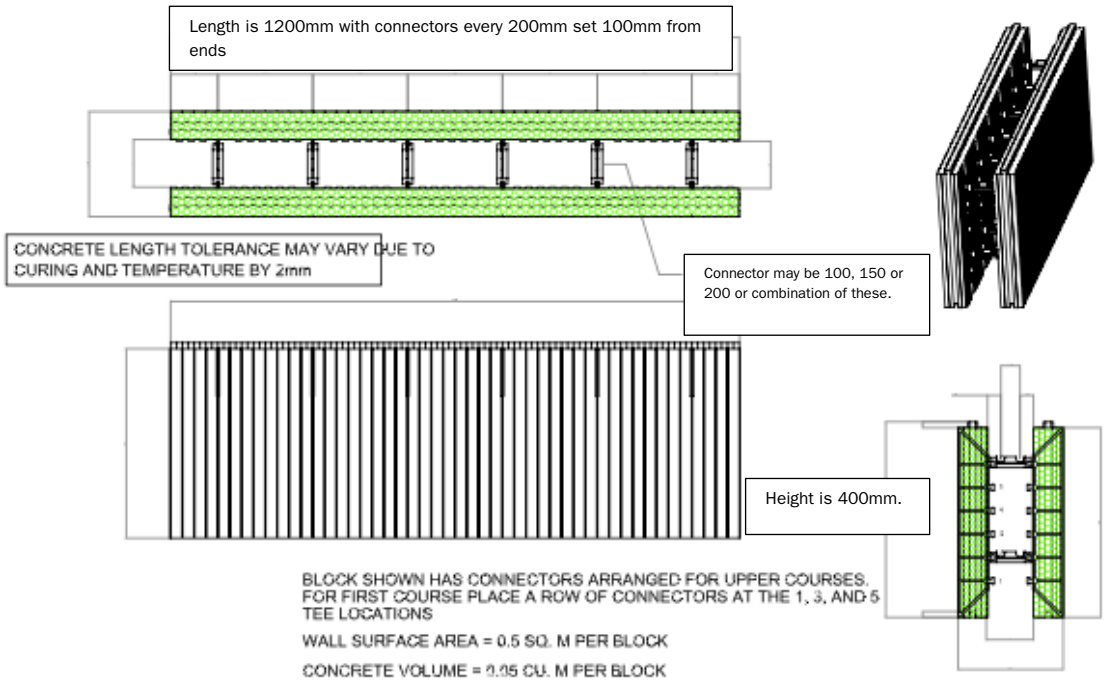
Before pouring begins the Engineer or Council must be notified and reasonable opportunity given for them to inspect the reinforcing as fixed to ensure compliance.

ECO-Blocks use Expanded Polystyrene (EPS) manufactured to high specification in New Zealand and use what is called H grade EPS. Details about Expanded Polystyrene (EPS) can be found in the product manual. There you will find details of it fire resistance, thermal resistance (R rating) acoustic abilities and its ecological footprint.

Section 2: Specifications

Product Specifications

System Components to create a ECO-Block



ARKFORM BUILD BETTER ICF Stu: 022 372 3109 stu@arkform.co.nz Dave: 021 223 3953 dave@arkform.co.nz Rob: 021 807 692 rob@arkform.co.nz www.arkform.co.nz	**The standard block**	ECO-BLOCK Insulated Concrete Forms Paul Jones: 021 760 590 pauljones@ecoicf.co.nz www.ecoicf.co.nz

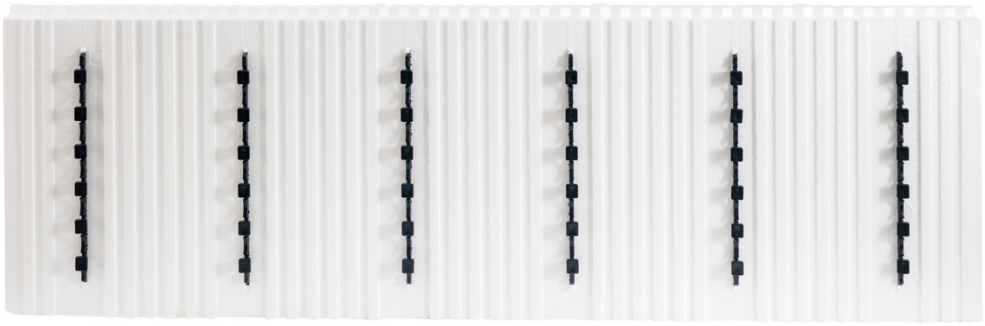
The Connectors

The Splice connector that allows block widths of multiples of 50mm above 150mm

The 100mm connector for the 230 series

The 150mm connector for the 280 Series

The 200mm connector for the 330 series



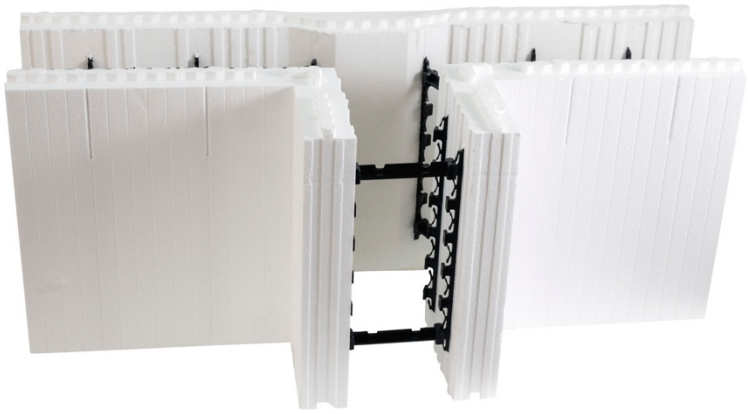
A standard straight wall panel for any series

The Corner Blocks

A standard Left-Hand corner on a series 280 ECO-Block. Note the insert in the corner that allows easy attachment of corner battens for cladding where necessary.

A standard Right-Hand Corner ECO-Block 280 series. Note the insert in the corner that allows easy attachment of corner battens for cladding where necessary.

T Blocks



Typical views of the ECO-Block 280 series. Note that the blocks are stacked alternatively to allow for joints in blocks to be staggered.

T Block for series 280 ECO-Block as shown from above

Why corner and T blocks

Good question - because walls can be constructed without them. A saw or hot knife and lots of plywood formwork and any shape is possible. Corner blocks- both LH and RH and T sections are supplied to make the job faster, easier, and stronger. T blocks are real time and money savers when it comes to internal walls, especially intertenancy walls and no additional formwork is needed. Standard bracing props supplied by us sees the job done quickly and easily. Similarly with the corners. Nothing extra required in formwork and the system automatically staggers all joints.

Useful tools in Construction

You will find the following tools useful in construction. Where it says ‘messy’ it means that there will be small polystyrene beads created. Best used in space where clean-up is easy and beads don’t blow to neighbouring properties.

Hand saw. Useful for small cuts in panels for fitting. Messy

Hammer. Metal and rubber. Often not needed at all.

Electric of Battery Circular Saw. Good for longer cuts in panels but messy.

Hot knife. Great for precise cuts in panels, right angle cuts, rectangular cut outs etc. No mess

Keyhole saw. Rectangular cuts. Messy

Electric or Battery Power drill. Doubles as impact driver. Good for circular holes in panels. Messy

Electric or Battery Impact driver. Useful for driving screws to attach objects to blocks.

Wire tying tool. For where wired reo joints and intersections are required.

Zip ties. Can be useful where blocks need to be jointed at non rebated ends.

Steel rebar benders and cutters. Not all steel arrives in exactly the right shape or length!

Electric or battery grinder. Steel cutting – but beware of hot sparks melting adjacent polystyrene.

Bench saw. Great for long straight precise cuts. Very messy

Router. Useful for rebates and similar. Very messy

Chain Saw. Avoid using unless absolutely necessary. Very very messy.

Gaffer tape. Often useful for holding in place while zip ties/wires are inserted.

Rebar Tie wires. Manual and mechanical are both useful.

Battery vibrator. Concrete should not be over vibrated in walls.

Foaming Glue. We recommend Wurth Purlogic as it is also suitable for surrounding penetrations.

Adhesive glue. We recommend Wurth façade adhesive as the most comprehensive.

Getting started

Setting out the slab

Your Engineer will design the footings and concrete slab; **you must follow the Engineers plans and steel placement. Note that usually there are specific steel rebars to go up the side of all doors and windows and these start in the slab.** You may also need to put rebates for doors into the slab at this point.

Use the grid aid on page 21 (230 series and 280 series) and you will save time and money with the placement of the vertical steel starter rebar. Note the various set outs that relate to potential spacing specified by the engineer.

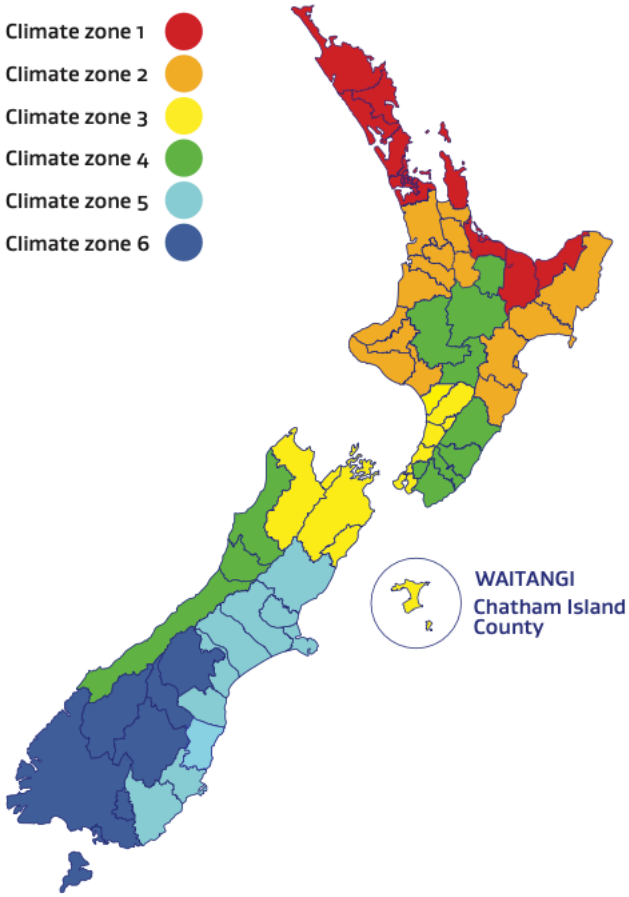
A level footing or slab will save you time installing the first course of the Eco Block Formwork as it will eliminate the need to shave the bottom of the block or packing it to achieve a level wall so try to achieve a +/- of no more than 5mm.

Check on the requirements in your specifications but it would be normal practice to wrap polytene running under the slab to at least ground level on the footing and foundations. Either waterproof behind the polythene using something like 'Sika BlackSeal Plus Bitumen' Waterproofing Membrane or use Autex 3000 that is self-glued to the polystyrene and have it go over the upturned polythene. Penetrations that go through the foundation polystyrene can be surrounded with Wurth Purlogicfor extra seal.

A typical waterproof paint / polythene wrap picture showing it covering all the outside edge of the building. With the new H1 regulations this outside perimeter must now include sufficient insulation to achieve R1.1 See picture of rebated blocks below if the wall construction is in timber.

Foundation slabs under the new H1 Code

All of us are familiar with the new code that comes into force in May 2023. The table that shows what is required is here below:

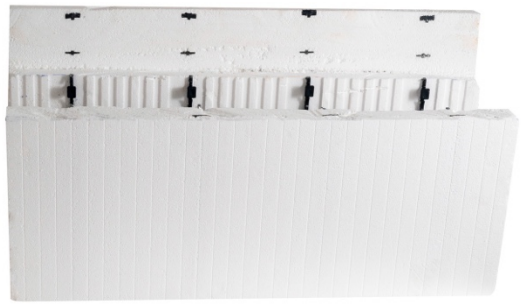


Required R values for slabs and walls under revised H1

Building element	Climate zone					
	1	2	3	4	5	6
Roof	R6.6↑					
Windows	R0.37↑		R0.46↑		R0.50↑	
Wall	R2.0↑			R2.0		
Slab-on-ground floors	R1.5↑			R1.5↑	R1.6↑	R1.7↑
Other floors	R2.5↑			R2.8↑	R3.0↑	

ECO-Block panels have an R value of 1.7 and combined with the concrete at 150mm thick (minimum for foundations) gives a value of R=2.9

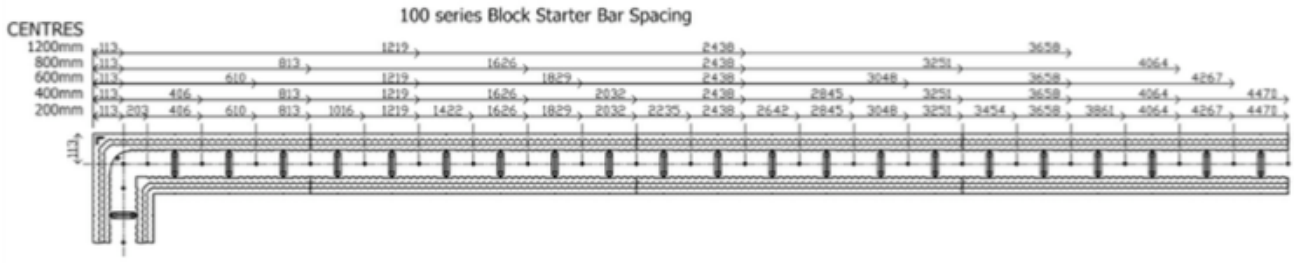
The foundation blocks for 90mm wood walls



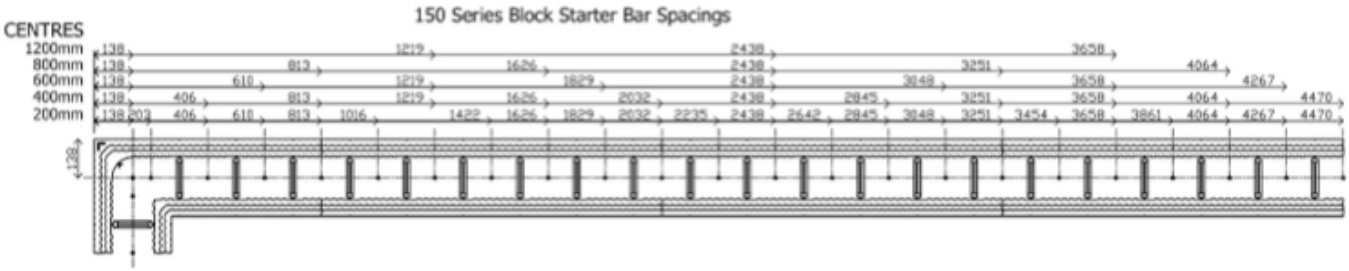
To achieve both the desired R rating and the cover necessary to bolt a 90mm frame to the slab a 100mm deep rebate is cut on the inside edge of the top of the out block. This is only necessary for 90mm timber walls and 140mm timber can be fastened to the slab without and changes needed.

Typical rebar starter set out for 230 and 280 series ECO-Blocks.

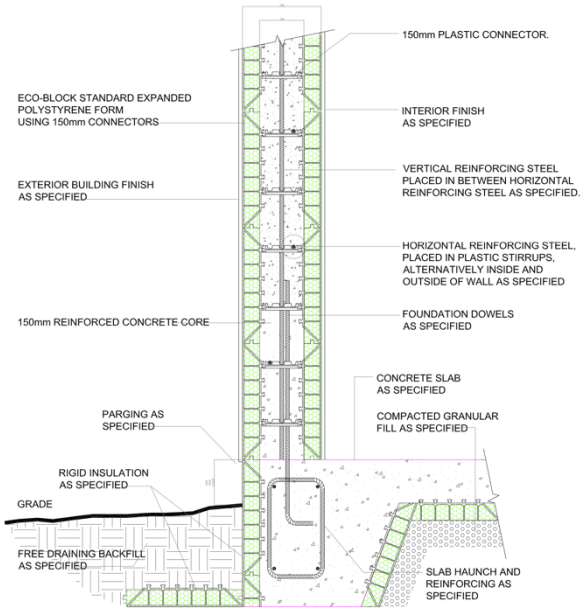
Typical 230 series layout



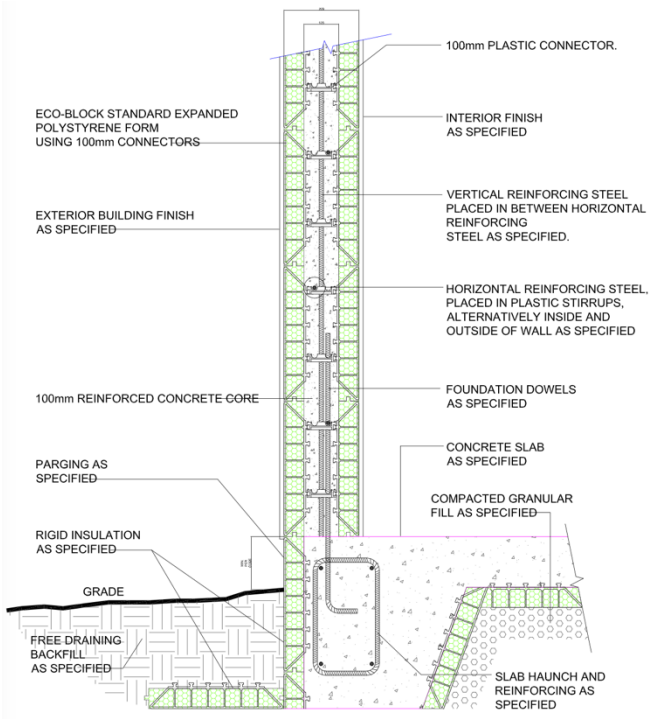
Typical 280 series layout



A typical detail for 230 series perimeter wall.



A typical detail for 280 series perimeter wall.

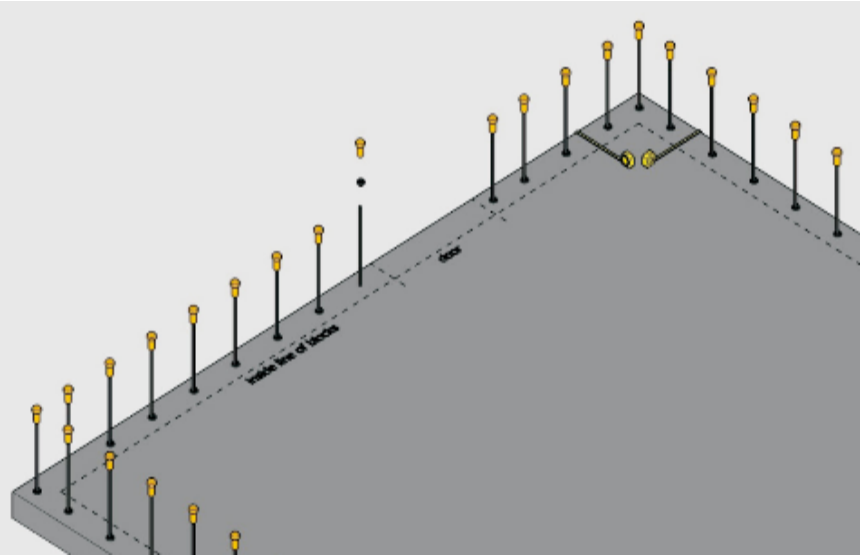


Installing the first course.

It is always easiest to pour the slab first and have a smooth clean surface on which to work. The first course can be places by:

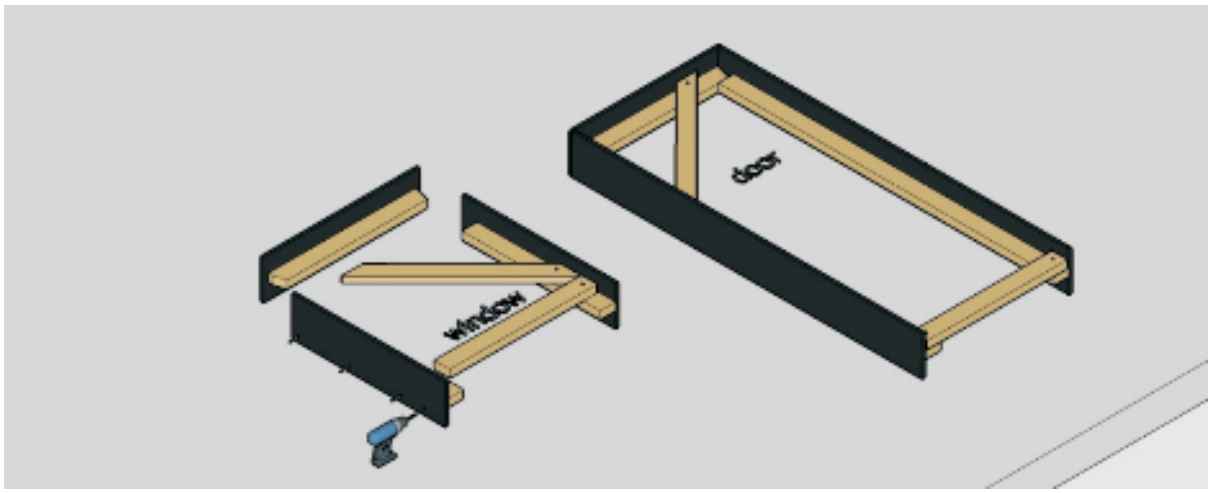
- Fixing a C shaped metal runner to the slab where the inside edge of the wall is to be.
- Fixing wooden 'kickers' to the slab about 500mm long on the inside corners
- Chalk line the inside edge of the ECO-Block line on the slab Any of these three techniques will ensure the first course is in line and in the correct place.

Mark out the window and door openings carefully on the slab. The special starters for the sides of doors and windows should already have been positioned in the slab before the slab was poured.



A typical layout would look like this. A good idea at this point is to slip a 30mm length of plastic pipe over the starters that is has an internal diameter at least 2 times the diameter of the rebar. This will allow the easy insertion of verticals when several courses have been added.

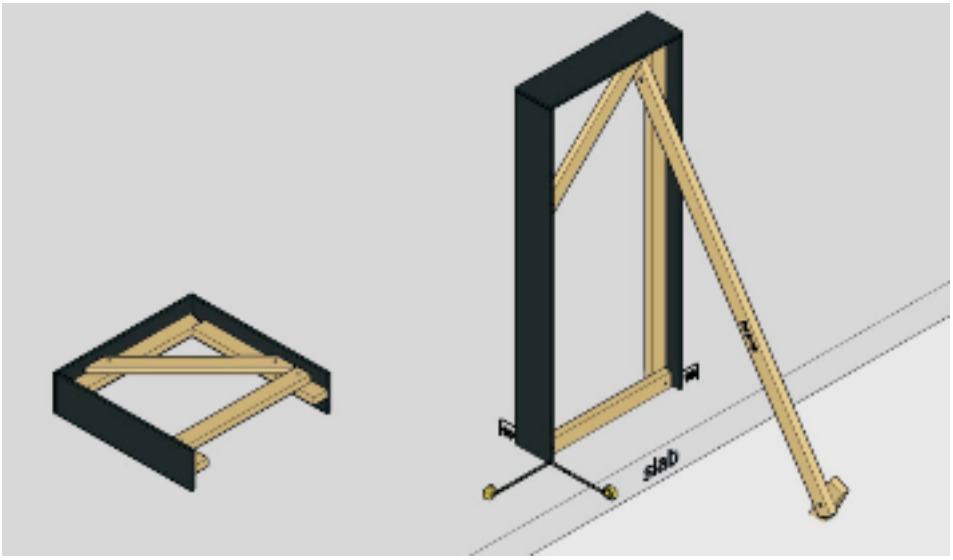
Prebuild the Door and Window framework.



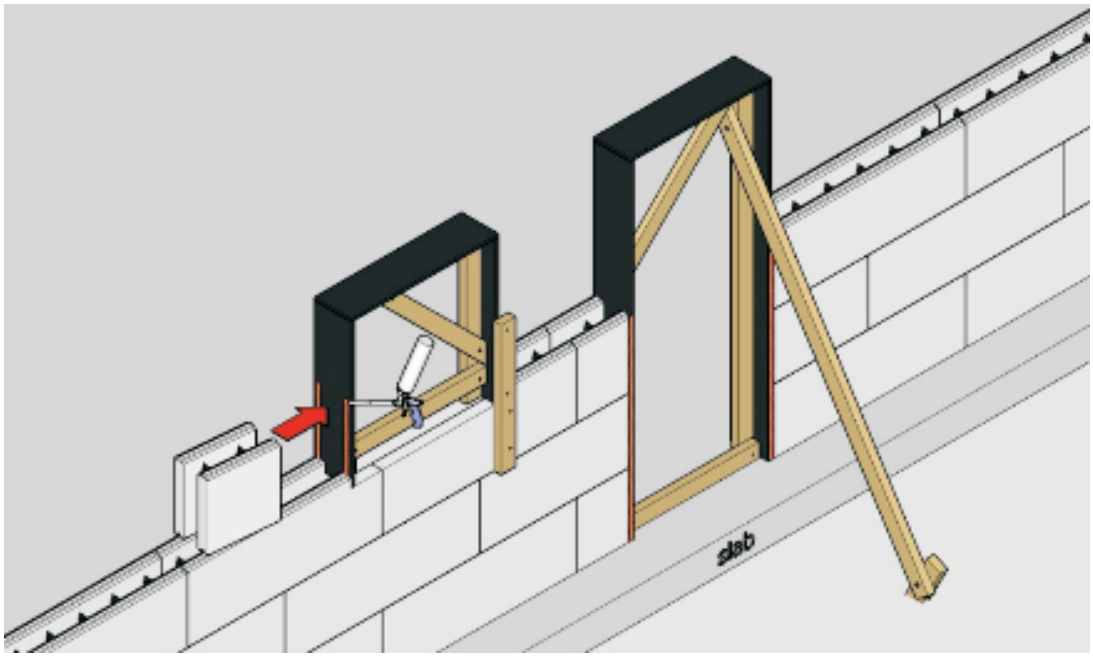
Some hints about door and window framework:

- Use Formply with its sealed coating as it is easy to strip and remove.
- Make the header the full width of the opening and the jambs to fit under the header. The bottom brace should go between the jambs and up 100-150mm from the bottom. When the concrete is poured and cured remove the bottom brace and pull the jambs inward for easy removal. The sill board can be shaped as specified and added when you can see the concrete is full across the base of a window.
- Use screws for bracing for ease of removal after pour.

After squaring the formwork locate and plumb it as below so the walls can be built up to it

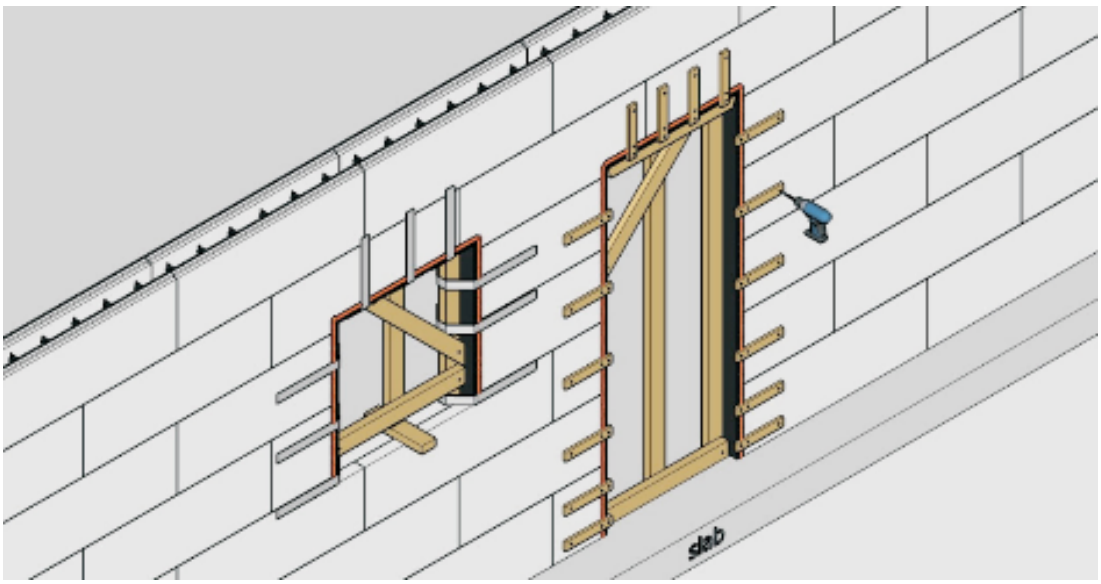


You may find on a windy day that the formwork needs to be held in place while the blockwork is built around it as below.



Accurately cutting the blocks against the formwork means that foaming between blocks and formwork will not be necessary. The props holding the walls vertical are adjustable during concrete pouring and should be on either side of door openings so blocks and formwork don't need to be glued together.

Remove any temporary bracing and plumbing bracing on doors that has been used and add vertical bracing every 600mm. Leave space for exiting and entering from outside at every level. Attach strapping blocks as shown over 2 vertical rails.



Now lay the first course. Starting with the corner blocks, lay the first row. Cut blocks to align the cut ends with openings and wall ends where possible. Otherwise make a staggered joint in the middle of a wall.

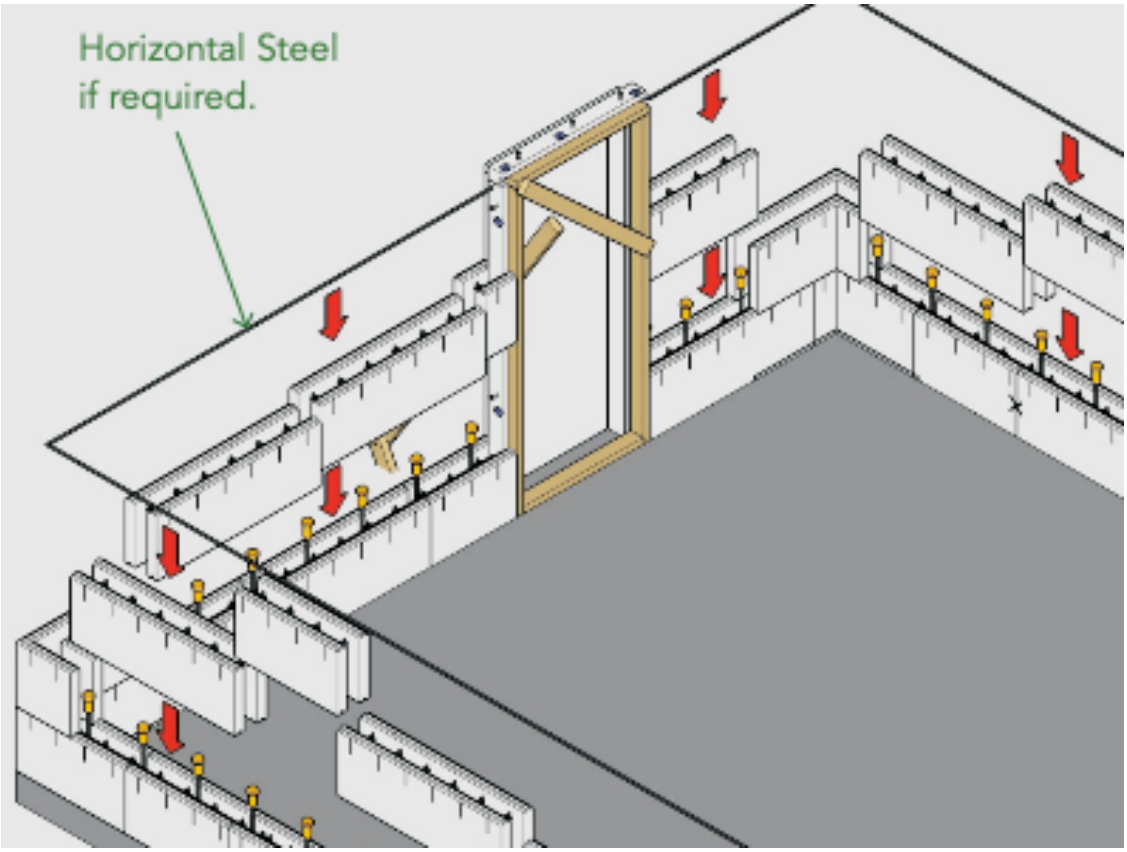
Once the wall is completed all the way around place the rebar as specified. This may necessitate leaving off the top connector (depending on the horizontal spacing of the rebar) Remember: The spacing of the steel is specified by your engineer. It is helpful to mark any cut joints for double checking for gaps and any additional possible bracing before pouring the concrete.

Making sure you stagger the joints, now install the second course. The webs must line up. This ensures ease of application of both internal and external cladding.

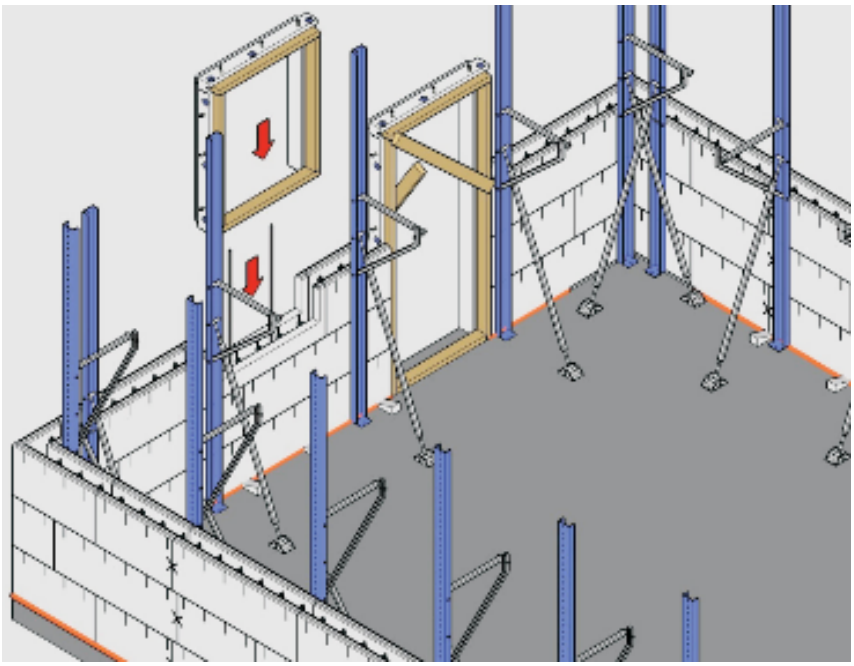
This is the point to check with a stringline that the horizontal line is no more than +/- 5mm for variation and trim or foam to get the line right horizontally.

TOO HIGH – trim the bottom of the first-course block with a keyhole saw and fill the void with low expansion foam adhesive.

TOO LOW – Wedge or shim low point to right height. Foam fills any voids.



Repeat for course 3 and 4 adding rebar as specified although no further adjustment should be needed for horizonal leveling. Course 1,3,5 etc. should be the same and course 2,4 and 6 will be the same as each other but with staggered joints from 1, 3, 5 etc. Window formwork may be needed at this point. Add to starter bars under windows to bring up to sill height and add sill bar as specified before placing window formwork.



Now place the props as shown. Average spacing should be 1.4m but props beside door openings are essential and window opening may also require them. Props must be attached to each course. Use hexagonal screws for ease of application – and they are easily removed stored and used multiple times. Props need to be close to corners (no more than 400mm away

With props, planks and safety rails in place add the vertical rebar by slipping it in from the scaffold to the plastic pipe holders you added at the start. Wire ‘crossovers’ where necessary.

Proceed up to lintel height and add lintels as specified and connect as required. Proceed to top of wall. Your wall should now look something like this and be ready to pour. If penetrations are required for things like air condition ducts or there is a need for pipes to be internal to the wall, ensure they are in place now.

NOTE: If you are constructing T walls and are not using the NZ standard T wall blocks you will need additional bracing on the outside of the T across at least 5 vertical rails on each course.

Now is the time to run through the pre-pour checklist

ITEM	DONE
Does this exactly match the layout in the plans.	
Have I checked for square	
Are the corners and walls all plumb	
Braces and planks all secured. Each course attached to braces	
Door and window framework securely fastened and plumb	
Voids foamed where necessary	
All door and window bracing in place	
Any weak spots/joints identified and reinforced	
Do I have some spare ply gussets in case a bulge develops	
Penetration sleeves in place and braced and glued	
Concrete vibrator ready to go	
Are all vertical bars in position and tied in place	
Are all lintels and beams in place and tied	
Do I have any ledgers? If so are the connections in place and fastened	
Do I have enough anchor bolts for the top plate ready to go – marked position?	
If there is a midfloor are the starters in the right place and tied	
Engineer inspection completed	
Concrete specified and ordered and quantity checked	
Pump truck order and space available. Overhead wires?	

Section 3 More Details

Important Considerations in Construction

The Block

All ECO-Blocks that ARKFORM sells are injection molded from fire retardant polystyrene beads in accordance with the specification contained in the BASF technical leaflet TL 423, January 1993, (see product manual) to produce accurate dimensionally stable blocks. Final density shall be between 27 and 30 kg per cubic metre. Fire Retardant Polypropylene bridges are to be bonded 6mm behind each external surface of the ECO-Block. The blocks may be cut with hand or circular saw, router, or a hot knife. Cut blocks may require gussets and/or foam glue to prevent building or breaking. We strongly recommend Wurth xxx foam glue.

Inspections

All local authorities require sign off on rebar concrete construction before the concrete is poured so that accuracy of placement can be confirmed. All rebar requires 30mm cover and all Chases, holes, cut outs, and recesses in masonry shall be constructed only as specified or approved by the Engineer. Fixing that are 'cast in' to the concrete may also require the polystyrene to be removed to give 30mm concrete cover around the fixings. Inspections are nearly always by a registered engineer or the Council inspector although some smaller residential pours may be signed off by a registered LBP. The inspection needs to be organized in advance of the pour and for some authorities this may be 2-3 weeks before anticipated date.

Transport

Please take care in in transporting and shifting blocks to not damage corners and rebates. Damaged blocks should be used to prevent waste BUT where damage has occurred, they may require additional gusset support. The general rule of thumb is 'better safe than sorry' or 'if in doubt support it out' Before use, blocks are best be kept dry, free from contact with the ground, and completely covered from the weather. Avoid contact with any solvent based product which dissolves polystyrene.

Keeping it clean

The secret to speed, safety and efficiency is a clean site. Removing all concrete splashes and adhesive spills when they occur is key to that. As soon as the pour is completed remove all rubbish and waste from the site so the removal of bracing and window/door formwork can be completed safely and quickly.

Tolerances

Any experienced builder or block-layer can assemble ECO-Blocks supplied by ARKFORM accurately using familiar techniques. This is why we insist on training any installer. Well laid ECO-Blocks should be laid with the following maximum deviations:

Deviation from vertical within a storey = 10mm per 3m height and adjacent storeys intended to be in vertical alignment no more than 5mm

Deviation from line plan: length up to 10m = 5mm max. Any length over 10 m =10mm max

Deviations from horizontal: Should not exceed 5mm up to 10 m and 10mm for lengths over 10m. Tight string lines ensures less deviation.

To ensure that walls that retain the dimensions on the plan all blocks need to be firmly pushed together both horizontally and vertically. All connectors and rails should align exactly (every 200mm) and the shape of the rebates at top and bottom should ensure that. Do not force blocks out of alignment. Where needed Wurth xxx can be used to cement blocks together. Use props to provide stability and avoid wind damage from 3rd course upwards.

Sills, reveals, and rebates.

Sills, reveals, and rebates must follow specific architectural/engineering details if they deviate from the standard diagrams provided in section 3. xxx

The Concrete

To conform to code concrete must be supplied from an approved ready mix concrete plant and all delivery dockets recorded on site. In larger multi-truck pours it is advisable to keep a record of placement as to where each truckload is placed. All concrete should be minimum of 25mpa All concrete will comply with NZS 3104: 2003. Grout grade and strength are defined in NZS 3104 and NZS 3108.

Concrete shall be High Grade Concrete with a minimum compressive strength of 20 MPA at 28 days, having a slump of 140. Concrete shall consist of cement, sand, aggregate up to 10 mm maximum size, water, and plasticiser/water reducing agent. Super plasticisers should not be used. As note previously best practice in using ICFs means the concrete is properly consolidated. This is achieved by using mechanical vibration or rodding with a reo bar with a small rectangular flange welded at the bottom – the flange needs to be able to get past the reinforcing in the blocks. D12 or D16 rebar is adequate for this. Pumping the concrete into the blocks should be a semi continuous operation allowing for consolidation as the pour continues. Each circuit shall be a maximum height of 1.2 metres (we recommend better to have 900mm per circuit) before consolidation of the new layer and reconsolidating previously poured concrete to a depth of 100mm. All concrete work shall comply with NZS 3109: 1997 “Specification for concrete construction.” If the pour is not continuous to the top of the wall then construction joints will follow NZS 3109: 1997. Joints should have a 10mm

thick slurry made of cement sand and water. Cement to sand should be 1:1. Grout specifications are defined in NZS 3104 and NZS 3108.

The concrete pour

Establish your crew and give clear directions as to who is responsible for what.

One person to place concrete (pump operator) Two people to consolidate concrete.

One or two people to level the wall.

Tell the operator how many lifts you will be doing and what slump concrete you want. Lifts of 1 to 1.2 meters are moderate and allow 20 minutes per pour approx. They need to supply through a 50mm nozzle with a right-angle corner at the bottom of the pipe. This prevents concrete falling vertically over distances greater than 3m. Boom pumps can drop the concrete 10m or more vertically and this is to be avoided.

Place the concrete at least 400mm from a corner (never into a corner as it could move the wall). Flow the concrete through the corner.

Create a lift of concrete on either side of the corner before filling the corner—the lifts on either side of the corner act as an anchor holding the corner in place.

Windows filled from one side and let the concrete flow under the window formwork. Stop the pump and move to the opposite side of the window and continue. Some wide windows may require extra concrete placed into the opening at the bottom of the formwork.

Consolidate concrete during each lift.

Monitor walls during and after concrete placement and then adjust turnbuckles to level the walls.

Install anchor bolts if required for roof truss fixing.

Ensure concrete placement at windows and doors is consolidated by hitting the formwork's face with a hammer or slap with a 100x50 piece of timber.

Clean all concrete off footings, slab, walls, and tools.

Before you leave, check to ensure your walls are straight and plumb.

The steel

All steel work is specific so reinforcement bars must be cut, bent, and placed as indicated on the drawings and in conformity with the appropriate sections NZS 3109:1997. Where specified by the engineer reinforcement must be secured with tie wire and the minimum 30mm cover maintained with plastic or concrete spacers.

Bars should be laid in the connector indentations and staggered by horizonal row to allow for easier concrete pour. The bars should be lapped only where detailed, but bars in foundation and slab edge beams can be lapped to suit supplied lengths while preserving a minimum number of laps and staggered where possible.

Fire rating

ECO-Blocks are made from EPS Polystyrene which like timber is combustible although the concrete inside is not. To conform to NZBC C1 the blocks need to be protected from heat sources such as chimneys, solid fuel heaters and flues and prevented from getting to temperatures above 50°C. Individual manufacturers have details on how to conform to the Local Authority guidelines and should be consulted.

Acoustics

As mentioned in the introduction, concrete provided excellent sound deadening in walls while EPS is not particularly good at sound insulation. However, the combination is good

The Blocks at a glance

	100mm Cavity Clock 230 Series	150mm Cavity Block 280 Series	200 mm Cavity block 330 Series
Block Dimensions (Standard Block)	1200 x 400 x 230	1200 x 400 x 280	1200 x 400 x 330
Concrete thickness	100	150	200
Concrete volume per block	0.048 m^3	0.072 m^3	0.096 m^3
Total EPS thickness	130	130	130
Fire rating (concrete filled)	90 minutes	180 minutes	240 minutes
Sound Insulation (lined both sides with 10mm gypsum) Dntw+ctr=	50	55	57
Thermal Insulation U Value	R-4.02	R-4.32	R-4.62
Block Dimensions 90 degree corner	800 mm long side 400 mm short side	800 mm long side 400 mm short side	800 mm long side 400 mm short side
Block weight/m^2 with 9.5mm interior gypsum lining and 6mm plaster exterior	270kg	390kg	510kg

Some helpful hints for concrete calculations

230 Series - 100mm concrete	Divide by 20	One cubic meter fills 20 blocks
280 Series - 150mm concrete	Divide by 14	One cubic meter fills 14 blocks
330 Series - 200mm concrete	Divide by 10	One cubic meter fills 10 blocks

Non-Specific Design

As stated elsewhere, many buildings require specific engineered design. However single and double storied residential and light commercial may be able to fit to a general structural strength as defined below.

The building scope shall be as defined by clause 1.1.2 of NZS 3604:2011 Construction is to be in accordance with NZS 3604: 2011 except as varied over below:

- All external walls shall be ECO-Block walls.
- Internal walls may be ECO-Block or timber framed walls build in accordance with NZS 3604: 2011
- Foundation walls must be minimum 280 series ECO-Block walls or built in accordance with the ECO-Block Manual.
- Floor to ceiling heights can be up to 2.5m.
- Single storey buildings based on 100mm thick or thicker concrete ECO-Block walls.
- Two storey buildings where the lower storey is of 230 series ECO-Block walls and the upper storey including the floor is light timber framed construction conforming to NZS 3604: 2011 OR the lower story is 280 series ECO-Block, and the upper story is 230 series ECO-Block – however this may require a specific design depending on the local authority.
- If 280 series or thick or thicker ECO-Block walls are to be used for the lower and upper walls of two storey construction with a timber floor or concrete floor, a specific design is required for bracing, lintels, foundations and concrete floored.

BRACING REQUIREMENTS

The following tables give the bracing units required for specific areas:

- Wind: Table 5.3 to 5.7 of NZS 3604 :2011
- Earthquake: Tables 5.8 and 5.10 of NZS 3604: 2011.

  The bracing ratings for ECOBlock walls is as set out in NZS3604: 2011 for reinforced concrete walls except that 230 Series ECO-Block walls have a rating of 120 bracing units per meter if the top of the storey in question finishes with a ceiling diaphragm built in accordance with Paragraph 12.5 of NZS3604. A

value of 200 bracing units per meter can be used for lower storey walls having a first-floor particleboard diaphragm built in accordance with Paragraph 7.3 NZS 3604. These strengths are governed by the ceiling diaphragm or the floor diaphragm respectively, as the concrete wall formed is stronger. The minimum length of wall for the above to apply is 1.5 m.

Also note that:

- ECO-Block walls must be evenly distributed around the perimeter of the building otherwise, a specific design will be necessary.
- Internal Timber framed walls can be used to provide bracing resistance to ARKFORM/ECOBlock walls. The bracing resistance provided by these shall be determined by NZS 3604 ;1999 or the latest version of the Gib "Ezybrace System" manual.
- Floor diaphragm connections to ARKFORM/ECOBlock walls shall be as detailed in Figure 9.5 NZS4229: 2013 except that the stringer or a 100mm square timber pack shall be bolted directly to the concrete by cutting away the EPS.
- Ceiling and roof diaphragm connections shall be as detailed in Figs 9.2 and 9.4 of NZS 4229:2013 except that connections shall be bolted directly to the concrete by cutting away the EPS, load bearing members at the top of the wall shall be located directly against the concrete.

Lintel Beams

The table below sets out the lintel beam requirements for a standard one- and two-story house or light commercial construction.

Limitations

It is vital that all loads are transferred directly to the concrete and not the polystyrene. This if any bearer, plate. Fixing etc is not fixed directly to the concrete then fixings must be designed to allow for any extra torque loading due to polystyrene spacing a load away from the concrete where the fixings is not bolted directly to the concrete.

The blocks need to be braced against the wind and site-working load during erection from the third course up, as pour height up to above3 m are achievable on gable ends and IT walls.

Small square or circular opening may be placed at mid depth of beams provided the reinforcement still has adequate cover and the holes are at least 200 mm apart. These shall be no more than 32 mm sq or 26 mm diameter. Penetrations in wall may have the same size, spacing and cover as beams but shall be at least 300 mm away from any wall edge. Design Engineer may permit larger holes subject to specific design.

Internal fixing

Internal sheet linings of plasterboard must be screwed and adhesive fixed in place. Sheet linings are fixed to the heavy-duty fire-retardant bridges which are clearly marked on the external side of ECO-Block panels by using 50 mm long countersunk 6-gauge self-tapping screws.

Where a FFR rating is not required: Spacing requirements are - a maximum of 400mm horizontally and vertically. Edge screws are required to be no closer than 12mm and a maximum of 200 mm from lining sheet edges at. They need to be at 400mm centres. This equates to six rows of screws 400mm apart per sheet.

Where FFR is required, the fixing is the same as for non FRR fixing but an additional screw is required midway between all the edge screws.

The adhesive should be applied in accordance with the adhesive manufacture's instruction. Where this is not stated the standard would be that the adhesive must be applied at 300mm centre's horizontally and vertically either as circular blobs of approximately 25mm diameter and 10mm thick, or as 10mm diameter beads 50mm long.

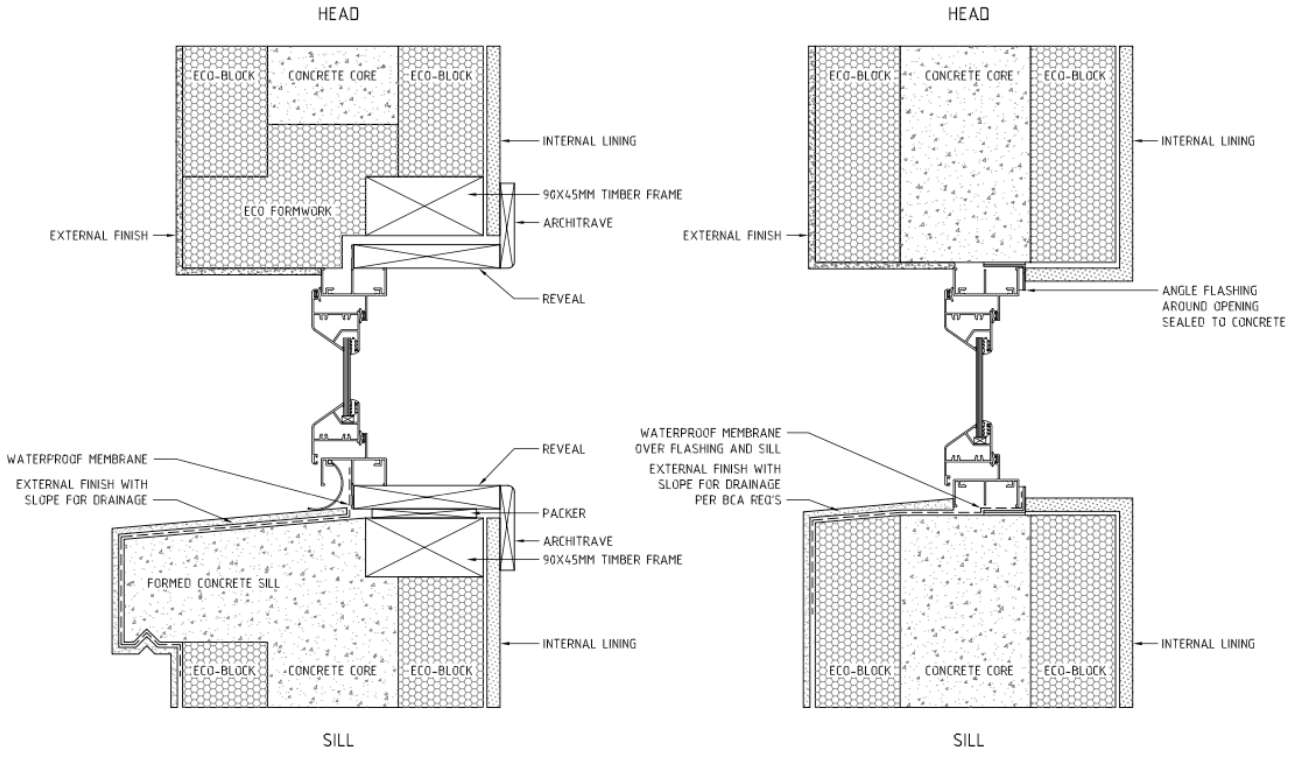
Pipes and wires can be cut into the polystyrene as shown. A hot blade shaped in a loop can form the chaser in the polystyrene. Make sure that the wire is rated for contact with polystyrene. (Usually its purple coated)

Waterproof of retaining walls

Because of its inherent strength ECO-Block can be both a retaining wall and the wall of a downstairs basement/garage. The important part of the process is to make sure that the wall is waterproof. This is achieved by folding the underfloor polythene up the wall by 200mm and taping it to the wall. Then apply an approved waterproofing material (we recommend Ardex 3000 as it is BRANZ approved for polystyrene) and ensure it properly adheres over the top of the polythene and adheres continuously up to above the ground level. Before placing the drain coil and backfilling, sheets of polystyrene (usually 40mm thick) should be placed continuously over the waterproofing membrane to protect it from cuts etc from the scoria backfill.

Waterproofing controls around windows and doors

Waterproofing window and door openings typically involve either external flashing or waterproofing membrane to be applied to the concrete and polystyrene. There are several products that are suitable, but you should consult the plans since the approved system will need variation from the consenting authority if you change it. Below is a typical detail you should be able to find in your plans.



Apply Cladding or render to the exterior wall.

» Eco Block ICF Formwork is a stay in place, Insulating Concrete Forming system (ICF)

» Cementitious materials can be applied directly to the Eco Block surface.

» The ICF surface can be lightly rasped to provide an even surface to accept the render base coat.

» The reinforcing mesh is embedded into the base coat or can be attached directly to the embedded webs in the ICF.

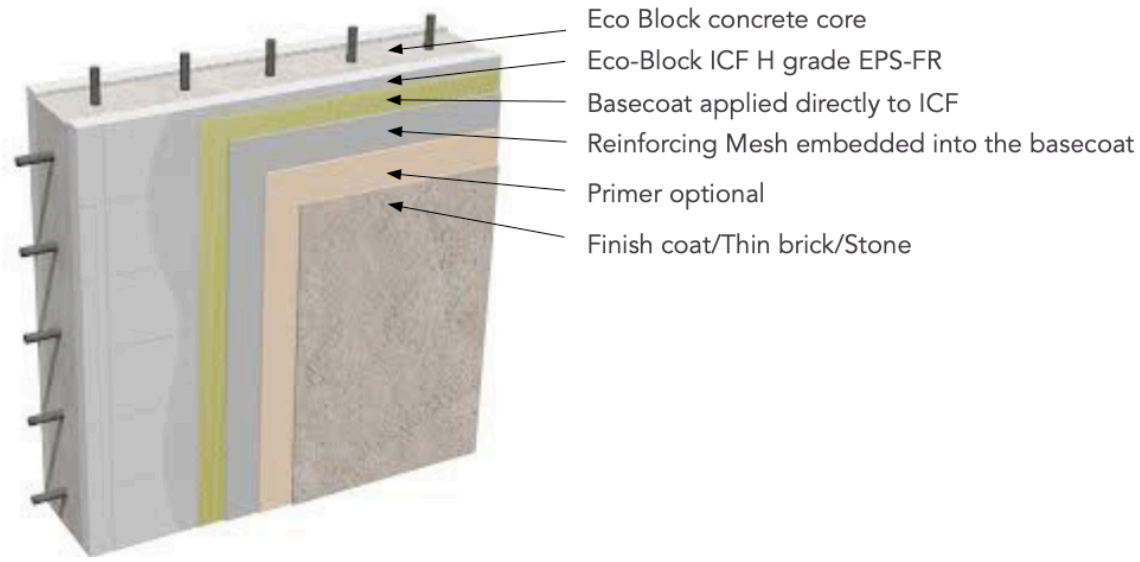
» The finish material such as thin bricks, acrylic render or thin veneer can then be applied to the base coat according to the respective manufacturer's installation instructions***. Craftstone®exteriors are BRANZ approved to 3 stories and can be applied directly to the ECO-Block surface.***

» The attachment of Fiber Cement cladding materials to Eco Block ICF Formwork is permitted ***but only under special circumstances like swimming pool base.***

» Please refer to the below Structural Certification: Cladding connection to Eco Block Walls.

» You must confirm with the Manufacturer of the Cladding for their install procedure and application.

Please refer to the certification below.



Newport
CONSULTING ENGINEERS

18th July, 2019

Structural Certification: Cladding connections to Eco-Block Wall

Newport Consulting Engineers hereby certify that connections between external cladding and the Eco-Block wall system, when fixed in accordance with the specifications below, are structurally adequate for the following wind loadings.

Wind loadings, derived from design wind classifications N1 to N5 as well as C1 to C3 (in accordance with AS 4055 -2012)

and

Design Ultimate Wind Pressures (as derived from AS 1170.2) of 7.18 kPa or less.

Fixing specifications are

- 10 gauge screws, (grade 3)
- Screws must be sufficient length so as to penetrate through the external cladding, as well as the Eco-Block expanded polystyrene foam outer-shell and into the vertical stud channel.
- Screws to be fixed to every second vertical stud channel (i.e. approximately 400mm horizontal centres.)
- Screws to be spaced at maximum 400mm vertical centres.

Compliance is based on

- Load testing results as described in Eco Block LLC Technical Bulletin "Fibre Cement Siding Attachment" (refer attached)
- Load testing results as described in Advanced Materials Testing Services "Load Test Report" dated 8 April 2019 (refer attached.)

The connection hereby meets the requirements of NCC BCA 2019 Part 3.5.4 "Timber and Composite Wall Cladding" and Performance Requirement P2.1.1

Please don't hesitate to contact us if you have any further questions in relation to this report.

Yours faithfully,

MATTHEW YOURELL
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