ICF® tech

advanced construction technology

Building Design with the ICF Tech Walling System




Quick

Cost effective

High performance

Sustainable

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... the next generation Insulating Concrete Form

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ICF Tech Ltd is part of the Litchfield Group of companies which includes Sheerframe Windows and Manse Masterdor doors

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1 Building Design and Setting Out With the ICF Tech Walling System

Setting Out

The ICF wall lengths should be designed in increments of 25mm, and the render or other external finish applied outside of this. For example, a wall could be 5750, 5775 or 5800 overall, but not 5790. This applies to overall external dimensions of the ICF Forms (overall wall, dimension to an internal or external corner etc.) without allowance for external finishes and applies to breaks and returns.

Windows are set into the ICF wall to suit the locations required by the design, subject to:

- Structural engineering design limitations in terms of proximity to corners, pier size relative to the overall wall size etc.
- Openings should be set off 75mm from the internal corner of a Form to take account of the web in the corner of the Form and the depth of FormCloser.

Windows and doors are set into openings created with our FormCloser system which provides for limitation of thermal bridging and retention of concrete during pour. In a rendered wall dimensions between windows can be whatever is required by the architectural design, for example 700mm. Alternatively when the building is clad with brick slips, the pier sizes can be sized to suit the brickwork dimensions required, for example 665mm.

The same constraints apply to internal party walls built in ICFs.

Foundations can be designed with strip footings and trench blocks, or a raft with a rebate around the edges, depending on the ground conditions, or in other ways as required.

Where the floor form is used, the distance from top of foundation to underside of beam and block floors should be the product of 230mm plus X no. Increments of 450mm. Depending on foundation construction, this may be where a ring beam is cast with a slab requiring a toe around the ring beam.

Structural Design

You will of course be appointing a structural engineer for your project. Their responsibility for structural design should include the walls and they should produce drawings and calculations of the reinforcement in the walls. We are happy to provide the names of engineers who understand construction with ICFs if this is of interest, or talk to your engineer to help him understand the concept.

It is important that the engineer understands the concept of ICF walls and how to detail to minimise reinforcement cost. Traditional walls built with load bearing blockwork are typically in the strength range 4.0-7.0N/mm². The external walls of an ICF will be a “lightly reinforced concrete” structure, which normally would be designed in the 20N/mm², which relative to blockwork is overdesign. We recommend a minimum of 20N/mm², especially where ledgers are used for securing perimeter beams for intermediate timber floors.

Due to the nature of the ICF form, concrete cures quicker and with very little cracking, and suffers minimal on-going thermal movement. Historically, the BS that covers reinforced concrete does not recognise concrete in the ICF situation and allow for reduced reinforcement for crack control.

The walls should therefore be justified by the engineer as if they were normal blockwork, with minimal reinforcement. They may be thought of as “poured blockwork”. We normally expect to see the following reinforcement used in our systems:

- H10 reinforcement bars vertically at 1200mm c/c’s, with starter bars into a first or second floor panel at 300-600 centres depending on structural design
- Two rows of H10 reinforcement, one top, one bottom of each wall (a wall being the space between two floors) which link around corners for continuity
- One H10 to cill and sides of openings, with a central additional vertical bar above and below
- Two H10/H12 bars with links at 150/300 centres as a lintol over openings (depending on span and loads)
- A vertical H10 600mm from a corner

Additional reinforcement may be required where the engineer deems necessary. No starter bar reinforcement is required from the foundation unless the wall is retaining.

Should piling be required on site, there is scope for the engineer to design the walls below ground to act as beams between pile caps using our 150mm core WallForm form. Savings can be made in not having to temporarily shutter ground beams, our wall being built of a blinding at a lesser depth than traditional ground beams require.

2 Floor, Wall and Finishes Specification

Ground Floor Construction

ICF walls may be applied to various foundation types. In this case the proposed section shows a strip foundation. We have therefore allowed to commence construct our walls directly off the foundation. The ground floor slab is shown as suspended, but ground bearing is also practical. Ground floor and foundations to be installed by others to the Architectural and Engineering design.

Tolerances

The foundation and floors should be constructed to a tolerance of ±5mm over 3m.

Radon Protection

If a radon protection membrane is required, this should be provided within the foundation design and wrap around the outside of the ICF walls.

Typical External Wall Construction

Constructed with HouseForm ICF Form 250mm wide comprising:

- External flexible render 6-8mm thick or:
- External Brick Slip facing on specialist adhesive and flexible pointing (by others)
- 75mm 30g/l EPS outer layer
- 100mm 20N lightly reinforced self compacting concrete core
- 75mm 30g/l EPS inner layer
- 12.5 or 15mm plasterboard with dry-lined (or skimmed) finish fixed with 10mm adhesive dabs with 4 no. 60mm Drywall screws one at each corner screwed through to our webs all by others. Drylining cavity used for services

External Finish Options

ICFs can be finished in a variety of ways including, but not limited to:

- Flexible acrylic renders and reinforced monocouche render
- Brick Slips and Stone slips
- Tile hanging / Timber boarding

Render Systems:

There are a variety of flexible thin coat render systems available from companies such as

- Henkel, who make Ceresit – a 6-8mm flexible render which comprises:
    - CT87 mortar base layer with CT325 fibreglass reinforcing mesh, 5mm thick
    - CT74 Silicone Decorative Stone Texture topcoat render 1.5 or 2.5mm thick.
    - Colour choice from Ceresit Colour palette, with RAL colours available at extra cost.
- BASF who make Relius – similar to Henkel Ceresit.
- Wetherby Building Systems Weber M1 Monocouche – 12.5mm thick spray or trowel applied with fibreglass mesh reinforcement, for the more traditional monocouche finish

- Sto Render systems have a render for use over external insulation systems which can be applied to ICF forms. Sto also produce a complimentary product called “StoDeco” which is a lightweight decorative moulding system for creating stone cills and heads, decorative features, band courses etc, and can be decorated direct to match the render colour and provide a smooth cast stone effect.
- Any external insulation finishing system designed to work with EPS
- Artcrete (www.artcretewales.co.uk) produce a render system which reproduces the texture and appearance of various kinds of stone and brick finishes, virtually any kind of stone finish can be replicated

Brick Slips:

- There are a variety of brick slip manufacturers specialising in slips including:
    - Celina Klinker
    - Banbury Innovations
- These manufacturers produce slips that are not cut from bricks, and are therefore more cost effective and less wasteful.
- Pistols and other specials for 90 degree reveals are available
- There are a number of adhesive / pointing systems available from people like:
    - Nickerson Adhesives
    - Henkel
    - Ronabond
- Stonework detailing can be made to specific patterns in various forms of cast stone
- Stone slips are available from Bradstone for most of their current range.
- Stone copings can be created in EPS and rendered to provide the colour and texture required
- NB. In some instances the slip companies will not be able to match specific planning requirements, or the cost of cutting slips from existing bricks becomes prohibitive. In such circumstances details are available for a 25mm cavity and a separate skin of brick (or stone) cladding which might prove more cost effective

Tile Hanging / Timber boarding

- Timber battens can be screwed to the webs embedded in our walls which have been designed to accommodate the loadings from plain clay tile hanging.
- Alternative finishes include vertical or horizontal timber boarding, again on battens,
- Whatever effect required can be achieved.

Stone Window Surrounds

- Stone window surrounds can be constructed in one of two ways – use of a proprietary purpose made stone facing system such as by www.sandstonespecialists.com which is supported on stainless steel anchors chemically fixed to the concrete core
- EPS profiles applied to the face of the wall and rendered over.

3 Services Installation and Other Trades

Roof Installation

A wall plate will be bedded into the top of the form, ready to receive trussed rafters. The carpenter may then fix standard roof trusses, secured down with truss clips. Plate straps will not be required, the wall plate will have anchors into the concrete core.

Gable walls will be constructed to either a braced pattern rafter, or the main roof trusses can be installed. Roofing straps at the gables can be screwed to the webs embedded in our forms. For Party walls, the roof should be completed one side and two to three trusses left loose to allow these to be moved to facilitate construction of the party wall. A scaffold to the external and party wall gables is to be provided by the main contractor with access to the apex of the gable for pouring the concrete.

Window Installation

The FormCloser incorporates tracks for three window positions, flush, 50/50 over the cavity / external skin, and check reveal. Windows are positioned using stainless steel clips from the LB Plastics cavity closer system, which can be applied to any window, 30mm back from the front face of the window. The window pushes in against a window stop. A sealant should be applied against the inside of the window stop on sides and head, with an additional bead applied to the sill. A further bead should be applied all round the window internally, and externally after the wall finishes are completed.

For higher code levels we recommend the use of an expanding sealing tape around the windows to ensure low air permeability.

Electrical Installation

Cables can be surface mounted behind standard electrical capping, which can be held in place with fibreglass tape. Alternatively standard PVC tube can be used and again retained by the fibreglass tape.

Electrical boxes may be glued in position with EPS friendly glue or screwed to webs. Deep boxes can be chased into the EPS.

EPS is known to leach the polymers that provide flexibility to PVC cable over a period of years. IEE Regulations require that cables should not be left in contact with the EPS. A basic, low cost polythene tape should be applied to the wall under the proposed cable path.

As an alternative to this, “low smoke” cables can be used, which are unaffected by this effect and available at similar cost.

4 ICF Benefits

- The ICF walling system typically achieves a U value of 0.19 W/m2K when used with 12.5mm dry lining on 10mm dabs internally, and a flexible render system such as Henkel Ceresit. That complies with Code for Sustainable Homes level 4 as standard (as interpreted by NGS GreenSpec).
- Air leakage has one of the biggest impacts on SAP rating performance. Subject to the quality of doors and windows, you should anticipate an air leakage rate of below 2.5 $m^3/hr/m^2$ at 50PA. ICF Tech have to date been tested to as low as 0.74 $m^3/hr/m^2$. The higher levels of the code require even greater control of air leakage, this can be achieved through use of proprietary sealing systems and expanding foam tapes.
- Our system achieves a typical design Y value of 0.016 for thermal bridging, reducing heat loss due to thermal bridging to half the normal level.
- These benefits combine to provide an enhanced SAP rating resulting in a leaner heating design at a lower capital cost, permanently lower running costs for heating and cooling, and increased flexibility in other areas of trade off to reduce costs and achieve the SAP rating you require
- Our ICF system has been assessed for Green Guide on completed projects and given an A+ rating for the 250mm form with 20mm clay brick slips externally and 12.5mm plasterboard internally.
- Recycled materials – the extrusions (FormCloser, FormLok) are made from recycled PVCu. All injection mouldings (the webs, the rebar cradles) are made from recycled polypropylene. Steel reinforcement in the UK is made from 100% recycled steel. Waste EPS is collected and can be reground for re-use in various forms.
- Concrete – our 100mm core typically uses 2/3 of the concrete that other ICF systems require.
- EPS contains no HFC's, CFC's or HCFC's. The blowing agent for expanded polystyrene is pentane which is rated Zero ODP – no impact on climate change or the ozone layer.
- Further enhanced U values are available – the ICF Tech system with the concrete core provides a native U value of 0.19 prior to any internal or external finishes. When taken into account the U value of the wall is typically 0.19. Where it is of benefit, simple solutions are available to upgrade the U value to 0.15 or even 0.11.
- No interstitial condensation occurs within the wall or internal or external finishes during a UK 12 month period.
- Our sister company Sheerframe are able to provide any style of window in PVCu, including foil and factory painted options. Standard windows provide a U-value of 1.7 and a window energy rating category 'C' (BFRC). Sheerframe windows can be provided with category 'A' window energy ratings and U values down to 1.3. Sheerframe have also developed the UK's first 0.8 U value PVCu window. PVCu is expected to receive an A in the new Green Guide.
- Another sister company Manse Masterdor produces a wide range of doors from budget GRP pre-finished doors to engineered timber sandwich pre-finished doors with a U Value of 1.0 with Secured by Design FD30 and FD60 options, and low air leakage options.

5 Revision History

1. 10th October 2008

    a. EPS changed to 30g/l, U value improved to 0.19w/m2K.

    b. Air leakage amended to reflect 2 Bingham Avenue.

    c. Low smoke cable note added to electrical services.

    d. Sealing tape note added to windows.

2. 25th June 2009

    a. Minimum design strength of 20N/mm2 added for use with floor ledger systems.
    b. Delta U value change to Y value.

3. 16th September 2009

    a. Concrete strengths changed to current working practise of a minimum 20N mix.
    b. No attached sketch D053 & D111, references removed.

4. 14th January 2011

    a. Amendments to section 4 ICF Benefits, Y value and sound performance.

5. 9th June 2011

    a. Amendments to section 4 ICF Benefits, new Y value.