# Improving U values by Substitution

GBE

# Green Building Encyclopaedia

I have attached the window and door junctions I have been trying to detail. It would be very helpful if you could take a look and let me know of any comments.

The single skin wall build up we are using consists of:
The build up of the wall consists of:
15 mm plasterboard and skim
140 mm blockwork
150 mm external insulation
15 mm render (to be applied prior to frame installation)

The details are as follows:
- Details A, B & C: Typical window head, sill and jamb details.
- Details D, E, F & G: Door D04 head and jamb details.

Note: D04 consists of a fixed glazed panel facing the terrace, joined to bifolding doors at 90 degrees by a corner post.

We are using Velfac windows, Sunflex bifolding doors (supplied by Velfac) and a Sto external render system.
I have attempted to adapt the manufacturer's standard cavity wall details to suit our single skin structure.
It is the contractor's intention to apply the render system prior to installation of the windows/doors due to the lead in times on the windows/doors.

I have highlighted some areas in red which we are concerned about in particular:

1. How to avoid cold bridging at the junctions?
   We need to ensure an overlap between the external wall insulation and the windows/door frames but unsure of how to fix this to the frame edges, particularly as the frames are to be installed after the render.
2. The fixings from the frames back to the structure?
   Is packing required between the frame and the structure and how close must these sit together to ensure the fixing will work?
3. Are DPCs required at the window and door thresholds?
   Where should these be located?

Wow some complications in there!
I suggest you look at:

Enviroform Solutions Ltd.
http://greenbuildingencyclopaedia.uk/encyclopaedia/products/manufacturer/enviroform-solutions/

External Insulated Render edge details. (designed for retrofit but some solutions work in new build too.

http://greenbuildingencyclopaedia.uk/encyclopaedia/products/systems/thermo-pro/
Tab 2 then scroll down to links to:
Thermo Bead at jambs
http://greenbuildingencyclopaedia.uk/encyclopaedia/products/accessories/thermo-bead/
Thermo Trac at ground level
http://greenbuildingencyclopaedia.uk/encyclopaedia/products/accessories/thermo-trac/
Look at Thermo fascia too in case its needed

There is also a verge gutter system made my another if needed

They also do a column cladding (on their website)
http://enviroform-insulation.com/product/steel-window-posts-lintels/

Swifix Ltd
For attaching all those everyday things to insulated render
http://www.swifix.co.uk

Partel IRL and UK
http://www.partel.ie/products-compacfoam.php
High density polystyrene Thermal break fixings block gap fillers

Iso-Chemic
Sorry about the home page
Trying to appeal to builders or Architects?
Don't they know that we are trying to attract more females to the industry?
Don't hey know Architects intake to Unis is 50% female?
Considerate Contractor scheme has not reached Switzerland yet
So straight to a relevant page
https://www.iso-chemie.eu/en-GB/sealing-solutions/sealing-products/multi-functional-sealing-tapes/iso-bloco-one/#pictures-videos
Insulating weathertight window perimeter sealing

They should keep you busy for a while.
Assuming they are new to you.
Speak later.

Early timber templates to create openings for late windows are common practice.
An alternative is permanent sub-frames (softwood or hardwood made to profile to suit construction and full decoration to all surfaces before installation) built into the wall as it progresses and the insulated render applied up to it, windows fitted to the sub-frames later

We are currently not meeting the required Building Regulations U-values on the floor, wall and roof build-ups.
What can be done to get there?

**Floor:** current proposed construction

- 15 mm floor finish
- 75 mm reinforced screed
- 90 mm Kingspan TF70 Thermafloor insulation PIR
- 150 mm concrete beam and block

Current U value: 0.20
(B Regs requirement 0.13)

We would not be able to change the floor insulation depth easily
but maybe we will need to change the product
Question:
Is there a pre camber on the beams and if so what is the height to be accommodated (less deflection under load)?
Is there a structural topping? What thickness?
Will you use anti-tickle layer and sand for leveling? What Maximum thickness?
Options:
Thermofloor is PIR consider replacing with PUR/foil faced/other blowing agent (these may be expensive)
Reinforced screed is thick, if it could be replaced with thinner component then insulation could be increased in thickness (less labour intensive?)
http://www.fermacell.co.uk/en/docs/Fermacell_Product_Selector_03.2014_ss.pdf
http://www.fermacell.co.uk/flooring_1215.php?type=download&getFile=3904&filename=fermacell_FlooringSystems_FC02200069_UK.pdf Page 10
111 RIGID SHEET FLOORING BOARDS:
Substrate: 150 mm concrete beam and block
Preparation: structural topping? Thickness?
Levelling: to make up difference 165 minus 25 to 38 (2 or 3 layers of 12.5) – 120 insulation
Will you use anti-tickle layer and sand for leveling? What Maximum thickness?
Fermacell levelling compound: 10 to 100 mm
Insulation: (options)
Extruded hard foam XPS DEO 500 kPA maximum 160 mm.
Extruded hard foam XPS DEO 300 kPa maximum 120 mm.
Polystyrene hard foam EPD DEO 150 kPa maximum 90 mm.
Material: dense wood fibre reinforced desulferisation gypsum
Manufacturer: Fermacell, 7 The Priory, Old London Road, Canwell, Sutton Coldfield, B72 5SH
T 0121 311 3480 F 0121 311 1882
E info@fermacell.co.uk W www.fermacell.co.uk
Product Reference: 2 E 22 Fermacell dry flooring element
Thickness: overall. 2 layers 12.5 mm
Accessories:
Floor glue.
Fermacell levelling Compound.
Fermacell Joint filler.
Fermacell countersunk cross slot Screws: 19 mm.
Fermacell floor perimeter insulation strips.
Handling & Storage: Refer to manufacturer

Consider insulation under slung the beam and block concrete floor (easy to add without changing details)
There is a basement version of their product
http://www.insumateltd.com/products/cellar-insulation-ceiling/
Consider composite timber I beam floor with insulation in joist zone (late redesign?)
http://www.steico.com/en/products/construction/steicojoist/overview/
Consider ground bearing aerated insulating concrete floor (late redesign?)
http://www.concretecentre.com/Performance-Sustainability-(1)/Special-Concrete/lightweight-concrete.aspx
http://www.agrodome.nl/2012/f_innovatie.html (sorry annotation in Dutch)

**Floor to wall junction**
Do you need a thermal break in the block wall at floor insulation level to prevent thermal bridges?
http://uk.foamglas.com/en/building/applications/foamglas_perinsul/foamglas_perinsul

**Walls:** current proposed construction
5 mm Sto Render
150 mm EPS external insulation system and fixing carrier?
140 mm Medium density concrete blockwork
15 mm plasterboard and skim and fixing void

Current U value: 0.21
(B Regs requirement 0.18)
The foundations are already poured.
We cannot change the blockwork or the insulation thickness of the Sto products
What prevents changing the blockwork materials to AAC? loadbearing capacity?
What prevents changing the blockwork materials to Extruded fired clay? Learning new details?
What prevents changing the Sto insulation thickness?
Drainage details? Eaves Details? Window/Door Details?
What prevents changing the insulated render material?
From EPS to XPS > PUR > Phenolic > PIR
but could potentially add some internal insulation to the wall build up.
Replace plasterboard, skim and dabs/rails with insulating plaster
(without thickness change or with thickness change)
https://www.diasen.com/sp/en/p/diathonite-evolution.3sp
Would this bring a condensation risk?
Yes, probably, needs a vapour check inside unless you use a hygroscopic moisture transport internal insulating plaster
Diathonite Evolution should manage moisture for you (see above)
Clay or lime should manage moisture but adds no insulation
Or
Calcium silicate insulation board on moisture permeable 'adhesive' and moisture permeable finish
http://www.ecologicalbuildingsystems.com/UK/Products/Calsitherm-Climate-Board

**Wall to roof junction**
Are there any linear thermal bridges to resolve?

**Main Roof:** current proposed construction
U value: 0.15
Roofing slates
19 x 38 mm sw battens
50 x 38 mm sw counter battens
50 mm AIM warm roof system stone wool 'Rockwool' overlay board
Glidevale Protect VP400 Type LR roofing underlay
150 mm trussed rafters
2 x 75 mm glass fibre 'earthwool rafter roll' between trussed rafters
12.5 mm plasterboard and skim
(B.Regs requirement 0.13)
We could potentially put a 'Kingspan' insulation in the roof instead of the 'earthwool'
and as this is not breathable we would then need to add a VCL layer.
Stone wool and glass fibre are not breathable
(i.e. Breathing construction) but they are moisture permeable.
Breathing construction also requires hygroscopicity
(absorbs moisture vapour from the interstices into the fibre helping it to insulate and releases when conditions are right)
Stone wool and glass fibre are not hygroscopic but hydrophobic
(rejects moisture from fibre keeping it in the interstices reducing its capacity to insulate)
Stone wool and glass fibre both need a vapour check layer always
Stone wool and glass fibre can be oversized and fit closely to timber sections
and any moisture in interstices could affect the timbers
Replacing stone wool fibre or glass fibre with PIR or PUR insulation

- Increases thermal resistance, improves U value with same thickness
- Is often cut to size and not resilient enough to enable a tight fit to timbers and remains gappy
- PIR and PUR are vapour resistant and so will concentrate moisture vapour at those gaps at timbers

- PIR and PUR both need a vapour check layer always

Stone wool, glass fibre, PIR and PUR

- offer no decrement delay to solar radiation heat and let heat in easily
- offer resistivity to heat escaping
- let heat in but do not let it out it lake will lead to overheating

Consider: Cellular glass, dense wood fibre, cork board, cellulose fibre flake, recycled newspaper

- Cellular glass not practical in timber frame (expensive)
- Dense wood fibre rigid board (above rafters)
- http://www.ecomerchant.co.uk/roofing/insulation/wood-fibre-rigid.html
- Dense wood fibre flexible batts (between rafters)
- http://www.ecomerchant.co.uk/steico-flex-wood-fibre-insulation-575mm.html
- Cork board (at rafter level)
- Cellulose fibre flake (at ceiling level) economical
- http://home.btconnect.com/penycoed/main.html

I am sorry to inundate you with information but if you do have any suggestions (which wouldn't increase the contract costs unduly) they would be gratefully received!

I am glad you did without it I could not respond in detail

I know very little about price so you will need to check out the alternatives

Do you want the Thicknesses of materials working out for you?

I have just created a ceiling U value calculator, I could develop it for these applications

**© GBE NGS ASWS Brian Murphy aka BrianSpecMan**
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This may be helpful if not comprehensive

**Insulation thicknesses required to achieve a U-value of 0.2W/m²k**

| | |
|---|---|
| 235mm | Cellulose fibre |
| 220mm | Glass wool fibre |
| 210mm | Rock wool fibre |
| 190mm | Extruded polystyrene foam |
| 185mm | Polyurethane foam with $CO_2$ |
| 180mm | Expanded polystyrene |
| 150mm | Polyurethane foam with pentane |
| 135mm | Phenolic foam |
| 130mm | Polyisocyanurate foam |
| 120mm | Phenolic foam with foil face |
| 95mm | Polyisocyanurate foam with foil face |
| 75mm | Aerogel blanket |
| 25mm | Vacuum insulation |