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Designing & building a Passivhaus using standard UK building techniques

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A technical case study of the Denby Dale Passivhaus

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Key features

- Detached 3 bed dwelling with integral two storey sun space, total floor area 118m^2
- One of first certified Passivhaus buildings in the UK
- First cavity wall Passivhaus in the UK
- £141K budget
- Completed April 2010

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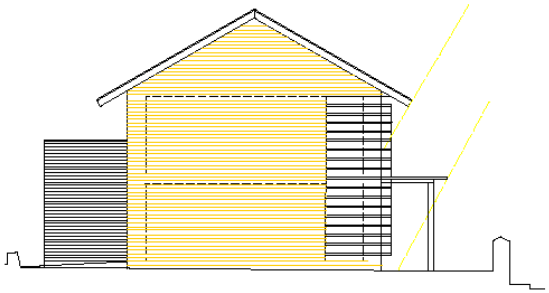
Elevations

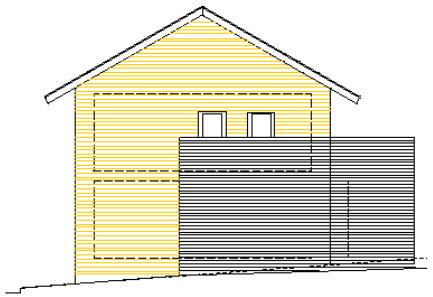
NOTES

ELEVATION TO ACCESS ROAD (south)
1:100 th SCALE

ELEVATION TO BACK GARDEN (north)
1:100 th SCALE



ELEVATION TO SIDE (west)
1:100 th SCALE



ELEVATION TO SIDE (east)
1:100 th SCALE

L003

Outline Planning Approval: 2006/64878
Planning Approval: 2008/

Proposed detached dwelling
at the rear of 373 and 371 Wakefield Road
Denby Dale West Yorkshire

Client: Geoff and Kate Tunstall
373 & 371 Wakefield Road Denby Dale West Yorkshire HD8 8RP

Derrie O'Sullivan Architects
28 Imperial Road Huddersfield HD3 3AF
tel: 01484 544850 fax: 01484 327 616
e.mail: derrie @ mtlworld.com

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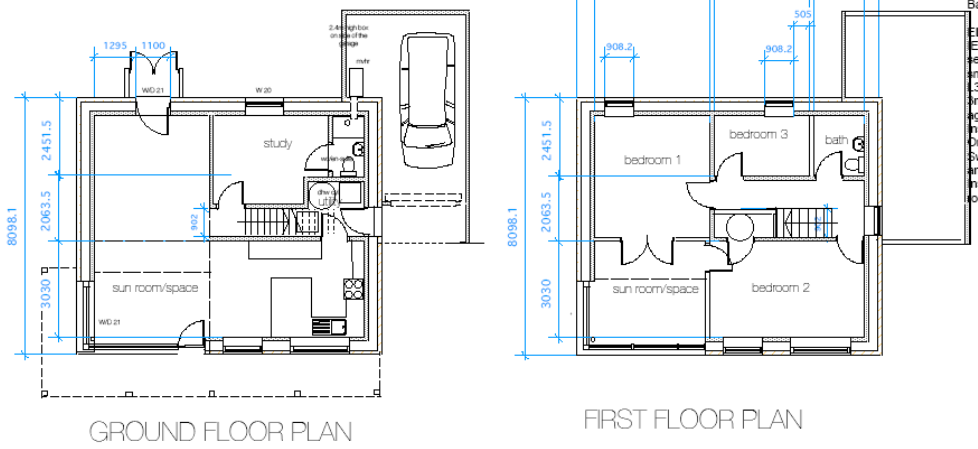
Floor plans



GROUND FLOOR PLAN

FIRST FLOOR PLAN

NOTES

MECHANICAL VENTILATION:
Mechanical Heat Recovery installation **MVHR** 'Thermos 200' manufactured by Paul and supplied/installed by the Green Store to provide full ventilation to all spaces and to excede the minimum Approved Documents Requirements of Kitchen 60 litres/second, Utility 30 litres/second, Bath and ensuites 15 litres/second.

ELECTRICAL INSTALLATION: To conform to IEE etc regulations. Install self contained - seperate circut - interlinked mains operated smoke detection and alarm to BS5839 PART 1 - L3 standard, located in all circulation areas within 3m of bedroom doors, 7m from habitable rooms; agree positions on site with LA Building inspector.
One smoke detector per storey.
Switches and sockets to be not less than 450mm and not more than 1200 above floor level.
Install energy saving light sockets at a ratio of 1 room in 3.

STAIRS: Main Staircase to be made of timber with timber treads. Dimensions to be taken on site - total height approximately 2750mm with 16 number risers @ 171mm and goings @ 300mm with maximum angle of 38 degrees. Landing to have same going as width of stairs, ie 900mm between wall and balustrade/handrail. Minimum headroom to be 2.0m above pitchline, handrail to both sides of stairs to be 900mm above pitchline. Trimmers; 2 x 50 x 150sw. Guarding/balustrading to the stairs and landing to be plywood panels or plasterboard with skim finish on 50 x70mm framing and hardwood handrails.
Balustrade at top of stairs to be 900mm above the floor; Balustrade to the landing to be 1100mm above the floor. Opening between the balustrade and the handrail to be a maximum of 95 mm spacing.

PLUMBING INSTALLATION: Install sanitary fittings as depicted on the plan. All sinks,showers,baths and basins to have re-sealing traps.Provide rodding eyes at all changes of direction.Wastes to basins to be 32mm upvc. All other wastes to be 32mm. to connect into existing underground drain. Provide access to base of soil stacks and connect branches with slow radius bends. UPVC soil vent pipes to have an automatic air admittance valve in accordance with manufacturers instructions or terminate 1.0m above the the uppermost first floor windows. Rainwater down pipes and gutters to be zinc. Fit fire proof collars in pipes in floor.

HEATING INSTALLATION: Background/backup heating dhw to be provided by a Commissioning of Heating and HWS Instalation; Inspection and Completion Certificates to be issued and be made available to the employer and the Building Control Authority

L002

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Planning Approval: 2008/

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Why cavity wall?

Advantages

- Familiar method for UK builders
- West Yorkshire planning requirements
- Thermal mass – acts as a heat store
- Budget restraints

Disadvantages

- Harder to get air tightness detailing correct
- Harder to test as you are going along

Passivhaus standard

Air-tightness	0.6ach @ 50Pa
Surface temp (windows)	>17degC
Summer overheating	Max 10% >25degC
Vent	~30m^3/hr.person
Heating	15kWh/m^2a
Primary Energy	120kWh/m^2a

Comfort

Comfort

Comfort

Comfort

Energy

Energy

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Key features of Passivhaus

- Super insulation
- Minimising thermal bridging
- Stringent airtightness measures
- Minimising thermal bypass

- Mechanical ventilation heat recovery (MVHR)

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Super insulation

Target: U-value of less than 0.15 W/m2K for external envelope.

- Cavity (300mm) fibreglass batts
- Roof void (500mm) fibreglass quilt
- Under groundfloor (225mm) polyfoam insulation.

Target: combined U-value of 0.8 W/m2K for windows

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Minimising thermal bridging

Measures taken to minimise thermal bridging at junctions:

- Insulation in cavity going right down to the strip foundation
- Use of lightweight aerated block below ground level
- Basalt resin cavity wall ties
- Positioning of windows in middle of insulation

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Stringent airtightness measures

Leakage target: less than 1m^3/h/m^2.

Measures include:

- Wet plaster coating to interior walls
- Floor slab carried across the top of the blockwork of the inner leaf of the wall
- Attention to airtightness detail around window and door openings and junctions between floors, walls and roofs.

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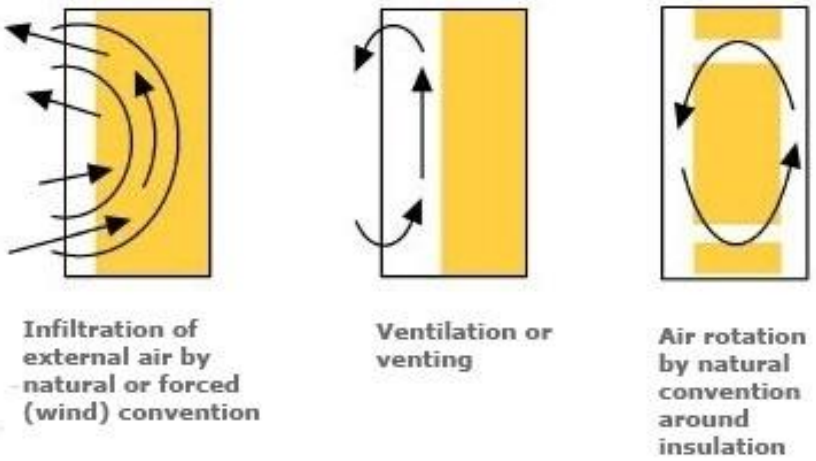
Minimising thermal bypass

Minimisation of air movement around insulation in cavity wall and roof void through windtightness detailing



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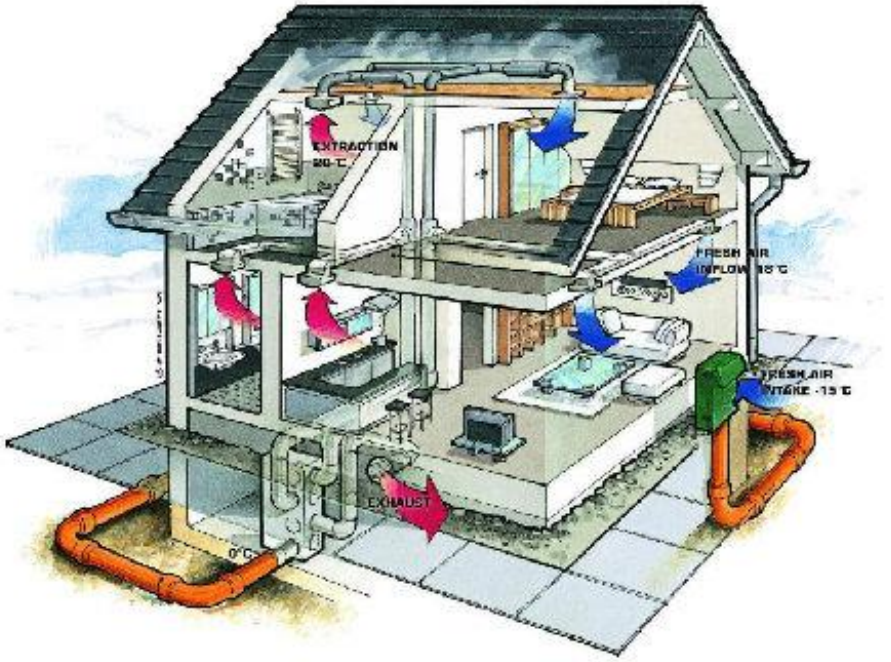
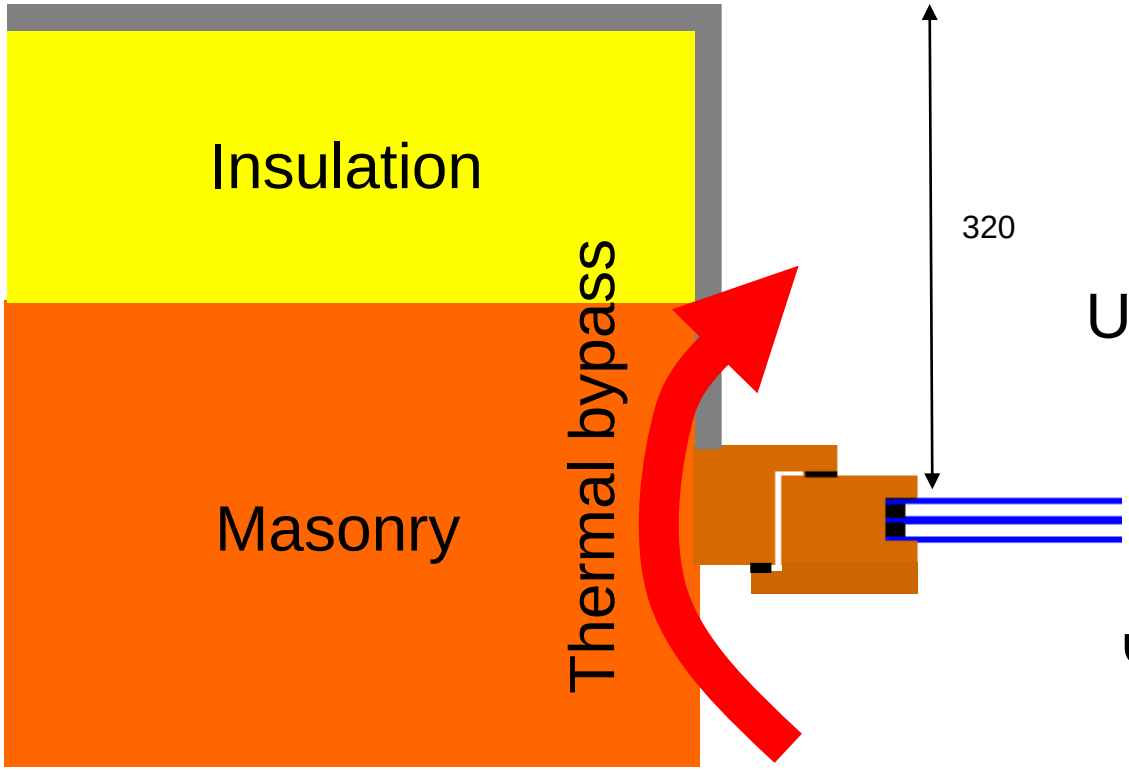
Mechanical ventilation with heat recovery (MVHR)

The PAUL Comfort Ventilation system used can transfer up to 90% of the heat from the outgoing air to the incoming air.



The effect of window position and insulation wrapping

Uw inst.* = 1.84 W/m²K



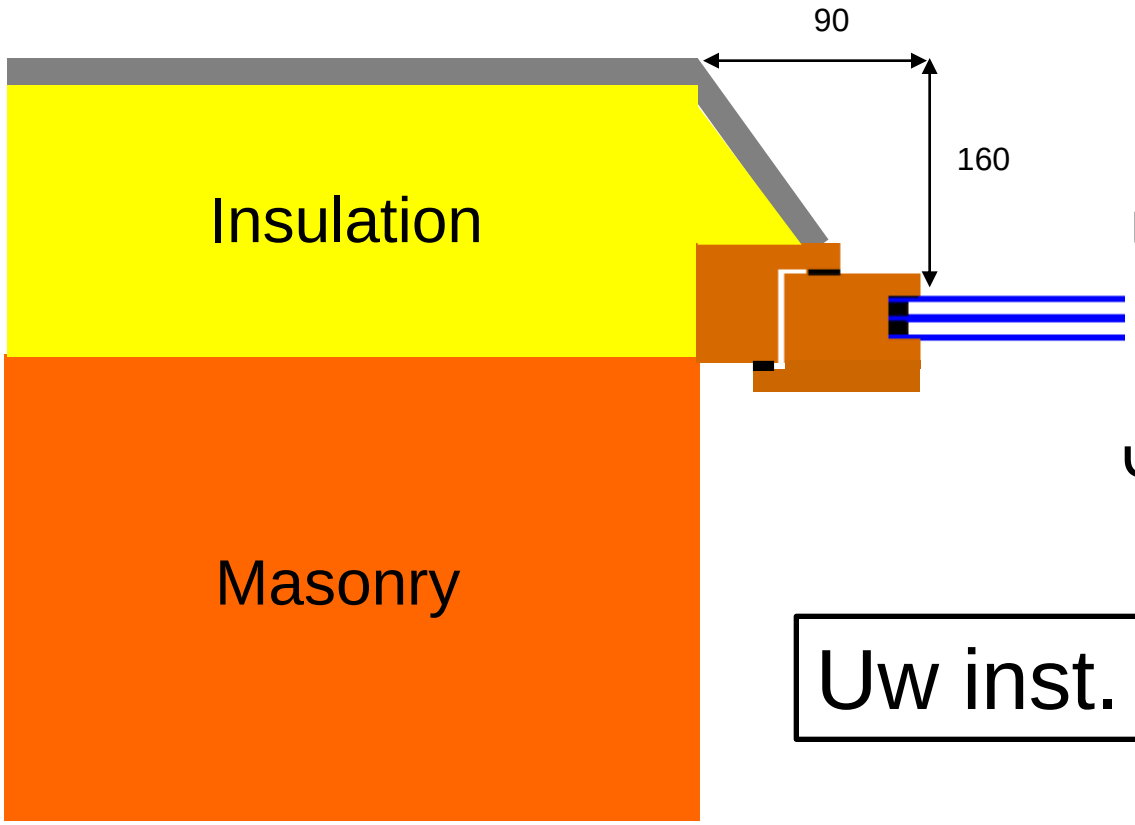
Uw = c. 0.8 W/m²K

Ψw = 0.26 W/mK

Schematic drawing based on an example from proceedings of the Passive House Conference 2006 for renovation of typical German construction using PH standard window. Freundorfer, Kaufmann and Krause

*1m x 1m window

The effect of window position and insulation wrapping



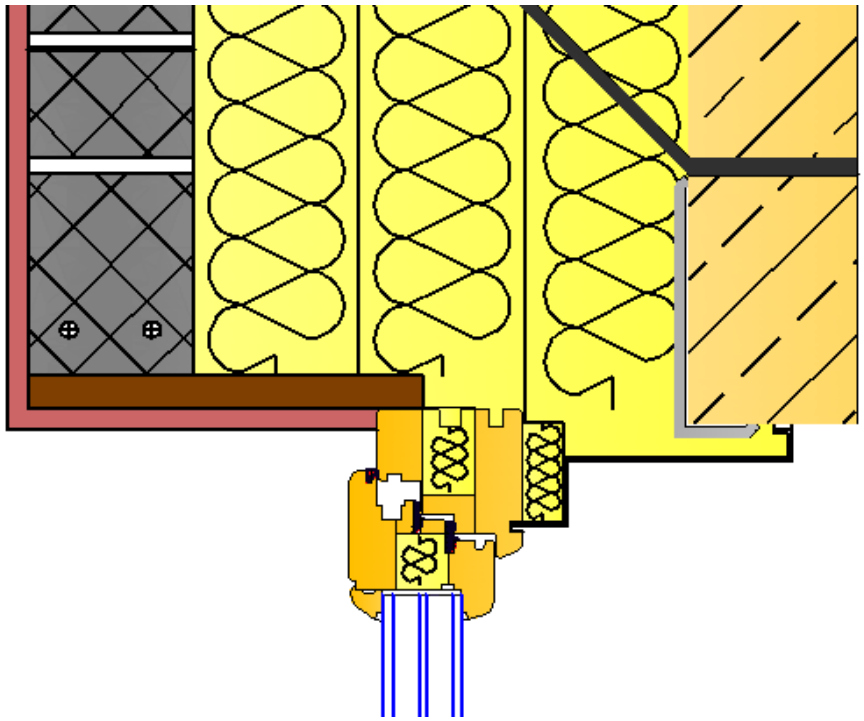
U_w = 0.8 W/m²K

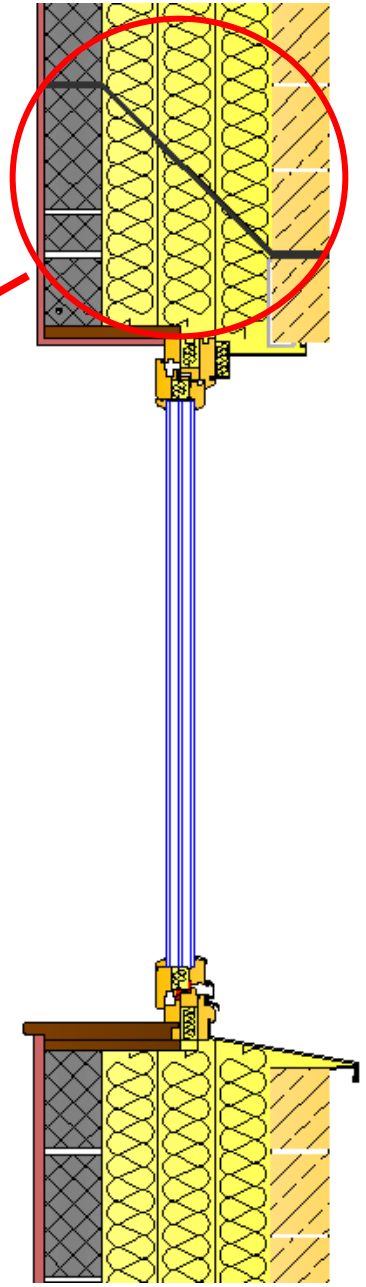
Ψ_w = 0.00 W/mK

U_w inst. = 0.8 W/m²K

Schematic drawing based on an example from proceedings of the Passive House Conference 2006 for renovation of typical German construction using PH standard window. Freundorfer, Kaufmann and Krause

Optimising window performance





Installed U Value 0.75 W/m2K

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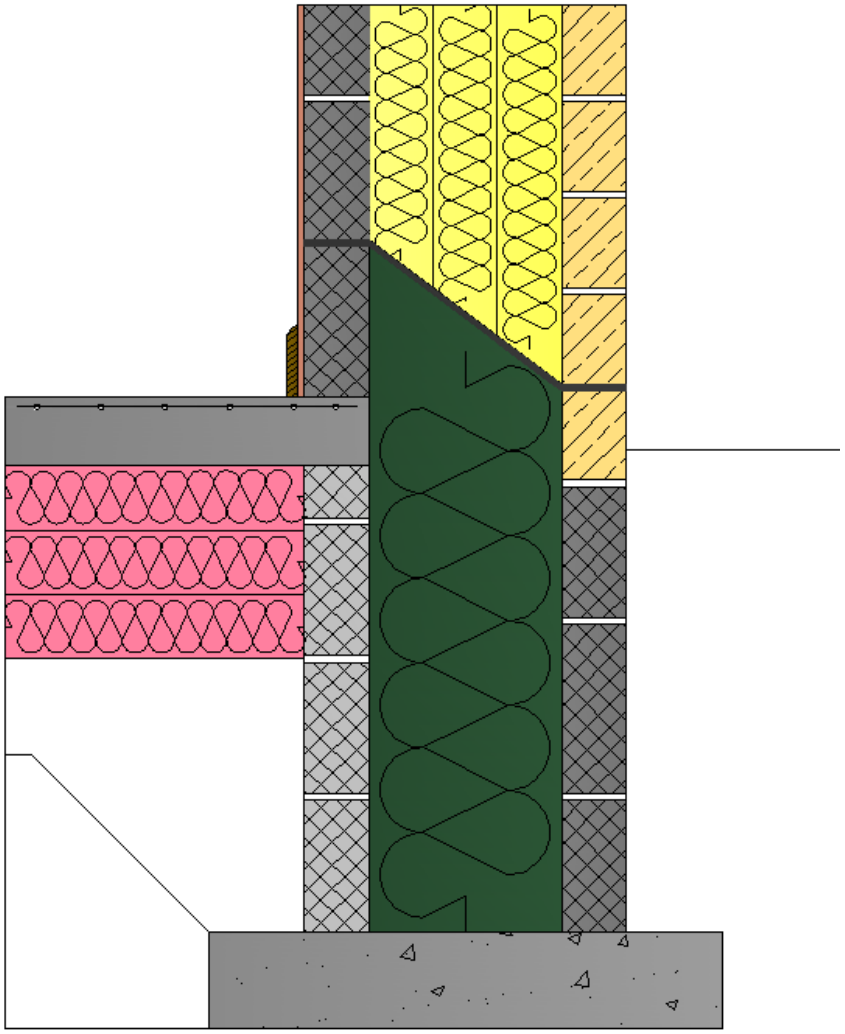
Strip Foundation and Ground Floor Slab to External Wall Junction



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Performance Results

- 0.31m3/(hm2) @ 50Pa
- Part L requires 10m3/(hm2) @ 50Pa

- 0.33 ac/m2/hr
- Passivhaus requires 0.6ac/m2/hr

- Space heating need 13 KWh/m2/annum?
- Passivhaus requires 15KWh/m2/annum

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Certification Documents

●WARM: Low Energy Building Practice ***awarded this building the certificate:***

Quality Approved Passive House

The certification is based solely on design data proofs and specifications by the client given to the ●WARM: Low Energy Building Practice *for the purpose of certification.* ●WARM: Low Energy Building Practice *has checked and approved energy balances according to these data.*

Quality assurance of construction work was not subject of this certification. By this certification ●WARM: Low Energy Building Practice *takes no warranty for any faults in design and/or execution of the building.*

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On site lessons

- The necessity for clear well thought through and consistent detailing
- The need for open communication channels between the design and construction sides of the ‘team’
- Imperative to share all knowledge of ‘why and how’ between all involved, from designers to site operatives
- There is no substitution for care with pride

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A very British Passivhaus

Dated: 30/04/2010

Green Building Store has succeeded in adapting the Passivhaus approach to British traditional building methods - by creating the first certified Passivhaus in the UK to use traditional cavity wall construction. The Denby Dale Passivhaus project (www.greenbuildingstore.co.uk/denbydalehouse) in West Yorkshire has today (Friday 30th April 2010) received its official Passivhaus certification.

The project - built by Green Building Store's construction division Green Building Company - has pioneered the combination of low energy Passivhaus methodology with standard British cavity wall construction and building materials. Passivhaus design originated in the 1990s in Germany and there are now over 10,000 certified Passivhaus buildings in the world. Typically, Passivhaus buildings are built using timber-frame construction or block work wall with external render.

Bill Butcher, Director of Green Building Store, said:

Latest News

How to build or retrofit your own Passivhaus
20/05/2010
Green Building Store offers advice for people wanting to build or retrofit to Passivhaus standards
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A very British Passivhaus
30/04/2010
Green Building Store adapts Passivhaus design to British building techniques with the UK's first cavity wall Passivhaus
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Bill Butcher

The Denby Dale home project draws to an end

Passivhaus diaries, part 21: Certification!

30 April 2010 | By Bill Butcher

PRINT EMAIL SHARE COMMENTS (2) SAVE

Today the Denby Dale Passivhaus gets its official certification - one of the first three projects to be certified today by Pete Warm of WARM: Low Energy Building Practice (and verified by the Passivhaus Institut in Germany). We had a party at the house on Monday in anticipation of this, attended by all the team (architect, clients, builders) as well as supportive local councillors and officials from our progressive council, Kirklees, presided over by the mayor of Kirklees herself. Much cake was consumed and tea drunk and it was great to be able to see the house looking lovely and fresh and bright, without scaffolding and building site mess. There will be an official Passivhaus plaque and certificate coming our way soon and it will be very nice for me to wave a copy of it at the Passivhaus conference in Dresden when I go there in May.

Certification processPassivhaus is a clearly defined standard for low energy building developed by the Passivhaus Institut in Germany. There is now a handful of Passivhaus certifying bodies in the UK - BRE, Inbuilt, Scottish Passive House

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