Project Documentation
South Devon College Passivhaus

1 Photograph

Three bedroom demonstration house at South Devon College, Paignton, UK

1.1 Building data

Year of construction	2013	Space heating	15 kWh/(m²a)
U-value external wall	0.111 W/(m²K)		
U-value basement ceiling/floor	0.119 W/(m²K)	Primary Energy Renewable	
U-value roof	0.058 W/(m²K)	Generation of renewable energy	
U-value window	0.87 W/(m²K)	Non-renewable Primary Energy	108 kWh/(m²a)
Heat recovery	85%	Pressure test n50	0.6 h-1
Special features	Solar PV		

1.2 Brief description of the construction task

South Devon College, as part of a larger project called the South West Energy Centre, commissioned Lacey Hickie Caley Ltd. (LHC)to design a demonstration house on the same site. The original brief was to use the Code for Sustainable Homes Level 5 as the design standard, but the client was persuaded that the Passivhaus Standard would offer a future-proof building.

Rob Rickey was an employee of LHC and a Certified Passive House Designer and produced a compact three bedroom design that would be a familiar product for local housebuilders. The main contractor, Kier, applied themselves to delivering a successful Passivhaus project.

1.3 Responsible project participant, certification ID, Passive House Database ID, name and signature of the author of the project documentation

Architect	Rob Rickey, on behalf of Lacey Hickie Caley Ltd.
Implementation planning	Contracts Mgr. Nick Rowe and Project Mgr. Andrew Ash
Building systems	Totus Engineering
Structural Engineering	Hyder Engineering (now Arcadis)
Building Physics	Rob Rickey, on behalf of Lacey Hickie Caley Ltd.
Passive House project planning	Rob Rickey, on behalf of Lacey Hickie Caley Ltd.
Construction management	Kier Group http://www.kier.co.uk/
Certifying body	Warm Associates http://www.peterwarm.co.uk/
Certification ID	5001
Author of project documentation	Rob Rickey, on behalf of Lacey Hickie Caley Ltd.
Date, Signature	17.11.2016

2 Views of SWEC Passivhaus

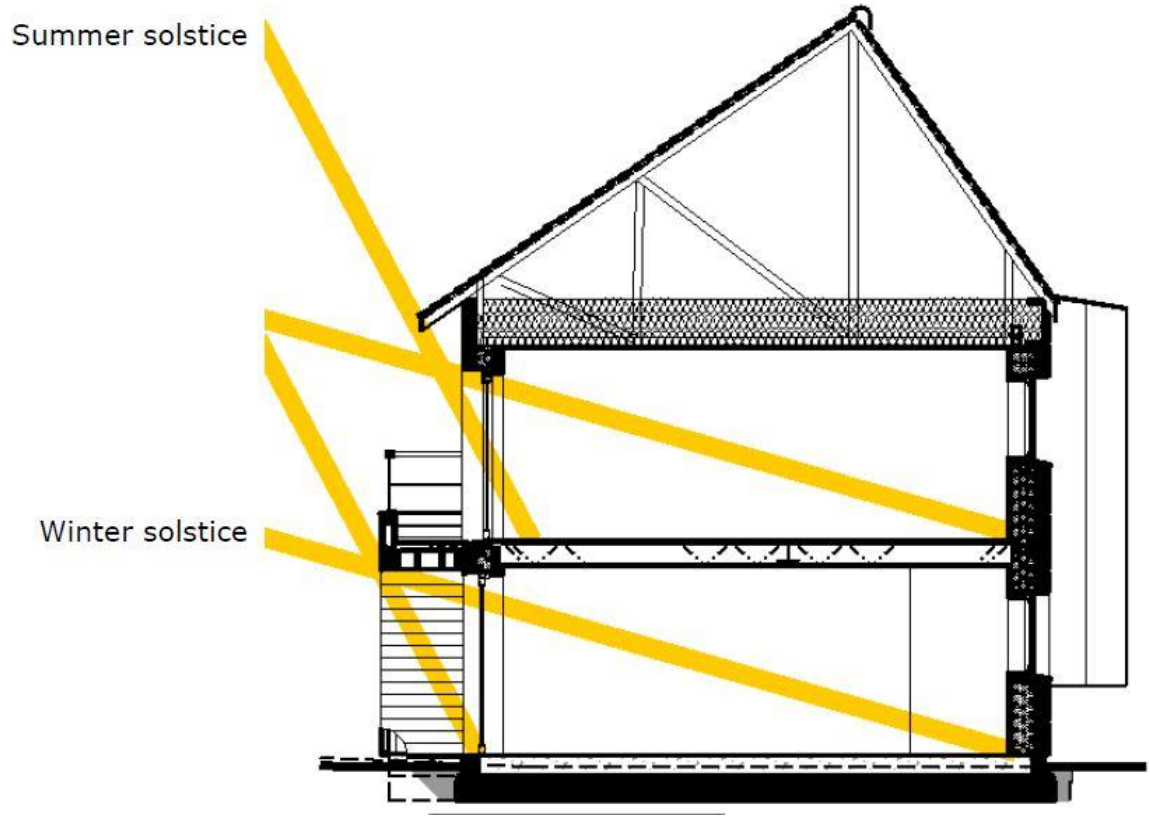
View from South West showing small balcony

View from South East

View from North

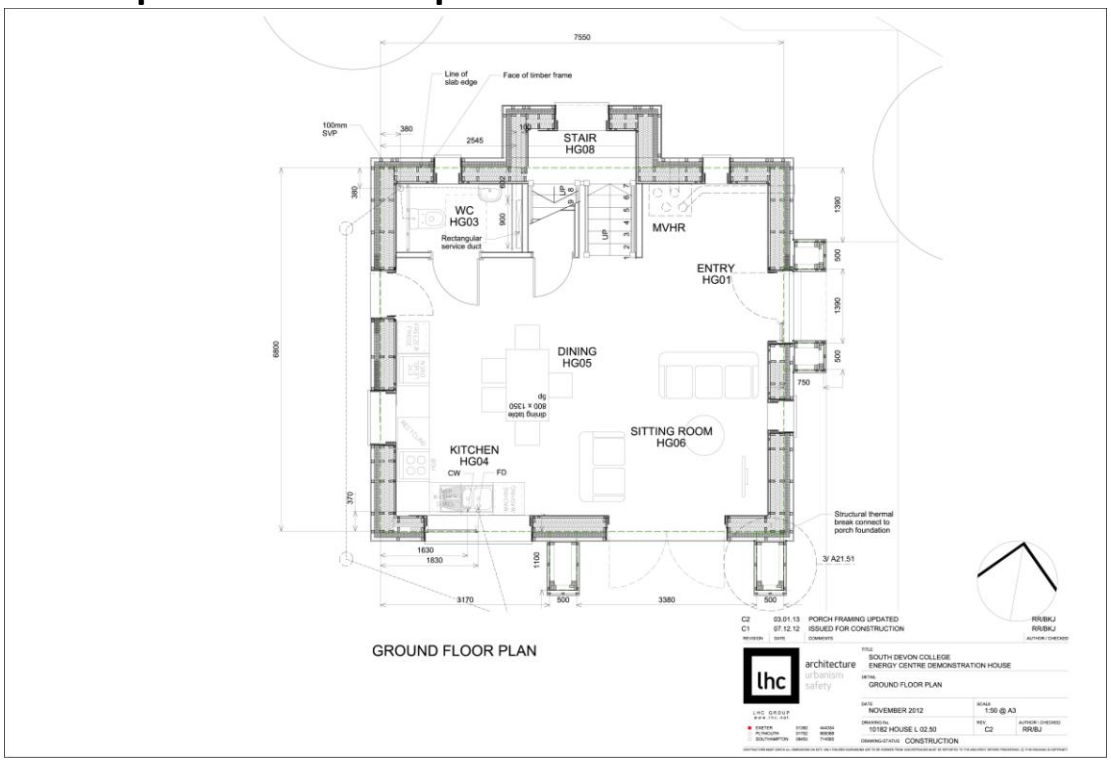
Interior view of ground floor

3 Sectional drawing with description – dating from implementation planning

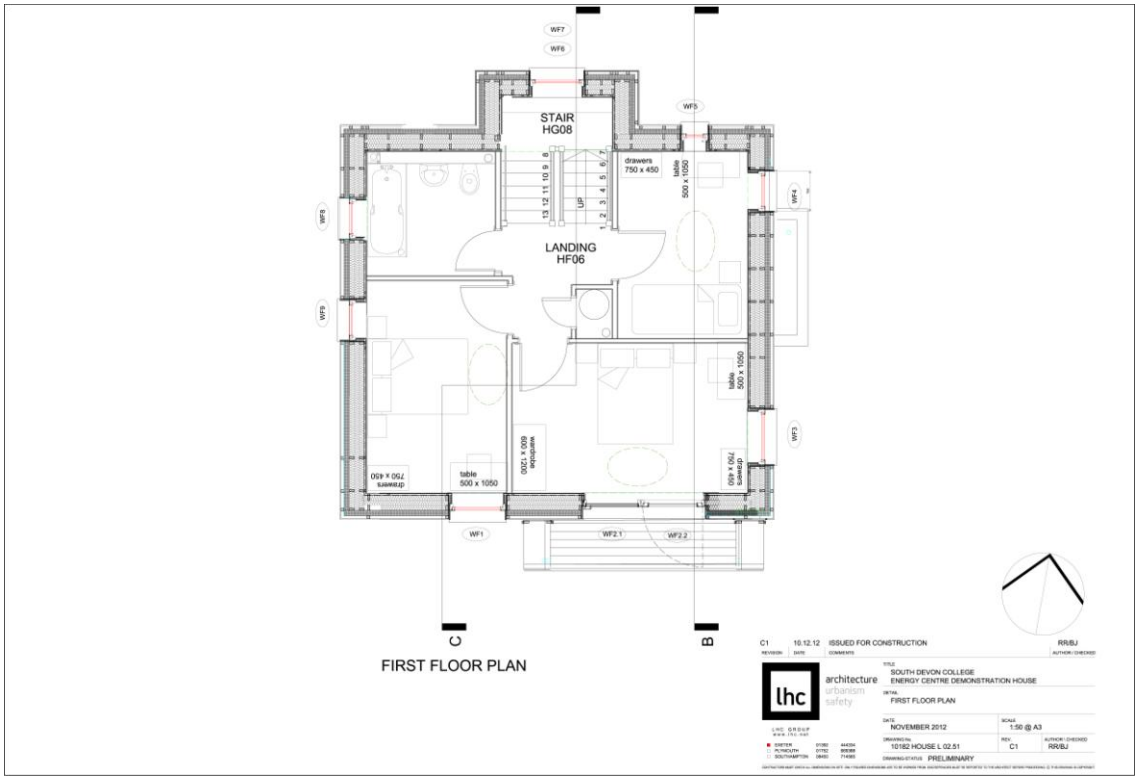


Section showing analysis of solar access and shading. The section also shows the continuity of insulation from the Isoquick foundation insulation, through the walls to the loft. The original design had a warm roof with sloping ceilings, but the form heat loss factor on this fairly small detached house made compliance unnecessarily expensive.

4 Floor plans with description

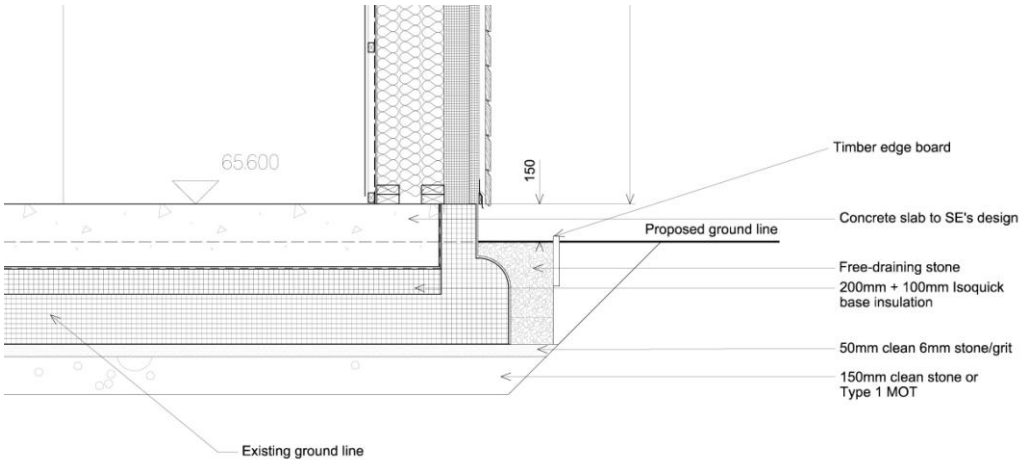


Ground floor plan. The plan form is nearly square, but the stair half-landing projects outside of the simple rectangle. This was a purely architectural decision that gave the house a feature similar to the main building on the same site, but which required additional attention to detailing. The porches are on isolated foundations to reduce thermal bridging.



First Floor Plan. The design is compact, but with attention paid to accessibility standards.

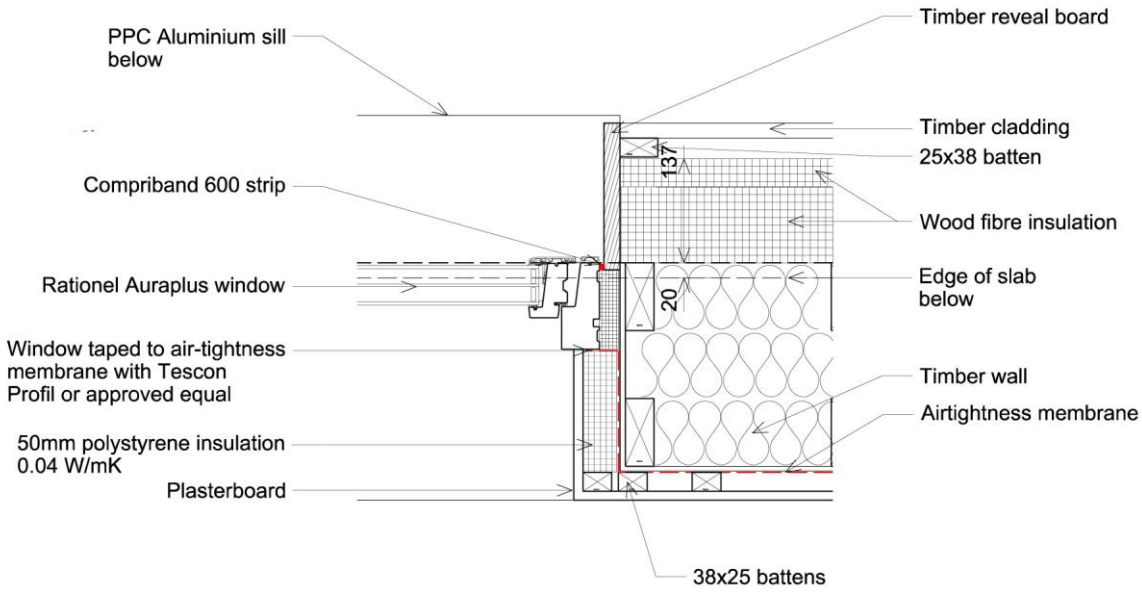
5.1 Description of the construction of the floor slab/basement ceiling including insulation



Foundation detail showing Isoquick insulation, concrete slab and alignment of external wall insulation with foundation insulation.

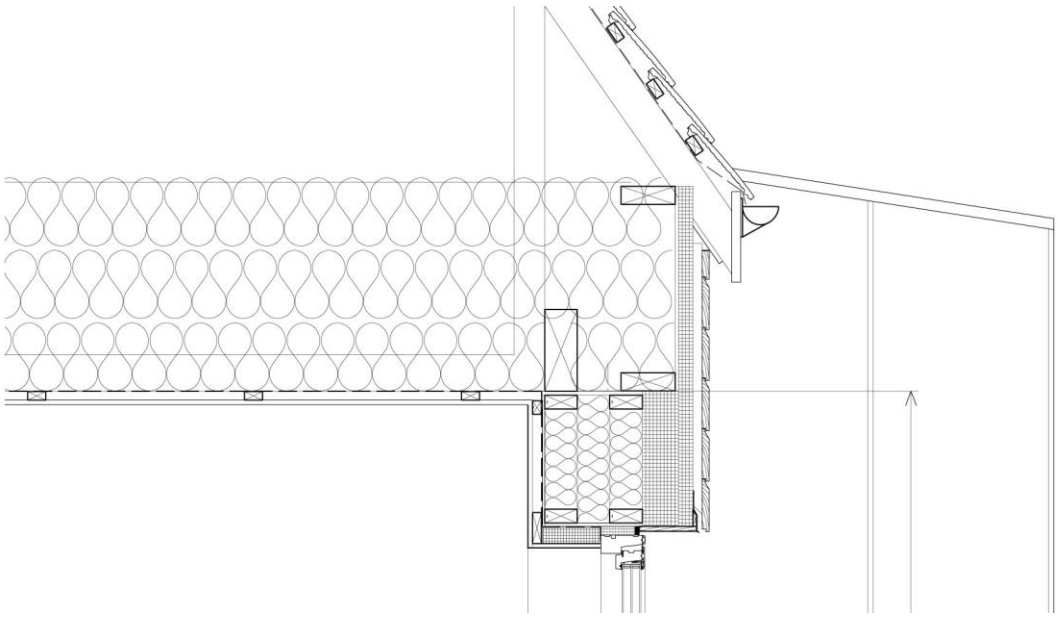
Foundation insulation during installation of damp proof membrane.

5.2 Description of the construction of the exterior walls including insulation



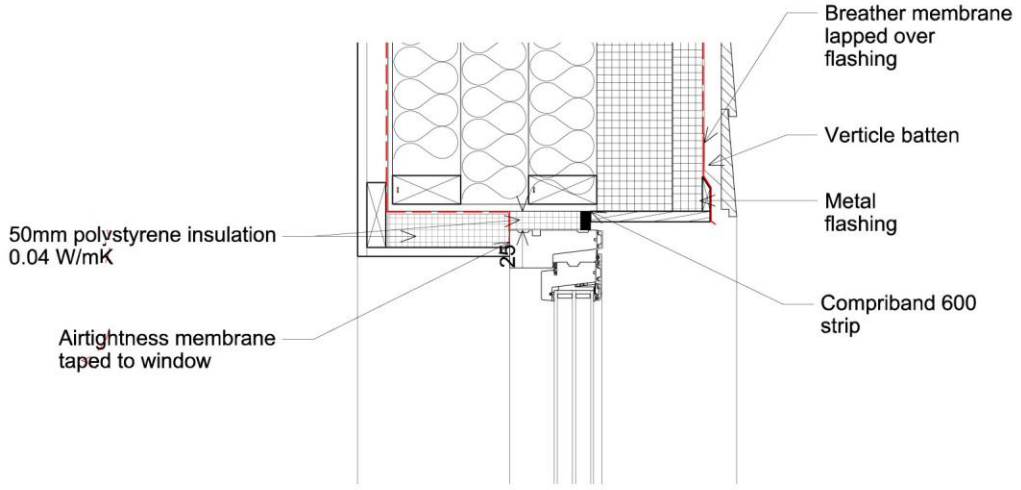
The wall construction consists of plasterboard on battens with ProClima Intello airtightness membrane. The structure is double stud construction (270mm) with full-fill glass fibre insulation and 100mm of Isoplaat wood fibre insulation. The exterior finish is timber cladding on battens.

5.3 Description of the construction of the roof/top floor ceiling

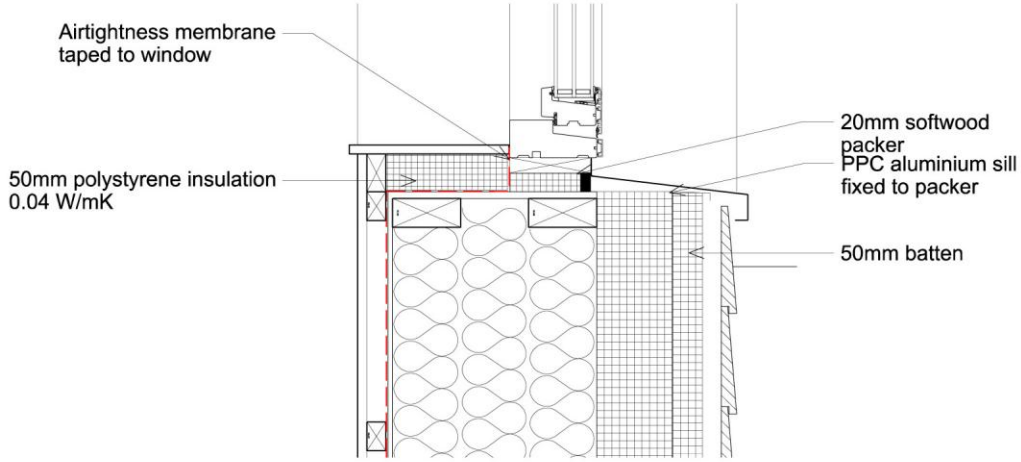


Roof/wall junction showing continuity of insulation. The ceiling insulation is 600mm of Warmcel cellulose insulation. The original design had the insulation along the roof pitch, but the form heat loss factor was adverse, so the design was changed to a cold roof application.

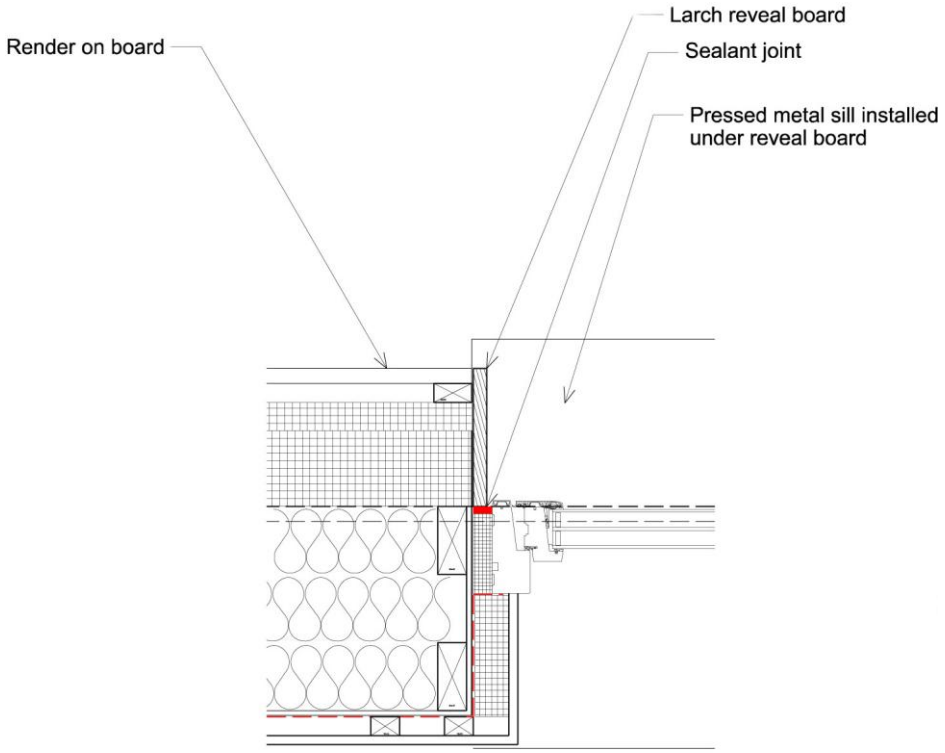
5.4 Description of the window sections including installation drawing



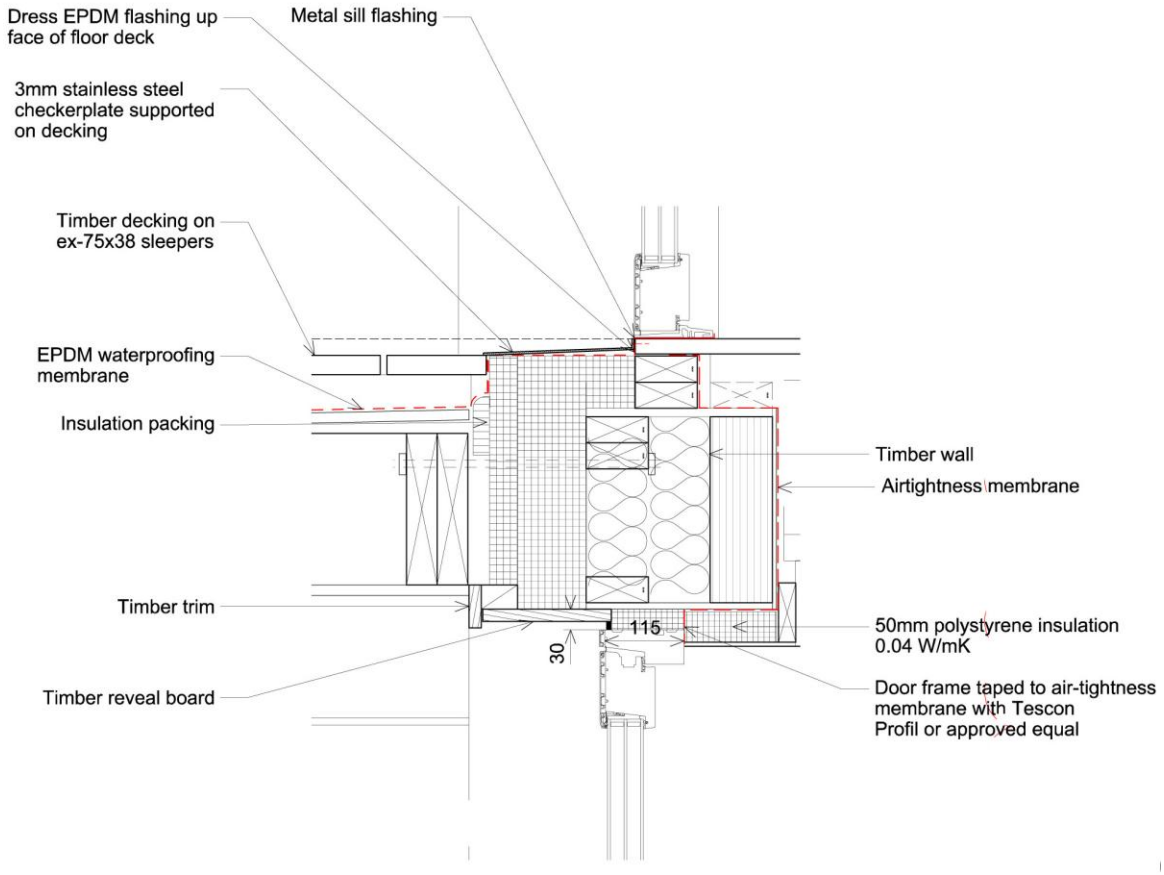
5 - WINDOW HEAD



4 - WINDOW SILL



6 - WINDOW JAMB WITH RENDER



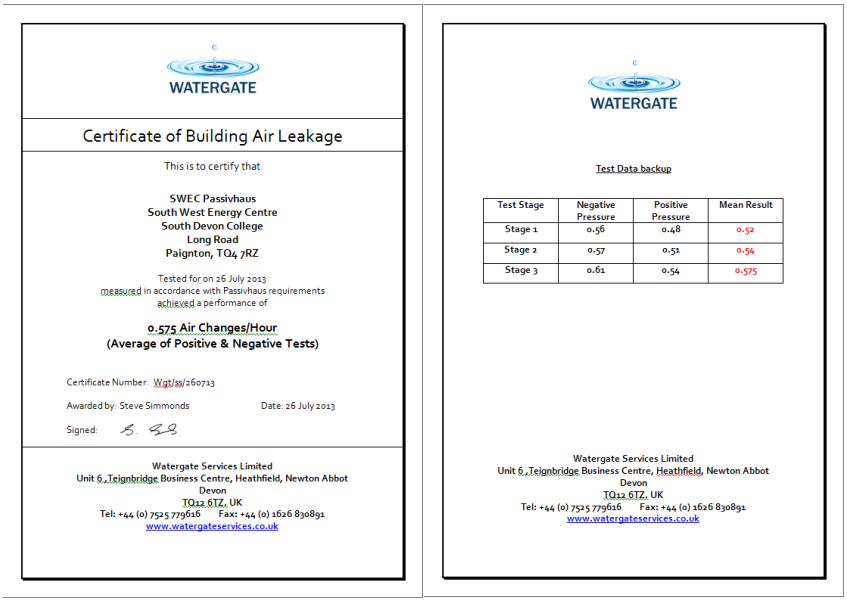
3 - PATIO DOOR HEAD/
FIRST FLOOR SILL

The Rationel windows have a solid timber frame and outward opening sashes with triple glazing, so although wrapping the external insulation on to the frame would reduce heat loss through the frame, it was not possible. Instead, insulated plasterboard was installed on the inside on the inside, overlapping the frame to reduce thermal bridging.
Window installation details. 1:10 @A3.
Window product: Rationel Auraplus; the timber frame U-value is 1.14 average. The triple-glazing U-value is 0.52 and the g value is 0.51.

6 Description of the airtight envelope

Air test in progress; smoke pen used to detect leaks

The airtightness layer was mostly created by the use of pro clima Intello membrane on the walls and first floor ceiling. The ground floor airtightness layer was the concrete slab. The membrane was taped to the floor slab, and all of the service penetrations were through the slab in one area, which was easier to test for leaks.
The testing was carried out by Steve Simmonds of Watergate Services Ltd.



WATERGATE

Certificate of Building Air Leakage

This is to certify that

SWEC Passivhaus
South West Energy Centre
South Devon College
Long Road
Paignton, TQ4 7RZ

Tested for on 26 July 2013
measured in accordance with Passivhaus requirements
achieved a performance of

0.575 Air Changes/Hour
(Average of Positive & Negative Tests)

Certificate Number: Wgt/ss/260713

Awarded by: Steve Simmonds Date: 26 July 2013

Signed:

Watergate Services Limited
Unit 6, Teignbridge Business Centre, Heathfield, Newton Abbot
Devon
TQ12 6TZ, UK
Tel: +44 (0) 7525 779616 Fax: +44 (0) 1626 830891
www.watergateservices.co.uk

WATERGATE

Test Data backup

Test Stage	Negative Pressure	Positive Pressure	Mean Result
Stage 1	0.56	0.48	0.52
Stage 2	0.57	0.51	0.54
Stage 3	0.61	0.54	0.575

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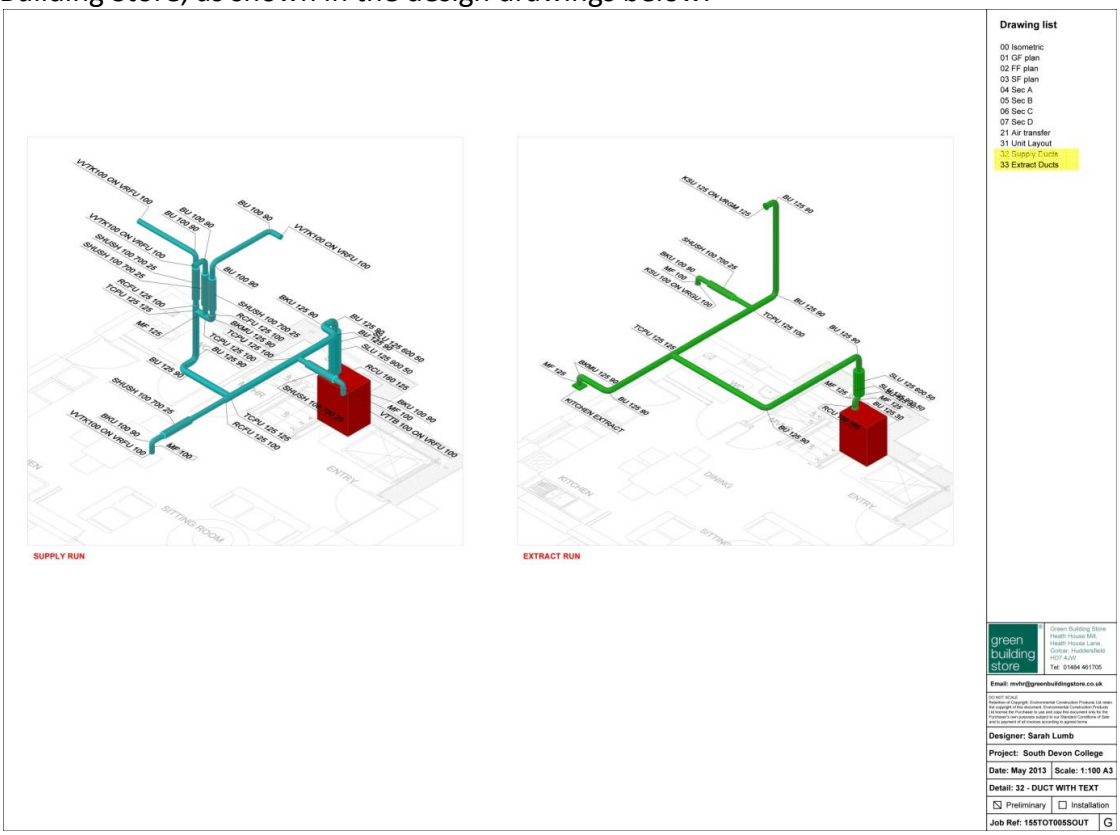
7.1 Description of the planning of the ventilation ductwork

The MVHR unit was located centrally on the ground floor, in the open plan area so it would be visible for teaching purposes. There was an extract valve at the kitchen area, the wc and the bathroom upstairs. The supply ductwork upstairs was taken to the wall next to the bedroom doors and Coanda valves used to reduce duct runs. Design was by the Green Building Store, as shown in the design drawings below.



Cad layouts showing implementation (Green Building Store)

7.2 Description of the planning for the central unit

The MVHR unit was a Paul Novus, sized to accommodate teaching groups, not just a family. The effective heat recovery efficiency is 85%. The electrical efficiency is 0.24 Wh/m^3

The Unit was located centrally on an outside wall, and in view of visitors so it can be used as a teaching aid.

STANDARD INPUT FOR BALANCED VENTILATION

Ventilation dimensioning for systems with one ventilation unit

Occupancy	m³/P	35				
Number of occupants	P	2.3				
Supply air per person	m³/(P*h)	30				
Supply air requirement	m³/h	69		Bathroom		
Extract air rooms		Kitchen	Bathroom	(shower only)	WC	
Quantity		1	1		1	
Extract air requirement per room	m³/h	60	40	20	20	
Total Extract Air Requirement	m³/h	120				
Design air flow rate (maximum)	m³/h	120				

Average air change rate calculation

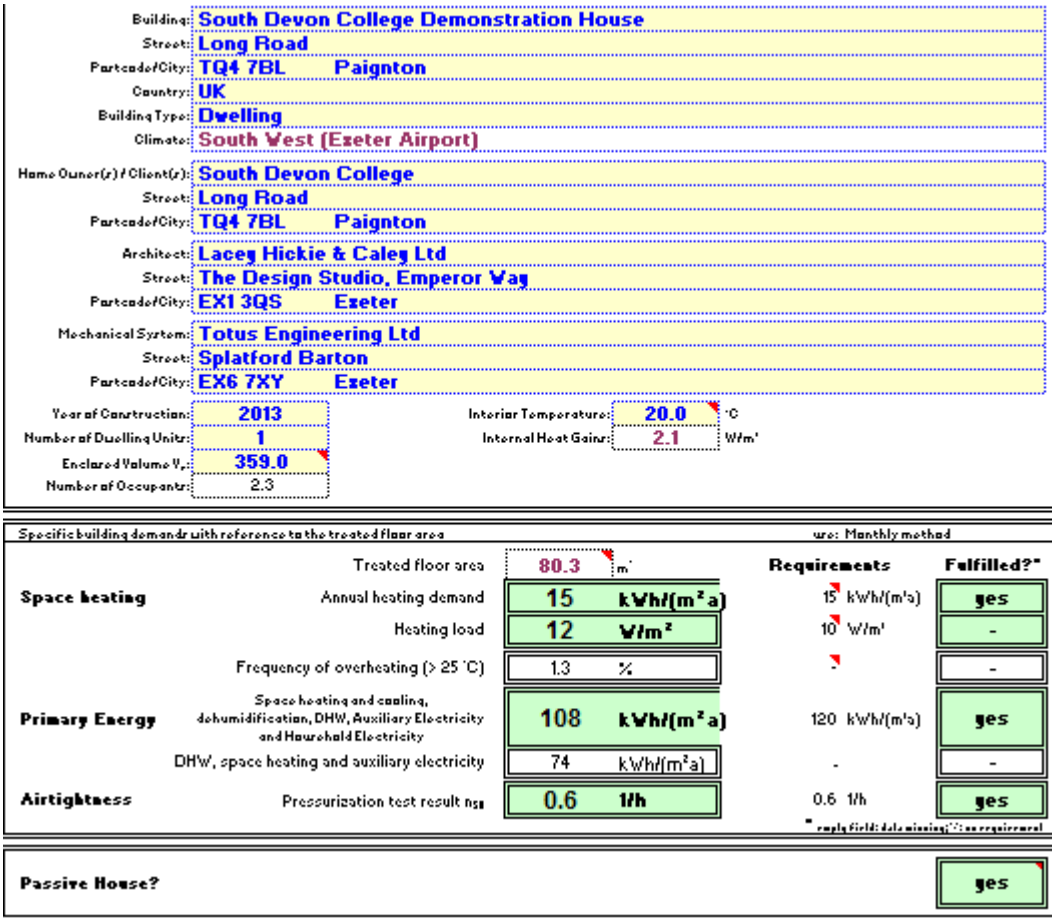
Type of operation	Daily operation duration h/d	Factors referenced to maximum	Air flow rate m³/h	Air change rate 1/h
Maximum		1.00	120	0.64
Standard	24.0	0.77	92	0.49
Basic		0.54	65	0.34
Minimum		0.40	48	0.25
	Average value	0.77	Average air flow rate (m³/h) 92	Average air change rate (1/h) 0.49

Extract from PHPP showing overall ventilation calculation

8 Description of the heat supply system

Heating is provided by two small electrical radiator units (no photo available)

9 Brief documentation of important PHPP results



Building:	South Devon College Demonstration House
Street:	Long Road
Postcode/City:	TQ4 7BL Paignton
Country:	UK
Building Type:	Dwelling
Climate:	South West (Exeter Airport)
Home Owner(s) / Client(s):	South Devon College
Street:	Long Road
Postcode/City:	TQ4 7BL Paignton
Architect:	Lacey Hickie & Caley Ltd
Street:	The Design Studio, Emperor Way
Postcode/City:	EX1 3QS Exeter
Mechanical System:	Totus Engineering Ltd
Street:	Splatford Barton
Postcode/City:	EX6 7XY Exeter

Year of Construction:	2013	Interior Temperature:	20.0 °C
Number of Dwelling Units:	1	Internal Heat Gains:	2.1 W/m²
Enclosed Volume V:	359.0		
Number of Occupants:	2.3		

Specific building demands with reference to the treated floor area — ure: Monthly method

				Requirements	Fulfilled?*
	Treated floor area	80.3	m²		
Space heating	Annual heating demand	15	kWh/(m²a)	15 kWh/(m²a)	yes
	Heating load	12	W/m²	10 W/m²	-
	Frequency of overheating (> 25 °C)	13	%	-	-
Primary Energy	Space heating and cooling, dehumidification, DHW, Auxiliary Electricity and Household Electricity	108	kWh/(m²a)	120 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	74	kWh/(m²a)	-	-
Airtightness	Pressurization test result n50	0.6	1/h	0.6 1/h	yes

* empty field: data missing; "-": no requirement

Passive House?	yes

10.1 Overall construction costs:

10.2 Building costs

1858 €/m2 Treated Floor Area according to PHPP