Passivhaus project documentation

Pippin Barn, Rouncil Lane,
Kenilworth CV8 1NN, UK.
Passivhaus database ID: 6892

Certified
Passive House
Passive House Institute
| classic | plus | premium |

1 Abstract

Figure 1: Front (south) elevation

1.1 Building data

Year of construction	2020	**Space heating demand**	13 kWh/(m²y)
U-value external wall timber clad	0.089 W/(m²K)	**Heat load** **Overheating**	9 W/m² 3%
U-value external wall brick finish	0.114 W/(m²K)	**Primary energy, PER** **Renewable energy**	43 kWh/(m²y) 18 kWh/(m²y)
U-value floor	0.173 W/(m²K)	**Ventilation rate**	0.30 ACH
U-value roof	0.131 W/(m²K)	**Heat recovery**	83%
U-value window	1.27 W/(m²K)	**Pressure test n_{50}**	0.6 ACH@50Pa

1.2 Brief description of project

Planning permission was granted to convert an existing barn into a row of three dwellings in a rural location to the west of Kenilworth. As a result the form of the building was constrained in height to two storeys with a long roof slope to the south.

Figure 2: Previously existing barn determined the form of the replacement building

And while the height limitation at the front gave rise to restricted headroom in the front of upstairs rooms, the long roofs were put to good use for both rooflights and solar PV.

The ambition was to create dwellings which not only were highly environmentally friendly but also had zero energy bills. The latter intention was thwarted when the government withdrew the electrical generation incentive payments. Nevertheless the high environmental credentials were enabled by a Passivhaus approach to fabric, a borehole for water supply and renewable energy in the form of solar PV and air source heat pump for hot water.

Figure 3: Computer generated image of the front (south) elevation of the terrace

Figure 4: Current image of the front (south) elevation of the terrace

Pippin barn is the middle house.

1.3 Project team

Developer	Design Buro
Energy consultant	Design Buro
Building design	Design Buro
Passivhaus consultants	Design Buro
Structure	Tellett Engineering
Ventilation	Total Home Environment
Contractor	Design Buro
Certifying body	Passive House Institute
Certifier	Kym Mead
Certificate-ID	27225_MEAD_PH_20200731_KM
Passive House Database ID	6892
Author	Steven Coulsting
Date	13.06.2022
Signature	

2 Views of Pippin Barn, Kenilworth

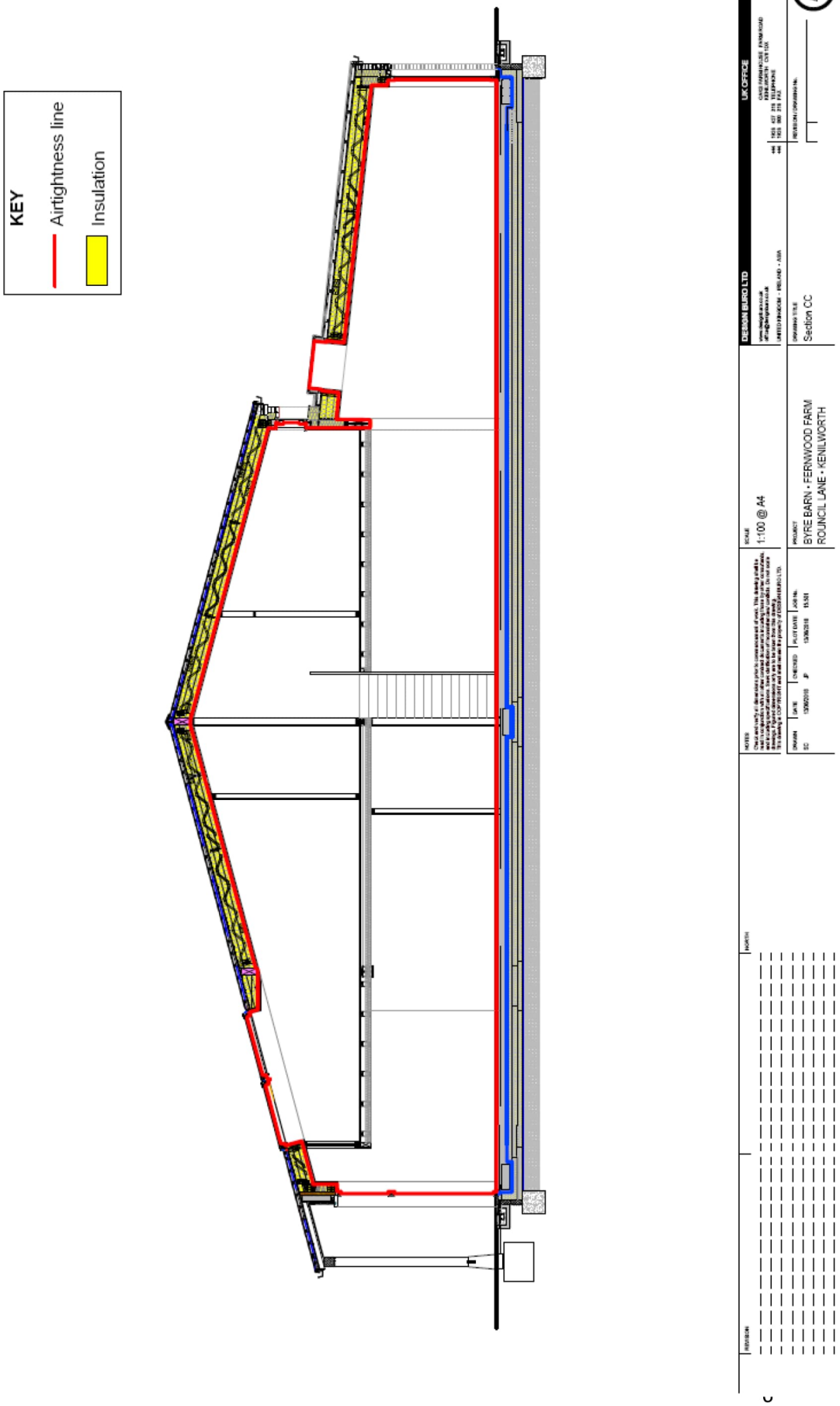
Figure 5: Front elevation (south)

Figure 6: Rear elevation (north)

Figure 7: Ground floor

Figure 8: First floor

3 Sectional drawing



4 Floor plans

Figure 9: Floor plans

5 Construction details

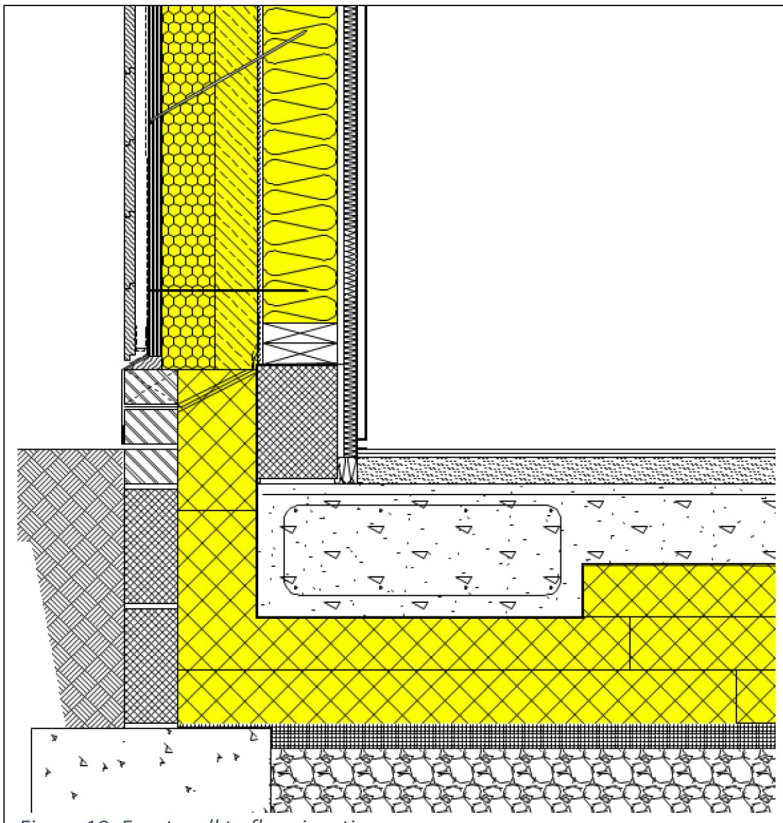


Figure 10: Front wall to floor junction

Ground floor construction
Crushed stone base
Sand blinding
DPM
300mm EPS 300*
150mm concrete
50 screed
14mm tiling
* Reduces to 200mm under external and load bearing walls

Front external wall
15mm plasterboard
25mm mineral fibre
12.5mm Smartply Propassiv
140 Mineral fibre insulation
9mm OSB
80 Wood fibre board
100mm PIR
25mm plywood
25mm ventilated cavity
20mm oak boarding

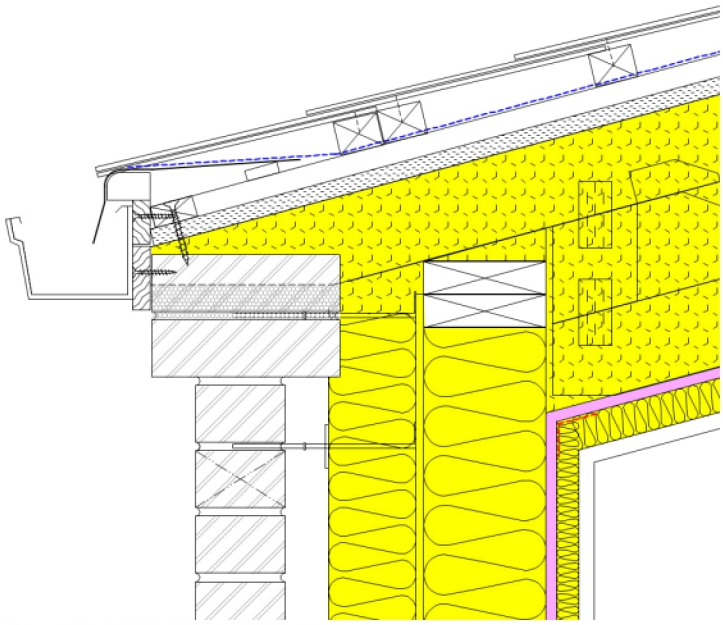


Figure 11: Rear wall to roof junction

Rear external wall
15mm plasterboard
25mm mineral fibre
12.5mm Smartply Propassiv
140 Mineral fibre insulation
9mm OSB
100mm Mineral fibre
50mm cavity
102mm brick external leaf

Roof construction
15mm plasterboard
38mm mineral fibre
12.5mm Smartply Propassiv
302 Cellulose insulation, blown
19mm OSB
25mm counterbattens and battens
Slate finish

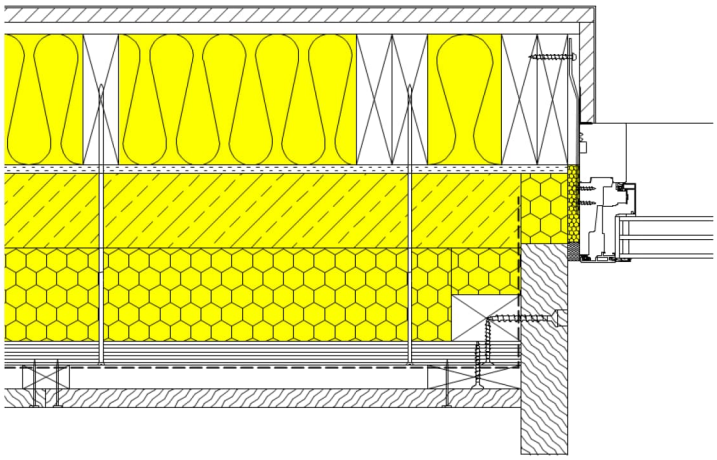


Figure 12: Window jamb

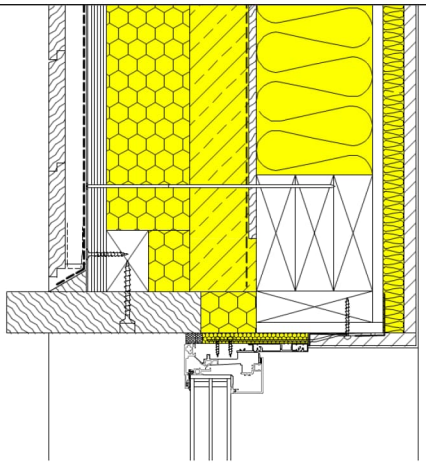


Figure 13: Window head

Frame	Idealcombi – Futura+		
U_f-value frame	0.98 W/(m²K)	**Frame width**	60mm
Ψ-glass edge	0.038 W/(mK)		
Glazing	Idealcombi triple glazing		
U_g-value	0.48 W/(m²K)	**g-value**	0.58

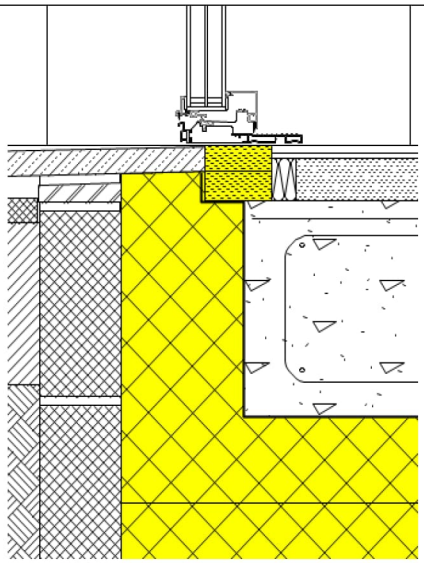


Figure 14: Window cill/door threshold

Figure 15: Pippin Barn was built between the insulation of the floor slab to the neighbouring dwelling in the foreground and the already erected frame the other neighbour in the background

Figure 16: Brick outer leaf coming out of the ground alongside the insulated floor slab

Figure 17: Propassiv airtight board being applied to insulated timber framed wall

Figure 18: Brick outer leaf with insulated cavity under construction

Figure 19: Insulated cavity closer

Figure 20: Airtightness connection between wall and floor

Figure 21: Warmcell insulation blown into roof cavity

Figure 22: Airtightness detailing around rooflight

Figure 23: Slate roof with inline solar PV installation and rooflights

Figure 24: Standing seam metal covering to rear roof with 3m long rooflight

Figure 25: Sitting room with underfloor heating mat

Figure 26: Borehole water purification unit

Figure 27: A 5.4 kWp solar PV system – inline roof installation

6 Airtight envelope and air test result

An airtight floor was formed by screeded concrete which extended monolithically throughout the ground floor. The walls and roofs were lined with Medite Smartply Propassiv boarding which is an airtight OSB product. Tescon Vana was used to tape the joints between the boards and between the boards and windows. Exoseal tape was used to join to the floor. Penetrations were sealed with an appropriate grommet or Tescon No.1 tape. See figs 17, 20 and 22.

6.1 Air test result

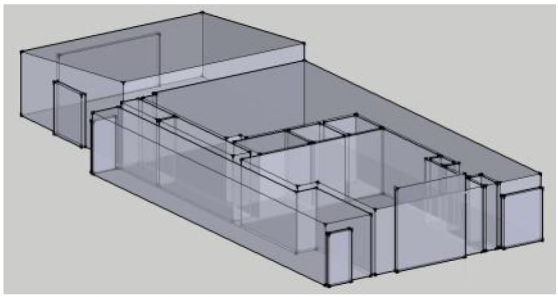


Figure 28: Ground floor air volume

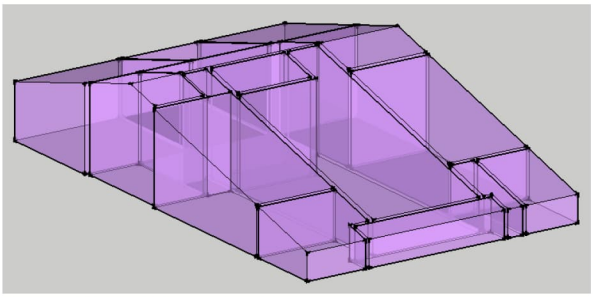


Figure 29: First floor air volume

Location	Pippin Barn, Rouncil Lane, Kenilworth CV8 1NN
Date	10 July 2020
Undertaken by	Jennings Aldas (2019) Ltd
n_{50} result	0.63 h^{-1}@50Pa

Figure 30: Air test being undertaken at Pippin Barn

7 Ventilation

Galvanised spiral ducts to distribution manifolds with radial semi-rigid distribution ductwork.

Figure 31: Zehnder MVHR unit

Figure 32: semi-flexible ventilation ductwork in intermediate floor void

7.1 Ventilation ductwork

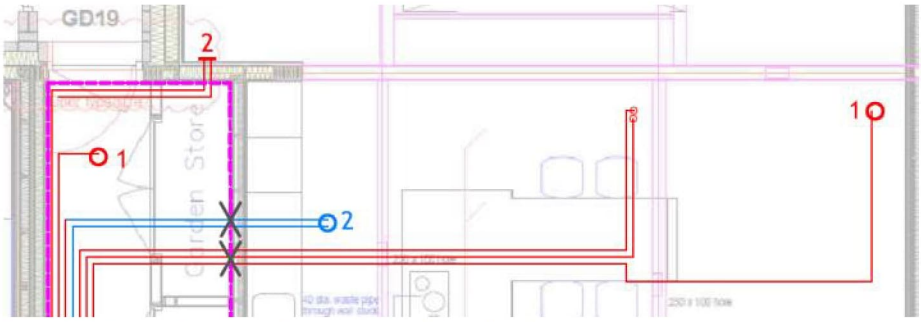


Figure 33: Extract from ventilation system design drawing

Design flow rates

Room	V_{SU} (m³/h)	V_{EX} (m³/h)	$V_{THROUGH}$ (m³/h)
Shared Access	20	20	
Studio workspace	38		
Kitchen/sitting &	80	80	10
Lobby			
Cloakroom			
Kitchenette		29	
WC		22	
Store			
Landing			13
WIC	10		
Studio	12	12	
Bathroom		29	
Bedroom 3	20		
Bedroom 2	20		
Bathroom		29	
Bedroom 4	20		
Master bedroom	30		
Ensuite master		29	

7.2 MVHR unit

Make	Zehnder
Model	Comfoair 600
Effective efficiency	83.3%
Electrical efficiency	0.24 Wh/m³

8. Heating

8.1 Hot water

DHW cylinder with integral ASHP – see Figure 34: ASHP DHW cylinder.
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Make	Dimplex
Model	Edel Hot Water Heat Pump
Heat loss rate	1.9 W/K
Storage volume	270 l
COP	3.5
Achievable hot water temperature via heat pump	60°C

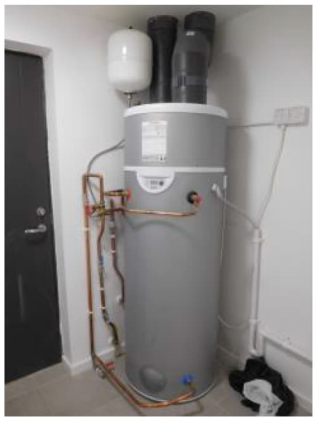


Figure 34: ASHP DHW cylinder

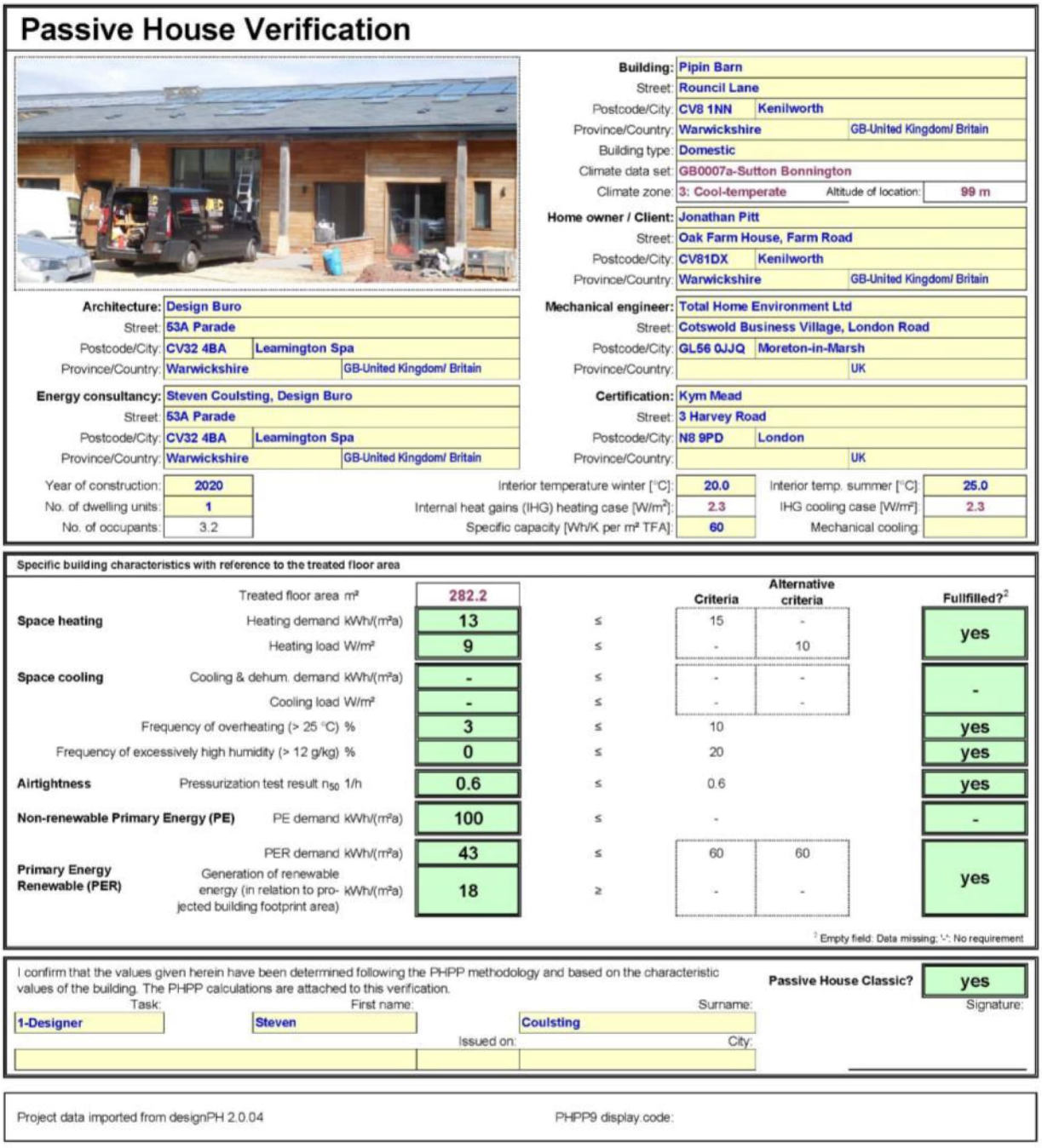
8.2 Space heating

Direct electric heating delivered by underfloor heat mats – see Figure 25 – thermostatically controlled room by room.

Figure 35: Thermostatic programmer

9 PHPP calculations

9.1 Verification



Passive House Verification

Building:	Pipin Barn		
Street:	Rouncil Lane		
Postcode/City:	CV8 1NN	Kenilworth	
Province/Country:	Warwickshire		GB-United Kingdom/ Britain
Building type:	Domestic		
Climate data set:	GB0007a-Sutton Bonnington		
Climate zone:	3: Cool-temperate	Altitude of location:	99 m
Home owner / Client:	Jonathan Pitt		
Street:	Oak Farm House, Farm Road		
Postcode/City:	CV81DX	Kenilworth	
Province/Country:	Warwickshire		GB-United Kingdom/ Britain
Architecture:	Design Buro		
Street:	53A Parade		
Postcode/City:	CV32 4BA	Leamington Spa	
Province/Country:	Warwickshire		GB-United Kingdom/ Britain
Mechanical engineer:	Total Home Environment Ltd		
Street:	Cotswold Business Village, London Road		
Postcode/City:	GL56 0JJQ	Moreton-in-Marsh	
Province/Country:			UK
Energy consultancy:	Steven Coulsting, Design Buro		
Street:	53A Parade		
Postcode/City:	CV32 4BA	Leamington Spa	
Province/Country:	Warwickshire		GB-United Kingdom/ Britain
Certification:	Kym Mead		
Street:	3 Harvey Road		
Postcode/City:	N8 9PD	London	
Province/Country:			UK

Year of construction:	2020	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.3	IHG cooling case [W/m²]:	2.3
No. of occupants:	3.2	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area m²	282.2				
Space heating	Heating demand kWh/(m²a)	13	≤	15	-	yes
	Heating load W/m²	9	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	3	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	100	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	43	≤	60	60	yes
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	18	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:
1-Designer	Steven	Coulsting	

Issued on: City:

Project data imported from designPH 2.0.04 PHPP9 display code:

Figure 36: Verification sheet from PHPP

9.2 Heat balance

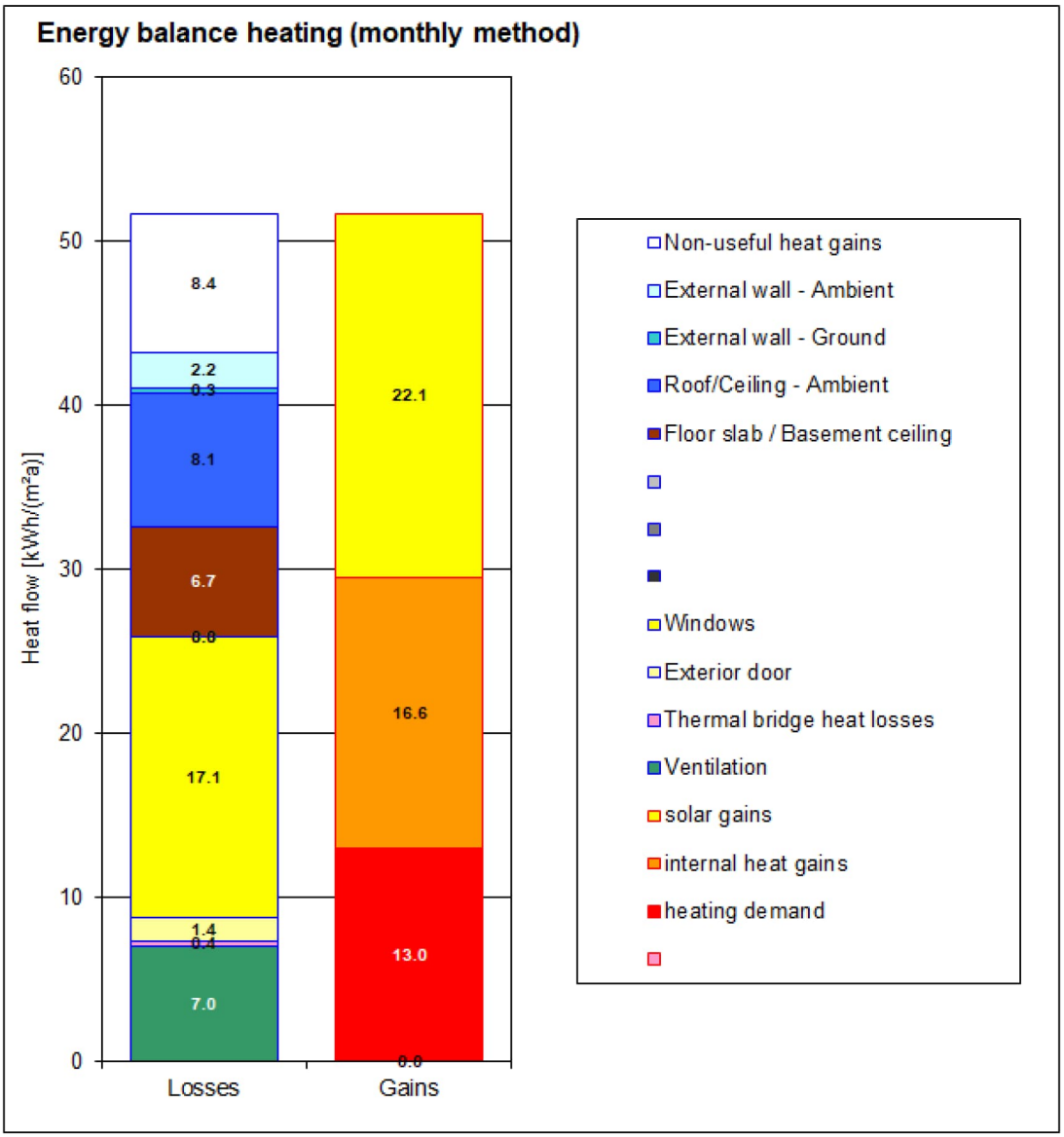


Figure 37: Energy balance from Heating sheet of PHPP

10. Construction costs

The construction cost is not available

11. Post occupancy evaluation at Pippin Barn, Kenilworth

There has been no monitoring of internal conditions or collection of meter readings at this property following occupation. The occupants are private individuals.