



Passivhaus Project Object Documentation

1.1 Abstract



Detached House with 2 Bedrooms, Kindar Coach House, New Abbey

1.1 Building data

Year of construction	2023	Space heating demand	43 kWh/(m ² a)
U-value wall – interior insulation	0.27 W/(m ² K)	Non-renewable primary energy (PE)	122 kWh/(m ² a)
U-value wall – new	0.13 W/(m ² K)		
U-value floor – ground bearing	0.14 W/(m ² K)	Generation of renewable energy	0 kWh/(m ² a)
U-value roof – sloping	0.125 W/(m ² K)		
U-value roof – horizontal	0.115 W/(m ² K)		
U-value windows	0.84 W/(m ² K)		
Heat recovery efficiency	90%	Pressure test n ₅₀	0.7
Special features	The house includes an ASHP and an electric car charging point		

1.2 Detached House with 2 Bedrooms, Kindar Coach House, New Abbey

Kindar Coach House is a renovation and extension of an existing traditional stone barn to create a single dwelling to be occupied by the client.

The client committed to rescuing the derelict building which had been on the Scottish Buildings at Risk Register since 2014 although the building had been empty for many years before that.

The building had an existing Planning Consent when the client purchased the property, but the client requested a redesign that restored the property, respecting its historic external form. The new extensions needed to be minimised to allow the original building to remain dominant on the site.

The existing building was vacant and derelict with collapsing roof and timber upper floors, water penetration, no windows and structural problems with the stone walls.

The site is within the New Abbey Conservation Area and next to the Sweetheart Abbey Scheduled Monument boundary.

1.3 Responsible project participants

Architect	White Hill Design Studio LLP
Implementation planning	White Hill Design Studio LLP
PassivHaus project planning	White Hill Design Studio LLP
Ventilation	Optimum Heating & Renewables Ltd
Developer	Mr & Mrs R Allen
Main contractor	Broatch Construction, Lochmaben
PassivHaus Certifier	Kym Mead, Mead Consulting Ltd
Certification ID	41405_MEAD_EP_20240110_KM
Project-ID www.passivehouse-database.org	7689
Author of project documentation:	David Major, White Hill design Studio LLP

Date/signature



09 October 2024

2 Views



North & East Elevations



South & West Elevations



West Elevation



West Elevation Detail

Internal views



Living Room



Dining Space through to Living Room



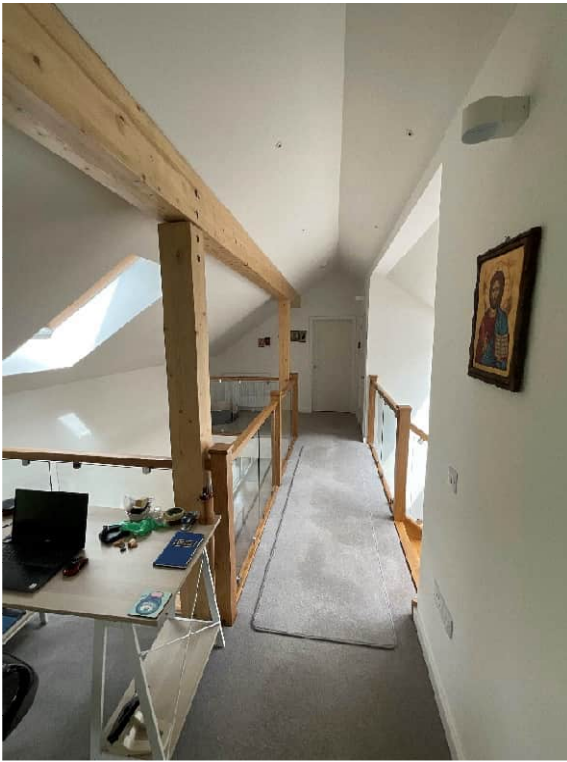
Dining Space through to Kitchen



Staircase



Kitchen



Gallery



Garden Room



Bedroom 1

Building before construction



South & West Elevations

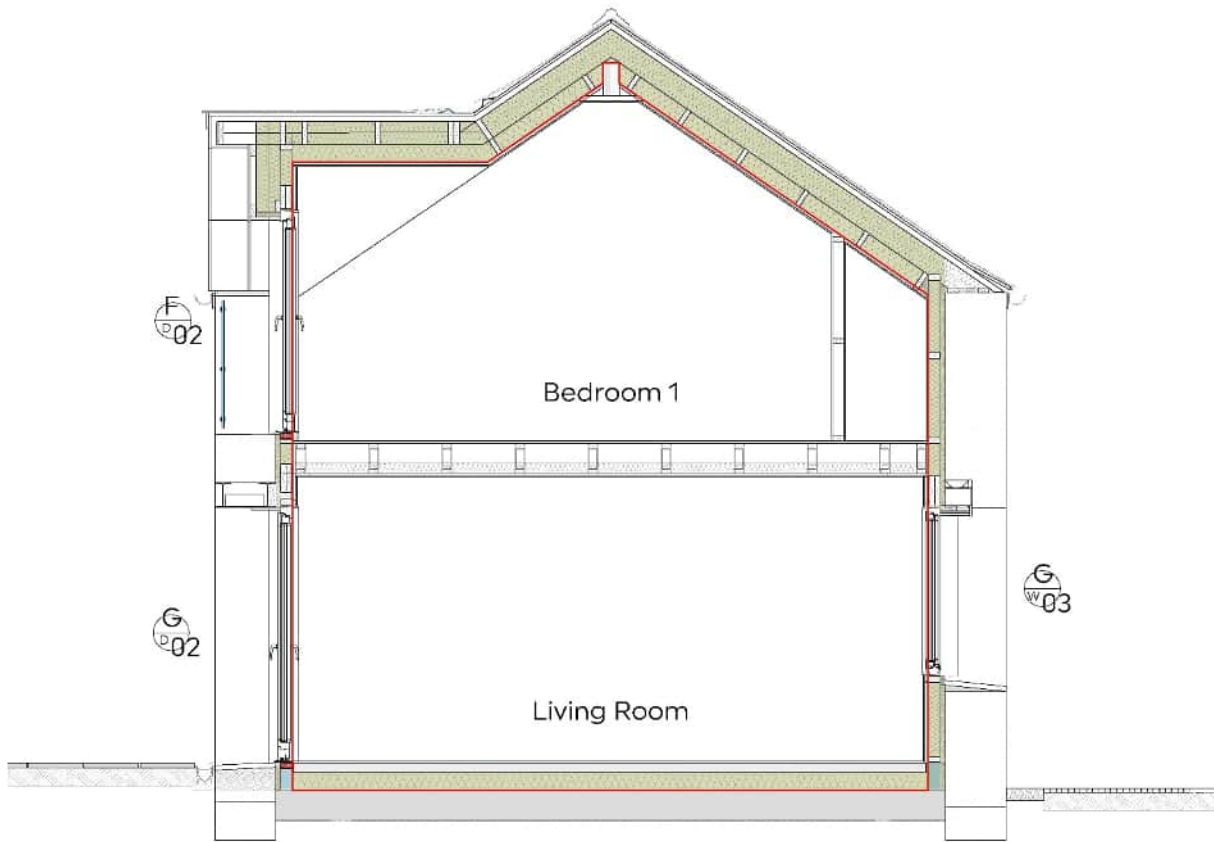


North & East Elevations



Ground floor interior

3 Sections

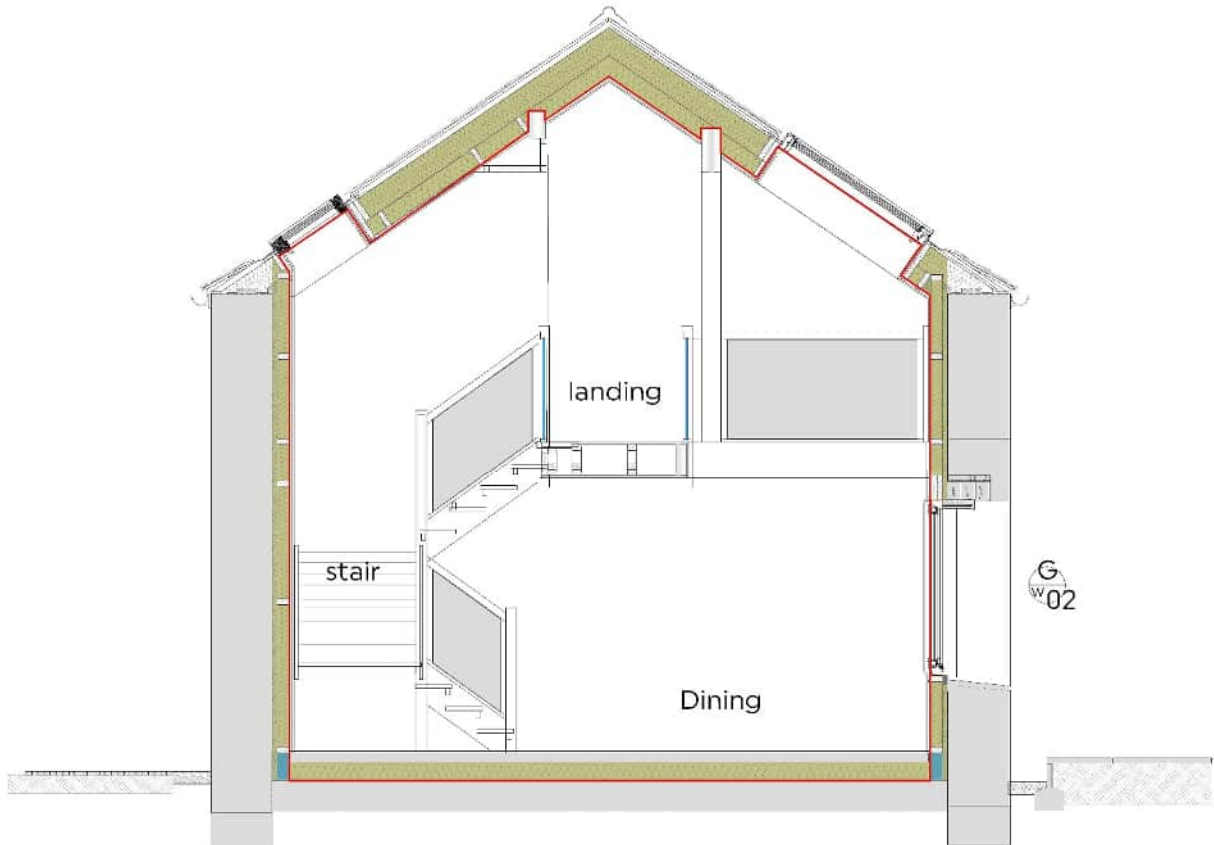


SECTION 1

The existing building was solid natural stone walls. To ensure the long term health of the building fabric a homogenous breathable internal insulation specification was used with Diathonite Evolution insulating lime render to the inside of the walls providing a smooth surface with Gutex Thermoflex woodfibre insulation between a new timber frame. The ground floor is a ground bearing concrete slab with rigid PIR insulation and a screed with underfloor heating. Due to limited headroom the ceilings are sloped with mineral fibre insulation within a new timber roof structure. A double membrane was used below the slate roof with a membrane below the slate on timber sarking and a ventilated void below the sarking with a windtight membrane over the roof insulation.

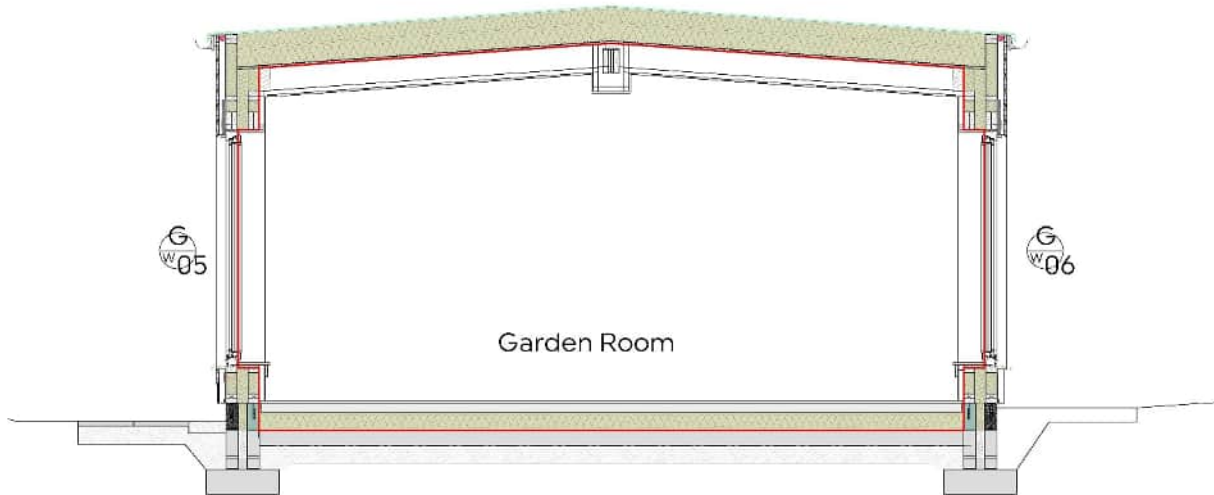
The section drawing shows the continuous insulation envelope has been maintained around the external fabric of the house. Doors and windows are sitting in the timber frame, making a recessed feature of the existing openings and primarily to limit thermal bridging.

Careful consideration was given to the junctions for floor, wall and roof. Blue hatching indicates locations where lightweight concrete block work was built in.



SECTION 2

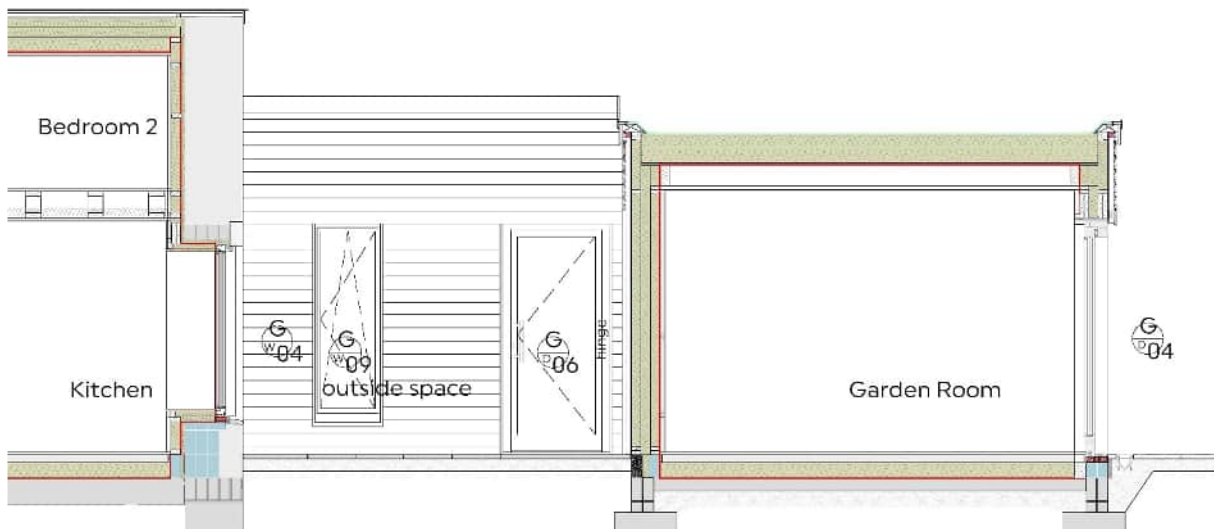
Section 2 shows the continuous insulation and air tightness layers around the laminated timber roof beams and roof windows.



SECTION 3

A key design aim was to preserve the historic building, allowing the original form of the building to be visually dominant. The new garden room extension is a single storey timber frame with a shallow pitch roof and timber cladding. The extension provides a light, modern addition to complement the existing traditional building.

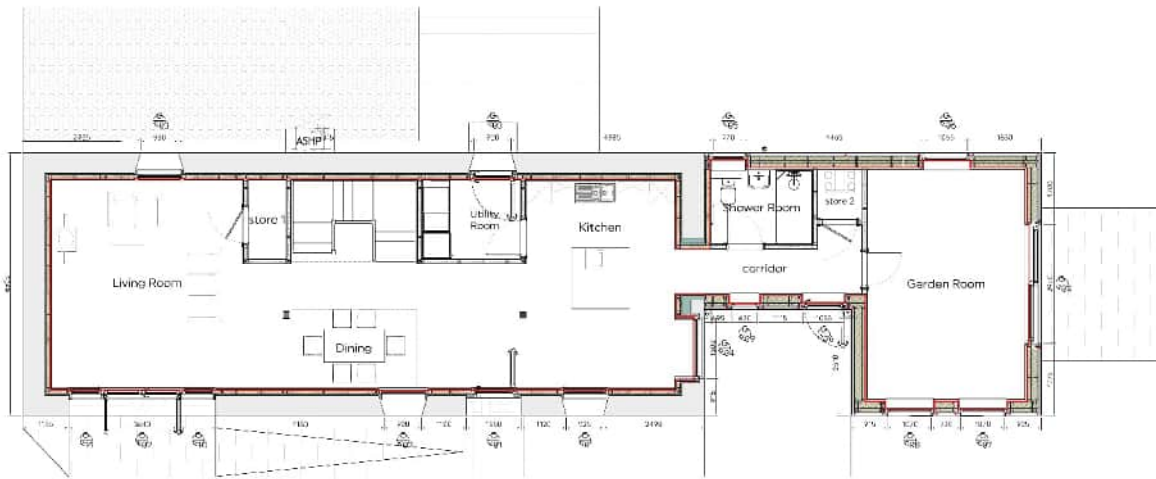
The ground floor is the same specification throughout the house. The extension walls are a double timber frame Larsen Truss fully filled with mineral fibre insulation. The roof is a proprietary single ply membrane insulated roof.



SECTION 4

The connection of the new extension to the existing building was carefully detailed to ensure continuity of insulation and the air tightness membrane.

4 Floor Plans



GROUND FLOOR PLAN



FIRST FLOOR PLAN

The existing building was a 2 storey workshop with natural stone walls. A key design aim was to maintain the existing building form and although ceiling heights were restricted, the construction of the additional space in the extension allowed the layout of the main house to be open plan with high linked spaces around the central stair and gallery.

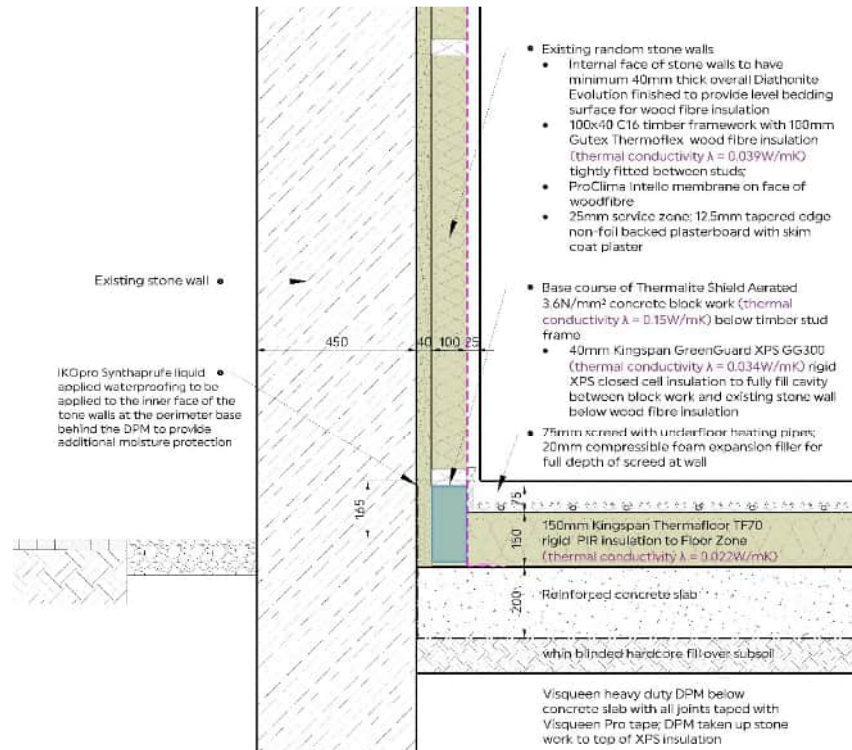
5 Construction Details

There are 2 types of construction in the building. Existing stone walls with internal insulation and new timber frame walls for the extension.

5.1 Ground Floor Details

The ground bearing floor slab is the same throughout the house with timber floor finish on screed with underfloor heating on rigid PIR insulation on a reinforced concrete slab with damp proof membrane below.

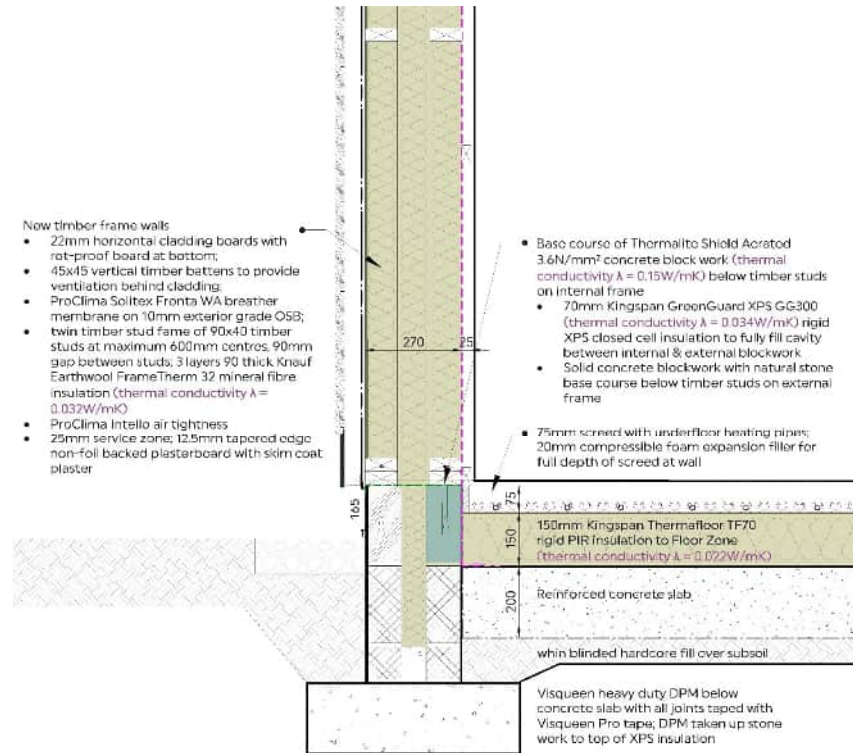
Existing stone walls detail



EXTERNAL STONE WALL
& GROUND FLOOR JUNCTION

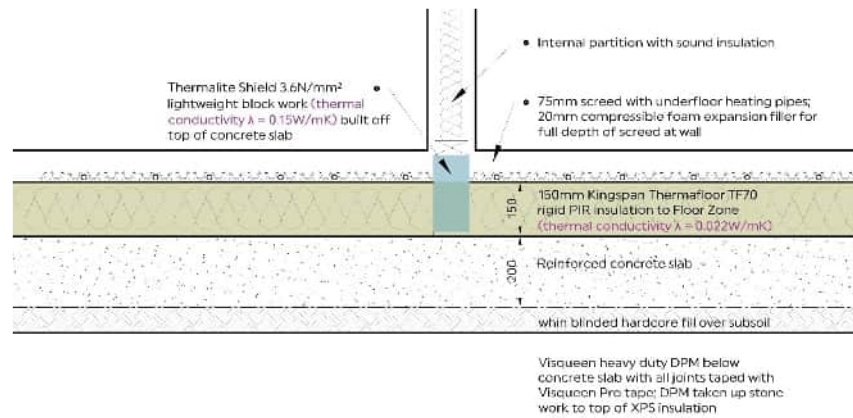
The perimeter of the existing stone external walls has a course of lightweight concrete blockwork with XPS closed cell insulation between the stone wall and the blockwork. The external walls were treated with waterproofing to reduce the moisture load at the base of the walls. The XPS is the same width as the Diathonite insulating render to maintain the insulation layer. The blockwork provides base support for the load bearing timber frame.

New timber kit detail



EXTERNAL TIMBER FRAME WALL & GROUND FLOOR JUNCTION

The timber kit is a Larsen truss design with 2 timber frames joined with plywood gussets. The timber kit sits on a masonry cavity wall on a concrete strip foundation. To limit thermal bridging, the substructure masonry cavity has XPS insulation in the cavity and a course of lightweight concrete blockwork.

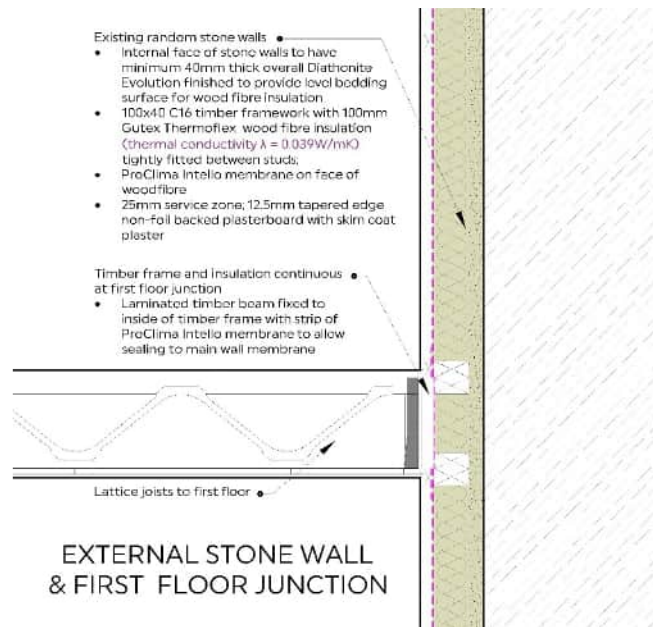


INTERNAL TIMBER PARTITION & GROUND FLOOR JUNCTION

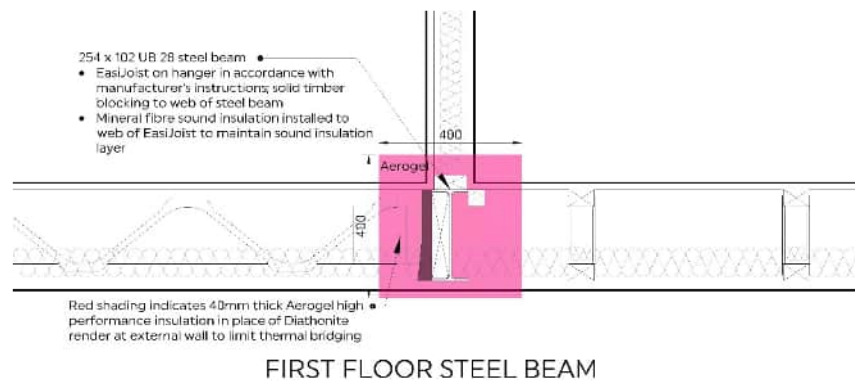
Internal timber partitions have a course of lightweight blockwork to limit thermal bridging through the floor insulation.

5.2 External Wall Details

The first floor junction to the external wall within the existing stone walls was designed to limit thermal bridging and simplify air tightness detailing.



The timber frame is continuous passed the first floor level with a laminated timber beam fixed to the inside face of the timber frame providing support for the lattice first floor joists. This simplifies the installation of the wall insulation and allows the air tightness membrane to run continuously on the face of the timber kit.

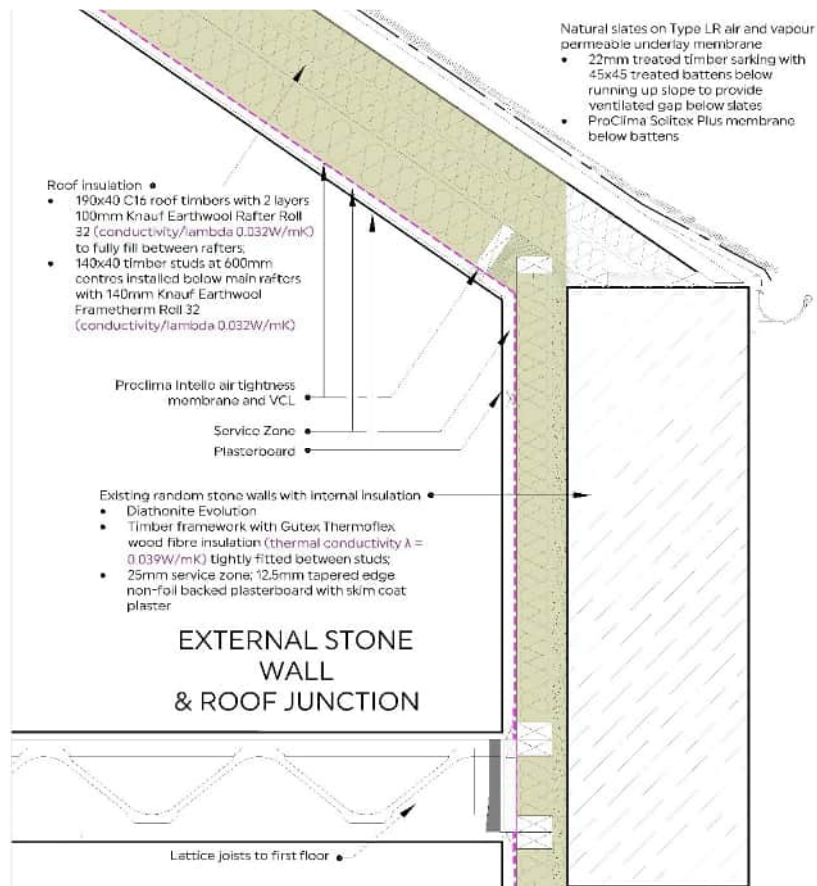


A single steel beam was needed within the first floor to support a change in direction of the lattice floor joists. This is supported on the timber frame at the external walls, so a section of high performance Aerogel insulation was included between the end of the steel beam and the existing stone walls to limit thermal bridging.

The new extension is single storey.

5.3 Roof Details

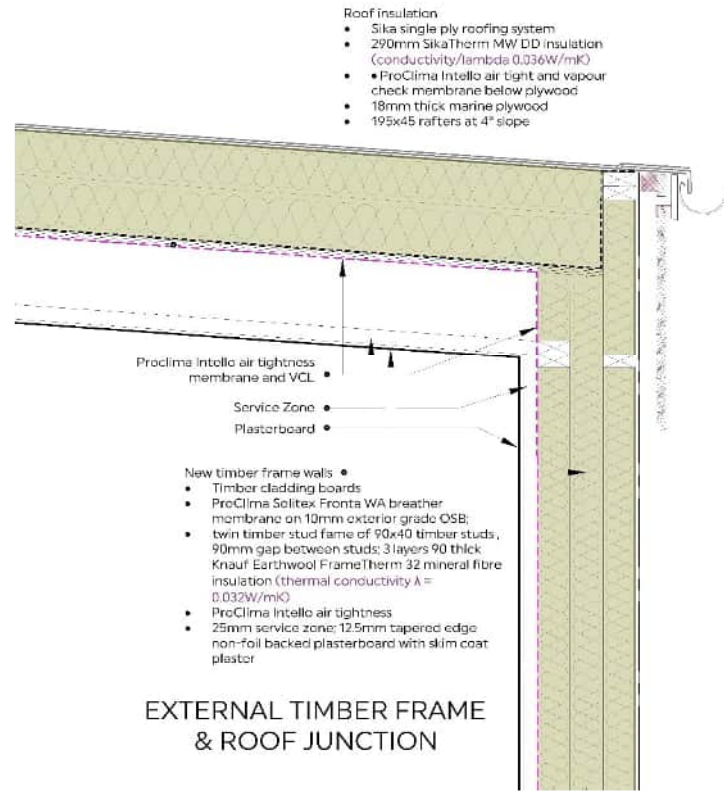
Existing stone walls detail



The existing building has a joiner built roof structure with laminated timber beams to provide ridge support. The roof is supported on the new internal timber frame.

Insulation is at rafter level which provides a continuous insulation envelope. The roof has a wind tightness membrane between the insulation and the ventilated gap below the slates.

New timber kit detail



The extension roof is a low pitch single ply membrane with rigid insulation on a plywood deck. The timber frame was stepped at the top to provide support for the rafters and provide continuous insulation from walls to roof.

5.4 Window Details

The windows are Green Building Store Ultra triple glazed timber tilt & turn and fixed.

The external doors are green Building Store Ultra triple glazed timber inward opening, outward opening and sliding.

Whole window U-value 0.75 W/(m²K)

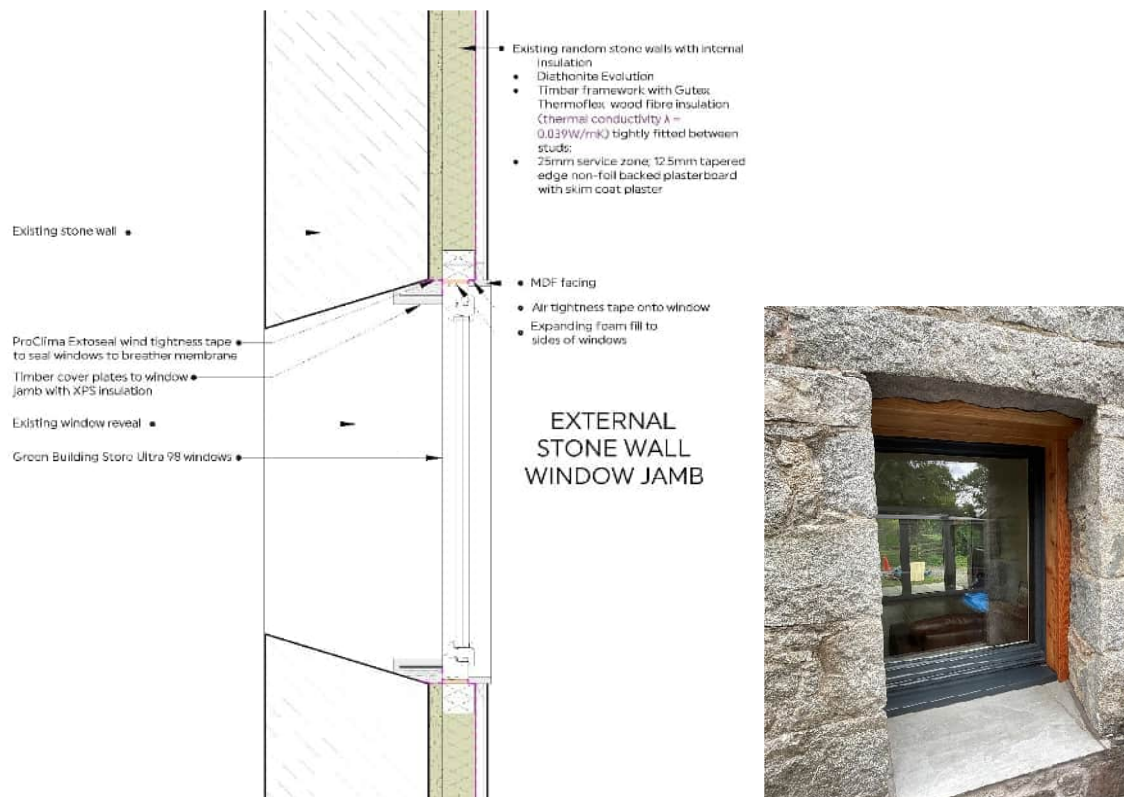
Window U-value: U_f: 0.96 W/(m²K)

Glazing specification: 4.E.Tgh-20-4-20-4.E.Tgh,

Glazing U-value: U_g: 0.52 W/(m²K)

Glazing G-value: 0.53

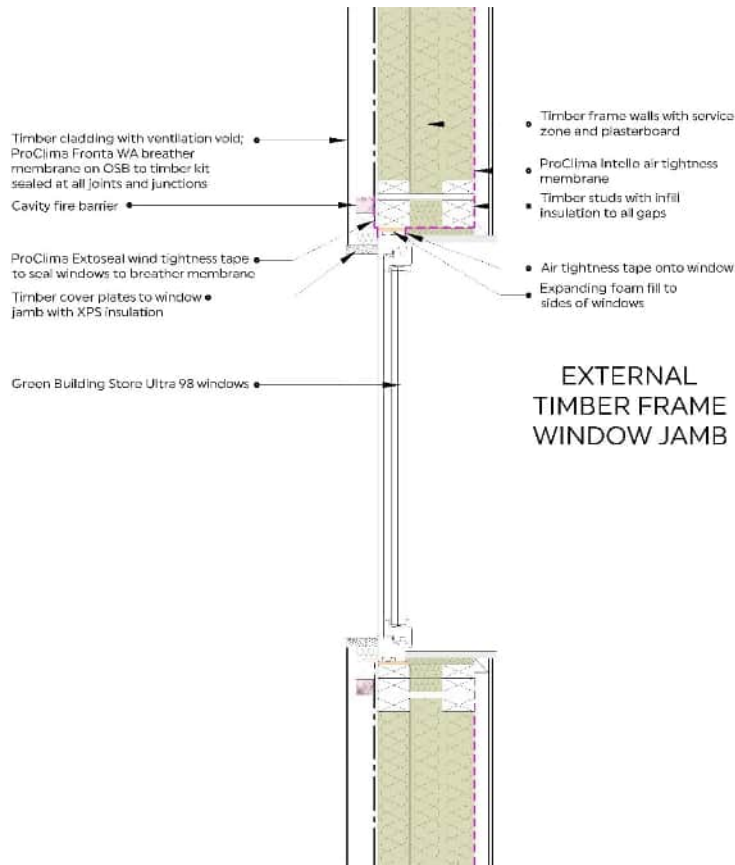
Existing stone walls detail



The existing stone wall window openings are unusual with sloped sides and no stone reveal on the outside where traditionally windows were installed. The new windows were installed at the back of the openings within the timber frame insulation layer limiting thermal bridging. Although this created deeper reveals, the glazed area of the windows could be larger due to the widening of the reveal.

The windows and external doors were all wind tightness sealed eternally with ProClima Extoseal tape with XPS insulation to provide over-insulation of the frame and timber reveals were tightly scribed and sealed to the stonework.

New timber kit detail



The windows and doors in the new timber kit were installed in outer timber frame.

The windows and external doors were all wind tightness sealed eternally with ProClima Extoseal tape with XPS insulation to provide over-insulation of the frame with timber reveals.

6 Airtightness

6.1 Air tightness strategy

Ground Floor:

Air tightness at ground floor level was provided by the top of the concrete slab

External Walls:

Air tightness at external walls was provided by ProClima Intello airtightness membrane, all joints taped with ProClima tapes

Roof:

Air tightness at roof level was provided by ProClima Intello airtightness membrane, all joints taped with ProClima tapes

Window and external doors:

Air tightness tapes were used to seal from the ProClima Intello airtightness membrane onto the window and door frames



First floor joist:

A strip of air tightness membrane was installed behind the first floor bearer beam before installation with a generous overlap to allow sealing onto the wall membrane when it was installed.



The same approach was taken to the timber ridge beams and the steel beam ends ensure easy sealing of the membrane.

Connection of existing building to the extension:

The new opening between the existing building and the extension was oversized to allow for continuous insulation, services in the ceiling space, and the air tightness membrane to be continuous between the rooms. This detail kept the existing stone walls outside the insulation and air tightness envelopes.



Services

A service zone was formed to the external walls and ceiling to keep all internal services within the air tightness membrane. Where services needed to be taken through the membrane they were sealed with air tightness tapes onto the air tightness layer.

Toolbox and manufacturer talks

During the construction phase of the project, we discussed the air tightness approach with the contractor who was experienced in delivering PassivHaus air tightness on new builds. We held on-site toolbox talks

with the contactor and tradespeople to discuss the products and techniques to deal with difficult details such as the connection between the existing and new construction and the need to allow sufficient room to make connections of the air tightness layer at these difficult details. These talks together with the contractors resolve to deliver high quality work allowed the team to achieve the required air tightness.

6.1 Air tightness test

The air tightness test was carried out by Thermal Image UK. The n_{50} over pressurisation test result was 0.710 and under pressurisation test result was 0.750 giving an average N50 of 0.730. The Airtightness Test Certificate is included at the end of this document.

7 Ventilation

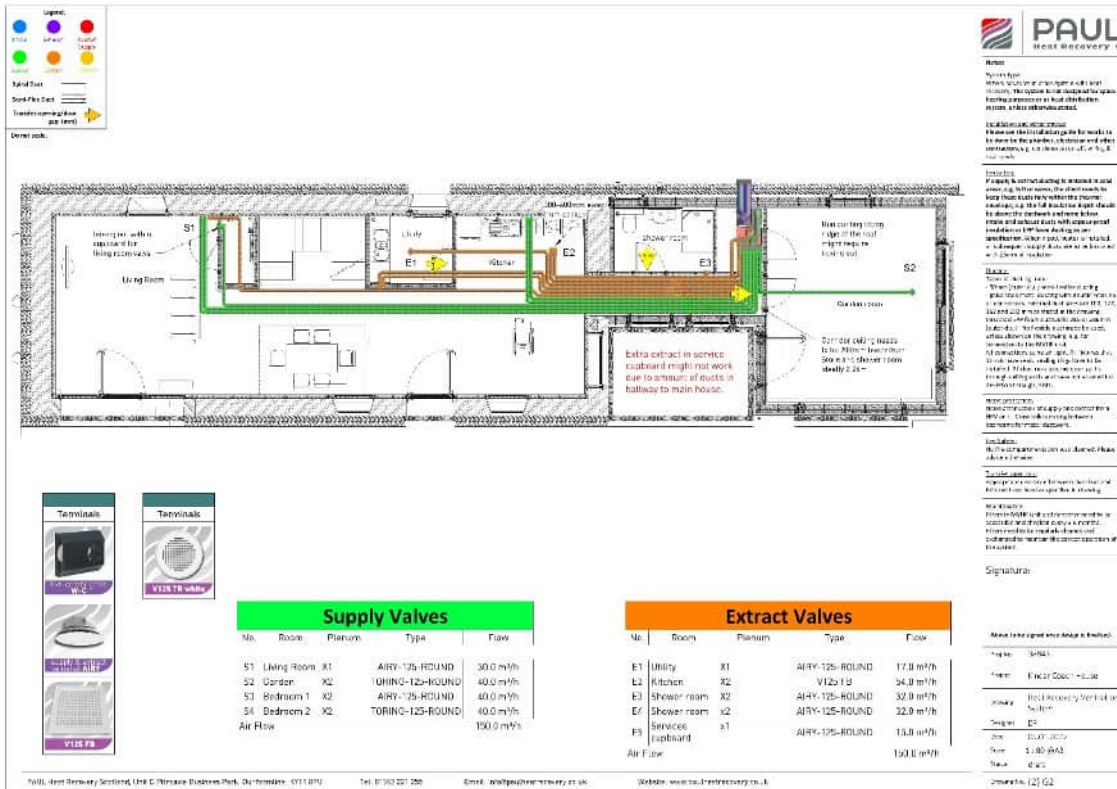
The ventilation system is a Zehnder ComfoAir Q350 unit with a combined external wall vent. Lindab spiral steel ducting was used for primary runs from the ventilation unit to manifolds with semi-rigid PE ducts Lindab to room valves.



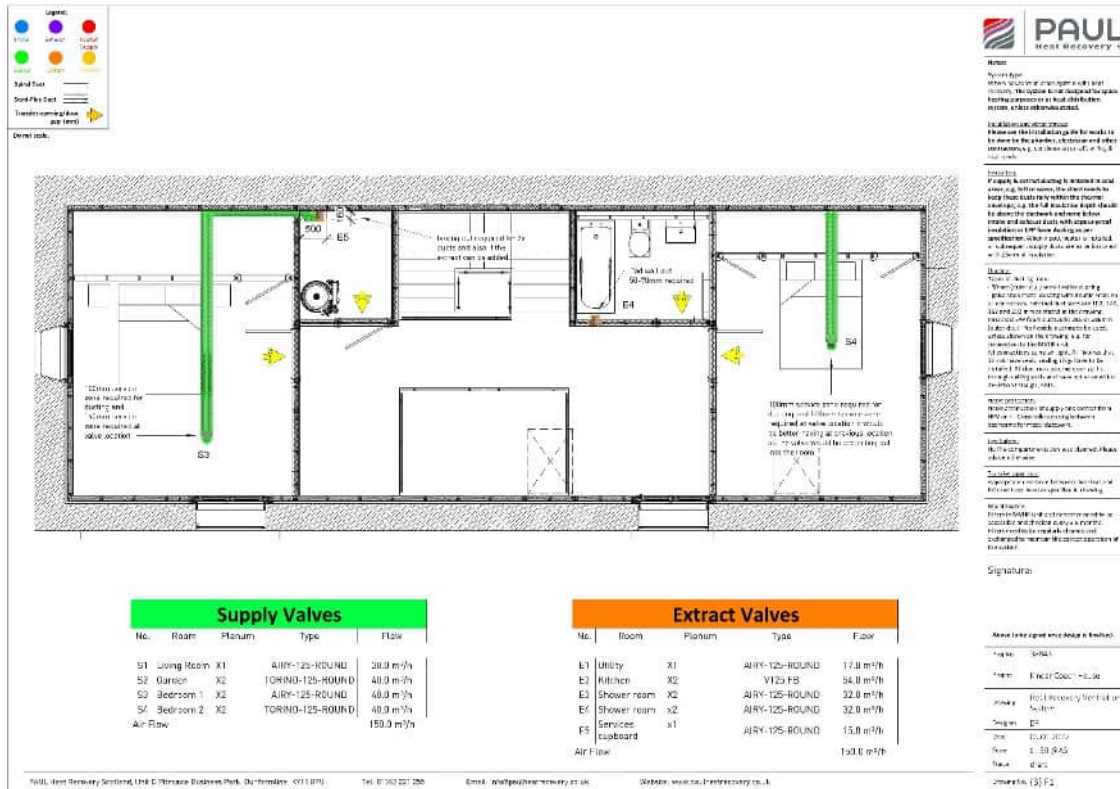
The system was designed by Paul Heat Recovery Scotland, Dunfermline. The system was installed and commissioned by Optimum Heating & Renewables Ltd, Newton Stewart.

The first floor joists are open web joists allowing a flexible service space for the ducts within the floor zone and short rises to valves at first floor level. Silencers were included in the system to prevent cross talk.

The MVHR unit is located on the ground floor in the extension in a services cupboard to allow for easy access for maintenance.



Ventilation Ground Floor layout (courtesy of Paul Heat Recovery Scotland)



Ventilation First Floor layout (courtesy of Paul Heat Recovery Scotland)

8 Heating & DHW



The heating and hot water system is from an air source heat pump with a hot water storage tank in a first floor services cupboard.

Space heating distribution is underfloor heating at ground floor and radiators at first floor.

The first floor services cupboard has been fitted with an extract valve from the MVHR system. This provides a successful drying room and avoids the need for a tumble drier.

9 PHPP Verification

Certificate

Certified retrofit
'EnerPHit Classic'
(Climate zone: Cool-temperate)

Mead:
Energy &
Architectural
Design Ltd.

Authorised by:

Passive House
Institute
Dr. Wolfgang
Feist
64283

Kindar Coach House

New Abbey, Dumfries & Galloway DG2 8EH, United Kingdom/ Britain

Certified
Retrofit

Passive House Institute

| classic | plus | premium |

Client	Mr & Mrs Allen Kindar Coach House DG2 8EH New Abbey, United Kingdom/ Britain
Architect	White Hill Design Studio LLP Annan Water DG10 9LS Moffat, United Kingdom/ Britain
Building Services	White Hill Design Studio LLP Annan Water DG10 9LS Moffat, United Kingdom/ Britain
Energy Consultant	White Hill Design Studio LLP Annan Water DG10 9LS Moffat, United Kingdom/ Britain

Buildings retrofitted to the EnerPHit Standard offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned building meets the criteria defined by the Passive House Institute for modernization to the 'EnerPHit Classic' standard:

Building quality		This building	Criteria	Alternative criteria
Heating	Heating demand [kWh/(m²a)]	43	≤	-
Cooling	Frequency of overheating (> 25 °C) [%]	0	≤	10
Airtightness	Pressurisation test result (n ₅₀) [1/h]	0.7	≤	1.0
Non-renewable primary energy (PE)				
	PE demand [kWh/(m²a)]	122	≤	-
Component quality				
	Building envelope to ambient air (U-value) [W/(m²K)]	0.13	≤	0.15
	Building envelope to ground (U-value) [W/(m²K)]	0.14	≤	0.22
	Wall with interior insulation to ambient air (U-value) [W/(m²K)]	0.27	≤	0.35
	Windows/Exterior doors (U _{w,installed}) [W/(m²K)]	0.84	≤	0.85
	Windows (U _{w,installed}) [W/(m²K)]	0.99	≤	1.00
	Glazing (g-value) [-]	0.52	≥	0.32
	Glazing/shading (max. solar load) [kWh/(m²a)]	203	≤	-
	Ventilation (effect. heat recovery efficiency) [%]	90	≥	75

Certifier: Kym Mead, Mead Ltd

www.passivehouse.com
41405_MEAD_EP_20240110_KM

10 Costs

The house was built for £2,930/m²

11 User experience

The house has been occupied since June 2023 and the house has maintained comfortable conditions throughout the year. The services systems have been easy to use and are working well together.

The owners of the house have provided positive feedback about living in the house. They say:

“The house has the advantage of being peaceful, through the quiet provided by triple glazing and the efficiency of the ventilation equipment. We are aware of its presence and working, through the inlets and outlets. The slight, and it is only slight, sounds: plus, the again slight breeze beneath the outlet points are surprisingly comforting. We know it is working (the comfort element) but are entirely untroubled by it.

The house has settled down in 2024 to a consistent performance and temperature. It took six months or so for it to absorb the heat into the structure. For the last six-nine months, it has acted as an efficient and effective heat sink. The proof - the heating costs have been falling for that length of time and we have no need to increase the heating as we enter winter. The ambient temperature, which can of course be adjusted throughout areas of the building, is comfortable and consistent.

And our heating costs are now dropping considerably.”

Airtightness Test Certificate

This is to certify that the following test has been carried out by an Elmhurst Airtightness Scheme (EAS) registered Tester in accordance with the Test Standard stated below. Deviations from the standard are also stated below. This certificate demonstrates the results achieved when conducting Airtightness Testing to Passivhaus standards. A full report in line with the current approved procedures can be requested from the EAS Tester.



Unique Certificate Number	10297275
Test Method	Blower Door
Test Standard	ATTMA TSL 1
Date of Test	6 th June 2023
Building name / Plot number	Kindar Coach House
Building Address	New Abbey, Dumfries, Dumfries and Galloway DG2 8EH
Envelope Area m ²	481.85
Volume m ³	308.37
Building Preparations	Drainage traps filled/sealed, Internal doors opened, Windows & external doors closed, Mechanical Ventilation grilles sealed
Deviations	None
Report Reference	ATTMA 2023-06-06 0957
Tester's Name	Colin Davidson
Company Name	Thermal Image UK
Tester No.	0410
Tester's level of competence	Level 2: Buildings over 4000m ³
Related party disclosure	No related party

Signed

A handwritten signature in black ink, appearing to read "Colin Davidson".

Elmhurst Airtightness Scheme
 Elmhurst Energy Systems Ltd
 16 St Johns Business Park,
 Lutterworth,
 Leicestershire, LE17 4HB

e: airtest-support@elmhurstenergy.co.uk
 t: 01455 555 217
 w: elmhurstairtightness-scheme.co.uk
 Company Registration No: 2805846

	Building Compliance	Passivhaus
Air permeability $m^3(h.m^2)$ at 50 Pa	0.48	N/A
Average air change rate (1/h) at 50 Pa	N/A	0.730

Test Validation Information

	Pressurised test	Depressurised test
r^2 (Correlation ≥ 0.98 - ≤ 1.00)	0.9901	0.9969
n (Slope ≥ 0.50 - ≤ 1.00)	0.710	0.715
n_{50} (Air Changes per Hour)	0.710	0.750

