# Project Documentation Gebäude-Dokumentation

# Certified Passive House Passive House Institute

# 1 Abstract / Zusammenfassung



Office building for Business and Education Centre in Devon

# 1.1 Data of building / Gebäudedaten

Year of construction/ Baujahr	2017	Space heating /	12	
U-value external wall/ U-Wert Außenwand	0.116 W/(m²K)	Heizwärmebedarf	kWh/(m²a)	
U-value basement ceiling/ U-Wert Kellerdecke	0.110 W/(m²K)	Primary Energy Renewable (PER) / Erneuerbare Primärenergie (PER)	0 kWh/(m²a)	
U-value roof/ U-Wert Dach	0.093 W/(m²K)	Generation of renewable energy / Erzeugung erneuerb. Energie	0 kWh/(m²a)	
U-value window/ U-Wert Fenster	0.82 W/(m²K)	Non-renewable Primary Energy (PE) / Nicht erneuerbare Primärenergie (PE)	101 kWh/(m²a)	
Heat recovery/ Wärmerückgewinnung	87.1 %	Pressure test n <sub>50</sub> / Drucktest n <sub>50</sub>	0.6 h-1	
Special features/ Besonderheiten	Solar collectors for howater, rainwater utilis	ot water generation, heat recovery from wa	sh water/grey	

#### 1.2 Brief Description

#### Office building for Business and Education Centre in Devon

This small office building was commissioned by a husband and wife team, each running their own businesses. The rectangular, single-storey building has a treated floor area of  $139\text{m}^2$  and was built in a countryside location in East Devon. The long elevations of the rectangular building face east and west. West-facing clerestorey windows bring additional light into the core of the building. A wood-burning stove generates most of the heat required on very cold overcast days. The very small amount of domestic hot water is provided by an instantaneous water heater. The architectural firm Alchemilla Architects Ltd designed and contract managed the project. The building will have been inhabited for one full year in August, at which point a review of the performance of the building will be carried out.

#### 1.3 Responsible project participants / Verantwortliche Projektbeteiligte

Architect/ Wiebke Rietz, Alchemilla Architects Ltd Entwurfsverfasser http://www.alchemillaarchitects.co.uk

Implementation planning/ Wiebke Rietz, Alchemilla Architects Ltd Ausführungsplanung http://www.alchemillaarchitects.co.uk

Building systems/ The Green Building Store

Haustechnik http://www. greenbuildingstore.co.uk

Structural engineering/ Allwood Timber Contruction

Baustatik http://www.allwoodtimber.co.uk

Passive House project Wiebke Rietz, Alchemilla Architects Ltd

planning/ http://www.alchemillaarchitects.co.uk Passivhaus-Projektierung

Construction management/ Wiebke Rietz, Alchemilla Architects Ltd

Bauleitung http://www.alchemillaarchitects.co.uk

Certifying body/ Mead:Energy & Architectural Design Ltd

Zertifizierungsstelle www. meadconsulting.co.uk

Certification ID/

Zertifizierungs ID Project-ID (www.passivehouse-database.org)

17440\_MEAD\_PH\_2018011 ID 5451

9 KM

Author of project documentation / Wiebke Rietz, Alchemilla Architects Ltd http://www.alchemillaarchitects.co.uk

Verfasser der Gebäude-Dokumentation

Date, Signature/
Datum, Unterschrift

# 2 Photographs of views from accessible sides



East elevation, the MVHR in- and outlets visible.



North elevation, the only window, facing into a small garden area, was added at a late stage, but was made small enough to not have any impact on the overall performance



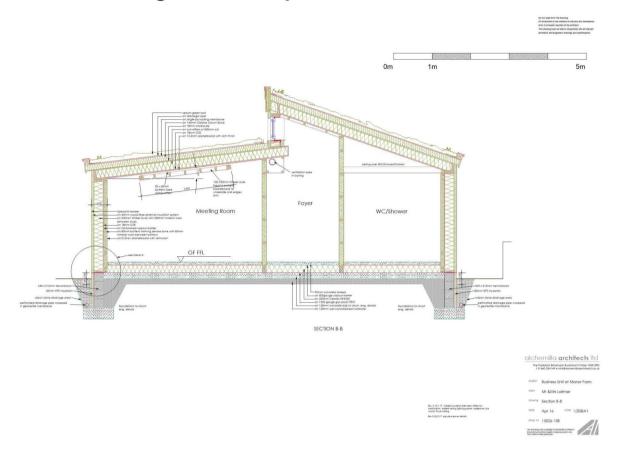
West elevation, the balustrade to the patio area was still unfinished when the photo was taken. The fenestration in this elevation helps with the overall energy balance.



Internal View of hallway, showing the light coming in from the clerestorey windows. To the left is the shower room and kitchenette, to the right is the meeting room and two offices. The hatch at high level provides access to some storage. At the other end of the hallway another hatch provides access to some of the pipework for the MVHR.

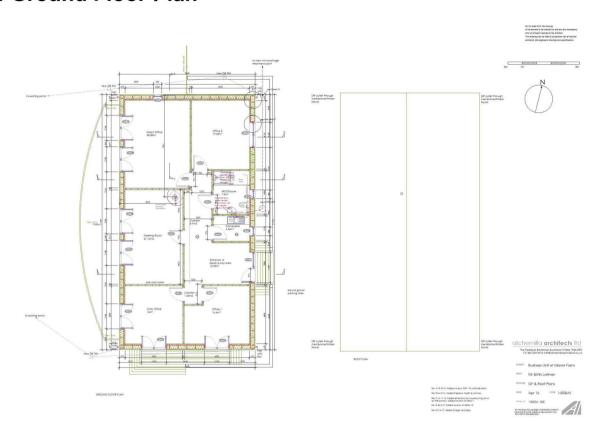
The South-facing elevation is shown on the cover page. This elevation is the most visible one when approaching the building.

# 3 Sectional drawing with description



Section BB is a typical section through the East-West width of the building, showing all the most important connection details as well as the clerestorey window installation arrangement. The completely continuous thermal insulation is clearly visible, as is the air-tightness layer. Each office has a central panel for the lighting to avoid having a ceiling service zone and to ensure the air-tightness layer is well protected in the long term. There is a useful area below the clerestorey windows for the central MVHR pipe.

#### 4 Ground Floor Plan



The building is single-storey with four offices and one meeting room, a kitchenette and a WC/shower room. The Foyer is used as a meeting space for the many networking and other events which are being hosted in the building. To the west of the building an existing pond creates a pleasant environment for users of the patio. Due to a slightly sloping site the building is set into the ground on the east -side, with a narrow walkway and two "bridges" to the front entrance and the south-facing patio doors. The MVHR unit was going to be located on a small mezzanine by the north-facing elevation. However, during the planning process the building had to be lowered substantially, which made this unviable. The unit is therefore located in the shower room. The only form of heating is the wood-burning stove in the meeting room. This works well, but on very cold days some extra electric heaters are required for some of the offices as the MVHR system does not appear to be capable of redistributing the heat sufficiently.

#### **5 Construction Details**

#### 5.1 Construction of floor slab



The concrete floor slab the day after it was poured.



The insulation is being fitted before pouring of the cement screed. The photo shows the junction with internal walls, which were filled with EcoTherm insulation to keep cold-bridging to a minimum.

Floor build-up: 75mm concrete screed on 500 gauge separating layer on 200mm Extratherm on 1200 gauge damp proof membrane on 150mm concrete slab on 150mm hardcore with sand blinding. U-value 0.110W/m<sup>2</sup>K.

#### 5.2 Construction of exterior walls



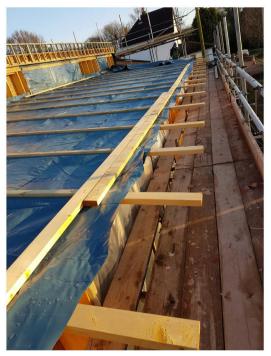
The timber frame before the installation of the insulation.



This photo shows the mineral wool fitted between the studs, with the wood-fibre insulation in progress. The pipes are for the MVHR intake and outlet.

Wall construction: Proprietary external render on 60mm wood-fibre insulation on 239mm timber frame fully filled with Knauf Earthwool mineral wool insulation on 18mm OSB on 80mm service zone fully filled with mineral wool insulation on 12.5mm plasterboard with skim-coat. At ground level the external wood-fibre insulation is changed to XPS, to avoid damp in this area to damage the insulation. U-value: 0.116W/m²K.

#### **5.3 Roof Construction**



The roof after the mineral wool was fitted between the rafters, but before the foam insulation installation.



The EcoTherm insulation installation in progress.

Roof build-up: Green roof on single-ply membrane on 140mm EcoTherm on 18mm plywood on 220mm timber rafters fully filled with Knauf Earthwool on 18mm OSB on vapour barrier, taped, on 12.5mm plasterboard with skim-coat. U-value: 0.093W/m2K.

#### **5.4 Window Sections**



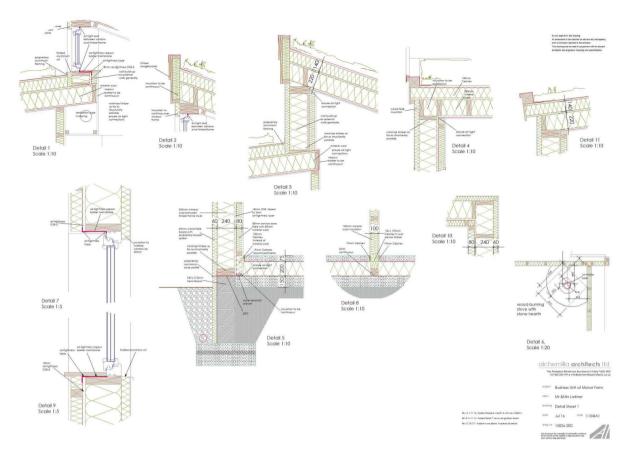
The windows installed with the air-tightness layer taped to the windows and the OSB. Service zone installed but before fitting of the mineral wool.



The External view of the window installation.



The wood-fibre insulation is being installed, overlapping the window frames.



Construction details, including the window installation.

The triple-glazed windows, model "Ultra", were supplied by "The Green Building Store". Installed U-values ranged from 0.80 to 0.83W/m²K, resulting in an average of 0.82W/m²K. The painted softwood timber frames were over-insulated externally by 40mm with the wood-fibre insulation and taped to a vapour barrier internally, which in turn was taped to the OSB. At threshold level the patio doors were fixed to an area of timber frame in the same way the windows were fixed elsewhere. The model, make and installation of the clerestorey windows was the same as for the windows and patio doors elsewhere.

#### 6 The air-tight envelope

The air-tightness layer in the roof consists of a proprietary vapour barrier membrane, taped with a suitably approved tape. For the walls no additional layer was required as the OSB, which was also taped with suitable tape, served as the air-tightness layer. The OSB was also taped to the 1200 gauge damp- and gas-proof membrane in the floor build-up.



The ceiling with the air-tightness sheeting in place.

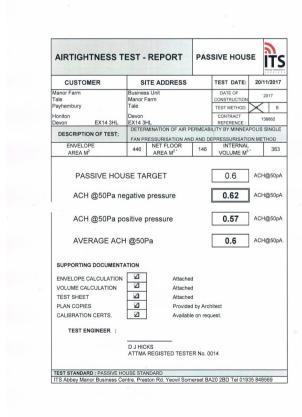


The taping and air-tightness membrane near the clerestorey.

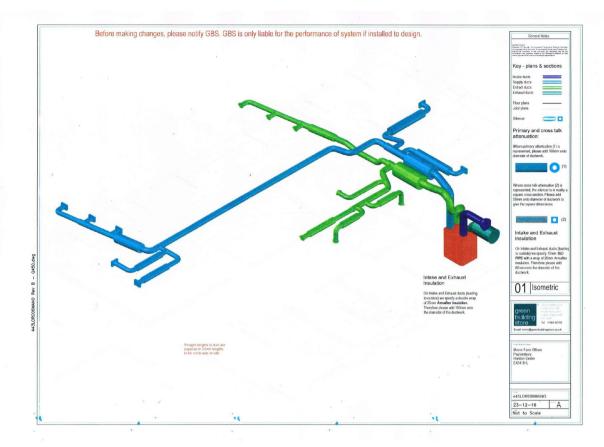


The final pressure test in progress.

#### Results of the pressure test on the 20/11/2017:



# 7.1 The ventilation ductwork



3D schematic plan of the ventilation ductwork.



The ductwork to the main meeting room.

The ductwork for this building was quite straightforward with a central duct running the length of the building for the supply air and a shorter run from the unit to the extract areas and rooms. Gaps under the doors provide some of the transfer of air from room to room. It was decided by The Green Building Store, who designed the system, that the meeting room should have extraction at one end and supply at the other. It is debatable however whether, by having supply ducts into this room, too much of the warm air created by the wood-burning stove gets re-supplied to this room, rather than being distributed to the other offices.

#### 7.2 The central ventilation unit



The MVHR and pipework after installation.

A Zehnder ComfoAir Q ventilation unit was chosen and supplied by The Green Building Store. The intake and outlet pipes were kept short by placing the unit next to the east-facing external wall. The unit is very quiet, which was a concern raised by the client, who was very happy once it became clear that the unit cannot be heard in the offices. The size of the unit was kept in line with the day-to-day use by the client, catering for 4 to 6 people working in the building most days. The meeting room is used for larger assemblies of people only a few times a month. It was therefore deemed acceptable to open the patio doors on these occasions, should the air-quality become too poor. A larger unit would not only have resulted in more cost and more space being taken up, it would also create more noise.

# 8 Description of the heat supply system



The wood-burning stove in the meeting room

In line with the common lore of PH it was assumed that a single heat-source in one room would suffice to keep the building warm throughout on particularly cold or sunless days. A 4.5kW HWAM room-sealed wood-burning stove was installed, with a direct air-intake pipe under the floor.

# 9 PHPP results

Street: Lower Tale Postcode(City EX14 3RL Architect Architect Street The Paddock, Blindmoor Postcode(City Ta20 3RD Mechanical System: The Green Building Store Street Heath House Mill, Heath House Lane Postcode(City Ta20 3RD Mechanical System: Street Heath House Mill, Heath House Lane Postcode(City Goldar, Hudderefield, HD7 4JW Year of Construction: 2016 Number of Dwelling Units: 0 Enclosed Volume V, 535.0 Number of Occupants: 6.0  Treated floor area Treated floor area Treated floor area Treated floor area 139.5 m' Heating load Heating load Heating load Frequency of overheating (> 25 °C) 1.3 % Frequency of overheating (> 25 °C) 1.3 %  Frequency of overheating (> 25 °C) 1.3 %  Trimary Energy  Trimary Energy  The Green Building Store Street Heath House Mill, Heath House Lane  Use: Monthly method  Requirements Fulfilled?* 15 kWh/(m²a) 10 W/m²		Passive Ho	use verification	. Y .	
Street: Lower Tale Postcode(Dig EX14 3HL Country UK Building Type: office building Climate South West Ident Cowner(s) / Client(s): Chris & Mary Lorimer Street: Lower Tale Postcode(Dig EX14 3HL Architect Alchemilla Architects Ltd Street: The Paddock, Blindmoor Postcode(Dig Tale) 3BD Mechanical System: The Green Building Store Street Heath Rouse Mill, Reath Rouse Lane Postcode(Dig Tale) 3BD Mechanical System: The Green Building Store Street Heath Rouse Mill, Reath House Lane Postcode(Dig Coloar, Ruddersfield, HD7 40W Year of Construction: 2016 Number of Douelling Units: 0 Interior Temperature: 20, 0 Interior Temperature: 3, 5 Number of Cocupants: 6, 0 Number of			Photo or Drawing	×	
Street: Lower Tale Postcode(Dt; EX14 3HL Country: UK Building Type: office building Climate South West Iome Owner(s) / Client(s): Chris & Mary Lorimer Street: Lower Tale Postcode(Dt; EX14 3HL Architect: Alchemilla Architects Ltd Street: The Paddock, Blindmoor Postcode(Dt; Tale 3MD Mechanical System: The Green Building Store Street: Heath House Mill, Heath House Lane Postcode(Ott) Golder, Huddersfield, HD7 40W Year of Construction Number of Dwelling Units: 0 Internal Heat Gains: 3.5 W/m² Postcode(Ott) Golder, Huddersfield, HD7 40W Year of Construction Number of Occupants: 0 internal Heat Gains: 3.5 W/m² Number of Occupants: 1 internal Heat Gains: 1 internal H					
Postcode/City EX14 3HL Country UK  Building Type: office building Climate: South West  Forme Owner(s) / Client(s): Chris & Mary Lorimer Street: Lower Tale Postcode/City: EX14 3HL Architect: Alchemilla Architects Ltd Street: The Paddock, Blindmoor Postcode/City: TA20 3RD  Mechanical System: The Green Building Store Street: Heath House Mill, Heath House Lane Postcode/City: Golcar, Huddersfield, HD7 4JW Year of Construction: 2016 Internal Heat Gains: 3.5 W/m²  Prescribe Heath House Mill, Heath House Lane Postcode/City: Golcar, Huddersfield, HD7 4JW Year of Construction: 2016 Internal Heat Gains: 3.5 W/m²  Prescribe Heath House Mill, Heath House Lane Postcode/City: Golcar, Huddersfield, HD7 4JW Year of Construction: 2016 Internal Heat Gains: 3.5 W/m²  Preclosed Volume V., 535.0 Number of Occupants: 6.0  Treated floor area  Treated floor area  Annual heating demand Heating load Heating load Cooling load Frequency of overfleating (> 25 °C) 1.3 % Frequency of overfleating (> 25 °C) 1.3 % Frequency of overfleating (> 25 °C) 1.3 % Frequency of overfleating and auxiliary electricity Ohlw, space heating and auxiliary electricity Specific primary energy reduction through solar electricity Specific primary energy reduction through solar electricity Specific primary energy reduction through solar electricity New York (Mr/m²a) Frequency of overfleating (> 25 °C) 1.3 % 101 kWh/(m²a) 120 kWh/(m²a				-	
Country: UK Building Type: office building Climate:  South West					
Building Type: office building Climate South West  frome Owner(s) Client(s): Chr.1s & Mary Loximer Street Postcode/City: EXT4 3HL  Architect Alchemilla Architects Ltd Street Postcode/City: TA20 3RD  Mechanical System: The Paddock, Blindmoor Postcode/City: TA20 3RD  Mechanical System: The Creen Building Store Street Heath House Mill, Reath House Lane Postcode/City: Golcar, Ruddersfield, HD7 4JW  Year of Construction: Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Number of Dowelling Units: Enclosed Volume V <sub>2</sub> : 535.0  Nu					,
Climate: South West  from Owner(s) / Client(s): Chris & Mary Lorimer  Street: Lower Tale Postcode/Cliv: EX14 3RL  Architect: Al-chemilla Architects Ltd Street: The Paddock, Blindmoor Postcode/Cliv: Ta20 3RD  Mechanical System: The Green Building Store Street: Health Rouse Mill, Health Rouse Lane Postcode/Cliv: Ta20 3RD  Mechanical System: The Green Building Store Street: Health Rouse Mill, Health Rouse Lane Postcode/Cliv: Glocar, Muddersfeld, HD7 4JW  Year of Construction: 2016 Interior Temperature: 20.0 °C Internal Heat Gains: 3.5 W/m²  Findised Outline V <sub>c</sub> : 535.0 Number of Occupants: 6.0  Treated floor area Annual heating demand Heating demand Heating demand Gooling load Frequency of overheating (> 25 °C) System Internal Heat Gains: W/m²  Treated floor area  Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating (> 25 °C) System Internal Heating load Cooling load Frequency of overheating load Cooling load Frequency of overheating (> 25 °C) System Internal Heat Gains: Full Heat Gains: F					
Street: Lower Tale Postcode(City EX14 3RL Architect Architect Street The Paddock, Blindmoor Postcode(City Ta20 3RD Mechanical System: The Green Building Store Street Heath House Mill, Heath House Lane Postcode(City Ta20 3RD Mechanical System: Street Heath House Mill, Heath House Lane Postcode(City Goldar, Hudderefield, HD7 4JW Year of Construction: 2016 Number of Dwelling Units: 0 Enclosed Volume V, 535.0 Number of Occupants: 6.0  Treated floor area Treated floor area Treated floor area Treated floor area 139.5 m' Heating load Heating load Heating load Frequency of overheating (> 25 °C) 1.3 % Frequency of overheating (> 25 °C) 1.3 %  Frequency of overheating (> 25 °C) 1.3 %  Trimary Energy  Trimary Energy  The Green Building Store Street Heath House Mill, Heath House Lane  Use: Monthly method  Requirements Fulfilled?* 15 kWh/(m²a) 10 W/m²					
Street: Lower Tale Postcode(City EX14 3RL Architect Architect Street The Paddock, Blindmoor Postcode(City Ta20 3RD Mechanical System: The Green Building Store Street Heath House Mill, Heath House Lane Postcode(City Ta20 3RD Mechanical System: Street Heath House Mill, Heath House Lane Postcode(City Goldar, Hudderefield, HD7 4JW Year of Construction: 2016 Number of Dwelling Units: 0 Enclosed Volume V, 535.0 Number of Occupants: 6.0  Treated floor area Treated floor area Treated floor area Treated floor area 139.5 m' Heating load Heating load Heating load Frequency of overheating (> 25 °C) 1.3 % Frequency of overheating (> 25 °C) 1.3 %  Frequency of overheating (> 25 °C) 1.3 %  Trimary Energy  Trimary Energy  The Green Building Store Street Heath House Mill, Heath House Lane  Use: Monthly method  Requirements Fulfilled?* 15 kWh/(m²a) 10 W/m²	Home Owner(s) / Client(s)	Chris & Mary Lorimer			
Postcode/City EX14 3HL  Architect Alchemilla Architects Ltd  Street The Paddock, Blindmoor Postcode/City 7a20 3RD  Mechanical System Street Heath House Mill, Reath House Lane Postcode/City Golear, Huddersfield, HD7 4JW  Year of Construction Number of Dwelling Units:  Enclosed Volume V <sub>e</sub> 535.0 Number of Occupants:  6.0  Interior Temperature:  20.0  Interior Temperature:  Enclosed Volume V <sub>e</sub> 535.0 Number of Occupants:  6.0  Interior Temperature:  20.0  Interior Temperature:  20.0  VC Internal Heat Gains:  3.5  W/m²  Freaded floor area  Annual heating demand Heating load Heating load Heating load  Frequency of overheating demand Frequency of overheating (>25 °C)  Specific primary Energy  Annual heating demand Frequency of overheating (>25 °C)  Specific primary energy reduction through solar electricity Specific primary energy reduction through solar electricity Specific primary energy reduction through solar electricity  Annual heating load  Fresurization test result n <sub>50</sub> O.6 1/h  Ves  **empty field: data missing, ** no requirement **empty fi					
Street: Postcode/City: TA20 3RD  Mechanical System: The Green Building Store  Street: Heath House Mill, Heath House Lane Postcode/City: Golcar, Ruddersfield, HD7 4JW Year of Construction: 2016 Interior Temperature: 20.0 °C Number of Dveling Units: 535.0 Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 °C Num					
Street: Postcode/City: TA20 3RD  Mechanical System: The Green Building Store  Street: Heath House Mill, Heath House Lane Postcode/City: Golcar, Ruddersfield, HD7 4JW Year of Construction: 2016 Interior Temperature: 20.0 °C Number of Dveling Units: 535.0 Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 Interior Temperature: 10.0 °C Number of Occupants: 0.0 °C Num					
Postcode/City TA20 3RD  Mechanical System: The Green Building Store Street: Heath House Mill, Heath House Lane Postcode/City Golcar, Huddersfield, HD7 4JW  Year of Construction: 2016 Interior Temperature: 20.0 °C Number of Dwelling Units: 0 Enclosed Volume V <sub>e</sub> : 535.0 Number of Occupants: 6.0  Decific building demands with reference to the treated floor area  Treated floor area  Treated floor area  139.5 m' Requirements Fulfilled?*  Pace heating Annual heating demand Heating load  Pace cooling Overall specific space cooling demand Cooling load  Frequency of overheating (>25 °C)  Specific primary energy reduction through solar electricity  Specific primary energy reduction through solar electricity  Specific primary energy reduction through solar electricity  Interior Temperature: 20.0 °C  Number of Occupants: 0.0  Requirements Fulfilled?*  Requirements Fulfilled?*  Pulfilled?*  Requirements Fulfilled?*  Pulfilled?*  Requirements Fulfilled?*  13 W/m²  10 VV/m²					
Mechanical System: Street: Street: Street: Postcode/City: Golcar, Ruddersfield, HD7 47W  Year of Construction: Number of Dwelling Units: Enclosed Volume V <sub>s</sub> : Sologian and System: Street: Street: Number of Overling Units: Enclosed Volume V <sub>s</sub> : Sologian and System: Street: Stree					
Street Postcode/City: Golcar, Ruddersfield, RD7 47W  Year of Construction: 2016 Number of Dwelling Units: 0 Enclosed Volume V., 535.0 Number of Occupants: 0 6.0  Sectic building demands with reference to the treated floor area  Treated floor area  Annual heating load Heating load Heating load Frequency of overheating (> 25 °C)  rimary Energy  Annual heating and auxiliary electricity Specific primary energy reduction through solar electricity Specific primary energy reduction through solar electricity Fressurization test result n <sub>50</sub> Registration number PHPP:  Registration number P	Mechanical System	The Green Building Store			
Year of Construction:   2016   Interior Temperature:   20,0   °C   Internal Heat Gains:   3.5   W/m²			Lane		
Number of Dwelling Units: Enclosed Volume V <sub>2</sub> : S35.0 Number of Occupants:  O	Postcode/City	Golcar, Huddersfield, HD7 4JW			
Number of Dwelling Units: Enclosed Volume V <sub>2</sub> : S3.5.0 Number of Occupants:    System   Syste	Vear of Construction	2016 Inte	rior Temperature: 20.0 °C		
Number of Occupants: 6.0    Coeffic building demands with reference to the treated floor area   1.39.5 m'   Requirements   Fulfilled?"					
Treated floor area  Treated floor area  Annual heating demand Heating load  Pace cooling  Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C)  Finary Energy  DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity Fresulting and auxiliary electricity Specific primary energy reduction through solar electricity assive House?  Pressurization test result n <sub>50</sub> Requirements Fulfilled?*  Requirements Fulfilled?*  Requirements Fulfilled?*  Name:  Requirements Fulfilled?*  Name: Monthly method  Requirements Fulfilled?*  15 kWh/(m²a) 10 W/m²					
Treated floor area pace heating  Annual heating demand Heating load Pace cooling  Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C)  Frimary Energy  Adhumidification, DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity Appears including an auxiliary electricity Specific primary energy reduction through solar electricity Appears including and auxiliary electricity Appears	Number of Dwelling Units Enclosed Volume V <sub>e</sub>	0 Int			
Annual heating demand Heating load  Pace cooling  Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C)  F	Number of Dwelling Units Enclosed Volume V <sub>e</sub>	0 Int			
Annual heating demand Heating load  Pace cooling  Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C)  F	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants	0 Int 535.0 6.0		m²	
Heating load  Pace cooling  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Frimary Energy  Adhumidification, DHW, bousehold electricity. DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity  Intightness  Pressurization test result n <sub>50</sub> Pressurization test result n <sub>50</sub> Registration number PHPP:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants	0 Int 535.0 6.0	ernal Heat Gains: 3.5 W/	m² use: Monthly method	
Pace cooling  Overall specific space cooling demand  Cooling load  Frequency of overheating (> 25 °C)  Firmary Energy  Adhumidification, DHW, cooling, household electricity.  DHW, space heating and auxiliary electricity  Specific primary energy reduction through solar electricity  irrightness  Pressurization test result n <sub>50</sub> Pressurization test result n <sub>50</sub> Registration number PHPP:  etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP  Surname:  Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with	0 Int 535.0 6.0  reference to the treated floor area  Treated floor area	ernal Heat Gains: 3.5 W/	use: Monthly method	Fulfilled?*
Cooling load Frequency of overheating (> 25 °C)  rimary Energy    Cooling load   Frequency of overheating (> 25 °C)   1.3 %     -	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants	0 Int 535.0 6.0 reference to the treated floor area  Treated floor area  Annual heating demand	139.5 m² (W/h/(m²a)	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes
Cooling load Frequency of overheating (> 25 °C)  rimary Energy    Primary Energy   Primary	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with	0 Int 535.0 6.0 reference to the treated floor area  Treated floor area  Annual heating demand	139.5 m² (W/h/(m²a)	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes
Frequency of overheating (> 25 °C)  rimary Energy    Cooling	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with	0 Int 535.0 6.0 Int Freetence to the treated floor area  Annual heating demand Heating load	139 . 5 m²  12 kWh/(m²a)  13 W/m²	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes -
rimary Energy deburnidification, DHW, household electricity.  DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity irrightness Pressurization test result n <sub>50</sub>	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with space heating	o Int 535 . 0 6.0  reference to the treated floor area  Treated floor area  Annual heating demand  Heating load  Overall specific space cooling demand	139 . 5 m' 12 kWh/(m²a) 13 W/m²	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes  -
DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity irrightness  Pressurization test result n <sub>50</sub> 0.6 1/h  0.6 1/h  yes  empty field: data missing, % no requirement  yes  fe confirm that the values given herein have been setermined following the PHPP methodology and based in the characteristic values of the building. The PHPP  Surname:  Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with space heating	o Int 535 . 0 6.0 Int 535 . 0 Int 535	139 .5 m' 12 kWh/(m²a) 13 W/m²  kWh/(m²a) w/m²	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes  -  -  -  -  -  -  -  -  -  -  -  -  -
DHW, space heating and auxiliary electricity Specific primary energy reduction through solar electricity irrightness  Pressurization test result n <sub>50</sub> 0.6 1/h  0.6 1/h  yes  empty field: data missing, % no requirement  yes  fe confirm that the values given herein have been setermined following the PHPP methodology and based in the characteristic values of the building. The PHPP  Surname:  Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with space heating	o Int 535.0 6.0  reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)	139 .5 m' 12 kWh/(m²a) 13 W/m²  kWh/(m²a) w/m²	use: Monthly method Requirements 15 kWh/(m²a)	Fulfilled?*  yes  -  -  -  -  -  -  -  -  -  -  -  -  -
Specific primary energy reduction through solar electricity kWh/(m²a)	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants pecific building demands with space heating	o Int 535.0 6.0  reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)	139.5 m² 12 kWh/(m²a) 13 W/m² kWh/(m²a) W/m² 1.3 %	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²	Fulfilled?*  yes
irtightness Pressurization test result n <sub>50</sub> 0.6 1/h 0.6 1/h yes  * empty field: data missing: *: no requirement  assive House?  //e confirm that the values given herein have been Name: Registration number PHPP: etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy	reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Space reasing and cooling, household electricity.	139.5 m² 12 kWh/(m²a) 13 W/m² kWh/(m²a) 1.3 % 101 kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²	Fulfilled?*  yes  -  -  yes  yes
assive House?  yes  //e confirm that the values given herein have been etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP Surname:    Surname:   Issued on:	Number of Dwelling Units Enclosed Volume Ve Number of Occupants pecific building demands with space heating Space cooling	reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Space ineating aim dehumidification, DHW, bousehold electricity.  DHW, space heating and auxiliary electricity	139.5 m² 12 kWh/(m²a) 13 W/m² kWh/(m²a) 1.3 % 101 kWh/(m²a) 66 kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²	Fulfilled?*  yes  -  -  yes  yes  -  yes
assive House?  /e confirm that the values given herein have been etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP  Surname:  Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy  Specific prim	o Int 535.0 6.0 Int 553.0 6.0 Integrated floor area Annual heating demand Heating load Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C) Opace meaning and cooling. Cooling load dehumidification, DHW, household electricity. DHW, space heating and auxiliary electricity ary energy reduction through solar electricity.	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -	Fulfilled?*  yes  -  yes  yes  -  yes
/e confirm that the values given herein have been Name: Registration number PHPP: etermined following the PHPP methodology and based In the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume Ve Number of Occupants pecific building demands with space heating Space cooling	o Int 535.0 6.0 Int 553.0 6.0 Integrated floor area Annual heating demand Heating load Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C) Opace meaning and cooling. Cooling load dehumidification, DHW, household electricity. DHW, space heating and auxiliary electricity ary energy reduction through solar electricity.	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  100 kWh/(m²a)  -  100 kWh/(m²a)	Fulfilled?*  yes  yes  yes  yes
/e confirm that the values given herein have been Name: Registration number PHPP: etermined following the PHPP methodology and based In the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy  Specific prim	o Int 535.0 6.0 Int 553.0 6.0 Integrated floor area Annual heating demand Heating load Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C) Opace meaning and cooling. Cooling load dehumidification, DHW, household electricity. DHW, space heating and auxiliary electricity ary energy reduction through solar electricity.	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  100 kWh/(m²a)  -  100 kWh/(m²a)	Fulfilled?*  yes  yes  yes  yes
etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume Ve Number of Occupants  pecific building demands with  space heating  Space cooling  Primary Energy  Specific prim  Airtightness	o Int 535.0 6.0 Int 553.0 6.0 Integrated floor area Annual heating demand Heating load Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C) Opace meaning and cooling. Cooling load dehumidification, DHW, household electricity. DHW, space heating and auxiliary electricity ary energy reduction through solar electricity.	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  100 kWh/(m²a)  -  100 kWh/(m²a)	Fulfilled?*  yes  yes  yes  yes  yes  yes
etermined following the PHPP methodology and based in the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy  Specific prim	o Int 535.0 6.0 Int 553.0 6.0 Integrated floor area Annual heating demand Heating load Overall specific space cooling demand Cooling load Frequency of overheating (> 25 °C) Opace meaning and cooling. Cooling load dehumidification, DHW, household electricity. DHW, space heating and auxiliary electricity ary energy reduction through solar electricity.	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  100 kWh/(m²a)  -  100 kWh/(m²a)	Fulfilled?*  yes  yes  yes  yes  yes  yes
n the characteristic values of the building. The PHPP Surname: Issued on:	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  Space heating  Space cooling  Primary Energy  Specific prim  Airtightness  Passive House?	o Int 535.0 6.0 Int 55.0	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)  0.6 1/h	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  0.6 1/h  ** empty field: data miss	Fulfilled?*  yes  yes  - yes  yes  yes  yes  ye
	Number of Dwelling Units Enclosed Volume V, Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy  Specific prim  Airtightness  Passive House?	o Int 535.0 6.0 Int 553.0 Int 553.0 6.0 Int 553.0 In	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) 66 kWh/(m²a) kWh/(m²a)  0.6 1/h	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  0.6 1/h  ** empty field: data miss	Fulfilled?*  yes  yes  - yes  yes  yes  yes  ye
riculations are attached to this application.	Number of Dwelling Units Enclosed Volume V <sub>e</sub> Number of Occupants  pecific building demands with  space heating  space cooling  Primary Energy  Specific prim  Airtightness  Passive House?	reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Space reasing and cooling, dehumidification, DHW, household electricity.  DHW, space heating and auxiliary electricity ary energy reduction through solar electricity  Pressurization test result n <sub>50</sub> s given herein have been PHPP methodology and based	139.5 m²  12 kWh/(m²a)  13 W/m²  kWh/(m²a)  1.3 %  101 kWh/(m²a)  66 kWh/(m²a)  kWh/(m²a)  0.6 1/h	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  0.6 1/h  ** empty field: data miss	Fulfilled?*  yes  yes  yes  yes  yes  rumber PHPP:
	Number of Dwelling Units Enclosed Volume Ve Number of Occupants  pecific building demands with  space heating  Space cooling  Primary Energy  Specific prim  Airtightness  Passive House?	reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Space treating and cooling, household electricity.  DHW, space heating and auxiliary electricity ary energy reduction through solar electricity  Pressurization test result n <sub>50</sub> s given herein have been PHPP methodology and based es of the building. The PHPP	139.5 m²  12 kWh/(m²a)  13 W/m²  kWh/(m²a)  1.3 %  101 kWh/(m²a)  66 kWh/(m²a)  kWh/(m²a)  0.6 1/h	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  0.6 1/h  ** empty field: data miss	Fulfilled?*  yes  yes  - yes  yes  yes  yes  ye
Company: Signature:	Number of Dwelling Units Enclosed Volume Ve Number of Occupants  pecific building demands with  space heating  Space cooling  Primary Energy  Specific prim  Airtightness  Passive House?	reference to the treated floor area  Treated floor area  Annual heating demand Heating load  Overall specific space cooling demand Cooling load  Frequency of overheating (> 25 °C)  Space treating and cooling, household electricity.  DHW, space heating and auxiliary electricity ary energy reduction through solar electricity  Pressurization test result n <sub>50</sub> s given herein have been PHPP methodology and based es of the building. The PHPP	139.5 m² 12 kWh/(m²a) 13 W/m²  kWh/(m²a) W/m²  1.3 %  101 kWh/(m²a) kWh/(m²a)  0.6 1/h  Name:	use: Monthly method  Requirements  15 kWh/(m²a)  10 W/m²  -  -  120 kWh/(m²a)  -  0.6 1/h  ** empty field: data miss	rulfilled?*  yes  yes  yes  yes  yes  unumber PHPP:  Issued on:

PHPP, Verification

170718 PHPP Manor Farm offices 15026.xlsm

- **10.1** Overall construction costs: £1424.00/m². This is a very good cost per m² ratio, with building prices in the area currently generally ranging from £1500 to £2000/m².
- **10.2** Building costs: £197,923.54