Project Documentation
Gebäude-Dokumentation

1 Abstract / Zusammenfassung

Residential development with 3 terraced houses and 6 flats at Luckham Road, Bournemouth, UK

1.1 Data of building / Gebäudedaten

Block 01 (terraced houses)

Year of construction/ Baujahr	2021	**Space heating / Heizwärmebedarf**	**15 kWh/(m²a)**
U-value external wall/ U-Wert Außenwand	0.208 W/(m²K)		
U-value basement ceiling/ U-Wert Kellerdecke	0.201 W/(m²K)	**Primary Energy Renewable (PER) / Erneuerbare Primärenergie (PER)**	42 kWh/(m²a)
U-value roof/ U-Wert Dach	0.102 W/(m²K)	**Generation of renewable energy / Erzeugung erneuerb. Energie**	0 kWh/(m²a)
U-value window/ U-Wert Fenster	1.01 W/(m²K)	**Non-renewable Primary Energy (PE) / Nicht erneuerbare Primärenergie (PE)**	105 kWh/(m²a)
Heat recovery/ Wärmerückgewinnung	82 %	Pressure test n_{50} / Drucktest n_{50}	0.6 h-1
Special features/ Besonderheiten	Ground source heat pump for domestic warm water and heating		

Block 02 (flats)

Year of construction/ Baujahr	2021	**Space heating** / **Heizwärmebedarf**	**10** **kWh/(m²a)**
U-value external wall/ U-Wert Außenwand	0.208 W/(m²K)		
U-value basement ceiling/ U-Wert Kellerdecke	0.201 W/(m²K)	**Primary Energy Renewable (PER)** / **Erneuerbare Primärenergie (PER)**	45 kWh/(m²a)
U-value roof/ U-Wert Dach	0.102 W/(m²K)	**Generation of renewable energy** / **Erzeugung erneuerb. Energie**	0 kWh/(m²a)
U-value window/ U-Wert Fenster	1.01 W/(m²K)	**Non-renewable Primary Energy (PE)** / **Nicht erneuerbare Primärenergie (PE)**	114 kWh/(m²a)
Heat recovery/ Wärmerückgewinnung	82 %	Pressure test n_{50} / Drucktest n_{50}	0.6 h-1
Special features/ Besonderheiten	Ground source heat pump for domestic warm water and heating		

1.2 Description

Passive House Affordable Housing, Luckham Road, Bournemouth

This project was the redevelopment of a brownfield site to provide affordable homes for local residents in Bournemouth. Two separate blocks with three new terraced houses and 6 new flats were constructed and completed in 2021.

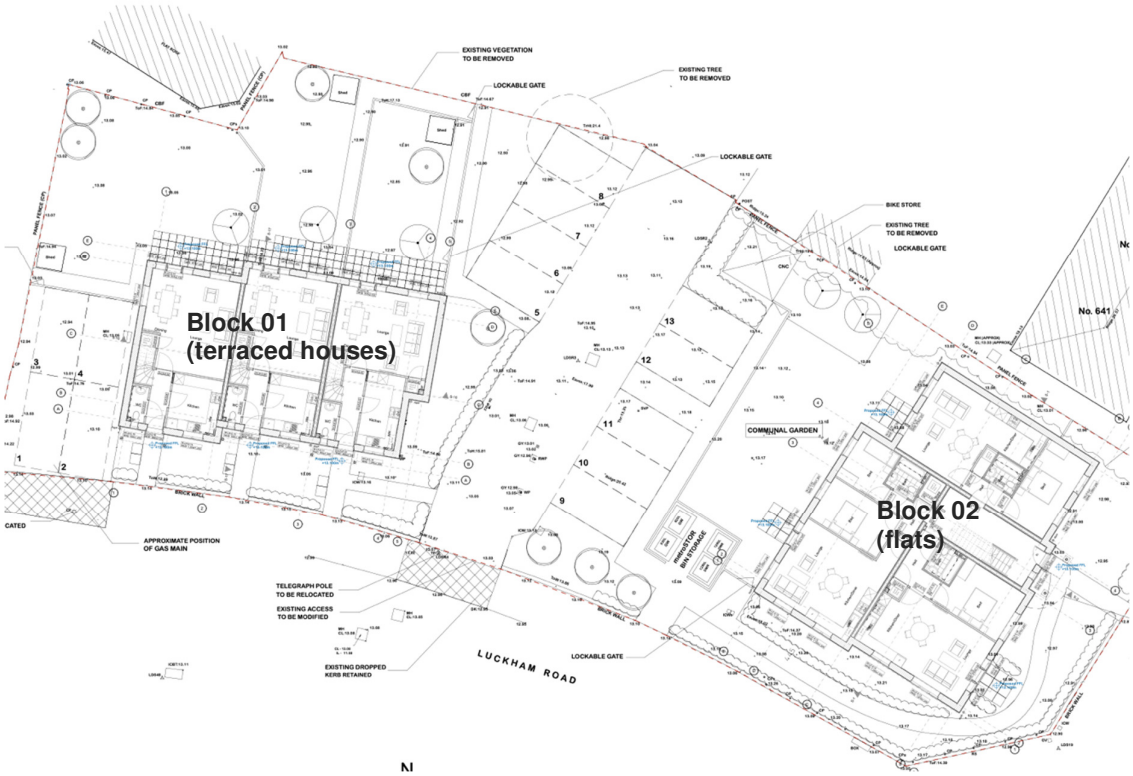
The architecture references local forms which are prominent within the surrounding estate to blend in with the existent. The designs feature simple layouts, forms and fenestration with all glazing sized for best practice daylight levels.

Both the flats and houses have an identical services strategy for heating, hot water and ventilation and share the same construction detailing for the building envelope.

The construction features a simple monolithic poroton clay block construction. This method allows for simplified construction sequencing, increased construction speed, reduction in number of trades involved and reduced construction waste as off cuts could be used as fill or aggregate on site and as a result could be diverted from landfill. An insulated suspended floor construction was specified to reduce the use of concrete.

The client, Bournemouth City Council, also acted as the contractor and developer via their in-house team from Seascape.

Site Plan showing the three new terraced houses to the East and a block with 6 new flats to the West of the site. (top of plan faces North).



1.3 Responsible project participants / Verantwortliche Projektbeteiligte

Architect/ Entwurfsverfasser	Tomas Gaertner, SE3D http://www.se3design.co.uk
Implementation planning/ Ausführungsplanung	Tomas Gaertner, SE3D http://www.se3design.co.uk
Building systems/ Haustechnik	Wessex Ducting Ltd, Bournemouth
Structural engineering/ Baustatik	RJWatkins, Bournemouth
Building physics/ Bauphysik	Tomas Gaertner, SE3D http://www.se3design.co.uk
Passive House project planning/ Passivhaus-Projektierung	Tomas Gaertner, SE3D http://www.se3design.co.uk
Construction management/ Bauleitung	Seascape, Bournemouth

Certifying body/ Zertifizierungsstelle	Mead Ltd, London		
Certification ID/ Zertifizierungs ID	33445-33447_MEAD_PH_20220211_KM	Project-ID (www.passivehouse-database.org) Projekt-ID (www.passivehouse-database .org)	7046

Author of project documentation / Verfasser der Gebäude-Dokumentation	Tomas Gaertner, SE3D http://www.se3design.co.uk
Date, Signature/ Datum, Unterschrift	Exeter, 26/10/2022

2 Views

View of terraced houses from South West

View of terraced houses, Streetview

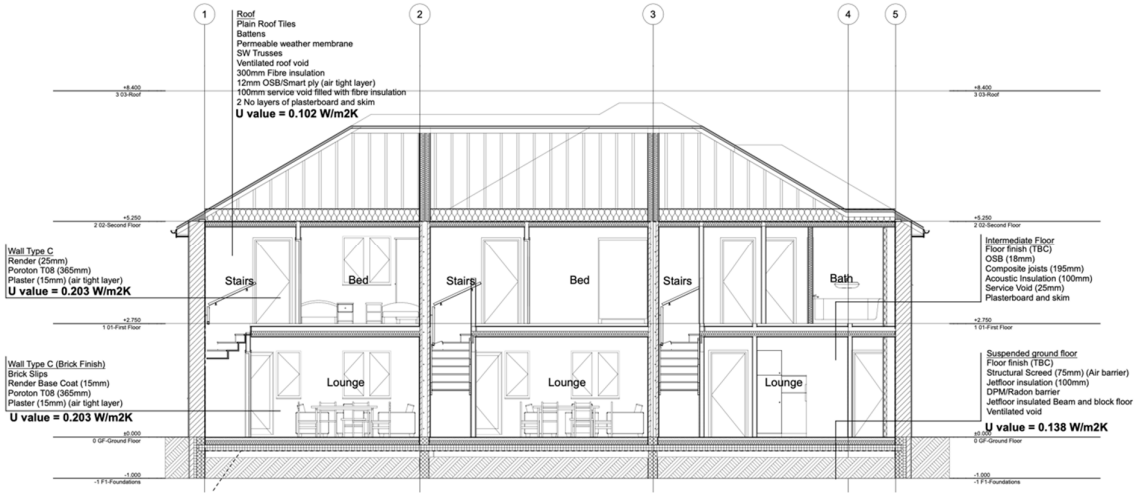
View of terraced houses from South

View of flats from South East

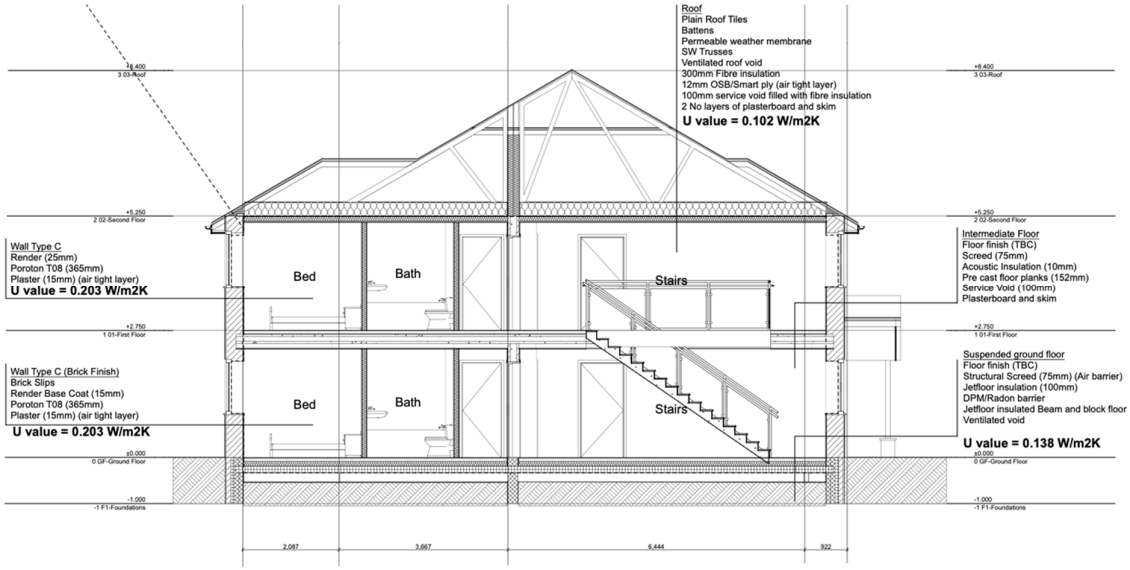
View of flats, Street Elevation

View of flats from South

3 Sections



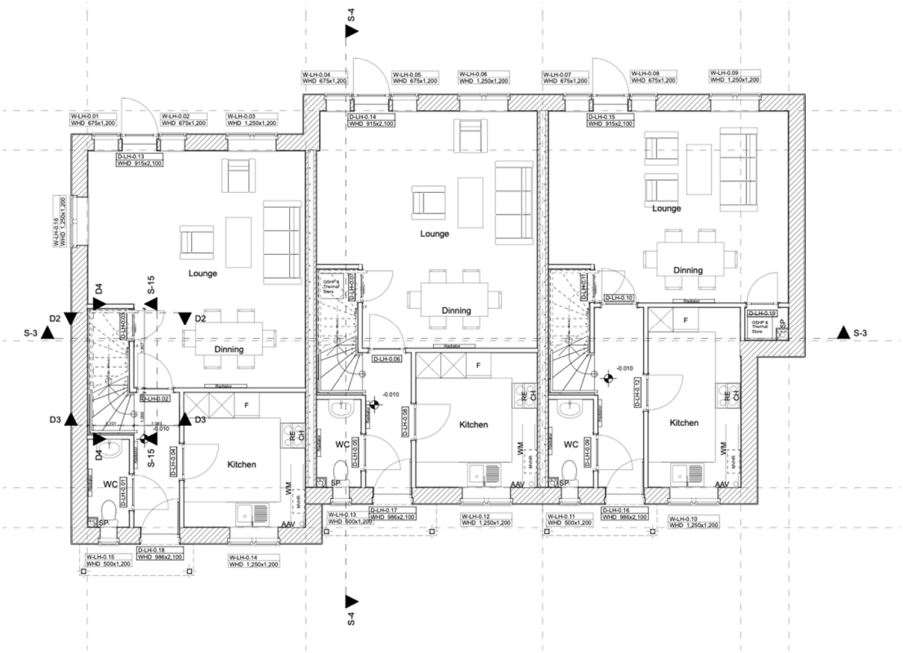
Section of terraced houses



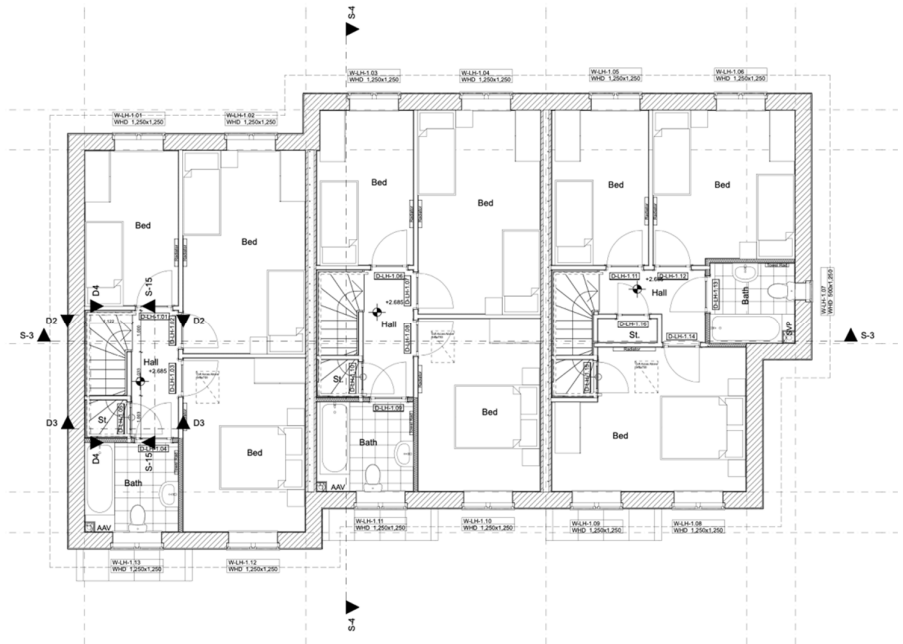
Section of block of flats

4 Floor plans

Terraced Houses - The terraced houses were designed as 3 bedroom 5 person homes with living rooms, dining and kitchens on the ground floor and bedrooms and family bathroom on the first floor. Each home has it own MVHR and GSHP system for heating and domestic hot water.

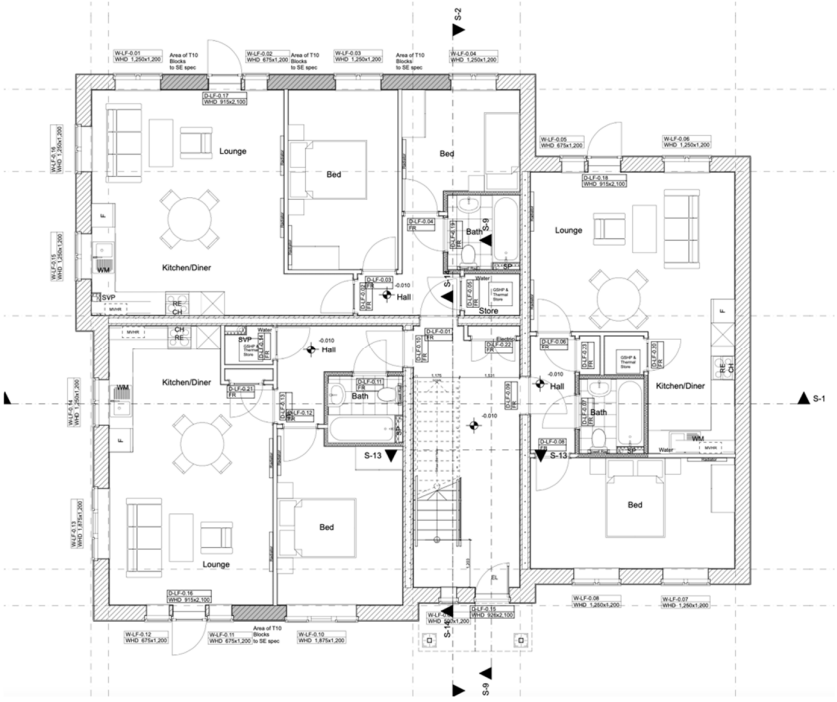


Ground floor plan, terraced houses

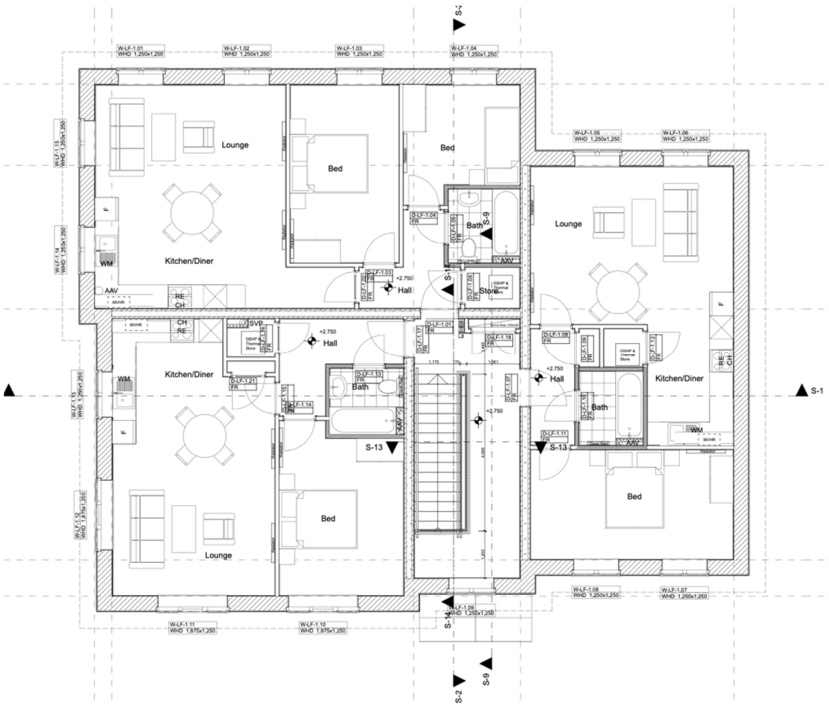


First floor plan, terraced houses

Block of flats - A two storey block of 6 flats including 2 2bed flats with 61m2 and 4 1bed flats with 50m2. The flats are accessed via a communal stair. Each flat has its own MVHR and heating/DHW system and the components used were identical to the terraced houses.



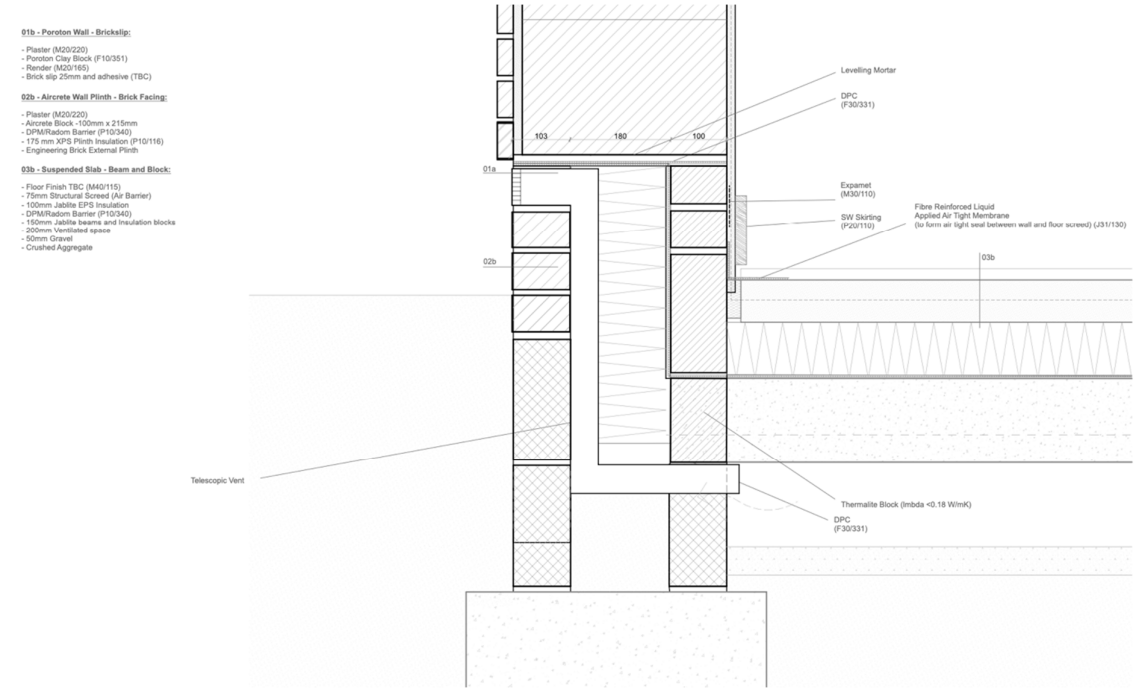
Ground floor plan, flats



First floor plan, flats

5 Building fabric construction details and Passivhaus technology

5.1 Floor construction



Ground floor junction detail showing suspended floor construction, warm foot detail and monolithic external wall construction.

Floor construction showing the different insulation layers, DPC and warm foot detail.

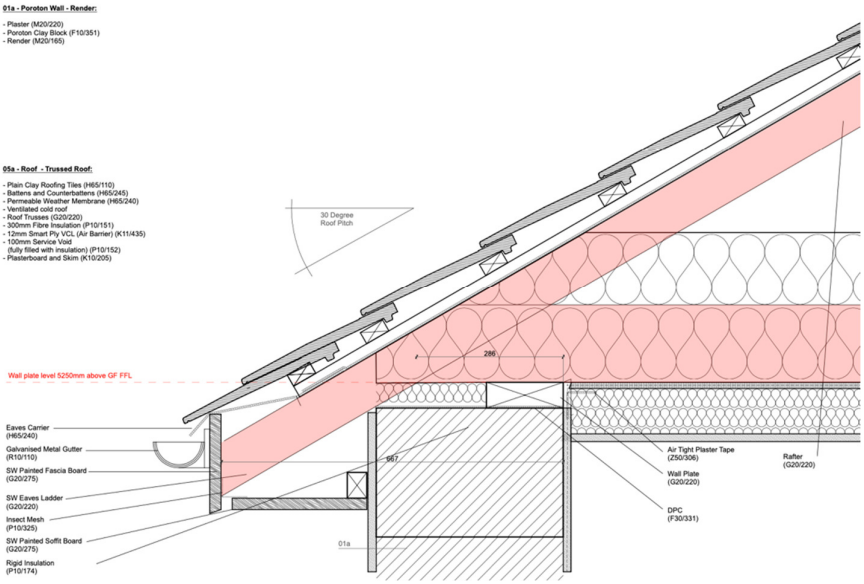
The floor is formed by an insulated beam and block floor with 175mm neopor insulation between beams, a DPC, a continuos layer of 100mm neopor insulation, PE membrane and screed over (air barrier). The specified system features a warm edge detail using aerated concrete blocks to reduce thermal bridging.

5.2 Wall construction

Walls were constructed using a monolithic poroton masonry construction consisting of a 15mm internal plaster layer (air tight layer), 365mm deep poroton blocks and a 20mm external silicate render with additional brick slips on ground floor.
A warm foot detail featuring aerated concrete blocks form the plinth. The roof is formed by traditional A frame trusses, insulated at ceiling level.

5.3 Roof/ceiling construction

The roof has been designed and specified as a cold roof using A frame trusses insulated at ceiling level with 300mm of mineral fibre over a 12mm OSB board (air barrier) with a 100mm mineral fibre insulation filled service void below and a plasterboard and skim finish.

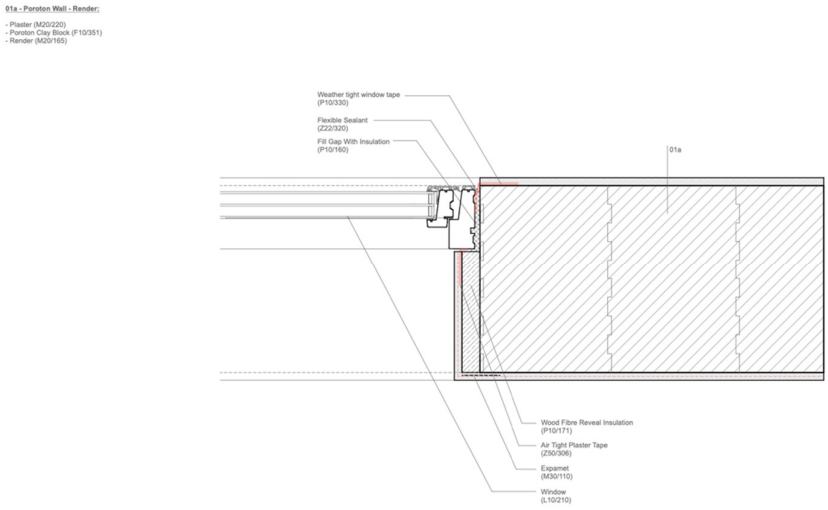


The wall plate has been set inwards with a continuous dense wood fibre insulation packer on the outside to reduce thermal bridge and increase surface temperatures.

5.4 Windows

The project is located in the 'warm temperate' PH climate zone and the temperatures are generally fairly mild. Higher Uw-installed are acceptable than in a central European climate.

Outward opening, aluminium clad, timber framed, triple glazed windows (not PH certified) were specified for this project with frame u values of 1.01 W/m2K (1.20 W/m2K at thresholds) and warm spacers with 0.032 W/mK. The argon filled, low e coated triple glazing (4/16/4/16/4) achieved a g value of 0.52 and a Ug value of 0.51 W/m2K.



The windows have been located towards the external skin of the building to maximise solar gains. Outward opening aluminium timber windows have been specified with an internal wood fibre reveal insulation to minimise thermal bridging and increase surface temperatures.

Openings were formed in poroton with preinsulated thermally broken lintels.

Outward opening windows were installed with an external permeable weathertightness tape. Internal reveals were insulated with woodfibre insulation overlapping the frames.

An air tight plaster tape was installed around windows to form a durable and flexible air tight junction

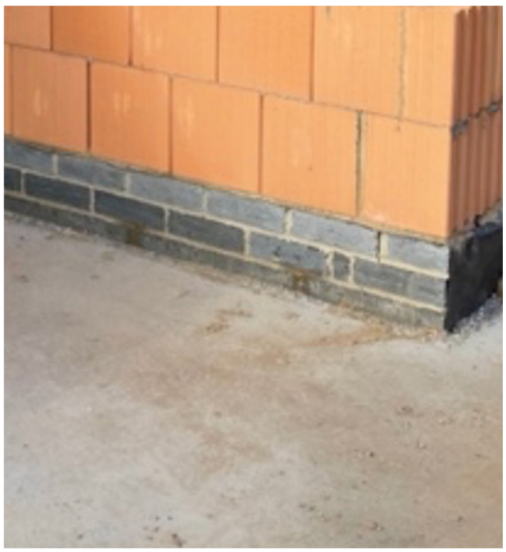
Walls and reveals were plastered to create the air barrier.

6 Air tightness

The air barrier is formed by the following elements:

Walls:	15mm Internal plaster layer
Roof:	12mm OSB board to underside of A frame trusses
Floor:	65mm Screed

6.1 Air tightness detailing

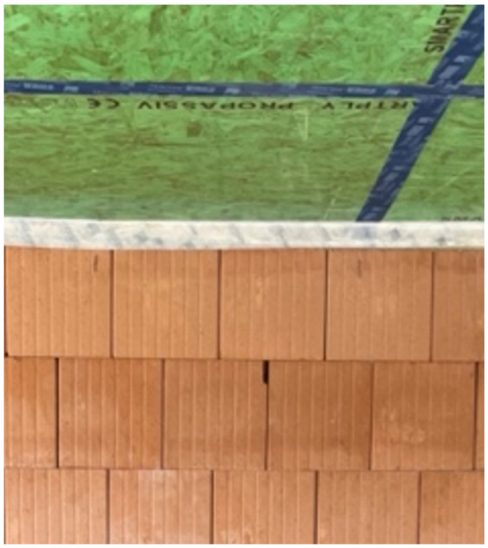


Ground floor junction the air tightness in the floor is formed by a continuous screed. The air barrier in the wall is formed by the internal plaster which is simply continued to the floor screed to form an air tight seal

Windows the air tight junction between walls and windows/doors was formed using a specialist air tight plaster tape.

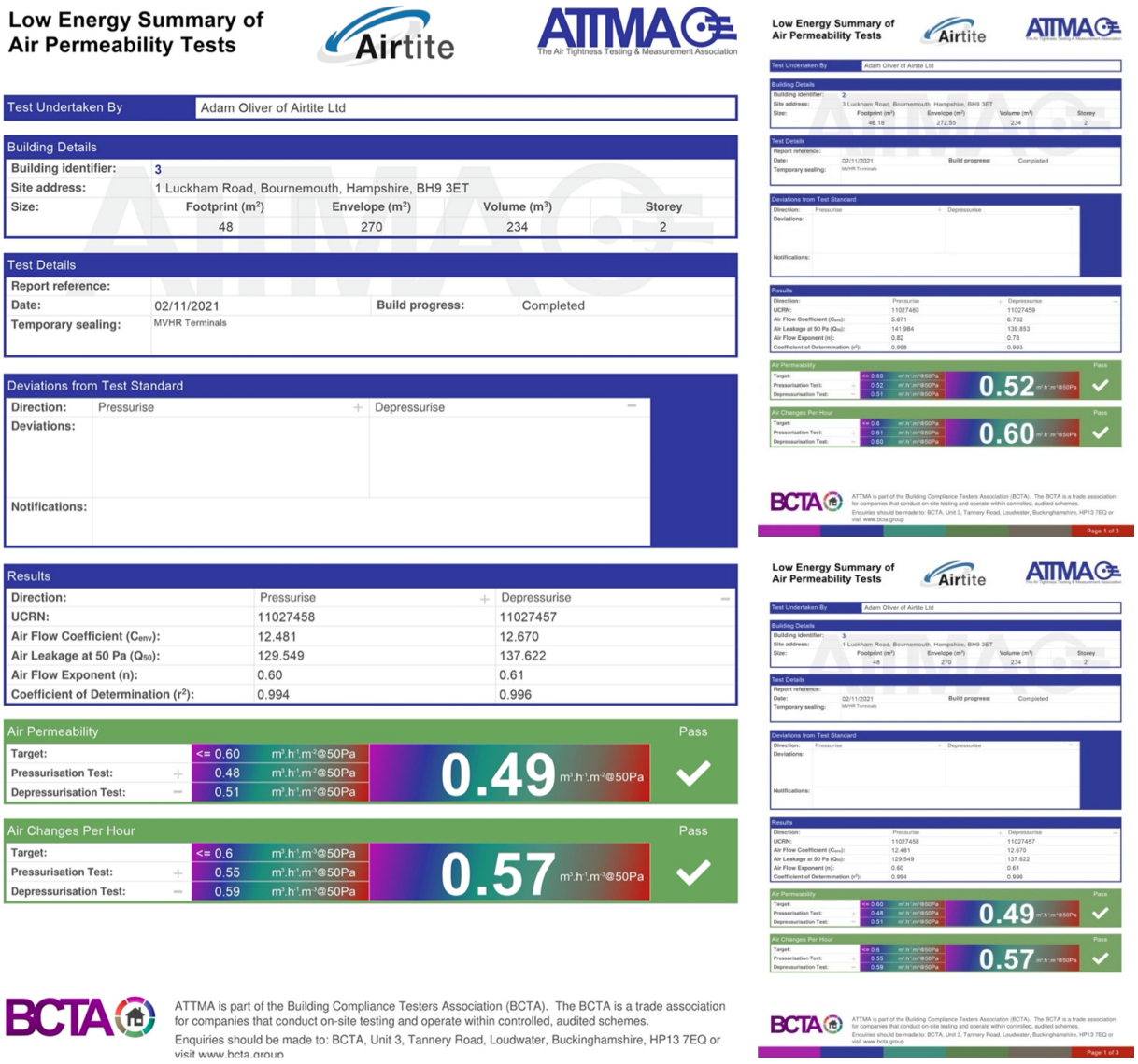
Ceiling/wall junctions were treated with a liquid applied air tight membrane (black areas shown on photo) prior to installation and before these areas became inaccessible. The liquid membrane was then plastered over to continue the air barrier.

Sockets socket boxes were chased out 25mm deeper and bedded in mortar. Trunking was cut 30mm short to allow for plaster to encase all cables.



Ceiling junction The air tightness junction between the wall (plaster) and the ceiling (OSB board) was formed using a plaster tape. Joints in the ceiling were taped using a specialist air tight tape.

6.2 Air tightness test



Low Energy Summary of Air Permeability Tests

Airtite

ATTMA — The Air Tightness Testing & Measurement Association

Test Undertaken By	Adam Oliver of Airtite Ltd

Building Details

Building identifier:	3			
Site address:	1 Luckham Road, Bournemouth, Hampshire, BH9 3ET			
Size:	Footprint (m²)	Envelope (m²)	Volume (m³)	Storey
	48	270	234	2

Test Details

Report reference:			
Date:	02/11/2021	Build progress:	Completed
Temporary sealing:	MVHR Terminals		

Deviations from Test Standard

Direction:	Pressurise	Depressurise
Deviations:		
Notifications:		

Results

Direction:	Pressurise	Depressurise
UCRN:	11027458	11027457
Air Flow Coefficient (C_{env}):	12.481	12.670
Air Leakage at 50 Pa (Q_{50}):	129.549	137.622
Air Flow Exponent (n):	0.60	0.61
Coefficient of Determination (r^2):	0.994	0.996

Air Permeability — Pass

Target:	<= 0.60	$m^3.h^{-1}.m^{-2}$@50Pa
Pressurisation Test:	0.48	$m^3.h^{-1}.m^{-2}$@50Pa
Depressurisation Test:	0.51	$m^3.h^{-1}.m^{-2}$@50Pa

0.49 $m^3.h^{-1}.m^{-2}$@50Pa

Air Changes Per Hour — Pass

Target:	<= 0.6	$m^3.h^{-1}.m^{-3}$@50Pa
Pressurisation Test:	0.55	$m^3.h^{-1}.m^{-3}$@50Pa
Depressurisation Test:	0.59	$m^3.h^{-1}.m^{-3}$@50Pa

0.57 $m^3.h^{-1}.m^{-3}$@50Pa

BCTA

ATTMA is part of the Building Compliance Testers Association (BCTA). The BCTA is a trade association for companies that conduct on-site testing and operate within controlled, audited schemes.

Enquiries should be made to: BCTA, Unit 3, Tannery Road, Loudwater, Buckinghamshire, HP13 7EQ or visit www.bcta.group

Air permeability test report prepared by Airtite Ltd. The three terraced houses were tested individually. The completed buildings achieved the following pressurisation, depressurisation and average air test results:

House No	1	2	3	
Pressurisation	0.55	0.61	0.55	
Depressurisation	0.59	0.60	0.53	
Average	0.57	0.61	0.54	**0.57**

Low Energy Summary of Air Permeability Tests

Airtite

ATTMA
The Air Tightness Testing & Measurement Association

Test Undertaken By	Adam Oliver of Airtite Ltd

Building Details

Building identifier:	4-9			
Site address:	Flats 1-6, 637-639 Charminster Rd, Bournemouth, Hampshire, BH8 9RH			
Size:	Footprint (m^2)	Envelope (m^2)	Volume (m^3)	Storey
	221.5	712	870	2

Test Details

Report reference:			
Date:	02/11/2021	Build progress:	Completed
Temporary sealing:	MVHR Terminals		

Deviations from Test Standard

Direction:	Pressurise +	Depressurise −
Deviations:		
Notifications:		

Results

Direction:	Pressurise +	Depressurise −
UCRN:	11027441	11027440
Air Flow Coefficient (C_{env}):	14.779	13.794
Air Leakage at 50 Pa (Q_{50}):	475.050	475.818
Air Flow Exponent (n):	0.89	0.90
Coefficient of Determination (r^2):	0.995	0.999

Air Permeability — Pass

Target:	<= 5.00	$m^3.h^{-1}.m^{-2}$@50Pa
Pressurisation Test: +	0.67	$m^3.h^{-1}.m^{-2}$@50Pa
Depressurisation Test: −	0.67	$m^3.h^{-1}.m^{-2}$@50Pa

0.67 $m^3.h^{-1}.m^{-2}$@50Pa ✓

Air Changes Per Hour — Pass

Target:	<= 0.6	$m^3.h^{-1}.m^{-3}$@50Pa
Pressurisation Test: +	0.55	$m^3.h^{-1}.m^{-3}$@50Pa
Depressurisation Test: −	0.55	$m^3.h^{-1}.m^{-3}$@50Pa

0.55 $m^3.h^{-1}.m^{-3}$@50Pa ✓

BCTA

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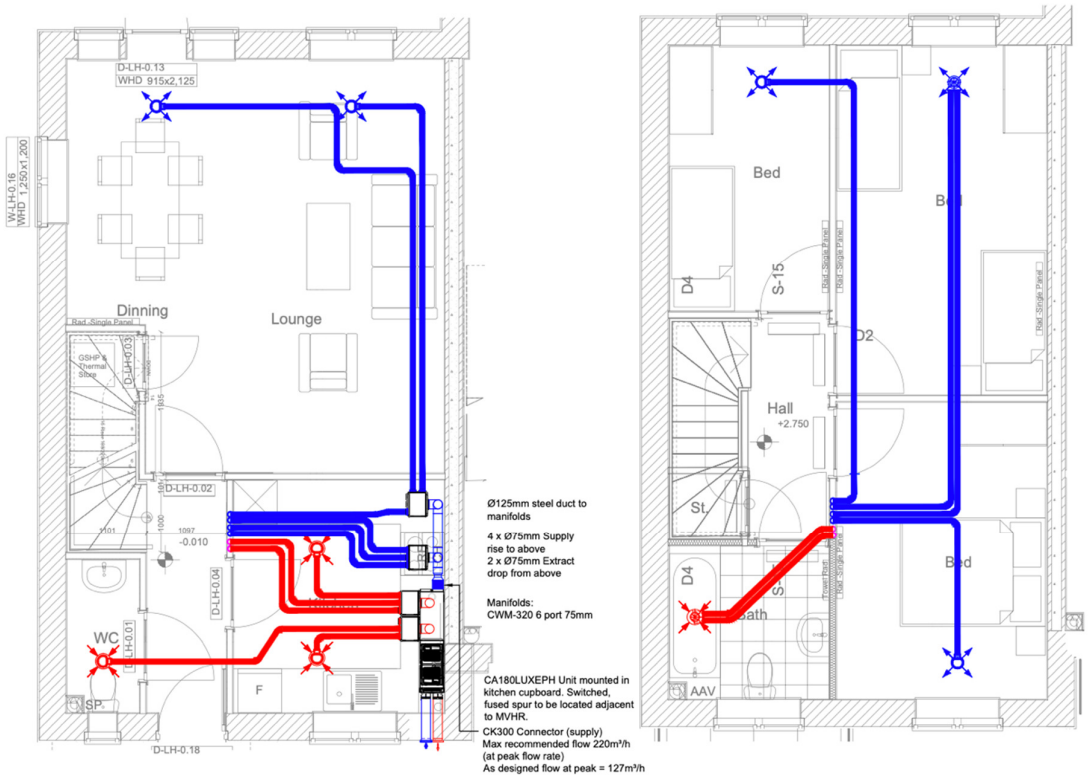
Page 1 of 3

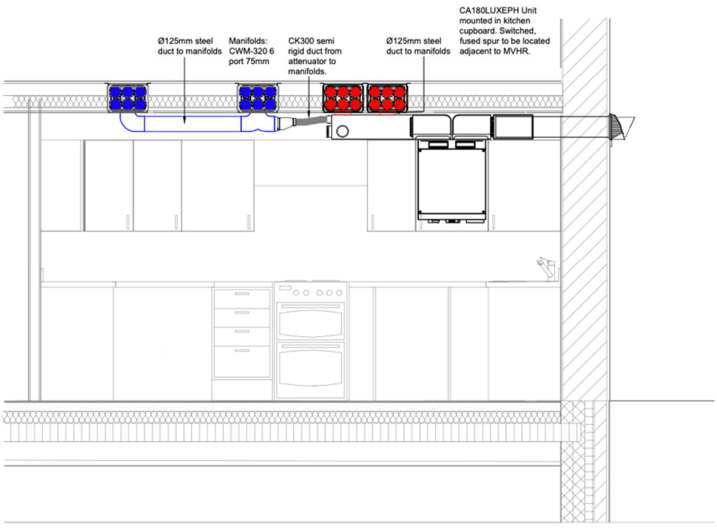
Air permeability test report prepared by Airtite Ltd. The block of flats was tested as a single entity with test fan installed in the main entrance and all internal and flat entrance doors fully open during the test.

7 Ventilation design

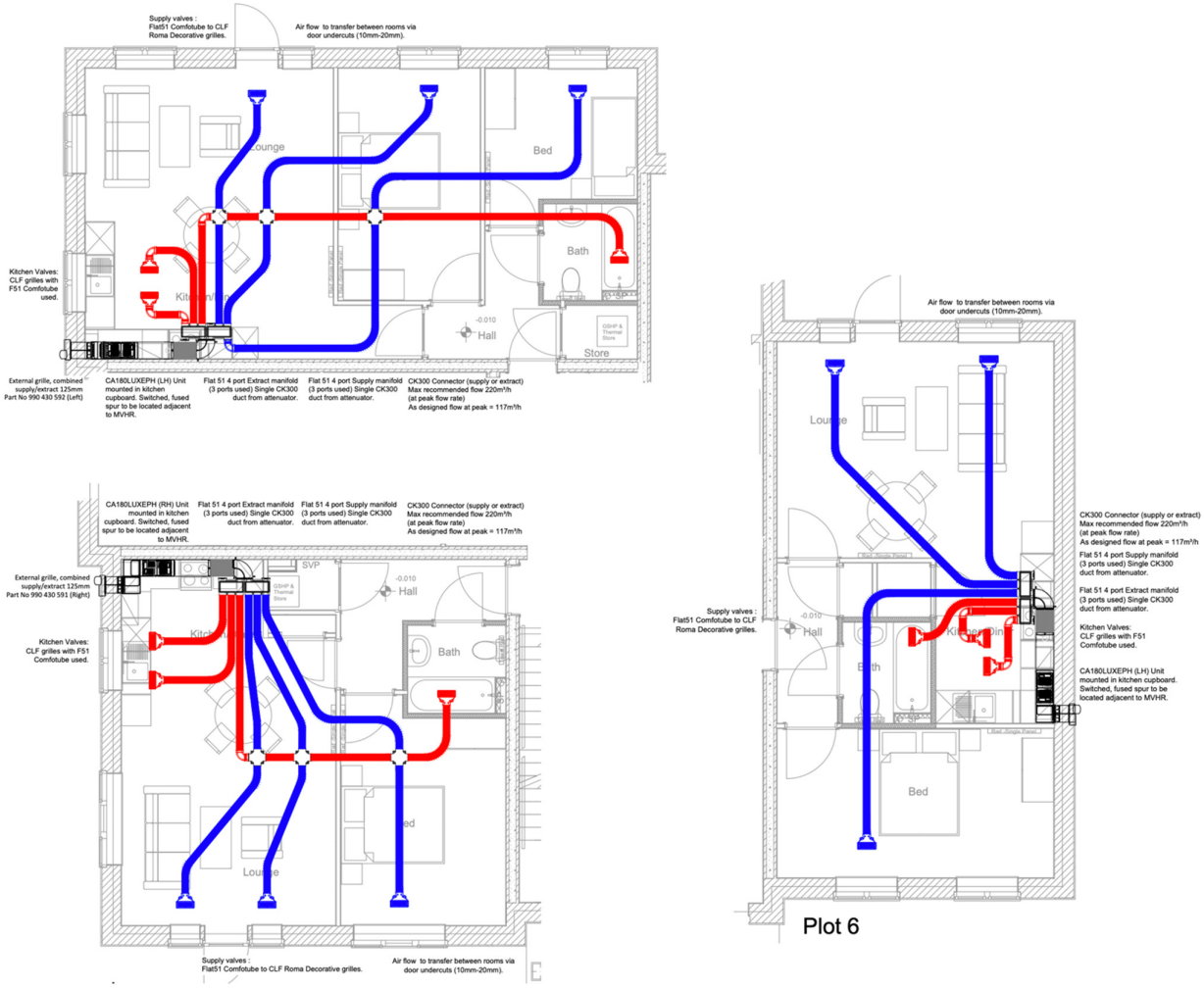
7.1 Ventilation layout



Suppliers installation drawings of ventilation duct layout for the terraced houses



Each home is served by its own MVHR system. The ventilation unit is located in a kitchen wall cupboard, close to an external wall allowing for short cold duct runs. A flexible duct system (Zehnder comfotube) with central manifolds which also act as cross talk silencers for supply and extract was specified. Air is supplied to bedrooms and lounge and extracted from the kitchen and WC on ground floor and bathroom on first floor. The hall, stairs and corridors are designed as transfer zones with all doors being undercut by 10mm as a minimum.



Suppliers installation drawings of ventilation duct layout for the flats (GF and FF are identical)

On the houses composite metal web joists were specified for ceilings to allow for simpler installation and routing of ducts.

Manifold and ducts were installed within the ceiling zone between composite joists.

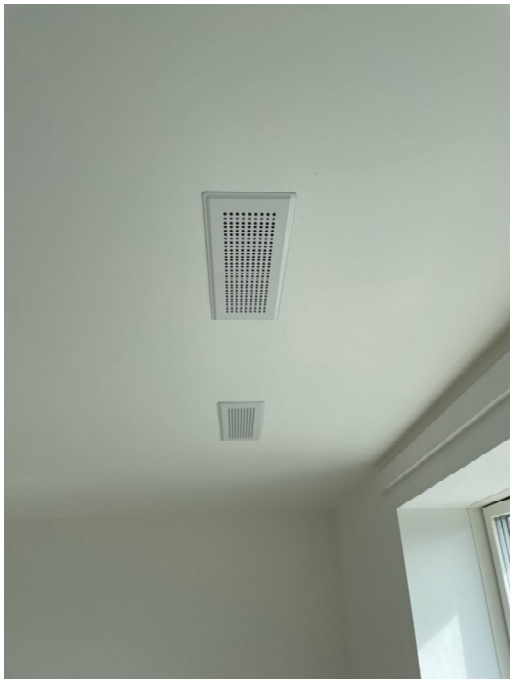
Supply/extract ducts to flats: Oval comfotube ducting was used to allow for increased ceiling heights

7.2 Ventilation unit and efficiency

A Passivhaus certified whole house ventilation unit was specified and this is identical for both the flats and houses:

Ventilation unit:	Zehnder Comfoair 180
Whole system efficiency (PHPP):	79.9%
Electrical Efficiency:	0.31Wh/m3

MVHR; The MVHR unit was incorporated into the kitchen design to neatly fit in. Ducts were taken across the top of the wall units and covered with plasterboard.



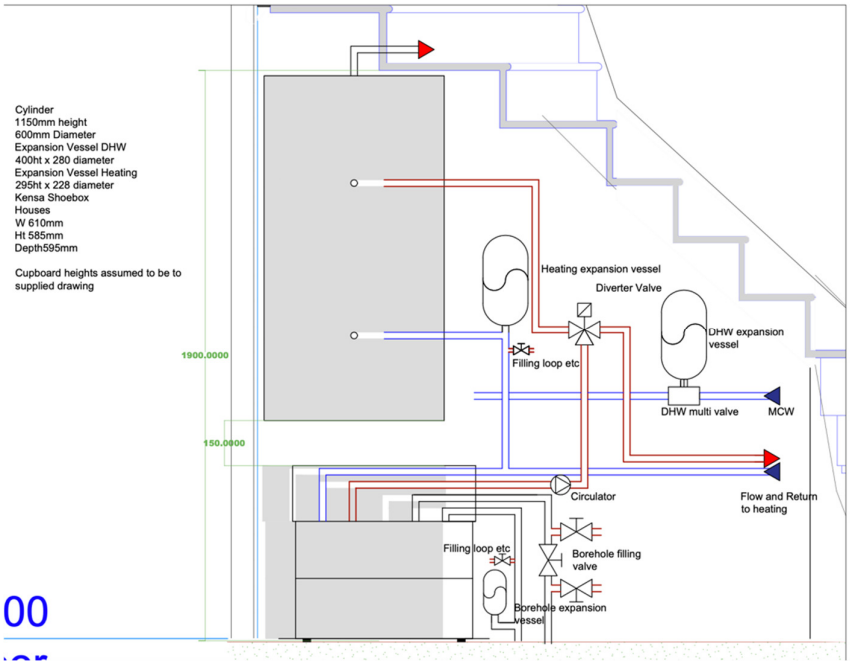
Internal supply grilles

External intake and exhaust
A combined external grille for both intake and exhaust was specified for each home.

8 Heating and DHW system

The scheme features a decentralised system for DHW and heating and each home has its own thermal store and heat pump. Heating and domestic hot water is provided via a thermal store. In the houses this is located under the stairs on the ground floor, fort he flats this is located in a plant cupboard. The thermal store is connected to a ground source heat pump with an immersion back up.

Heating is provided via small wet radiators in the lounge and bedrooms. Additional towel radiators within all wetrooms are connected to the thermal store.



Suppliers schematic of thermal store and GSHP set up.

Thermal store and ground source heat pump including buffer vessels and circulation pumps were installed under the stairs on the ground floor.

9 PHPP verification sheet

Passive House Verification

Building:	Houses				
Street:	Luckham Road				
Postcode/City:	BH9 3ET	Bournemouth			
Province/Country:	UK		GB-United Kingdom/ Britain		
Building type:	Terraced House				
Climate data set:	GB0004a-Efford				
Climate zone:	4: Warm-temperate		Altitude of location:	20 m	
Home owner / Client:	BCP Council				
Street:	Bourne Avenue				
Postcode/City:	BH26DY	Bournemouth			
Province/Country:	Dorset		GB-United Kingdom/ Britain		
Architecture:	SE3D				
Street:	21 Canon Street				
Postcode/City:	TA11SW	Taunton			
Province/Country:	Somerset		GB-United Kingdom/ Britain		
Mechanical engineer:	Wessex Ducting Ltd				
Street:	3 Telford Road				
Postcode/City:	BH21 7QN	Wimborne			
Province/Country:	Dorset		GB-United Kingdom/ Britain		
Energy consultancy:	SE3D				
Street:	21 Canon Street				
Postcode/City:	TA11SW	Taunton			
Province/Country:	Somerset		GB-United Kingdom/ Britain		
Certification:	Mead Ltd				
Street:	3 Harvey Road				
Postcode/City:	N8 9PD				
Province/Country:	London		GB-United Kingdom/ Britain		

Year of construction:	2020	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	3	Internal heat gains (IHG) heating case [W/m²]:	2.7	IHG cooling case [W/m²]:	2.7
No. of occupants:	6.4	Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	259.0				
Space heating	Heating demand	kWh/(m²a)	15	≤	15	-	yes
	Heating load	W/m²	10	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	0	≤	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)	105	≤	135		yes
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	42	≤	-	-	-
	Generation of renewable energy (in relation to pro-jected building footprint area)	kWh/(m²a)	0	≥	-	-	

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

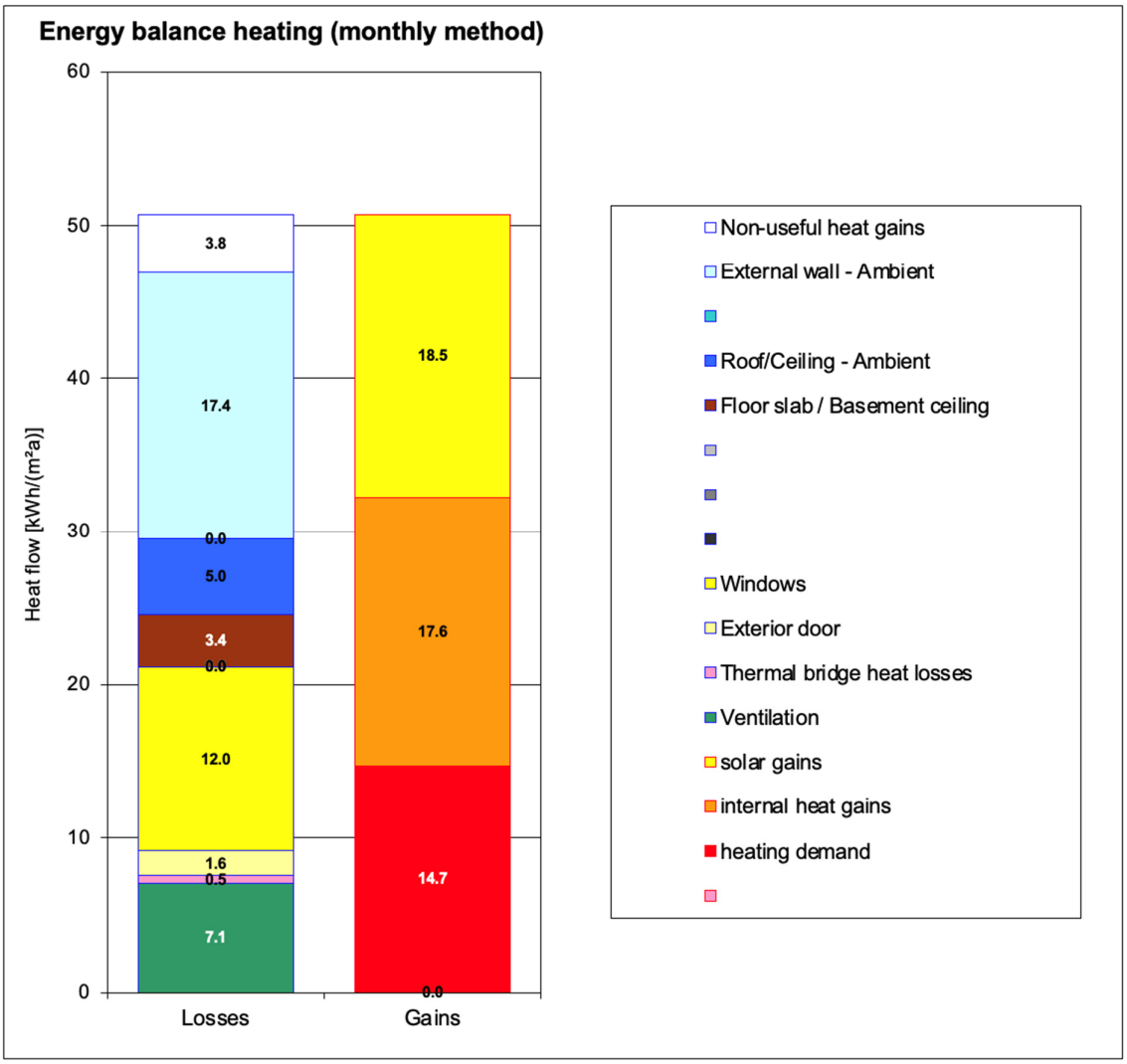
I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:
1-Designer	Tomas	Gaertner	

Issued on:	City:
14/12/21	Exeter

PHPP verification sheet for the three terraced houses.



Heating energy balance calculated using the PHPP; energy losses from external walls and windows proportionally represent the highest losses. Overall window solar gains exceed losses from transmission resulting in a positive energy balance without affecting summer comfort levels. Ventilation heat losses are elevated due to the relatively high occupancy.

Passive House Verification

Building:	Houses		
Street:	Luckham Road		
Postcode/City:	BH9 3ET	Bournemouth	
Province/Country:	UK		GB-United Kingdom/ Britain
Building type:	Block of flats		
Climate data set:	GB0004a-Efford		
Climate zone:	4: Warm-temperate	Altitude of location:	20 m
Home owner / Client:	BCP Council		
Street:	Bourne Avenue		
Postcode/City:	BH26DY	Bournemouth	
Province/Country:	Dorset		GB-United Kingdom/ Britain
Architecture:	SE3D		
Street:	21 Canon Street		
Postcode/City:	TA11SW	Taunton	
Province/Country:	Somerset		GB-United Kingdom/ Britain
Mechanical engineer:	Wessex Ducting Ltd		
Street:	3 Telford Road		
Postcode/City:	BH21 7QN	Wimborne	
Province/Country:	Dorset		GB-United Kingdom/ Britain
Energy consultancy:	SE3D		
Street:	21 Canon Street		
Postcode/City:	TA11SW	Taunton	
Province/Country:	Somerset		GB-United Kingdom/ Britain
Certification:	Mead Ltd		
Street:	3 Harvey Road		
Postcode/City:	N8 9PD		
Province/Country:	London		GB-United Kingdom/ Britain

Year of construction:	2020	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	6	Internal heat gains (IHG) heating case [W/m²]:	3.0	IHG cooling case [W/m²]:	3.0
No. of occupants:	9.4	Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area	m²	336.3				
Space heating	Heating demand	kWh/(m²a)	10	≤	15	-	yes
	Heating load	W/m²	9	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	0	≤	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)	114	≤	135		yes
	PER demand	kWh/(m²a)	45	≤	-	-	-
Primary Energy Renewable (PER)	Generation of renewable energy (in relation to pro-jected building footprint area)	kWh/(m²a)	0	≥	-	-	

[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	Tomas	Gaertner	

Issued on:	City:
14/12/21	Exeter

PHPP verification sheet for the block of flats..

10 Construction costs

Construction costs including all building structures, access, drainage and landscaping were £2,400/m2 TFA.

11 User experience and actual consumption

All nine homes have only been fully occupied since February 2022 and no data on energy consumption is available as yet.