



Remington Road

Energy Statement

September 2022

CONTENTS

1. Executive Summary	3
2. Be Lean – Energy Efficient Measures.....	4
3. Renewable Technologies - ASHP.....	7
4. Renewable Technologies - Photovoltaics.....	8

Appendix 1 – CO₂ Emission Calculations (SAP10)

Appendix 2 – SAP Data Input Sheet (SAP12)

Appendix 3 – SAP Worksheets (SAP12)

Appendix 4 – PV Drawings and Datasheet

DOCUMENT CONTROL SHEET

Report Reference	CBE1955/RR/ES/202209-EC
Issue Purpose	Planning Condition 4
Author	Ed Coate
Approved By	Ryan Thrower
Date of Issue	29th September 2022

DISCLAIMER

This Report has been produced to support a Planning Application and is not to be used 'For Construction', for Building Control compliance or for a Planning Condition on an approved scheme.

The information contained within this Report is based on Drawings and Specifications provided by the Design Team along with information assumed by NRG Consulting for the purposes of compliance where no other information was available. Any budget costs or plant sizing contained within this document are based upon available information and are to be taken as an estimation and guideline only.

NRG Consulting disclaims any responsibility to the Client and others in respect of any matters outside the intended scope of this report.

This report is for the use of the specified Client only unless in the case that there is a signed Letter of Reliance to accompany the Report. NRG Consulting accepts no responsibility whatsoever to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

1. EXECUTIVE SUMMARY

- 1.1 NRG Consulting have been appointed to undertake an Energy Statement on a proposed major development at Remington Road, London, N15 6SS, in the London Borough of Haringey.
- 1.2 The proposed scheme is described as: “Redevelopment of site including demolition of garages to provide 46 new homes for Council rent (Use Class C3) comprising part 3, 5 and 6 storey apartment buildings (31 homes) and 1, 2 and 3 storey houses and maisonettes (15 homes) with associated amenity space, landscaping, refuse/ recycling and cycle storage facilities. Reconfiguration of Remington Road as one-way street, 7 on-street parking spaces, children's play space, public realm improvements and relocation of existing refuse/recycling facilities.”
- 1.3 This document has been written to address Condition 4 of the Decision Notice (HGY/2021/2882) which states:

“The development hereby approved shall be constructed in accordance with the Energy, Sustainability and Overheating Statement prepared by Icení (dated August 2021) delivering a minimum 81% improvement on carbon emissions over 2013 Building Regulations Part L, with SAP10 emission factors, high fabric efficiencies (min. 15% reduction), air source heat pumps (ASHPs) and minimum 98.4kWp solar photovoltaic (PV) energy generation.”.

(a) Prior to above ground construction, details of the proposed ventilation and heating systems and solar PV shall be submitted to and approved by the Local Planning Authority. This must include:

- Location, specification and efficiency of the proposed ASHPs (Coefficient of Performance, Seasonal Coefficient of Performance, and the Seasonal Performance Factor), with plans showing the ASHP pipework and noise and visual mitigation measures;
- Specification and efficiency of the proposed Mechanical Ventilation and Heat Recovery (MVHR), with plans showing the rigid MVHR ducting and location of the unit;
- Details of the PV including: a roof plan; the number, angle, orientation, type, and efficiency level of the PVs; how overheating of the panels will be

minimised; their peak output (kWp) and the final carbon reduction at the Be Green stage of the energy hierarchy;

- A metering strategy

RESULTS

	CO ₂ Emissions (Tonnes per Annum) (SAP 10)	
	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	58.3	
Be Lean: Energy Demand Reduction	55.6	
Be Clean: Supply Energy Efficiently	55.6	
Be Green: Renewable Energy	10.9	
Regulated CO₂ Savings at 'Be Green' over Part L 2013	81.19%	

Table 1: Final Carbon Emissions

2. BE LEAN – ENERGY EFFICIENT MEASURES

2.1 In order to estimate the predicted energy demand and regulated CO₂ emissions for the site, SAP Calculations have been carried out by a licensed and OCDEA accredited SAP Assessor using Elmhurst Design SAP 2012 and converted into SAP 10 figures using the GLA's conversion spreadsheet (V1.2).

2.2 The baseline CO₂ emissions covered by Part L 2013 of the Building Regulations will be expressed as the Target Emissions Rate (TER), obtained from the SAP calculations. SAP Calculations cover regulated energy use that comprises of:

- Heating - Hot Water
- Lighting - Pumps and Fans

PASSIVE AND ACTIVE DESIGN

2.3 The design of the development prioritises passive measures to minimise heat loss. The U-values and the air permeability rate have been selected to exceed the minimum requirements of the Building Regulation and the development will incorporate efficient building services to limit carbon emissions, including a NOX-free heating system and low energy lighting. The proposed building services are compliant with the recommendations of the Domestic Building Services Compliance Guide (2013).

	CO ₂ Emissions (Tonnes per Annum) – SAP10
	Regulated
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER) – Be Lean	58.3
Be Lean: Energy Demand Reduction	55.6
Regulated CO ₂ Savings at 'Be Lean' over Part L 2013	5.04%

Table 2: Be Lean Reduction

ELEMENT	PART L1A LIMITING FABRIC PARAMETERS	PROPOSED U-VALUES (W/m ² K)
<i>Walls</i>		
External Walls – E1 – E2 – E3 – E4 (Houses and Flats)	0.3 W/m ² K	0.21 W/m ² K
External Walls – E5 (Flats)	0.3 W/m ² K	0.15 W/m ² K
Sheltered Walls – Flats	0.3 W/m ² K	0.28 W/m ² K
Party Walls	0.3 W/m ² K	0.0 W/m ² K
<i>Roof</i>		
Roof – Flats – R1 & R2	0.2 W/m ² K	0.19 W/m ² K
Roof – Flats – R3	0.2 W/m ² K	0.20 W/m ² K
Roof – Houses – R1	0.2 W/m ² K	0.18 W/m ² K
Roof – Houses – R2	0.2 W/m ² K	0.16 W/m ² K
<i>Floor</i>		
Ground Floor - Flats	0.3 W/m ² K	0.14 W/m ² K
Exposed Floor - Flats	0.3 W/m ² K	0.16 W/m ² K
Ground Floor – Houses	0.3 W/m ² K	0.14 W/m ² K
<i>Openings</i>		
Windows	2.2 W/m ² K	1.3 W/m ² K
Front Doors	2.2 W/m ² K	1.0 W/m ² K
<i>Thermal Bridging</i>		
NRG Concrete Frame Details (Flats) ACDs (Houses)		

Table 3: Proposed Fabric Specification

MVHR and cMEV

2.4 As seen below in Table 4 the Flats and Houses will have different ventilation systems based on the proposed heating.

The flats will be ventilated via System 3 cMEV (see table 5). This system is integrated into the Joule Exhaust Air Heat Pump unit as the system provides Heating, Hot Water and Ventilation.

The houses will be ventilated via a standalone MVHR system (System 4)(see table 6).

Plans showing these ventilation layouts can be seen in Figure 1 and 2.

ELEMENT	PROPOSED DETAILS
Air Permeability	4 m ³ /(hm ²) @50Pa
Ventilation - Flats	System 3 – Centralised Mechanical Ventilation (Joule Inventum BV)
Ventilation - Houses	System 4 – Vectaire WHHR Midi
Heating – Be Lean <u>Only</u>	Gas Combi Boiler – 89.5% Efficient
Heating Controls	Time and Temperature Zone Controls
Heat Emitters	Radiators
Lighting	100% Low Energy

Table 4: Proposed Mechanical and Electrical Specification (Flats and Houses)

DETAIL	SPECIFICATION
Model	Joule Inventum BV (Built with EAHP)
Minimum Duct Size	125 mm diameter or 204 x 60 rectangular or larger
Duct Type	Rigid
SFP	0.32 – 0.45 W/l/s
Manufacturer	Joule Ltd

Table 5: Ventilation Details - Flats

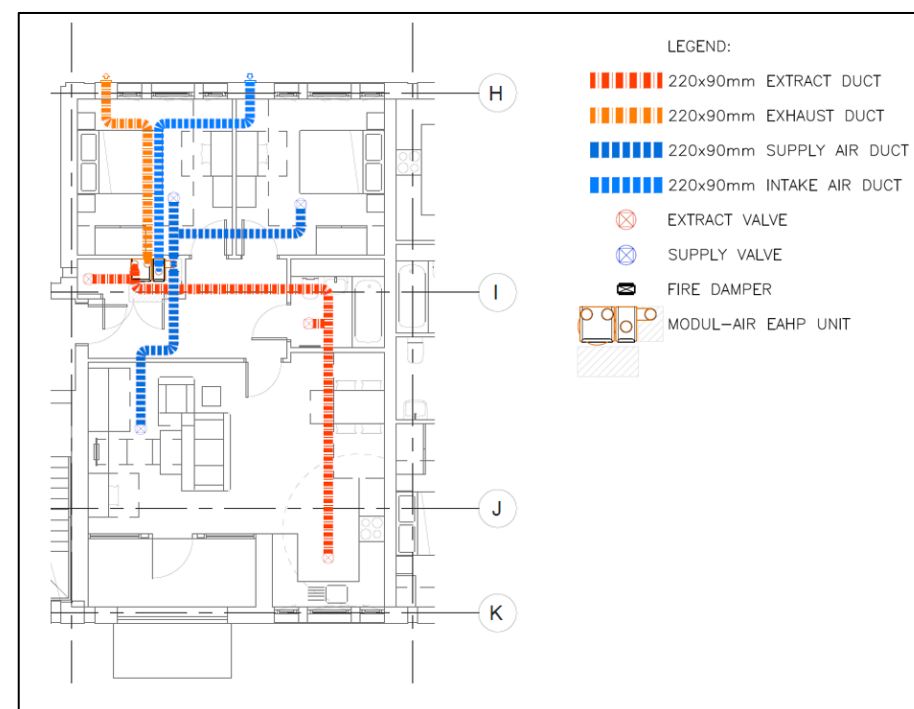


Figure 1: cMEV Layout

DETAIL	SPECIFICATION
Model	Vectaire midi WHHR
Dimensions	600mm (W) * 382mm (L) * 612mm (H)
Efficiency	Up to 94%
SFP	0.50 W/l/s
Manufacturer	Vectaire

Table 6: Ventilation Details - Houses

Metering Strategy

- 2.5 Both Exhaust Air Heat Pumps (Joule) and Air Source Heat Pumps (Samsung) are supplied individually per property

As such the only metering for the development will be from an individual smart meter for each unit.

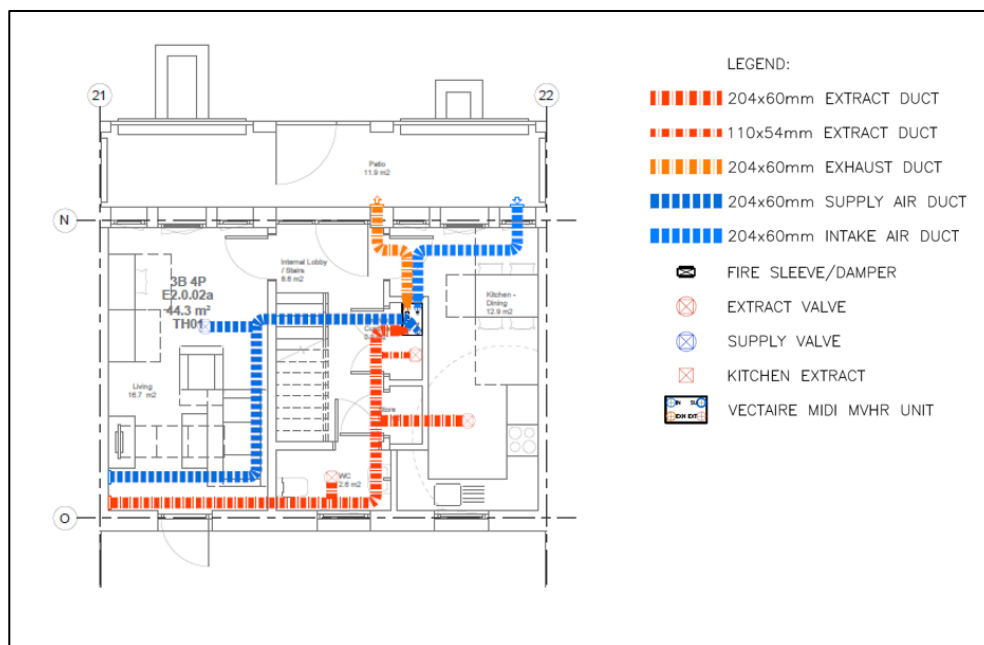


Figure 2: MVHR Layout

3. RENEWABLE TECHNOLOGIES – ASHP & EAHP

- 3.1 In order to achieve the required CO₂ reduction, the implementation of low carbon or renewable technology will be required. For this development, EAHP have been selected as the most suitable technology.

EXHAUST AIR HEAT PUMPS

- 3.2 To provide renewable heating and hot water, Exhaust Air Heat Pumps (EAHP) are proposed for the Flats. An EAHP system Combines the aspects of both a conventional air source heat pump and a mechanical extract ventilation system (cMEV) to provide 100% of the space heating requirements and DHW demand for a dwelling. The system works optimally with smaller, well-insulated, apartments. These systems can reduce a home's energy consumption for heating by up to 50% compared to conventional heating systems.
- 3.3 Therefore this report shows that this new build development is being designed with the new incoming Part L in mind and that the proposed heating negates the need for fossil fuels.

EAHP Provision & Details

- 3.4 Exhaust Heat Pumps are proposed as the primary heat source, servicing each flat individually. They have been chosen because:
- It is a high efficiency system that can cater for the space & water heating for the proposed development;
 - The system functions effectively with the designed layout and flat dwelling type;
 - It can be integrated with the proposed ventilation strategy; and,
 - It is simple to install when compared to other renewable technologies.



Figure 3: Example EAHP Unit

EAHP System Details	
Dwellings to be Heated	30
Number of Heat Pumps	30
Size of Heat Pumps	2100mm (H) * 592mm (W) * 672mm (D)
Make and Model	Joule Inventum BV
SCOP	4.9
Fraction of Heat	100%

Table 7: Proposed EAHP Specification

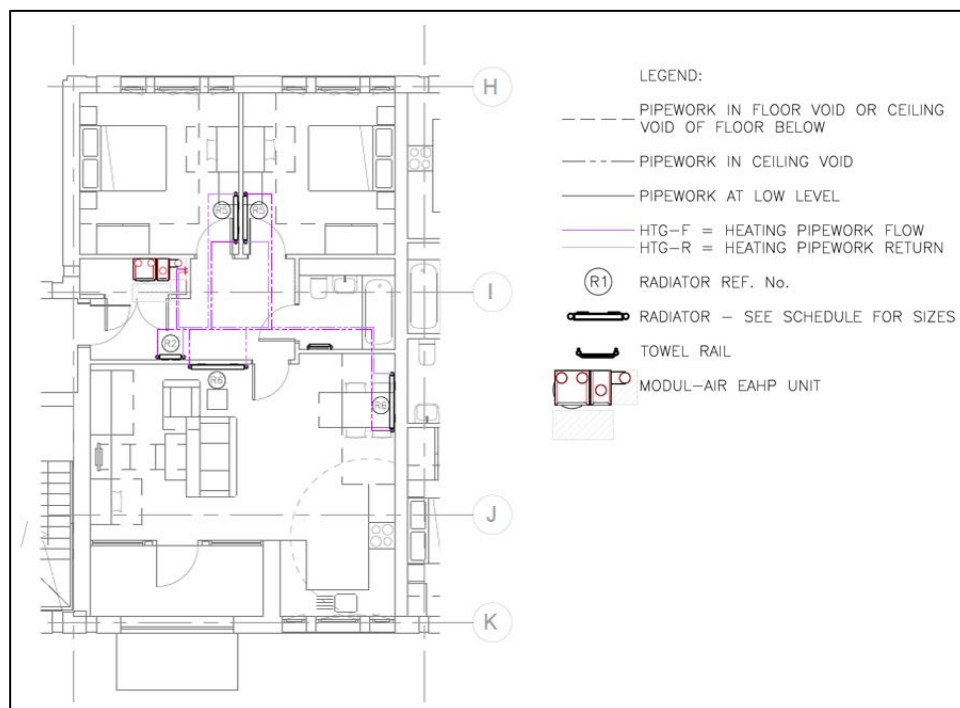


Figure 4: EAHP Pipework Schematic

AIR SOURCE HEAT PUMPS

3.5 To provide renewable heating and hot water for the houses, individual Air Source Heat Pumps are proposed. An ASHP extracts heat from ambient air via a heat exchanger and raises the temperature of an internal refrigerant via the compression cycle.

The ASHPs will consist of an internal unit and an external unit, and the design will be in-line with the schematic shown via Figure 7.

3.6 Therefore this report shows that this new build development is being designed with the new incoming Part L in mind and that the proposed heating negates the need for fossil fuels.

ASHP Provision & Details

3.7 As part of the on-site heat provision, Air Source Heat Pumps are proposed as the heat source for the houses. They have been chosen because:

- It is a high efficiency system that can cater for the space heating and cooling of the most energy-intensive areas of the proposed development;
- Requires less capital cost than GSHP and other renewable technologies
- It is simple to install when compared to other renewable technologies.

ASHP System Details	
Dwellings to be Heated	15
Number of Heat Pumps	15
Make and Model	Samsung Electronics Heat Pump (Samsung Electronics AE080RXYDEG)
SCOP	2.6
Fraction of Heat	100%

Table 6: Proposed ASHP Specification

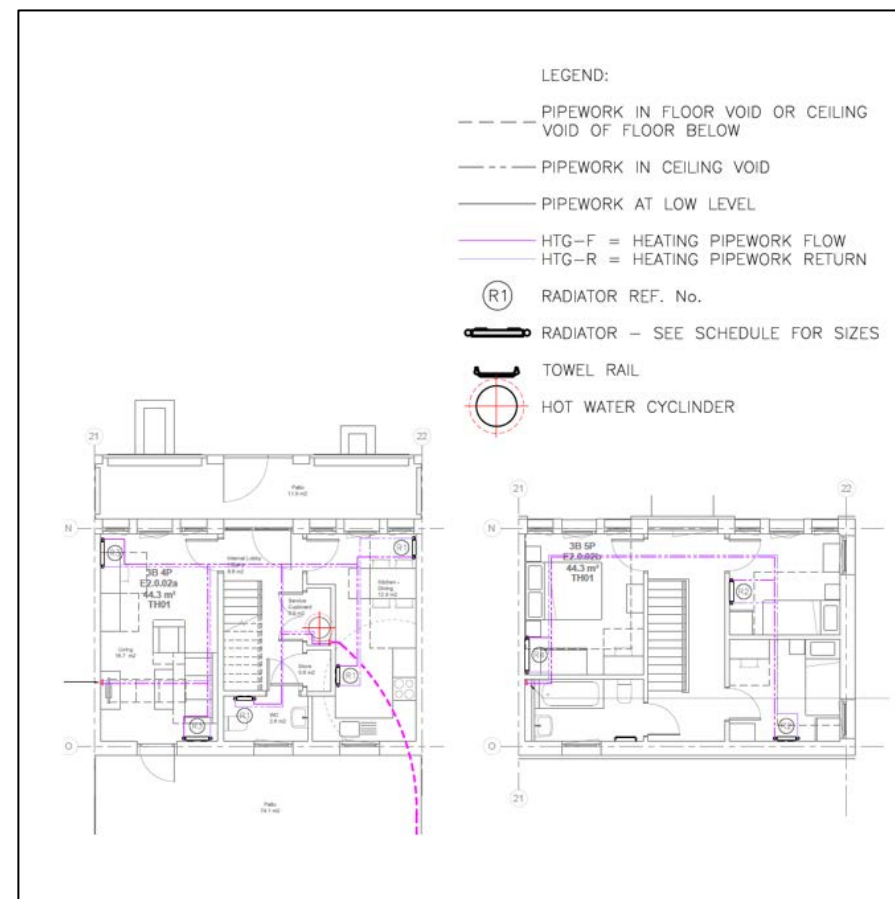


Figure 5: ASHP Pipework Schematic

4. RENEWABLE TECHNOLOGIES – PHOTOVOLTAICS

- 4.1 To assist in achieving the desired CO₂ reduction, a photovoltaic array will be installed across the site. The details of this array can be seen across via Table 7 and Figure 6. Full PV illustrative drawings can be found in Appendix 4 of this report.

PV System Details	
CO ₂ Reduction Provided	17.5 tonnes CO ₂ /year
CO ₂ Offset via 1kWp	0.177
PV Proposed	98.415 kWp
Module Output	405 Watts
Number of Panels (sitewide)	243
Panel Orientation	Horizontal
Tilt of Collectors	Horizontal
Over-Shading Factor	<20%

Table 7: Proposed PV Specification

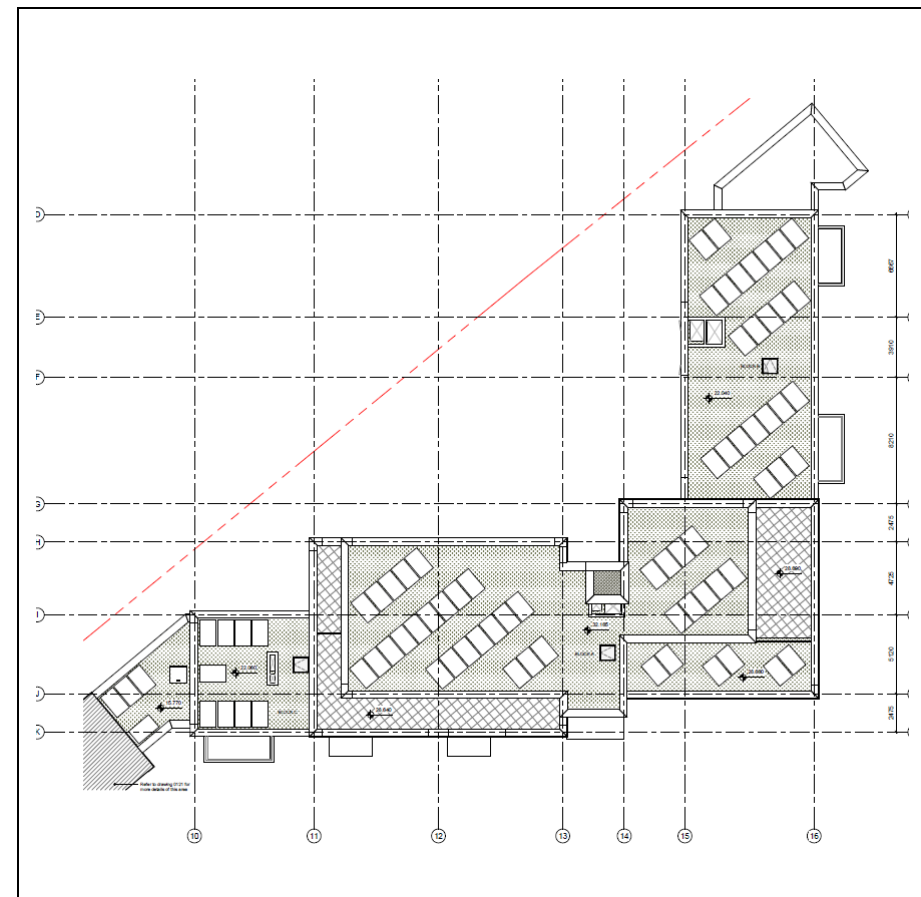


Figure 6: Proposed PV Drawing (Flats only - for illustration only – not for Construction)
Full drawings can be found in the Appendices

4.2 Final Carbon Emissions table:

	CO ₂ Emissions (Tonnes per Annum) (SAP 10)	
	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	58.3	
Be Lean: Energy Demand Reduction	55.6	
Be Clean: Supply Energy Efficiently	55.6	
Be Green: Renewable Energy	10.9	
Regulated CO ₂ Savings at ' <i>Be Green</i> ' over Part L 2013	81.19%	

Appendix 1



Remington

RESIDENTIAL UNITS - SAP 10

All Plots	AREA	TER <i>Part L 2013 Baseline</i>	Total TER	DER 'Be Lean'	Total DER 'Be Lean'	DER 'Be Green'	Total DER 'Be Green'
	m ²	kg CO2/m ² /yr	kg CO2/yr	kg CO2/m ² /yr	kg CO2/yr	kg CO2/m ² /yr	kg CO2/yr
A0.01 - BL	69.7	18.1	1,262	18.0	1,256	5.1	357
A0.02 - BL	73.6	16.9	1,245	16.0	1,177	4.2	310
A0.03 - BL	58.2	18.2	1,058	18.0	1,046	5.1	295
A1.01R - BL	91.0	14.7	1,342	14.1	1,285	2.9	261
A1.02R - BL	71.8	15.7	1,124	14.5	1,044	3.5	255
A1.03 - BL	52.3	16.4	855	15.4	806	4.2	221
A2.01R - BL	91.0	14.7	1,342	14.1	1,285	2.9	261
A2.02R - BL	71.6	15.7	1,122	14.6	1,043	3.6	256
A2.03R - BL	52.3	16.4	855	15.4	806	4.2	221
A3.01R - BL	82.1	15.0	1,231	14.4	1,180	3.2	260
A3.02R - BL	71.6	15.7	1,122	14.6	1,043	3.6	256
A3.03R - BL	52.3	17.8	933	17.4	910	5.0	261
A3.04R - BL	82.1	16.5	1,356	16.3	1,337	4.0	328
A4.01R - BL	82.1	15.6	1,284	15.2	1,245	3.6	293
A4.02R - BL	71.6	16.7	1,198	16.4	1,174	4.4	316
A4.03R - BL	52.3	18.1	946	17.7	925	5.1	269
A4.04R - BL	82.1	16.5	1,356	16.3	1,337	4.0	328
A5.01R - BL	61.3	18.1	1,109	18.1	1,113	5.5	337
A5.02R - BL	67.4	18.5	1,248	18.3	1,236	5.6	380
A5.03R - BL	61.3	19.5	1,198	21.0	1,290	6.9	420
B0.01 - BL	63.4	18.6	1,179	18.5	1,172	5.6	355
B0.02 - BL	51.5	21.7	1,116	21.4	1,104	7.1	364
B1.01R - BL	63.3	16.3	1,034	16.1	1,018	4.3	269
B1.02R - BL	51.5	19.6	1,008	19.5	1,002	6.0	310
B2.01R - BL	63.3	18.2	1,153	18.6	1,178	5.7	361
B2.02R - BL	51.5	21.1	1,086	21.3	1,099	7.0	361
C0.01 - BL	34.7	28.9	1,002	29.6	1,026	11.7	406
C0.01a - BL	69.6	22.6	1,573	19.8	1,377	6.4	447
C0.02 - BL	98.8	13.6	1,346	15.6	1,538	3.3	328
C1.02 - BL	78.0	15.3	1,196	14.6	1,136	3.3	258

C2.02 - BL	78.0	15.3	1,196	14.6	1,136	3.3	258
E1.0.01 - BL	47.4	22.1	1,047	20.4	967	4.8	227
E1.0.02 - BL	47.4	22.1	1,047	20.4	967	4.8	227
E1.0.03 - BL	96.6	15.9	1,536	14.7	1,424	0.6	61
E1.0.04 - BL	96.6	15.9	1,536	14.7	1,424	0.6	61
E2.0.01 - BL	78.6	19.4	1,524	17.6	1,383	2.0	158
E2.0.02 - BL	88.6	17.9	1,584	16.3	1,448	1.2	110
E2.0.03 - BL	56.1	22.9	1,285	20.9	1,172	4.3	239
W.0.01 - BL	88.6	17.4	1,538	15.7	1,393	0.8	72
W.0.02 - BL	116.4	14.4	1,673	12.5	1,455	0.0	2
W.0.03 - BL	116.4	14.2	1,650	12.4	1,439	0.0	0
W.0.04 - BL	116.4	14.2	1,650	12.4	1,439	0.0	0
W.0.05 - BL	116.4	14.4	1,673	12.5	1,455	0.0	2
W.0.06 - BL	88.6	16.5	1,462	15.0	1,330	0.7	65
W.0.07 - BL	88.6	16.5	1,462	15.0	1,330	0.7	65
W.0.08 - BL	88.6	17.4	1,538	15.7	1,393	0.8	72
Total Site Area (m ²):	3,433	TOTAL TER CO2:	58,278	TOTAL DER CO2:	55,342	TOTAL DER CO2:	10,963

Total Site TER	58,278	kg CO2/yr
Total Site DER	10,963	kg CO2/yr

Final CO2 Emissions at 'Be Lean'	55,342	kg CO2/yr
Final CO2 Emissions at 'Be Green'	10,963	kg CO2/yr

CO2 Savings at 'Be Green'	81.19%	
---------------------------	--------	--

Appendix 2



SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	C0.01 - BL			Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4		
Property	88, Remington Road, London, N15				
SAP Rating	69 C	DER	26.05	TER	47.41
Environmental	79 C	% DER<TER	45.06		
CO ₂ Emissions (t/year)	1.08	DFEE	96.70	TFEE	96.82
General Requirements Compliance	Pass	% DFEE<TFEE	0.12		
Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org			Assessor ID	Z417-0001
Client					

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:		31.00 m	34.70 m²	2.90 m
7.0 Living Area	19.50	m²		
8.0 Thermal Mass Parameter	Simple calculation - Medium			
Thermal Mass	250.00	kJ/m²K		

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	0.21	56.30	34.78
External Wall 2	Cavity Wall	0.21	33.60	31.29

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Heat Loss Floor 1	Ground Floor - Solid		0.14	36.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Opening Type 1	SAP table	Door to Corridor							1.40
Opening Type 2	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30

13.0 Openings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Door to Corridor	[2] External Wall 2	South East							2.31	
Opening 5	Window	[1] External Wall 1	North East	None	0.00					6.53	
Opening 3	Window	[1] External Wall 1	North East	None	0.00					5.86	
Opening 4	Window	[1] External Wall 1	South West	None	0.00					3.27	
Opening 5	Window	[1] External Wall 1	South West	None	0.00					5.86	

14.0 Conservatory

15.0 Draught Proofing

%

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	25.07	0.068	No
Independently assessed	E3 Sill	23.97	0.060	No
Independently assessed	E4 Jamb	67.12	0.064	No
Table K1 - Approved	E5 Ground floor (normal)	19.40	0.160	No
Independently assessed	E5 Ground floor (normal)	11.60	0.230	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	19.40	0.107	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	11.60	0.101	No
Independently assessed	E16 Corner (normal)	5.80	0.058	No
Independently assessed	E16 Corner (normal)	8.70	0.130	No
Table K1 - Approved	E18 Party wall between dwellings	5.80	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	2.20	0.160	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.20	0.000	No

Y-value

W/m²K

18.0 Pressure Testing

Designed AP₅₀

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

Wet Rooms

20.0 Fans, Open Fireplaces, Flues

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Sap Code

Is MHS Pumped

Heat Emitter

Flow Temperature

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

Immersion Only Heating Hot Water

29.0 Hot Water Cylinder

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.872	kWh/day

32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.99	Horizontal	Horizontal	None Or Little	No

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	A0.01 - BL	Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4
Property	91, Remington Road, London, N15		

SAP Rating	81 B	DER	11.42	TER	29.15
Environmental	92 A	% DER<TER	60.82		
CO ₂ Emissions (t/year)	0.49	DFEE	52.33	TFEE	58.26
General Requirements Compliance	Pass	% DFEE<TFEE	10.18		

Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org	Assessor ID	Z417-0001
------------------	--	-------------	-----------

Client	
--------	--

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements				
	Ground Floor:	Heat Loss Perimeter 26.90 m	Internal Floor Area 69.70 m ²	Average Storey Height 2.90 m

7.0 Living Area	29.90	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m ² K

9.0 External Walls				
Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	0.21	34.51	17.68
External Wall 2	Cavity Wall	0.21	43.50	43.50

11.0 Heat Loss Floors				
Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Heat Loss Floor 1	Ground Floor - Solid		0.14	69.70

12.0 Opening Types									
Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Opening Type 1	SAP table	Door to Corridor							1.40
Opening Type 2	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 3	Manufacturer	Solid Door							1.00

13.0 Openings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Solid Door	[1] External Wall 1	South West							2.31	
Opening 5	Window	[1] External Wall 1	North East	None	0.00					2.42	
Opening 3	Window	[1] External Wall 1	North East	None	0.00					2.42	
Opening 4	Window	[1] External Wall 1	South West	None	0.00					4.84	
Opening 5	Window	[1] External Wall 1	South West	None	0.00					4.84	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	7.10	0.068	No
Independently assessed	E3 Sill	6.00	0.060	No
Independently assessed	E4 Jamb	47.76	0.064	No
Table K1 - Approved	E5 Ground floor (normal)	11.90	0.160	No
Independently assessed	E5 Ground floor (normal)	15.00	0.230	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	11.90	0.107	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	15.00	0.101	No
Independently assessed	E16 Corner (normal)	2.90	0.058	No
Independently assessed	E16 Corner (normal)	5.80	0.130	No
Table K1 - Approved	E18 Party wall between dwellings	5.80	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	12.10	0.160	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	12.10	0.000	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

Wet Rooms

20.0 Fans, Open Fireplaces, Flues

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Sap Code

Is MHS Pumped

Heat Emitter

Flow Temperature

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

Immersion Only Heating Hot Water

29.0 Hot Water Cylinder

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.872	kWh/day

32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.00	Horizontal	Horizontal	None Or Little	No

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	W.0.06 - BL	Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4
Property	85, Remington Road, London, N15		
SAP Rating	88 B	DER	1.63
Environmental	99 A	TER	26.66
CO ₂ Emissions (t/year)	-0.09	% DER<TER	93.89
General Requirements Compliance	Pass	DfEE	52.08
		TFEE	55.45
		% DfEE<TFEE	6.09
Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org		Assessor ID
			Z417-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South									
Property Tenure	Unknown									
Transaction Type	New dwelling									
Terrain Type	Urban									
1.0 Property Type	House, End-Terrace									
2.0 Number of Storeys	2									
3.0 Date Built	2022									
4.0 Sheltered Sides	1									
5.0 Sunlight/Shade	Average or unknown									
6.0 Measurements										
			Heat Loss Perimeter		Internal Floor Area		Average Storey Height			
Ground Floor:			16.30 m		44.30 m²		2.90 m			
1st Storey:			16.30 m		44.30 m²		2.90 m			
7.0 Living Area		16.70								m²
8.0 Thermal Mass Parameter		Simple calculation - Low								
Thermal Mass		100.00								kJ/m²K
9.0 External Walls										
Description		Type			U-Value (W/m²K)		Gross Area (m²)	Nett Area (m²)		
External Wall 1		Cavity Wall			0.21		94.54	58.60		
10.0 External Roofs										
Description		Type			U-Value (W/m²K)		Gross Area (m²)	Nett Area (m²)		
External Roof 1		External Flat Roof			0.16		44.30	44.30		
11.0 Heat Loss Floors										
Description		Type	Construction				U-Value (W/m²K)	Area (m²)		
Heat Loss Floor 1		Ground Floor - Solid					0.14	44.30		
12.0 Opening Types										
Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)	
Opening Type 1	Manufacturer	Solid Door							1.00	
Opening Type 2	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Solid Door	[1] External Wall 1	South							2.31	
Opening 2	Window	[1] External Wall 1	South	None	0.00					7.17	
Opening 3	Window	[1] External Wall 1	South	None	0.00					10.56	
Opening 7	Window	[1] External Wall 1	South	None	0.00					1.68	
Opening 5	Window	[1] External Wall 1	North	None	0.00					9.60	
Opening 6	Window	[1] External Wall 1	North	None	0.00					2.10	
Opening 7	Window	[1] External Wall 1	South	None	0.00					2.52	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	18.22	0.300	No
Table K1 - Approved	E3 Sill	17.12	0.040	No
Table K1 - Approved	E4 Jamb	76.20	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	16.30	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	16.30	0.070	No
Table K1 - Default	E14 Flat roof	16.30	0.080	No
Table K1 - Approved	E18 Party wall between dwellings	23.20	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	11.00	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	11.00	0.000	No
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	11.00	0.240	No

Y-value 0.114 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

4.00

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

Cross ventilation possible

Yes

Night Ventilation

Yes

Air change rate

8.00

Mechanical Ventilation

Mechanical Ventilation System Present

Yes

Approved Installation

Yes

Mechanical Ventilation data Type

Database

Type

Balanced mechanical ventilation with heat recovery

MV Reference Number

500352

Configuration

2

MVHR Duct Insulated

Yes

Manufacturer SFP

0.70

Duct Type

Rigid

MVHR Efficiency

91.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Wet Rooms

2

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	1	
Total number of L.E.L. fittings	1	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
------------------------	----

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	104368	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	36° - 45°C	

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Immersion Only Heating Hot Water	No			
29.0 Hot Water Cylinder	Hot Water Cylinder			
Cylinder Stat	Yes			
Cylinder In Heated Space	Yes			
Independent Time Control	Yes			
Insulation Type	Measured Loss			
Cylinder Volume	210.00	L		
Loss	1.20	kWh/day		
Pipes insulation	Fully insulated primary pipework			
31.0 Thermal Store	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.54	Horizontal	Horizontal	None Or Little	No

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Appendix 3



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	C0.01 - BL			Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4		
Property	88, Remington Road, London, N15				
SAP Rating	69 C	DER	26.05	TER	47.41
Environmental	79 C	% DER<TER	45.06		
CO ₂ Emissions (t/year)	1.08	DFEE	96.70	TFEE	96.82
General Requirements Compliance	Pass	% DFEE<TFEE	0.12		
Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org			Assessor ID	Z417-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 35 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 47.41 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)96.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)96.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.31 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
JOULE Victorium COMPACT 62210022

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls: No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Continuous extract system
Specific fan power: 0.32
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average
Windows facing North East:	12.39 m ² , No overhang
Windows facing South West:	9.13 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Photovoltaic array	0.99 kW
--------------------	---------

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.7000 (1b)	x 2.9000 (2b)	= 100.6300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	34.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.6300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Opening Type 1			2.3100	1.4000	3.2340		(26)
Opening Type 2 (Uw = 1.30)			21.5200	1.2357	26.5932		(27)
Heat Loss Floor 1			36.0000	0.1400	5.0400		(28a)
External Wall 1	56.3000	21.5200	34.7800	0.2100	7.3038		(29a)
External Wall 2	33.6000	2.3100	31.2900	0.2100	6.5709		(29a)
Total net area of external elements Aum(A, m2)			125.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		48.7419		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.6254 (36)
Total fabric heat loss						(33) + (36) =	67.3673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040	16.6040 (38)
Heat transfer coeff	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712	83.9712 (39)
Average = Sum(39)m / 12 =												83.9712 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199	2.4199 (40)
HLP (average)												2.4199 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.2737 (42)
Average daily hot water use (litres/day)	64.4503 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	70.8953	68.3173	65.7393	63.1613	60.5832	58.0052	58.0052	60.5832	63.1613	65.7393	68.3173	70.8953 (44)
Energy conte	105.1357	91.9523	94.8866	82.7244	79.3760	68.4955	63.4711	72.8340	73.7039	85.8948	93.7609	101.8183 (45)
Energy content (annual)												Total = Sum(45)m = 1014.0535 (45)
Distribution loss (46)m = 0.15 x (45)m	15.7703	13.7928	14.2330	12.4087	11.9064	10.2743	9.5207	10.9251	11.0556	12.8842	14.0641	15.2727 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8720 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0109 (55)
Total storage loss													
	31.3373	28.3046	31.3373	30.3264	31.3373	30.3264	31.3373	31.3373	30.3264	31.3373	30.3264	31.3373	(56)
If cylinder contains dedicated solar storage													
	31.3373	28.3046	31.3373	30.3264	31.3373	30.3264	31.3373	31.3373	30.3264	31.3373	30.3264	31.3373	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	136.4729	120.2570	126.2238	113.0508	110.7133	98.8219	94.8084	104.1713	104.0303	117.2321	124.0873	133.1555	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h													
	136.4729	120.2570	126.2238	113.0508	110.7133	98.8219	94.8084	104.1713	104.0303	117.2321	124.0873	133.1555	(64)
Heat gains from water heating, kWh/month													
	34.9576	30.5741	31.5498	27.5059	26.3925	22.7747	21.1041	24.2173	24.5066	28.5600	31.1755	33.8546	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	9.6703	8.5891	6.9851	5.2882	3.9530	3.3373	3.6060	4.6873	6.2912	7.9882	9.3234	9.9391	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	108.4712	109.5968	106.7604	100.7219	93.0994	85.9353	81.1493	80.0237	82.8602	88.8986	96.5211	103.6852	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	(71)
Water heating gains (Table 5)													
	46.9860	45.4972	42.4056	38.2026	35.4738	31.6316	28.3658	32.5502	34.0369	38.3871	43.2993	45.5035	(72)
Total internal gains													
	207.2330	205.7886	198.2565	186.3181	174.6316	163.0096	155.2265	159.3665	165.2937	177.3793	191.2492	201.2331	(73)

6. Solar gains

[Jan]													
	Area												
	m2												
	Solar flux												
	Table 6a												
	W/m2												
	Specific data												
	or Table 6b												
	Specific data												
	or Table 6c												
	Access												
	factor												
	Table 6d												
	Gains												
	W												
Northeast	12.3900												48.8267 (75)
Southwest	9.1300												117.3301 (79)
Solar gains	166.1568	299.2448	452.5184	632.8986	774.8057	798.1928	757.4787	647.1775	514.2858	342.3444	201.9711	140.2845	(83)
Total gains	373.3898	505.0334	650.7749	819.2167	949.4373	961.2024	912.7053	806.5441	679.5795	519.7237	393.2203	341.5176	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	28.6970	
alpha	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	2.9131	
util living area													
	0.9844	0.9637	0.9179	0.8183	0.6679	0.5086	0.3870	0.4480	0.6825	0.8972	0.9717	0.9878	(86)
Tweekday	16.2521	16.7839	17.5343	18.3227	18.8229	19.0193	19.0612	19.0555	18.9211	18.1964	17.0472	16.1297	
Tweekend	19.5296	19.7705	20.1186	20.5088	20.7914	20.9310	20.9769	20.9645	20.8357	20.4217	19.8844	19.4748	
24 / 16	8	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	19	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	3	20	3	0	0	0	0	0	0	0	0	22	
MIT	20.8103	19.7705	19.7050	20.2330	20.6781	20.8940	20.9644	20.9452	20.7435	20.1075	19.2580	19.4748	(87)
Th 2	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	19.0681	(88)
util rest of house													
	0.9786	0.9509	0.8896	0.7596	0.5714	0.3746	0.2247	0.2729	0.5467	0.8472	0.9594	0.9833	(89)
Tweekday	16.2521	16.7839	17.5343	18.3227	18.8229	19.0193	19.0612	19.0555	18.9211	18.1964	17.0472	16.1297	
Tweekend	16.2521	16.7839	17.5343	18.3227	18.8229	19.0193	19.0612	19.0555	18.9211	18.1964	17.0472	16.1297	
MIT 2	18.7047	16.7839	17.5343	18.3227	18.8229	19.0193	19.0612	19.0555	18.9211	18.1964	17.0472	16.1297	(90)
Living area fraction													
MIT	19.8880	18.4622	18.7542	19.3962	19.8655	20.0728	20.1307	20.1175	19.9452	19.2703	18.2896	18.0095	(91)
Temperature adjustment													
adjusted MIT	19.8880	18.4622	18.7542	19.3962	19.8655	20.0728	20.1307	20.1175	19.9452	19.2703	18.2896	18.0095	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9814	0.9457	0.8839	0.7710	0.6142	0.4473	0.3164	0.3717	0.6143	0.8537	0.9525	0.9798	(94)
Useful gains	366.4303	477.5877	575.2343	631.6216	583.1830	429.9648	288.8179	299.8124	417.4559	443.6861	374.5248	334.6155	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1308.9404	1138.8383	1028.9969	881.3817	685.6632	459.5614	296.4768	312.1602	490.8307	728.0594	939.6039	1159.6012	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	701.2275	444.3605	337.5994	179.8273	76.2453	0.0000	0.0000	0.0000	0.0000	211.5738	406.8569	613.7893	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 2971.4800 (98)
85.6334 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 239.2558 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 1241.9676 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	701.2275	444.3605	337.5994	179.8273	76.2453	0.0000	0.0000	0.0000	0.0000	211.5738	406.8569	613.7893	(98)
Space heating efficiency (main heating system 1)	239.2558	239.2558	239.2558	239.2558	239.2558	0.0000	0.0000	0.0000	0.0000	239.2558	239.2558	239.2558	(210)
Space heating fuel (main heating system)	293.0869	185.7261	141.1039	75.1611	31.8677	0.0000	0.0000	0.0000	0.0000	88.4299	170.0510	256.5410	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	136.4729	120.2570	126.2238	113.0508	110.7133	98.8219	94.8084	104.1713	104.0303	117.2321	124.0873	133.1555	(64)
Efficiency of water heater (217)m	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	(216)
Fuel for water heating, kWh/month	100.8818	88.8949	93.3056	83.5680	81.8401	73.0499	70.0831	77.0042	76.9000	86.6588	91.7263	98.4296	(219)
Water heating fuel used												1022.3423	(219)
Annual totals kWh/year													
Space heating fuel - main system												1241.9676	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.4160)
mechanical ventilation fans (SFP = 0.4160) 59.6784 (230a)
Total electricity for the above, kWh/year 59.6784 (231)
Electricity for lighting (calculated in Appendix L) 170.7804 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.99 * 951 * 1.00) = -752.8879 (233)
Total delivered energy for all uses 1741.8808 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1241.9676	0.5190	644.5812	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1022.3423	0.5190	530.5957	(264)
Space and water heating			1175.1768	(265)
Pumps and fans	59.6784	0.5190	30.9731	(267)
Energy for lighting	170.7804	0.5190	88.6350	(268)
Energy saving/generation technologies				
PV Unit	-752.8879	0.5190	-390.7488	(269)
Total CO2, kg/year			904.0361	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			26.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

	DER	TFA	N	EF	
Total Floor Area		34.7000			
Assumed number of occupants			1.2737		
CO2 emission factor in Table 12 for electricity displaced from grid			0.5190		
CO2 emissions from appliances, equation (L14)			18.5239		ZC2
CO2 emissions from cooking, equation (L16)			4.3103		ZC3
Total CO2 emissions			48.8842		ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000		ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000		ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000		ZC7
Net CO2 emissions			48.8842		ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	34.7000 (1b)	x 2.9000 (2b)	= 100.6300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	34.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.6300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1987 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4487 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4151 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5292	0.5189	0.5085	0.4566	0.4462	0.3943	0.3943	0.3840	0.4151	0.4462	0.4670	0.4877 (22b)
Effective ac	0.6400	0.6346	0.6293	0.6042	0.5996	0.5778	0.5778	0.5737	0.5862	0.5996	0.6090	0.6189 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.3100	1.0000	2.3100		(26)
TER Opening Type (Uw = 1.40)			6.3600	1.3258	8.4318		(27)
Heat Loss Floor 1			36.0000	0.1300	4.6800		(28a)
External Wall 1	56.3000	6.3600	49.9400	0.1800	8.9892		(29a)
External Wall 2	33.6000	2.3100	31.2900	0.1800	5.6322		(29a)
Total net area of external elements Aum(A, m ²)			125.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.0432		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.7670 (36)
Total fabric heat loss						(33) + (36) =	44.8102 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	21.2547	21.0741	20.8971	20.0656	19.9101	19.1859	19.1859	19.0518	19.4648	19.9101	20.2248	20.5538 (38)
Heat transfer coeff	66.0649	65.8843	65.7073	64.8758	64.7203	63.9961	63.9961	63.8620	64.2750	64.7203	65.0350	65.3640 (39)
Average = Sum(39)m / 12 =												64.8751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.9039	1.8987	1.8936	1.8696	1.8651	1.8443	1.8443	1.8404	1.8523	1.8651	1.8742	1.8837 (40)
HLP (average)												1.8696 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.2737 (42)
Average daily hot water use (litres/day)												64.4503 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	70.8953	68.3173	65.7393	63.1613	60.5832	58.0052	58.0052	60.5832	63.1613	65.7393	68.3173	70.8953 (44)
Energy conte	105.1357	91.9523	94.8866	82.7244	79.3760	68.4955	63.4711	72.8340	73.7039	85.8948	93.7609	101.8183 (45)
Energy content (annual)												Total = Sum(45)m = 1014.0535 (45)
Distribution loss (46)m = 0.15 x (45)m	15.7703	13.7928	14.2330	12.4087	11.9064	10.2743	9.5207	10.9251	11.0556	12.8842	14.0641	15.2727 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	151.7306	134.0380	141.4815	127.8162	125.9709	113.5873	110.0660	119.4289	118.7958	132.4897	138.8527	148.4132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	151.7306	134.0380	141.4815	127.8162	125.9709	113.5873	110.0660	119.4289	118.7958	132.4897	138.8527	148.4132 (64)
Heat gains from water heating, kWh/month	72.2335	64.2427	68.8257	63.5793	63.6685	58.8482	58.3801	61.4932	60.5800	65.8359	67.2490	71.1305 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847	63.6847 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	9.8490	8.7478	7.1142	5.3859	4.0260	3.3989	3.6727	4.7739	6.4075	8.1358	9.4957	10.1228 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	108.4712	109.5968	106.7604	100.7219	93.0994	85.9353	81.1493	80.0237	82.8602	88.8986	96.5211	103.6852 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685	29.3685 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478	-50.9478 (71)
Water heating gains (Table 5)	97.0881	95.5993	92.5077	88.3046	85.5759	81.7336	78.4678	82.6522	84.1389	88.4892	93.4014	95.6055 (72)
Total internal gains	260.5138	259.0494	251.4877	239.5179	227.8067	216.1733	208.3952	212.5552	218.5120	230.6290	244.5236	254.5189 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			3.6600	11.2829	0.6300	0.7000	0.7700	12.6205 (75)				
Southwest			2.7000	36.7938	0.6300	0.7000	0.7700	30.3606 (79)				

Solar gains	42.9811	77.4047	117.0432	163.6857	200.3768	206.4210	195.8935	167.3747	133.0150	88.5509	52.2448	36.2889 (83)
Total gains	303.4948	336.4540	368.5309	403.2036	428.1835	422.5943	404.2887	379.9300	351.5270	319.1799	296.7684	290.8078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.4751	36.5751	36.6736	37.1436	37.2329	37.6542	37.6542	37.7333	37.4908	37.2329	37.0527	36.8662
alpha	3.4317	3.4383	3.4449	3.4762	3.4822	3.5103	3.5103	3.5156	3.4994	3.4822	3.4702	3.4577
util living area												
	0.9913	0.9867	0.9764	0.9495	0.8873	0.7660	0.6227	0.6699	0.8582	0.9594	0.9858	0.9925 (86)
MIT	19.0904	19.2643	19.5867	20.0376	20.4685	20.7936	20.9283	20.9056	20.6597	20.1215	19.5380	19.0674 (87)
Th 2	19.3982	19.4017	19.4052	19.4217	19.4248	19.4392	19.4392	19.4419	19.4336	19.4248	19.4185	19.4120 (88)
util rest of house												
	0.9882	0.9819	0.9672	0.9275	0.8329	0.6456	0.4341	0.4865	0.7679	0.9372	0.9797	0.9899 (89)
MIT 2	16.9669	17.2213	17.6891	18.3400	18.9221	19.3095	19.4173	19.4086	19.1775	18.4708	17.6311	16.9417 (90)
Living area fraction												
MIT	18.1603	18.3694	18.7555	19.2940	19.7911	20.1435	20.2664	20.2499	20.0104	19.3984	18.7027	18.1363 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1603	18.3694	18.7555	19.2940	19.7911	20.1435	20.2664	20.2499	20.0104	19.3984	18.7027	18.1363 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9848	0.9776	0.9621	0.9252	0.8478	0.7059	0.5409	0.5896	0.8069	0.9367	0.9758	0.9868 (94)
Ext temp.	298.8736	328.9103	354.5677	373.0587	363.0150	298.3068	218.6845	224.0136	283.6472	298.9860	289.5950	286.9649 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	915.6759	887.4209	805.2735	674.3192	523.6585	354.7633	234.6371	245.8602	379.8932	569.4371	754.5808	910.9288 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	458.9009	375.3191	335.3251	216.9076	119.5188	0.0000	0.0000	0.0000	0.0000	201.2156	334.7898	464.2292 (98)
Space heating per m2										(98) / (4) =		72.2250 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2680.4343 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	458.9009	375.3191	335.3251	216.9076	119.5188	0.0000	0.0000	0.0000	0.0000	201.2156	334.7898	464.2292	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	490.8031	401.4108	358.6365	231.9867	127.8276	0.0000	0.0000	0.0000	0.0000	215.2039	358.0640	496.5018	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	151.7306	134.0380	141.4815	127.8162	125.9709	113.5873	110.0660	119.4289	118.7958	132.4897	138.8527	148.4132	(64)
Efficiency of water heater (217)m	87.5820	87.4156	87.0371	86.2138	84.6740	79.8000	79.8000	79.8000	79.8000	85.9257	87.0771	79.8000	(216)
Fuel for water heating, kWh/month	173.2441	153.3343	162.5531	148.2550	148.7716	142.3400	137.9274	149.6603	148.8669	154.1910	159.4595	169.3193	(219)
Water heating fuel used												1847.9223	(219)
Annual totals kWh/year													
Space heating fuel - main system												2680.4343	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												173.9368	(232)
Total delivered energy for all uses												4777.2934	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2680.4343	0.2160	578.9738 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1847.9223	0.2160	399.1512 (264)
Space and water heating			978.1250 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	173.9368	0.5190	90.2732 (268)
Total CO2, kg/m2/year			1107.3232 (272)
Emissions per m2 for space and water heating			28.1880 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.6015 (272b)
Emissions per m2 for pumps and fans			1.1218 (272c)
Target Carbon Dioxide Emission Rate (TER) = (28.1880 * 1.55) + 2.6015 + 1.1218, rounded to 2 d.p.			47.4100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	A0.01 - BL			Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4		
Property	91, Remington Road, London, N15				
SAP Rating	81 B	DER	11.42	TER	29.15
Environmental	92 A	% DER<TER	60.82		
CO ₂ Emissions (t/year)	0.49	DFEE	52.33	TFEE	58.26
General Requirements Compliance	Pass	% DFEE<TFEE	10.18		
Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org			Assessor ID	Z417-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 70 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 29.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.42 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
JOULE Victorium COMPACT 62210022

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls: No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%		
Minimum	75%	OK

8 Mechanical ventilation

Continuous extract system
Specific fan power: 0.29
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
Based on:		
Overshading:	Average	
Windows facing North East:	4.84 m ² , No overhang	
Windows facing South West:	9.68 m ² , No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Door U-value	1.00 W/m ² K
Photovoltaic array	2.00 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.7000 (1b)	x 2.9000 (2b)	= 202.1300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 202.1300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			14.5200	1.2357	17.9430		(27)
Opening Type 3			2.3100	1.0000	2.3100		(26)
Heat Loss Floor 1			69.7000	0.1400	9.7580		(28a)
External Wall 1	34.5100	16.8300	17.6800	0.2100	3.7128		(29a)
External Wall 2	43.5000		43.5000	0.2100	9.1350		(29a)
Total net area of external elements Aum(A, m ²)			147.7100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.8588		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.2479 (36)
Total fabric heat loss							(33) + (36) = 58.1067 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515	33.3515 (38)
Heat transfer coeff	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582	91.4582 (39)
Average = Sum(39)m / 12 =												91.4582 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122	1.3122 (40)
HLP (average)												1.3122 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2388 (42)
Average daily hot water use (litres/day)												87.3720 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.1092	92.6143	89.1194	85.6245	82.1296	78.6348	78.6348	82.1296	85.6245	89.1194	92.6143	96.1092 (44)
Energy conte	142.5271	124.6551	128.6329	112.1453	107.6061	92.8559	86.0446	98.7374	99.9167	116.4433	127.1069	138.0299 (45)
Energy content (annual)												Total = Sum(45)m = 1374.7012 (45)
Distribution loss (46)m = 0.15 x (45)m	21.3791	18.6983	19.2949	16.8218	16.1409	13.9284	12.9067	14.8106	14.9875	17.4665	19.0660	20.7045 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8720 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0109 (55)
Total storage loss													
31.3373	28.3046	31.3373	30.3264	31.3373	30.3264	31.3373	31.3373	30.3264	31.3373	30.3264	31.3373	30.3264	31.3373 (56)
If cylinder contains dedicated solar storage													
31.3373	28.3046	31.3373	30.3264	31.3373	30.3264	31.3373	31.3373	30.3264	31.3373	30.3264	31.3373	30.3264	31.3373 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month													
173.8644	152.9598	159.9702	142.4717	138.9434	123.1823	117.3819	130.0747	130.2431	147.7805	157.4333	169.3672	169.3672 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Solar input (sum of months) = Sum(63)m =													0.0000 (64)
Output from w/h													
173.8644	152.9598	159.9702	142.4717	138.9434	123.1823	117.3819	130.0747	130.2431	147.7805	157.4333	169.3672	169.3672 (64)	
Heat gains from water heating, kWh/month													
47.3903	41.4478	42.7704	37.2883	35.7790	30.8746	28.6098	32.8302	33.2223	38.7174	42.2631	45.8949	45.8949 (65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5851	15.6189	12.7021	9.6163	7.1883	6.0687	6.5574	8.5236	11.4404	14.5262	16.9542	18.0738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.5959	198.6359	193.4951	182.5508	168.7356	155.7513	147.0769	145.0369	150.1777	161.1220	174.9372	187.9215 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528 (71)
Water heating gains (Table 5)	63.6966	61.6783	57.4872	51.7893	48.0901	42.8814	38.4541	44.1266	46.1421	52.0395	58.6987	61.6867 (72)
Total internal gains	334.4598	332.5154	320.2666	300.5387	280.5963	261.2836	248.6707	254.2694	264.3425	284.2700	307.1724	324.2644 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.8400	11.2829	0.7200	0.7000	0.7700	19.0735 (75)			
Southwest				9.6800	36.7938	0.7200	0.7000	0.7700	124.3982 (79)			
Solar gains	143.4718	250.7209	359.8755	474.1096	556.7879	564.0861	539.1264	475.7134	399.1631	281.6374	172.9999	122.0354 (83)
Total gains	477.9316	583.2364	680.1421	774.6484	837.3842	825.3697	787.7972	729.9828	663.5056	565.9073	480.1722	446.2998 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234	52.9234
alpha	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282	4.5282
util living area	0.9964	0.9908	0.9757	0.9307	0.8254	0.6580	0.4986	0.5552	0.7980	0.9591	0.9924	0.9974 (86)
Tweekday	18.0202	18.3179	18.7552	19.2605	19.6376	19.7970	19.8271	19.8237	19.7317	19.2321	18.5099	17.9434
Tweekend	20.1107	20.2431	20.4395	20.6737	20.8652	20.9643	20.9918	20.9869	20.9140	20.6545	20.3276	20.0766
24 / 16		0	0			0		0	0	0	0	7
24 / 9	22	0	0	0	0	0	0	0	0	0	0	19
16 / 9	0	20	9		0	0	0	0	0	0	0	3
MIT	21.0000	20.2431	20.2595	20.4905	20.7919	20.9451	20.9874	20.9798	20.8658	20.4667	19.9500	20.8511 (87)
Th 2	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313	19.8313 (88)
util rest of house												
	0.9952	0.9877	0.9672	0.9062	0.7674	0.5580	0.3724	0.4245	0.7117	0.9395	0.9893	0.9965 (89)
Tweekday	18.0202	18.3179	18.7552	19.2605	19.6376	19.7970	19.8271	19.8237	19.7317	19.2321	18.5099	17.9434
Tweekend	18.0202	18.3179	18.7552	19.2605	19.6376	19.7970	19.8271	19.8237	19.7317	19.2321	18.5099	17.9434
MIT 2	19.8313	18.3179	18.7552	19.2605	19.6376	19.7970	19.8271	19.8237	19.7317	19.2321	18.5099	19.5268 (90)
Living area fraction									fLA = Living area / (4)			0.4290 (91)
MIT	20.3327	19.1438	19.4005	19.7881	20.1328	20.2895	20.3249	20.3197	20.2182	19.7617	19.1277	20.0949 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3327	19.1438	19.4005	19.7881	20.1328	20.2895	20.3249	20.3197	20.2182	19.7617	19.1277	20.0949 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9958	0.9853	0.9633	0.9051	0.7839	0.5992	0.4269	0.4809	0.7432	0.9380	0.9867	0.9967 (94)
Useful gains	475.9163	574.6702	655.1742	701.1338	656.4066	494.5284	336.2846	351.0536	493.1377	530.8370	473.7667	444.8252 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1466.3174	1302.7100	1179.8558	995.8072	771.2462	520.3532	340.6694	358.4877	559.5584	837.9132	1100.0302	1453.7174 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	736.8584	489.2428	390.3631	212.1649	85.4407	0.0000	0.0000	0.0000	0.0000	228.4647	450.9097	750.6159 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 3344.0600 (98)
Space heating per m2 (98) / (4) = 47.9779 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 238.6374 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 1401.3143 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	736.8584	489.2428	390.3631	212.1649	85.4407	0.0000	0.0000	0.0000	0.0000	228.4647	450.9097	750.6159	(98)
Space heating efficiency (main heating system 1)	238.6374	238.6374	238.6374	238.6374	238.6374	0.0000	0.0000	0.0000	0.0000	238.6374	238.6374	238.6374	(210)
Space heating fuel (main heating system)	308.7774	205.0151	163.5800	88.9068	35.8036	0.0000	0.0000	0.0000	0.0000	95.7372	188.9518	314.5424	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	173.8644	152.9598	159.9702	142.4717	138.9434	123.1823	117.3819	130.0747	130.2431	147.7805	157.4333	169.3672	(64)
Efficiency of water heater (217)m	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	135.2800	(216)
Fuel for water heating, kWh/month	128.5219	113.0690	118.2512	105.3162	102.7080	91.0573	86.7696	96.1522	96.2767	109.2405	116.3759	125.1975	(219)
Water heating fuel used												1288.9358	(219)
Annual totals kWh/year													
Space heating fuel - main system												1401.3143	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEV)Centralised, Database: in-use factor = 1.3000, SFP = 0.3770)
mechanical ventilation fans (SFP = 0.3770) 53.8184 (230a)
Total electricity for the above, kWh/year 53.8184 (231)
Electricity for lighting (calculated in Appendix L) 310.5577 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 2.00 * 951 * 1.00) = -1520.9856 (233)
Total delivered energy for all uses 1533.6405 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1401.3143	0.5190	727.2821	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1288.9358	0.5190	668.9577	(264)
Space and water heating			1396.2398	(265)
Pumps and fans	53.8184	0.5190	27.9317	(267)
Energy for lighting	310.5577	0.5190	161.1794	(268)
Energy saving/generation technologies				
PV Unit	-1520.9856	0.5190	-789.3915	(269)
Total CO2, kg/year			795.9594	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

	DER	TFA	N	EF	
Total Floor Area		69.7000			11.4200 ZC1
Assumed number of occupants			2.2388		2.2388
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190	16.7143 ZC2
CO2 emissions from appliances, equation (L14)					2.4782 ZC3
CO2 emissions from cooking, equation (L16)					30.6125 ZC4
Total CO2 emissions					0.0000 ZC5
Residual CO2 emissions offset from biofuel CHP					0.0000 ZC6
Additional allowable electricity generation, kWh/m²/year					0.0000 ZC7
Resulting CO2 emissions offset from additional allowable electricity generation					30.6125 ZC8
Net CO2 emissions					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.7000 (1b)	x 2.9000 (2b)	= 202.1300 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 202.1300 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.0989 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3489 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2966 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3782	0.3708	0.3633	0.3263	0.3188	0.2818	0.2818	0.2744	0.2966	0.3188	0.3337	0.3485 (22b)
Effective ac	0.5715	0.5687	0.5660	0.5532	0.5508	0.5397	0.5397	0.5376	0.5440	0.5508	0.5557	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.3100	1.0000	2.3100		(26)
TER Opening Type (Uw = 1.40)			14.5200	1.3258	19.2500		(27)
Heat Loss Floor 1			69.7000	0.1300	9.0610		(28a)
External Wall 1	34.5100	16.8300	17.6800	0.1800	3.1824		(29a)
External Wall 2	43.5000		43.5000	0.1800	7.8300		(29a)
Total net area of external elements Aum(A, m ²)			147.7100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 41.6334		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3290 (36)
Total fabric heat loss						(33) + (36) =	52.9624 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.1211	37.9359	37.7544	36.9017	36.7421	35.9994	35.9994	35.8619	36.2855	36.7421	37.0649	37.4023 (38)
Heat transfer coeff	91.0835	90.8983	90.7168	89.8641	89.7045	88.9618	88.9618	88.8243	89.2479	89.7045	90.0273	90.3647 (39)
Average = Sum(39)m / 12 =												89.8633 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3068	1.3041	1.3015	1.2893	1.2870	1.2764	1.2764	1.2744	1.2805	1.2870	1.2916	1.2965 (40)
HLP (average)												1.2893 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2388 (42)
Average daily hot water use (litres/day)												87.3720 (43)
Daily hot water use	96.1092	92.6143	89.1194	85.6245	82.1296	78.6348	78.6348	82.1296	85.6245	89.1194	92.6143	96.1092 (44)
Energy conte	142.5271	124.6551	128.6329	112.1453	107.6061	92.8559	86.0446	98.7374	99.9167	116.4433	127.1069	138.0299 (45)
Energy content (annual)										Total = Sum(45)m =		1374.7012 (45)
Distribution loss (46)m = 0.15 x (45)m	21.3791	18.6983	19.2949	16.8218	16.1409	13.9284	12.9067	14.8106	14.9875	17.4665	19.0660	20.7045 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	189.1220	166.7408	175.2278	157.2371	154.2010	137.9477	132.6395	145.3323	145.0085	163.0382	172.1988	184.6248 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	189.1220	166.7408	175.2278	157.2371	154.2010	137.9477	132.6395	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	84.6662	75.1164	80.0464	73.3618	73.0549	66.9480	65.8858	70.1061	69.2958	75.9933	78.3365	83.1709 (65)
								Total per year (kWh/year) = Sum(64)m =				1923.3186 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410	111.9410 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5851	15.6189	12.7021	9.6163	7.1883	6.0687	6.5574	8.5236	11.4404	14.5262	16.9542	18.0738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.5959	198.6359	193.4951	182.5508	168.7356	155.7513	147.0769	145.0369	150.1777	161.1220	174.9372	187.9215 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941	34.1941 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528	-89.5528 (71)
Water heating gains (Table 5)	113.7986	111.7804	107.5892	101.8914	98.1921	92.9834	88.5561	94.2287	96.2441	102.1415	108.8007	111.7888 (72)
Total internal gains	387.5619	385.6175	373.3687	353.6408	333.6983	314.3856	301.7728	307.3714	317.4445	337.3720	360.2744	377.3664 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.8400	11.2829	0.6300	0.7000	0.7700	16.6894 (75)			
Southwest				9.6800	36.7938	0.6300	0.7000	0.7700	108.8484 (79)			

Solar gains	125.5378	219.3808	314.8910	414.8459	487.1894	493.5754	471.7356	416.2492	349.2677	246.4327	151.3749	106.7809 (83)
Total gains	513.0997	604.9983	688.2597	768.4867	820.8877	807.9610	773.5084	723.6207	666.7122	583.8047	511.6493	484.1474 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.1411	53.2494	53.3559	53.8622	53.9580	54.4085	54.4085	54.4927	54.2341	53.9580	53.7646	53.5638
alpha	4.5427	4.5500	4.5571	4.5908	4.5972	4.6272	4.6272	4.6328	4.6156	4.5972	4.5843	4.5709
util living area	0.9952	0.9894	0.9744	0.9304	0.8279	0.6568	0.4951	0.5465	0.7878	0.9532	0.9901	0.9963 (86)
MIT	19.6763	19.8664	20.1546	20.5107	20.7967	20.9490	20.9889	20.9827	20.8808	20.5051	20.0217	19.6407 (87)
Th 2	19.8355	19.8376	19.8396	19.8492	19.8510	19.8594	19.8594	19.8610	19.8562	19.8510	19.8474	19.8436 (88)
util rest of house	0.9936	0.9858	0.9656	0.9060	0.7708	0.5587	0.3724	0.4202	0.7015	0.9316	0.9862	0.9951 (89)
MIT 2	18.0987	18.3760	18.7918	19.2955	19.6615	19.8276	19.8557	19.8544	19.7674	19.3003	18.6103	18.0523 (90)
Living area fraction	18.7755	19.0154	19.3764	19.8168	20.1485	20.3087	20.3418	20.3384	20.2450	19.8172	19.2158	0.4290 (91)
MIT	18.7755	19.0154	19.3764	19.8168	20.1485	20.3087	20.3418	20.3384	20.2450	19.8172	19.2158	18.7337 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7755	19.0154	19.3764	19.8168	20.1485	20.3087	20.3418	20.3384	20.2450	19.8172	19.2158	18.7337 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9916	0.9825	0.9611	0.9052	0.7871	0.5992	0.4253	0.4747	0.7336	0.9308	0.9832	0.9934 (94)
Useful gains	508.7693	594.3816	661.4633	695.6064	646.0806	484.1076	329.0097	343.4927	489.1216	543.3984	503.0733	480.9418 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1318.4757	1283.0659	1168.1079	981.0263	757.8656	507.8548	332.8758	349.8300	548.4313	826.8227	1090.7483	1313.3330 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	602.4215	462.7958	376.9436	205.5023	83.1680	0.0000	0.0000	0.0000	0.0000	210.8677	423.1260	619.2991 (98)
Space heating	2984.1240 (98)											
Space heating per m2	(98) / (4) = 42.8138 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3191.5765 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4215	462.7958	376.9436	205.5023	83.1680	0.0000	0.0000	0.0000	0.0000	210.8677	423.1260	619.2991	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	644.3011	494.9688	403.1482	219.7886	88.9497	0.0000	0.0000	0.0000	0.0000	225.5270	452.5412	662.3519	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	189.1220	166.7408	175.2278	157.2371	154.2010	137.9477	132.6395	145.3323	145.0085	163.0382	172.1988	184.6248	(64)
Efficiency of water heater (217)m	87.6907	87.3962	86.8063	85.5289	83.2486	79.8000	79.8000	79.8000	79.8000	85.5010	87.1211	79.8000	(216)
Fuel for water heating, kWh/month	215.6695	190.7873	201.8607	183.8410	185.2295	172.8668	166.2149	182.1207	181.7149	190.6856	197.6546	210.2873	(219)
Water heating fuel used												2278.9328	(219)
Annual totals kWh/year													
Space heating fuel - main system												3191.5765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												310.5577	(232)
Total delivered energy for all uses												5856.0670	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3191.5765	0.2160	689.3805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2278.9328	0.2160	492.2495 (264)
Space and water heating			1181.6300 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	310.5577	0.5190	161.1794 (268)
Total CO2, kg/m2/year			1381.7344 (272)
Emissions per m2 for space and water heating			16.9531 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3125 (272b)
Emissions per m2 for pumps and fans			0.5585 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.9531 * 1.55) + 2.3125 + 0.5585, rounded to 2 d.p.			29.1500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	W.0.06 - BL			Issued on Date	15/09/2022
Assessment Reference	001	Prop Type Ref	House 3-4		
Property	85, Remington Road, London, N15				
SAP Rating	88 B	DER	1.63	TER	26.66
Environmental	99 A	% DER<TER	93.89		
CO ₂ Emissions (t/year)	-0.09	DFEE	52.08	TFEE	55.45
General Requirements Compliance	Pass	% DFEE<TFEE	6.09		
Assessor Details	Mr. Edward Coate, Edward Coate, Tel: 07427310051, ed.coate@nrgconsulting.org			Assessor ID	Z417-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

End-Terrace House, total floor area 89 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 26.66 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 1.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)52.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Samsung Electronics AE080RXYDEG

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.20 kWh/day	
Permitted by DBSCG 2.30	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power:	0.70	
Maximum	1.5	OK
MVHR efficiency:	91%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	11.70 m ² , No overhang
Windows facing South:	21.93 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Door U-value	1.00 W/m ² K
Photovoltaic array	2.54 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.3000 (1b)	x 2.9000 (2b)	= 128.4700 (1b) - (3b)
First floor	44.3000 (1c)	x 2.9000 (2c)	= 128.4700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 256.9400 (5)
Dwelling volume			

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	Air changes per hour	0.0000 (8)
Pressure test																Yes	0.0000
Measured/design AP50																Yes	4.0000
Infiltration rate																	0.2000 (18)
Number of sides sheltered																	1 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.1850 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)					
Balanced mechanical ventilation with heat recovery																	
If mechanical ventilation:																	0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =																	77.3500 (23c)
Effective ac	0.3491	0.3445	0.3399	0.3168	0.3121	0.2890	0.2890	0.2844	0.2983	0.3121	0.3214	0.3306 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Opening Type 1			2.3100	1.0000	2.3100		(26)					
Opening Type 2 (Uw = 1.30)			33.6300	1.2357	41.5580		(27)					
Heat Loss Floor 1			44.3000	0.1400	6.2020		(28a)					
External Wall 1	94.5400	35.9400	58.6000	0.2100	12.3060		(29a)					
External Roof 1	44.3000		44.3000	0.1600	7.0880		(30)					
Total net area of external elements Aum(A, m2)			183.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.4640		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							20.8058 (36)					
Total fabric heat loss						(33) + (36) =	90.2698 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.6024	Feb 29.2102	Mar 28.8181	Apr 26.8573	May 26.4651	Jun 24.5044	Jul 24.5044	Aug 24.1122	Sep 25.2887	Oct 26.4651	Nov 27.2495	Dec 28.0338 (38)
Heat transfer coeff	119.8722	119.4800	119.0879	117.1271	116.7349	114.7742	114.7742	114.3820	115.5585	116.7349	117.5192	118.3035 (39)
Average = Sum(39)m / 12 =												117.0290 (39)
HLP	Jan 1.3530	Feb 1.3485	Mar 1.3441	Apr 1.3220	May 1.3175	Jun 1.2954	Jul 1.2954	Aug 1.2910	Sep 1.3043	Oct 1.3175	Nov 1.3264	Dec 1.3353 (40)
HLP (average)												1.3209 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6061 (42)
Average daily hot water use (litres/day)												96.0941 (43)
Daily hot water use	Jan 105.7035	Feb 101.8598	Mar 98.0160	Apr 94.1722	May 90.3285	Jun 86.4847	Jul 86.4847	Aug 90.3285	Sep 94.1722	Oct 98.0160	Nov 101.8598	Dec 105.7035 (44)
Energy conte	156.7553	137.0992	141.4741	123.3405	118.3482	102.1255	94.6343	108.5942	109.8912	128.0676	139.7958	151.8091 (45)
Energy content (annual)												Total = Sum(45)m = 1511.9348 (45)
Distribution loss (46)m = 0.15 x (45)m	23.5133	20.5649	21.2211	18.5011	17.7522	15.3188	14.1951	16.2891	16.4837	19.2101	20.9694	22.7714 (46)

Water storage loss:													
Store volume												210.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.6480 (55)	
Total storage loss													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(56)
If cylinder contains dedicated solar storage													
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880	(57)
Primary loss													
	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	200.1057	176.2544	184.8245	165.2925	161.6986	144.0775	137.9847	151.9446	151.8432	171.4180	181.7478	195.1595	(62)
Solar input													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
												0.0000	(63)
Output from w/h													
	200.1057	176.2544	184.8245	165.2925	161.6986	144.0775	137.9847	151.9446	151.8432	171.4180	181.7478	195.1595	(64)
Total per year (kWh/year) = Sum(64)m =													
												2022.3508	(64)
Heat gains from water heating, kWh/month													
	86.8015	76.9096	81.7205	74.5723	74.0311	67.5183	66.1462	70.7879	70.1004	77.2628	80.0437	85.1569	(65)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating	598.8461	434.3747	347.5393	197.7851	97.3560	0.0000	0.0000	0.0000	0.0000	194.5640	404.7508	618.2849 (98)
Space heating per m2												2893.5007 (98)
											(98) / (4) =	32.6580 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												261.6912 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1105.6926 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.8461	434.3747	347.5393	197.7851	97.3560	0.0000	0.0000	0.0000	0.0000	194.5640	404.7508	618.2849 (98)
Space heating efficiency (main heating system 1)	261.6912	261.6912	261.6912	261.6912	261.6912	0.0000	0.0000	0.0000	0.0000	261.6912	261.6912	261.6912 (210)
Space heating fuel (main heating system)	228.8369	165.9875	132.8051	75.5795	37.2026	0.0000	0.0000	0.0000	0.0000	74.3487	154.6673	236.2650 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	200.1057	176.2544	184.8245	165.2925	161.6986	144.0775	137.9847	151.9446	151.8432	171.4180	181.7478	195.1595 (64)
Efficiency of water heater (217)m	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150	442.4150 (216)
Fuel for water heating, kWh/month	45.2303	39.8392	41.7763	37.3614	36.5491	32.5661	31.1890	34.3444	34.3214	38.7460	41.0808	44.1123 (219)
Water heating fuel used												457.1162 (219)
Annual totals kWh/year												
Space heating fuel - main system												1105.6926 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8750)												
mechanical ventilation fans (SFP = 0.8750)												274.2835 (230a)
Total electricity for the above, kWh/year												274.2835 (231)
Electricity for lighting (calculated in Appendix L)												372.3186 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.54 * 951 * 1.00) =												-1931.6517 (233)
Total delivered energy for all uses												277.7592 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1105.6926	0.5190	573.8545 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	457.1162	0.5190	237.2433 (264)
Space and water heating			811.0978 (265)
Pumps and fans	274.2835	0.5190	142.3531 (267)
Energy for lighting	372.3186	0.5190	193.2334 (268)
Energy saving/generation technologies			
PV Unit	-1931.6517	0.5190	-1002.5272 (269)
Total CO2, kg/year			144.1570 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			1.6300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		1.6300 ZC1
Total Floor Area	TFA	88.6000
Assumed number of occupants	N	2.6061
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.8163 ZC2
CO2 emissions from cooking, equation (L16)		2.0490 ZC3
Total CO2 emissions		19.4953 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		19.4953 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.3000 (1b)	x 2.9000 (2b)	= 128.4700 (1b) - (3b)
First floor	44.3000 (1c)	x 2.9000 (2c)	= 128.4700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 256.9400 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)							
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)							
Number of intermittent fans																3 * 10 =	30.0000 (7a)							
Number of passive vents																0 * 10 =	0.0000 (7b)							
Number of flueless gas fires																0 * 40 =	0.0000 (7c)							
										Air changes per hour														
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1168 (8)							
Pressure test										Yes														
Measured/design AP50										5.0000														
Infiltration rate										0.3668 (18)														
Number of sides sheltered										1 (19)														
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)									
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3393 (21)									
													Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed													5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor													1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate													0.4325	0.4241	0.4156	0.3732	0.3647	0.3223	0.3223	0.3138	0.3393	0.3647	0.3817	0.3986 (22b)
Effective ac													0.5935	0.5899	0.5864	0.5696	0.5665	0.5519	0.5519	0.5492	0.5575	0.5665	0.5728	0.5794 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.3100	1.0000	2.3100		(26)					
TER Opening Type (Uw = 1.40)			19.8400	1.3258	26.3030		(27)					
Heat Loss Floor 1			44.3000	0.1300	5.7590		(28a)					
External Wall 1	94.5400	22.1500	72.3900	0.1800	13.0302		(29a)					
External Roof 1	44.3000		44.3000	0.1300	5.7590		(30)					
Total net area of external elements Aum(A, m2)			183.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.1612		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0810 (36)					
Total fabric heat loss						(33) + (36) =	66.2422 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.3271	Feb 50.0191	Mar 49.7171	Apr 48.2991	May 48.0338	Jun 46.7987	Jul 46.7987	Aug 46.5700	Sep 47.2744	Oct 48.0338	Nov 48.5705	Dec 49.1316 (38)
Heat transfer coeff	116.5693	116.2613	115.9594	114.5413	114.2760	113.0409	113.0409	112.8122	113.5167	114.2760	114.8127	115.3739 (39)
Average = Sum(39)m / 12 =												114.5400 (39)
HLP	Jan 1.3157	Feb 1.3122	Mar 1.3088	Apr 1.2928	May 1.2898	Jun 1.2759	Jul 1.2759	Aug 1.2733	Sep 1.2812	Oct 1.2898	Nov 1.2959	Dec 1.3022 (40)
HLP (average)												1.2928 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6061 (42)
Average daily hot water use (litres/day)												96.0941 (43)
Daily hot water use	Jan 105.7035	Feb 101.8598	Mar 98.0160	Apr 94.1722	May 90.3285	Jun 86.4847	Jul 86.4847	Aug 90.3285	Sep 94.1722	Oct 98.0160	Nov 101.8598	Dec 105.7035 (44)
Energy conte	156.7553	137.0992	141.4741	123.3405	118.3482	102.1255	94.6343	108.5942	109.8912	128.0676	139.7958	151.8091 (45)
Energy content (annual)										Total = Sum(45)m =		1511.9348 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.5133	20.5649	21.2211	18.5011	17.7522	15.3188	14.1951	16.2891	16.4837	19.2101	20.9694	22.7714 (46)	
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)													0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	208.5019	183.8380	193.2207	173.4179	170.0948	152.2028	146.3809	160.3408	159.9685	179.8141	189.8731	203.5557	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	208.5019	183.8380	193.2207	173.4179	170.0948	152.2028	146.3809	160.3408	159.9685	179.8141	189.8731	203.5557	(64)
Heat gains from water heating, kWh/month	93.5184	82.9766	88.4374	81.0726	80.7480	74.0186	72.8632	77.5048	76.6007	83.9797	86.5440	91.8738	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	130.3034	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0806	18.7236	15.2271	11.5279	8.6172	7.2750	7.8609	10.2179	13.7144	17.4136	20.3243	21.6665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	236.4784	238.9323	232.7485	219.5840	202.9662	187.3478	176.9138	174.4599	180.6436	193.8081	210.4259	226.0443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	36.0303	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	-104.2427	(71)
Water heating gains (Table 5)	125.6968	123.4770	118.8675	112.6008	108.5323	102.8036	97.9344	104.1732	106.3898	112.8760	120.2000	123.4863	(72)
Total internal gains	448.3468	446.2240	431.9341	408.8038	385.2068	362.5175	347.8001	353.9420	365.8389	389.1888	416.0412	436.2882	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					6.9000	10.6334	0.6300	0.7000			0.7700	22.4229 (74)
South					12.9400	46.7521	0.6300	0.7000			0.7700	184.8872 (78)
Solar gains	207.3102	345.6490	458.5255	552.8961	611.8281	605.8434	584.6201	539.7538	490.4674	377.6047	246.8160	178.4525 (83)
Total gains	655.6570	791.8730	890.4596	961.6999	997.0349	968.3609	932.4202	893.6958	856.3063	766.7934	662.8572	614.7406 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7821	52.9220	53.0598	53.7167	53.8414	54.4296	54.4296	54.5400	54.2015	53.8414	53.5897	53.3290	
alpha	4.5188	4.5281	4.5373	4.5811	4.5894	4.6286	4.6286	4.6360	4.6134	4.5894	4.5726	4.5553	
util living area	0.9951	0.9882	0.9729	0.9340	0.8463	0.6863	0.5194	0.5601	0.7834	0.9480	0.9894	0.9963	(86)
MIT	19.6683	19.8785	20.1603	20.4962	20.7736	20.9390	20.9865	20.9810	20.8836	20.5229	20.0293	19.6326	(87)
Th 2	19.8286	19.8313	19.8339	19.8465	19.8488	19.8598	19.8598	19.8618	19.8556	19.8488	19.8441	19.8391	(88)
util rest of house	0.9935	0.9842	0.9636	0.9105	0.7920	0.5875	0.3919	0.4316	0.6965	0.9245	0.9852	0.9951	(89)
MIT 2	18.0823	18.3888	18.7956	19.2742	19.6345	19.8209	19.8552	19.8546	19.7693	19.3219	18.6189	18.0375	(90)
Living area fraction	18.3812	18.6696	19.0528	19.5046	19.8492	20.0316	20.0684	20.0669	19.9793	19.5483	18.8847	18.3381	(91)
MIT	18.3812	18.6696	19.0528	19.5046	19.8492	20.0316	20.0684	20.0669	19.9793	19.5483	18.8847	18.3381	(92)
Temperature adjustment	18.3812	18.6696	19.0528	19.5046	19.8492	20.0316	20.0684	20.0669	19.9793	19.5483	18.8847	18.3381	(93)
adjusted MIT	18.3812	18.6696	19.0528	19.5046	19.8492	20.0316	20.0684	20.0669	19.9793	19.5483	18.8847	18.3381	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9904	0.9787	0.9553	0.9019	0.7920	0.6035	0.4160	0.4558	0.7071	0.9166	0.9801	0.9927	(94)
Ext temp.	649.3905	775.0094	850.6602	867.3598	789.6310	584.4506	387.9200	407.3372	605.4922	702.8120	649.6661	610.2258	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1641.4364	1600.8742	1455.6199	1214.6593	931.2544	613.9951	392.0719	413.6687	667.3976	1022.5770	1353.0347	1631.1723	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	738.0821	554.9811	450.0900	250.0557	105.3678	0.0000	0.0000	0.0000	0.0000	237.9052	506.4254	759.5842	(98)
Space heating per m2												3602.4915	(98)
												40.6602	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3852.9320 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.0821	554.9811	450.0900	250.0557	105.3678	0.0000	0.0000	0.0000	0.0000	237.9052	506.4254	759.5842	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	789.3927	593.5627	481.3796	267.4392	112.6929	0.0000	0.0000	0.0000	0.0000	254.4441	541.6314	812.3895	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	208.5019	183.8380	193.2207	173.4179	170.0948	152.2028	146.3809	160.3408	159.9685	179.8141	189.8731	203.5557	(64)
Efficiency of water heater (217)m	87.9038	87.5780	86.9964	85.7893	83.5799	79.8000	79.8000	79.8000	79.8000	85.5615	87.3077	79.8000	(216)
Fuel for water heating, kWh/month	237.1933	209.9134	222.1019	202.1439	203.5115	190.7304	183.4347	200.9283	200.4618	210.1579	217.4757	231.2974	(219)
Water heating fuel used												2509.3501	(219)
Annual totals kWh/year													
Space heating fuel - main system												3852.9320	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.2899	(232)
Total delivered energy for all uses												6809.5721	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3852.9320	0.2160	832.2333 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2509.3501	0.2160	542.0196 (264)
Space and water heating			1374.2529 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.2899	0.5190	193.2185 (268)
Total CO2, kg/m2/year			1606.3964 (272)
Emissions per m2 for space and water heating			15.5108 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.1808 (272b)
Emissions per m2 for pumps and fans			0.4393 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5108 * 1.55) + 2.1808 + 0.4393, rounded to 2 d.p.			26.6600 (273)

Appendix 4



Vertex S

BACKSHEET MONOCRYSTALLINE MODULE

PRODUCT: TSM-DE09
PRODUCT RANGE: 390-405W

405W+

MAXIMUM POWER OUTPUT

0~+5W

POSITIVE POWER TOLERANCE

21.1%

MAXIMUM EFFICIENCY



Small in size, big on power

- Small form factor. Generate a huge amount of energy even in limited space. Up to 405W, 21.1% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping effect, lower series resistance and improved current collection
- Reduce installation cost with higher power bin and efficiency
- Boost performance in warm weather with lower temperature coefficient (-0.34%) and operating temperature



Universal solution for residential and C&I rooftops

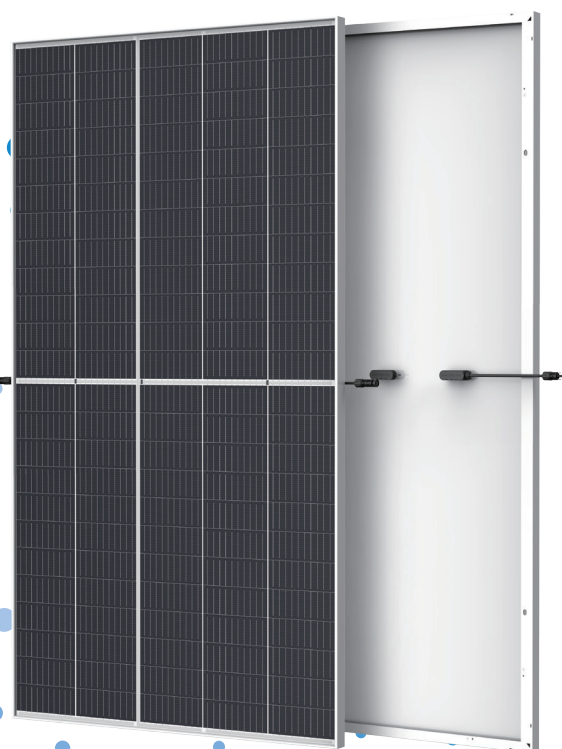
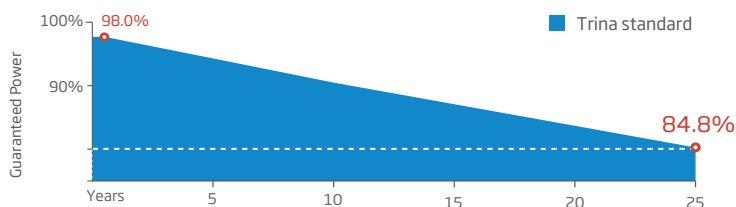
- Designed for compatibility with existing mainstream optimizers, inverters and mounting systems
- Perfect size and low weight. Easy for handling. Economy for transporting
- Diverse installation solutions. Flexible for system deployment



High Reliability

- 25 year performance warranty with lowest degradation;
- Ensured PID resistance through cell process and module material control
- Mechanical performance up to 6000 Pa positive load and 4000 Pa negative load

Trina Solar's Backsheet Performance Warranty



Comprehensive Products and System Certificates



IEC61215/IEC61730/IEC61701/IEC62716

ISO 9001: Quality Management System

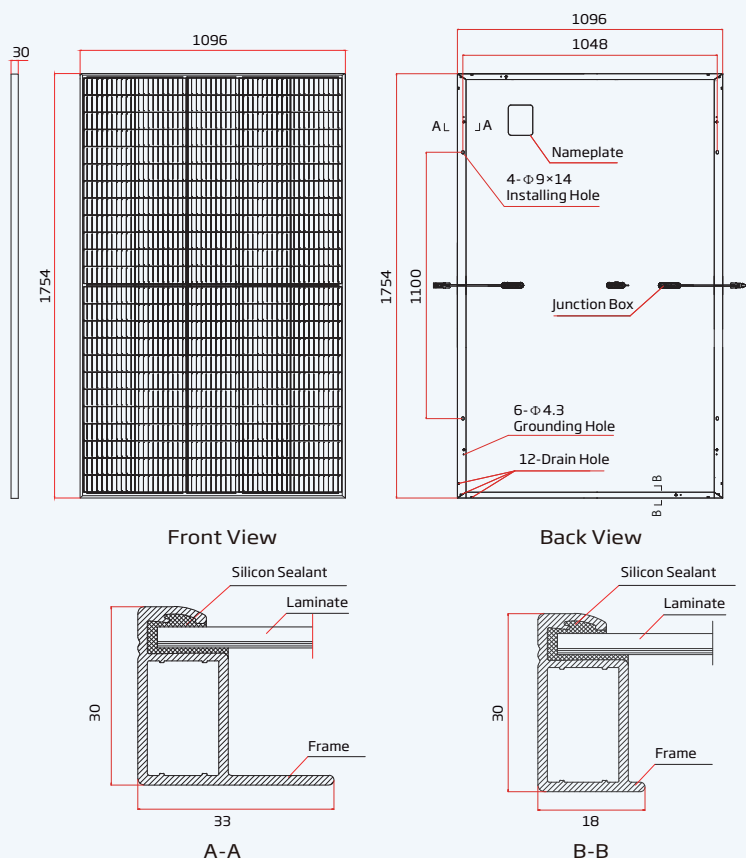
ISO 14001: Environmental Management System

ISO14064: Greenhouse Gases Emissions Verification

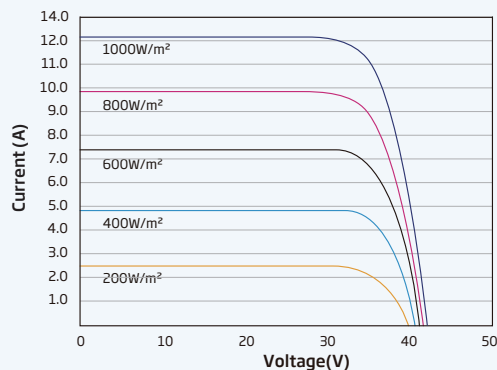
ISO45001: Occupational Health and Safety Management System



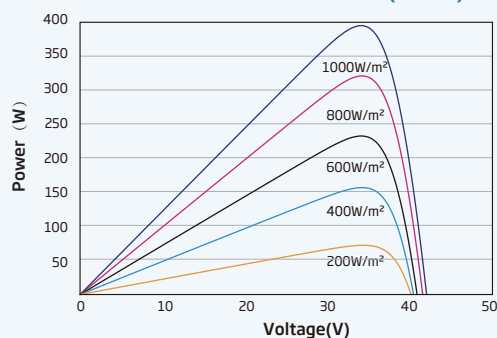
DIMENSIONS OF PV MODULE(mm)



I-V CURVES OF PV MODULE(395 W)



P-V CURVES OF PV MODULE(395W)



ELECTRICAL DATA (STC)

Peak Power Watts-P _{MAX} (Wp)*	390	395	400	405
Power Tolerance-P _{MAX} (W)	0 ~ +5			
Maximum Power Voltage-V _{MPP} (V)	33.8	34.0	34.2	34.4
Maximum Power Current-I _{MPP} (A)	11.54	11.62	11.70	11.77
Open Circuit Voltage-V _{OC} (V)	40.8	41.0	41.2	41.4
Short Circuit Current-I _{SC} (A)	12.14	12.21	12.28	12.34
Module Efficiency η _m (%)	20.3	20.5	20.8	21.1

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5. *Measuring tolerance: ±3%.

ELECTRICAL DATA (NOCT)

Maximum Power-P _{MAX} (Wp)	295	298	302	306
Maximum Power Voltage-V _{MPP} (V)	31.8	32.0	32.2	32.5
Maximum Power Current-I _{MPP} (A)	9.26	9.32	9.38	9.41
Open Circuit Voltage-V _{OC} (V)	38.4	38.6	38.8	38.9
Short Circuit Current-I _{SC} (A)	9.78	9.84	9.90	9.95

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	120 cells
Module Dimensions	1754×1096×30 mm (69.06×43.15×1.18 inches)
Weight	21.0 kg (46.3 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Backsheet	White
Frame	30mm (1.18 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm ² (0.006 inches ²), Portrait: 280/280 mm(11.02/11.02 inches) Landscape: 1100/1100 mm(43.31/43.31 inches)
Connector	MC4 EV02 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of P _{MAX}	-0.34%/°C
Temperature Coefficient of V _{OC}	-0.25%/°C
Temperature Coefficient of I _{SC}	0.04%/°C

MAXIMUM RATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1500V DC (IEC)
Max Series Fuse Rating	20A

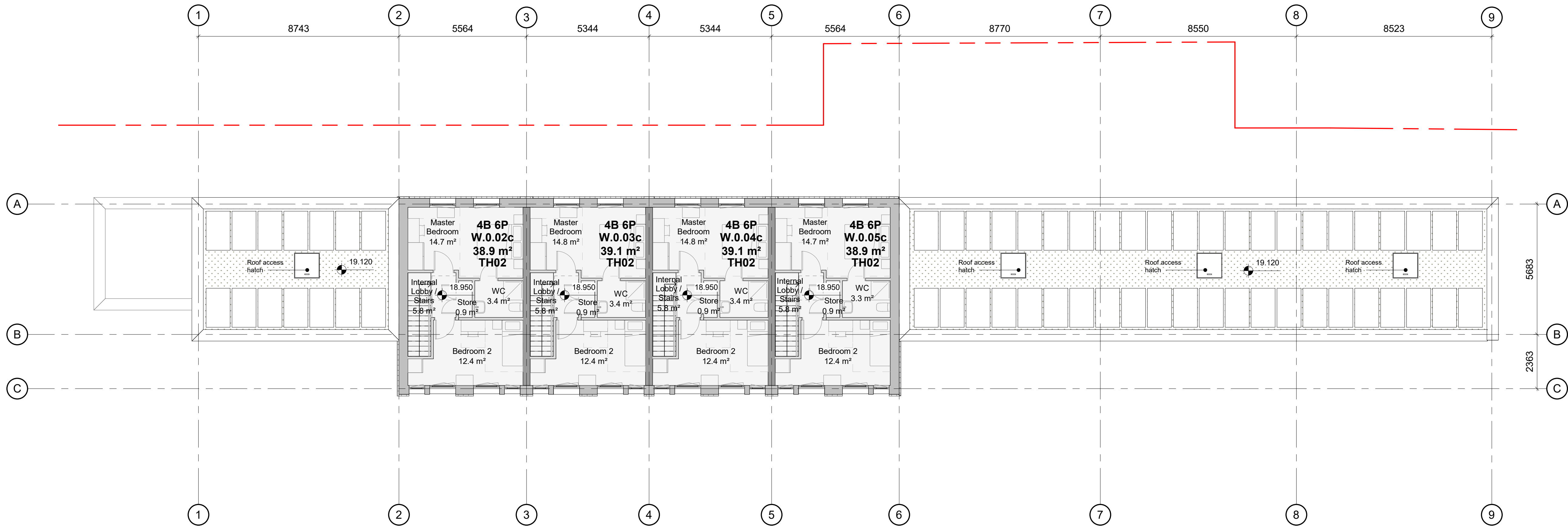
WARRANTY

12 year Product Workmanship Warranty
25 year Power Warranty
2% first year degradation
0.55% Annual Power Attenuation

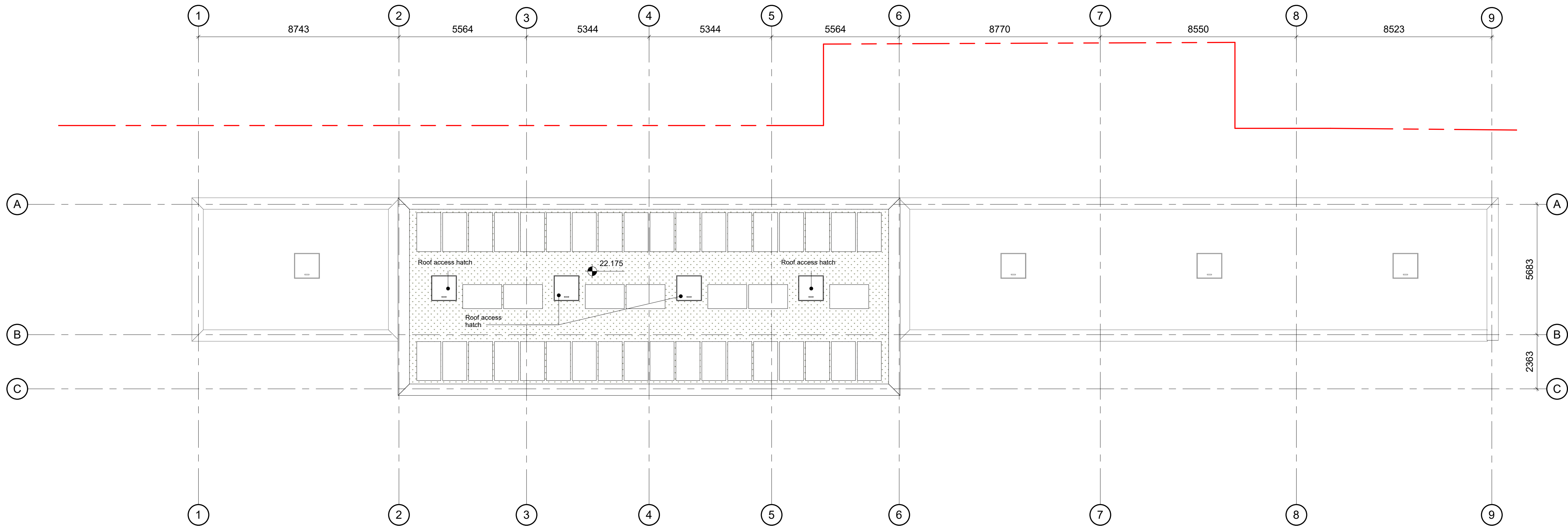
(Please refer to product warranty for details)

PACKAGING CONFIGURATION

Modules per box: 36 pieces
Modules per 40' container: 936 pieces



1 Townhouses Second Floor GA Plan
1 : 100

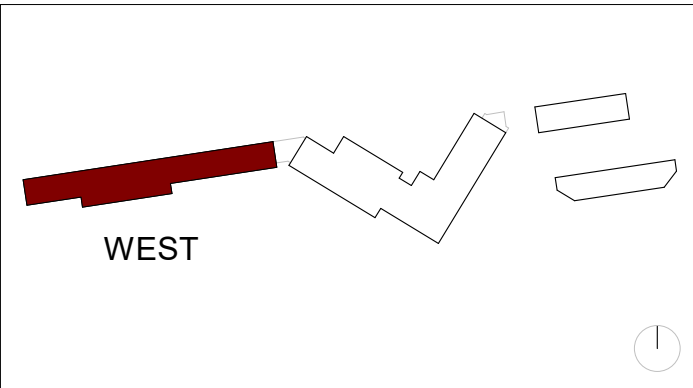


2 Townhouses Roof GA Plan
1 : 100

Copyright reserved

All dimensions to be checked on site before work commences.
Figured dimensions to be taken in preference to scaled dimensions.
If in doubt please ask.

KEY PLAN



GENERAL NOTES

1. All levels shown in plan are FFL.

P3	First Issue / General update	08/07/22
P2	Revised as clouded	18/05/22
P1	First Issue / Revised as clouded	13/05/22

Revision	Description	Date
----------	-------------	------

STATUS

Preliminary

PROJECT

Remington Road

DRAWING

2nd Floor and Roof GA Plan West -
Townhouses

DRAWN BY	CHECKED BY	DATE
LB	CB	May 2022

SCALE (@ A1)	PROJECT NUMBER
As indicated	21019

DRAWING NUMBER	REV
RER - DAR - ZW - XX - DR - A - 0121	P3

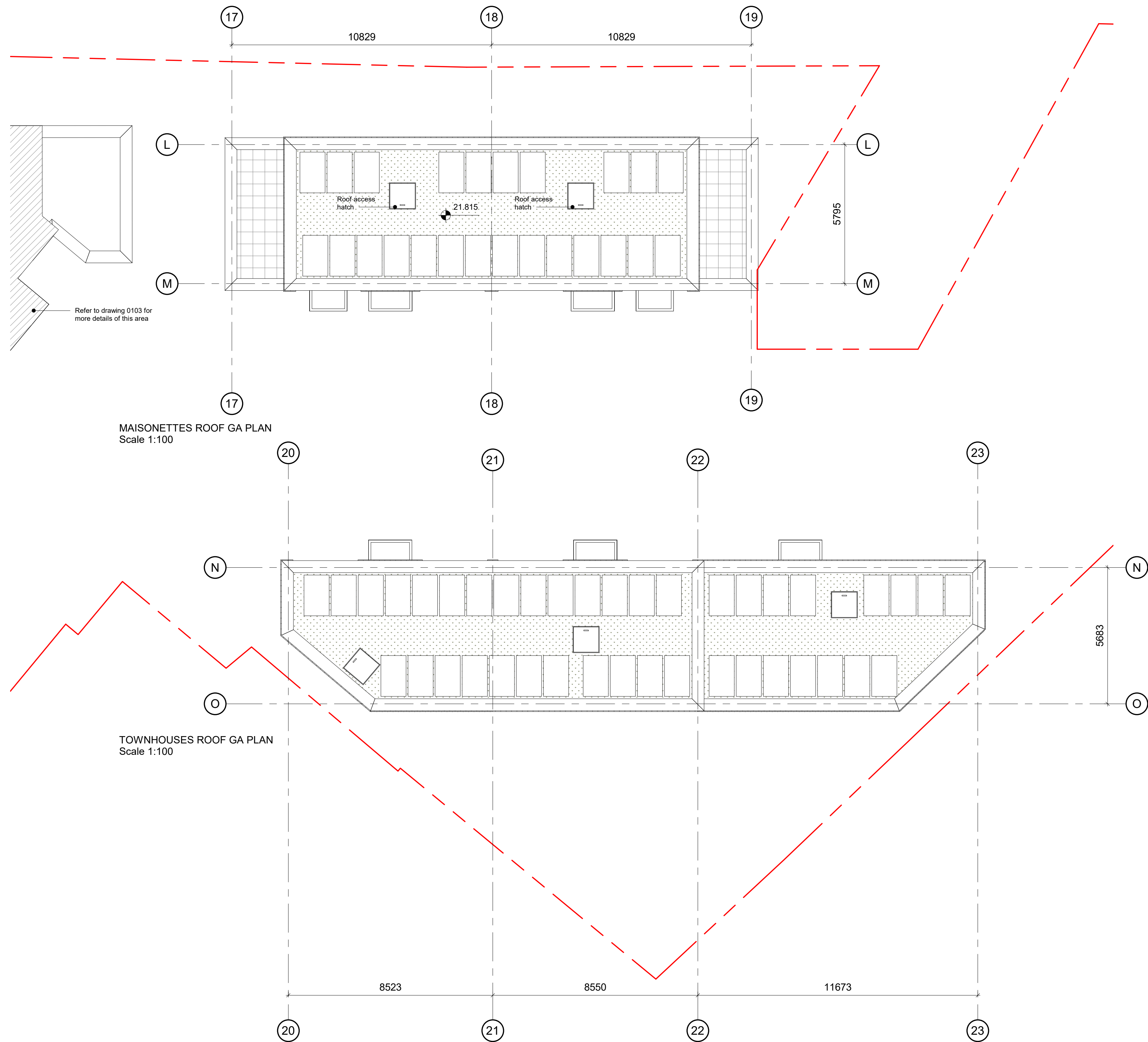
Project Identifier	Originator	Zone	Level	Type	Discipline	Number	Revision
--------------------	------------	------	-------	------	------------	--------	----------



Delta Architects
1 Batemans Row
London
EC2A 3HH

T 020 7613 5702

www.deltaarchitects.co.uk

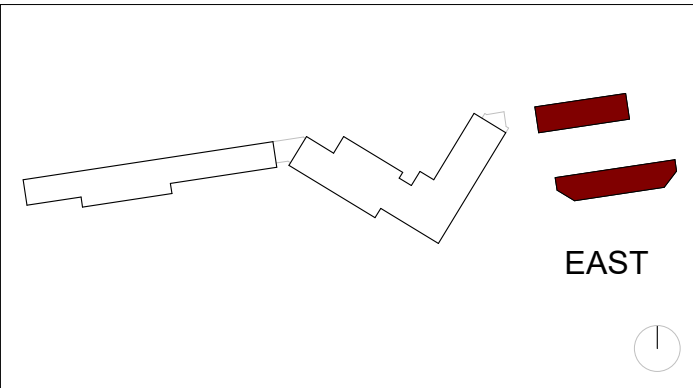


1 Roof GA Plan
1 : 100

Copyright reserved

All dimensions to be checked on site before work commences.
Figured dimensions to be taken in preference to scaled dimensions.
If in doubt please ask.

KEY PLAN



GENERAL NOTES

1. All levels shown in plan are FFL.

P4	First Issue / General update	08/07/22
P3	Revised as clouded	23/05/22
P2	Revised as clouded	18/05/22
P1	First Issue / Revised as clouded	13/05/22

Revision	Description	Date
----------	-------------	------

STATUS

Preliminary

PROJECT

Remington Road

DRAWING

Roof GA Plan East - Maisonettes and Townhouses

DRAWN BY	CHECKED BY	DATE
LB	CB	May 2022

SCALE (@ A1)	PROJECT NUMBER
As indicated	21019

DRAWING NUMBER	REV
RER - DAR - ZE - 03 - DR - A - 0133	P4

Project Identifier	Originator	Zone	Level	Type	Discipline	Number	Revision
--------------------	------------	------	-------	------	------------	--------	----------

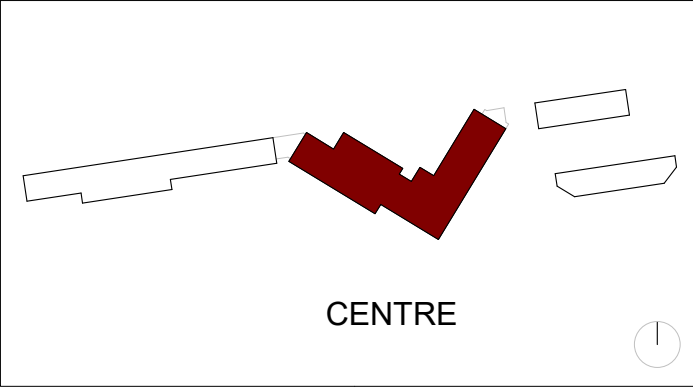




Copyright reserved

All dimensions to be checked on site before work commences.
Figured dimensions to be taken in preference to scaled dimensions.
If in doubt please ask.

KEY PLAN



GENERAL NOTES

- All levels shown in plan are FFL.

P4	First Issue / General update	08/07/22
P3	Revised as clouded	23/05/22
P2	Revised as clouded	18/05/22
P1	First Issue / Revised as clouded	13/05/22

STATUS

Preliminary

PROJECT

Remington Road

DRAWING

Roof Overview GA Plan - Blocks
A,B,C

DRAWN BY	CHECKED BY	DATE
LB	CB	May 2022

SCALE (@ A1)	PROJECT NUMBER
As indicated	21019

DRAWING NUMBER	REV
RER - DAR - ZC - 07 - DR - A - 0107	P4

Project Identifier	Originator	Zone	Level	Type	Discipline	Number	Revision
--------------------	------------	------	-------	------	------------	--------	----------



www.deltaarchitects.co.uk