



Partridge Way

Energy Statement

August 2023

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DOCUMENT CONTROL SHEET

Report Reference	PL2098/PR/ES/202308-EC
Issue Purpose	Planning Condition 6
Author	Ed Coate
Approved By	Ryan Thrower
Date of Issue	August 2023

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.

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1. EXECUTIVE SUMMARY

- 1.1 NRG Consulting have been appointed to undertake an Energy Statement on a proposed major development at Land at the junction of Partridge Way and Trinity Road, N22 within the London Borough of Haringey.
- 1.2 The proposed scheme is described as: “Redevelopment of the site comprising the demolition of existing garages and the erection of a nine-storey building to accommodate 23 residential units for council rent (Class C3). Associated cycle and refuse/recycling storage facilities, accessible car-parking spaces, and landscaping and public realm improvements including a children's play space. Relocation of existing refuse/recycling facility.”
- 1.3 This document has been written to address Condition 6a of the proposed development which states:

6) The development hereby approved shall be constructed in accordance with the Energy Statement (dated 6 September 2021) prepared by Sweco, delivering a minimum 67% improvement on carbon emissions over 2013 Building Regulations Part L, with SAP10 emission factors, high fabric efficiencies (min. 13% reduction), air source heat pumps (ASHPs) and minimum 8.4 kWp 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.

The development shall be implemented strictly in accordance with the approved details prior to first operation and shall be maintained and retained for the lifetime of the development. The solar PV array shall be installed with monitoring equipment prior to completion and shall be maintained and cleaned at least annually thereafter.

Reason: To ensure the development reduces its impact on climate change by reducing carbon emissions on site in compliance with the Energy Hierarchy, and in accordance with London Plan (2021) Policy SI2, and Local Plan Policy SP4 and DM22.

	CO ₂ Emissions (Tonnes per Annum)	
Baseline: Part L 2021 of the Building Regulations (TER)	12.99	Regulated CO ₂ Savings at ‘Be Lean’ over Part L 2021 15.06 %
Be Lean: Energy Demand Reduction	11.03	
Be Clean: Supply Energy Efficiently	11.03	
Be Green: Renewable Energy (DER)	2.57	
Regulated CO ₂ Savings at ‘Be Green’ over Part L 2021	80.18 %	
Table: Carbon Emissions Table		

2. ENERGY EFFICIENCY MEASURES (BE LEAN)

2.1 In order to estimate the CO₂ emissions for the site, SAP Calculations have been carried out by a licensed and accredited OCDEA Domestic Energy Assessor using Design SAP 10's online platform.

In-line with GLA Guidance, a Be Lean set of SAPs have been undertaken and the heating has been modelled according to the GLA Guidance on Energy Statements.

2.2 The baseline CO₂ emissions covered by Part L 2021 of the Building Regulations will be expressed as the Target Emissions Rate (TER). This covers regulated carbon emissions from:

- Heating
- Cooling
- Hot Water
- Lighting
- Auxiliary (Pumps and Fans)

2.3 Passive Design

Passive design measures utilised by the architect in the concept and development of the schemes design include:

- Through good design, MVHR, and careful construction, air infiltration will be minimised and thus a low Air Permeability target has been sort.
- Optimising orientation and site layout to reduce energy demand.
- Provision of cross-ventilation.
- High performance glazing system and façade design to reduce heat demand and increase solar gains.
- Thermal Bridging has been reviewed and appropriate industry schemes have been proposed, for this scheme specific details relating to the steel frame have been used.

ELEMENT	PART L1a LIMITING FABRIC PARAMETERS	PROPOSED U-VALUES (W/m ² K)
<i>Walls</i>		
External Wall	0.26 W/m ² K	0.22 W/m ² K
Sheltered Walls	0.26 W/m ² K	0.34 W/m ² K
<i>Floors</i>		
Exposed Floor	0.18 W/m ² K	0.11 W/m ² K
<i>Roof</i>		
Roof	0.16 W/m ² K	0.12 W/m ² K
<i>Openings</i>		
Windows & Rooflights	1.6 W/m ² K	0.86 W/m ² K
<i>Air Permeability</i>		
3 m ³ /(hm ²) @50Pa		
<i>Thermal Bridging</i>		
Concrete Frame with Steel Frame Infill		
Table: Proposed Fabric Specification		

2.4 Active Design

The development will incorporate efficient building services to limit carbon emissions, including:

- A zero-NOx heating system
- LED Lighting
- Charging System Linked to Use
- Mechanical Ventilation with Heat Recovery

Be Lean – M&E Specifications

ELEMENT	PROPOSED DETAILS
Ventilation	System 4 – MVHR – Vectaire MIDI
Heating – Be Lean (MODELLING ONLY)	89.5% Individual Combi Gas Boilers
Heating – Be Green	Communal ASHP (100% FoH 295% Efficient - Panasonic U-250PZH2E8)
Heating Controls	Charging System Linked to Use, Programmer, TRVs
Heat Emitters	Underfloor
Hot Water	HIU
Lighting	LED (85 lm/W)
Table: Proposed Mechanical and Electrical Specification	

Metering Strategy

- 2.5 The metering strategy revolves around by a charging system linked to the exact usage of the communal ASHP system. This metering strategy ensures fair distribution of energy costs based on individual consumption, encourages energy efficiency, and provides accurate and transparent billing information to the users.

Furthermore, Water is from a boosted system with individual water meters in the risers on each floor.

Electrical Metering is from meters in the risers on each floor.

Heating/Hot Water information will be supplied from the Evinox heat interface unit which monitors the usage within the dwelling.

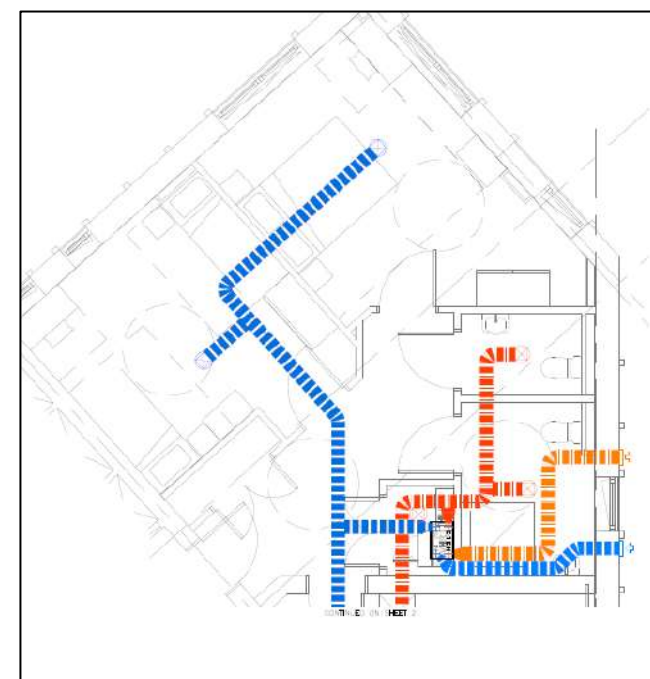
MVHR

2.6 The dwellings will use MVHR to provide ventilation.

Plans showing these ventilation layouts, including ducting, can be seen in this section across. Full layouts can be seen in Appendix 5.

The specification for the MVHR can be seen below.

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



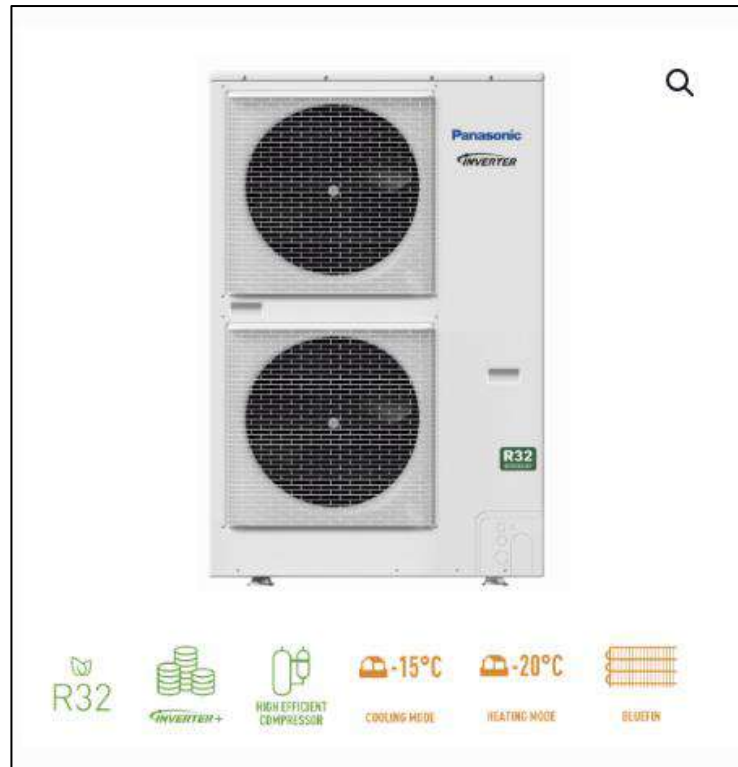
3. RENEWABLE TECHNOLOGIES – ASHP

ASHP Provision & Details

3.1 Communal Air Source Heat Pumps will be located at the roof level, have been proposed to provide the heating and hot water for the scheme. The technology has been chosen because:

- It is a high efficiency system that can cater for the space heating and hot water of the proposed development;
- Requires less capital cost than GSHP and other renewable technologies;
- Can work with complimentary PV
- It is simple to install when compared to other renewable technologies.

ASHP System Details	
Area Used	Roof
Number of Heat Pumps	12
Thermal Store	No
Make and Model	Panasonic U-250PZH2E8
SCOP	3.6
Fraction of Heat	100%
Efficiency (COP)	295%

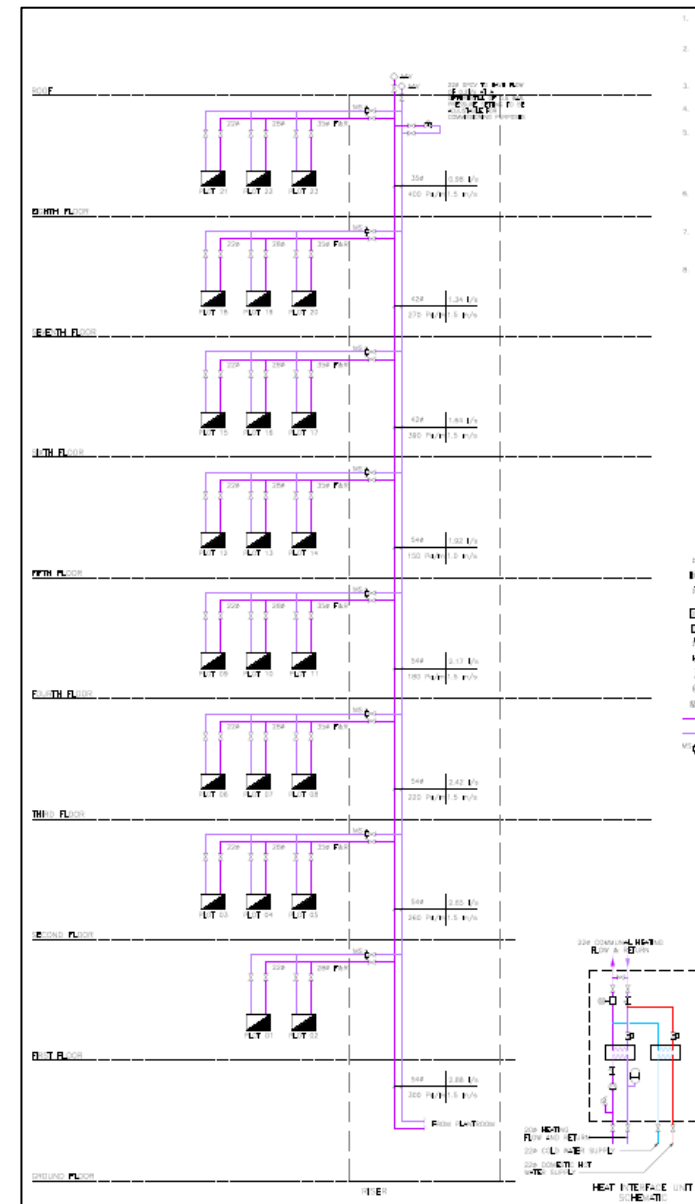
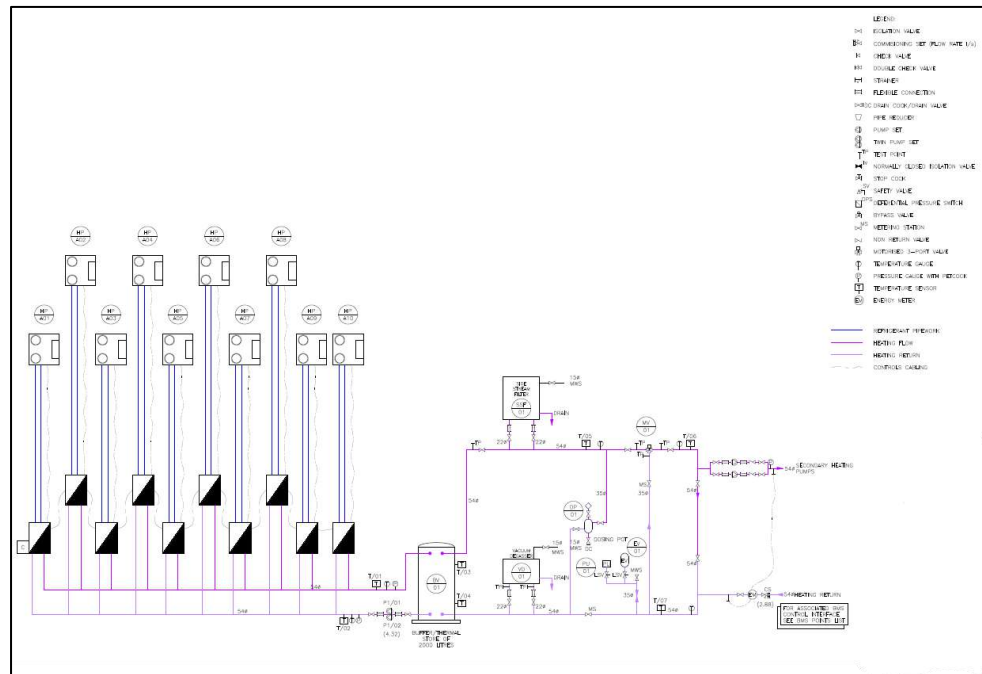


Noise Mitigation Measures

In the appendices is a Technical Note from the appointed Acoustic Consultants (Cass Allen) detailing how the noise impacts of the Air Source Heat Pumps will be mitigated by the proposed location, design and specification.

ASHP Layouts and Schematic

Schematics of the ASHP layouts and plantroom can be seen below. Full versions of these can be seen in Appendix 4.

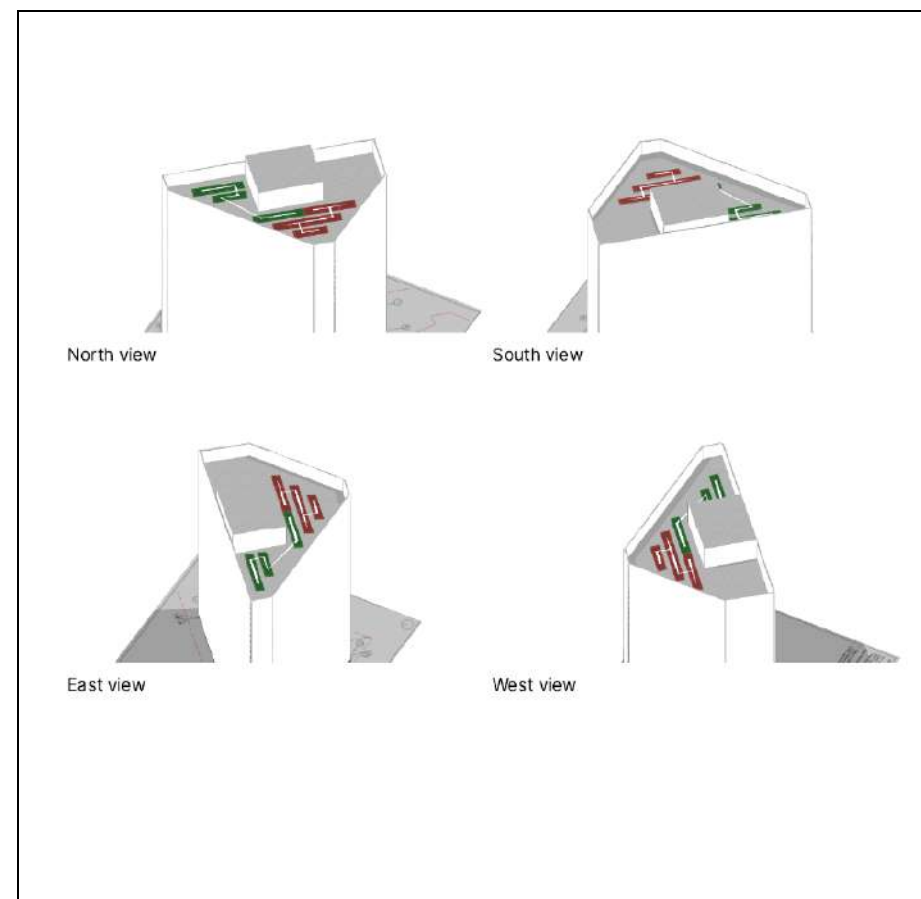


4. RENEWABLE TECHNOLOGIES – PHOTOVOLTAICS

- 4.1 A photovoltaic array will be installed across the site. The details of this array can be seen below and across. Full PV illustrative drawings can be found in Appendix 5 of this report.

PV System Details	
CO ₂ Reduction Provided	1.4 tonnes CO ₂ /year
CO ₂ Offset via 1kWp	0.168
PV Proposed (peak output)	8.40 kWp
Module Output	400 Watts
Number of Panels (sitewide)	21
Panel Orientation	Horizontal
Tilt of Collectors	Horizontal
Over-Shading Factor	<20%

Full details of the PV array can be seen in Appendix 6. This provision is in-line with the requirements of the Planning Condition.



5. CONCLUSION

- 5.1 This document illustrates the reduction in carbon emissions of the proposed development in-line with the requirements of Condition 6.
- 5.2 This includes demonstrating the renewable energy provisions for the development, and high-performance ventilation systems, including:
- MVHR
 - ASHPs
 - Photovoltaics
- 5.3 Via the above measures, the scheme achieves a 80.18% reduction in CO₂ which can be seen at each stage of the energy hierarchy on the other side of this page.

	CO ₂ Emissions (Tonnes per Annum)	
Baseline: Part L 2021 of the Building Regulations (TER)	12.99	Regulated CO ₂ Savings at ‘Be Lean’ over Part L 2021 15.06 %
Be Lean: Energy Demand Reduction	11.03	
Be Clean: Supply Energy Efficiently	11.03	
Be Green: Renewable Energy (DER)	2.57	
Regulated CO ₂ Savings at ‘Be Green’ over Part L 2021	80.18 %	
Table: Carbon Emissions Table		

Appendix 1



Partridge Way

RESIDENTIAL UNITS - SAP 10

Plot Name	AREA (2)	TER <i>Part L 2021 Baseline</i> (3)	Total TER	DER 'Be Lean' (4)	Total DER 'Be Lean'	DER 'Be Green' (4)	Total DER <i>Green'</i> 'Be
	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
1.1	82.00	14.16	1161.12	11.59	950.38	2.72	223.04
1.2	96.80	13.14	1271.95	10.43	1009.62	2.45	237.16
2.1	52.00	14.15	735.80	12.16	632.32	2.83	147.16
2.2	72.20	10.62	766.76	8.88	641.14	2.06	148.73
2.3	51.50	14.05	723.58	12.02	619.03	2.80	144.20
3.1	52.00	14.18	737.36	12.21	634.92	2.71	140.92
3.2	72.20	10.65	768.93	8.95	646.19	2.08	150.18
3.3	51.50	14.09	725.64	12.12	624.18	2.76	142.14
4.1	52.00	14.20	738.40	12.25	637.00	2.88	149.76
4.2	72.20	10.65	768.93	8.95	646.19	2.05	148.01
4.3	51.50	14.09	725.64	12.12	624.18	2.83	145.75
5.1	52.00	14.20	738.40	12.25	637.00	2.88	149.76
5.2	72.20	10.65	768.93	8.95	646.19	2.08	150.18
5.3	51.50	14.09	725.64	12.12	624.18	2.83	145.75
6.1	52.00	14.20	738.40	12.07	627.64	2.63	136.76
6.2	72.20	10.65	768.93	8.95	646.19	2.24	161.73
6.3	51.50	14.09	725.64	12.12	624.18	2.83	145.75
7.1	52.00	14.20	738.40	12.25	637.00	2.88	149.76
7.2	72.20	10.65	768.93	8.95	646.19	2.08	150.18
7.3	51.50	14.09	725.64	12.12	624.18	2.83	145.75
8.1	52.00	15.60	811.20	13.79	717.08	3.27	170.04
8.2	72.20	11.96	863.51	10.22	737.88	2.40	173.28
8.3	51.50	15.49	797.74	13.74	707.61	3.23	166.35
Total Area Assessed							3,622
Average							2.57
Total Site Area (m ²):							3,622

Total Site TER	18,295	kg CO2/yr
Total Site DER - Be Lean	15,540	kg CO2/yr
CO2 Savings at 'Be Lean'	15.06%	%

Final CO2 Emissions at 'Be Green'	3,622	kg CO2/yr
Total CO2 Savings at 'Be Green' (inc. PV)	80.20	%

Appendix 2



Summary for Input Data

Property Reference	3.3_Copy_Copy	Issued on Date	26/07/2023
Assessment Reference	2.3_Copy_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	80 C	DER	12.12	TER	14.55
Environmental	92 A	% DER < TER			16.70
CO ₂ Emissions (t/year)	0.57	DFEE	31.15	TFEE	31.71
Compliance Check	See BREL	% DFEE < TFEE			1.76
% DPER < TPER	0.55	DPER	78.76	TPER	79.20

Assessor Details	Mr. Edward Coate	Assessor ID	Z417-0001
Client	NRG, TBC		

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

Orientation	West	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, End-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	2	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground floor:	22.30 m	51.50 m ²	2.50 m

8.0 Living Area	23.80	m ²
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Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall 1	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22		40.45	27.76	0.00	None	12.69	Calculate Wall Area
External Wall 2	Cavity Wall	Other	0.34		15.30	13.39	0.00	None	1.91	Enter Gross Area

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Other	0.00	51.50

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Other	0.00	51.50

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	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	Triple Low-E Hard 0.2			0.72		0.70	0.86

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
Opening	Opening Type 1	External Wall 2	West	1.91	
Opening	Opening Type 2	External Wall 1	South East	2.12	

Summary for Input Data

Opening Opening Opening	Opening Type 2 Opening Type 2 Opening Type 2	External Wall 1 External Wall 1 External Wall 1	East North East North	2.12 4.23 4.23
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14.0 Conservatory

15.0 Draught Proofing %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	6.31	0.07	0.07	No
E3 Sill	Independently assessed	5.40	0.06	0.06	No
E4 Jamb	Independently assessed	23.00	0.06	0.06	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	27.50	0.05	0.05	No
E16 Corner (normal)	Independently assessed	10.00	0.06	0.06	No
E18 Party wall between dwellings	Independently assessed	5.00	0.04	0.04	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	12.20	0.10	0.10	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.40	0.00	0.00	No
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	Independently assessed	5.10	0.16	0.16	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

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	500500
Configuration	1
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	90.00
Wet Rooms	1
SFP from Installer Commissioning Certificate	Yes
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	85.00	5	425	11

24.0 Main Heating 1

Manufacturer	Manufacturer
Percentage of Heat	100.00 %
Fuel Type	Mains gas
SAP Code	104
In Winter	89.50
In Summer	89.50
Model Name	D
Manufacturer	D
Controls SAP Code	2106

Summary for Input Data

Delayed Start Stat	Yes
Burner Control	On/Off
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Radiators
Flow Temperature	Enter value
Flow Temperature Value	45.00
Boiler Interlock	Yes
Combi boiler type	Standard Combi
Combi keep hot type	Electric, time clock

25.0 Main Heating 2

26.0 Heat Networks
Space Community Heating

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1									
Heat source 2									
Heat source 3									
Heat source 4									
Heat source 5									

28.0 Water Heating	
Water Heating	Main Heating 1
SAP Code	901
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
Cold Water Source	From mains
Bath Count	0

28.1 Showers					
Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	None
In Airing Cupboard	No

34.0 Small-scale Hydro				None							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations			
Lower cost measures			
None			
Further measures to achieve even higher standards			
	Typical Cost	Typical savings per year	Ratings after improvement
			SAP rating Environmental Impact
			0 0
			0 0
			0 0

Appendix 3



Summary for Input Data

Property Reference	3.3_Copy	Issued on Date	26/07/2023
Assessment Reference	2.3_Copy_Copy	Prop Type Ref	
Property			

SAP Rating	85 B	DER	2.76	TER	14.09
Environmental	98 A	% DER < TER			80.41
CO ₂ Emissions (t/year)	0.13	DFEE	29.77	TFEE	31.71
Compliance Check	See BREL	% DFEE < TFEE			6.11
% DPER < TPER	60.39	DPER	30.39	TPER	76.72

Assessor Details	Mr. Edward Coate	Assessor ID	Z417-0001
Client	NRG, TBC		

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

Orientation	West	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, End-Terrace	
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Which Floor	2	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	250.00	kJ/m²K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground floor:	22.30 m	51.50 m ²	2.50 m

8.0 Living Area	23.80	m ²
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Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
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External Wall 2	Cavity Wall	Other	0.34		15.30	13.39	0.00	None	1.91	Enter Gross Area

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Party Ceiling 1	Other	0.00	51.50

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Other	0.00	51.50

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	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	Triple Low-E Hard 0.2			0.72		0.70	0.86

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
Opening	Opening Type 1	External Wall 2	West	1.91	
Opening	Opening Type 2	External Wall 1	South East	2.12	

Summary for Input Data

Opening	Opening Type 2	External Wall 1	East	2.12
Opening	Opening Type 2	External Wall 1	North East	4.23
Opening	Opening Type 2	External Wall 1	North	4.23

14.0 Conservatory

15.0 Draught Proofing %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	6.31	0.07	0.07	No
E3 Sill	Independently assessed	5.40	0.06	0.06	No
E4 Jamb	Independently assessed	23.00	0.06	0.06	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	27.50	0.05	0.05	No
E16 Corner (normal)	Independently assessed	10.00	0.06	0.06	No
E18 Party wall between dwellings	Independently assessed	5.00	0.04	0.04	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	12.20	0.10	0.10	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.40	0.00	0.00	No
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	Independently assessed	5.10	0.16	0.16	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

MVHR System Location

Duct Installation Specification

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	85.00	5	425	11

24.0 Main Heating 1

25.0 Main Heating 2

26.0 Heat Networks

Space Community Heating

Distribution Loss

Distribution Loss Value

SAP Code

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power	Electrical	Fuel Factor	Efficiency type
-------------	-----------	-------------	------------	--------------------	------	------------	------------	-------------	-----------------

Summary for Input Data

Ratio

Heat source 1
Heat source 2
Heat source 3
Heat source 4
Heat source 5

28.0 Water Heating

Water Heating	Community Heating
SAP Code	901
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
Cold Water Source	From mains
Bath Count	0

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
-------------	-------------	-------------------	------------------	-----------	--------------

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

	HIU	
Loss	1.46	kWh/day
In Airing Cupboard	No	

32.0 Photovoltaic Unit

	One Dwelling
Export Capable Meter?	Yes
Connected To Dwelling	No
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
0.31	Horizontal	Horizontal	None Or Little		No	1.00		

34.0 Small-scale Hydro

.0 Small-scale Hydro				None							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
		0	0
		0	0
		0	0

Appendix 4

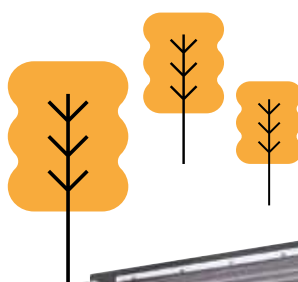




NEW PANASONIC BIG PACi SERIES R32

20,00 – 25,00kW is ideally suited for small, to medium retail applications.

In addition to its lightweight and compact body, its split-able hide away design has been newly developed to enable easy pipe work in a narrow installation space.



NEW PANASONIC BIG PACi, NOT ONLY ENVIRONMENTALLY FRIENDLY BUT ALSO GROUNDBREAKING PRODUCTS

1 Compact & light indoor body

The compact and light indoor bod, is highly efficient and has a split-able design for easy pipe work in a limited narrow space. Plus it is easy to maintain due to the simplified disassembly design.

3 High external static pressure, max 200 Pa* setting

A maximum static pressure enables the use of long ducts for installation in a wide range of spaces.

* S-250PE3ESB.

2 Easy piping work with split-able Hide Away indoor design

Part of the heat exchanger and part of fan (fan + casing) can be separated while being installed. The Hide Away indoor unit is newly designed to be easy to reassemble and to fit into a narrow space.

4 New Comfort Cloud control

Ready to control via Panasonic Comfort Cloud App on your smartphones.**

**New Panasonic WLAN adaptor CZ-CAPWFC1 is required.



Big PACi is a useful and cost saving solution for small and mid size projects, can be offered also with VRF system.

- 3 step static pressure set up
- Design flexibility thanks to large air volume
- Bluefin anti-rust coating
- PACi Water Heat Exchanger compatible*

Easy piping work with split-able Hide Away indoor design



* Connection to the outdoor unit only.

Big PACi with R32 has been introduced with full renewal of its indoor unit, offering hydronic application by PACi Water Heat Exchanger.

Compact and light indoor body keeping high efficiency

15% lighter weight vs conventional model helps installation work drastically.

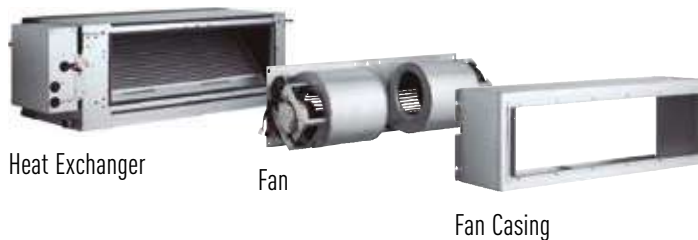
	Conventional model	New
20,00kW	100kg	86kg
25,00kW	104kg	88kg

DEPTH WAS
REDUCED BY
230mm



Easy Installation with Light Components

Indoor unit can easily be split into 3 components, the heaviest of which measures at 48kg.



Dimensions of Each Component (lightweight design for easy disassembly).



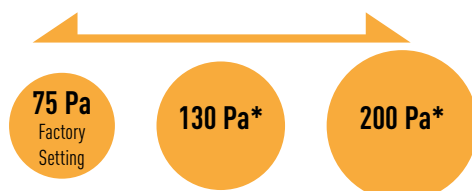
The weight is for S-200PE3E5B model.

Maximum 200 Pa* static pressure setting

A maximum static pressure enables the use of long ducts for installation in a wide range of spaces.

3-step static pressure set up.

Selectable of Static Pressure modes can change 200 Pa / 130 Pa / 75 Pa for extra installation flexibility.



* In case of S-250PE3E5B.

PACi R32 Refrigerant Gas



Panasonic recommends R32 because it is comparably environmentally friendly. Compared to R22 and R410A, R32 has a very low potential impact on global warming. Panasonic is leading the switch to R32.

New Comfort Cloud control

New Panasonic CZ-CAPWFC1 interface adaptor, allows connection of one or a group of indoor units to be managed by the Panasonic Comfort Cloud App, which provides control, monitoring, scheduling and error alerts.



Panasonic AC Smart Cloud for professionals

With Panasonic AC Smart Cloud, have your business under control, and start saving! Flexible solution and scalable solution

- Energy saving
- Zero downtime
- Site(s) management



Datanavi, a new way to connect. Simple and easy support tool with your smartphone



Just holding up your smartphone to the LED display on a remote controller (CZ-RTC5B) to receive useful AC system information super fast by Panasonic Light ID Technology.

- Scan & Save AC system info
- Easy access to manual database
- Commissioning, F gas check data history



Big PACi High Static Pressure Hide Away Inverter+ R32 GAS



				Three Phase	
				20,00kW	25,00kW
KIT				KIT-200PE3ZH8	KIT-250PE3ZH8
Remote controller				CZ-RTCSB	CZ-RTCSB
Cooling capacity	Nominal (Min - Max)	kW		19,50 [5,70 - 21,00]	23,20 [6,10 - 27,00]
SEER ¹⁾				5,25	4,84
Heating capacity	Nominal (Min - Max)	kW		22,40 [5,00 - 25,00]	28,00 [5,50 - 29,00]
SCOP ¹⁾				3,61	3,64
External static pressure at shipment (adjustable)		Pa		75 ³⁾ - 120 - 180	75 ³⁾ - 130 - 200
Indoor unit				S-200PE3E5B	S-250PE3E5B
Air volume	Hi / Med / Lo	m³/min		72 / 63 / 53	84 / 72 / 59
Sound pressure ⁴⁾	Hi / Med / Lo	dB(A)		46 / 44 / 41	47 / 45 / 42
Dimension	H x W x D	mm		486 x 1456 x 916	486 x 1456 x 916
Net weight		kg		86	88
Outdoor unit				U-200PZH2E8	U-250PZH2E8
Air volume	Cool / Heat	m³/min		164 / 164	160 / 160
Dimension ⁵⁾	H x W x D	mm		1500 x 980 x 370	1500 x 980 x 370
Net weight		kg		117	128
Pipe length range		m		5 ~ 90	5 ~ 60
Elevation difference (in/out) ⁴⁾		m		30	30
Accessories				Accessories	
CZ-RTCSB	Wired remote controller with Econavi function and datanavi			PAW-GRDSTD40	Outdoor elevation platform 400 x 900 x 400mm
CZ-RWS3 + CZ-RWRC3	Infrared remote controller			CZ-CAPWFC1	NEW Commercial WLAN Adaptor
CZ-RE2C2	Simplified remote controller				



1) For models below 12kW, the SEER and SCOP is calculated based on values of EU/626/2011. For models above 12kW, the SEER and SCOP is calculated based on values of EU/2281/2016. 2) Factory setting. 3) The sound pressure of the units shows the value measured of the position 1,5 below the unit. The sound pressure is measured in accordance with Eurovent 6/C/006-97 specification. 4) Add 100mm for indoor unit or 70mm for outdoor unit for piping port. 5) When installing the outdoor unit at a higher position than the indoor unit. * No filter included. * These models will be available in May 2019.

R32

INVERTER+

HIGH EFFICIENCY COMPRESSOR

COOLING MODE -15°C

HEATING MODE -20°C

BLUEFIN

Refrigerant gas R32 that shows a drastic reduction in the value of Global Warming Potential (GWP). — Inverter Plus System classification highlights the highest performing Panasonic systems. — High efficiency compressor. Compressors that operate with a wider Hz range realize a more efficient operation throughout the year. — The air conditioner works in cooling mode with an outdoor temperature of -15°C. — The air conditioner works in heating mode even when outdoor temperatures are as low as -20°C. — Bluefin. Panasonic has extended the life of its condensers with an original anti-rust coating.

Outdoor units offer various flexibility

- Twin, Triple, Double twin split options
- Water Heat Exchanger Compatibility



LARGE FAN

R22/R410A RENEWAL

OPTIONAL WLAN

DATANAVI

BMS CONNECTIVITY

5 YEARS COMPRESSOR WARRANTY

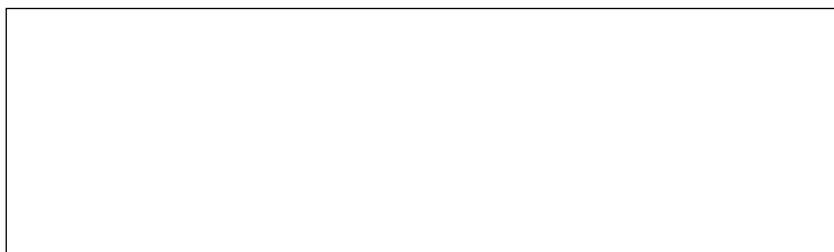
Large Fan. Large fan provides larger airflow rate and very quiet operation at low speed. — R410A/R22 renewal. — Internet Control. A next generation system providing a user-friendly remote controller of air conditioning or heat pump units from everywhere, using a simple Android or iOS smartphone, tablet or PC via internet. — Datanavi, a new way to connect. Simple and easy support tool with your smartphone. — BMS connectivity. The communication port can be integrated into the indoor unit and provides easy connection to, and control of, your Panasonic heat pump to your home or building management system. — 5 Years compressor warranty.

Panasonic®

To find out how Panasonic cares for you, log on to: www.aircon.panasonic.eu

Panasonic Marketing Europe GmbH
Panasonic Air Conditioning
Hagenauer Strasse 43, 65203 Wiesbaden, Germany

heating & cooling solutions



PAW-250W5APAC

PACi with Water Heat Exchanger for chilled and hot water production

Introducing a highly-efficient Water Heat Exchanger for PACi Series. This ground-breaking product provides further possibilities by adding hydronic options.

- A+++ Energy efficiency class (scale from A+++ to D)
- Cost effective water projects thanks to lower cost for PACi compared to VRF
- Reducing the amount of HFC refrigeration in the project
- 2 installation possibilities (wall-mounted / floor-standing)
- Compact, lightweight unit design, only 27kg
- Quick mounting process
- Flow switch kit is included as a standard
- Direct access to electrical box
- Operation down to -20°C without glycol



Highly-efficient Water Heat Exchanger for PACi Series

Short-term investment

[FIND OUT MORE](#)



PACi with Water Heat Exchanger · R32		THREE PHASE
		25.0 kW
Reference		PAW-250W5APAC
Cooling capacity (1)	kW	25,00
EER (1)	W/W	2,89
Heating capacity (2)	kW	28,00
COP (2)	W/W	2,95
ηsh (LOT1) (3)	%	178
Energy efficiency class (Scale A+++ to D) (4)		A+++
Dimension (Height)	mm	550
Dimension (Width)	mm	455
Dimension (Depth)	mm	205
Net weight	kg	27
Water pipe connector	Inch	Male Thread 1
Cooling water flow (ΔT=5 K. 35°C)	m³/h	4,30
Heating water flow (ΔT=5 K. 35°C)	L/min	4,85
Flow switch		Included
Water filter		Included
Outdoor unit		U-250PZH2E8
Outdoor sound pressure (Cool -Hi)	dB(A)	59
Outdoor sound pressure (Heat -Hi)	dB(A)	63
Outdoor dimension (Height)	mm	1500
Outdoor dimension (Width)	mm	980
Outdoor dimension (Depth)	mm	370
Outdoor net weight	kg	128
Pipe diameter (Liquid)	Inch (mm)	1/2 (12,70)
Pipe diameter (Gas)	Inch (mm)	1 (25,40)
Pipe length range	m	5 ~ 60
Elevation difference (in/out)	m	30
Pipe length for additional gas	m	30
Additional gas amount	g/m	80
Water outlet temperature range (Cool - Min)	°C	+5
Water outlet temperature range (Cool - Max)	°C	+15

PACi with Water Heat Exchanger · R32		THREE PHASE
		25.0 kW
Water outlet temperature range (Heat - Max)	°C	+50
Operating range (Cool - Min)	°C	-15
Operating range (Cool - Max)	°C	+46
Operating range (Heat - Min)	°C	-20
Operating range (Heat - Max)	°C	+24

(1) Data refers to 7°C leaving chilled water temperature and 35°C ambient air temperature, according to EN14511 standard.

(2) Data refers to 35°C leaving warm water temperature and 7°C ambient air temperature according to EN14511 standard.

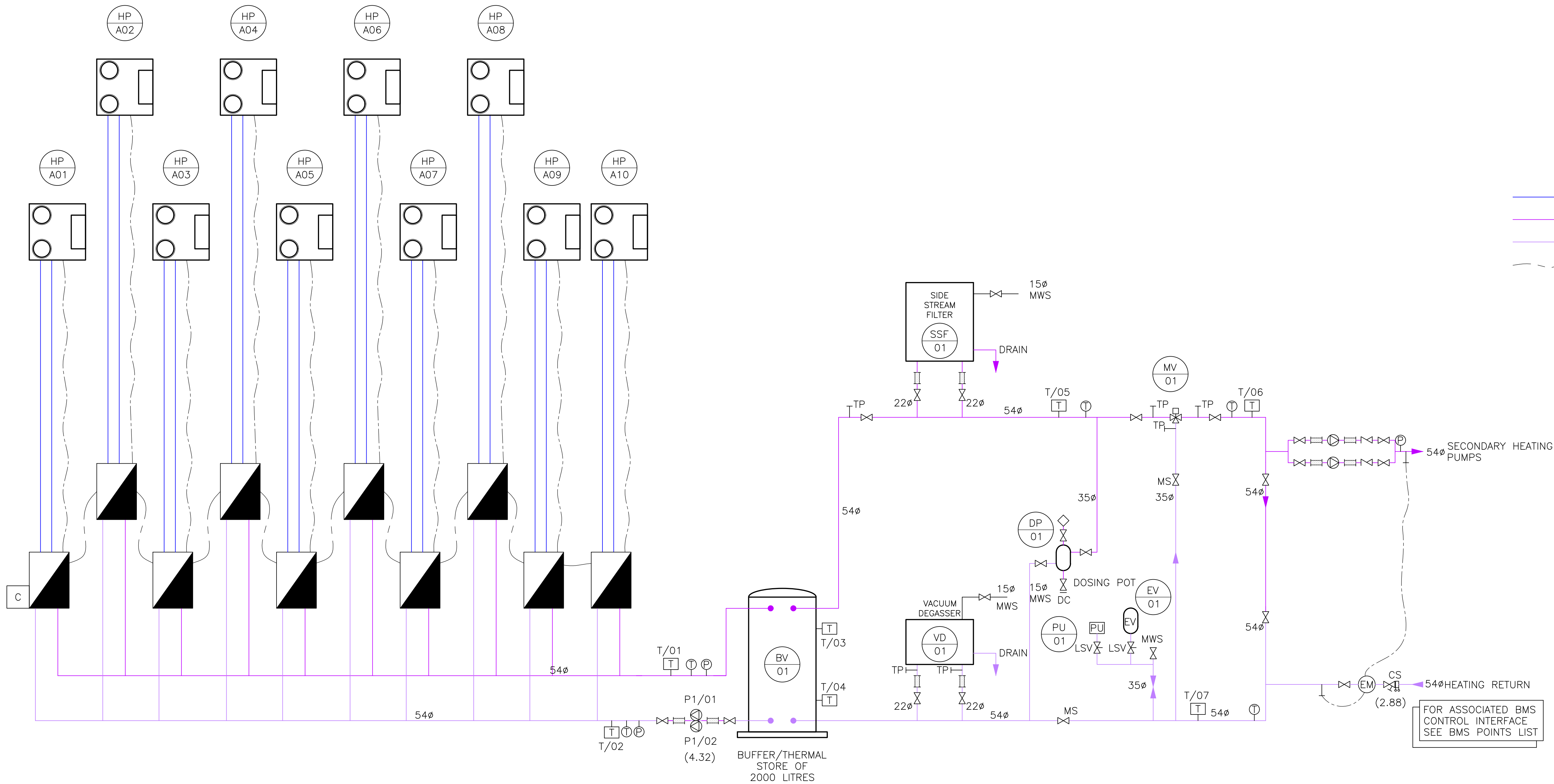
(3) Following COMMISSION REGULATION (EU) No 813/2013 for low-temperature heat pumps.

(4) Following COMMISSION REGULATION (EU) No 811/2013 for low-temperature heat pumps. Scale from A+++ to D.

Complementary products

- LEGEND:
- ISOLATION VALVE
 - COMMISSIONING SET (FLOW RATE l/s)
 - CHECK VALVE
 - DOUBLE CHECK VALVE
 - STRAINER
 - FLEXIBLE CONNECTION
 - DC DRAIN COCK/DRAIN VALVE
 - PIPE REDUCER
 - PUMP SET
 - TWIN PUMP SET
 - TP TEST POINT
 - NORMALLY CLOSED ISOLATION VALVE
 - STOP COCK
 - SV SAFETY VALVE
 - DPS DEFERENTIAL PRESSURE SWITCH
 - BYPASS VALVE
 - MS METERING STATION
 - NON RETURN VALVE
 - MOTORIZED 3-PORT VALVE
 - TEMPERATURE GAUGE
 - PRESSURE GAUGE WITH PETCOCK
 - TEMPERATURE SENSOR
 - ENERGY METER

- REFRIGERANT PIPEWORK
- HEATING FLOW
- HEATING RETURN
- CONTROLS CABLING



P1	27/04/23	CD	PRELIMINARY ISSUE.	NY
REV1	DATE	DRN	REVISION HISTORY:	CHK

NLY Building Services Ltd
Email: info@nlybuildingservices.com Website: www.nlybuildingservices.com

CLIENT: FORMATION DESIGN AND BUILD

PROJECT: PARTRIDGE WAY

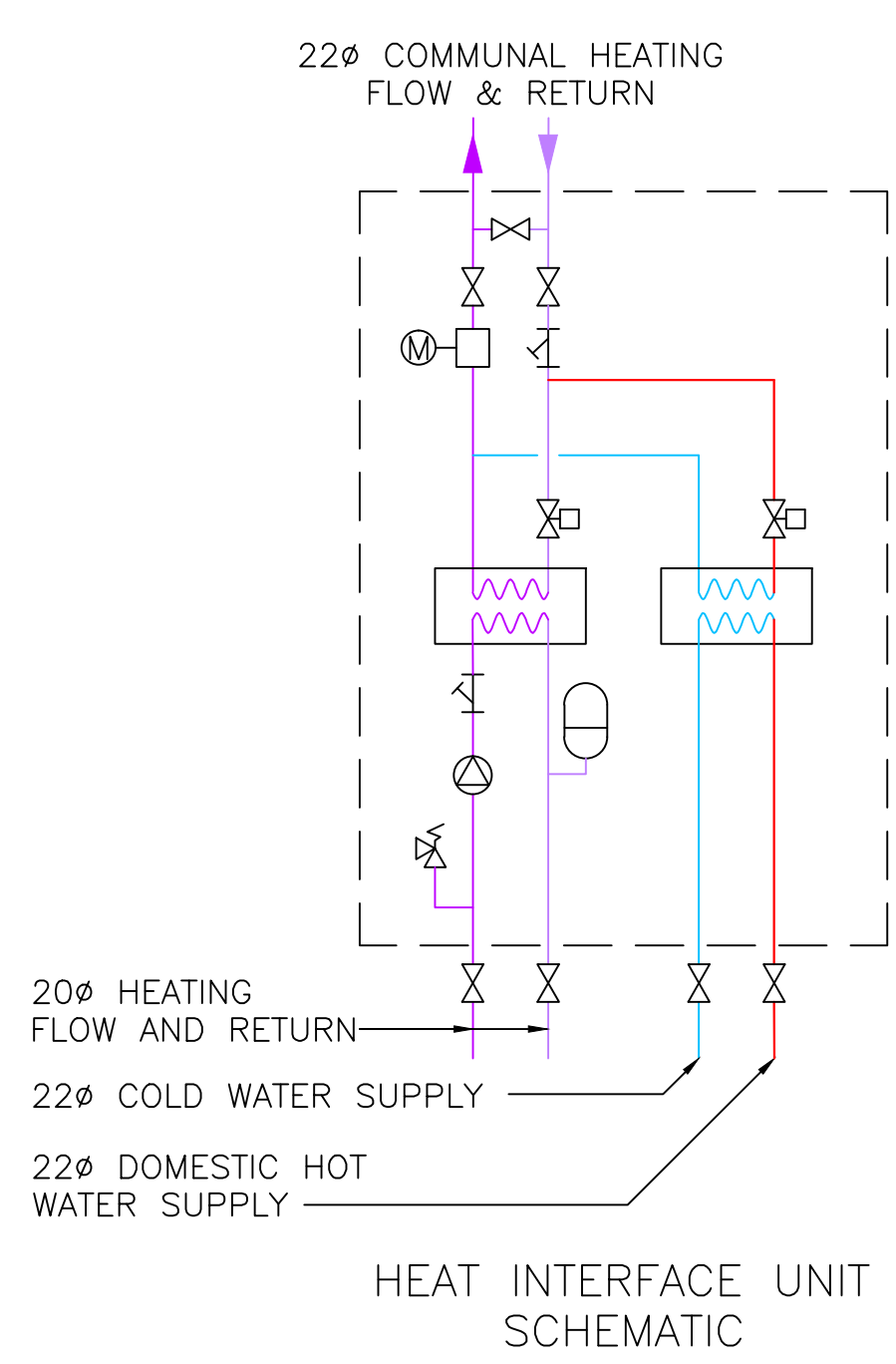
DRAWING TITLE: PLANTROOM SCHEMATIC

DRAWING NO: P23005-M-003 REV: P1 PROJECT Ref: P23005

SCALE: AT A1: NTS STATUS: PRELIMINARY

DATE: 26/04/2023 DRAWN BY: CD CHECKED BY: NY

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- | INSULATION TO
CONTROL HEAT LOSS | |
|------------------------------------|---|
| NOMINAL
PIPE ϕ
(mm) | PHENOLIC FOAM
0.023 W/mk
THICKNESS (mm) |
| 22 | 30 |
| 28 | 30 |
| 35 | 30 |
| 42 | 30 |
| 54 | 40 |
| 67 | 40 |

- | PIPE SIZE | FLOW RATE l/s |
|--------------------------|---------------|
| PRESSURE
DROP
Pa/M | VELOCITY m/s |

P1	27/04/23	CD	PRELIMINARY ISSUE.		NY
REV1	DATE	DRN	REVISION HISTORY:		CHK



NLV Building Services Ltd

Email: info@nlvbuildingservices.com Website: www.nlvbuildingservices.com

CLIENT: FORMATION
DESIGN AND BUILD

PROJECT: PARTRIDGE WAY

DRAWING TITLE: HEATING SCHEMATIC

DRAWING NO: P23005 - M-004

REV: P1

PROJECT Ref P23005

SCALE AT A1: NTS

STATUS: PRELIMINARY

DATE: 26/04/2023

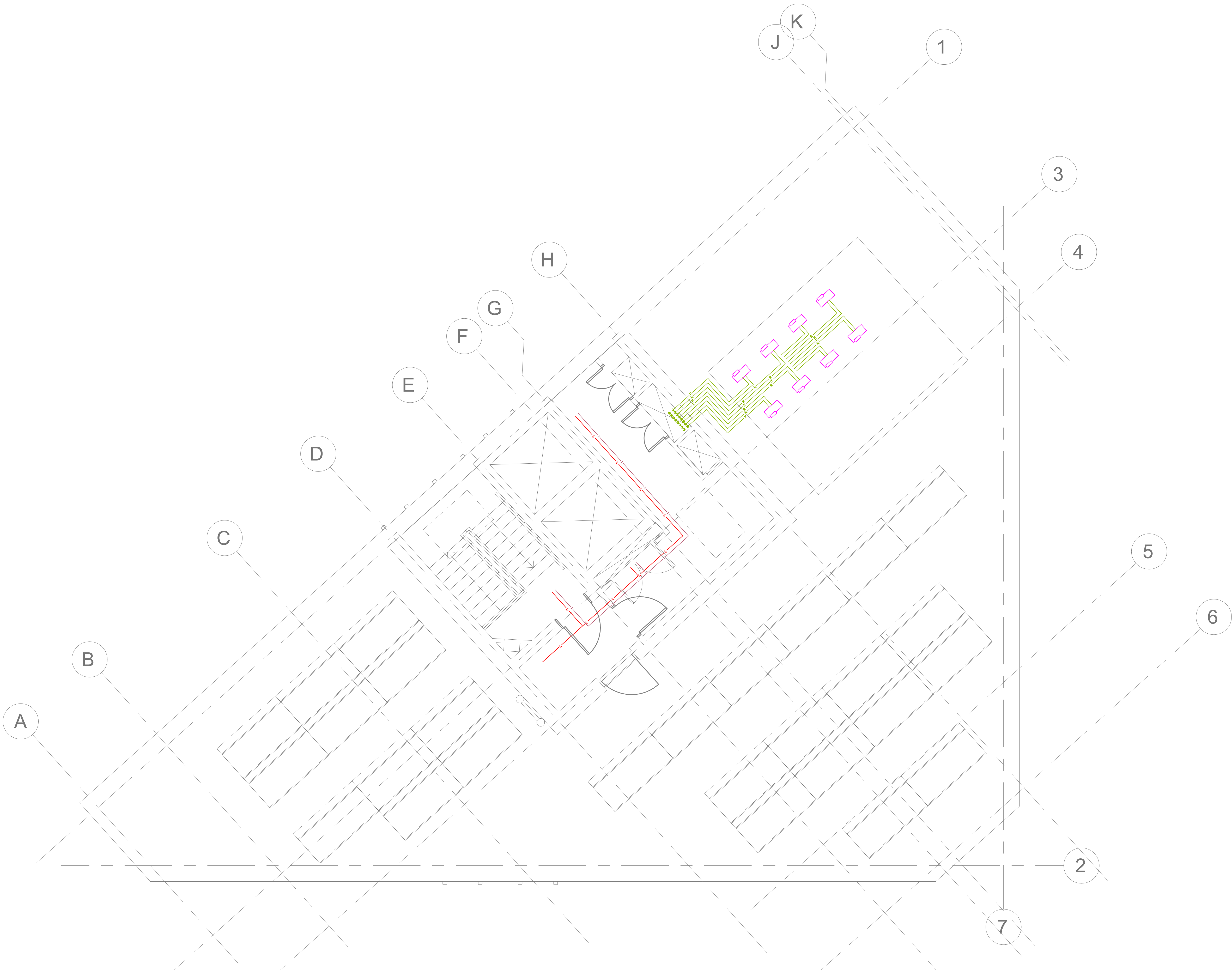
DRAWN BY: CD

CHECKED BY: NY

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- NOTES:
1. SUPPORTS FOR PVC-C PIPEWORK SHOULD BE SPACED NO MORE THAN 1.5m APART.
 2. SUPPORTS FOR HEP,O PIPEWORK SHOULD BE SPACED NO MORE THAN 300mm HORIZONTALLY AND NO MORE THAN 500mm VERTICALLY.

- LEGEND:
- ELECTRIC SUBMAINS CABLE TRAY
 - COMMUNAL LIGHTING & SMALL POWER CABLE TRAY
 - TELECOM SERVICES (BT) CABLE TRAY
 - IRS SERVICES (TV/FM/DAB AND DOOR ACCESS) CABLE TRAY
 - MAINS COLD WATER SERVICE
 - BOOSTED COLD WATER SERVICE
 - HEATING FLOW
 - HEATING RETURN
 - REFRIGERANT PIPEWORK
 - ASHP CONDENSING UNIT



P1	07/06/23	CD	PRELIMINARY ISSUE.	NY
REV1	DATE	DRN	REVISION HISTORY:	CHK

NLY Building Services Ltd
Email: info@nlybuildingservices.com Website: www.nlybuildingservices.com

CLIENT: FORMATION
DESIGN AND BUILD

PROJECT: PARTRIDGE WAY

DRAWING TITLE: SERVICES DISTRIBUTION
LAYOUT
NINTH FLOOR

DRAWING NO: P23005-S-104 REV: P1 PROJECT Ref: P23005

SCALE AT A1: 1:50 STATUS: PRELIMINARY

DATE: 07/06/2023 DRAWN BY: CD CHECKED BY: NY

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Appendix 5





Midi



Midi

- with summer bypass and frost-stat
- efficient, low energy solution to controlling condensation and pollution in residential properties up to 170m²
- up to 94% heat exchange efficiency
- variable choice of low (trickle), boost and purge speed at installation
- for wall, cupboard or loft installation
- universal hanging for models without humidistat
- very quiet
- low running costs
- complies with Building Regulations Parts L1A 2013 and F 2013
- manufactured in UK to ISO 9001
- accurate commissioning via optional integral LCD or remote LCD commissioning unit



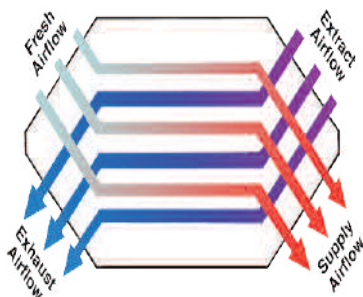
Midi

GENERAL FEATURES

- up to 95 litre/sec at 50Pa - max 101 litre/sec capacity
- sfp down to 0.50 W/l/s
- summer bypass activated when inside temperature is above 24°C [and outside temperature between 14°C and 24°C];
- frost-stat - proportionally reduces intake motor speed as temperature falls - activated when the outside temperature between +2°C to -8°C.
- run-time and power outage counters
- easy to install and maintain
- easy to access G3 filters
- universal handing for models without humidistat - left or right [see separate diagram on page 6 for handing on humidistat models]
- for fitting vertically into lofts, or cupboards - wall fixing bracket supplied
- variable low (trickle), boost and purge options for each motor
- boost speed can be activated by a 230V switched live, or a 0-10V connection from:
 - a light switch (if more than one light switch is used, each one must be a double pole switch)
 - Remote humidistat (230V - DRH240)
 - Passive infra red (230V - PIRFF)
 - Thermostat (230V - THM)
 - Remote switch/pull cord - 230V
- ultra quiet
- low running costs
- 5 year warranty - 1 year parts and labour, 4 years parts only

TECHNICAL FEATURES

- compact unit - casing from steel sheet - epoxy paint finish
- thermo-acoustic lining
- low energy EC brushless motor with single width, single inlet, direct drive, forward curved impellers
- operates in temperature up to 60°C
- easy to access standard, disposable G3 filters
- counter flow heat exchanger



MODELS AVAILABLE:

- WHHR-Midi/BY - bypass, universal
- WHHR-Midi/LBYH - bypass, left drain, humidistat
- WHHR-Midi/RBYH - bypass, right drain, humidistat
- Midi-BY+LCD - bypass, universal, integral LCD
- Midi-BY+LCDLH - bypass, integral LCD, left drain, humidistat
- Midi-BY+LCDRH - bypass, integral LCD, right drain, humidistat

CONTROL FEATURES - STANDARD

- independent variable speed adjustment for each motor for trickle, boost and purge speeds.
- adjustable boost speed over-run timer from 0 to 30 minutes.
- adjustable boost speed delay from 0 to 5 minutes
- adjustable purge speed over-run timer from 0 to 250 minutes, pre-set to 15 minutes [adjustable at factory].
- adjustable night time boost and purge inhibitor
- integral frost-stat - proportionally reduces intake motor speed as temperature falls
- automatic summer bypass

CONTROL FEATURES - FACTORY SET

- change of ductwork handing on humidistat version (trip point can be set at manufacture)
- integral humidistat - proportionally increases motor speeds with rising humidity
- 0-10V connections can be added for:
 - BMS - for remote motor shut-off
 - CO₂ detector
 - home automation system
 - external pre-heater
 - 3 speed selector switch
- purge speed over-run time
- holiday mode for reduced speeds when property is unoccupied (factory set option) - default setting is 50% of trickle speed
- run-time and power outage counters downloadable via QR code.

COMPLIES WITH

- Part L1A 2013 of Building Regulations for enhanced energy saving capability
- Part F 2013 of Building Regulations for reliable, efficient ventilation
- EU RoHS Directive Compliant.
- Complies with IEC60335-2-80, LVD2006/95/CE and EMC2014/30/UE (European Directive against radio interference and electro-magnetic compatibility)
- manufactured in UK to ISO 9001
- CE marked
- SAP PCDB Listed

SEE PAGE 96 FOR SPECIFICATION. ALSO AVAILABLE AT
<http://www.vectaire.co.uk/downloads>

Vectaire Ltd can supply all accessories for use with these units, including product filters, air filter cassettes, silencers, fire dampers, air valves, ducting, outside grilles and wall cowl. Additionally, Vectaire offers a design service to ensure that the unit installed is the best possible to provide efficient, effective, low energy and low running cost ventilation. Vectaire can also organise installation, commissioning and maintenance of these products



Midi

TECHNICAL CHARACTERISTICS										
Model	Airflow l/sec					Total Power - Watts				
	100%	80%	60%	40%	20%	100%	80%	60%	40%	20%
Midi	101	79	58	36	14	120	69	31	11	2.2

Midi		Sound Power Levels, L_w [dB] - Octave Bands Frequency Hz.								Sound Pressure dBA @ 3m
Curve Ref		63	125	250	500	1k	2k	4k	8k	
100% (101 l/sec)	Extract	65	65	63	63	59	58	57	54	29.7
	Supply	70	70	68	68	64	63	62	59	
	Breakout	55	57	53	42	34	31	24	17	
80% (79 l/sec)	Extract	61	61	58	58	54	53	50	46	27.2
	Supply	66	66	63	63	59	58	55	51	
	Breakout	53	57	49	38	32	28	21	15	
60% (58 l/sec)	Extract	55	55	51	51	47	45	41	36	24.4
	Supply	60	60	56	56	52	50	46	41	
	Breakout	50	55	45	36	30	23	16	13	
40% (36 l/sec)	Extract	47	46	41	41	38	35	29	21	21.6
	Supply	52	51	46	46	43	40	34	26	
	Breakout	42	52	41	36	27	17	12	11	
20% (14 l/sec)	Extract	33	32	24	24	22	18	8	4	19.2
	Supply	38	37	29	29	27	23	14	7	
	Breakout	38	52	35	28	18	10	10	11	

The breakout dB(A) sound pressure values are given for hemispherical free field propagation at a distance of 3m from the unit

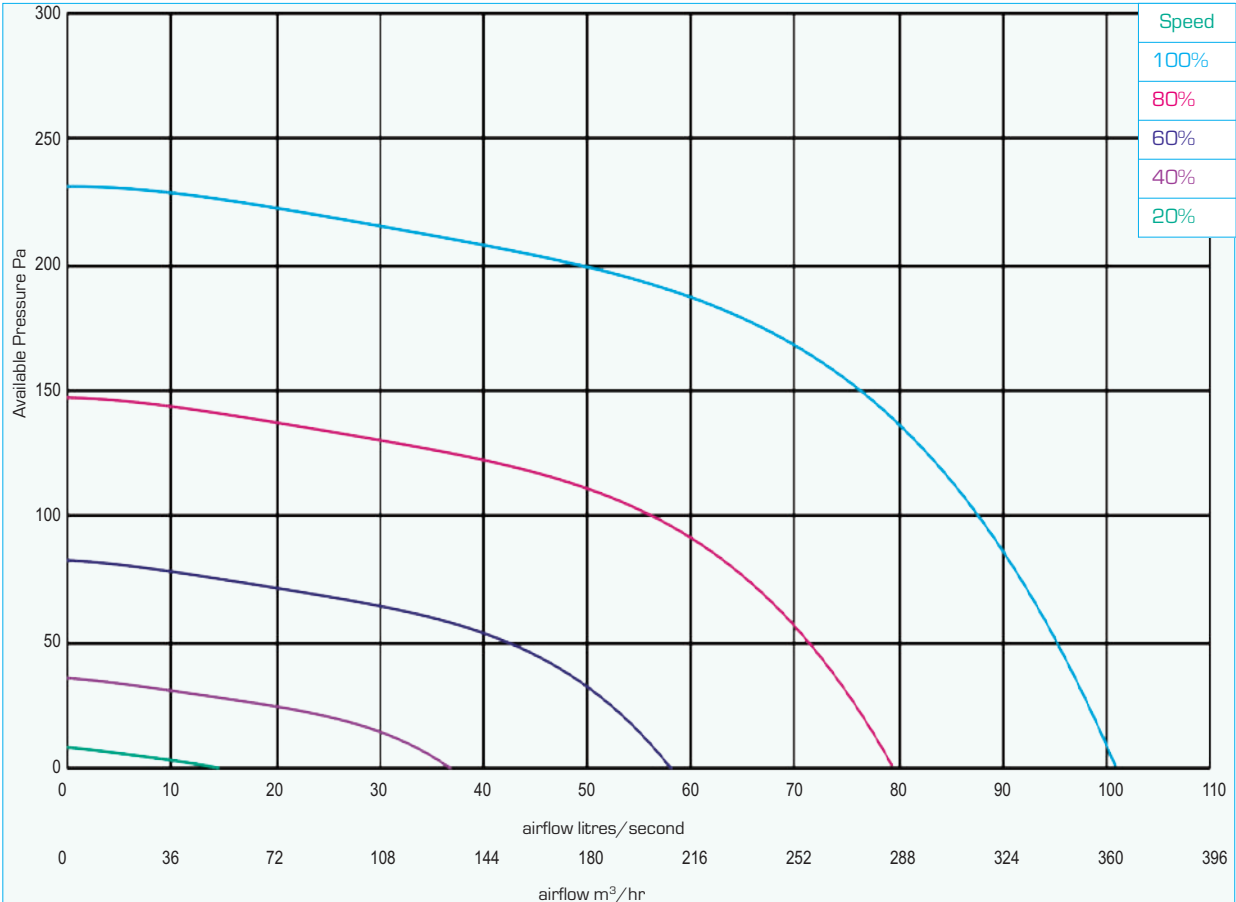
RESULTS for SAP CALCULATIONS						
ENERGY LEVEL PERFORMANCE - using rigid ducting only						
	2009 Data			2012 Data		
Exhaust Terminal Configuration	Airflow [l/sec]	Specific Fan Power [W/l/sec]	Heat Exchange Efficiency	Airflow [l/sec]	Specific Fan Power [W/l/sec]	Heat Exchange Efficiency
Kitchen + 1 additional wet room	15	0.50	94%	21	0.51	93%
Kitchen + 2 additional wet rooms	21	0.50	93%	29	0.61	91%
Kitchen + 3 additional wet rooms	27	0.55	92%	37	0.75	90%
Kitchen + 4 additional wet rooms	33	0.65	91%	45	0.92	89%
Kitchen + 5 additional wet rooms	39	0.76	89%			
Kitchen + 6 additional wet rooms	45	0.88	89%			

Figures at minimum flow rate conditions

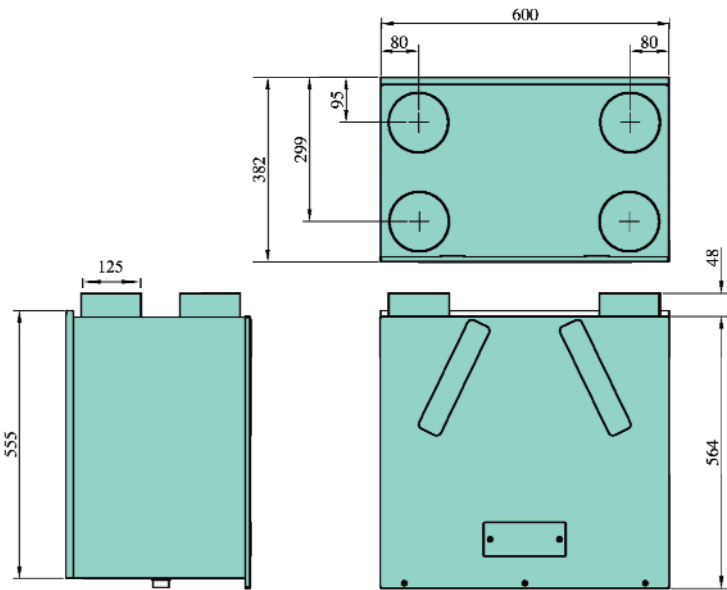


Midi

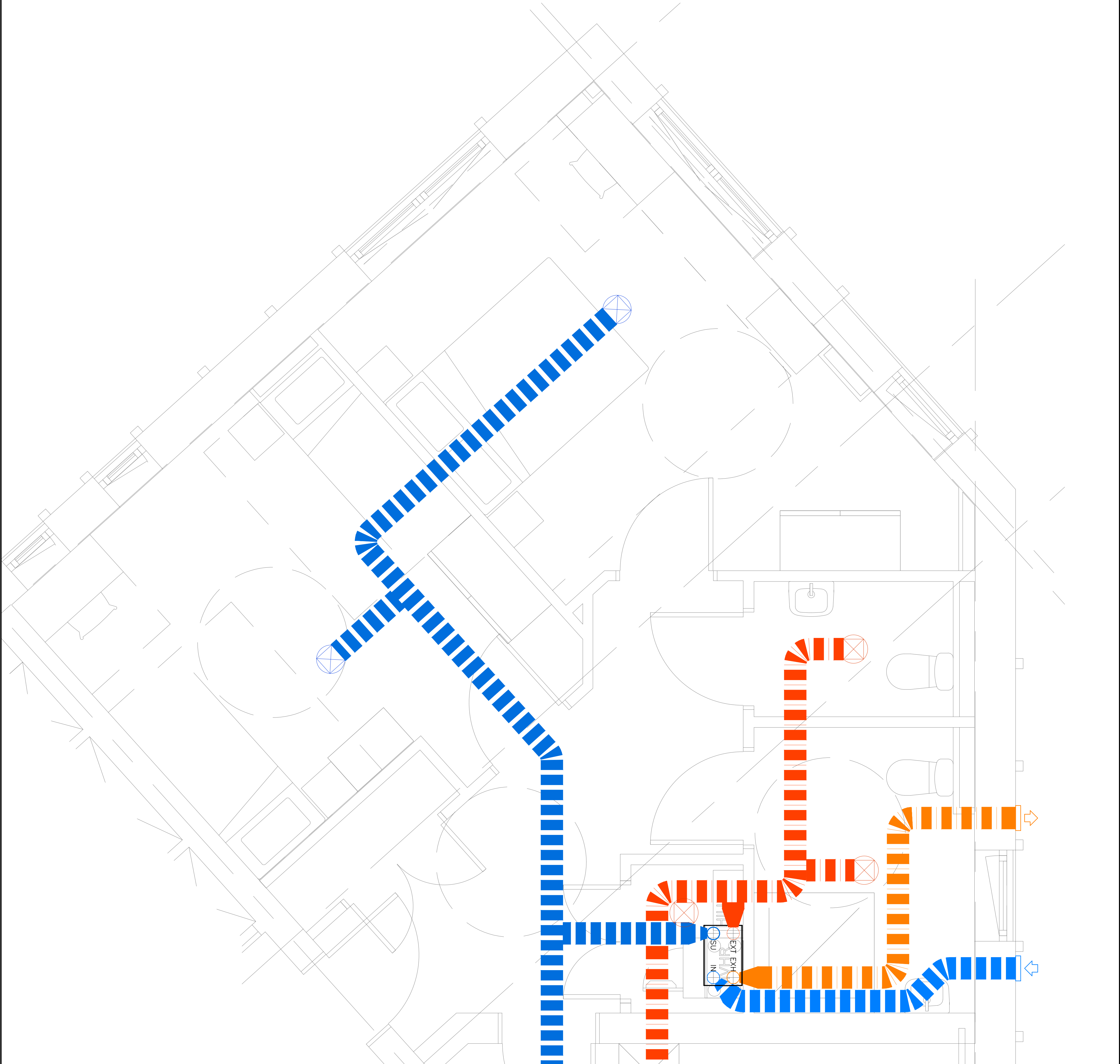
PERFORMANCE (curves are for guidance only)



DIMENSIONS - mm



N.B a clearance of at least 150 mm should be allowed on each side of the cabinet for access to the interior



CONTINUED ON SHEET 2

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE; DO NOT SCALE FROM THIS DRAWING.
2. TO BE READ IN CONJUNCTION WITH DESIGN DRAWINGS AND NLY BUILDING SERVICES LTD. SPECIFICATION.
3. DRAWING IS INDICATIVE ONLY, COMPONENTS CAN BE MOVED TO SUIT INSTALLATION REQUIREMENTS.

LEGEND:

- 220x90mm EXTRACT DUCT
- 220x90mm EXHAUST DUCT
- 220x90mm SUPPLY AIR DUCT
- 220x90mm INTAKE AIR DUCT
- FIRE SLEEVE/DAMPER
- EXTRACT VALVE
- SUPPLY VALVE
- VECTAIRE MIDI MVHR UNIT

P1	05/06/23	CD	PRELIMINARY ISSUE	NY
REV	DATE	DRN	REVISION HISTORY	CHK

NLY Building Services Ltd

Email: info@nlybuildingservices.com Website: www.nlybuildingservices.com

CLIENT: FORMATION
DESING AND BUILD

PROJECT: PARTRIDGE WAY

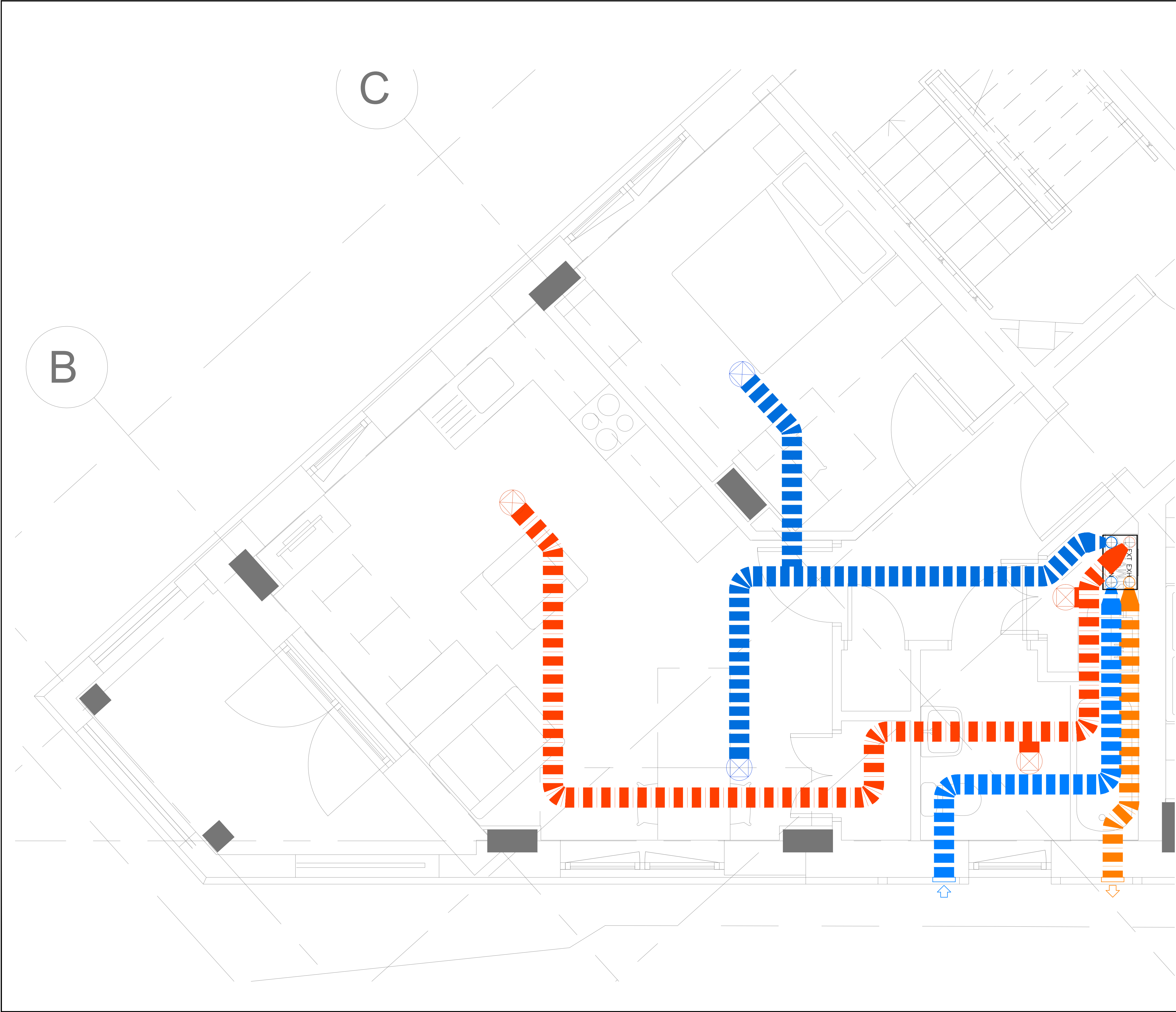
DRAWING TITLE: VENTILATION LAYOUT
FLAT TYPE 2
SHEET 1 of 2

DRAWING NO: P23005-M-303 REV: P1 PROJECT Ref: P23005

SCALE AT A1: 1:20 STATUS: PRELIMINARY

DATE: 05/06/2023 DRAWN BY: CD CHECKED BY: NY

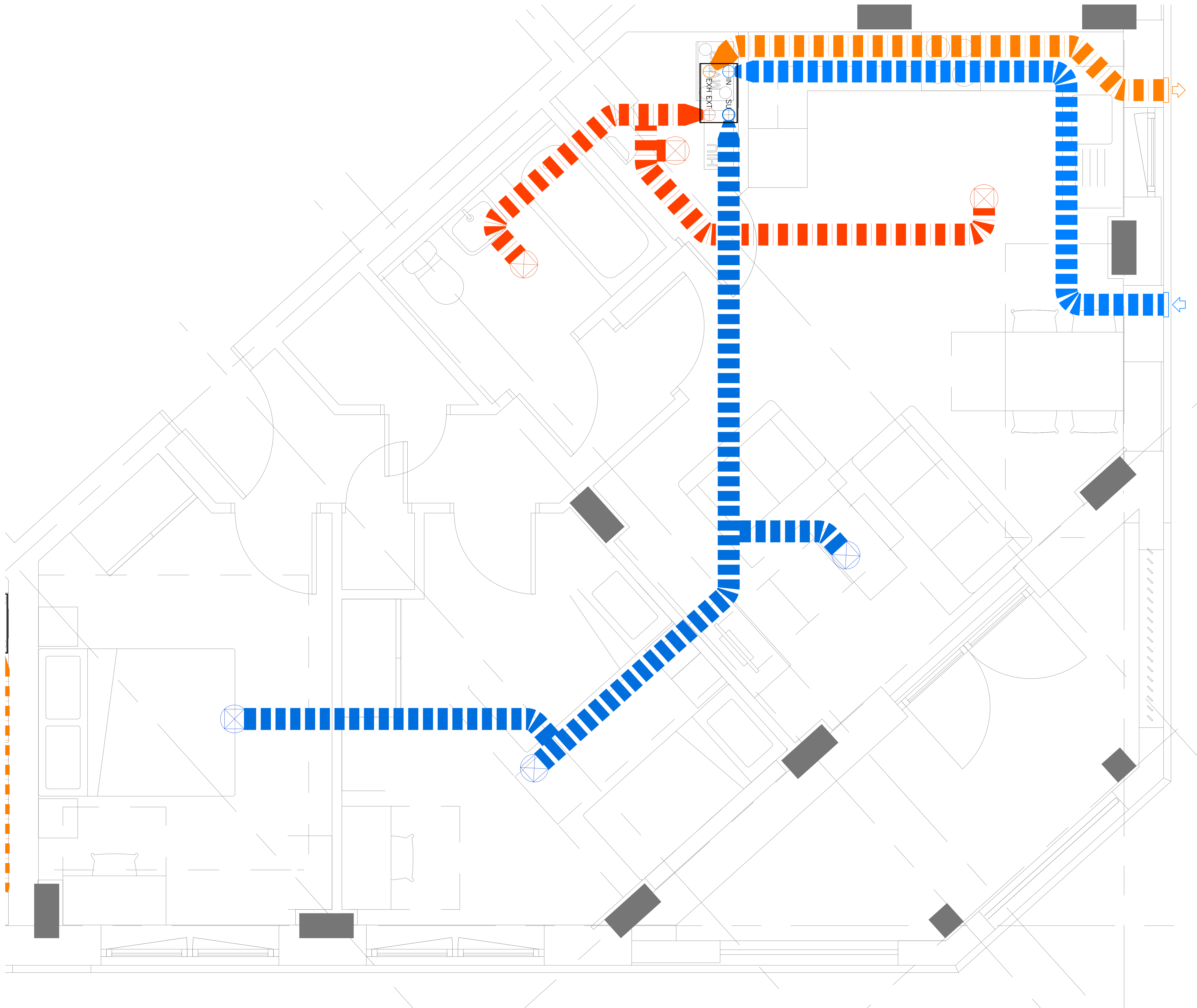
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 - 220x90mm INTAKE AIR DUCT
 - FIRE SLEEVE/DAMPER
 - EXTRACT VALVE
 - SUPPLY VALVE
 - VECTAIRE MIDI MVHR UNIT

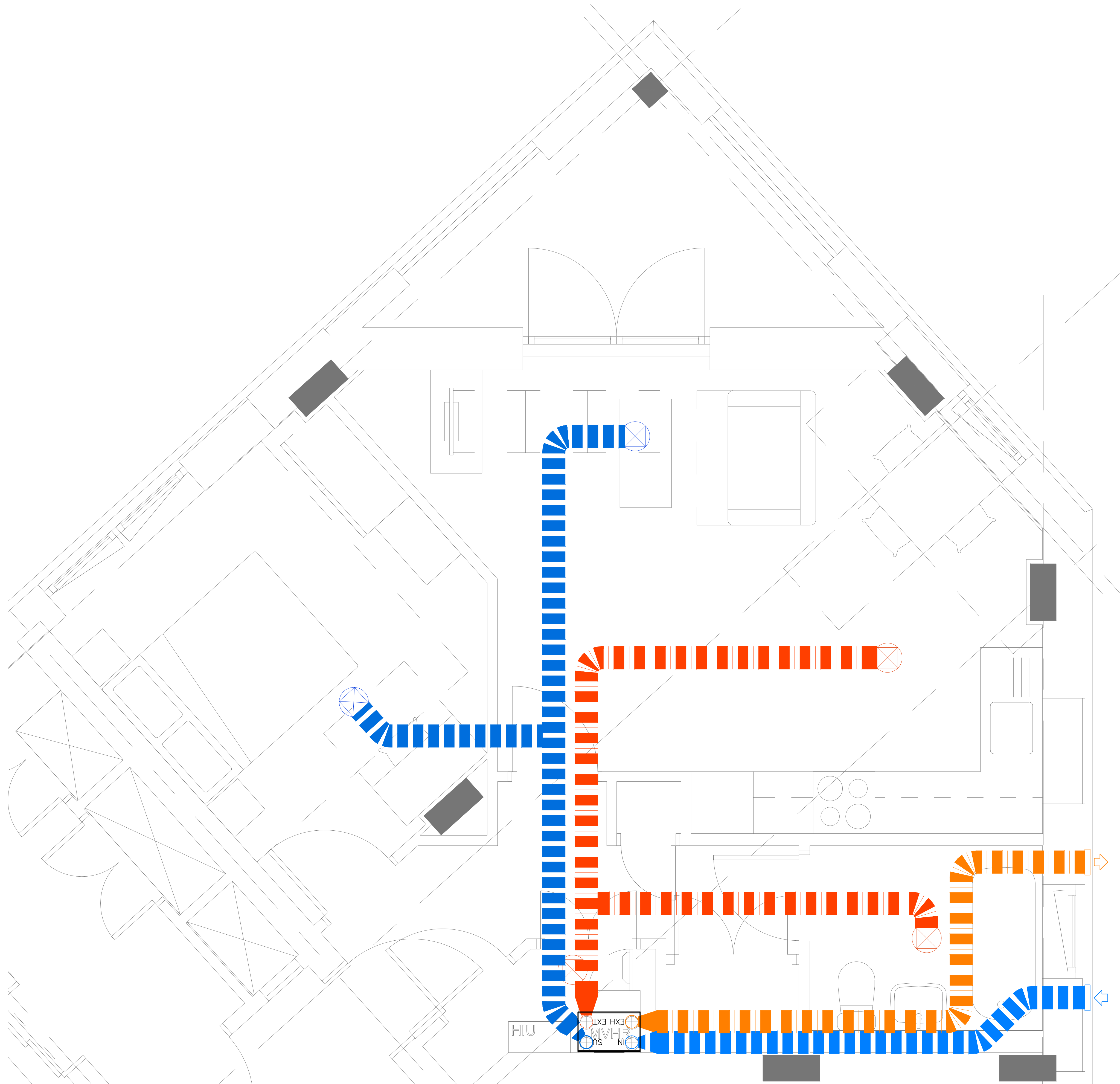
P1	05/06/23	CM	PRELIMINARY ISSUE.	NY
REV1	DATE	DRN	REVISION HISTORY:	CHK
NLY Building Services Ltd				
Email: info@nlybuildingservices.com			Website: www.nlybuildingservices.com	
CLIENT: FORMATION DESIGN AND BUILD				
PROJECT: PARTRIDGE WAY				
DRAWING TITLE: VENTILATION LAYOUT FLAT TYPE 3				
DRAWING NO: P23005-M-304			REV: P1	PROJECT Ref P23005
SCALE AT A1: 1:20			STATUS: PRELIMINARY	
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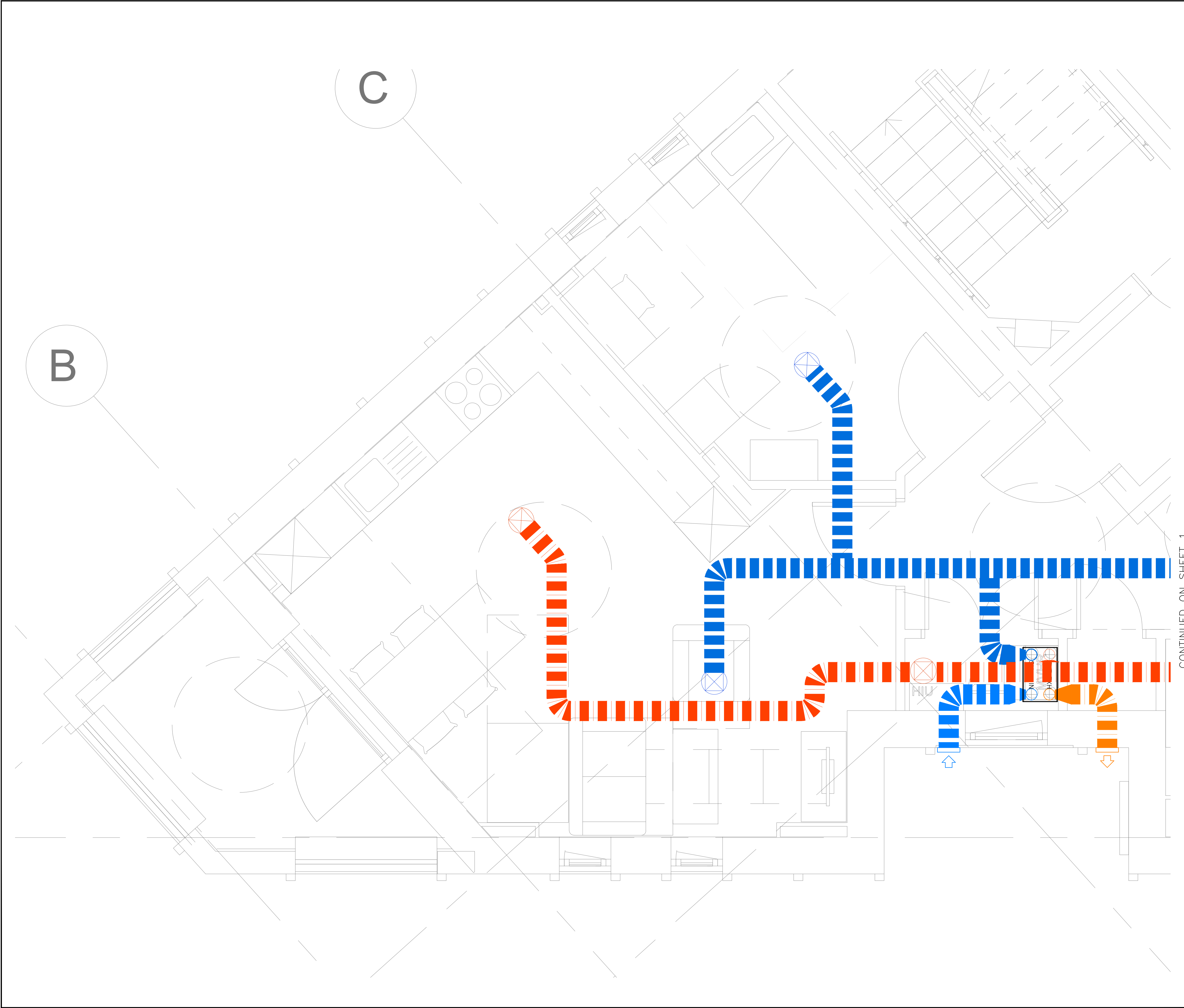
P1		05/06/23		CM	PRELIMINARY ISSUE.		NY	
REV1		DATE		DRN	REVISION HISTORY:		CHK	
NLY Building Services Ltd Email: info@nlybuildingservices.comWebsite: www.nlybuildingservices.com								
CLIENT: FORMATION DESIGN AND BUILD								
PROJECT: PARTRIDGE WAY								
DRAWING TITLE: VENTILATION LAYOUT FLAT TYPE 4								
DRAWING NO: P23005-M-305				REV: P1		PROJECT Ref P23005		
SCALE AT A1: 1:20				STATUS: PRELIMINARY				
DATE: 05/06/2023			DRAWN BY: CD			CHECKED BY: NY		
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REV1		DATE		DRN		REVISION HISTORY:		CHK	
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CLIENT:FORMATION DESIGN AND BUILD									
PROJECT:PARTRIDGE WAY									
DRAWING TITLE:VENTILATION LAYOUT FLAT TYPE 5									
DRAWING NO: P23005-M-306				REV: P1		PROJECT Ref P23005			
SCALE AT A1: 1:20				STATUS: PRELIMINARY					
DATE: 05/06/2023				DRAWN BY: CD		CHECKED BY: NY			
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Email: info@nlybuildingservices.com Website: www.nlybuildingservices.com

CLIENT: FORMATION DESIGN AND BUILD

PROJECT: PARTRIDGE WAY

DRAWING TITLE: VENTILATION LAYOUT
FLAT TYPE 1
SHEET 1 of 2

DRAWING NO:	REV:	PROJECT Ref
P23005-M-300	P1	P23005

SCALE AT A1:	STATUS:
1:20	PRELIMINARY

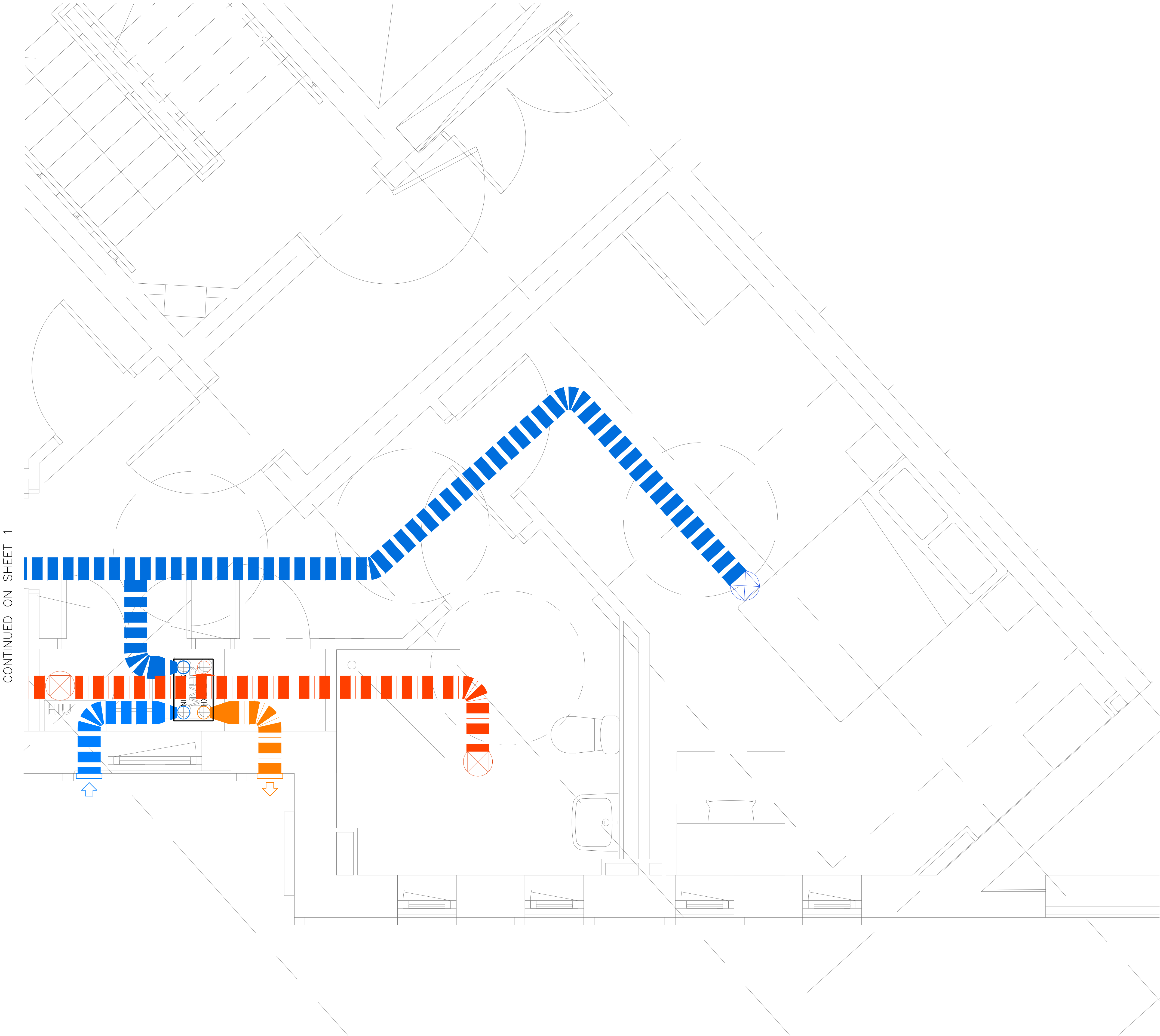
DATE:	DRAWN BY:	CHECKED BY:
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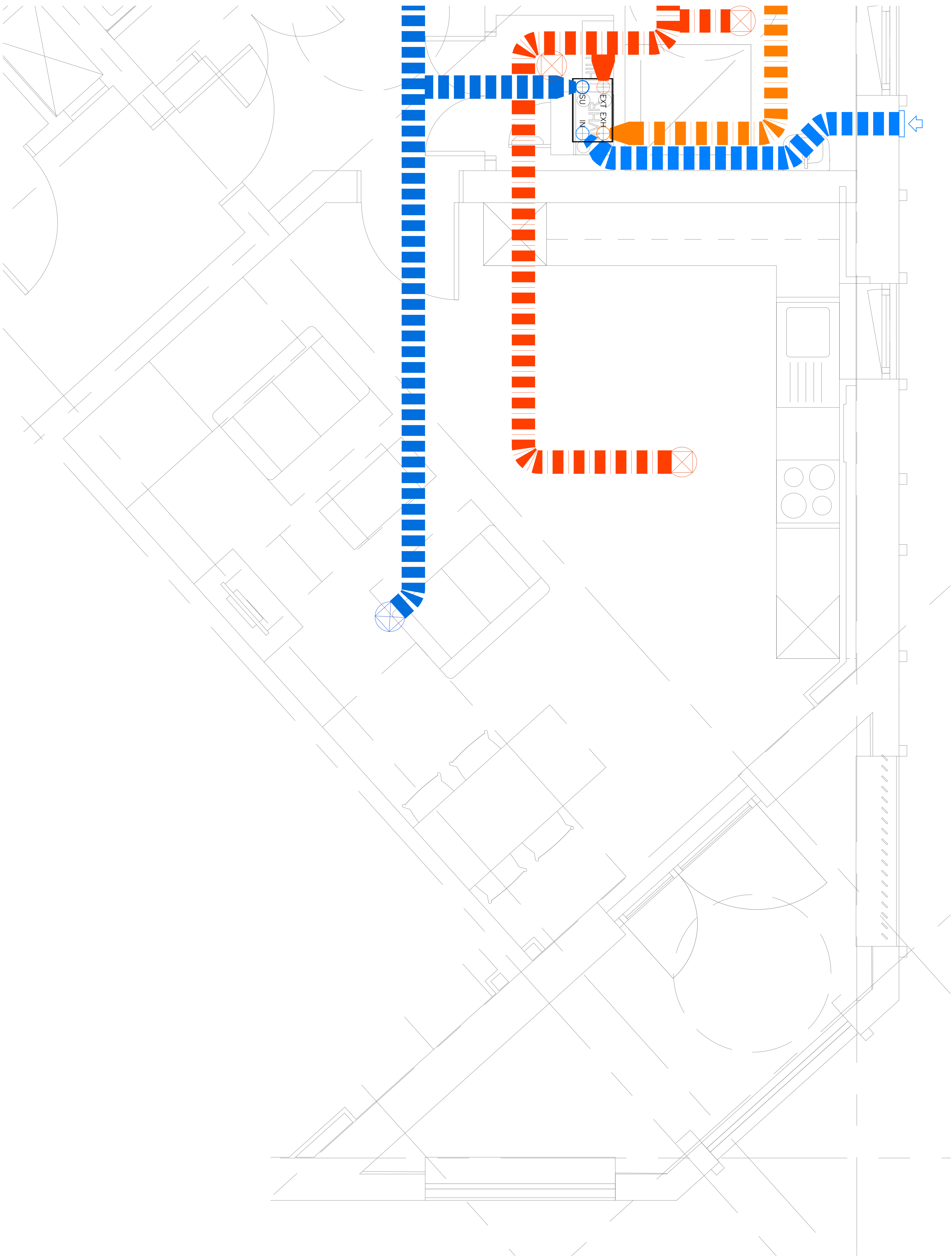
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P1	05/06/23	CD	PRELIMINARY ISSUE.		NY
REV1	DATE	DRN	REVISION HISTORY:		CHK
Client: FORMATION DESIGN AND BUILD Project: PARTRIDGE WAY Drawing Title: VENTILATION LAYOUT FLAT TYPE 1 SHEET 2 of 2 Drawing No: P23005-M-301 Rev: P1 Project Ref: P23005 Scale: AT A1: 1:20 Status: PRELIMINARY Date: 05/06/2023 Drawn By: CD Checked By: NY Copyright: NLY BUILDING SERVICES LTD. ALL RIGHTS RESERVED. NO PART OF THIS DRAWING IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT THE WRITTEN PERMISSION OF NLY BUILDING SERVICES LTD.					



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REV	DATE	DRN	REVISION HISTORY	CHK

NLY Building Services Ltd

Email: info@nlybuildingservices.com Website: www.nlybuildingservices.com

CLIENT: FORMATION
DESING AND BUILD

PROJECT: PARTRIDGE WAY

DRAWING TITLE: VENTILATION LAYOUT
FLAT TYPE 2
SHEET 1 of 2

DRAWING NO: P23005-M-302 REV: P1 PROJECT Ref: P23005

SCALE AT A1: 1:20 STATUS: PRELIMINARY

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Appendix 6



DATED

01 MARCH 2020

VAN DER VALK



VALK SOLAR SYSTEMS UK LIMITED

Registered in England and Wales No. 8787914

Registered office:
Innovation House, Discovery Park
Ramsgate Road
Sandwich CT13 9FF
United Kingdom

**TERMS AND CONDITIONS FOR THE SUPPLY OF
GOODS AND/OR SERVICES**

The Customer's attention is particularly drawn to the provisions of clause 12 for which the Customer should arrange its own insurance.

1. INTERPRETATION

1.1 Definitions. In these Conditions, the following definitions apply:

"Business Day"	a day other than a Saturday, Sunday or public holiday in England when banks in London are open for business;
"Commencement Date"	has the meaning set out in clause 2.2;
"Conditions"	these terms and conditions as amended from time to time in accordance with clause 15.7;
"Contract"	the contract between the Supplier and the Customer for the supply of Goods and/or Services in accordance with these Conditions;
"Credit Account Customer"	a Customer with a prior approved credit limit;
"Customer"	the person or firm who purchases the Goods and/or Services from the Supplier.
"Deliverables"	the deliverables set out in the Confirmation Order;
"Delivery Location"	has the meaning set out in in the Order Confirmation;
"Force Majeure Event"	has the meaning given to it in clause 14;
"Goods"	the goods and/or materials (or any part of them) set out in the Order.
"Goods Specification"	any specification for the Goods, including any relevant plans or drawings, that is agreed in writing by the Customer and the Supplier and/or set out in the Order Confirmation, as the case may be;
"Intellectual Property Rights"	patents, rights to inventions, copyright and related rights, trade marks, business names and domain names, rights in get-up, goodwill and the right to sue for passing off, rights in designs, database rights, rights to use, and protect the confidentiality– of, confidential information (including know-how), and all

	other intellectual property rights, in each case whether registered or unregistered and including all applications and rights to apply for and be granted, renewals or extensions of, and rights to claim priority from, such rights and all similar or equivalent rights or forms of protection which subsist or will subsist now or in the future in any part of the world
"Order"	the Customer's order for the supply of Goods and/or Services, as set out in the Order Confirmation, or the Customer's written acceptance of the Supplier's quotation, or the Customer's oral telephone order or, as the case may be.
"Order Confirmation"	the Supplier's written confirmation of the Customer's Order;
"Services"	the services, including the Deliverables, supplied by the Supplier to the Customer as set out in the Service Specification below.
"Service Specification"	the description or specification for the Services provided in writing by the Supplier to the Customer;
"Supplier"	Valk Solar Systems UK Limited registered in England and Wales with company number 08787914
"Supplier Materials"	has the meaning set out in clause 8.1.7.

1.2 **"Construction"**. In these Conditions, the following rules apply:

- 1.2.1 a **person** includes a natural person, corporate or unincorporated body (whether or not having separate legal personality);
- 1.2.2 a reference to a party includes its personal representatives, successors or permitted assigns;
- 1.2.3 a reference to a statute or statutory provision is a reference to such statute or statutory provision as amended or re-enacted. A reference to a statute or statutory provision includes any subordinate legislation made under that statute or statutory provision, as amended or re-enacted;

1.2.4 any phrase introduced by the terms **including, include, in particular** or any similar expression shall be construed as illustrative and shall not limit the sense of the words preceding those terms; and

1.2.5 a reference to **writing** or **written** includes faxes and e-mails.

2. **BASIS OF CONTRACT**

2.1 The Order constitutes an offer by the Customer to purchase Goods and/or Services in accordance with these Conditions.

2.2 The Order shall only be deemed to be accepted when the Supplier issues the Order Confirmation at which point and on which date the Contract shall come into existence ("**Commencement Date**"). In the absence of an Order Confirmation then acceptance of delivery of the Goods by the Customer shall be deemed conclusive evidence of the Customers' acceptance of the Suppliers Condition

2.3 The Contract constitutes the entire agreement between the parties. The Customer acknowledges that it has not relied on any statement, promise, representation, assurance or warranty made or given by or on behalf of the Supplier which is not set out in the Contract.

2.4 Any samples, drawings, descriptive matter or advertising issued by the Supplier and any descriptions of the Goods or illustrations or descriptions of the Services contained in the Supplier's catalogues or brochures are issued or published for the sole purpose of giving an approximate idea of the Services and/or Goods described in them. They shall not form part of the Contract or have any contractual force.

2.5 These Conditions apply to the Contract to the exclusion of any other terms that the Customer seeks to impose or incorporate, or which are implied by trade, custom, practice or course of dealing. Any variation must be authorised by a director of the Supplier in writing.

2.6 Any quotation given by the Supplier shall not constitute an offer, and is only valid for a period of 20 Business Days from its date of issue.

2.7 All of these Conditions shall apply to the supply of both Goods and Services except where application to one or the other is specified.

3. **GOODS**

- 3.1 The Goods are described in the Supplier's catalogue as modified by any applicable Goods Specification **OR** the Goods Specification as set out in the Order Confirmation.
- 3.2 To the extent that the Goods are to be manufactured in accordance with a Goods Specification or using material supplied by the Customer, the Customer shall indemnify the Supplier against all liabilities, costs, expenses, damages and losses (including any direct, indirect or consequential losses, loss of profit, loss of reputation and all interest, penalties and legal and other reasonable professional costs and expenses) suffered or incurred by the Supplier in connection with any claim made against the Supplier for actual or alleged infringement of a third party's intellectual property rights arising out of or in connection with the Supplier's use of the Goods Specification. This clause 3.2 shall survive termination of the Contract.
- 3.3 The Supplier reserves the right to amend the specification of the Goods **OR** Goods Specification if required by any applicable statutory or regulatory requirements.
- 3.4 The Customer shall be responsible for checking the Goods Specification meets its requirements before the Supplier commences manufacture or supply of the Goods.

4. **DELIVERY OF GOODS**

- 4.1 The Supplier shall ensure that:
- 4.1.1 each delivery of the Goods is accompanied by a delivery note which shows the date of the Order, all relevant Customer and Supplier reference numbers, the type and quantity of the Goods (including the code number of the Goods, where applicable), special storage instructions (if any) and, if the Order is being delivered by instalments, the outstanding balance of Goods remaining to be delivered; and
 - 4.1.2 if the Supplier requires the Customer to return any packaging material to the Supplier, that fact is clearly stated on the delivery note. The Customer shall make any such packaging materials available for collection at such times as the Supplier shall reasonably request. Returns of packaging materials shall be at the Supplier's expense.
- 4.2 The Goods shall be delivered to the delivery address stated in the Order Confirmation ("**Delivery Location**") from which the Customer must collect, unless

alternative delivery arrangements are organised and agreed with the Supplier and set out in the Order Confirmation, within three Business Days of the Supplier notifying the Customer that the Goods are ready, unless otherwise agreed by the Supplier.

- 4.3 Delivery of the Goods shall be completed on the completion of loading of the Goods at the Delivery Location. As the risk in the Goods shall pass to the Customer upon such delivery taking place and so the Customer should effect the appropriate insurance at its cost.
- 4.4 Any dates quoted for delivery of the Goods are approximate only, and the time of delivery is not of the essence and shall not be made so by the service of any notice by the Customer. The Supplier shall not be liable for any delay in delivery of the Goods that is caused by a Force Majeure Event or the Customer's failure to pay any deposit or prepayment or instalment of the Price due prior to delivery or to provide the Supplier with adequate delivery instructions or any other instructions that are relevant to the supply of the Goods. Likewise if any special items or materials are required by the Customer for the manufacture of the Goods, which are to be supplied by a third party, any dates for delivery shall be so extended to allow for this delivery by such third party and the time for manufacturing the Goods shall likewise be so extended.
- 4.5 If the Supplier fails to deliver the Goods, its liability shall be limited to the costs and expenses incurred by the Customer in obtaining replacement goods of similar description and quality in the cheapest market available, less the price of the Goods. The Supplier shall have no liability for any failure to deliver the Goods to the extent that such failure is caused by a Force Majeure Event the Customer's failure to provide the Supplier with adequate delivery instructions for the Goods or any relevant instruction related to the supply of the Goods.
- 4.6 If the Customer fails to accept or take delivery of the Goods within 10 Business Days of the Supplier notifying the Customer that the Goods are ready, then except where such failure or delay is caused by a Force Majeure Event or by the Supplier's failure to comply with its obligations under the Contract in respect of the Goods:
 - 4.6.1 delivery of the Goods shall be deemed to have been completed at 9.00 am on the 10th Business Day following the day on which the Supplier notified the Customer that the Goods were ready; and
 - 4.6.2 the Supplier shall store the Goods until delivery takes place, and charge the Customer for all related costs and expenses (including insurance).

- 4.7 If 10 Business Days after the Supplier notified the Customer that the Goods were ready for delivery the Customer has not accepted delivery of them, the Supplier may resell or otherwise dispose of part or all of the Goods and, after deducting reasonable storage and selling costs, account to the Customer for any excess over the price of the Goods or charge the Customer for any shortfall below the price of the Goods.
- 4.8 The Customer shall not be entitled to reject the Goods if the Supplier delivers up to and including 5 per cent more or less than the quantity of Goods ordered, but a pro-rata adjustment shall be made to the Order invoice on receipt of notice from the Customer that the wrong quantity of Goods was delivered.
- 4.9 The Supplier may deliver the Goods by instalments, which shall be invoiced and paid for separately. Each instalment shall constitute a separate contract. Any delay in delivery or defect in an instalment shall not entitle the Customer to cancel any other instalment.

5. **QUALITY OF GOODS**

- 5.1 The Supplier warrants that on delivery, and for the applicable periods set out in the attached schedule (“**warranty periods**”) from the date of delivery, the Goods shall:
- 5.1.1 conform in all material respects with their description and any applicable Goods Specification;
 - 5.1.2 be free from material defects in design, material and workmanship;
 - 5.1.3 be of satisfactory quality (within the meaning of the Sale of Goods Act 1979); and
 - 5.1.4 be fit for any purpose held out by the Supplier,
- PROVIDED the Goods are used in accordance with the Supplier's technical guidelines and instructions manuals and/or where applicable the relevant European/UK standards.
- 5.2 If and to the extent that any warranty given by a third party manufacturer in respect of the Goods can be assigned, the Supplier will pass these onto the Customer.
- 5.3 Subject to clause 5.4, if:
- 5.3.1 the Customer gives notice in writing during the applicable warranty periods within a reasonable time of discovery that some or all of the Goods do not comply with the warranty set out in clause 5.1;

- 5.3.2 the Supplier is given a reasonable opportunity of examining such Goods; and
- 5.3.3 the Customer (if asked to do so by the Supplier) returns such Goods to the Supplier's place of business at the Supplier's cost,

the Supplier shall, at its option, repair or replace the defective Goods, or refund the price of the defective Goods in full.
- 5.4 The Supplier shall not be liable for the Goods' failure to comply with the warranty in clause 5.1 if:
 - 5.4.1 the Customer makes any further use of such Goods after giving a notice in accordance with clause 5.3;
 - 5.4.2 the defect arises because the Customer failed to follow the Supplier's oral or written instructions as to the construction of the base for the installation of the Goods, storage, installation or assembly of the Goods, commissioning, use or maintenance of the Goods, and/or to follow any service manual or other written instructions of the Supplier, or (if there are none) good trade practice;
 - 5.4.3 the defect arises as a result of the Supplier following any drawing, design or Goods Specification or use of material or other goods supplied by the Customer;
 - 5.4.4 the Customer or any third party installs, fits, assembles or alters such Goods other than in accordance with the Supplier's instruction manuals, or otherwise attempts to repair such Goods;
 - 5.4.5 the defect arises as a result of fair wear and tear, wilful damage, negligence, or abnormal working conditions;
 - 5.4.6 the Goods differ from the Goods Specification as a result of changes made to ensure they comply with applicable statutory or regulatory standards;
 - 5.4.7 the Customer provided the Supplier with incorrect and/or incomplete information, including but not limited to information relating to the prevailing weather conditions of the location of the installation of the Goods, the stability of the base for the installation or other environmental or external influences;

- 5.4.8 the Customer using unauthorised chemicals or controls for controlling weeds or other chemicals such as fertilisers which have a toxic effect on the Goods;
- 5.4.9 the Customer using damaged or defective components for attachment to the Goods in installation or otherwise not following the Supplier's recommendations as to installation; or
- 5.4.10 the Customer uses other goods or material not supplied by the Supplier.
- 5.5 Except as provided in this clause 5, the Supplier shall have no liability to the Customer in respect of the Goods' failure to comply with the warranty set out in clause 5.1 or any third party manufacturer warranty.
- 5.6 The terms of these Conditions shall apply to any repaired or replacement Goods supplied by the Supplier under clause 5.3.
- 6. **TITLE AND RISK**
- 6.1 The risk in the Goods shall pass to the Customer on completion of delivery.
- 6.2 Title to the Goods shall not pass to the Customer until the Supplier has received payment in full (in cash or cleared funds) for:
 - 6.2.1 the Goods; and
 - 6.2.2 any other goods that the Supplier has supplied to the Customer in respect of which payment has become due.
- 6.3 Until title to the Goods has passed to the Customer, the Customer shall:
 - 6.3.1 hold the Goods on a fiduciary basis as the Supplier's bailee;
 - 6.3.2 store the Goods separately from all other goods held by the Customer so that they remain readily identifiable as the Supplier's property;
 - 6.3.3 not remove, deface or obscure any identifying mark or packaging on or relating to the Goods;
 - 6.3.4 maintain the Goods in satisfactory condition and keep them insured against all risks for their full price on the Supplier's behalf from the date of delivery;
 - 6.3.5 notify the Supplier immediately if it becomes subject to any of the events listed in clause 13.2.2 to clause 13.2.13; and

6.3.6 give the Supplier such information relating to the Goods as the Supplier may require from time to time,

but the Customer may resell or use the Goods in the ordinary course of its business.

6.4 If before title to the Goods passes to the Customer the Customer becomes subject to any of the events listed in clause 13.2.2 to clause 13.2.13, or the Supplier reasonably believes that any such event is about to happen and notifies the Customer accordingly, then, provided the Goods have not been resold, or irrevocably incorporated into another product, and without limiting any other right or remedy the Supplier may have, the Supplier may at any time require the Customer to deliver up the Goods and, if the Customer fails to do so promptly, enter any premises of the Customer or of any third party where the Goods are stored in order to recover them.

7. **SUPPLY OF SERVICES**

7.1 The Supplier shall provide the Services to the Customer in accordance with the Service Specification in all material respects.

7.2 The Supplier shall use all reasonable endeavours to meet any performance dates for the Services specified in the Order Confirmation , but any such dates shall be estimates only and time shall not be of the essence for the performance of the Services.

7.3 The Supplier shall have the right to make any changes to the Services which are necessary to comply with any applicable law or safety requirement, or which do not materially affect the nature or quality of the Services, and the Supplier shall notify the Customer in any such event.

7.4 The Supplier warrants to the Customer that the Services will be provided using reasonable care and skill.

8. **CUSTOMER'S OBLIGATIONS**

8.1 The Customer shall:

8.1.1 ensure that the terms of the Order and (if submitted by the Customer) the Goods Specification are complete and accurate;

8.1.2 co-operate with the Supplier in all matters relating to the Services;

- 8.1.3 provide the Supplier, its employees, agents, consultants and subcontractors, with access to the Customer's premises, office accommodation and other facilities as reasonably required by the Supplier to provide the Services;
 - 8.1.4 provide the Supplier with such information and materials as the Supplier may reasonably require to supply the Services, and ensure that such information is accurate in all material respects;
 - 8.1.5 prepare the Customer's premises for the supply of the Services;
 - 8.1.6 obtain and maintain all necessary licences, permissions and consents which may be required for the Services before the date on which the Services are to start;
 - 8.1.7 keep and maintain all materials, equipment, documents and other property of the Supplier ("**Supplier Materials**") at the Customer's premises in safe custody at its own risk, maintain the Supplier Materials in good condition until returned to the Supplier, and not dispose of or use the Supplier Materials other than in accordance with the Supplier's written instructions or authorisation; and
- 8.2 If the Supplier's performance of any of its obligations in respect of the Goods and/or the Services is prevented or delayed by any act or omission by the Customer or failure by the Customer to perform any relevant obligation ("**Customer Default**"):
- 8.2.1 the Supplier shall without limiting its other rights or remedies have the right to suspend performance of the manufacture/and supply of the Goods/and or Services until the Customer remedies the Customer Default, and to rely on the Customer Default to relieve it from the performance of any of its obligations to the extent the Customer Default prevents or delays the Supplier's performance of any of its obligations;
 - 8.2.2 the Supplier shall not be liable for any costs or losses sustained or incurred by the Customer arising directly or indirectly from the Supplier's failure or delay to perform any of its obligations as set out in this clause 8.2; and
 - 8.2.3 the Customer shall reimburse the Supplier on written demand for any costs or losses sustained or incurred by the Supplier arising directly or indirectly from the Customer Default.

9. CHARGES AND PAYMENT

- 9.1 The price for Goods shall be the price set out in the Order Confirmation or, if no price is quoted, the price set out in the Supplier's published price list as at the date of delivery. The price of the Goods is exclusive of VAT and any other tax or duty payable by the Customer and all costs and charges of packaging, insurance, transport of the Goods.
- 9.2 The charges for Services shall be on a time and materials basis:
- 9.2.1 the charges shall be calculated in accordance with the Supplier's standard daily fee rates, as published from time to time or as set out in the Order Confirmation;
 - 9.2.2 the Supplier's standard daily fee rates for each individual person are calculated on the basis of an eight-hour day from 8.00 am to 5.00 pm worked on Business Days;
 - 9.2.3 the Supplier shall be entitled to charge the Customer for any expenses reasonably incurred by the individuals whom the Supplier engages in connection with the Services including, but not limited to, travelling expenses, hotel costs, subsistence and any associated expenses, and for the cost of services provided by third parties and required by the Supplier for the performance of the Services, and for the cost of any materials.
 - 9.2.4 Any delivery charges, packaging, insurance and transport costs are extra and where applicable shall be specified in the Order Confirmation.
- 9.3 The Supplier reserves the right to:
- 9.3.1 increase its standard daily fee rates for the charges for the Services,
 - 9.3.2 increase the price of the Goods and/or Service, by giving notice to the Customer at any time before delivery, to reflect any increase in the cost of the Goods and/or Services to the Supplier that is due to:
 - 9.3.2.1 any factor beyond the control of the Supplier (including foreign exchange fluctuations, increases in taxes and duties, and increases in labour, transport, materials and other manufacturing costs);

9.3.2.2 any request by the Customer to change the delivery date(s), quantities or types of Goods ordered, or the Goods Specification or the Services; or

9.3.2.3 any delay caused by any instructions of the Customer in respect of the Goods and/or the Services or failure of the Customer to give the Supplier adequate or accurate information or instructions in respect of the Goods and/or Services.

9.4 In respect of Goods the Supplier shall invoice the Customer on or at any time after completion of delivery. In respect of Services, the Supplier shall invoice the Customer monthly in arrears.

9.5 The Customer shall pay each invoice submitted by the Supplier:

9.5.1 For non-Credit Account Customers payment in full (cleared funds) is required before delivery and is payable immediately on receipt of the Order Confirmation

9.5.2 For Goods manufactured specially for the Customer, whether a Credit Account Customer or not, payment in full (cleared funds) is required or as set out in the Order Confirmation and is payable immediately on receipt of the Order Confirmation and before Production shall commence.

9.5.3 For a Customer who is a Credit Account Customer, a deposit as set out in the Order Confirmation is required to be paid immediately on receipt of the Order Confirmation and the balance of the price and any other payments as required by the terms set out in the Supplier' Order Confirmation or Invoice shall be paid

9.5.3.1 within 30 days of the date of the invoice; and

9.5.3.2 in full and in cleared funds to a bank account nominated in writing by the Supplier.

In all cases time for payment shall be of the essence of the Contract.

9.6 All amounts payable by the Customer under the Contract are exclusive of amounts in respect of value added tax chargeable from time to time ("**VAT**"). Where any taxable supply for VAT purposes is made under the Contract by the Supplier to the Customer, the Customer shall, on receipt of a valid VAT invoice from the Supplier,

pay to the Supplier such additional amounts in respect of VAT as are chargeable on the supply of the Services or Goods at the same time as payment is due for the supply of the Services or Goods.

- 9.7 If the Customer fails to make any payment due to the Supplier under the Contract by the due date for payment, then the Customer shall pay interest on the overdue amount at the rate of 8 % per annum above Nat West Bank PLC's base rate from time to time. Such interest shall accrue on a daily basis from the due date until actual payment of the overdue amount, whether before or after judgment. The Customer shall pay the interest together with the overdue amount.
- 9.8 The Customer shall pay all amounts due under the Contract in full without any set-off, counterclaim, deduction or withholding except as required by law. The Supplier may, without limiting its other rights or remedies, set off any amount owing to it by the Customer against any amount payable by the Supplier to the Customer.
- 9.9 In the case of any quotation issued by the Supplier the price of the Goods and/or Services shall be the Supplier's quoted price which shall be binding on the Supplier provided that the Customer shall accept the Supplier's quotation within 20 Business Days of the date of its issue. The price is exclusive of VAT which shall be due at the date falling on the date of the VAT invoice.
- 9.10 The Supplier may by giving notice to the Customer, at any time up to 20 Business Days before delivery increase the price of the Goods to reflect any increase in the cost of the Supplier which is due to factors occurring after the Commencement Date which are beyond the reasonable control of the Supplier (including, without limitation, foreign exchange fluctuation, taxes and duties and the cost of labour, materials and other manufacturing costs) PROVIDED that the Customer may cancel the Contract within 10 Business Days and before delivery is effected.

10. **INTELLECTUAL PROPERTY RIGHTS AND USE OF TRADE MARKS**

- 10.1 All Intellectual Property Rights in or arising out of or in connection with the Goods and/or Services shall be owned by the Supplier.
- 10.2 The Goods are sold and/or supplied subject to the rights of any person whether in respect of any patent, trade mark, registered design, copyright, confidential disclosure or otherwise howsoever to prevent or restrict the sale or use of the Goods in any part of the world; the Customer will in this respect accept such title to the Goods as the Supplier may have.
- 10.3 Where the Goods have been manufactured according to designs or configurations or processes specified or supplied by the Customer, the Customer represents and

warrants to the Supplier that the Goods so designed or configured and processes so used do not infringe the rights of any person whether in respect of any patent, trade mark, registered design, copyright, confidential disclosure or otherwise howsoever to prevent or restrict the sale or use of the Goods or materials or the use of such processes in any part of the world. The Customer shall indemnify the Supplier against all actions suits claims demands losses charges costs and expenses which the Supplier may suffer or incur in connection with any claim by any third party alleging facts which, if established, would indicate a breach of the representations and warranties contained in this clause 10.3

10.4 All Supplier Materials are the exclusive property of the Supplier.

11. **CONFIDENTIALITY**

11.1 A party ("**receiving party**") shall keep in strict confidence all technical or commercial know-how, specifications, inventions, processes or initiatives which are of a confidential nature and have been disclosed to the receiving party by the other party ("**disclosing party**"), its employees, agents or subcontractors, and any other confidential information concerning the disclosing party's business, its products and services which the receiving party may obtain. The receiving party shall only disclose such confidential information to those of its employees, agents and subcontractors who need to know it for the purpose of discharging the receiving party's obligations under the Contract, and shall ensure that such employees, agents and subcontractors comply with the obligations set out in this clause as though they were a party to the Contract. The receiving party may also disclose such of the disclosing party's confidential information as is required to be disclosed by law, any governmental or regulatory authority or by a court of competent jurisdiction. This clause 11 shall survive termination of the Contract.

12. **LIMITATION OF LIABILITY: THE CUSTOMER'S ATTENTION IS PARTICULARLY DRAWN TO THIS CLAUSE AND THE CUSTOMER SHOULD ARRANGE ITS OWN INSURANCE.**

The Suppliers price are set on the basis of the limitation of liability as set out in this condition 12.

The Customers may request the Supplier to provide a higher level of cover by means of an insurance policy provided it is available and, the Customer supplies such information as the Insurer requires and the Customer pays the additional costs of such insurance.

12.1 Nothing in these Conditions shall limit or exclude the Supplier's liability for:

- 12.1.1 death or personal injury caused by its negligence, or the negligence of its employees, agents or subcontractors;
 - 12.1.2 fraud or fraudulent misrepresentation;
 - 12.1.3 breach of the terms implied by section 2 of the Supply of Goods and Services Act 1982 (title and quiet possession);
 - 12.1.4 breach of the terms implied by section 12 of the Sale of Goods Act 1979 (title and quiet possession); or
 - 12.1.5 defective products under the Consumer Protection Act 1987.
- 12.2 Subject to clause 12.1:
- 12.2.1 the Supplier shall under no circumstances whatever be liable to the Customer, whether in contract, tort (including negligence), breach of statutory duty, or otherwise, for any loss of profit, or any indirect or consequential loss arising under or in connection with the Contract ; and
 - 12.2.2 the Supplier's total liability to the Customer in respect of all other losses arising under or in connection with the Contract, whether in contract, tort (including negligence), breach of statutory duty, or otherwise, shall in no circumstances exceed the price of the Goods and/or Services.
- 12.3 The terms implied by sections 13 to 15 of the Sale of Goods Act 1979 and the terms implied by sections 3 to 5 of the Supply of Goods and Services Act 1982 are, to the fullest extent permitted by law, excluded from the Contract.
- 12.4 This clause 12 shall survive termination of the Contract.

13. **TERMINATION**

- 13.1 Subject to clause 13.6, and without limiting its other rights or remedies either party may terminate the Contract by giving the other party not less than 20 Business Days written notice.
- 13.2 Without limiting its other rights or remedies, each party may terminate the Contract with immediate effect by giving written notice to the other party if:

- 13.2.1 the other party commits a material breach of its obligations under this Contract and (if such breach is remediable) fails to remedy that breach within 20 Business Days after receipt of notice in writing to do so;
- 13.2.2 the other party suspends, or threatens to suspend, payment of its debts or is unable to pay its debts as they fall due or admits inability to pay its debts or (being a company or limited liability partnership) is deemed unable to pay its debts within the meaning of section 123 of the Insolvency Act 1986 or (being an individual) is deemed either unable to pay its debts or as having no reasonable prospect of so doing, in either case, within the meaning of section 268 of the Insolvency Act 1986 or (being a partnership) has any partner to whom any of the foregoing apply;
- 13.2.3 the other party commences negotiations with all or any class of its creditors with a view to rescheduling any of its debts, or makes a proposal for or enters into any compromise or arrangement with its creditors other than (where a company) for the sole purpose of a scheme for a solvent amalgamation of that other party with one or more other companies or the solvent reconstruction of that other party;
- 13.2.4 a petition is filed, a notice is given, a resolution is passed, or an order is made, for or in connection with the winding up of the other party (being a company) other than for the sole purpose of a scheme for a solvent amalgamation of the other party with one or more other companies or the solvent reconstruction of that other party;
- 13.2.5 the other party (being an individual) is the subject of a bankruptcy petition or order;
- 13.2.6 a creditor or encumbrancer of the other party attaches or takes possession of, or a distress, execution, sequestration or other such process is levied or enforced on or sued against, the whole or any part of its assets and such attachment or process is not discharged within 14 days;
- 13.2.7 an application is made to court, or an order is made, for the appointment of an administrator or if a notice of intention to appoint an administrator is given or if an administrator is appointed over the other party (being a company);

- 13.2.8 the holder of a qualifying charge over the assets of the other party (being a company) has become entitled to appoint or has appointed an administrative receiver;
 - 13.2.9 a person becomes entitled to appoint a receiver over the assets of the other party or a receiver is appointed over the assets of the other party;
 - 13.2.10 any event occurs, or proceeding is taken, with respect to the other party in any jurisdiction to which it is subject that has an effect equivalent or similar to any of the events mentioned in clause 13.2.2 to clause 13.2.9 (inclusive);
 - 13.2.11 the other party suspends, threatens to suspend, ceases or threatens to cease to carry on, all or substantially the whole of its business;
 - 13.2.12 the other party's financial position deteriorates to such an extent that in the Supplier's opinion the Customer's capability to adequately fulfil its obligations under the Contract has been placed in jeopardy; or
 - 13.2.13 the other party (being an individual) dies or, by reason of illness or incapacity (whether mental or physical), is incapable of managing his own affairs or becomes a patient under any mental health legislation.
- 13.3 Without limiting its other rights or remedies, the Supplier may terminate the Contract with immediate effect by giving written notice to the Customer if the Customer fails to pay any amount due under this Contract on the due date for payment.
- 13.4 Without limiting its other rights or remedies, the Supplier may suspend the supply of Services or all further deliveries of Goods under the Contract or any other contract between the Customer and the Supplier if the Customer fails to pay any amount due under this Contract on the due date for payment, the Customer becomes subject to any of the events listed in clause 13.2.2 to clause 13.2.13, or the Supplier reasonably believes that the Customer is about to become subject to any of them.
- 13.5 On termination of the Contract for any reason:
- 13.5.1 the Customer shall immediately pay to the Supplier all of the Supplier's outstanding unpaid invoices and interest and, in respect of Services supplied but for which no invoice has yet been submitted, the Supplier shall submit an invoice, which shall be payable by the Customer immediately on receipt;

- 13.5.2 the Customer shall return all of the Supplier Materials and any Deliverables which have not been fully paid for. If the Customer fails to do so, then the Supplier may enter the Customer's premises and take possession of them. Until they have been returned, the Customer shall be solely responsible for their safe keeping and will not use them for any purpose not connected with this Contract;
- 13.5.3 the accrued rights and remedies of the parties as at termination shall not be affected, including the right to claim damages in respect of any breach of the Contract which existed at or before the date of termination or expiry; and
- 13.5.4 clauses which expressly or by implication have effect after termination shall continue in full force and effect.
- 13.6 Where the Goods are manufactured specially for the Customer, then the Customer shall not be entitled to terminate the Contract in accordance with clause 13.1, without the Supplier's written agreement and on terms that the Customer shall indemnify the Supplier in full against all loss (including loss of profit), costs (including the cost of all labour and materials used) damages, charges and expenses of whatsoever nature incurred by the Supplier as a result of the cancellation.
14. **FORCE MAJEURE**
- 14.1 For the purposes of this Contract, "**Force Majeure**" **Event** means an event beyond the reasonable control of the Supplier including but not limited to strikes, lock-outs or other industrial disputes (whether involving the workforce of the Supplier or any other party), failure of a utility service or transport network, act of God, war, riot, civil commotion, malicious damage, compliance with any law or governmental order, rule, regulation or direction, accident, breakdown of plant or machinery, fire, flood, storm or default of suppliers or subcontractors.
- 14.2 The Supplier shall not be liable to the Customer as a result of any delay or failure to perform its obligations under this Contract as a result of a Force Majeure Event.
- 14.3 If the Force Majeure Event prevents the Supplier from providing any of the Services and/or Goods for more than 26 weeks, the Supplier shall, without limiting its other rights or remedies, have the right to terminate this Contract immediately by giving written notice to the Customer.

15. **GENERAL**

15.1 **Assignment and other dealings.**

- 15.1.1 The Supplier may at any time assign, transfer, mortgage, charge, subcontract or deal in any other manner with all or any of its rights under the Contract and may subcontract or delegate in any manner any or all of its obligations under the Contract to any third party.
- 15.1.2 Except as set out in clause 15.1.3, the Customer shall not, without the prior written consent of the Supplier, assign, transfer, charge, subcontract, declare a trust over or deal in any other manner with all or any of its rights or obligations under the Contract.
- 15.1.3 The Customer (and subsequent owners of the Goods), after having given prior written notice to the Supplier of the transfer of ownership of the Goods and the new owner's contact details, may pass on the warranties in clause 5.1 and clause 5.2 (provided such third party manufacturer warranty is capable of assignment) to subsequent owners of the Goods.

15.2 **Notices.**

- 15.2.1 Any notice or other communication given to a party under or in connection with this Contract shall be in writing, addressed to that party at its registered office (if it is a company) or its principal place of business (in any other case) or such other address as that party may have specified to the other party in writing in accordance with this clause, and shall be delivered personally or sent by prepaid first-class post or other next working day delivery service, or by commercial courier, fax or e-mail.
- 15.2.2 A notice or other communication shall be deemed to have been received: if delivered personally, when left at the address referred to in clause 12.2(a); if sent by pre-paid first class post or other next working day delivery service, at 9.00 am on the second Business Day after posting; if delivered by commercial courier, on the date and at the time that the courier's delivery receipt is signed; or, if sent by fax or e-mail, one Business Day after transmission.
- 15.2.3 The provisions of this clause shall not apply to the service of any proceedings or other documents in any legal action

15.3 **Severance.**

15.3.1 If any provision or part-provision of the Contract is or becomes invalid, illegal or unenforceable, it shall be deemed modified to the minimum extent necessary to make it valid, legal and enforceable. If such modification is not possible, the relevant provision or part-provision shall be deemed deleted. Any modification to or deletion of a provision or part-provision under this clause shall not affect the validity and enforceability of the rest of the Contract.

15.3.2 If one party gives notice to the other of the possibility that any provision or part-provision of this Contract is invalid, illegal or unenforceable, the parties shall negotiate in good faith to amend such provision so that, as amended, it is legal, valid and enforceable, and, to the greatest extent possible, achieves the intended commercial result of the original provision.

15.4 **Waiver.** A waiver of any right under the Contract or law is only effective if it is in writing and shall not be deemed to be a waiver of any subsequent breach or default. No failure or delay by a party in exercising any right or remedy under the Contract or by law shall constitute a waiver of that or any other right or remedy, nor prevent or restrict its further exercise of that or any other right or remedy. No single or partial exercise of such right or remedy shall prevent or restrict the further exercise of that or any other right or remedy.

15.5 **No partnership or agency.** Nothing in the Contract is intended to, or shall be deemed to, establish any partnership or joint venture between any of the parties, nor constitute either party the agent of another party for any purpose. Neither party shall have authority to act as agent for, or to bind, the other party in any way.

15.6 **Third parties.** A person who is not a party to the Contract shall not have any rights to enforce its terms.

15.7 **Variation.** Except as set out in these Conditions, no variation of the Contract, including the introduction of any additional terms and conditions shall be effective unless it is agreed in writing and signed by the Supplier.

15.8 **Governing law.** This Agreement and any dispute or claim arising out of or in connection with it or its subject matter or formation (including non-contractual disputes or claims) shall be governed by and construed in accordance with the law of England and Wales.

- 15.9 **Jurisdiction** Each party irrevocably agrees that the courts of England and Wales shall have exclusive jurisdiction to settle any dispute or claim arising out of or in connection with this Contract or its subject matter or formation (including non-contractual disputes or claims).

WARRANTY PERIODS

Van der Valk Products only

1.	Pitched Roof System	10 years
2.	Flat Roof System	10 years
3.	Field System	10 years
4.	Tracker Field System:	
4.1	Static parts	10 years
4.2	Dynamic parts	5 years
4.3	Actuator (factory guarantee)	5 years
4.4	Control unit (factory guarantee)	3 years

March 2020

Hi-MO 5m

LR5-66HIH 485~505M

- Based on M10-182mm wafer, best choice for ultra-large power plants
- Advanced module technology delivers superior module efficiency
 - M10 Gallium-doped Wafer
 - Smart Soldering
 - 9-busbar Half-cut Cell
- Excellent outdoor power generation performance
- High module quality ensures long-term reliability



12-year Warranty for
Materials and Processing



25-year Warranty for Extra
Linear Power Output

Complete System and Product Certifications

IEC 61215, IEC 61730, UL 61730

ISO9001:2015: ISO Quality Management System

ISO14001: 2015: ISO Environment Management System

ISO45001: 2018: Occupational Health and Safety

TS62941: Guideline for module design qualification and type approval

LONGi



21.5%
MAX MODULE
EFFICIENCY

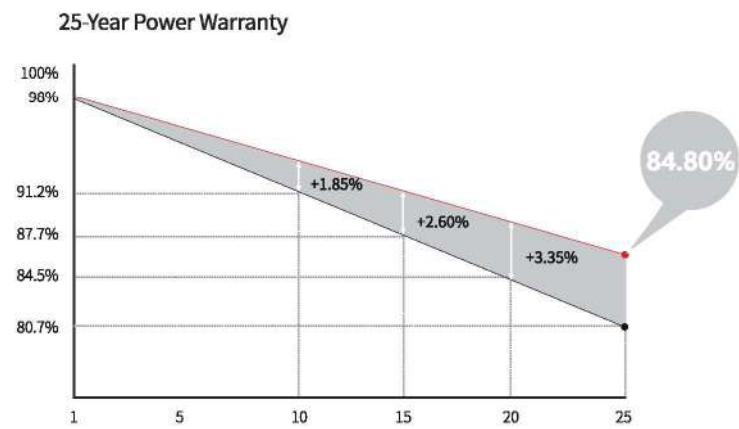
0~3%
POWER
TOLERANCE

<2%
FIRST YEAR
POWER DEGRADATION

0.55%
YEAR 2-25
POWER DEGRADATION

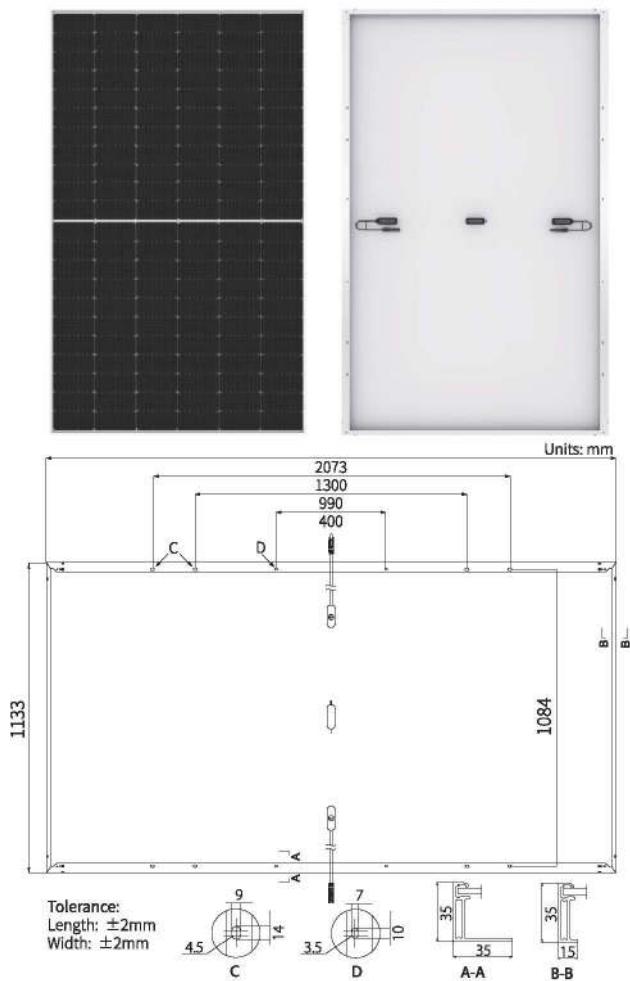
HALF-CELL
Lower operating temperature

Additional Value



Mechanical Parameters

Cell Orientation	132 (6×22)
Junction Box	IP68, three diodes
Output Cable	4mm², +400, -200mm length can be customized
Glass	Single glass, 3.2mm coated tempered glass
Frame	Anodized aluminum alloy frame
Weight	25.1kg
Dimension	2073×1133×35mm
Packaging	31pcs per pallet / 155pcs per 20' GP / 682pcs per 40' HC



Electrical Characteristics	STC : AM1.5 1000W/m² 25°C				NOCT : AM1.5 800W/m² 20°C 1m/s				Test uncertainty for Pmax: ±3%	
	LR5-66HIH-485M		LR5-66HIH-490M		LR5-66HIH-495M		LR5-66HIH-500M		LR5-66HIH-505M	
Module Type	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	485	362.5	490	366.3	495	370.0	500	373.7	505	377.5
Open Circuit Voltage (Voc/V)	45.10	42.41	45.25	42.55	45.40	42.69	45.55	42.83	45.70	42.97
Short Circuit Current (Isc/A)	13.67	11.05	13.74	11.11	13.82	11.17	13.90	11.24	13.97	11.30
Voltage at Maximum Power (Vmp/V)	37.93	35.23	38.08	35.37	38.23	35.51	38.38	35.65	38.53	35.79
Current at Maximum Power (Imp/A)	12.79	10.29	12.87	10.35	12.95	10.42	13.03	10.48	13.11	10.55
Module Efficiency(%)	20.6		20.9		21.1		21.3		21.5	

Operating Parameters

Operational Temperature	-40°C ~ +85°C
Power Output Tolerance	0~3%
Voc and Isc Tolerance	±3%
Maximum System Voltage	DC1500V (IEC/UL)
Maximum Series Fuse Rating	25A
Nominal Operating Cell Temperature	45±2°C
Protection Class	Class II
Fire Rating	UL type 1 or 2 IEC Class C

Mechanical Loading

Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

Temperature Ratings (STC)

Temperature Coefficient of Isc	+0.050%/°C
Temperature Coefficient of Voc	-0.265%/°C
Temperature Coefficient of Pmax	-0.340%/°C

Limited Warranty for Solar Modules

(Single Glass Series)

V08_20190901

This Limited Warranty is suitable for the following LONGI Modules model	
LR6-60PE-xxxM	LR6-72PE-xxxM
LR6-60PH-xxxM	LR6-72PH -xxxM
LR6-60PB-xxxM	LR6-72PB -xxxM
LR6-60HP-xxxM	LR6-72HP-xxxM
LR6-60HPH-xxxM	LR6-72HPH-xxxM
LR6-60HPB-xxxM	LR6-72HPB-xxxM
LR6-66HP-xxxM	LR6-78HP-xxxM
LR6-66HPH-xxxM	LR6-78HPH-xxxM
LR6-66HPB-xxxM	LR6-78HPB-xxxM
<i>LR6-60HIH-xxxM</i>	<i>LR6-72HIH-xxxM</i>
<i>LR6-60HIB-xxxM</i>	
<i>LR4-60HPH-xxxM</i>	<i>LR4-72HPH-xxxM</i>
<i>LR4-60HIH-xxxM</i>	<i>LR4-72HIH-xxxM</i>
<i>LR4-60HPB-xxxM</i>	<i>LR4-60HIB-xxxM</i>

Supplier is committed to the following quality performance warranty for solar modules (hereinafter referred to as “modules”). The Product Warranty Term starts as of the delivery date as per INCOTERMS 2010 or 6 months after the modules are shipped out of the production plant, which the earlier date shall be effective (hereinafter short as the “Warranty Effective Date”).

1. Limited Product Warranty-Repair or Replacement within 10 years

Supplier assures that under the conditions for regular application, installation, use and service, the integral module (including attached DC connectors, cables) can meet the demand of regular application, use and installation and have no defect caused by material and process within 120 months as of the Warranty Effective Date. If the modules get out of order or fail to operate due to material or process defects within 120 months as of the Warranty Effective Date, Supplier provides remedy, only repairing and replacing the failed modules after verification and confirmation by an independent testing institution agreed by Supplier and the customer in advance. The remedy of repair or replacement is the exclusive measure within this “Limited Product Warranty”, which does not involve assurance for the module power output. The power output assurance is to be specially elaborated in the Section 2 “Limited Warranty for Peak Power” below.

2. Limited Warranty for Peak Power - Limited Compensation

Supplier provides power output loss assurance within 25 years as of the Warranty Effective Date. Power output loss is calculated by comparing the minimum “module nominal power under standard testing conditions” (short as nominal power) marked on the nameplate with the actual power output under standard testing conditions.

The annual attenuation is less than 2% within the 1st year from the Warranty Effective Date and is less than 0.55% from the 2nd year to the 25th year within the peak power warranty period. The output power can reach 84.8% in the last year of the 25-year peak power warranty period.

Supplier assures that any qualified module sold out can meet the power guarantee value mentioned above within 25 years of power warranty period from the Warranty Effective Date. If any power loss exceeds the guaranteed value verified by Supplier, and Supplier attributes such power loss to its material or process defects, or such power loss is further (required by customers) verified by the third party testing institution (agreed

by both the customer and Supplier), Supplier will make judgment at its discretion and take either remedial measures as (1) provide extra modules to make up for power loss as above; or (2) repair or replace the defected modules and provide the shipment free of charge to the initial delivery location.

The above-mentioned compensations in “Limited Warranty for Peak Power” are the sole and exclusive remedy measures.

Note: If any customer finds that the defective modules need to be returned before the treatment, the freight shall be borne on the customer. If the third party testing institution confirms that it is the responsibility within the scope of Supplier quality warranty, the shipping cost can be compensated as per the freight or related invoice provided by the customer.

3. Exceptions and Restrictions

(a) All quality warranty claims shall be submitted to Supplier or Supplier authorized distributors in written form within but not beyond the warranty period in any cases.

(b) “Limited Product Warranty” and “ Limited Warranty for Peak Power” do not apply to modules in situations below:

- Improper use, misuse, negligence, intentional damage or accidents;
- Fabrication without permission, improper installation or application;
- The customers move the installed module or change the location of the module installed without any prior written consent or authorization by the supplier.
- Fail to follow the repair and recovery instructed by the producer;
- Fail to follow the Supplier maintenance instructions;
- Power failure, power surge, lightning, fire and flood, accidental damage or force majeure.

(c) “Limited Product Warranty” and “Limited Warranty for Peak Power” do not compensate costs as, any costs related to module installation, demounting and re-installation (except for those stated in the last part of Section 5) or custom clearance costs and other costs related to return and replacement of modules.

(d) Claims will be rejected if the module model and serial number labels are falsified, removed or blurred without written authorization by Supplier.

4. Quality Warranty Scope

Unless Supplier agrees on and signs and recognizes other obligations and liabilities in written form, the warranty clauses in this quality warranty will replace and exclude other explicit or implied assurances including but not limited to the merchantability assurance, or assurance for special purposes or applications, and other obligations and liabilities undertaken by Supplier. Supplier shall not be responsible for human injury or property losses nor for other losses or injuries caused by modules or module-related problems (including but not limited to any module defect or any defect caused by use and installation). Supplier shall not compensate any collateral damages, derived damages or special damages by any cause. Losses such as profit loss, production loss or revenue loss caused by product faults are excluded hereby. If Supplier makes compensation for customers, the accumulated compensation amount shall not exceed the invoicing price for a single module paid by the customer.

5. Quality Warranty Performance

If any customer proposes legitimate quality warranty requirements in accordance with the “Limited Product Warranty”, they shall send a written notice by registered letter to Supplier at the address below or send email to Supplier email address. The customer shall attach proof of quality warranty herewith, corresponding module serial number and purchasing date and provide the invoice marked with clear purchasing date, price, module model and Supplier seal or signature.

If modules need to be shipped to Supplier for testing, repair or replacement, Supplier shall provide the return merchandise authorization (RMA) to the customer. Supplier will not accept returned modules without RMA. With approval of the customer service department, the reasonable, normal and proved shipping cost (including return cost and re-shipping cost of repaired and replaced modules) of modules related to “Limited Product Warranty” and “Limited Warranty for Peak Power” will be compensated by Supplier to customers.

6. Transferability

The clauses of this “Quality Warranty” will cover end users and can be transferred to any successive owners if the module’s installation position is unchanged and the

inheritance or transferring relations can be sufficiently proved.

7. Severability of Clauses

Should a part or a clause of the “Quality Warranty” is considered invalid or ineffective or not executable, or this part or clause to some people or some conditions is deemed invalid or ineffective or not executable, this situation shall not affect effectiveness of other parts or clauses of the “Quality Warranty”. In this case, the other parts or clauses in this “Quality Warranty” or the applicability of this “Quality Warranty” are considered independently effective.

8. Dispute Resolution

If any dispute occurs with quality warranty claims, one of the domestic first-class testing institutions such as TÜV SUD, Intertek, UL, CQC and CGC shall be invited for verdict of the final claim. All the cost shall be borne by the losing party unless otherwise stipulated in the verdict. Supplier reserves the right for the final interpretation.

Further dispute resolutions shall be executed by the applicable legal jurisdiction agreed upon in the sales contract signed by both parties.

9. Alteration

The repair, replacement or the provision of extra modules does not mean that the warranty period is renewed and the original warranty period shall not extend. Any replaced modules are possessed by Supplier and shall be treated or disposed of at its own discretion. In case Supplier has stopped producing the same model as the defective modules which the claim is made against, Supplier shall keep the right to provide the modules of other models (different sizes, color, shape or power), either new brand or original brand.

10. Force Majeure

If Supplier fails to perform or postpone performing sales articles or this “Quality Warranty” in the event of fire, flood, storm, typhoon, lightning, natural disaster, change of public policies, terrorism, war, riot, strike, or unavailability of proper and sufficient labor and materials or due to any other reasons or situations out of control of Supplier, Supplier shall not take any responsibilities for customers or any third party. In this case, Supplier shall not take any responsibilities for end users or any third party in any form.

Note: “Peak power” is the maximum power of solar module under the standard testing

conditions (STC). Standard testing conditions refer to as:

- (a) Spectrum amplitude AM1.5
- (b) 1000W/m² irradiance
- (c) Irradiance at the correct angle and the cell temperature is 25°C.

Testing is done at the terminal of the junction box according to IEC61215 (equivalent to GB/T 9535). Supplier's calibration and testing standard are effective on the manufacturing date of the solar modules. Supplier's calibration standards are consistent with the approved standards by international institutions. During the period of 'Limited Warranty for Peak Power', measurement uncertainty shall be counted when determining module's output power, according to standard IEC 60904.

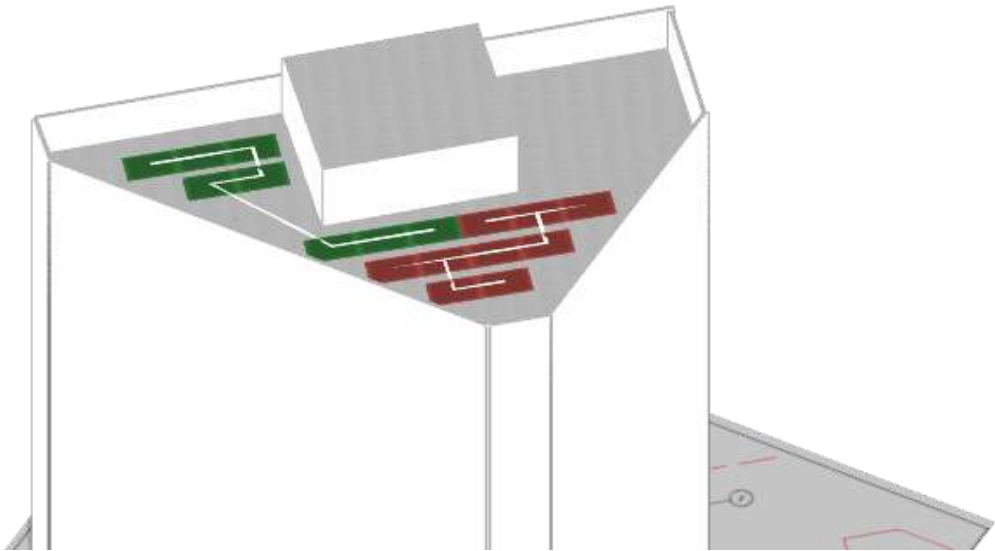
Block B, No.8989 Shangji Road, Xi'an Economic and Technological Development Zone, Xi'an, Shaanxi, China.

Tel: +86- 4009696199

Fax: +86-29-86686228

Postal code: 710018

Official website: en.longi-solar.com



Solar Access and Shade Report

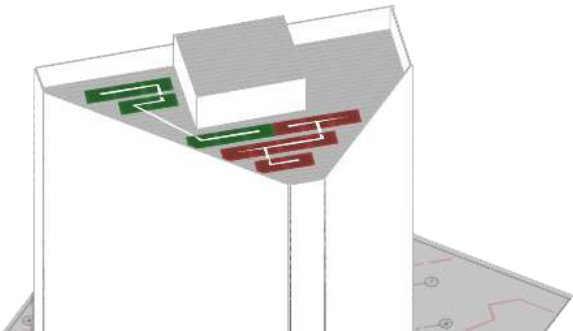
Customer Name	Customer
Report Author	Rob Banford
Contractor Name	Rob Banford
Address	12 Partridge Way, England N22 8DW, GB
Lat/Ion	51.60 / -0.12
Report Created	13th July 2023

Project Data	
System Size	8.500 kW (DC)
Array Count	2 Arrays
Module	17 x LR5-66HIH-500M (LONGi)
DC Optimizers	-
Inverter	1 x S5-GR3P8K (SOLIS - Ningbo Ginlong Technologies)
Expected Production	6415 kWh per year
Consumption Offset	183%
Overall Sun Access	92.0%
Overall TOF	81.7%
Overall TSRF	75.2%

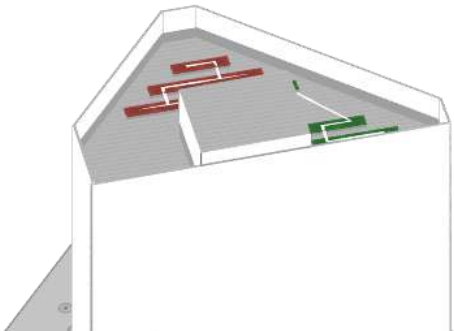
The sun access values shown in this report take into account of all 3 components of irradiance: direct, diffuse and reflected irradiance. Hence, the sun access value may be non-zero even if an object completely blocks out direct

irradiance from reaching the PV modules due to contributions from diffuse and reflected irradiance.

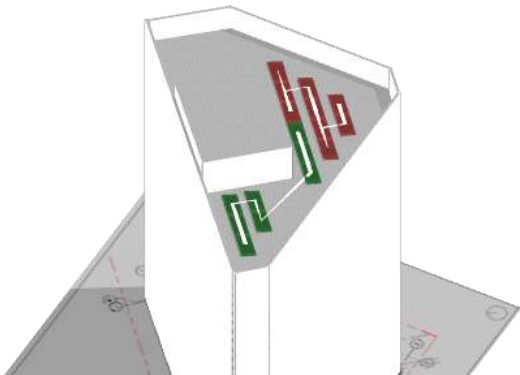
System Views



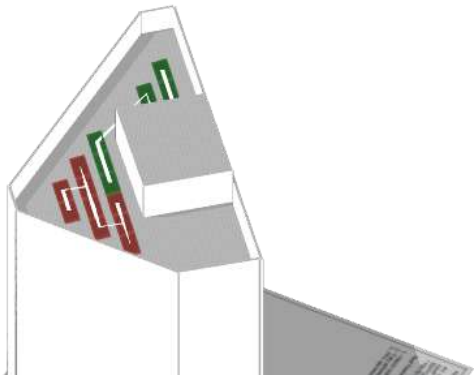
North view



South view



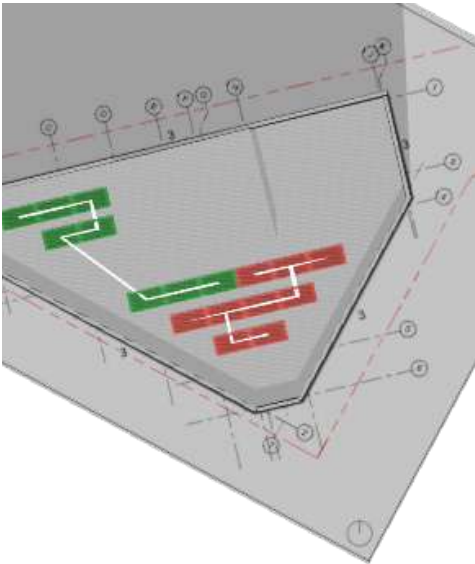
East view



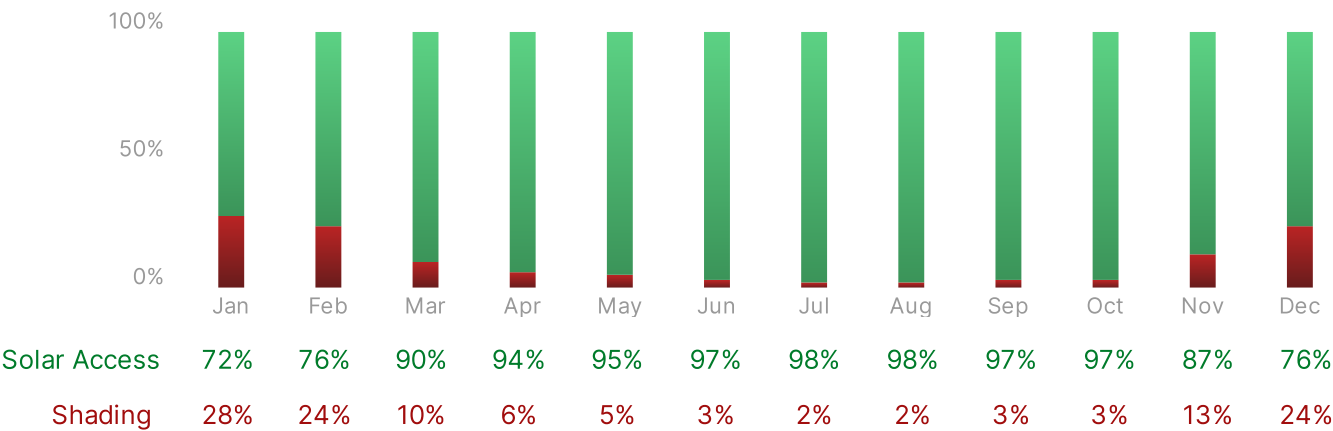
West view

Array 1

Array Size	6.000 kW (DC)
Module Manufacturer	Unknown
Module Count	12 x LR5-66HIH-500M
Tilt	10.0 degrees
Azimuth	167.0 degrees
Sun Access	93.7%
TOF	81.7%
TSRF	76.5%

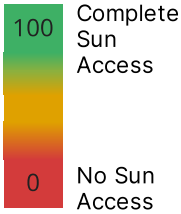


Monthly Solar Access and Shading Averages Solar Access



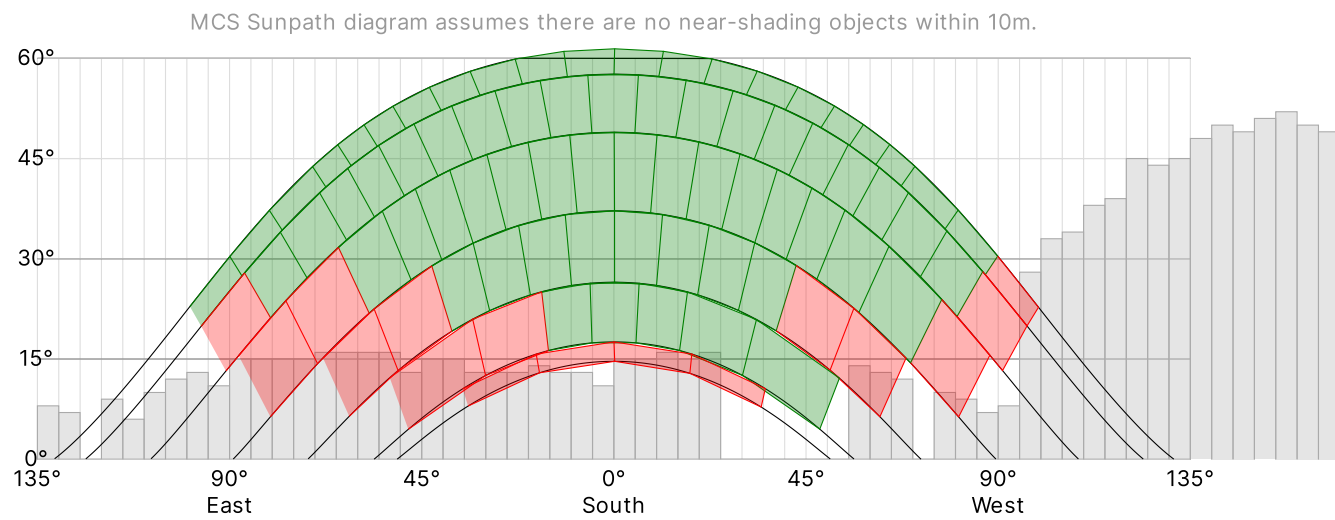
Hour by Month Sun Access Values

	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm
Jan	-	-	-	-	79	70	69	74	78	74	89	-	-	-	-	-
Feb	-	-	-	81	74	75	76	80	82	76	67	85	-	-	-	-
Mar	-	-	80	75	85	92	98	96	95	93	88	79	100	-	-	-
Apr	-	74	74	83	93	99	100	100	100	100	95	89	78	-	-	-
May	-	75	87	94	100	100	100	100	100	100	100	100	91	77	-	-
Jun	82	89	94	99	100	100	100	100	100	100	100	100	88	72	-	-
Jul	83	89	94	98	100	100	100	100	100	100	100	100	91	77	-	-
Aug	90	88	94	96	99	100	100	100	100	100	100	100	96	80	-	-
Sep	-	88	83	92	96	100	100	100	100	100	98	96	95	-	-	-
Oct	-	-	90	91	97	100	100	100	98	96	95	85	-	-	-	-
Nov	-	-	97	85	86	84	86	90	88	82	100	-	-	-	-	-
Dec	-	-	-	96	84	72	72	77	76	73	-	-	-	-	-	-



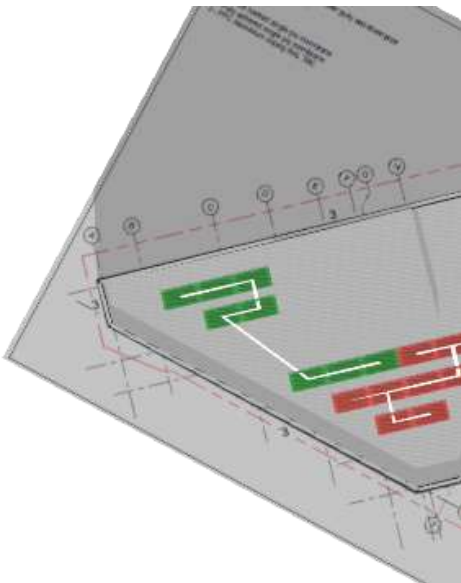
Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.

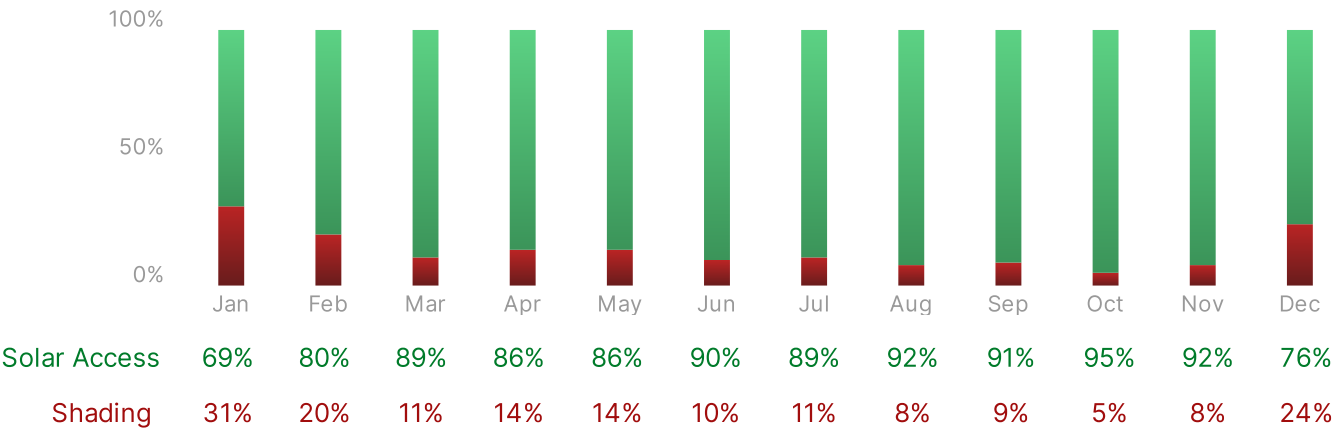


Array 2

Array Size	2.500 kW (DC)
Module Manufacturer	Unknown
Module Count	5 x LR5-66HIH-500M
Tilt	10.0 degrees
Azimuth	167.0 degrees
Sun Access	88.0%
TOF	81.7%
TSRF	71.9%

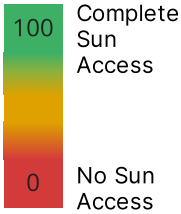


Monthly Solar Access and Shading Averages Solar Access



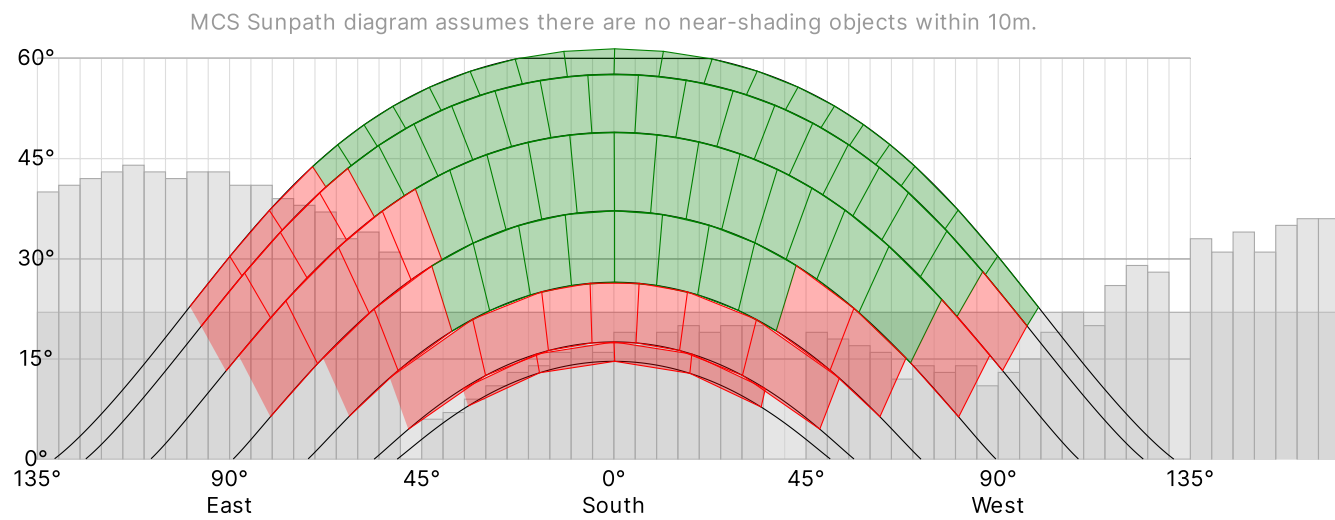
Hour by Month Sun Access Values

	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm
Jan	-	-	-	-	67	72	73	68	71	71	90	-	-	-	-	-
Feb	-	-	-	77	83	85	89	82	79	68	63	85	-	-	-	-
Mar	-	-	75	70	78	89	100	100	97	96	84	69	100	-	-	-
Apr	-	72	61	48	68	87	100	100	100	100	99	94	78	-	-	-
May	-	58	53	63	84	91	100	100	100	100	100	100	95	64	-	-
Jun	75	67	62	71	83	94	100	100	100	100	100	100	100	80	-	-
Jul	75	62	61	69	81	94	100	100	100	100	100	100	100	84	-	-
Aug	89	78	72	69	84	94	100	100	100	100	100	100	100	74	-	-
Sep	-	87	66	63	78	91	100	100	100	100	100	99	95	-	-	-
Oct	-	-	87	85	90	97	100	100	100	99	93	79	-	-	-	-
Nov	-	-	96	87	89	97	96	92	90	80	100	-	-	-	-	-
Dec	-	-	-	95	78	80	75	76	70	71	-	-	-	-	-	-



Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.





WARRANTY - EUROPE

Solis Inverters and accessories are manufactured by Ginlong Technologies Co., Ltd. (referred to as "Ginlong") which provides the following warranty to the purchaser (referred to as "Customer") of the inverters and accessories (referred to as "Products"). (Customer is deemed to be the owner of the installed Products at first sale.)

1. Warranty Terms

Ginlong warrants all Products to be free from defects in material and function under normal use and service from the date of sale to the Customer. This warranty extends the Customer's statutory rights and cannot be construed so as to diminish such statutory rights.

All grid tied inverters and RHI/RAI hybrid inverters receive: 5 Year warranty

(All 4G, 5G/SS & S6 Models)

All accessories receive: 2 Year warranty

(DL-S-W, S3-WFI-ST, S2-Logger, S3-LAN-ST, DLS-LAN, DLS-G, DLB-W, DLB-G, RF-Link, PLC-CCO, EPM1-5G, EPM3-5G, EMP3-5G-PLUS, 4G-CT, EXTERNAL METERS.)

For the duration of this period Ginlong guarantees the proper functions of the Products. The warranty shall be executed by the terms included here but not limited to PO/PI/CI of goods.

The warranty period begins when the Product is-

(1) Commissioned at the installation

Or

(2) 6 months after the Product is dispatched from the factory depending on which occurs first.

2. Warranty Extension

The Customer may apply for a warranty extension within 12 months of installation by providing the relevant inverter serial number along with proof of purchase. An extended warranty can be purchased to provide the following:

10 Years total

15 Years total

20 Years total

Warranty extension certificates will be provided to confirm the extension upon purchase.

Until further notice from 1st July 2020, the following countries automatically receive a 10-year warranty extension for grid tied inverters less or equal to 10kW in rating:

Holland, Belgium, France, Germany, Poland, Italy (Subject to change)

3. Warranty Limitations

The Warranty is valid only for Products purchased either directly from Ginlong or from an authorised reseller of Ginlong. The Warranty applies to brand new product only.

The Warranty does not cover:

- Access, labour or transport costs;
- Consequential damages including but not limited to loss of revenue;
- Claims by third parties other than the owner;
- If Products are damaged as a consequence of not installing in accordance with the installation instructions as contained within the Product installation manual. (Except where the installation is performed by Ginlong);
- Items ancillary to installation not supplied by Ginlong;
- Duties, import/export fees or costs and other general administrative costs;
- Damage to Products caused by misuse, improper handling or unauthorised modification;
- Loss or damage occurring whilst in transit;
- Accidental (for any damage or defect caused by lightning, flood, power surge, fire, pest damage, corrosion, actions of third parties or any other act of Force Majeure, event or accident outside Ginlong's reasonable control and not arising under normal and standard operating conditions;) or wilful damage;
- Any Products described in a quotation or delivery note as 'ex-display' or 'reconditioned'. (A separate Warranty extension may have been issued to cover such Products)
- If Products are not initially purchased from Ginlong or the authorised reseller of Ginlong;
- If Products are out of the warranty period;
- If the fault has been caused by another component in the warranty holder's photovoltaic system; or could not be identified upon examination of Products;
- The replaced Products have not been returned to Ginlong or the authorised reseller in time; unless the Products was installed correctly by a local grid company qualified installer and as per the installation instructions supplied with the Products or installed by Ginlong or the authorised reseller;
- Unless the warranty holder has paid in full all amounts owing to Ginlong by the warranty holder;
- If the defect occurs wholly or partially as a result of any act or omission by the warranty holder, or any person other than a person employed or sub-contracted by Ginlong;
- If the Products are not satisfactorily maintained, is subject to misuse, neglect, accident or abuse or the warranty holder continues to use the Products after the defect becomes apparent;
- If the Products are repaired, or any attempt to repair the Products are made, by anyone other

than authorised by Ginlong;

- If the Products are moved for any reason after it has been installed (regardless of whether the Products are subsequently reinstalled or moved back to the same location) unless the Products are reinstalled at the same address by a qualified installer and it is stored during any interim period in accordance with the Product manual;
- If the Products are altered or modified in any way (including if the Products' serial or identification number is altered, defaced or removed) unless such modification has been approved in writing by Ginlong;
- For any other fault which does not affect the basic performance of the Products, notwithstanding any external scratch or stain, or natural mechanical wearing which does not represent a defect or normal wear and tear;

4. Data Protection

If the Customers accept the warranty service provided by Ginlong, the Customers allow Ginlong to access, collect and process information related to failure, detection, identifying and debugging when providing services. Such information will only be used to provide warranty services. Since Customers are the controllers of such information, Ginlong cannot confirm whether such information contains confidential information or personal data of the Customers.

Customers should ensure that they will obtain or retain all necessary consent, permission and authorisation ("Consent") in accordance with applicable legal requirements for Ginlong to provide such service, so that Ginlong will not violate applicable legal requirements, Customers privacy policies, or Customer user-agreements in providing related services.

Ginlong will take reasonable measures to ensure the security of such Customer information, but Ginlong is not responsible for any direct or indirect liability caused by the acquisition and processing of such information in the process of providing services.

If the Customer returns the Products to Ginlong, it indicates that the Customer has backed up any confidential, private, personal or other information stored in the Products and has completely deleted such information from the Products, and authorises Ginlong to transfer the Products to the Ginlong service centre in other countries for maintenance. Customers shall be solely responsible for deleting the above information before delivering the hardware to Ginlong. They shall also further indemnify, defend and hold harmless Ginlong from and against any and all claims, liabilities, obligations, costs, expenses, penalties, fines, confiscations and ruling imposed by any government agency or third party as a result of Ginlong failing to comply with applicable laws and regulations in transferring and disposing of the above information.

Ginlong does not guarantee the data stored in the Products; the Customers are responsible for backing up relevant data to prevent loss.

5. Warranty Claims Procedure

To make a warranty claim the following information needs to be provided:

- Completed Warranty Claim Form – Provided by Solis Service Agent
- Products Model (ie. 4G 3.6kW) and Products Serial Number (ie.160D72198270017)
- Copy of the invoice for the inverter
- Copy of the installation report/certificate

If Ginlong receives a legitimate written claim, Ginlong shall, at its discretion:

- 1) Provide replacement Product; which will be functionally equivalent to the Customer's defective device (in terms of features, function, compatibility).
or
- 2) Instruct an accredited service provider to attend the Customer's premises and repair the defect or provide a replacement Product(s);
or
- 3) Direct the Customer to return the Products to Ginlong so that Ginlong may repair or provide a replacement Product(s).

Ginlong may, at its own discretion, use new or factory refurbished Products for replacement.

Ginlong may repair or replace faulty components at its discretion. If the Products or any part thereof is replaced by Ginlong under this limited warranty, all of the rights, title and interests in the replaced Products or parts, shall vest in Ginlong upon it being replaced.

Any Products replaced or repaired under this limited warranty will be covered by the Products' remaining warranty period, or three months, whichever is greater.

The warranty holder must return replaced parts or devices in the original packaging or equivalent.

If the replaced faulty part or device is not received by Ginlong within 30 days, the warranty holder will be charged for the part/device at the current price for a new part/device.

Labour, travel and delivery (to and from Customer) will be charged if Products returned are found to be not faulty following a warranty claim.

A claim for compensation cannot be made for any loss of profit, (including energy that has not been fed into the grid or energy that has not been used for self-consumption, etc.) In any case, whether in contract, tort or otherwise, the maximum compensation for Customer losses caused by its fault shall not exceed the amount paid by the Customer for the purchase of the equipment.

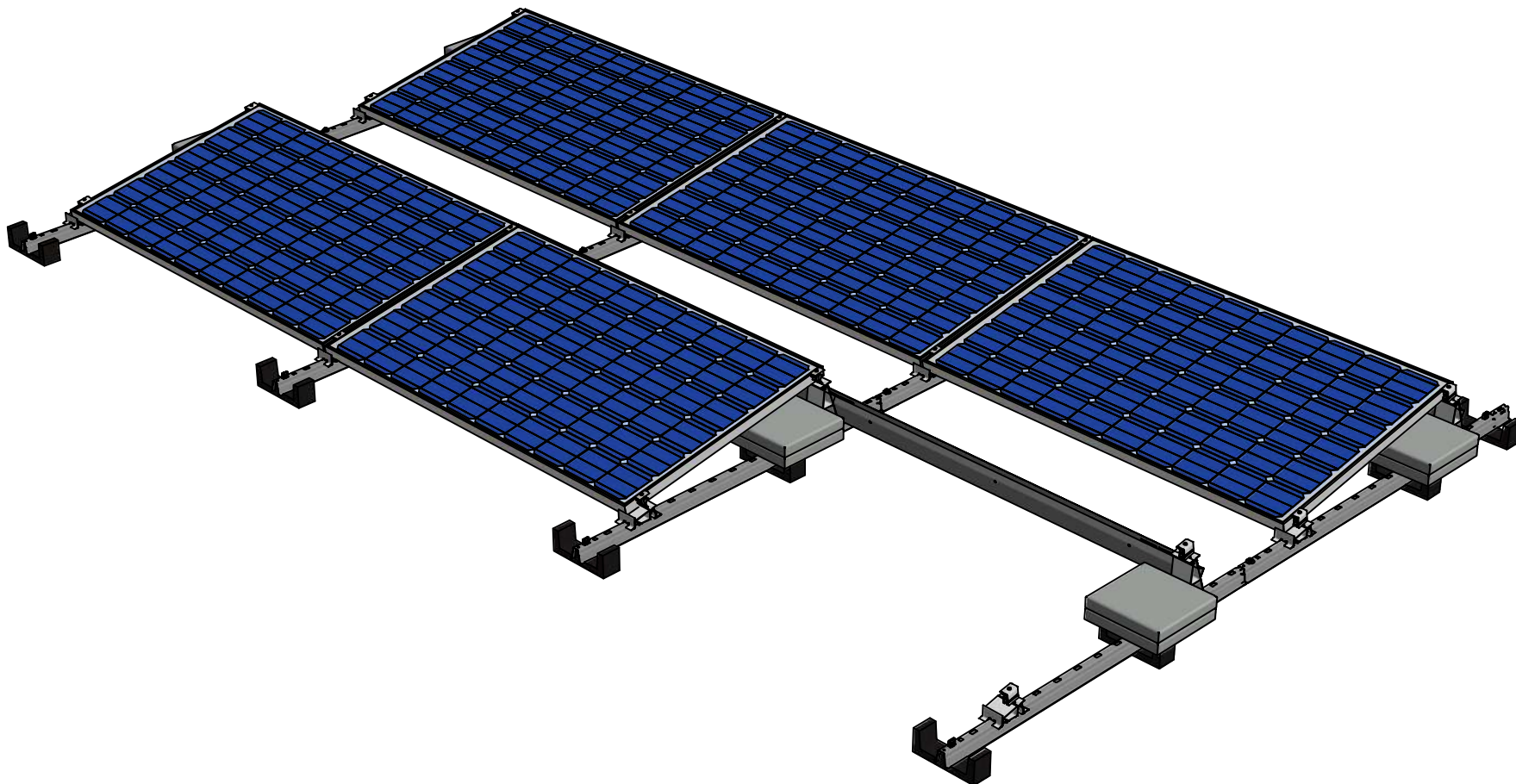
Version: 1.4 - 20210512



ValkPro+ Landscape 10°

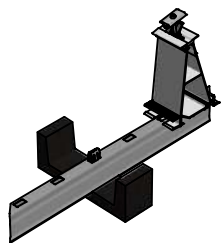
Suitable panel length:	1520 - 2320 mm
Suitable panel width:	977 - 1350 mm
Panel inclination:	10°
Available pitch:	1300 - 1600 mm (default 1500 mm)

* See next page for system details and drawings.

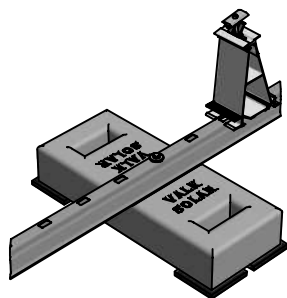




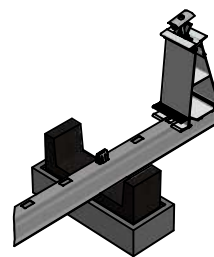
Foundation types:



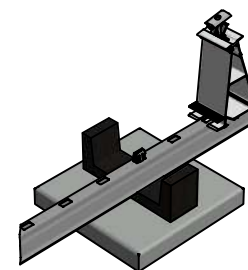
Rubber tile carriers:
Bitumen / EPDM / Concrete / PVC



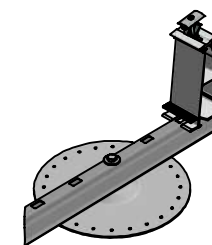
Mass blocks:
Roof or field systems



Elevation blocks:
for gravel roofs

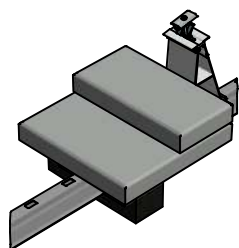


Foundation tile:
for sedum / green roofs
or field systems

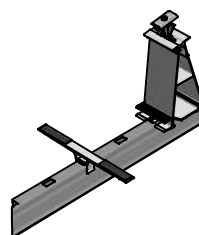


ValkSolarFix:
for mechanical fixation

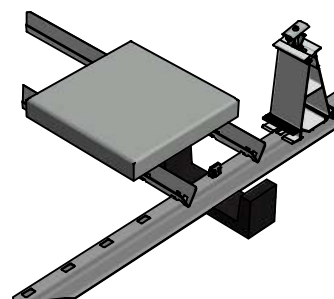
Ballast options:



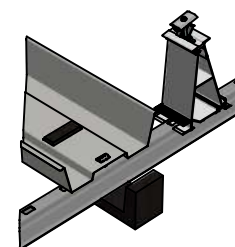
Rubber tile carriers



Ballast wings

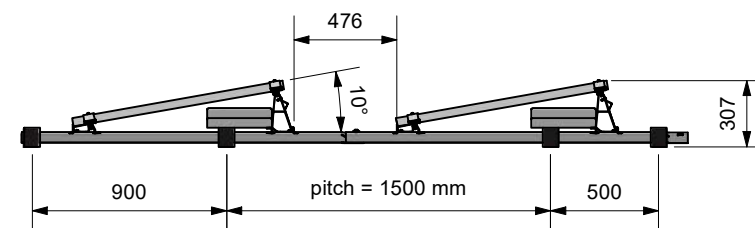
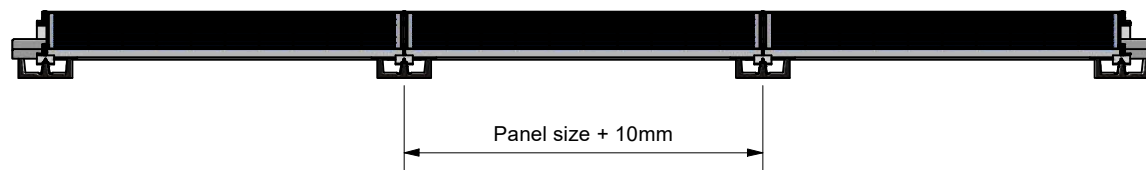


Mass carriers

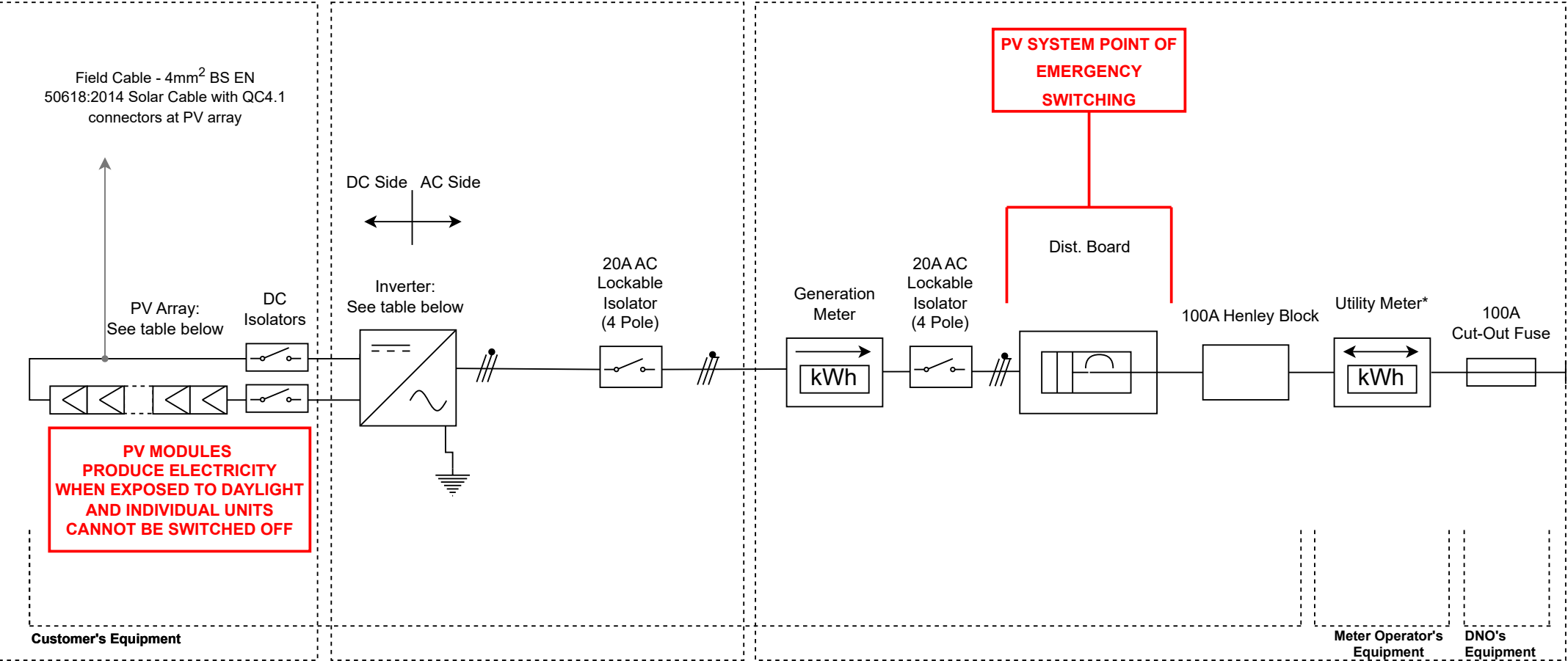


Ballast trays

Technical dimensions:



Solar PV Electrical Schematic



Roof Array Inverter Mounting Location Consumer Unit Location / Point of Connection

* Meter operator's import/export meter (settlement).

System Specifications
Modules and Strings 17 x LONGi LR5-66HIH-500M 500Watts 2 Total Strings. V_{OC} for strings 443.52, 394.24. I_{SC} for strings = 14.12, 14.12.
Inverters Manufacturer(s): SOLIS - Ningbo Ginlong Technologies Inverter(s): 1 x S5-GR3P8K Total rating: 8kW Max AC Current: %AC Current%A
Battery Storage (ESS)

Project Details
Contact Name: (NOT SPECIFIED) Address: 12 Partridge Way Postcode: N22 8DW
Meter Identifier: (NOT SPECIFIED) System Title: (NOT SPECIFIED) System Size: 8.5kW Annual output: 6658.370000000001kWh

Arc Line Design Ltd.
12 Boundary Avenue
NR6 5HY
sales@arclinedesign.com
www.arclinedesign.com



- Notes:
1. All wiring and equipment designed, and to be installed in accordance with 18th Edition electrical regulations, BS 7671:2015.
 2. Please refer to 'Guide to the Installation of Photovoltaic Systems' (MCS) and Guidance document MGD003 - Battery storage
 3. Always follow manufacturers guidelines and specifications when installing components
 4. All calculations assume $Z_e = 0.35\Omega$ at the point of connection.
 5. As per IET, plugs and sockets that are mated shall always be the same model and from the same manufacturer.

Version Control:

Design Completed By: Rob Banford,
Managing Director
Date: (NOT SPECIFIED)
Version Number: Version 1.0
Project ID: 2561788
Scale: Not to scale

Solis Three Phase Inverters

» S5-GR3P(3-20)K



360 degree

Efficient

- ▶ Max. efficiency 98.7%
- ▶ String current up to **16A**
- ▶ Wide voltage range and low startup voltage

Smart

- ▶ Supports export power control
- ▶ Supports RS485, WiFi, GPRS
- ▶ Scan to register on SolisCloud, supports remote upgrade and control

Safe

- ▶ IP66
- ▶ AFCI protection, proactively reduces fire risk
- ▶ Automatic voltage stabilization technology in weak grid conditions

Economic

- ▶ Compact design, simple installation and maintenance
- ▶ > 150% DC/AC ratio
- ▶ Supports high power modules for lower installation costs

Model:

S5-GR3P3K	S5-GR3P4K	S5-GR3P5K	S5-GR3P6K	S5-GR3P8K	S5-GR3P9K	S5-GR3P10K
S5-GR3P12K	S5-GR3P13K	S5-GR3P15K	S5-GR3P17K	S5-GR3P20K		

Datasheet

Model Name	S5-GR3P3K	S5-GR3P4K	S5-GR3P5K	S5-GR3P6K	S5-GR3P8K	S5-GR3P9K	S5-GR3P10K	S5-GR3P12K	S5-GR3P13K	S5-GR3P15K	S5-GR3P17K	S5-GR3P20K
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Input DC

Recommended max. PV power	4.5 kW	6 kW	7.5 kW	9 kW	12 kW	13.5 kW	15 kW	18 kW	19.5 kW	22.5 kW	25.5 kW	30 kW
Max. input voltage	1100 V											
Rated voltage	600 V											
Start-up voltage	180 V											
MPPT voltage range	160-1000 V											
Max. input current	16 A / 16 A						32 A / 32 A					
Max. short circuit current	20 A / 20 A						40 A / 40 A					
MPPT number/Max. input strings number	2/2						2/4					

Output AC

Rated output power	3 kW	4 kW	5 kW	6 kW	8 kW	9 kW	10 kW	12 kW	13 kW	15 kW	17 kW	20 kW
Max. apparent output power	3.3 kVA	4.4 kVA	5.5 kVA	6.6 kVA	8.8 kVA	9.9 kVA	11 kVA	13.2 kVA	14.3 kVA	16.5 kVA	18.7 kVA	22 kVA
Max. output power	3.3 kW	4.4 kW	5.5 kW	6.6 kW	8.8 kW	9.9 kW	11 kW	13.2 kW	14.3 kW	16.5 kW	18.7 kW	22 kW
Rated grid voltage	3/N/PE, 220 V / 380 V, 230 V / 400 V											
Rated grid frequency	50 Hz / 60 Hz											
Rated grid output current	4.6 A / 4.3 A	6.1 A / 5.8 A	7.6 A / 7.2 A	9.1 A / 8.7 A	12.2 A / 11.5 A	13.7 A / 13.0 A	15.2 A / 14.4 A	18.2 A / 17.3 A	19.8 A / 18.8 A	22.8 A / 21.7 A	25.8 A / 24.6 A	30.4 A / 28.9 A
Max. output current	4.7 A	6.4 A	7.9 A	9.5 A	12.7 A	14.3 A	15.9 A	19.1 A	20.7 A	23.8 A	27 A	31.8 A
Power Factor	>0.99 (0.8 leading - 0.8 lagging)											
THDi	<2%											

Efficiency

Max. efficiency	98.3%				98.5%				98.6%				98.7%
EU efficiency	97.7%				97.9%				98.0%				98.1%

Protection

DC reverse-polarity protection	Yes											
Short circuit protection	Yes											
Output over current protection	Yes											
Surge protection	Yes											
Grid monitoring	Yes											
Anti-islanding protection	Yes											
Temperature protection	Yes											
Integrated AFCI (DC arc-fault circuit protection)	Yes ⁽¹⁾											
Integrated DC switch	Optional											

General Data

Dimensions (W*H*D)	310*563*219 mm		
Weight	17.8 kg	18.8 kg	20 kg
Topology	Transformerless		
Self consumption (night)	<1 W		
Operating ambient temperature range	-25 ~ +60°C		
Relative humidity	0-100%		
Ingress protection	IP66		
Cooling concept	Natural convection	Intelligent redundant fan-cooling	
Max. operation altitude	4000 m		
Grid connection standard	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15 / VFR:2019, RD 1699 / RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC 60068, IEC 61683, EN 50530		
Safety/EMC standard	IEC/EN 62109-1/-2, IEC/EN 61000-6-1/-2/-3/-4		

Features

DC connection	MC4 connector											
AC connection	Quick connection plug											
Display	LCD											
Communication	RS485, Optional: Wi-Fi, GPRS											

(1) Activation required.



Datasheet ValkPro+ | ValkPro+ East-West | ValkPro+ Max

The concept

- Mounting system for PV-panels on flat roofs (commercial and domestic).
- For south and east-west configurations.
- Fixed tilt angle of 10° (Landscape or Portrait).
- Low ballast, shielded system with wind deflectors (south).

ValkPro+ vs. competitive systems

- Most cost effective solution.
- All metal connections, no plastic. This ensures high strength and reliability and makes the system easy to ground and for equalization of potential.
- Also suitable for roofs higher than 25 mtrs.
- Can be placed with ballast only on flat roofs with a maximum slope up to 5°. On roofs with a bigger slope, the system needs to be fixed to the roof.
- Universal integrated panel clamps (28-50 mm frame height).
- Suitable to be placed on roofs with gravel, "green roofs" or fixed on steel structures above the roof.
- Elevated mounting on roof for guaranteed drainage.

Additional features

- Designed and calculated according to latest building regulations.
- Low ballast and roof load, thanks to the use of wind deflectors and coupled rows.
- Easy and fast installation, thanks to limited number of parts and screw joints.
- Maximum logistical advantage, thanks to limited number of different parts and dimensions.
- Smart solutions to hold cables and cable baskets.
- Easy to disassemble.

Panel formats

- ValkPro+ (south & east-west) is standard applicable for panels with the following dimensions:

Configuration	Panel length min [mm]	Panel length max [mm]*	Panel width min [mm]	Panel width max [mm]	Pitch [mm]
L10° South	1520	2320	977	1250	1500*
L10° East-West	1520	2320	977	1070	2300
			1071	1120	2400
			1121	1170	2500
P10° South	1559	2200	900	1500	2300*
P10° East-West	1560	1680	900	1500	3500
	1681	1730	900	1500	3600
	1731	1830	900	1500	3800
	1831	2035	900	1500	4200
	2036	2135	900	1500	4400
Max South	2096	2500	900	1500	3000*
Max East-West	2096	2172	900	1500	4500
	2173	2268	900	1500	4700
	2269	2369	900	1500	4900
	2370	2471	900	1500	5100

* Other pitch sizes available on request. Please contact Van der Valk Solar Systems for possibilities.

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Appendix 7



Partridge Way, London

ASHP Noise Assessment

Client: Formation Design and Build Ltd
Ref: TN01-22323-R0
Date: 1 August 2023
Note by: Fabio Lassandro, MSc BEng MIOA, Associate Director

1. INTRODUCTION

- 1.1 Cass Allen has assessed the acoustic design of the air source heat pump (ASHP) unit that will serve the Partridge Way development in London.
- 1.2 This technical note will be included in the main report for the discharge of Planning Condition 6 provided by the M&E Team.
- 1.3 The ASHP design is controlled by Planning Condition 6 of the development's planning consent (HGY/2021/2075). The condition states:

The development hereby approved shall be constructed in accordance with the Energy Statement (dated 6 September 2021) prepared by Sweco, delivering a minimum 67% improvement on carbon emissions over 2013 Building Regulations Part L, with SAP10 emission factors, high fabric efficiencies (min. 13% reduction), air source heat pumps (ASHPs) and minimum 8.4 kWp 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;

... (the remainder of Planning Condition 6 is not relevant to acoustics).

2. CRITERIA

- 2.1 Planning Condition 6 does not contain specific criteria to be achieved and therefore BS4142:2014+A1:2019 – *Methods for rating and assessing industrial and commercial sound* (BS4142) has been adopted for this assessment.
- 2.2 The BS4142 assessment methodology can be summarised as follows:
1. Measure the existing background noise levels (LA90,T dB) at locations of nearby noise sensitive receptors during the quietest periods when the mechanical plant is expected to operate.
 2. Predict the noise emissions (LAeq,T dB) from the plant items at locations of the nearby sensitive receptors and add corrections for any distinguishable acoustic features (e.g., tones, whines, screeches, hisses etc) to determine the rating noise level (LAr,Tr dB).
 3. Subtract the measured background noise levels with the predicted rating noise levels at each sensitive receptor.
- 2.3 Background noise levels were measured at the site from the 19th to the 20th October 2020 by MLM Consulting Engineers Ltd as part of a site noise survey to support the planning application, and by Cass Allen on the 24th February 2023 to validate noise data from MLM Consulting Engineers Ltd. The lowest typical measured background noise levels (LA90,T) at the site are:
- 56 dB during the daytime (0700-2300hrs); and
 - 39 dB during the night-time (2300-0700hrs).
- 2.4 In line with the experience of previous similar developments, a criterion of 5 dB below background noise levels during the daytime and night-time at the location of existing residential facades has been adopted. The noise limits shown in Table 1 have therefore been developed based on the measured background noise levels.

Table 1 BS4142 Noise Limits – Free-field Levels

Location	Period	
	Daytime (0700-2300hrs)	Night-time (2300-0700hrs)
Existing sensitive facades	51 dB LAr,Tr	34 dB LAr,Tr

3. ASSESSMENT

- 3.1 The ASHP unit will be installed on the top roof of the development as shown in Appendix 1 and is located about 32m away from the nearest existing receptors with no line of sight due to screening provided by the roof edge and parapet.
- 3.2 Technical details of the ASHP units were provided by the project M&E team and are shown in Appendix 2. The sound power levels for the ASHP are summarised in Table 2 below.

Table 2 ASHP Technical Details

Model	No. of units	A-weighted SWL (cooling/heating)
Panasonic U-250PZH2E8	1	78/82 dB

- 3.3 The ASHP units will be powered by modern, inverter-driven, high specification fan components which are expected to generate broadband noise with no distinctive characteristics. No additional character corrections are therefore required to calculate the noise rating level in accordance with BS4142.
- 3.4 The calculated rating noise levels from the ASHP at the location of nearest existing noise sensitive receptors are shown in Table 3 below.

Table 3 Calculated Free-field Noise Levels

Receiver	Noise Level Cooling Mode (L _{Ar} ,Tr)	Noise Level Cooling Mode (L _{Ar} ,Tr)
Existing nearest receptor (32m away)	30 dBA	34 dBA

- 3.5 Calculation results shown in Table 3 above and in Appendix 3 confirm that the noise levels from the proposed ASHP at the location of nearest noise sensitive receptors comply with the criteria in Table 1 above.

4. CONCLUSIONS

- 4.1 The ASHP unit is predicted to comply with the adopted criteria and therefore it is our view that this technical note contains all the required noise-related information to recommend the discharge of Condition 6.

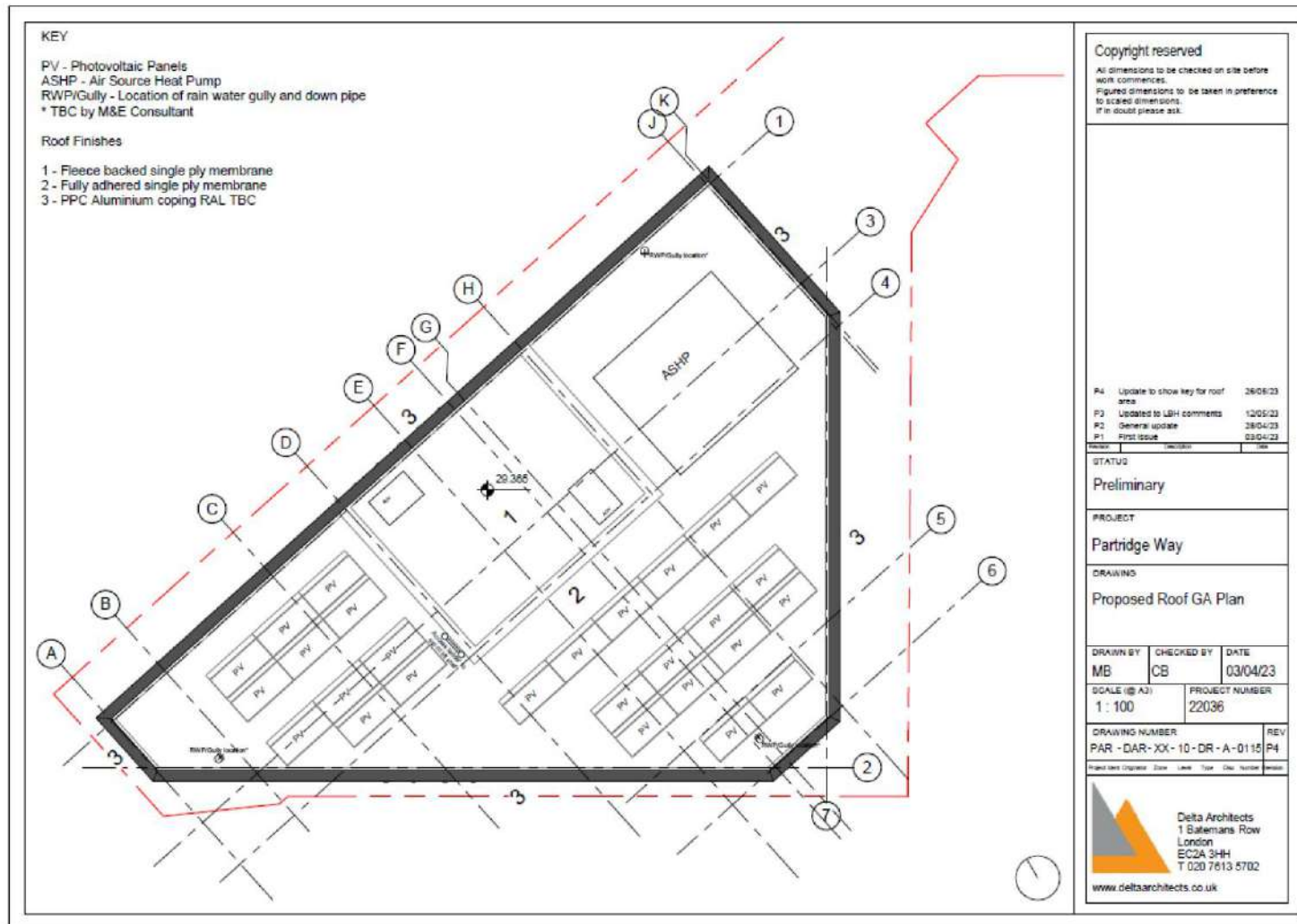
Quality Assurance

CHECKED BY

Henry Cox, BEng AMIOA,
Acoustics Consultant

Appendix 1

Roof Layout with ASHP Location



Specifications

Outdoor unit

Single Split Outdoor Unit (R32)

Model Name		U-200PZH2E8	U-250PZH2E8
Power source		380 - 400 - 415 V 3N~ 50 Hz	
Cooling capacity (High Static Pressure Ducted / 4-Way Cassette)	kW	19.5 / 20.0	23.2 / 25.0
	BTU/h	66,500 / 68,200	79,200 / 85,300
Heating capacity	kW	22.4	28.0
	BTU/h	76,400	95,500
Sound pressure level (Cooling / Heating)	dB(A)	59 / 61	59 / 63
Sound power level (Cooling / Heating)	dB(A)	77 / 79	78 / 82
Unit dimensions (H×W×D)	mm	1,500×980×370	1,500×980×370
Net weight	kg	117	128

Appendix 3 ASHP Calculations

Distance Correction Calculation

Heating

Sound Power Level (dBA)	82
Distance to Receiver (m)	32
Sound Pressure Level (dBA)	44
Corrected for screening (dBA)	34
(due to building edge)	

$$SPL = SWL - 20\log r - N$$

where N=11 for point source in space and 8 for radiation over non-abs ground

on non-absorbitive ground

Cooling

Sound Power Level (dBA)	78
Distance to Receiver (m)	32
Sound Pressure Level (dBA)	40
Corrected for screening (dBA)	30
(due to building edge)	

$$SPL = SWL - 20\log r - N$$

where N=11 for point source in space and 8 for radiation over non-abs ground

on non-absorbitive ground