Noise & Vibration Consultants
4 Mulberry Place, Pinnell Road, London, SE9 6AR
Tel: 020 8859 0303
Email: **info@acousticsplus.co.uk** Web: www.acousticsplus.co.uk

ACOUSTICS PLUS

Proposed Installation of Mechanical Plant

5 Cannon Place, London, NW3 1EH

Environmental Noise Assessment

Author: Phil Huffer B.Sc. (Hons) MIOA
Principal Consultant

Doc Ref: 104626.ph.Issue1

Company Registration Number: 4304440
VAT Registration Number: 788 2610 94

Proposed Installation of Mechanical Plant	
Project Address:	5 Cannon Place London NW3 1EH
Project Reference:	104626

Issue/Revision Record

Issue:	Date:	Remarks:	Author:
1	21/06/2024	First Issue	Phil Huffer

	Signature:	Print:	Title:	Date:
Author:		**Phil Huffer**	**Principal Consultant**	**21/06/2024**
Reviewer:		**Andy Dodd**	**Senior Consultant**	**21/06/2024**

1. INTRODUCTION

1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients. APL is a registered member of The Association of Noise Consultants (ANC) and the author is a corporate member of The Institute of Acoustics (IOA).

1.2 APL has been instructed by Fraher & Findlay Architects (on behalf of the applicant), to consider and advise upon the noise implications of a proposed installation of mechanical plant.

1.3 It is understood that it is the intention to install a new climate control system which will consist of 2No. externally located air source heat pumps (ASHPs). One ASHP will provide the house heating and hot water with the second ASHP utilised for backup in the event of failure.

1.4 It is understood the London Borough of Camden (LBC) require further information on noise levels from the proposed installation in order to fully assess the noise impact upon the surrounding neighbourhood. This report provides the response to the LBC, on behalf of the Applicant.

1.5 It should be recognised that heat pumps are part of the Government's drive towards net zero carbon emissions by 2050 and this report is offered to assist this transition towards a more sustainable future by addressing potential noise issues that might otherwise hinder this process.

1.6 This report has been prepared by Acoustics Plus Limited (APL) with all reasonable skill, care, and diligence in accordance with generally accepted acoustic consultancy principles and taking account the services and terms agreed between APL and our client.

1.7 Any information provided by third-parties and referred to herein may not have been checked or verified by APL unless expressly stated otherwise. Certain statements made in the report are predictions based on reasonable assumptions and good industry practice.

1.8 Such statements involve risk and uncertainty which could cause measured and predicted results to differ materially. APL does therefore not guarantee or warrant any prediction contained in this report.

2. BASELINE SITUATION

2.1 The Application Site (the "site") is situated at 5 Cannon Place, London, NW3 1EH. A location plan is shown in Diagram 1. The site is an existing residential building arranged over lower ground, ground and two upper levels. The side of the site and surrounding area is shown in Figures 1 to 8 attached.

Diagram 1 – Site plan

2.2 It is the proposal to redevelop the house which will include the addition of a new energy efficient mechanical climate control system to provide heating and hot water to the property. This will require the installation of 2No. external air source heat pumps. The units will be located within proprietary acoustic enclosures that will be sited in the side return behind the entrance stairs. The details of the acoustic enclosure are contained in Appendix A.

2.3 Although the proposal is for the installation of 2No. ASHPs, the heating requirements of the house will be supported by 1No. unit. The second ASHP will be used in the event of failure of the primary unit. Both units will be Mitsubishi Ecodan R32 PUZ-WM85VAA.

2.4 The proposed location of the ASHPs is shown in Diagram 2 and 3 below.

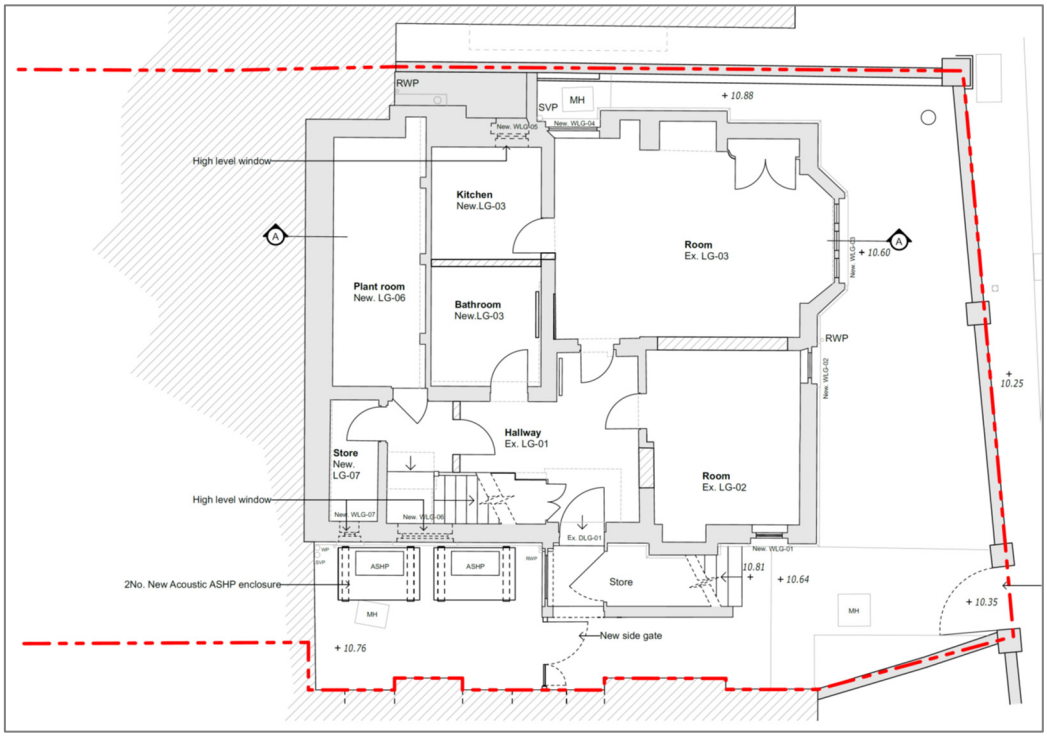


Diagram 2 – Proposed lower ground floor plan

Diagram 3 – Proposed side elevation

2.5 It is anticipated that the nearest noise sensitive façade to the proposed acoustic enclosures is located at No.3 Cannon Place as indicated in Diagram 4 below. Further to information provided by Fraher & Findlay Architects it is understood that the lower ground floor windows at No.3 belong to a toilet and study. These windows would have direct line of sight to the enclosures.

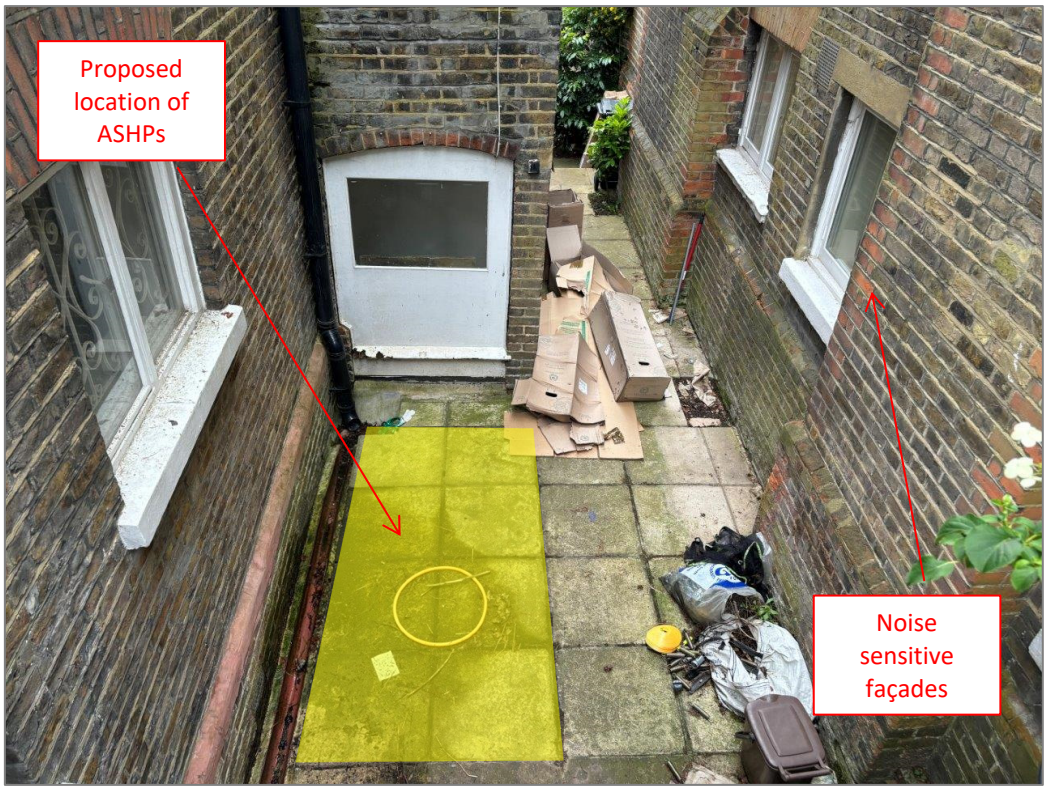


Diagram 4 – Adjacent windows at No.3 Cannon Place

2.6 Although it is unlikely that the study at lower ground floor level would be used during the more sensitive night-time period, it is possible that this room could be repurposed as a guest bedroom and therefore should be considered as noise sensitive.

3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise in the locality of the installation. It was not possible to monitor background noise levels within the side return due to the presence of an intermittent ambiguous noise source.

3.2 Measurements of background noise were obtained over a 24 hour period at a location deemed representative of background noise levels experienced at the nearest noise sensitive façade in the absence of the ambiguous noise source. Noise monitoring equipment was installed at the front of No.5 Cannon Place, adjacent to the noise sensitive property.

3.3 To ensure the data's validity, spot measurements were obtained within the side return (in the absence of the intermittent ambiguous noise source) and compared with spot measurements obtained at the front façade of No.5 Cannon Place. Good correlation was observed.

3.4 The particulars of the measurement exercise are recorded below:

Date:	11th – 12th June 2024
Start Time:	12:15 hrs
Location:	Front façade at 1st floor level.
Weather:	Appropriate to monitor environmental noise (see Diagram 5) - weather data obtained from local weather station

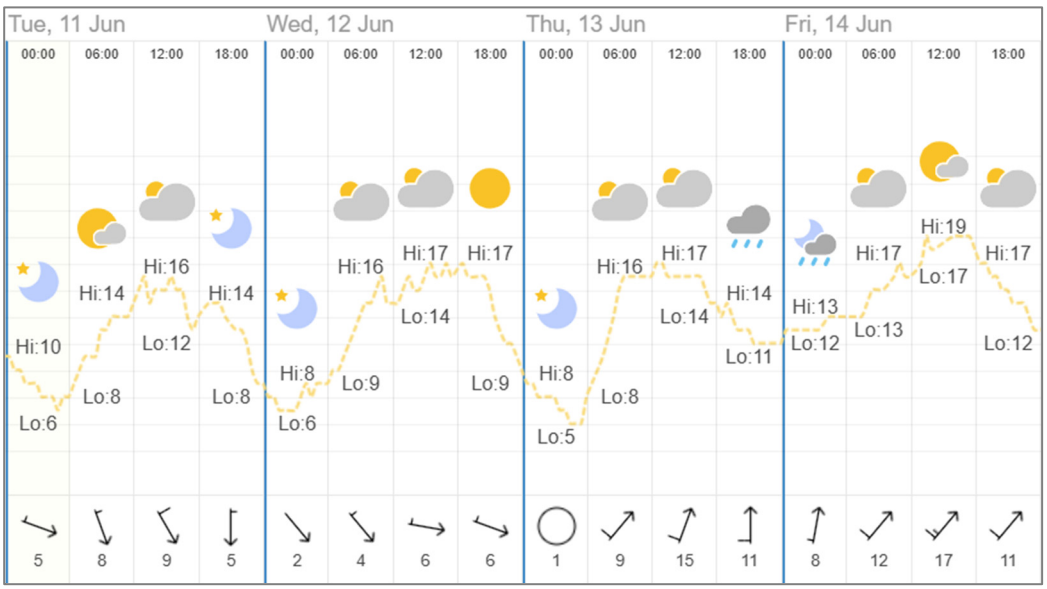


Diagram 5

3.5 Minimum background and average noise levels obtained at the rear of the site are shown in Table 1 below with the full level vs time history shown in Diagram 6 (L_{Aeq} and L_{A90}).

Measurements obtained at front façade of No.5 Cannon Place		
Time period	**Lowest $L_{A90,15min}$**	**Average $L_{Aeq,T}$**
12/06/2024 07:00-23:00hrs	40dB	55dB
12-13/06/2024 23:00-07:00hrs	30dB	43dB
13/06/2024 07:00-23:00hrs	31dB	54dB
13-14/06/2024 23:00-07:00hrs	32dB	44dB

Table 1

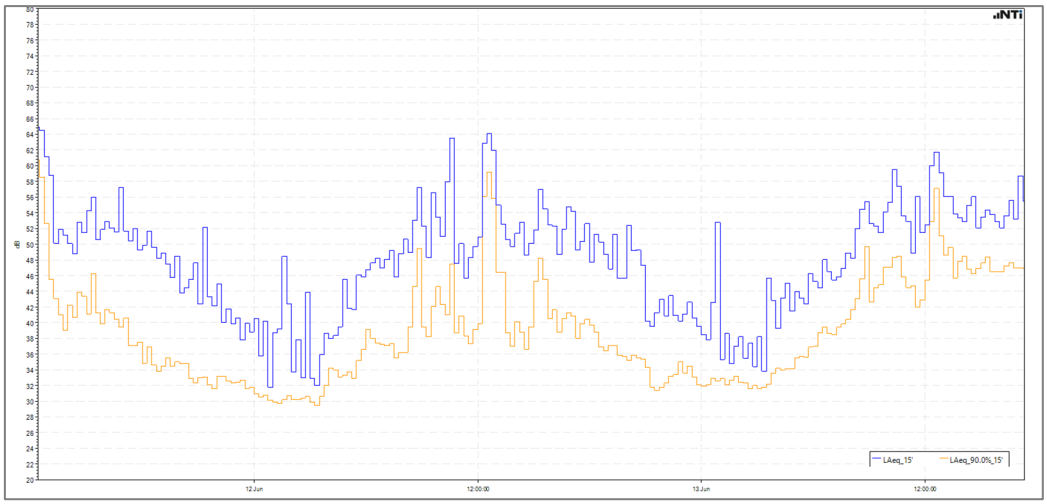


Diagram 6

4. EQUIPMENT

4.1 All measurements were obtained using the following equipment:

- NTi XL2 Sound Level Meter Class 1 Serial No. A2A-14612-E0, FW4.71
- Rion Calibrator Type NC-74 Class 1 Serial No. 00410215

4.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

5. DESIGN CRITERIA

5.1 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the London Borough of Camden's Local Plan Policy A4 adopted 3 July 2017 (Appendix 3 Noise thresholds). Please see extract below:

"Industrial and Commercial Noise Sources

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing noise sensitive receptor	Assessment Location	Design Period	LOAEL (green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dB L_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.
**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.
The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration."

5.2 The procedure contained in BS4142 is to quantify the "specific sound level", which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

5.3 The specific sound level is converted to a rating level by adding penalties to account for either tonality or impulsivity. The standard sets out objective methods for determining the presence of tones or impulsive elements but notes that it is acceptable to subjectively determine these effects.

5.4 The penalty for tonal elements is between 0dB and 6dB, and the standard notes:

"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."

5.5 The penalty for impulsive elements is between 0dB and 9dB, and the standard notes:

"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

5.6 Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

5.7 The background sound level should be established in terms of the LA90 noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15-minute intervals. The standard states that:

"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

5.8 The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

5.9 The standard goes on to note that:

"*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

5.10 In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

5.11 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram of L_{A90} noise levels obtained during the more noise sensitive night-time period sof the proposed ASHP operation can be seen in Diagram 7.

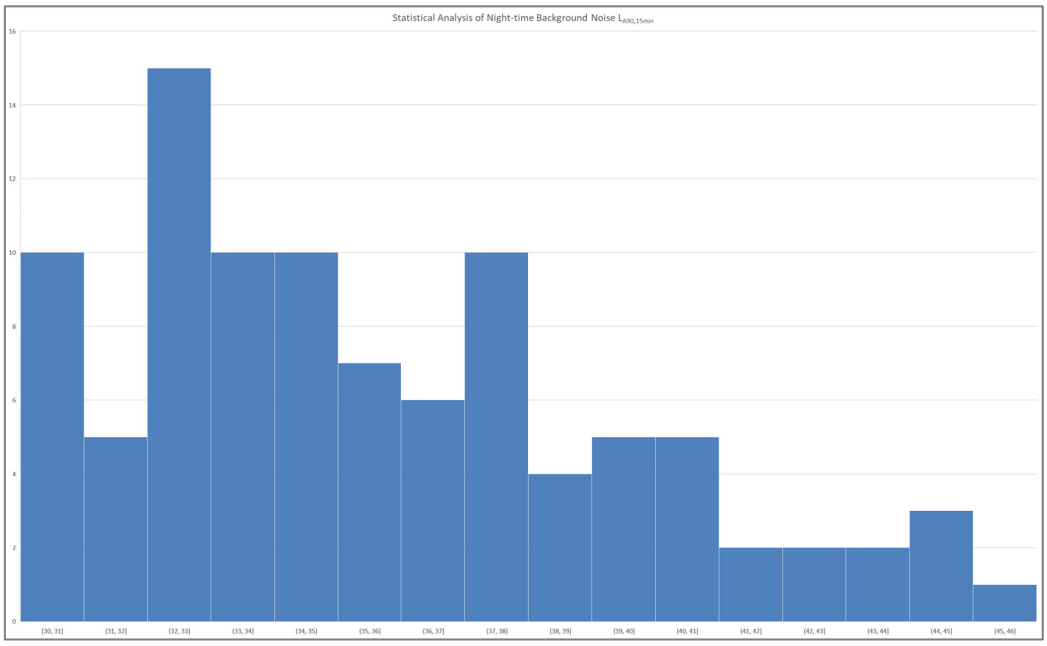


Diagram 7

5.12 In this instance the most commonly occurring night-time background noise level was 2dB higher than the absolute lowest background noise level. In the context in which the sound occurs and given the unlikelihood of the ASHP operating at maximum duty during the early night period (02:00-03:00hrs when the lowest background noise occurs), the statistically lowest value of 32dB $L_{A90,15min}$ is considered as representative for night-time noise levels at the nearest noise sensitive façade.

5.13 The plant noise emission criteria that should not be exceeded is therefore based on the statistical analysis and is shown in Table 2 below. This level should not be exceeded at the nearest noise sensitive façade and is representative of the LOAEL green value.

Noise emission limit for mechanical plant
L_{Aeq} ≤22dB

Table 2

6. NOISE IMPACT OF PLANT

6.1 Where necessary, mitigation measures have been incorporated into the calculation exercise to ensure that compliance with the local planning criteria is obtained. These mitigation measures are identified separately in the body of the report and are an essential requirement in meeting the LBC criteria.

6.2 In order to predict the noise impact of the proposed installation of plant, consideration has been given to noise egress from the acoustic enclosure to the nearest noise sensitive façade. It has been assumed that the unit will be operational at any time during the daytime or night-time period.

6.3 The calculation exercise utilised information provided by Mitsubishi and Environ Group. A copy of the data sheets are provided in Appendix A.

6.4 Environ Group state that their acoustic enclosure will reduce the stated output of the air source heat pump unit from 45dBA to 19dBA.

unity acoustic enclosures

environ group

+ 44 (0) 20 3540 7179

DATA SHEET

www.environgroup .uk

EG-U22-ME11

Acoustic enclosure for AC Split Systems

20 June 2024

CUSTOMER:	SITE / LOCATION / REFERENCE
Acoustucs Plus	Carlton Place

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA

MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0M FREE FIELD

MAKE	MODEL	AIR IN	AIR OUT
Mitsubishi Electric	PUZ-WM85VAA	H - 2 Side	H - Front

WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPW dB(A)
1050	480	1020	0.74	1	45

INNER CUBE DIMENSION			ENCLOSURE DETAIL		
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1150	650	1230	1700	1100	1295
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)	AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)
0.74	1.0	45	0.74	1.0	19

INLET AIRWAYS			DESIGN CRITERIA		
WIDTH (MM)	HEIGHT (MM)	NO.	UNIT SIZE	INTLET	OUTLET
200	1230	1	OK	OK	OK

OUTLET AIRWAYS			AIRFLOW INFORMATION		
WIDTH (MM)	HEIGHT (MM)	NO.	PD (NM^{-2})	INLET (MS^{-1})	OUTLET (MS^{-1})
200	1230	1	11	3.0	3.0

ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	200		1230
OUTLET AIRWAY	200		1230
EXTERNAL SIZE	1700	1100	1295
INDICATIVE NOISE LEVEL	19	**SPW dB(A) SOUND PRESSURE	

Diagram 8

6.5 The following acoustic feature corrections were used to determine a rating level:

Results	Penalty	Relevant clause	Commentary
Acoustic feature corrections BS4142	+3dB	9.2	Other acoustic characteristics

Table 3

6.6 The noise impact assessment of the proposed installation is shown in Table 4.

Air source heat pump noise impact	Noise impact calculation
Mitsubishi Ecodan PUZ-WM85VAA (heating)	45dBA @ 1m
Mitsubishi Ecodan PUZ-WM85VAA (in enclosure)	19dBA @ 1m
Distance attenuation	0dB
BS4142 Acoustic corrections	+3dB
Total Rated Level	**22dBA**
LPA requirement (based on night-time L_{A90})	≤22dB

Table 4

6.7 Any noise from the installation of the air source heat pump and enclosure (related to the climate control of the house) should not exceed a level of 22dBA at the nearest noise sensitive façade.

6.8 The calculation exercise (Table 4) demonstrates that the plant noise impact meets Local Plan Policy A4 adopted 3 July 2017 (Appendix 3 Noise thresholds) as reproduced in para 5.1 above. The noise impact meets the LOAEL green LPA criteria.

7. CONCLUSION

7.1 The foregoing assessment indicates that the proposed installation will meet the specific noise threshold requirements from Appendix 3 of Camden Council's Local Plan referenced in Policy A4. Further mitigation measures, other than those identified, will not be required. The mitigation measures that must be implemented are as follows:

- The air source heat pump units should be located within proprietary acoustic enclosures as specified (or equivalent performance).

7.2 The acoustic enclosures are often supplied flat packed and require assembling on site. Careful attention should be paid to the manufacturers assembly instructions to ensure that unwanted panel resonance is not introduced.

7.3 If an alternative supplier/manufacturer of air source heat pump unit is chosen, the acoustic performance should be checked prior to installation to ensure that the installation will still meet the requirements imposed by the LPA.

Figures

5 Cannon Place, London, NW3 1EH


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5


Figure 6


Figure 7


Figure 8

Appendix A

Heating | Product Information

MITSUBISHI ELECTRIC

PUZ-WM85VAA(-BS)

Ecodan R32
Monobloc Air Source Heat Pump

R32

Key Features:

- A+++ high efficiency system
- Ultra quiet noise levels
- Maintains full heating capacity at low temperatures
- Zero carbon solution
- MELCloud enabled

Key Benefits:

- Ultra low running cost
- Flexible product placement
- Confident and quick product selection
- Help to tackle the climate crisis
- Remote control, monitoring, maintenance and technical support

MELCloud

Manufactured in the UK

037-0033-20-03

ecodan®
Renewable Heating Technology

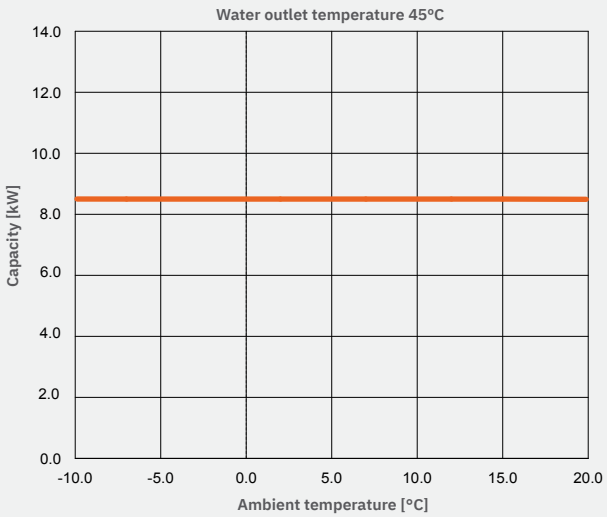
ecodan.co.uk

Heating | **Product Information**

PUZ-WM85VAA(-BS)
Ecodan R32
Monobloc Air Source Heat Pump

OUTDOOR UNIT		PUZ-WM85VAA(-BS)
HEAT PUMP SPACE HEATER - 55˚C	ErP Rating	A++
	η_s	139%
	SCOP (MCS)	3.48
HEAT PUMP SPACE HEATER - 35˚C	ErP Rating	A+++
	η_s	193%
	SCOP (MCS)	4.84
HEAT PUMP COMBINATION HEATER - Large Profile*1	ErP Rating	A+
	η_{wh}	145%
HEATING*2 (A-7/W35)	Capacity (kW)	8.5
	Power Input (kW)	3.27
	COP	2.60
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA*3	Pressure Level at 1m (dBA)	45
	Power Level (dBA)*4	58
WATER DATA	Pipework Size (mm)	28
	Flow Rate (l/min)	24
	Water Pressure Drop (kPa)	15.0
DIMENSIONS (mm)	Width	1050
	Depth	480
	Height	1020
WEIGHT (kg)		98
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz
	Phase	Single
	Nominal Running Current [MAX] (A)*5	9.1 [22]
	Fuse Rating - MCB Sizes (A)*6	25
REFRIGERANT CHARGE (kg) / CO_2 EQUIVALENT (t)	R32 (GWP 675)	2.2 / 1.49

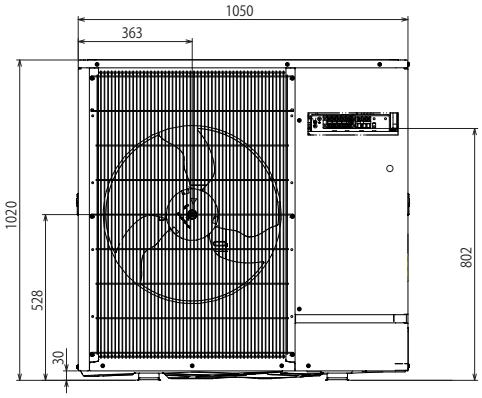
NOMINAL HEATING CAPACITY



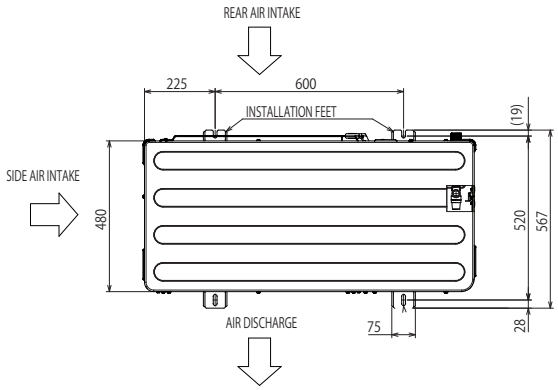
Notes:
*1 Combination with E*PT20X Cylinder
*2 Under normal heating conditions at outdoor temp: -7°CDB / -8°CWB, outlet water temp 35°C, inlet water temp 30°C.
*3 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 55°C, inlet water temp 47°C as tested to BS EN14511.
*4 Sound power level tested to BS EN12102.
*5 Under nominal heating conditions at outdoor temp: 7ºC, outlet water temp: 35ºC.
*6 MCB Sizes BS EN60898-2 & BS EN60947-2.
η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

PUZ-WM85VAA(-BS) DIMENSIONS

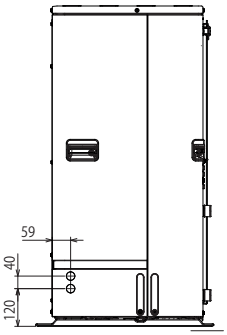
FRONT VIEW



UPPER VIEW



SIDE VIEW



All dimensions (mm)

MITSUBISHI ELECTRIC
Changes for the Better

Telephone: **01707 282880**
email: **heating@meuk.mee.com**
heating.mitsubishielectric.co.uk

@meuk_les @green_gateway | Mitsubishi Electric Living Environmental Systems UK | Mitsubishi Electric Cooling and Heating UK | mitsubishielectricuk_les | Mitsubishi Electric Living Environmental Systems UK | BLOG thehub.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division, Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England. Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (003531)

Note: Refer to 'Installation Manual' and 'Instruction Book' for further 'Technical Information'. The fuse rating is for guidance only and please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/ electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of August 2020

Green Gateway greengateway.mitsubishielectric.co.uk

+ 44 (0) 20 3540 7179

www.environgroup .uk

DATA SHEET

EG-U22-ME11

Acoustic enclosure for AC Split Systems

20 June 2024

CUSTOMER:	SITE / LOCATION / REFERENCE
Acoustucs Plus	Carlton Place

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA

MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0M FREE FIELD

MAKE	MODEL	AIR IN	AIR OUT
Mitsubishi Electric	PUZ-WM85VAA	H - 2 Side	H - Front

WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPW dB(A)
1050	480	1020	0.74	1	45

INNER CUBE DIMENSION			ENCLOSURE DETAIL		
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1150	650	1230	1700	1100	1295
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)	AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)
0.74	1.0	45	0.74	1.0	19

INLET AIRWAYS			DESIGN CRITERIA		
WIDTH (MM)	HEIGHT (MM)	NO.	UNIT SIZE	INTLET	OUTLET
200	1230	1	OK	OK	OK

OUTLET AIRWAYS			AIRFLOW INFORMATION		
WIDTH (MM)	HEIGHT (MM)	NO.	PD (NM^{-2})	INLET (MS^{-1})	OUTLET (MS^{-1})
200	1230	1	11	3.0	3.0

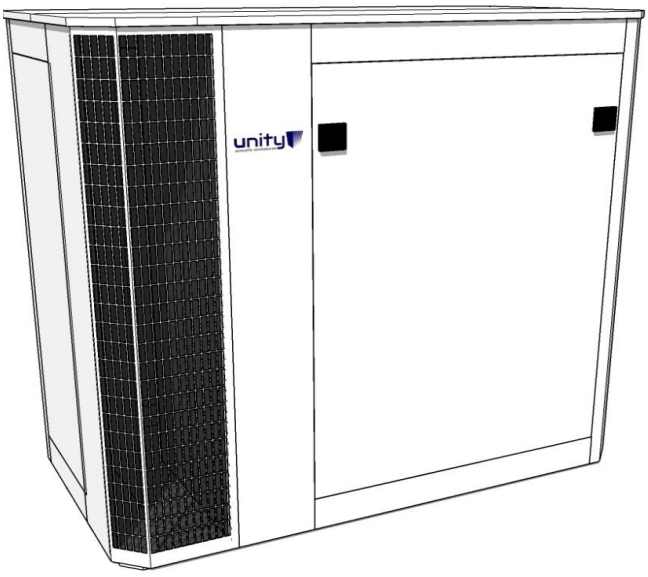
ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	200		1230
OUTLET AIRWAY	200		1230
EXTERNAL SIZE	1700	1100	1295
INDICATIVE NOISE LEVEL	19	**SPW dB(A) SOUND PRESSURE	

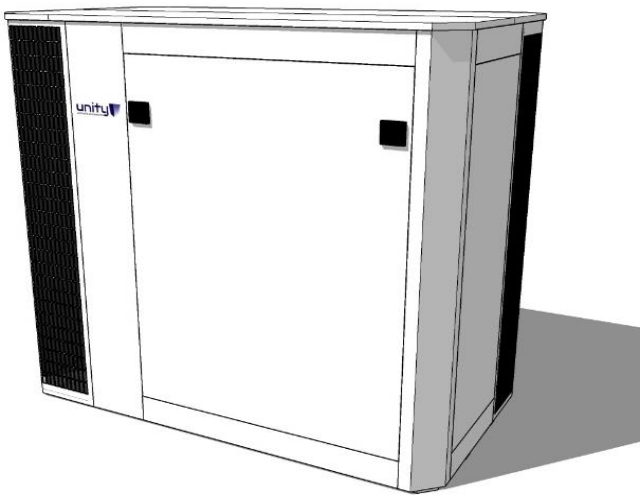
NOTES CONCERNING ENCLOSURE DESIGN

****Minimum Space Required in front of airways - 300mm****

Unity Access Panels Lift Off or Hinged for Maintenance/Service

** Noise level above based on Free Field condition - actual noise levels will be dependant on site conditions





+ 44 (0) 20 3540 7179
+ 44 (0) 1767 631026
www.environgroup .uk

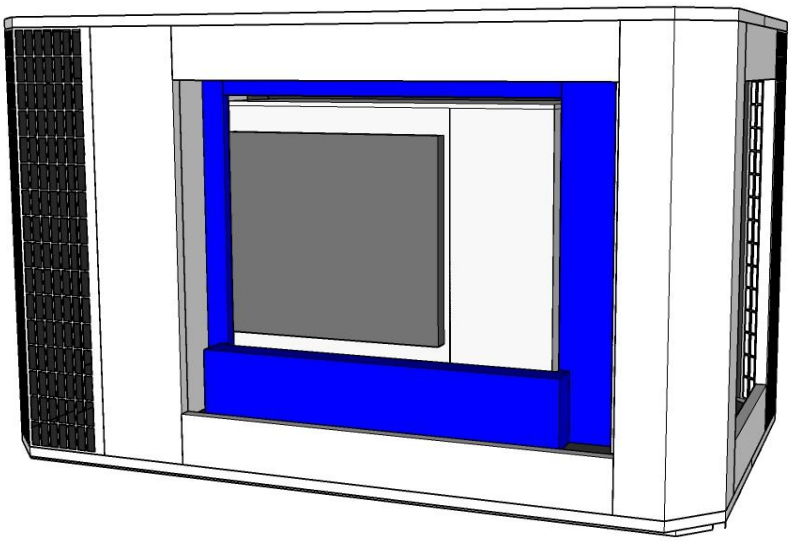
DATA SHEET

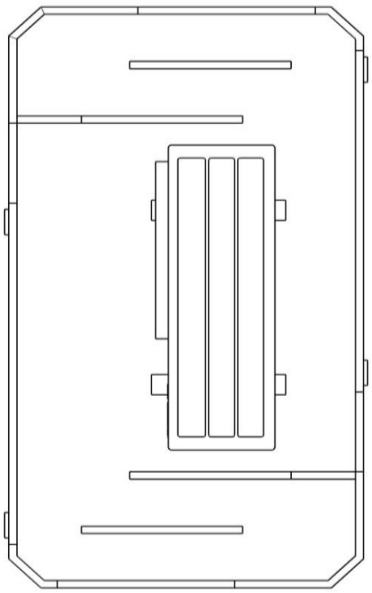
EG-U22-ME11

Acoustic enclosure for AC Split Systems

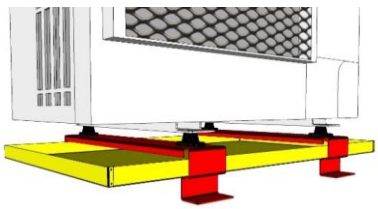
20 June 2024

Exterior Colour
Any RAL/BS Colour
Special Finishes Available





Service/Maintenance Access



OPTIONAL EXTRAS
Anti Vibration Mounts
Condensate Drain Pan
Drain Pan Heater Tape
Invisible' Wall Mounting Frame

Balanced Air Flow
Internal Plenum Seals stop
Air Recirculation