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

1 Villas on the Heath, London, NW3 1BA.

Environmental Noise Assessment

Author: Andy Dodd B.Sc. (Hons) MIOA
Senior Consultant

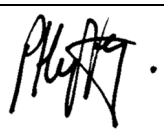
Doc Ref: 104305.ad.Issue2

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

Proposed Installation of Mechanical Plant	
Project Address:	1 Villas on the Heath London NW3 1BA
Project Reference:	104305

Issue/Revision Record

Issue:	Date:	Remarks:	Author:
1	22/04/2022	First Issue	Andy Dodd
2	04/05/2022	Second issue	Andy Dodd

	Signature:	Print:	Title:	Date:
Author:		**Andy Dodd**	**Senior Consultant**	**04/05/2022**
Reviewer:		**Phil Huffer**	**Principal Consultant**	**04/05/2022**

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 the applicant's architect Fraher and Findlay, to consider and advise upon the noise implications of the proposed installation of 1no. external air source heat pump unit.

1.3 It is understood the Local Planning Authority (LPA) 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 LPA, on behalf of the Applicant.

1.4 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.

1.5 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.

1.6 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 1 Villas on the Heath, London, NW3 1BA. The site is a terraced house located over ground, first and second floor levels

2.2 The site is to undergo refurbishment and it is now the intention to install an air source heat pump (ASHP) to service the residential accommodation.

2.3 This will require the installation of 1no. external ASHP unit which is proposed to be located within a rear courtyard. The proposed ASHP unit will be a Mitsubishi PUHZ-W112VHA unit. The drawing indicates that the unit would be acoustically enclosed.

2.4 The hours of operation of the unit will be on demand and as such could operate at any time during the daytime and night time periods.

2.5 The proposed location of the unit can be seen in Diagram 1 below.

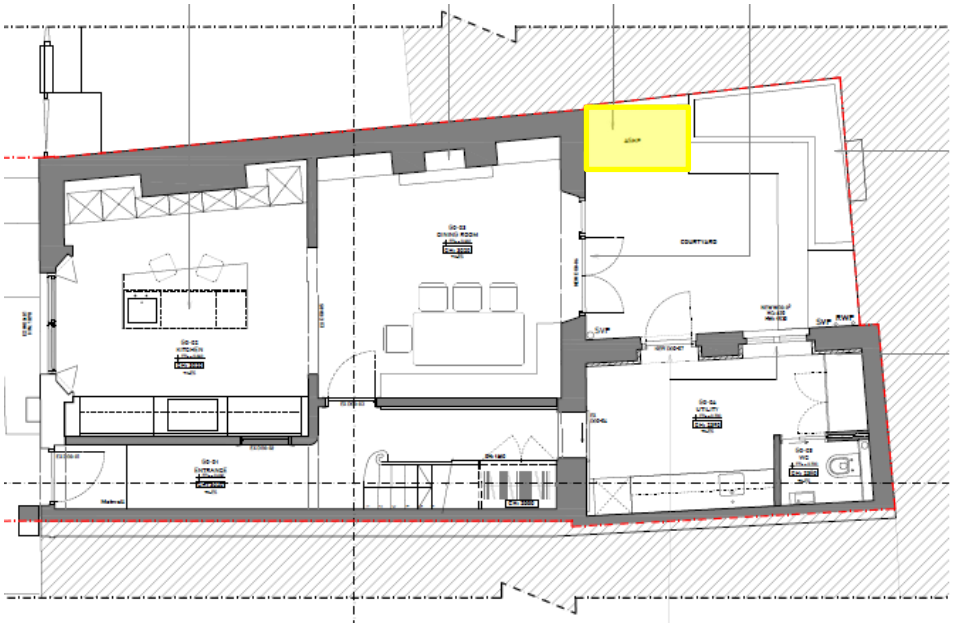


Diagram 1

2.6 The nearest noise sensitive façade to the proposed ASHP unit is understood to belong to a top floor front façade windows of an adjacent dwelling located at The Old Cottage. The distance from the nearest noise sensitive façade to the location of the proposed ASHP unit was determined from measurements obtained from scaled drawings and online mapping and determined to be a minimum of 8m. It is known that this window belongs to a habitable room.

2.7 The proposed location and surroundings can be seen in Figures 1-7 included within the appendix section of this report.

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.

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. The data obtained during the exercise was captured at first floor roof level at the rear of the property, in close proximity to the noise sensitive façade considered.

3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date: 4th – 5th April 2022.
Start Time: 12:00 hrs.
Location: Rear first floor window of site.

3.4 Minimum background and average noise levels over the day and night-time periods are shown in Table 1 below with the full 24 hour level vs time history shown in Diagram 2 (L_{Aeq} and L_{A90}).

Time period	Lowest $L_{A90,15min}$	Average $L_{Aeq,T}$
07:00 to 23:00hrs	36	45
23:00 to 07:00hrs	29	40

Table 1

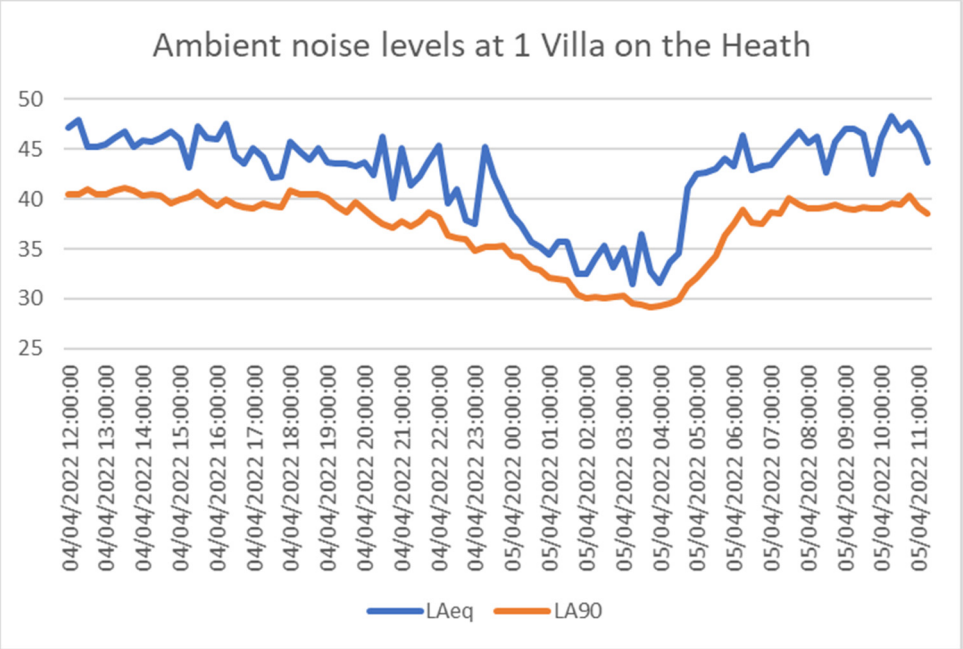


Diagram 2

4. DESIGN CRITERIA

4.1 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the LPA (London Borough of Camden) Local Plan Adopted version June 2017 (Appendix 3 Noise thresholds).

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.

4.2 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.

4.3 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.

4.4 The commentary to paragraph 9.2 of BS 4142:2014+A1:2019 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

Intermittency

4.5 When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Impulsivity

4.6 A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. 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.

Tonality

4.7 For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating 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.

4.8 If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, BS4142:2014 suggests using the one-third octave method and/or the reference methods, as appropriate.

4.9 The ⅓ octave method tests for the presence of a prominent, discrete-frequency spectral component (tone) and typically compares the LZeq,T sound pressure level averaged over the time when the tone is present in a ⅓ octave band with the time-average linear sound pressure levels in the adjacent ⅓ octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the ⅓ octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent ⅓ octave bands by some constant level difference. The level differences between adjacent ⅓ octave bands that identify a tone are:

- *15 dB in the low-frequency one-third-octave bands (25Hz to 125Hz);*
- *8 dB in the middle-frequency one-third-octave bands (160Hz to 400Hz); and*
- *5 dB in the high-frequency one-third-octave bands (500Hz to 10,000Hz).*

Other Sound Characteristics

4.10 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.

4.11 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *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.*

4.12 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram can be seen in Diagram 3.

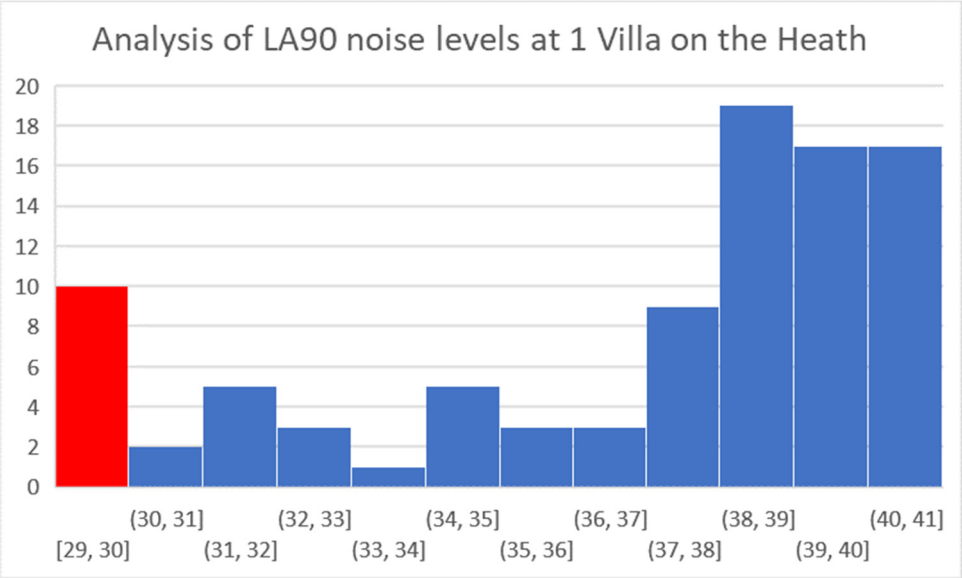


Diagram 3

4.13 The background noise level varied during the measurement period and consideration was given that the unit could operate on demand at any given time. The most commonly occurring background noise level during the measurement period was 38dB $L_{A90,15min}$ but in this instance consideration has been given to 29dB $L_{A90,15min}$ as being indicative of the noise climate during the more noise sensitive night-time period.

4.14 The plant noise emission criteria that should not be exceeded is therefore based on Table 1 and is shown in Table 2 below. This level should not be exceeded at the nearest noise sensitive façade and is indicative of being 10dB less than the considered measured background noise. At such a level, there is an indication that the specific sound source will have a low impact.

Noise emission limit for mechanical plant
L_{Aeq} ≤19dB

Table 2

4.15 The unit that is proposed to be installed is listed below (with the data sheet provided in Appendix A):

- 1 No. Mitsubishi PUHZ-W112VHA @ 53dBA @ 1m (heating)

5. EQUIPMENT

5.1 All background noise measurements were obtained using the following equipment:

- Svantek Svan 958 Class 1 Serial No. 45530
- Rion Calibrator Type NC-74 Class 1 Serial No. 00410215

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

6. CALCULATIONS

6.1 In order to predict the noise impact of the operation of the ASHP, consideration has been given to noise egress to the nearest noise sensitive façade. In considering the propagation of noise from the unit, consideration was given to point source propagation.

6.2 Noise leaving the ASHP unit was propagated over 8m to the nearest noise sensitive façade. The output level of the unit was adjusted (+9dB) to account for the reflecting planes below, behind and adjacent to the unit.

6.3 The following corrections were accounted for to determine a rating level:

Results	Correction	Relevant clause	Commentary
On time correction	-3dB	7.3.14	The unit is likely to switch on and off as required on a demand for heating/cooling basis. The unit is assumed to be operating for half the 15min assessment period during the night
Acoustic feature corrections	+2dB +3dB	9.2 9.2	Just perceptible tonality Readily distinctive intermittency

Table 3

6.4 A further correction to account for building edge diffraction as follows was assumed. This was extracted from the Department of Energy and Climate Change Planning Standard MCS020. The planning standard MCS020 states the following (Note 5):

"Note 5: Barriers between the heat pump and the assessment position (STEP 5)
A correction should be made for attenuation due to barriers between the air source heat pump and an assessment position. A correction will be necessary if an installer is unable to see an assessment position from the top edge of the air source heat pump. Use the following instructions to determine whether a correction is appropriate:

- *For a solid barrier (e.g. a brick wall or a fence) that completely obscures an installer's vision of an assessment position from the top edge of the air source heat pump attenuation of -10 dB may be assumed.*
- *Where a solid barrier completely obscures an installer's vision of an assessment position from the top or side edges of the air source heat pump, but moving a maximum distance of 25 cm in any direction to the air source heat pump allows an assessment position to be seen, attenuation of -5 dB may be assumed.*
- *If it is possible for an installer to see any part of an assessment position from the top or side edges of the air source heat pump no attenuation may be assumed."*

6.5 It is proposed that the ASHP unit be housed within an Environ enclosure. The Environ selection matrices are shown in Diagrams 4 below. A copy of the selection matrix is contained with Appendix B.

environ™

Tel: 0870 383 3344
www.environ.co.uk

SELECTION MATRIX

environlite T8-1700 P1

Acoustic enclosures for Split AC Unit Applications

CUSTOMER:	SITE / LOCATION / REFERENCE

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA					
MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0M FREE FIELD					
MAKE:		MODEL:		AIR IN	AIR OUT
Mitsubishi		PUHZ-W112VHA		Rear & 1 Side	Front
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (M^3S^{-1})	SPL dB(A)	DISTANCE (M)
900	330+30	1350	1.67	51	1

INNER CUBE DIMENSIONS		
1050	400	1635
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1.67	1.0	51
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)

ENCLOSURE DETAIL		
1700	1000	1700
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1.67	1.0	25
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)

INLET AIRWAYS		
1635	275	1
WIDTH (MM)	HEIGHT (MM)	NO.

DESIGN CRITERIA		
OK	OK	OK
UNIT SIZE	OUTLET	INLET

OUTLET AIRWAYS		
275	1635	1
WIDTH (MM)	HEIGHT (MM)	NO.

AIRFLOW INFORMATION		
16	3.7	3.7
PD (NM^{-2})	OUTLET (MS^{-1})	INLET (MS^{-1})

Select Inlet & Outlet Airway Sizes to Ensure Airflows are kept Below 6.0m/s

ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	275		1635
OUTLET AIRWAY	275		1635
EXTERNAL SIZE	1700	1000	1700
NOISE LEVEL @ 1 M (Free Field)	25	SPL dB(A) SOUND PRESSURE	

Diagram 4

6.6 The calculation exercise for the proposed ASHP is shown in Table 4.

ASHP within courtyard	L_p dBA
1no. Mitsubishi PUHZ-W112VHA	53dB
1no. Mitsubishi PUHZ-W112VHA in Environ enclosure	27@1m[1]
Distance attenuation (8m)	-18dB [20Log(8/1)]
Reflective plane correction	+9dB
BS4142 acoustic feature corrections	+2dB [-3+2+3]
Building edge diffraction (no line of sight)	-10
Rated noise level at nearest noise sensitive façade	**10 dB**

Table 4

[1] Amended prediction as selection matrix considers a stated output of 51dBA and the PUHZ-W112VHA has an output of 53dBA @1m.

6.7 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 19 dBA at 1m from the nearest noise sensitive façade.

6.8 The calculated noise impact is 10 dBA. The calculation exercise (Table 4) demonstrates that the proposed installation meets the LPA criteria.

7. CONCLUSION

7.1 The foregoing assessment indicates that the proposed installation meets the LPA planning criteria. Additional mitigation measures other than the Environ acoustic enclosure would not be required.

7.2 If an alternative supplier or manufacturer of ASHP or enclosure 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.

7.3 It is also recommended that the unit is positioned on vibration isolation mounts to minimise structural borne vibration and re-radiated noise into the fabric of the building. Rubber turret mounts are suitable for this kind of application, available from the following, as shown in Diagram 5 below.

	Christie & Grey Limited Morley Road, Tonbridge, Kent, TN9 1RA, United Kingdom T: +44 (0)1732 371100 F: +44 (0)1732 359666 E: sales@christiegrey.com OR Mason UK Ltd Unit 6 Abbey Business Park Monks Walk Farnham Surrey GU9 8HT Tel: (01252) 716610 Fax: (01252) 716630 info@masonuk.co.uk

Diagram 5

Figures

Courtyard of 1 Villas on the Heath and neighbouring area

Proposed location of ASHP in enclosure

Figure 1

Figure 2

Neighbouring non habitable room window of The Old Cottage

Figure 3

Figure 4

Figure 5

Figure 6

Measurement location at first floor level

Figure 7

1 Villas on the Heath

ASHP location in courtyard

Nearest noise sensitive window at first floor level - The Old Cottage

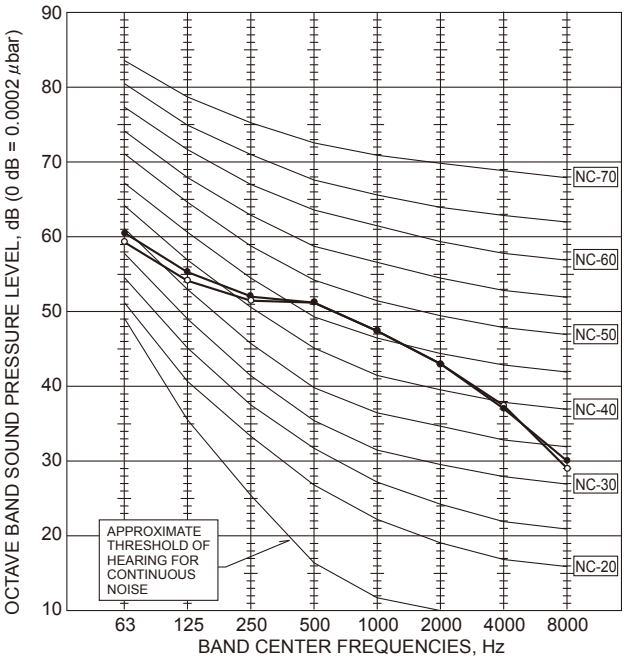
Appendix A

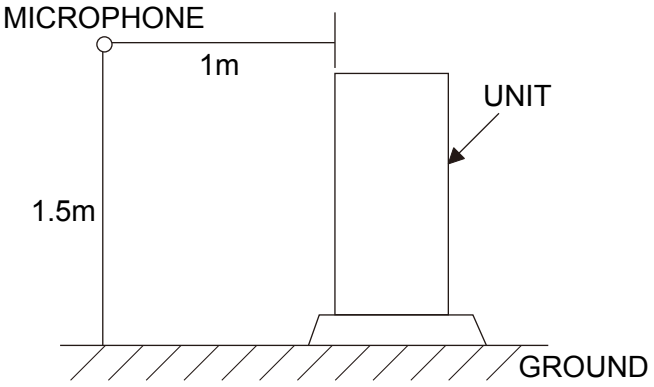
3 DATA

3-1. NOISE CRITERION CURVES

PUHZ-W112VHA
PUHZ-W112VHA-BS

MODE	SPL(dB)	LINE
COOLING	53	○—○
HEATING	53	●—●





Appendix B

Tel: 0870 383 3344
www.environ.co.uk

SELECTION MATRIX

environlite T8-1700 P1

Acoustic enclosures for Split AC Unit Applications

CUSTOMER:	SITE / LOCATION / REFERENCE

ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA

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

MAKE:	MODEL:	AIR IN	AIR OUT
Mitsubishi	PUHZ-W112VHA	Rear & 1 Side	Front

WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)	AIRFLOW (M^3S^{-1})	SPL dB(A)	DISTANCE (M)
900	330+30	1350	1.67	51	1

INNER CUBE DIMENSIONS		
1050	400	1635
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1.67	1.0	51
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)

ENCLOSURE DETAIL		
1700	1000	1700
WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
1.67	1.0	25
AIRFLOW (M^3S^{-1})	DISTANCE (M)	SPL dB(A)

INLET AIRWAYS		
1635	275	1
WIDTH (MM)	HEIGHT (MM)	NO.

DESIGN CRITERIA		
OK	OK	OK
UNIT SIZE	OUTLET	INLET

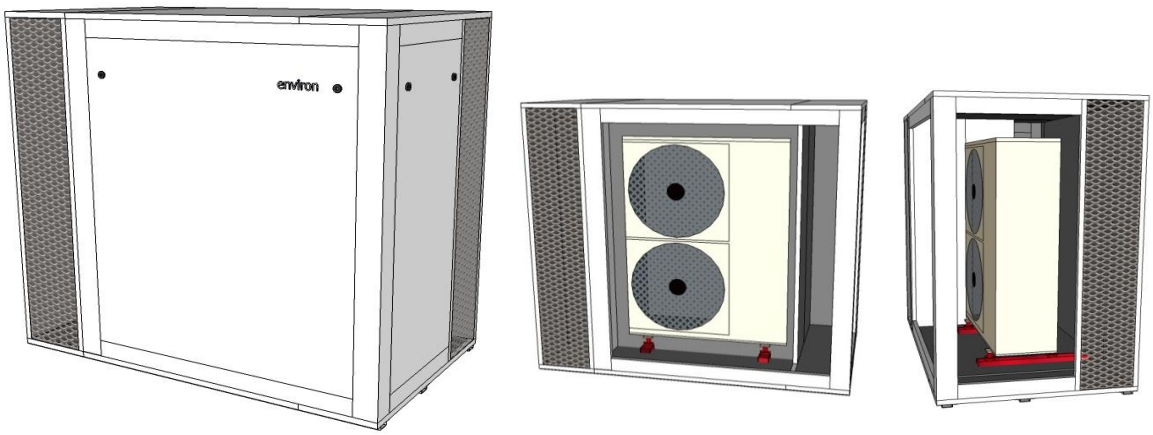
OUTLET AIRWAYS		
275	1635	1
WIDTH (MM)	HEIGHT (MM)	NO.

AIRFLOW INFORMATION		
16	3.7	3.7
PD (NM^{-2})	OUTLET (MS^{-1})	INLET (MS^{-1})

Select Inlet & Outlet Airway Sizes to Ensure Airflows are kept Below 6.0m/s

ENCLOSURE INFORMATION	WIDTH (MM)	DEPTH (MM)	HEIGHT (MM)
INLET AIRWAY	275		1635
OUTLET AIRWAY	275		1635
EXTERNAL SIZE	1700	1000	1700
NOISE LEVEL @ 1 M (Free Field)	25	SPL dB(A) SOUND PRESSURE	

NOTES CONCERNING ENCLOSURE DESIGN

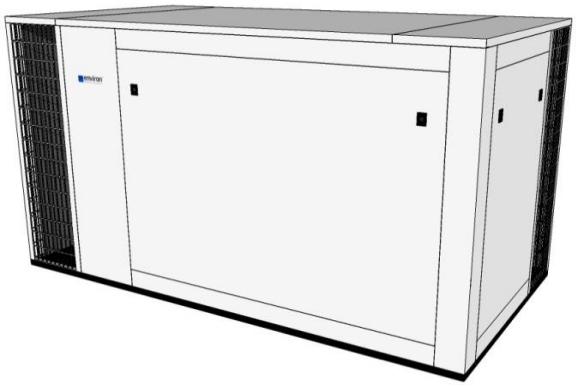


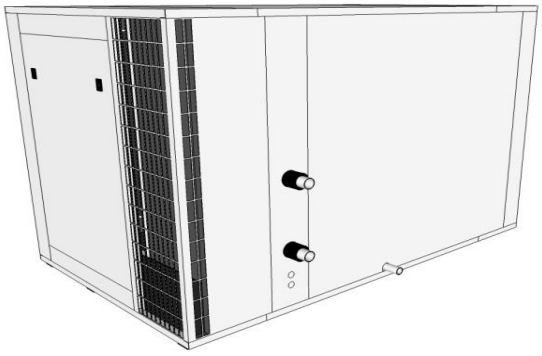
Tel: 0870 383 3344
www.environ.co.uk

SELECTION MATRIX

environlite T8-1700 P1

Acoustic enclosures for Split AC Unit Applications

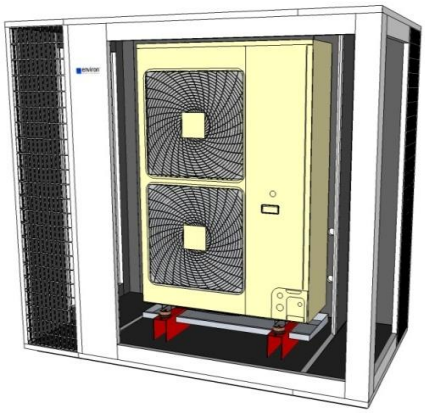




System/Electrical/Condensate Services

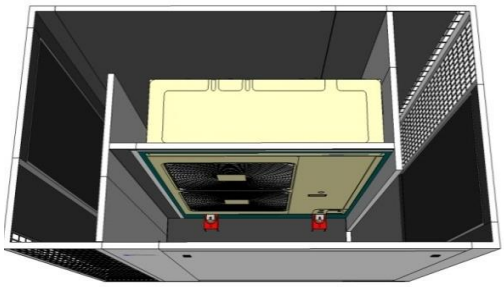
Exterior Colour

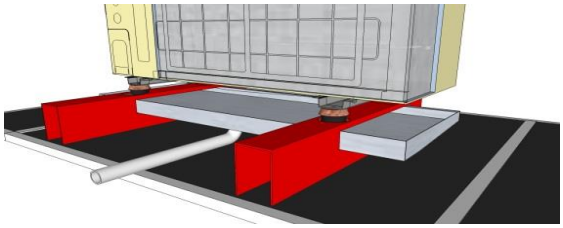
Any RAL/BS Colour

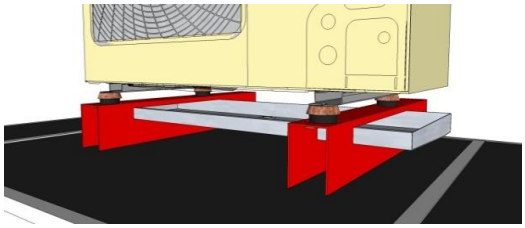


Service/Maintenance Access

Balanced Air Flow
Internal Plenum Seals stop
Air Recirculation







Optional Extras

Condensate Drain Pan
Drain Pan Heater Tape

Anti Vibration Mounts