



MACH
GROUP

THINKING DIFFERENTLY

WHITLEY WOOD FIRE STATION

Plant Noise Impact Assessment
Rev02

Atkins Realis

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1.0 INTRODUCTION

MACH has been appointed by Atkins Realis to undertake a noise impact assessment at the proposed site of Whitley Wood Fire Station in Reading.

The development is an existing fire station which includes the installation of new air source heat pumps. This impact assessment undertaken is required to assist with the following:

- Determine appropriate background noise levels representative of nearby noise sensitive receivers appropriate for a BS4142:2014 plant noise impact assessment.
- Assess the noise impact of the proposed mechanical plant equipment at the nearby noise sensitive receivers.

Details of the noise survey which facilitated this assessment is presented within APPENDIX A -

2.0 SITE DESCRIPTION

The existing Fire Station is located on Whitley Wood Road. The surrounding buildings include residential dwellings to the South.

The site in relation to its surroundings and nearby noise sensitive receivers is presented in Figure 2.1.



Figure 2.1: Worst-affected noise sensitive receivers

2.1 Noise Sensitive Receivers

Locations that are noise sensitive receivers (NSR), which will be assessed within this exercise are listed below.

NSR Reference	Location	Type	Distance from Plant Installation (m)
NSR.1	Whitley Wood Road	Residential window	40
NSR.2	Whitley Wood Road	Residential window	30
NSR.3	Swallowfield Drive	Residential window	44

Table 2.1: Worst-affected noise sensitive receivers

3.0 ASSESSMENT CRITERIA

3.1 Local Planning Policies

It is understood that the requirements of the Reading Council regarding noise emissions generated by new building services plant are as follows.

“EN17: NOISE GENERATING EQUIPMENT Where noise generating equipment is proposed, the noise source specific⁶¹ level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor”

As per above, a plant noise assessment will be undertaken in accordance with BS 4142:2014 and that the plant noise rating level limit at the worst-affected noise sensitive receptor will be assessed against the existing background noise levels, $L_{A90,T}$.

In line with BS 4142: 2014, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty will be subtracted from any of the above proposed noise emission limits.

3.2 Summary of Criteria

In summary of the criteria requirements above, if the targeted rating level from noise is 10dB below the existing background noise for the daytime and night period, then the Local Authority planning criteria will be achieved.

4.0 EXISTING BACKGROUND NOISE LEVELS

To establish the existing background noise levels on site, a noise survey was conducted between 12:10 on the 18/06/2024 and 10:30 on the 19/06/2024 by Chase Bartlett and in accordance with BS 7445-1: 2003.

More information on the methodology of this survey, site information and survey data, is presented in APPENDIX A -

When considering the existing background levels of a site, BS 4142:2014, "Methods for Rating and Assessing Industrial and Commercial Sound" states that the background sound level used for the assessment should be representative of the period being assessed.

BS4142:2014 goes on to state:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. 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."

The table below presents measured noise levels of the $L_{A90,T}$ values measured on site. For the purpose of this assessment, the modal $L_{A90,5\text{minute}}$ was considered representative of the existing background noise level on site, in line with the requirements of the Local Authority.

Measurement Position	$L_{A90,T}$ Method	Background Noise Level $L_{A90,T}$	
		Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
F1	Mode	42	32

Table 4.1: $L_{A90,T}$ background noise levels for plant noise break-out assessment

5.0 PLANT NOISE IMPACT ASSESSMENT

5.1 Noise Sensitive Receivers

The noise impact generated by the new plant installation has been assessed at the worst-affected NSR's which are described in Section 2.1 of this report.

5.2 Items of Noise Generating Plant

Information on the proposed plant installations have been provided by Atkins Realis. The items of plant within each group, along with their locations and operational hours are as follows:

Reference	Type of Source	Quantity	Manufacturer/ model	Location	Operational Hours
ASHP01	Air Source Heat Pump/ Breakout noise	1	Mitsubishi/ PUHY-P250YNW-A2	Shown in Figure 5.1	24-hours
ASHP02	Air Source Heat Pump/ Breakout noise	1	Mitsubishi/ PUHY-P450YSNW-A2		

Table 5.1: Proposed items of noise generating plant

The following site plan shows the proposed plant installation.

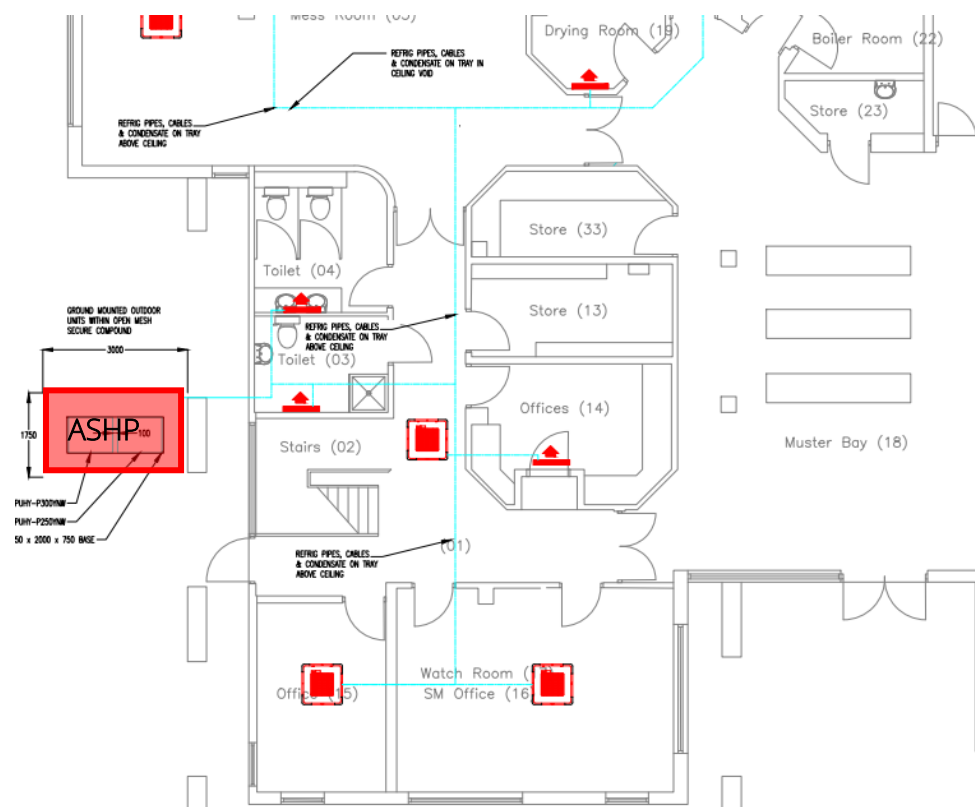


Figure 5.1: Site plan showing proposed plant layout

5.3 Plant Noise Data

The following noise levels for the individual items of plant are presented below. All data is based on manufacturers data. All plant noise data sheets are included within APPENDIX B -

Unit Reference	Noise Data Type	Duty Rate	Sound Levels, dB, at Octave Band Centre Frequencies, Hz							
			63	125	250	500	1000	2000	4000	dBA
ASHP01	Breakout L _p @ 1m	Heating mode	70	63	62	60	54	50	50	61
ASHP02	Breakout L _p @ 1m		71	65	65	62	56	52	52	63

Table 5.2: Plant equipment data

5.4 3D Acoustic Model

A 3D acoustic model of the development has been constructed in CadnaA such to accurately predict noise break out from individual items of plant from the development at nearby noise sensitive receivers. CadnaA is an industry standard noise modelling software which calculates how sound travels over distance. The model considers reflections off hard surfaces, ground absorption, acoustic screening, and geometrical spreading. The calculations are performed in accordance with ISO 9613: Attenuation of sound during propagation outdoors.

The following assumptions have been made in the model, based on observation of the site and proposed development has identified the following features. These features will be included within the calculation model including any other additional parameters stated.

- Ground absorption has been set to acoustically hard.
- Topography of the site is assumed to be flat.
- Order of reflections has been set to 3.

A screenshot of the 3D noise model is illustrated below.



Figure 5.2: 3D Acoustic model with noise sources

5.5 Noise Impact Assessment (Proposed Installation)

The resultant noise map which calculated the combined specific noise level at each receiver is presented below. Additionally, the table below provides the calculated rating levels at the worst-affected noise sensitive receptors.

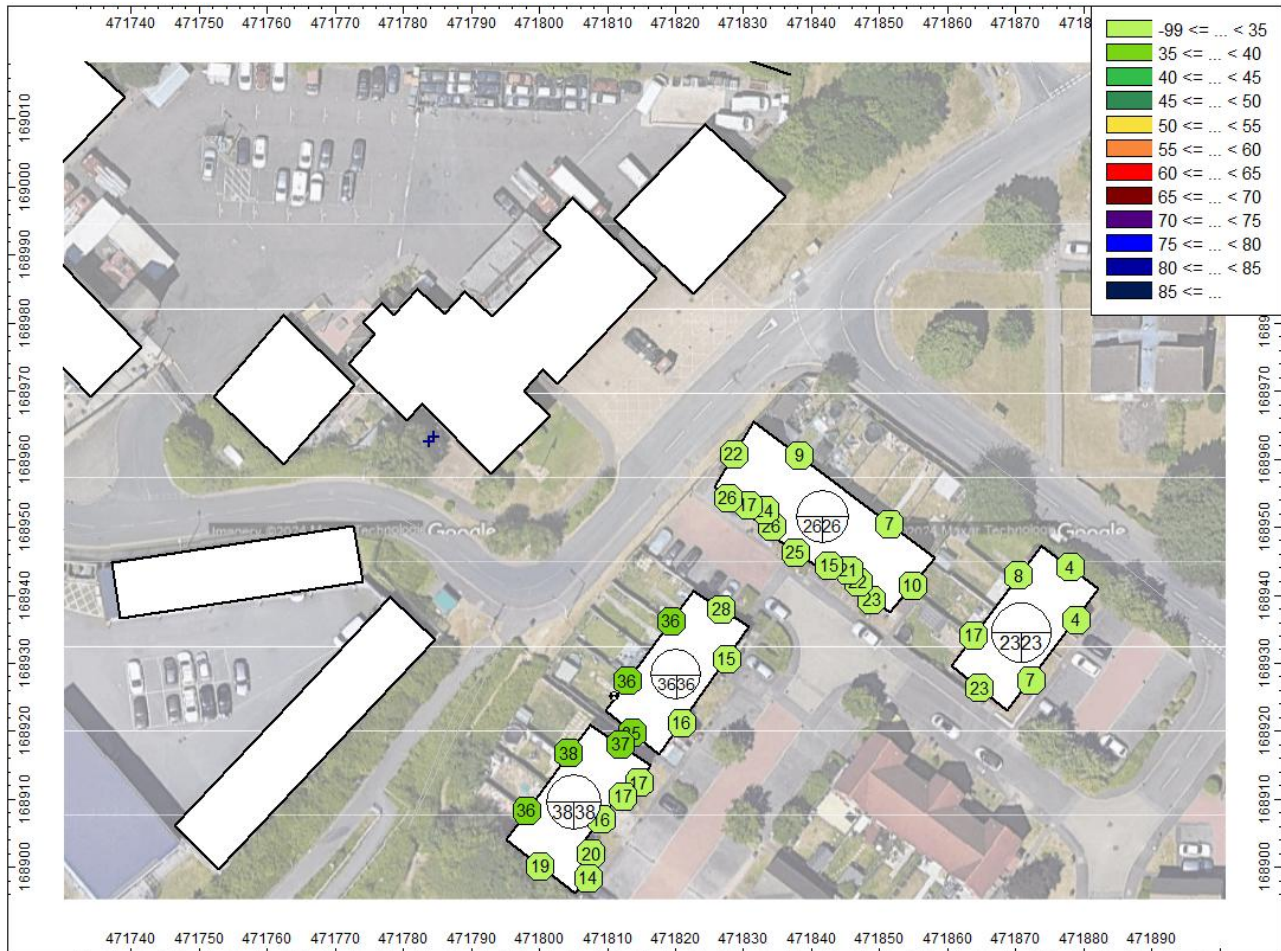


Figure 5.3: Noise map

NSR Reference	Time Period	Background Noise Level (dB L _{A90,T})	Criteria (dB)	Specific Noise Level (dB L _{Aeq,T})	Feature Correction	Rating Level (dB L _{Ar,Tr})	Assessment Outcome
NSR1	07:00–23:00	42	10dB Below Background	38	+3	41	-1
	23:00–07:00	32	10dB Below Background	38		41	+9
NSR2	07:00–23:00	42	10dB Below Background	36		39	-3
	23:00–07:00	32	10dB Below Background	36		39	+7
NSR3	07:00–23:00	42	10dB Below Background	26		29	-13
	23:00–07:00	32	10dB Below Background	26		29	-3

Table 5.3: BS4142 assessment outcome

5.5.1 Acoustic Feature Correction

The following acoustic feature corrections have been considered in regards to the rating level, L_{Ar,Tr} at the affected NSR's.

5.5.1.1 Intermittency

Due to the intermittent nature of the operation of the ASHP units, a 3dB penalty correction has been applied to the specific noise level.

5.5.1.2 Tonality

The tonality of the proposed M&E items could not be assessed as third octave noise data is required for the assessment and only octave band noise data was available at the time of writing. However, the proposed M&E items are typically broadband in character. Based on previous projects, in our experience extract fans, air source heat pumps and condenser units are broadband in nature.

5.6 Acoustic Mitigation Strategy

5.6.1 Acoustic Screening

The initial assessment shows acoustic screening will be required, as outlined below. The height stated for the plant compound is from ground level.

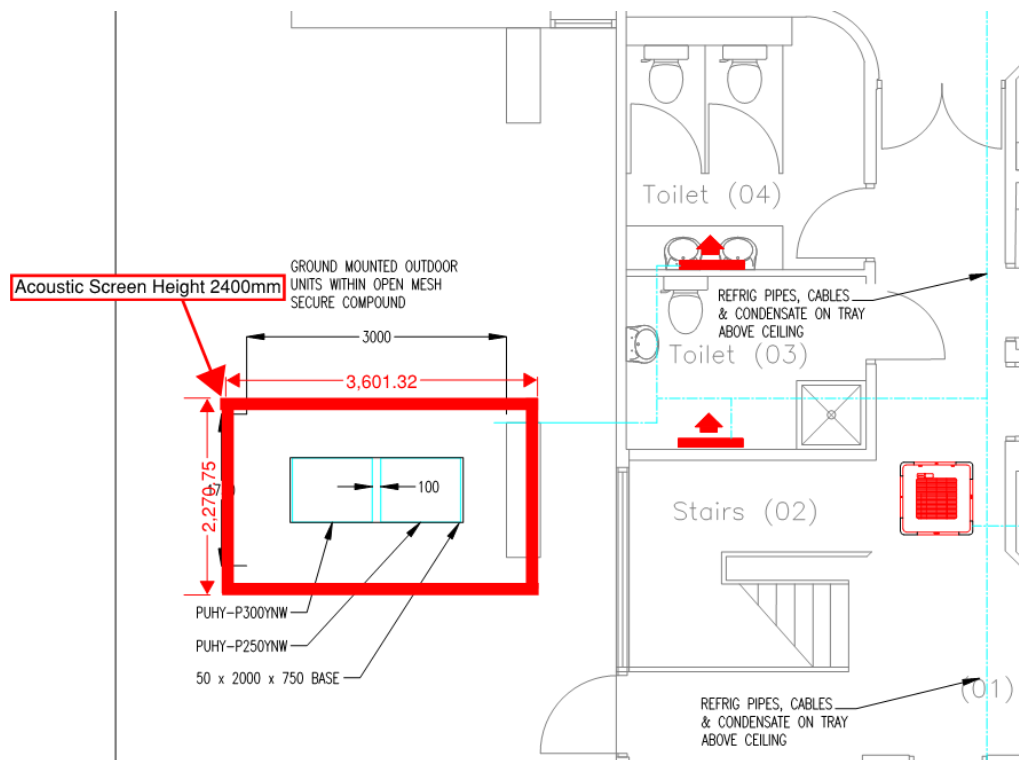


Figure 5.4: Proposed acoustic screens (red)

Where acoustic screens have been specified these should meet the following specification:

- Be of solid construction with no holes or gaps.
- Minimum height of 2400mm.-
- Have no gaps between the floor and the acoustic screen
- Must be non-permeable and thus have no gaps within the acoustic barrier
- Have a surface mass of $\geq 12\text{kg/m}^2$. Typical suitable materials include 10mm cement particle board, 2mm sheet steel or 18mm plywood.

5.6.2 ASHP Attenuation Kits

Our assessment also shows that all ASHP units will require an attenuation kit. The following attenuation shroud spectrum has been provided by Atkins Reais. The acoustic shroud kit that is applicable to the finalised units should achieve no less than the following specification.

Unit Reference	Location	Minimum Insertion Loss, dB at Octave-band Frequency, Hz						
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
ASHP's (All ASHP Units)	Full Kit	3	6	8	9	13	14	9

Table 5.4 - Minimum insertion loss for ASHP attenuation kits

The acoustic attenuation kit is presented in APPENDIX C -

5.7 Noise Impact Assessment (Post-mitigation)

A noise map which shows the specific noise level at each NSR is presented below.



Figure 5.5: Plant noise prediction at nearest noise sensitive receiver

The table below provides the predicted plant noise rating level at the worst affected noise sensitive receptors, with the mitigation strategies implemented.

NSR Reference	Time Period	Background Noise Level (dB L _{A90,T})	Criteria (dB)	Specific Noise Level (dB L _{Aeq,T})	Feature Correction	Rating Level (dB L _{A,r,Tr})	Assessment Outcome
NSR1	07:00–23:00	42	10dB Below Background	22		22	-20
	23:00–07:00	32	10dB Below Background	22		22	-10
NSR2	07:00–23:00	42	10dB Below Background	21		21	-21
	23:00–07:00	32	10dB Below Background	21		21	-11
NSR3	07:00–23:00	42	10dB Below Background	8		8	-34
	23:00–07:00	32	10dB Below Background	8		8	-24

Table 5.5: Plant Noise Assessment Outcome

5.7.1 Acoustic Feature Correction

The following acoustic feature corrections have been considered in regards to the rating level, L_{A,r,Tr} at the affected NSR's.

5.7.1.1 Intermittency

The proposed condenser units are seen to be intermittently operating; however, as the predicted specific noise level of these units are 10dB or greater, below the measured background noise level, the intermittency is seen to be inaudible. Therefore, the acoustic feature correction for intermittency has not been applied.

5.7.1.2 Tonality

The tonality of the proposed M&E items could not be assessed as third octave noise data is required for the assessment and only octave band noise data was available at the time of writing. However, the proposed M&E items are typically broadband in character. Based on previous projects, in our experience extract fans, air source heat pumps and condenser units are broadband in nature.

5.8 Vibration Control

Although not necessarily related to planning matters, It is also important to consider the potential transfer of structure borne noise to the development itself, in the form of vibration.

It is typically recommended that condenser units and fans or anything generating vibration are isolated from the supporting structure by either steel spring isolators or rubber footings. Where there are particularly sensitive locations nearby, or when equipment is mounted on lightweight structures, consideration to use caged restrained type anti-vibration mounts should be made.

In addition, it is critical that the isolation is not "short-circuited" by associated ductwork or pipework. As such, flexible connectors should be introduced between the plant and any associated pipework or ductwork. Associated pipework and ductwork should be resiliently mounted, as appropriate.

5.9 Uncertainty

Consideration of the potential uncertainties involved in the sound level measurements and the assessment methodology have been made to ensure a high level of confidence in the outcome of the assessment. Annex B of BS4142:2014 presents a range of factors and good practice methods which should be made, and these have been considered in this assessment.

6.0 CONCLUSION

In summary the following points set out the conclusions of this report;

- A noise survey has been conducted at the proposed site in order to establish representative background noise levels (L_{A90}) at the nearby noise sensitive receivers. These background noise levels are presented in Section 4.0 of this report and the details of the noise survey itself are included in APPENDIX A - .
- The assessment criteria to be used for the purpose of planning submission has been established and is provided Section 3.2.
- Details of the plant equipment have been provided to us, including location, hours of operation, and noise data has been presented in Section 5.0 of this report.
- Calculations have shown that the criteria for the purpose of planning submission can be achieved provided further acoustic mitigation is implemented. The suggested mitigation strategy is provided in Section 5.6.

APPENDIX A - ENVIRONMENTAL NOISE SURVEY

To establish the existing environmental noise levels on site, a noise survey was conducted between 12:10 on the 18/06/2024 and 10:30 on the 19/06/2024.

This site assessment was undertaken by Chase Bartlett of MACH Group.

A.1 Site Description

The site is located at 270 Whitley Wood Rd, Reading RG2 8FT and is situated in an urban area near business parks and Basingstoke main road (B3270).

A.1.1 Subjective Noise Climate (On-site)

Noise Type	Noise Characteristics	Sources
Dominant	A primary contributor of noise levels on the site.	Basingstoke main road (B3270), Whitley wood Rd.
Other Noise Contributions	Contributors to the remainder of the noise climate on site.	Residential housing

Table A.1.1 Subjective Summary of the Noise Sources

A.1.2 Non-Representative Noise Sources

During the survey, no noise events occurred which would be deemed as atypical of the site location.

A.2 All Measurement Locations

To help with the understanding of the site and measurement locations all the measurement positions are presented on the map below. Photos of the locations in situ are in the following sections.



Figure 6.1 All Measurement Locations on a Map

A.3 Fixed Measurement

A fixed microphone position was used to record noise levels between 12:10 on the 18/06/2024 and 10:30 on the 19/06/2024, where the fixed long-term meter was set to measure consecutive 'A' weighted 5-minute time samples. Measurements have been taken in free field conditions.

To help with the understanding of the site and the measurement locations, the figures below present the location of the microphone position(s) in situ.

A.3.1 Fixed Measurement Location – F1

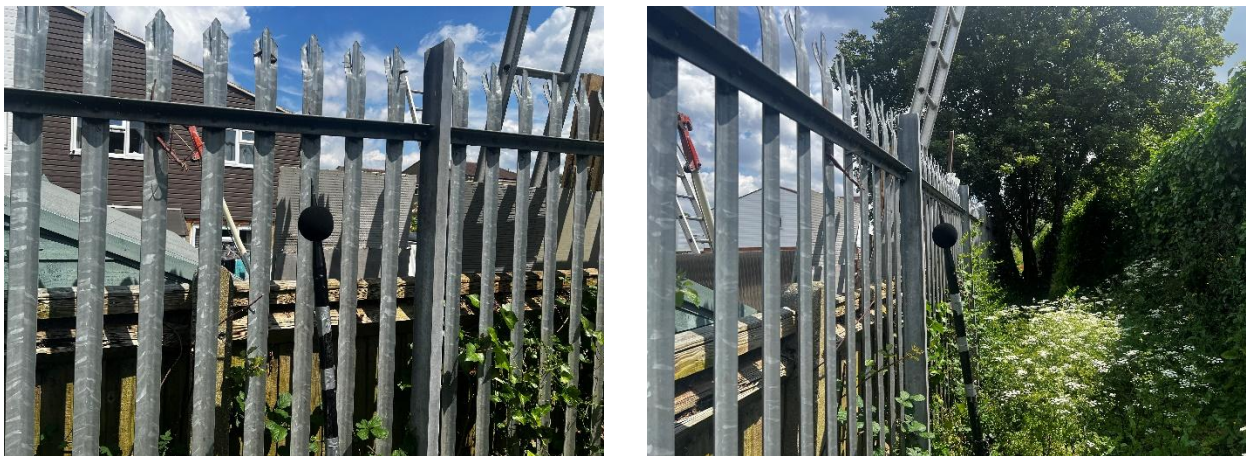


Figure 6.2 Fixed measurement F1 location in situ

A.3.2 Fixed Measurement Results – F1

The following graph presents the noise levels recorded over the measurement period at the fixed location (F1).

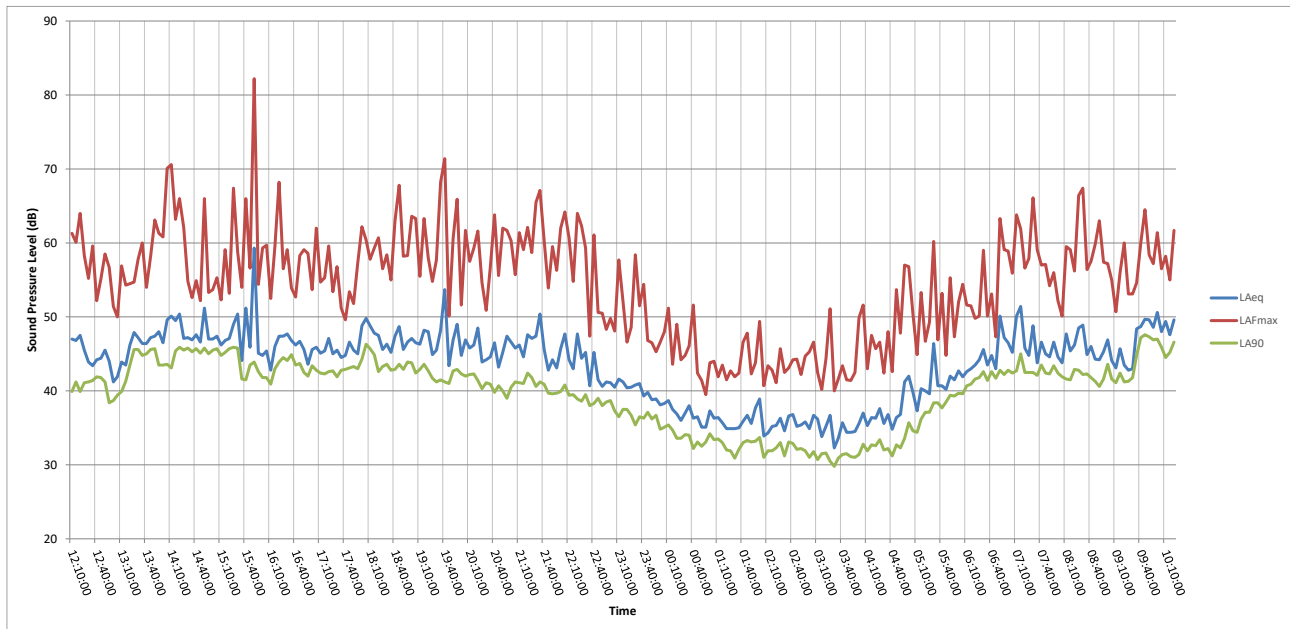


Figure 6.3 Sound Pressure Level at fixed location, F1

A.4 Measurement Equipment

Item	Serial No.	Last Calibration	Certificate No.	Calibration Due
NTI Precision Sound Analyser XL2 TA	A2A-13314-E0	02/02/2024	207923	02/02/2026
NTI Pre-amplifier MA220	7677	02/02/2024	207923	02/02/2026
NTI Microphone Capsule MC230A	A14417	26/01/2024	207907	26/01/2026
Svantek Acoustic Calibrator SV33A	64140	13/12/2023	204757	13/12/2024

Table A.4.2 Measurement Equipment

A.5 Meteorological Conditions

Data Taken from: <https://www.timeanddate.com/weather/>

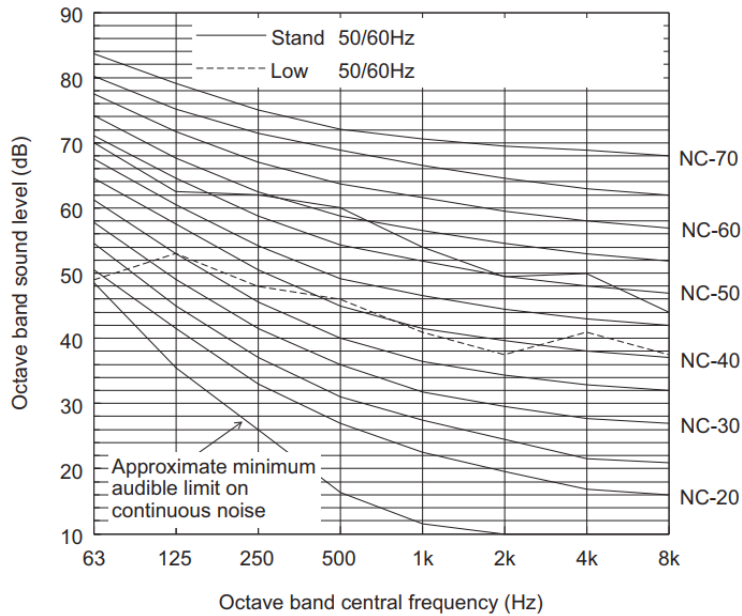
Date	Time (hh:mm)	Temperature (High / Low) (°C)	Humidity (%)	Pressure (hPa)	Wind Speed (m/s)	Wind Direction	Conditions
18/06/2024	12:00	20/19	55	1015	4.4	NNW	Scattered Clouds
	18:00	18/12	70	1016	2.5	NNW	Passing Clouds
19/06/2024	00:00	12/11	89	1019	3.6	NNE	Overcast
	06:00	17/12	71	1021	4.7	NNE	Partly Sunny

Table A.5.3 Meteorological Conditions

APPENDIX B - PLANT NOISE DATA

ASHP01

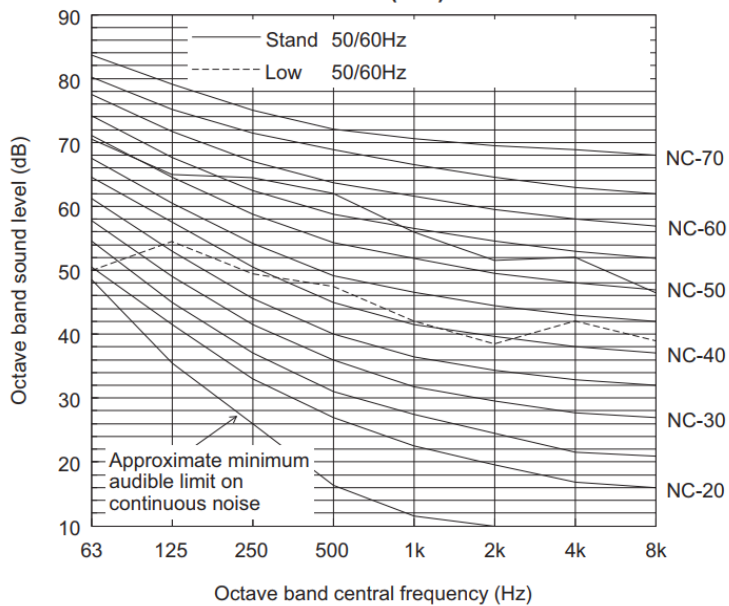
Sound level of PUHY-P250YNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	70.0	62.5	62.0	60.0	54.0	49.5	50.0	44.0	61.0
Low noise mode	50/60Hz	49.0	53.0	48.0	46.0	41.0	37.5	41.0	37.5	48.5

ASHP02

Sound level of PUHY-P450YSNW-A(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	70.5	65.0	64.5	62.0	56.0	51.5	52.0	46.5	63.0
Low noise mode	50/60Hz	50.0	54.5	49.5	47.5	42.0	38.5	42.0	39.0	50.0

APPENDIX C - ATTENUATION KIT

Key Features

- Up to 8dBA noise reduction
- Mitsubishi approved
- No impact on machine functionality

TYPES OF KIT

Both a 'full kit' and 'top only' kit are available. The 'full kit' comprises left, right and back louvres with a top attenuator. The 'top only' has a top attenuator only.

If space is an issue, then the 'top only' kit is available which can still reduce the noise level by up to 4dBA.

The noise level is calculated from an average of the noise at a height of 1m and distance of 1m from the front, back, left, right and 1m above the top. All noise measurements are performed in an anechoic chamber.

BASIC ACOUSTIC KIT COSTS



S-module

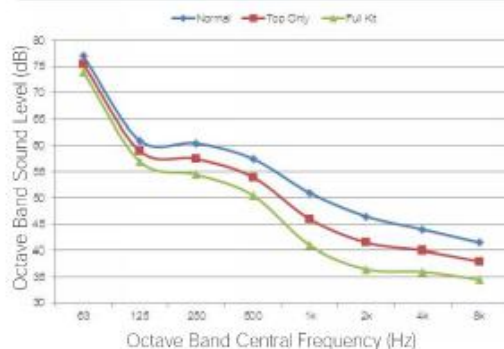


L-module



XL-module

PURY-EP200YNW-A ACOUSTIC NOISE LEVEL DATA*



* Indication only

For all PUHY and PURY Series (YNN)

3 models are available, small, large and extra large. Small fits on the S-module outdoor units, large fits on the L-module outdoor units and extra large on the XL-module outdoor units.

S-module	Complete acoustic kit target price	£2695.00
	Top attenuator only target price	£960.00
L-module	Complete acoustic kit target price	£3164.00
	Top attenuator only target price	£1305.00
XL-module	Complete acoustic kit target price	£4142.00
	Top attenuator only target price	£1920.00

All costs include delivery to England & Wales. Scotland shipping costs vary - please contact us for more info.

APPENDIX D - BS 4142:2014

BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level.

BS 4142 states that one should ‘obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:

- 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.

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if ‘a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources. To summarise, BS4142 Section 9.2 advises the following with regards to corrections for acoustic characteristics:

- **Tonality** – 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 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.
- **Impulsivity** – 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.
- **Other sound characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied
- **Intermittency** – When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.