9-10 WINDMILL STREET, FITZROVIA W1T 2JE

Plant Noise Assessment

Reference: 12299.RP01.PNA.0
Prepared: 14 November 2022
Revision Number: 0

Planning Potential
Magdalen House
148 Tooley Street
SE1 2TU

Plant Noise Assessment

9-10 WINDMILL STREET, FITZROVIA W1T 2JE

Reference: 12299.RP01.PNA.0
Prepared: 14 November 2022

Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	14 November 2022	Maxim Billingham	David Johnston

Terms of contract:

RBA Acoustics Ltd have prepared this report in accordance with our Scope of Work 12299.SW01.0 dated 19 October 2022. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

RBA ACOUSTICS

LONDON
44 Borough Road
London SE1 0AJ
T. +44 (0) 20 7620 1950

MANCHESTER
Bloc, 17 Marble Street
Manchester, M2 3AW
T. +44 (0) 161 661 4504

Contents

1. INTRODUCTION

RBA Acoustics has been commissioned by Planning Potential to undertake a noise impact assessment in relation to the proposed installation of 2No. Air Source Heat Pump (ASHP) units at the rear of 9-10 Windmill Street, London W1T property. The assessment is required in order to support a planning application and to demonstrate compliance with Local Authority's noise control requirements at the nearby noise-sensitive receptors.

Measurements of the prevailing noise conditions at the site have been undertaken and used to determine atmospheric noise emission limits in accordance with Camden Council's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

A summary of acoustic terminology is included in Appendix A.

2. SITE DESCRIPTION

The property at 9-10 Windmill Street is a commercial property located on a ground level of five-storey building, with residential apartments on the upper levels. The property is approximately 18 metres in height and situated in a mixed-use, commercial and residential area. The site is bordered by Windmill Street to the north and adjacent, mixed-use properties to the west and east. More adjacent commercial use properties are located on the south boundary of the site.

The nearest, noise-sensitive residential receptors are located at the residential flats above in the same building and detailed in Section 5.4. The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix B).

3. ENVIRONMENTAL NOISE SURVEY

3.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following period:

12:15 hours, Thursday 3rd of November to 11:15 hours, Friday 4th of November 2022

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were generally considered suitable for obtaining representative noise measurements, being predominantly dry with little wind.

Continuous measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes.

3.2 Measurement Location

To determine the existing noise climate around the site measurements were undertaken with the microphone positioned on a pole, which was attached to railings of the fire escape, located at the rear of the property, such that the microphone was approximately 2 metres above the ground level overlooking the rear lightwell and windows of the adjacent properties to the site.

The prevailing noise climate was noted to be dominated by traffic noise from Windmill Street and Percy Street, as well as remote construction noise in the area, existing plant noise from another property, and aircraft noise. The measurements at this position were subject to façade reflections.

The measurement position is also illustrated on the site plan in Figure 1 and the photo in Figure 3 in Appendix B. The measurements of sound at this position were considered to be representative of the noise climate as experienced at the nearest noise-sensitive receptor.

3.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix C. The sound level meter and field calibrator have both been laboratory calibrated within the past two years, while the field calibrator has undergone an additional calibration check within the past year.

The sound level meter was calibrated both prior to and on completion of the survey with the field calibrator. No significant calibration drift was observed.

3.4 Results

The typical-lowest L_{A90} noise levels measured are summarised in Table 1.

Table 1 – Measured Levels

Measurement Period	Typical Lowest $L_{A90,15min}$ (dB)
Daytime (07:00 – 23:00)	42
Night-time (23:00 – 07:00)	36
Operating Hours (8:30 – 18:30)	42

The period averaged L_{A90} and L_{Aeq} noise levels measured are shown as time-histories on the attached Graphs 1-3 (Appendix D).

"Typical-Lowest" Background Levels

When considering the existing background levels of a site, BS 4142:2014, Methods for Rating and Assessing Industrial and Commercial Sound" recommends assessing to the "typical" measured $L_{A90,\ 15mins}$ background levels, BS 4142:2014 goes on to state:

> *"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."*

BS 4142:2014 suggests that statistical analysis is a suitable method to determine the "typical" background level. This can be carried out by calculating the level of the most-commonly occurring $L_{A90,\ 15mins}$ period during the proposed operating hours of equipment.

We generally consider that designing to the most-commonly occurring $L_{A90,\ 15mins}$ period is not sufficient during those slightly quieter periods. In our opinion, a more representative value would be the "typical-lowest" level, which can be determined statistically as the lowest rounded $L_{A90,\ 15mins\ level}$ which occurs for at least 10% of the assessment period.

4. PLANT NOISE CRITERIA

4.1 Local Authority Criteria

The requirements of Camden Council's Environmental Health Department regarding new building services plant are understood to be as follows.

> *"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 criteria"*

4.2 British Standard 4142:2014

BS4142:2014 *Methods for rating and assessing industrial and commercial sound* describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- sound from industrial and manufacturing processes
- sound from fixed installations which comprise mechanical and electrical plant and equipment
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described within BS4142:2014 use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The standard is also applicable to determine rating levels for sound of an industrial or commercial nature at proposed new dwellings or premises used for residential premises. The standard is only appropriate for the assessment of external sound levels.

The assessment method described in BS4142:2014 is based on the continuous sound pressure level produced by a specific source ($L_{Aeq,Tr}$) at the assessment location. Appropriate corrections allowing for any tonality, impulsivity, other characteristics or intermittency of the specific sound source are then applied to derive the rating level ($L_{Ar,Tr}$). The rating level is then compared to the background sound level ($L_{A90,T}$) to produce the relative difference, or excess of rating level over background sound level. BS4142:2014 quantifies the estimated impact from the excess as:

a) *Typically the greater this difference, the greater the magnitude of impact.*
b) *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
c) *A difference of around +5dB 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.

4.3 Summary

In line with the Local Authority requirements and results of the noise monitoring in Table 1, we would propose items of mechanical services be designed so that noise emissions from the plant do not exceed the below levels when assessed at 1 metre from the external façade of the nearest residential properties:

- Operating Hours (08:30 to 18:30) 32 dB

In line with BS4142: 2014, should the proposed plant be identified as having intermittent, tonal or other attention-grabbing characteristics, further penalties should be subtracted from any of the above proposed noise emission limits in line with BS 4142 methodology

5. PLANT NOISE ASSESSMENT

This assessment has been based on the information provided to RBA Acoustics by the Client and is described in the following sections.

5.1 Proposed Plant Items

The following plant is proposed for the scheme:

Table 2 – Plant Types

Ref.	Manufacturer/Model/Duty	Plant Type
ASHP.01	Mitsubishi PUMY-P140VKM5	Air Source Heat Pump
ASHP.02	Mitsubishi MUZ-AP20VG	

The above plant is understood to operate only during the daytime trading hours, therefore only daytime criteria is applicable.

5.2 Plant Locations

Two ASHP units are to be positioned on the lower ground floor-level, next to the wall underneath the fire escape staircase, located at the rear of 9-10 Windmill Street property.

The equipment positions are indicated on the site plan in Figure 1 and Figure 2 in Appendix B.

5.3 Plant Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturer of the unit. The associated plant noise levels are detailed as follows:

Table 3 – Plant Noise Levels

Unit	Parameter	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
ASHP.01 (Cooling)	L_p at 1m	64	52	51	50	46	40	34	28	51
ASHP.01 (Heating)		59	60	50	52	47	41	37	31	53
ASHP.02 (Cooling)		52	50	51	44	42	36	31	26	47
ASHP.02 (Heating)		49	52	52	45	42	36	33	28	48

Review of the octave band data provides no indication of any tonal characteristics associated with the proposed plant. On this basis, it is not considered necessary or appropriate to apply any rating corrections in accordance with BS 4142 methodology.

For the purposes of this assessment, we have assumed both units running in heating mode as this mode results in the highest noise levels.

5.4 Location of the Nearest Noise-Sensitive Receptors

Based on observations made on site we understand the nearest noise-sensitive receptors to the proposed plant to be as follows:

Receptor A – 10 Windmill Street, Level 1

The closest residential window to the plant location is understood to be the first-floor level window belonging to 10 Windmill Street, which is located approximately 8 metres to the north-west from the proposed plant location.

Our assessment of the potential noise impact has predicted noise due to the items of plant at the above receptor as the nearest, and therefore worst affected, residential receptor. Noise levels at other receptors will be lower than those at Receptors A, hence the potential impact will be further reduced. The receptor is also shown in the site plan in Figure 1 in Appendix B.

5.5 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

Our calculation method for predicting noise levels from the proposed plant at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SPL
- Distance Attenuation
- Reflections
- Mitigation (if applicable)

Calculation sheets are attached for further information in Appendix E.

Table 4 – Predicted Noise Levels

Operating Period	Noise Level (dB) at Receptor A	
	Prediction	Criterion
Operating Hours (08:30 – 18:30)	42	32

Noise from the proposed plant installations is above the target criteria. Therefore, we recommend the following mitigation measures to be included in the design and installation.

5.6 Mitigation

Based on the above assessments, acoustic mitigation will be required to the condenser units in order that the adopted plant noise emission limits may be achieved at the nearby noise sensitive receptors.

These reductions are able to be achieved by means of accommodating the units within a bespoke acoustic louvre, within attenuated openings to maintain sufficient airflow and heat rejection from the units. The acoustic louvre should provide the following insertion losses presented in Table 5.

Table 5 – Acoustic Louvre Performance

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
4	5	7	12	16	16	16	18

With the above mitigation measures included, the resultant predicted noise levels at Receptor A are as follows:

Table 6 – Predicted Noise Levels with Mitigation

Operating Period	Noise Level (dB) at Receptor A	
	Prediction	Criterion
Operating Hours (08:30 – 18:30)	32	32

Noise from the proposed plant with the mitigation measures incorporated is within the Local Authority criteria.

Alternative strategies for mitigating the noise to acceptable levels include:

- Provision of acoustic absorption to the lightwell to reduce reverberant build-up
- Provision of line-of-sight screening between the condenser and the window.

6. VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that ASHP units be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped, and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7. CONCLUSION

RBA Acoustics has undertaken noise monitoring at 9-10 Windmill Street, London W1T. The measured noise levels are presented within this report. The resultant noise levels have been used to determine the required criteria for atmospheric noise emissions from the proposed plant installations.

The following mitigation measures are proposed within this report:

- The units should be enclosed within acoustic louvre, capable of achieving the performance levels detailed in Table 5.

Provided the above mitigation measures are included in the design and installation or measures capable of achieving the same reductions in noise level, the results of the assessment indicate atmospheric noise emissions from the proposed plant are within the criteria required by Camden council and, as such, can be considered acceptable in terms of noise.

Appendix A – Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
L_{eq}	The level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
L_{An} (e.g. L_{A10}, L_{A90})	The sound level exceeded for n% of the time. E.g. L_{A10} is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, L_{A90} is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise.
$L_{Amax,T}$	The instantaneous maximum A-weighted sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level.

Appendix B – Site Plans

9-10 Windmill Street, Fitzrovia W1T 2JE

Site Plan showing Measurement Position, Plant Location, and the Nearest Receptor

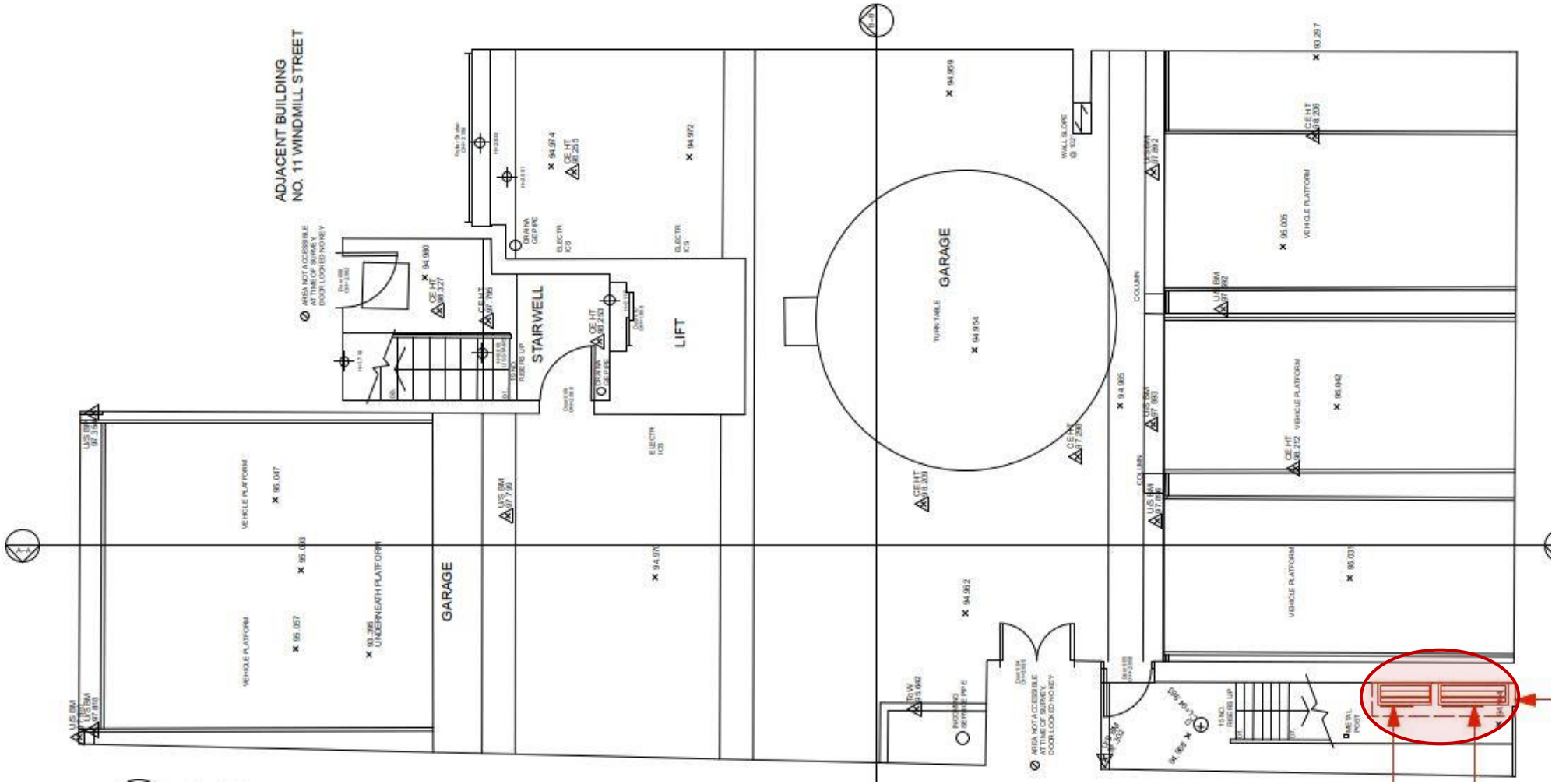
Project 12299

Figure 1

14 November 2022

Not to Scale

RBA ACOUSTICS



9-10 Windmill Street, Fitzrovia W1T 2JE

Site Plan showing Proposed Plant Location

Project 12299

Figure 2

14 November 2022

Not to Scale

RBA ACOUSTICS

9-10 Windmill Street, Fitzrovia W1T 2JE

Photo showing Measurement Position

Project 12299

Figure 3

14 November 2022

Not to Scale

RBA ACOUSTICS

Appendix C – Instrumentation

The following equipment was used for the measurements.

Table C1– Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406255	U37581	7 April 2023
Norsonic Pre Amplifier	1209	20491		
Norsonic ½“ Microphone	1225	225529	37580	7 April 2023
Norsonic Sound Calibrator	1251	34391	U37579	7 April 2023

Appendix D – Graphs

9-10 Windmill Street, Fitzrovia

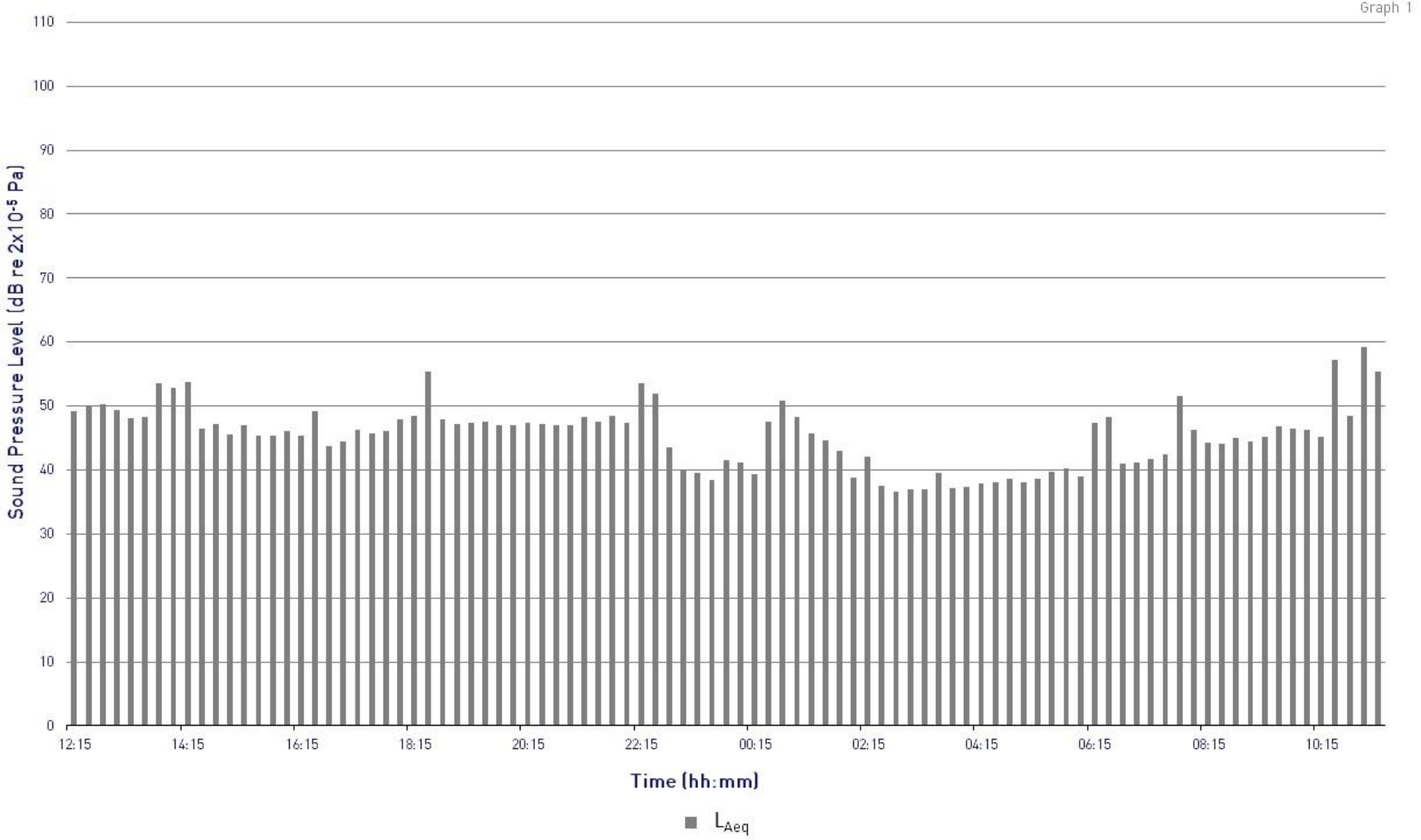
L_{Aeq} Time History

Measurement Position 1, Thursday 3rd of November to Friday 4th of November 2022

RBA ACOUSTICS

Project: 12299

Graph 1



9-10 Windmill Street, Fitzrovia

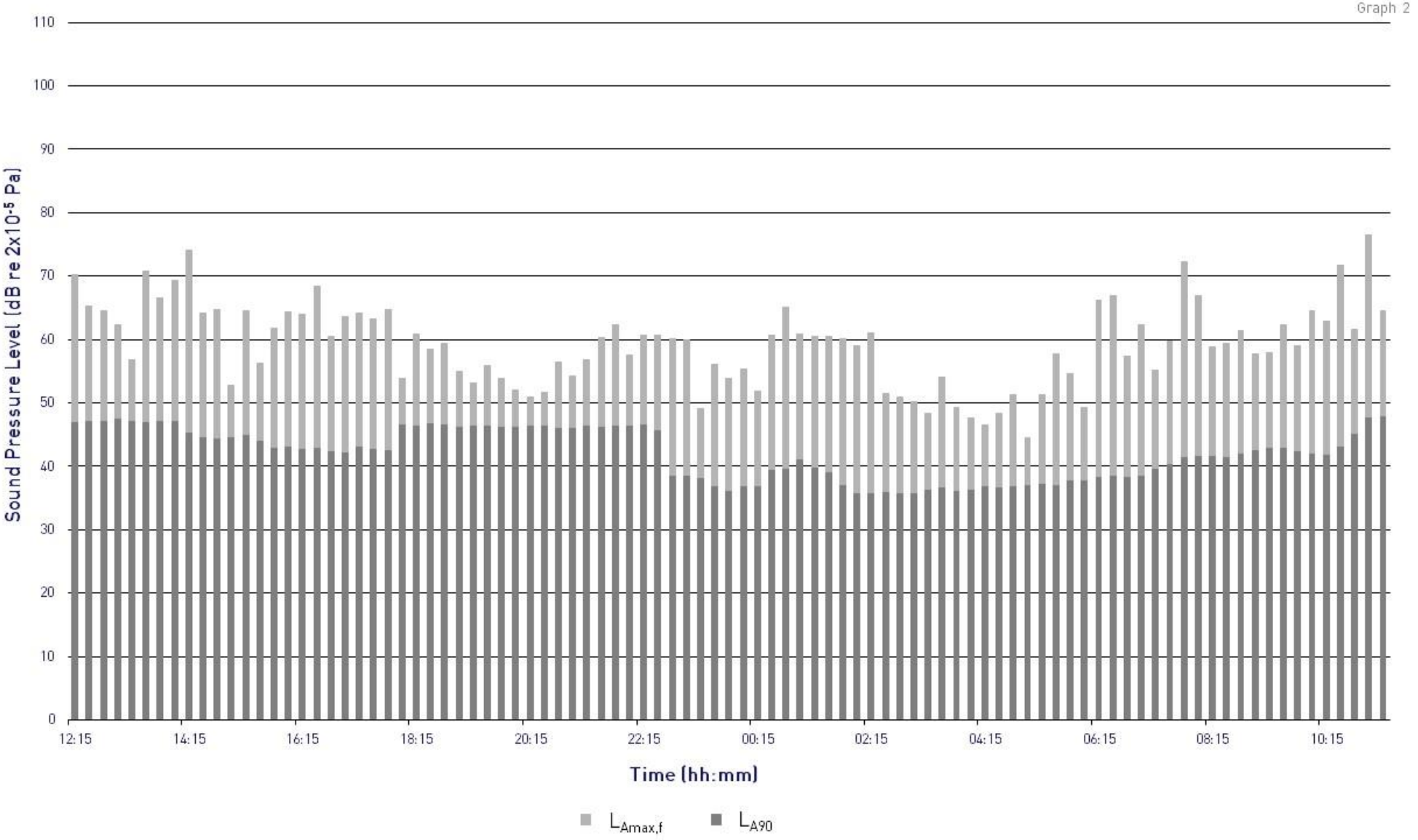
$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 1, Thursday 3rd of November to Friday 4th of November 2022

RBA ACOUSTICS

Project: 12299

Graph 2



9-10 Windmill Street, Fitzrovia

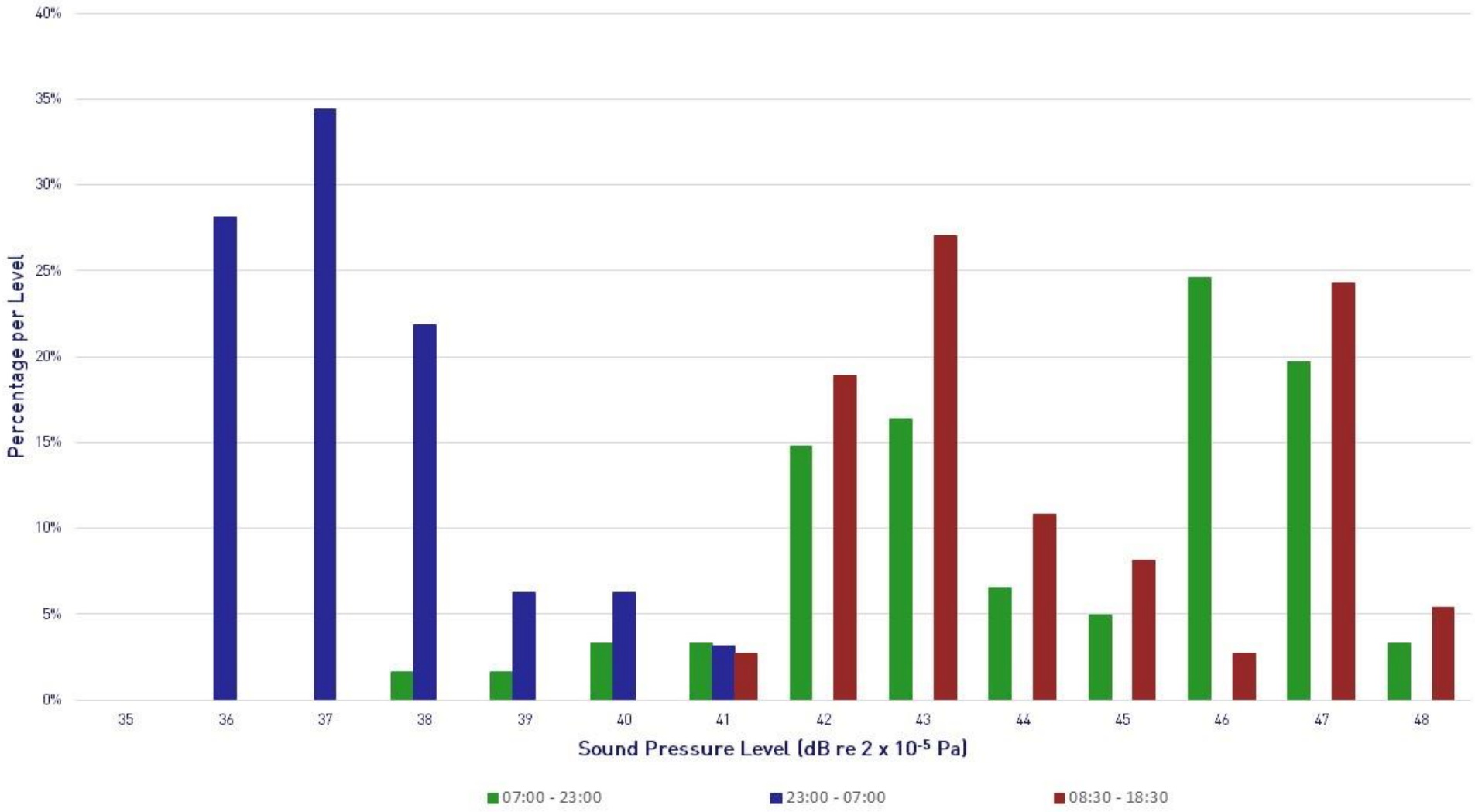
$L_{A90,15\ minutes}$ Histogram

Measurement Position 1, Thursday 3rd of November to Friday 4th of November 2022

RBA ACOUSTICS

Project: 12299

Graph 3



Appendix E – Plant Calculations

Table E1 – Example Calculation, ASHP.01 to Receptor A (Heating Mode)

Parameter	Octave-band Noise Levels (dB) at Octave-band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
L_p at 1m	59	60	50	52	47	41	37	31	53
Reflections	+6	+6	+6	+6	+6	+6	+6	+6	-
Distance loss (8m)	-18	-18	-18	-18	-18	-18	-18	-18	-
Mitigation (Acoustic Louvre)	-4	-5	-7	-12	-16	-16	-16	-18	-
Noise level at Receptor A	**43**	**44**	**35**	**29**	**20**	**14**	**10**	**3**	**32**

Table E2 – Summary Noise Levels at 1m from Receptor A (dB)

Unit	Noise Level (dBA) during Operating Hours
ASHP.01	31
ASHP.02	26
Total Received Level (dBA)	**32**

*Possible discrepancies within one dB are subject to number rounding.

Appendix F – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation for more than 3 days)
4 – Serious (e.g. fracture, hospitalisation for more than 24 hours, incapacitation for more than 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiplying the two scores and is then used to determine the course of action.

Table F1 – Risk Ratings

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonably practicable controls where possible	Avoidance action is required; therefore, alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Table F2 – Risk Assessment

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Vibration Isolators	Injury to hands	Contractors	3	3	9	Care needs to be taken during adjustment. Follow manufacturers guidance	1	3	3
Acoustic Louvre - Weight	Strain of neck, limbs or back. Fall from height.	Contractors	3	5	15	Provide sufficient manpower, lifting gear and structural support	1	5	5

L: Likelihood S: Severity R: Rating

RBA ACOUSTICS
W. www.rba-acoustics.co.uk
E. info@rba-acoustics.co.uk

London:
44 Borough Road
London SE1 0AJ
T. +44 (0) 20 7620 1950

Manchester:
Bloc, 17 Marble Street
Manchester M2 3AW
T. +44 (0) 161 661 4504