

**Proposed Installation of
Mechanical Plant**

**28 Fitzroy Square, Fitzrovia
London W1T 6DD**

Environmental Noise Assessment

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Project Address:	28 Fitzroy Square Fitzrovia London W1T 6DD
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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.
- 1.2 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).
- 1.3 APL has been instructed by the applicant, PSG Global, to consider and advise upon the noise implications of the proposed installation of a climate control system.
- 1.4 The climate control system will consist of 3No. external condenser units. Two of the units are related to climate control of the office space whilst the third unit is related to cooling of a comms room.
- 1.5 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.
- 1.6 This report provides the response to the LPA, on behalf of the Applicant.

2. BASELINE SITUATION

- 2.1 The Application Site (the "site") is situated at 28 Fitzroy Square, London, W1T 6DD. The rear of the site is shown in Figures 1 to 16 attached.
- 2.2 It is proposed to remodel the ground floor roof area at the rear of the site. As part of this refurbishment, it is proposed to install a mechanical climate control system that will provide heating and cooling to the property.
- 2.3 The external condenser units associated with the climate control system (2No.) will be located in an acoustic enclosure on the new ground floor terrace at the rear of the site. The proposed location of the enclosure can be seen in Diagram 1 overleaf. Ventilation to the enclosure will be provided naturally. These units will be operational on a demand basis during typical office hours, considered to be 08:00 to 20:00hrs.
- 2.4 It is also proposed to install a condenser unit within the ground floor lightwell at the rear of the site. This unit will provide cooling to an equipment room and therefore will operate 24/7. The location of this condenser can be seen in Diagram 2.
- 2.5 The nearest noise sensitive windows to the condenser units are considered to be the roof lights of No.9 and No.10 Fitzroy Mews (see Figures 5, 6 and 8).

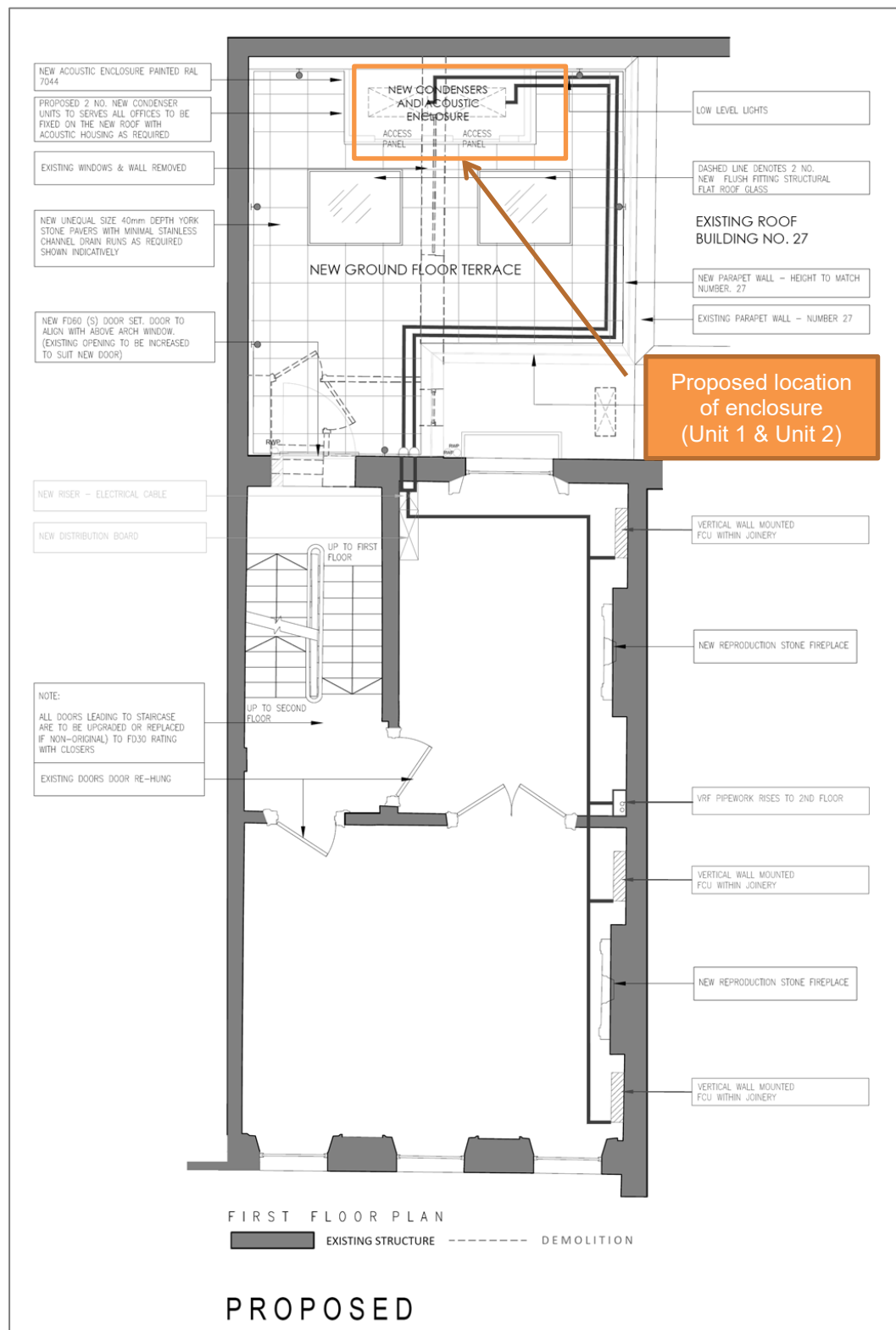


Diagram 1

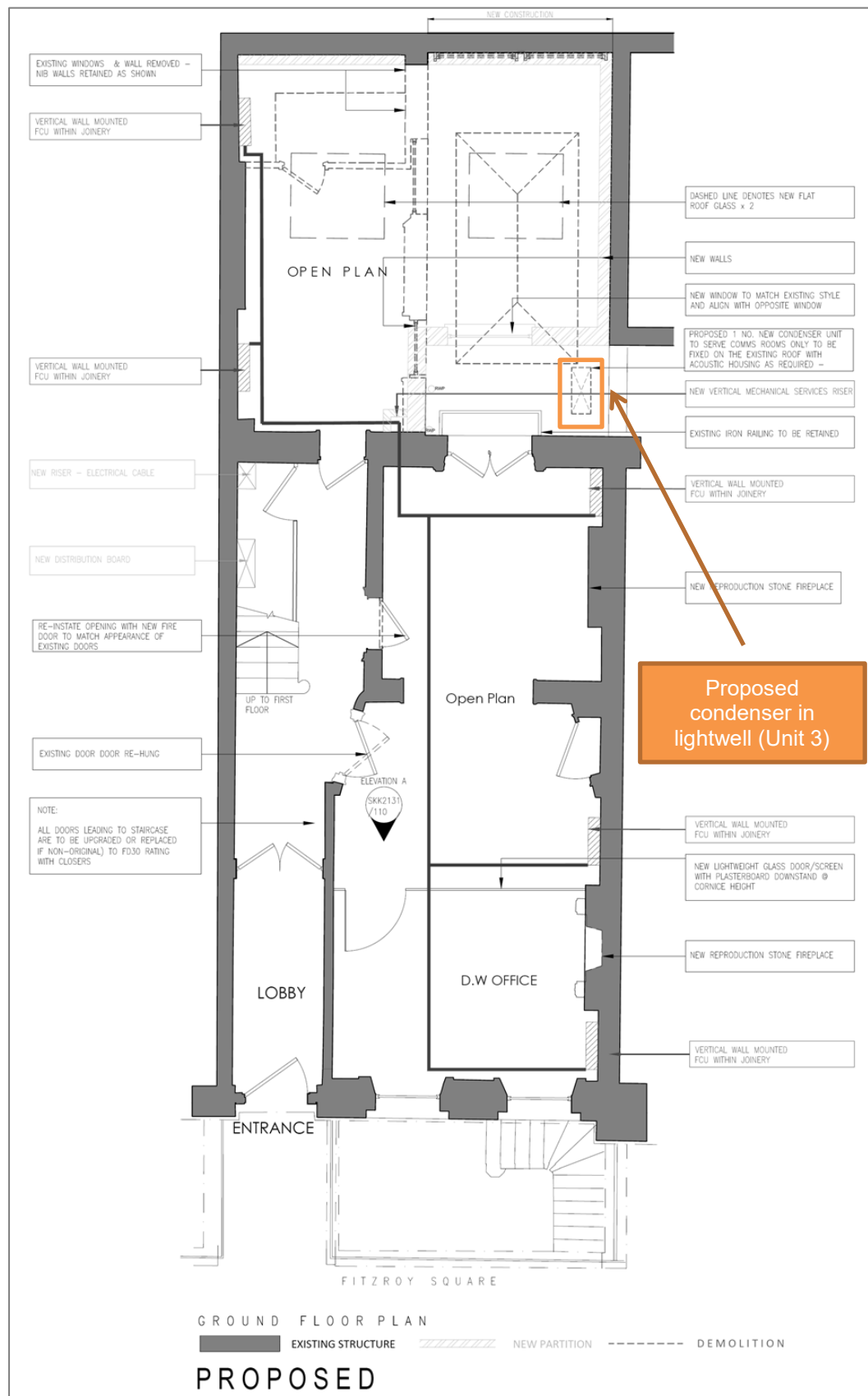


Diagram 2

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 measurements were obtained on the existing 1st floor flat roof at the rear of the building.
- 3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date: 5th – 6th March 2018
Start Time: 14:15 hrs
Location: rear of 28 Fitzroy Square

Weather conditions

Date	Precipitation	Wind	Temperature
05/03/18	0.2mm	6km/h	6 °C
06/03/18	0.2mm	7km/h	8 °C

- 3.4 Minimum background and average noise levels are shown in Table 1 below with the full 24 hour time history shown in Diagram 3 (L_{Aeq} and L_{A90}). Noise levels were influenced by items of mechanical plant located adjacent to the site.

Time period	Lowest L _{A90,15min}	Average L _{Aeq,T}
07:00-23:00hrs	45	49
23:00-07:00hrs	42	46

Table 1

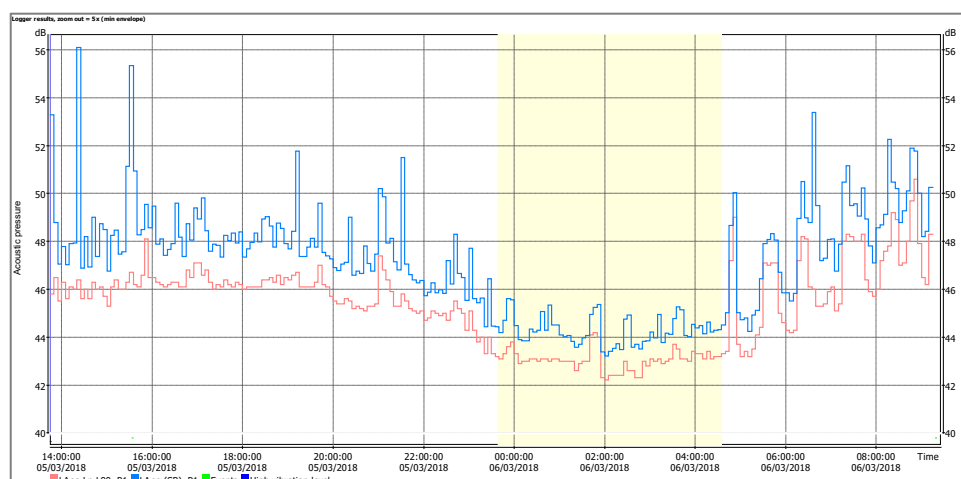


Diagram 3

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.

4.1 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.

4.2 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.

4.3 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.”

4.4 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.”

4.5 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.”

4.6 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.”*

4.7 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.”

- 4.8 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.”

- 4.9 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram for the operational hours of the condenser units can be seen in Diagrams 4 and 5.

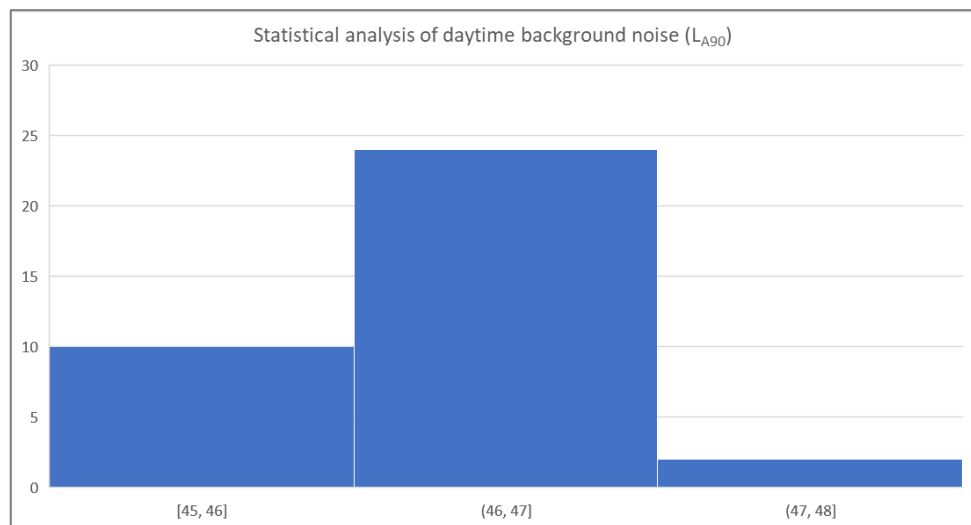


Diagram 4

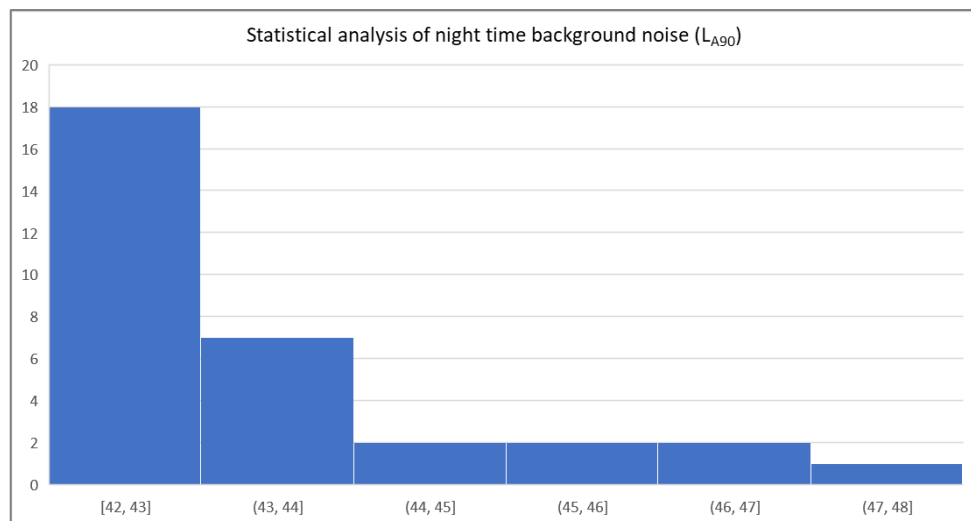


Diagram 5

- 4.10 The background noise level did not vary significantly throughout the measurement period, save for periods of time when the adjacent mechanical plant was operational. This can be clearly depicted in the time history plot of Diagram 3.
- 4.11 In this instance the most commonly occurring daytime background noise level was 1dB higher than the lowest background noise level. The most commonly occurring night-time background noise level was the same as the lowest background noise level. In the context in which the sound occurs, 45dB $L_{A90,15min}$ is considered as appropriate for daytime levels and 42dB $L_{A90,15min}$ for night-time levels.
- 4.12 In determining a rating level, corrections to account for tonality and impulsivity must be added to the specific noise level of the unit. The octave band sound levels of the condenser (see Appendix A) do not seem to indicate any tonal component. A correction of 3dB was added to account for perceptible impulsivity.
- 4.13 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 13dB below the considered background noise.

Noise emission limit for mechanical plant	
Daytime limit	Night time limit
L_{Aeq} 32dB	L_{Aeq} 29dB

Table 2

- 4.14 The noise levels of the proposed condenser units were obtained from manufacturers data sheets as follows. Condenser units 1 and 2 relate to the climate control of the office space and condenser unit 3 relates to the cooling of an equipment room.
- (a) Condenser unit 1 – Daikin RXYSQ10TY1 55dBA @ 1m
- (b) Condenser unit 2 – Daikin RXYSQ10TY1 55dBA @ 1m
- (c) Condenser unit 3 – Daikin RZASG71M2 46dBA @ 1m

5. EQUIPMENT

- 5.1 All background noise measurements were obtained using the following equipment:
- Svantek Svan971 Class 1 Serial No. 51704
 - 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 climate control system, consideration has been given to noise egress from the condenser units to the nearest noise sensitive façade. The following noise impacts were considered:

- (a) Noise impact from daytime use of office climate control system;
- (b) Noise impact from night time use of equipment room cooling system.

Noise impact (a)

- 6.2 In considering the propagation of noise from the condensers, consideration was given to their location within an acoustic enclosure and point source propagation to the nearest noise sensitive window. The following formulas were utilised:

$$L_p = L_w + 10\log_{10}T - 10\log_{10}V + 14$$

Where L_p is the reverberant sound pressure level in the enclosure
 L_w is the sound power level of the condenser units
 T is the enclosure reverberation time, s
 V is the enclosure volume, m³

$$L_{p_2} = L_{p_1} - R - 6$$

Where L_{p_2} is the sound pressure level close to the enclosure on the outside
 L_{p_1} is the reverberant sound pressure level in the enclosure
 R is the sound reduction index of the acoustic enclosure

- 6.3 The calculation is based on the Transmission Loss figures provided by Environ Technologies Ltd. These values are shown in Table 3 and were obtained from their website (<http://www.environ.co.uk/features/noise-performance.html>).

Acoustic enclosure	Transmission Loss							
	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Environ Packaged Plant	12	13	20	29	36	37	39	39

Table 3

6.4 The calculation exercise provided the following results.

Both units operational	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Daikin RXYSQ10TY1	75	75	71	73	68	64	60	52	74
2No. RXYSQ10TY1	78	78	74	76	71	67	63	55	77
Reverberant L_p in enclosure	73	73	69	71	66	62	58	50	72
Acoustic enclosure	-12	-13	-20	-29	-36	-37	-39	-39	
Level outside of enclosure	55	54	43	36	24	19	13	5	41
Distance attenuation	0	0	0	0	0	0	0	0	
Building edge diffraction	-10	-10	-10	-10	-10	-10	-10	-10	
Façade level	45	44	33	26	14	9	3	0	31

Table 4

- 6.5 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 32 dBA (13dB below the statistically considered measured background noise over the operational hours of the plant 08:00-20:00hrs) at 1m from the nearest noise sensitive façade.
- 6.6 The calculated noise impact is 31dBA. The calculation exercise (Table 4) demonstrates that the proposed installation meets the LPA criteria by 1dB with the noise impact 14dB lower than the statistically considered measured background noise level of 45dB L_{A90} .

Noise impact (b)

- 6.7 In considering the propagation of noise from the condenser, consideration was given to its location within a reverberant lightwell and point source propagation to the nearest noise sensitive window. The distance from the location of the unit to the noise sensitive façade was determined from scaled drawings as approximately 6m.
- 6.8 Given the unit is located in a semi-enclosed lightwell, the noise level of the unit was corrected by +9dB to account for the reverberant nature of the lightwell.
- 6.9 A further correction to account for building edge diffraction of -10dB was assumed. This was extracted from the Department of Energy and Climate Change Planning Standard MCS020.
- 6.10 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. "

6.11 The calculation exercise provided the following results.

Unit for equipment room	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Daikin RZASG71MV1	52	46	41	45	41	35	35	23	46
Reverberant correction	+9	+9	+9	+9	+9	+9	+9	+9	
Distance attenuation	-16	-16	-16	-16	-16	-16	-16	-16	
Building edge diffraction	-10	-10	-10	-10	-10	-10	-10	-10	
Façade level	35	29	24	28	24	18	18	6	29

Table 5

- 6.12 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 29 dBA (13dB below the statistically considered measured background noise over the operational hours of the plant) at 1m from the nearest noise sensitive façade.
- 6.13 The calculated noise impact is 29dBA. The calculation exercise (Table 5) demonstrates that the proposed installation meets the LPA criteria with the noise impact 13dB lower than the statistically considered measured background noise level of 42dB L_{A90} .

7. CONCLUSION

- 7.1 The foregoing assessment indicates that the proposed installation meets the requirements imposed by the LPA. Additional mitigation measures will not be required.
- 7.2 Lest there be any misunderstanding, the mitigation measures included in this report are as follows:
 - (a) *Acoustic enclosure surrounding 2No. units on ground floor terrace. Sound transmission loss data as published by Environ Technologies Ltd.*
- 7.3 In the event that an alternative manufacturer of condenser is used or an alternative acoustic enclosure is specified, the calculation exercise should be revisited to ensure that compliance with the LPA requirements is maintained.

Figures

Rear of 28 Fitzroy Square, London



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8

Noise
sensitive
façades

Rear of 28 Fitzroy Square, London



Figure 9



Figure 10



Figure 11



Figure 12



Figure 13

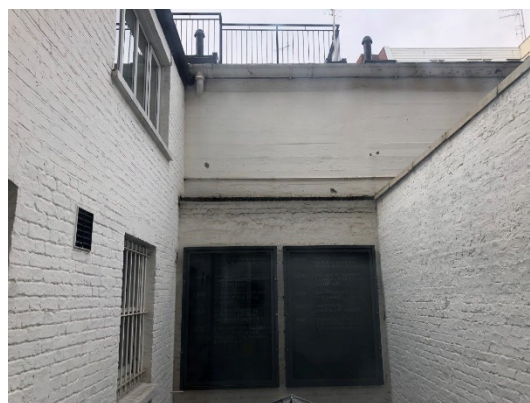


Figure 14



Figure 15



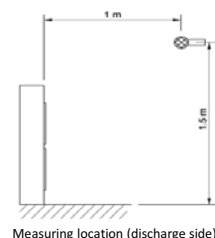
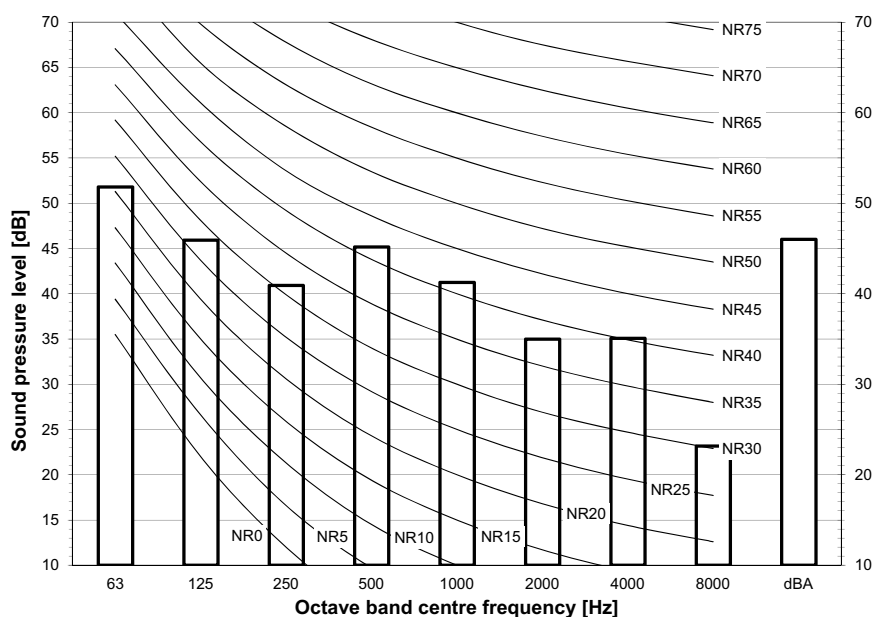
Figure 16

Appendix A

11 Sound data

11 - 2 Sound Pressure Spectrum - Cooling

AZAS71MV1
RZASG71MV1

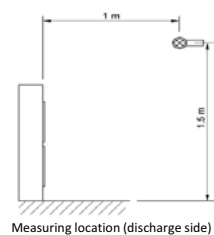
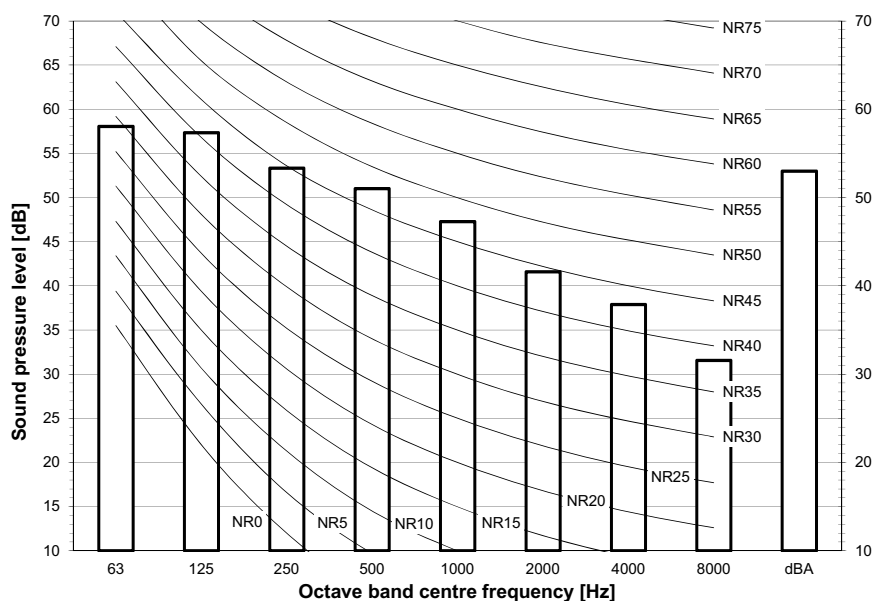


Notes

- Data is valid at free field condition.
- Data is valid at nominal operation condition.
- dBA = A-weighted sound pressure level (A scale according to IEC).
- Reference acoustic pressure 0 dB = 20 μ Pa

3D110049

AZAS100MV1
AZAS100MY1
RZASG100MV1
RZASG100MY1



Notes

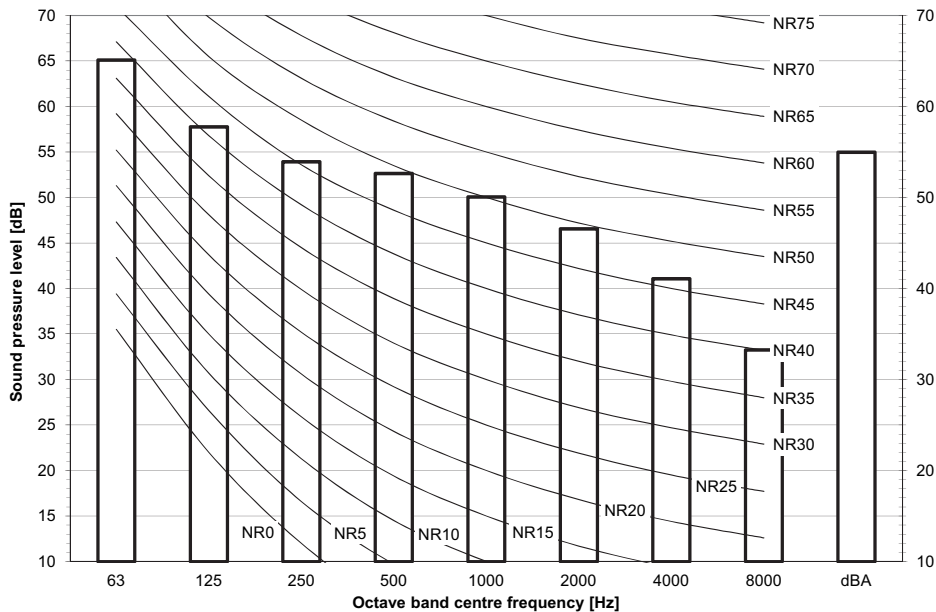
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- Data is valid at nominal operation condition.
- dBA = A-weighted sound pressure level (A scale according to IEC).
- Reference acoustic pressure 0 dB = 20 μ Pa

3D110050

11 Sound data

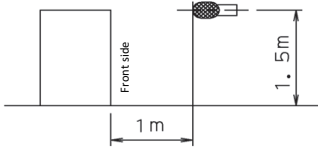
11 - 2 Sound Pressure Spectrum

RXYSQ10TY1



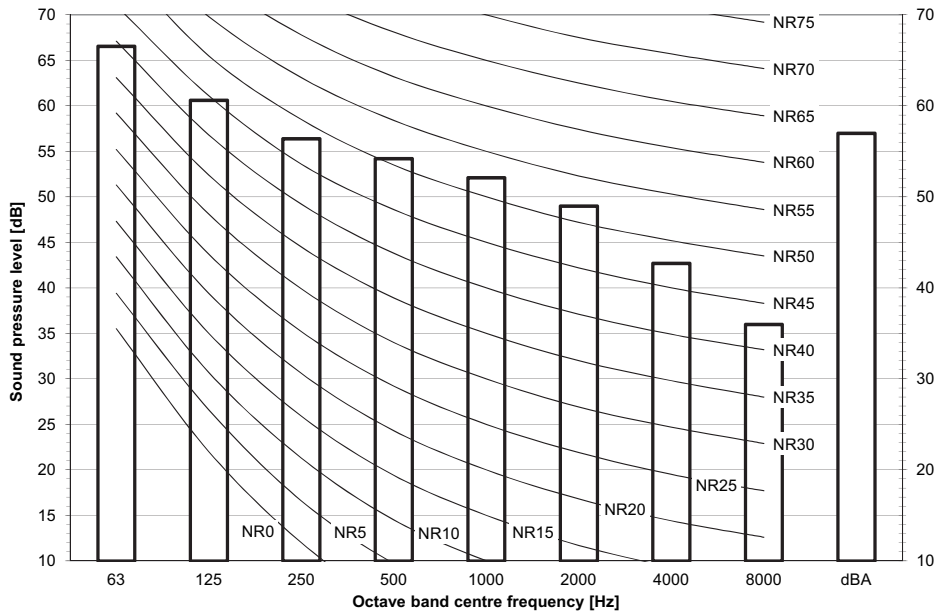
Notes

- Data is valid at free field condition.
- Data is valid at nominal operation condition.
- dBA = A-weighted sound pressure level (A scale according to IEC).
- Reference acoustic pressure 0 dB = 20 μ Pa



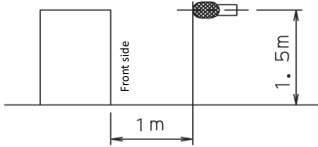
3D098246

RXYSQ12TY1



Notes

- Data is valid at free field condition.
- Data is valid at nominal operation condition.
- dBA = A-weighted sound pressure level (A scale according to IEC).
- Reference acoustic pressure 0 dB = 20 μ Pa



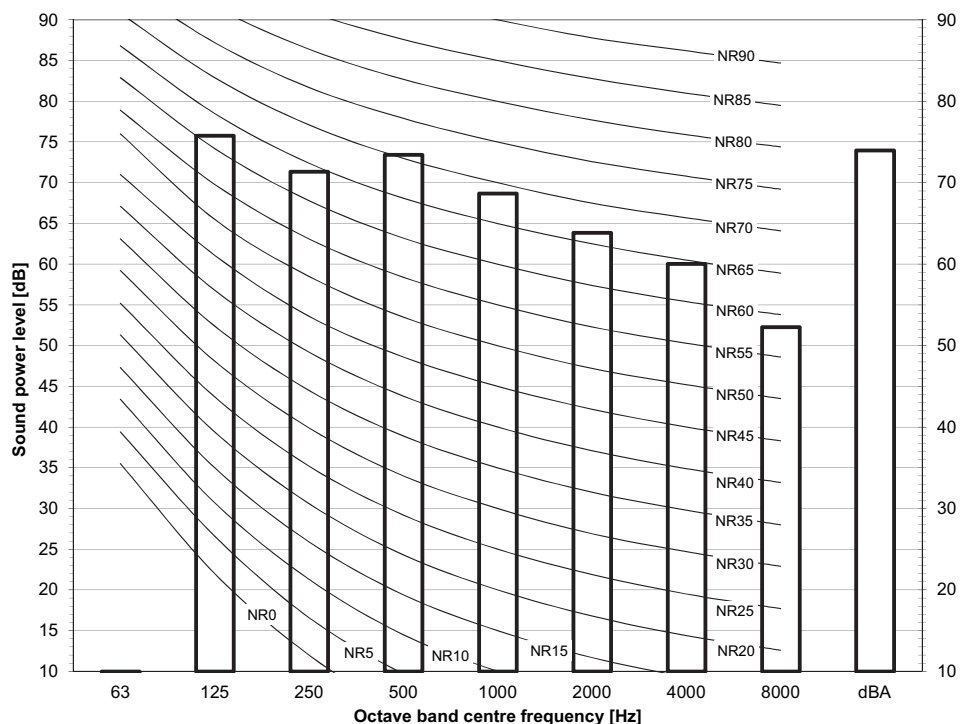
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11 Sound data

11 - 1 Sound Power Spectrum

11

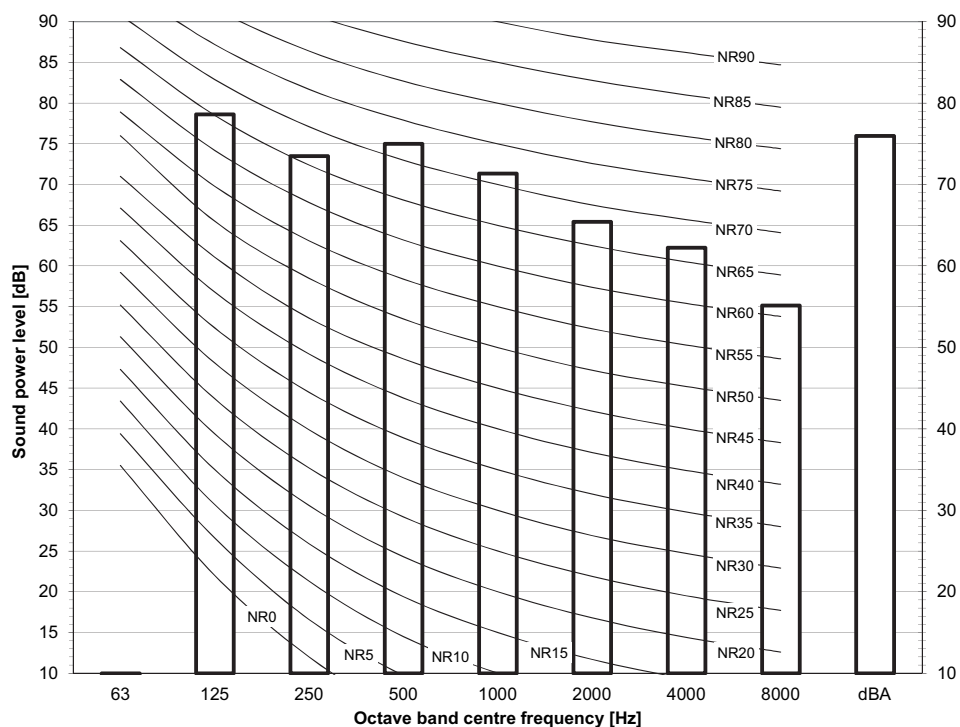
RXYSQ10TY1



Notes
 - dBA = A-weighted sound power level (A scale according to IEC).
 - Reference acoustic intensity $OdB = 10E-6 \mu W/m^2$
 - Measured according to ISO 3744

3D098241

RXYSQ12TY1



Notes
 - dBA = A-weighted sound power level (A scale according to IEC).
 - Reference acoustic intensity $OdB = 10E-6 \mu W/m^2$
 - Measured according to ISO 3744

3D098242