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26 Lower Belgrave Street London

Planning Compliance Report
Report 23535.PCR.01

Alexander Rayden
26 Lower Belgrave Street
SW1W 0LN

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1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Alexander Rayden, 26 Lower Belgrave Street, London, SW1W 0LN to undertake a noise impact assessment of a proposed air conditioning unit installation serving the building at 26 Lower Belgrave Street, London, SW1W 0LN.

A 24 hour environmental noise survey has been undertaken on site and the background noise levels measured will be used to determine daytime and night-time noise emission criteria for the air conditioning unit in agreement with the planning requirements of Westminster City Council.

This report presents the overall methodology and results from the environmental survey, followed by calculations to demonstrate the feasibility of the plant unit installation to satisfy the emissions criterion at the closest noise-sensitive receiver. Mitigation measures will be outlined as appropriate.

2.0 SITE SURVEYS

2.1 Site Description

As shown in Figure 2.1, the site is bounded by Lower Belgrave Street and Chester Square to the Southwest, residential properties to the Northwest and Southeast, and residential gardens to the Northeast.

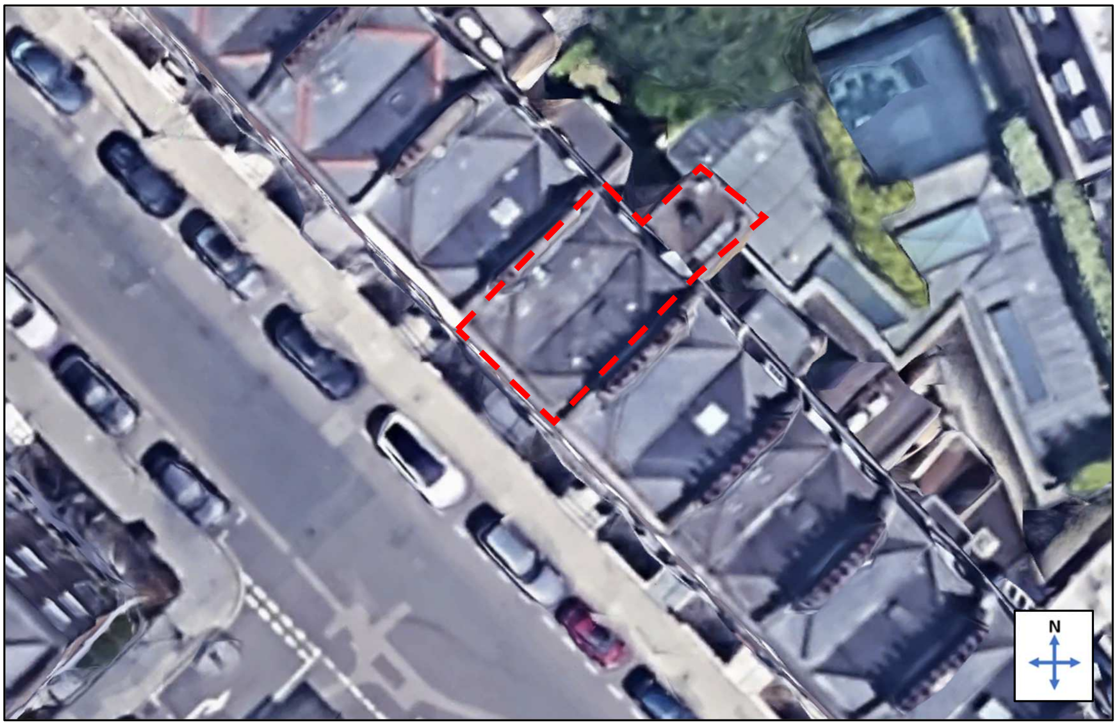


Figure 2.1 Site Location Plan (Image Source: Google Maps)

Initial inspection of the site revealed that the background noise profile at the monitoring location was typical of an urban cityscape environment, with the dominant source being road traffic noise from the surrounding roads. Construction work being carried out at the property and at other nearby properties also contributed to the average ambient noise level during working hours, which affected noise data collected during these hours.

2.2 Environmental Noise Survey Procedure

Continuous automated monitoring was undertaken for the duration of the noise survey between 11:00 on 26/10/2021 and 10:00 on 27/10/2021.

The environmental noise measurement position, proposed plant installation location, and the closest noise sensitive receiver relative to the plant installation are described within Table 2.1 and shown within Figure 2.2.

Icon	Descriptor	Location Description
	Noise Measurement Position	The meter was installed on the fencing of the roof terrace on the 2nd floor of the rear façade, as shown in figure 2.2. A correction of 3dB has been applied to account for non-free field conditions.
	Closest Noise Sensitive Receiver	Rear façade. 3rd Floor window. Residential house to the Southeast.
	Proposed Plant Installation Location	Proposed air conditioning unit installation outlined in Section 5.1

Table 2.1 Measurement position and description

Figure 2.2 Site measurement position, identified receiver and proposed plant unit installation (Image Source: Google Map)

The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver relative to the proposed air conditioning unit.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.3.

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 13	Svantek Type 958 Class 1 Sound Level Meter	36552	06/07/2021	1500548-3
	Free-field microphone PCB 377B02	127258		
	Preamp PCB 378M07			
	PCB External Windshield	-	-	-
Larson Davis CAL200 Class 1 Calibrator		17148	27/04/2021	05223/1

Table 2.3 Measurement instrumentation

3.0 RESULTS

The $L_{Aeq:\ 5min}$, $L_{Amax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as a time history in Figure 23535.TH1.

Minimum background noise levels and logarithmically averaged L_{Aeq} levels are shown in Table 3.1 for daytime and night-time.

Time Period	Minimum background noise level L_{A90} dB(A)	Average ambient noise level L_{Aeq} dB(A)
Daytime (07:00-23:00)	40	46*
Night-time (23:00-07:00)	35	41

Table 3.1 Minimum background noise levels and average ambient noise levels

***Note: The daytime average ambient noise level was calculated using the data recorded between the hours of 17:00 and 23:00, to exclude construction noise and give a more accurate representation of the average ambient noise level during the day**

4.0 NOISE ASSESSMENT GUIDANCE

4.1 Westminster City Guidance on New Plant Installations

The Draft Noise Technical Guidance Note (Nov 2019) issued by Westminster City Council notes the following with regards to new plant installations:

Development including plant or machinery, or contains activities that cause noise from amplified and unamplified music or human voices both internally and externally should achieve the following standards:

Existing External Ambient Noise Level	Tonal or Intermittent Noise / Noise Source	Sound Emissions Level that should not be Exceeded at the nearest Noise Sensitive Receptor[1]
Exceed WHO Guideline levels. L_{Aeq} 55dB over periods of daytime (07:00-23:00hrs) and L_{Aeq} 45dB at night-time (23:00-07:00hrs)	Does not contain tones or intermittent noise sufficient to attract attenuation.	10dB below the minimum external background noise level
	Contains tones or be intermittent noise sufficient to attract attention	15dB below the minimum external background noise level.
	Noise emitted from emergency plant or an emergency life supporting generators	10dB above the lowest background noise level within a 24-hour period
Does not exceed WHO Guideline levels. L_{Aeq} 55dB over periods of daytime (07:00-23:00hrs) and L_{Aeq} 45dB at night-time (23:00-07:00hrs)	Does not contain tones or intermittent noise sufficient to attract attention.	5dB below the minimum external background noise level
	Contains tones or be intermittent noise sufficient to attract attention.	10dB below the minimum external background noise level.
	Noise emitted from emergency plant or an emergency life supporting generators	10dB above the lowest background noise level within a 24-hour period
Below 30 dB $L_{A90,15min}$ at the nearest noise sensitive receptors Both daytime (07.00-23.00hrs) and night-time (23.00-07.00hrs).	Noise contains and/or does not contain tones or intermittent noise	Site specific standards that avoid noise disturbance to nearest noise sensitive receptors may be considered

Table 4.1 Noise criteria for plant machinery and internal/external activities

[1]Measured at the nearest noise sensitive receptors 1m from the most affected façade, relative to the existing external background noise level in this location and including assessment at the quietest time during which the plant operates or when there is internal activity at the development site. The

background noise level should be expressed in terms of the lowest L A90,15min during daytime or night-time (depending on the hours of use being applied for

4.2 Noise Emissions Criterion

As the proposed air conditioning unit could be used at any time, and falls within *"Does not exceed WHO Guideline levels L_{Aeq} 55dB over periods of daytime (07:00-23:00hrs) and L_{Aeq} 45dB at night-time (23:00-07:00hrs)"* of the guidance above and does not contain any tones or intermittent noise sufficient to attract attenuation, the criterion has been set as shown in Table 4.2 in order to comply with the above requirements.

Time Period	Noise Criterion at Nearest Residential Receiver
Plant Operational During Night-time Hours (23:00 to 07:00)	30 dB(A)

Table 4.2 Proposed noise emissions criteria for night-time hours

5.0 NOISE IMPACT ASSESSMENT

5.1 Proposed Plant Installations

It is understood that the proposed plant installation is comprised of the following unit:

- 1 RXYSCQ5TV1 Low Height Compact Condensing Unit

The proposed installation location for the air conditioning unit will be on the roof terrace of the 2nd floor at the rear of the building, as shown in Figure 2.2 above.

The noise emission level as provided by the manufacturer for the unit is shown in Table 5.1.

Unit	Descriptor	Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
RXYSCQ5TV1 Low Height Compact Condensing Unit	SPL @ 1m (dBA)	51	53	52	53	46	41	34	27	53

Table 5.1 Plant Units Noise Emission Levels as provided by the manufacturer

5.2 Closest Noise Sensitive Receiver

The closest noise sensitive receiver to the proposed installation location has been identified as being a residential window of 24 Lower Belgrave Street, located approximately 6 metres from the proposed plant installation location, as shown in Figure 2.2.

5.3 Calculations

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest residential window from the air conditioning unit would be as shown in Table 5.2. Detailed calculations are shown in Appendix B.

Receiver	Criterion	Noise Level at 1m From the Closest Noise Sensitive Window
3rd floor window at rear façade of 24 Lower Belgrave Street	30 dB(A)	30 dB(A)

Table 5.2 Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the air conditioning unit installation satisfies the emissions criterion of Westminster City Council, providing that the mitigation measures outlined in Section 6 are implemented.

6.0 NOISE CONTROL MEASURES

In order to achieve the specific sound level and subsequent rating level shown in the assessment above, the following noise control strategy should be adopted.

6.1 Air Conditioning Unit Installed on 2nd Floor Roof Terrace

In order to control the noise emissions from the RXYSCQ5TV1 Low Height Compact Condensing Unit, we would recommend that a rooftop plant enclosure is installed which should provide the minimum insertion loss levels shown in Table 6.2.

Unit	Insertion Loss Levels (dB) in each Octave Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Louvres of acoustic enclosure	6	7	7	10	13	18	13	13

Table 6.2 Insertion loss figures to be provided by acoustic enclosure

We would recommend the following suppliers of the aforementioned enclosure:

- Environmental Equipment Corporation
- Noico Ltd
- Waterloo Acoustics
- Allaway Acoustics

- Wakefield Acoustics
- Caice

6.2 Anti-Vibration Mounting Strategy

In the case of all plant units, appropriate anti-vibration mounts should be installed in order to ensure that vibrations do not give rise to structure-borne noise. Appendix C outlines detailed advice in order to ensure that the system installer selects the appropriate anti-vibration mount for the installation.

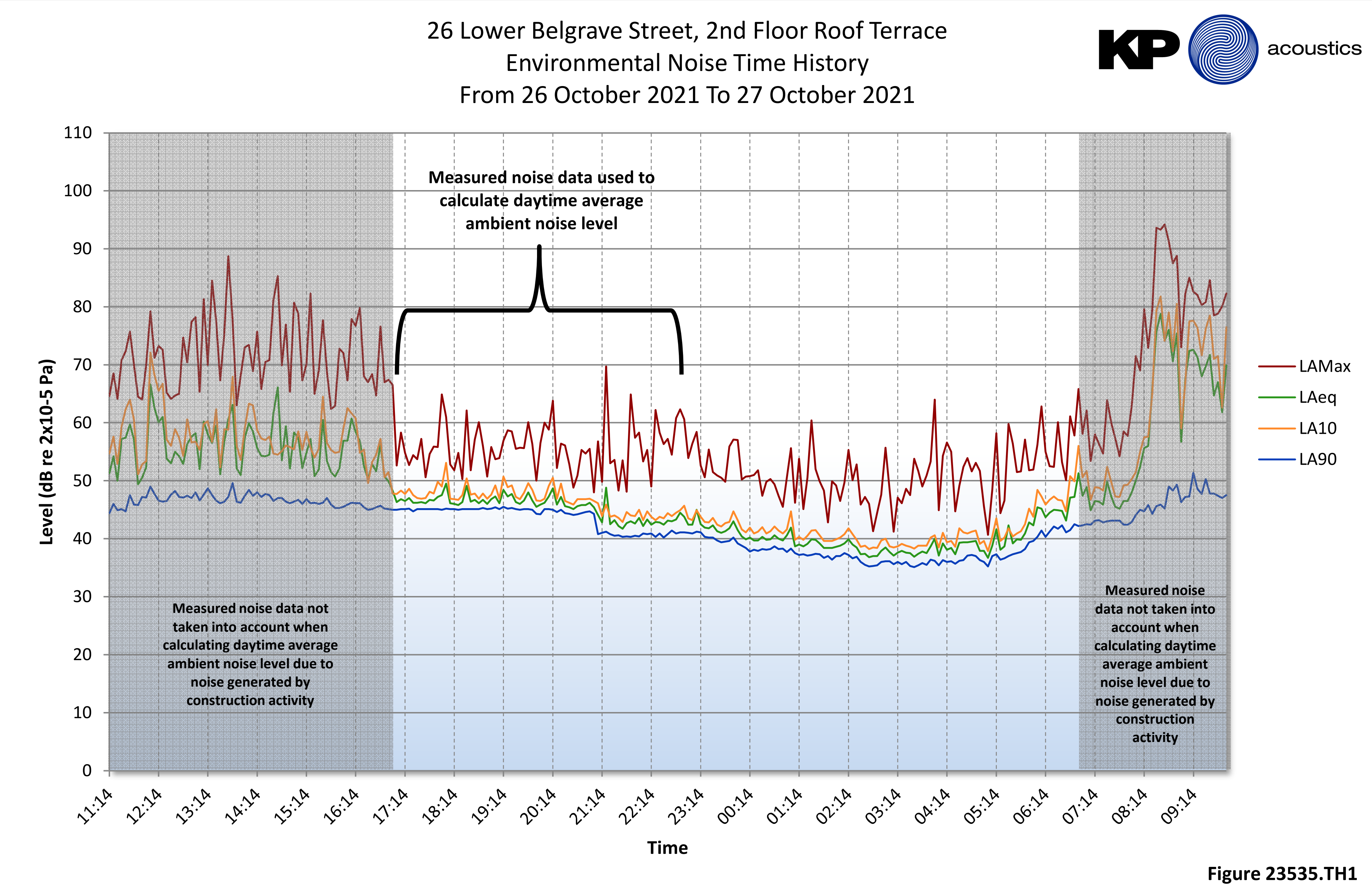
It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail.

7.0 CONCLUSION

An environmental noise survey has been undertaken at 26 Lower Belgrave Street, London, SW1W 0LN, by KP Acoustics Ltd between 11:00 on 26/10/2021 and 10:00 on 27/10/2021. The results of the survey have enabled criteria to be set for noise emissions.

Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receivers for compliance with current requirements.

Calculations show that noise emissions from the air conditioning unit installation would meet the requirements of Westminster City Council, providing that the mitigation measures outlined in Section 6 are implemented.



26 Lower Belgrave Street, 2nd Floor Roof Terrace
Environmental Noise Time History
From 26 October 2021 To 27 October 2021
acoustics
Measured noise data used to calculate daytime average ambient noise level
Measured noise data not taken into account when calculating daytime average ambient noise level due to noise generated by construction activity
Measured noise data not taken into account when calculating daytime average ambient noise level due to noise generated by construction activity
Level (dB re 2x10-5 Pa)
110
100
90
80
70
60
50
40
30
20
10
0
11:14
12:14
13:14
14:14
15:14
16:14
17:14
18:14
19:14
20:14
21:14
22:14
23:14
00:14
01:14
02:14
03:14
04:14
05:14
06:14
07:14
08:14
09:14
Time
LAMax
LAeq
LA10
LA90
Figure 23535.TH1

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels fo

r many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

26 Lower Belgrave Street

PLANT NOISE EMISSIONS CALCULATIONS

Source: RXYSCQ5TV1 Low Height Compact Condensing Unit Receiver: 2nd Floor Window of 24 Lower Belgrave Street	*Frequency, Hz* *63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
RXYSCQ5TV1 (Sound Pressure Level at 1m), dB	51	53	52	53	46	41	34	27	53
Correction due to surface reflections (1), dB	3	3	3	3	3	3	3	3	
Minimum attenuation provided by distance (6m), dB	-16	-16	-16	-16	-16	-16	-16	-16	
Minimum attenuation required by proposed acoustic enclosure, dB	-6	-7	-7	-10	-13	-18	-13	-13	
Sound Pressure Level at Receiver due to Air Conditioning Unit, dB	**32**	**34**	**32**	**30**	**21**	**11**	**8**	**1**	**30**

Design Criterion	**30**

ANTI-VIBRATION MOUNTING SPECIFICATION REFERENCE DOCUMENT

1.0 General

1.1 All mountings shall provide the static deflection, under the equipment weight, shown in the schedules. Mounting selection should allow for any eccentric load distribution or torque reaction, so that the design deflection is achieved on all mountings under the equipment, under operating conditions.

1.2 It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail. Particular attention should be paid to mountings which will be exposed to atmospheric conditions to prevent corrosion.

1.3 All mountings shall be colour coded, or otherwise marked, to indicate their load capacity, to facilitate identification during installation.

Where use of resilient supports allows omission of pipe flexible connections for vibration/noise isolation, it shall be the Mechanical Service Consultant's or Contractor's responsibility to decide whether such devices are required to compensate for misalignment or thermal strain.

2.1 Type A Mounting (Caged Spring Type)

2.1.1 Each mounting shall consist of cast or fabricated telescopic top and bottom housings enclosing one or more helical steel springs as the principle isolation elements, and shall incorporate a built-in levelling device. The housing should be designed to permit visual inspection of the springs after installation, i.e. the spring must not be totally enclosed.

2.1.2 The springs shall have an outside diameter of not less than 75% of the operating height, and be selected to have at least 50% overload capacity before becoming coil-bound.

2.1.3 The bottom plate of each mounting shall have bonded to it a rubber/neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.1.4 Mountings incorporating snubbers or restraining devices shall be designed so that the snubbing, damping or restraining mechanism is capable of being adjusted to have no significant effect during the normal running of the isolated machine.

2.1.5 All nuts, bolts or other elements used for adjustment of a mounting shall incorporate locking mechanisms to prevent the isolator going out of adjustment as a result of vibration or accidental or unauthorised tampering.

2.2 Type B Mounting (Open Spring Type)

2.2.1 Each mounting shall consist of one or more helical steel springs as the principal isolation elements, and shall incorporate a built-in levelling device.

2.2.2 The springs shall be fixed or otherwise securely located to cast or fabricated top and bottom plates, shall have an outside diameter of not less than 75% of the operating height, and shall be selected to have at least 50% overload capacity before becoming coil-bound.

2.2.3 The bottom plate shall have bonded to it a rubber/ neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.3 Type C Mounting (Rubber/Neoprene Type)

Each mounting shall consist of a steel top plate and base plate completely embedded in oil resistant rubber/neoprene. Each mounting shall be capable of being fitted with a levelling device, and should have bolt holes in the base plate and a threaded metal insert in the top plate so that they can be bolted to the floor and equipment where required.

3.0 Plant Bases

3.1 Type A Bases (A.V. Rails)

An A.V. Rail shall comprise a steel beam with two or more height-saving brackets. The steel sections must be sufficiently rigid to prevent undue strain in the equipment and if necessary should be checked by the Structural Engineer.

3.2 Type B Bases (Steel Plant Bases)

Steel plant bases shall comprise an all-welded steel framework of sufficient rigidity to provide adequate support for the equipment, and fitted with isolator height saving brackets. The frame depth shall be approximately 1/10 of the longest dimension of the equipment with a minimum of 150 mm. This form of base may be used as a composite A.V. rail system.

3.3 Type C Bases (Concrete Inertia Base: for use with steel springs)

These shall consist of an all-welded steel pouring frame-work with height saving brackets, and a frame depth of approximately 1/12 of the longest dimension of the equipment, with a minimum of 100 mm. The bottom of the pouring frame should be blanked off, and concrete (2300 kg/m^3) poured in over steel reinforcing rods positioned 35 mm above the bottom. The inertia base should be sufficiently large to provide support for all parts of the equipment, including any components which over-hang the equipment base, such as suction and discharge elbows on centrifugal pumps.