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41 Sheen Park
Richmond

Planning Compliance Report
Report 28321.PCR.02

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Disclaimer

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List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned to undertake a noise impact assessment of a proposed external condenser unit installation serving the residential property at 41 Sheen Park, Richmond, TW9 1UN.

A 24 hour environmental noise survey has been undertaken on site in order to inform our noise impact assessment in accordance with BS4142:2014 '*Method for rating and assessing industrial and commercial sound'* as part of the planning requirements of London Borough of Richmond upon Thames Council.

This report presents the methodology and results from the environmental survey, followed by calculations in accordance with BS4142 to provide an indication as to the likelihood of the noise emissions from the proposed plant unit installation having an adverse impact on the closest noise sensitive receiver. Mitigation measures will be outlined as appropriate.

2.0 SITE SURVEYS

As shown in Figure 2.1, the site is surrounded by residential houses. A railway is located further to the north of the site, with Richmond train station to the west.

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 suburban residential environment, with dominant sources being railway noise and road traffic noise.

2.1 Environmental Noise Survey Procedure

Continuous automated monitoring was undertaken for the duration of the noise survey between 12:00 on 09/04/2024 and 12:00 on 10/04/2024.

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.

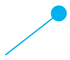
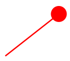
Icon	Descriptor	Location Description
1	Noise Measurement Position 1	The microphone was attached to a tripod at ground level in the rear garden of the property, as shown in Figure 2.2. The microphone was positioned within free-field conditions at least approx. 1.5 metres from the nearest surface.
	Nearest noise sensitive receptor 1 (NSR1)	Rear façade. 1st Floor window. 39 Sheen Park to the west.
	Nearest noise sensitive receptor 2 (NSR2)	Rear façade. 1st Floor window. 43 Sheen Park to the east.
	Proposed plant installation location	Proposed plant installation is outlined in further detail in Section 5.1.

Table 2.1 Measurement position and descriptions

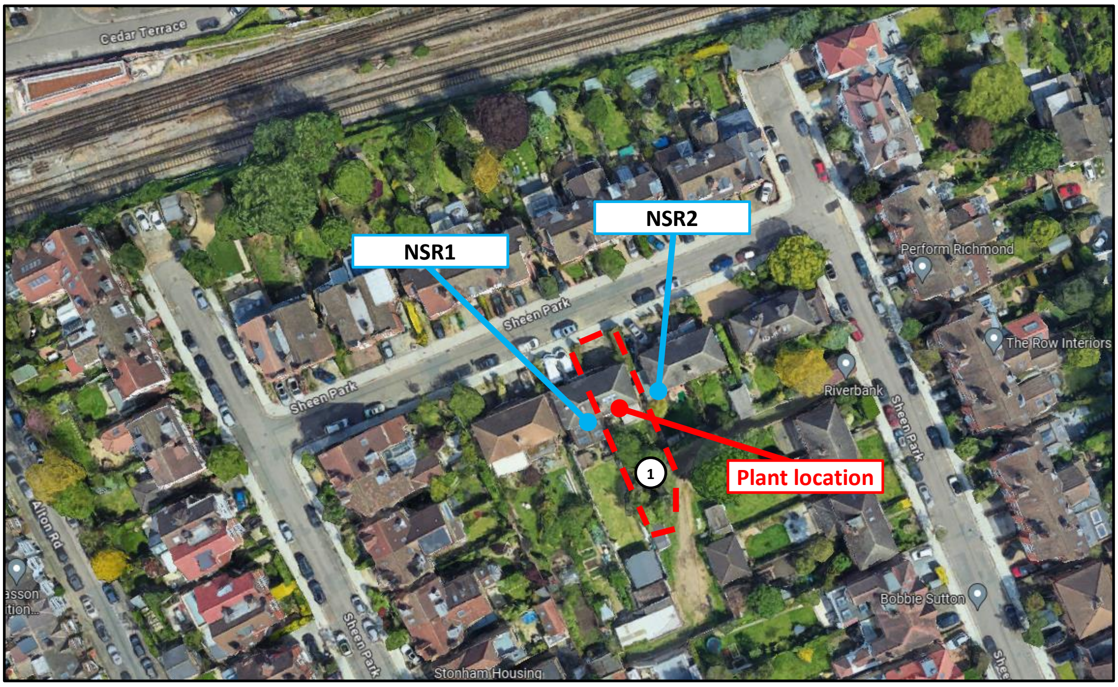


Figure 2.2 Site measurement positions (Image Source: Google Maps)

The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receivers and the proposed plant installation.

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*'.

2.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

<table>
<tr><th colspan="2">Measurement instrumentation</th><th>Serial no.</th><th>Date</th><th>Cert no.</th></tr>
<tr><td rowspan="4">Noise Kit 26</td><td>NTI Audio XL2 Class 1 Sound Level Meter</td><td>A2A-21130-E0</td><td rowspan="3">21/07/2022</td><td rowspan="3">UK-22-067</td></tr>
<tr><td>Free-field microphone NTI Acoustics MC230A</td><td>A23541</td></tr>
<tr><td>Preamp NTI Acoustics MA220</td><td>11023</td></tr>
<tr><td>NTI Audio External Weatherproof Shroud</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Larson Davis CAL200 Class 1 Calibrator</td><td>17148</td><td>21/02/2024</td><td>UCRT24/1285</td></tr>
</table>

Table 2.2 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 28321.TH1.

Noise Levels are shown in Table 3.1 for daytime and night-time.

It should be noted that the representative background noise level has been derived by statistical analysis of the occurring $L_{A90,5\ min}$ levels measured during the environmental noise survey undertaken on site, as shown in 28321.Daytime L90.TH1 and 28321.Night-time L90.TH1 attached.

Time Period	Representative background noise level L_{A90} dB(A)
Daytime (07:00-23:00)	42
Night-time (23:00-07:00)	31

Table 3.1 Representative background noise levels

4.0 NOISE ASSESSMENT GUIDANCE

4.1 BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound'*

British Standard BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*' describes a method 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, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

This Standard compares the Rating Level due to the noise source/s under assessment for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) with the existing background noise level in terms of an L_{A90} when the noise source is not operating.

It should be noted that the Rating Level is the Specific Sound Level in question ($L_{Aeq,\ Tr}$), including any relevant acoustic feature corrections, as follows:

- **Tonality** – '*For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible'*
- **Impulsivity** – '*A correction of up to +9dB 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 3dB for*

impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible'

- **Intermittency** – '*If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied'*
- **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 3dB can be applied'*

Once the Rating Level has been obtained, the representative background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact, as follows:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5 dB could 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 there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context

NOTE: Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

4.2 Local Authority Guidance

We understand London Borough of Richmond upon Thames requirements from previous projects is as follows:

"*All industrial and commercial development with the potential to generate noise will be assessed and, where relevant, controlled by planning conditions in order to protect residential amenity. Conditions may be used, for example, to restrict noise levels and to control hours of operation. The most relevant standard for assessing new industrial and commercial development is BS4142:2014.*

As a general rule, the Borough will seek to achieve the external noise standards detailed in the table below."

Noise Significance Risk	BS4142 Outcome	Planning Advice
Minimal	$L_{A,Tr} - L_{A90,T} \leq -5$	Where the rating level of noise is below the background noise level by at least 5dB, this indicates that the proposed NGD is likely to be acceptable from a noise perspective. The Borough will seek this level of compliance in most noise sensitive areas and/or where there is a requirement to mitigate creeping background effects.

Table 4.1 London Borough of Richmond Upon Thames Council Requirements

4.3 Noise Emissions Criterion

As the proposed plant installation could be used at any time of the day or night, the criterion has been set based on the night-time noise levels, which is worst-case, as shown in Table 4.1 in order to comply with the above requirements.

Time Period	Maximum Plant Noise Emissions Criterion at Nearest Residential Receiver
Night-time (23:00 to 07:00)	≤26 dB(A)

Table 4.1 Proposed noise emissions criterion

5.0 PLANT NOISE IMPACT ASSESSMENT

5.1 Proposed Plant Installations

It is understood that the proposed plant comprises 1no. Daikin 5MXS90E Heat Pump unit.

The proposed location for the Daikin 5MXS90E Heat Pump unit will be the rear of the property, on the first floor flat roof, as shown in Figure 2.2 above.

The noise emission levels as provided by the manufacturer is shown in Table 5.1.

Unit	Descriptor	Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Daikin 5MXS90E Heat Pump	SPL@1m (dB)	56	53	52	50	48	42	38	31	52

Table 5.1 Plant Noise Emission Levels as provided by the manufacturer

The proposed installation location is shown in Figure 5.1.

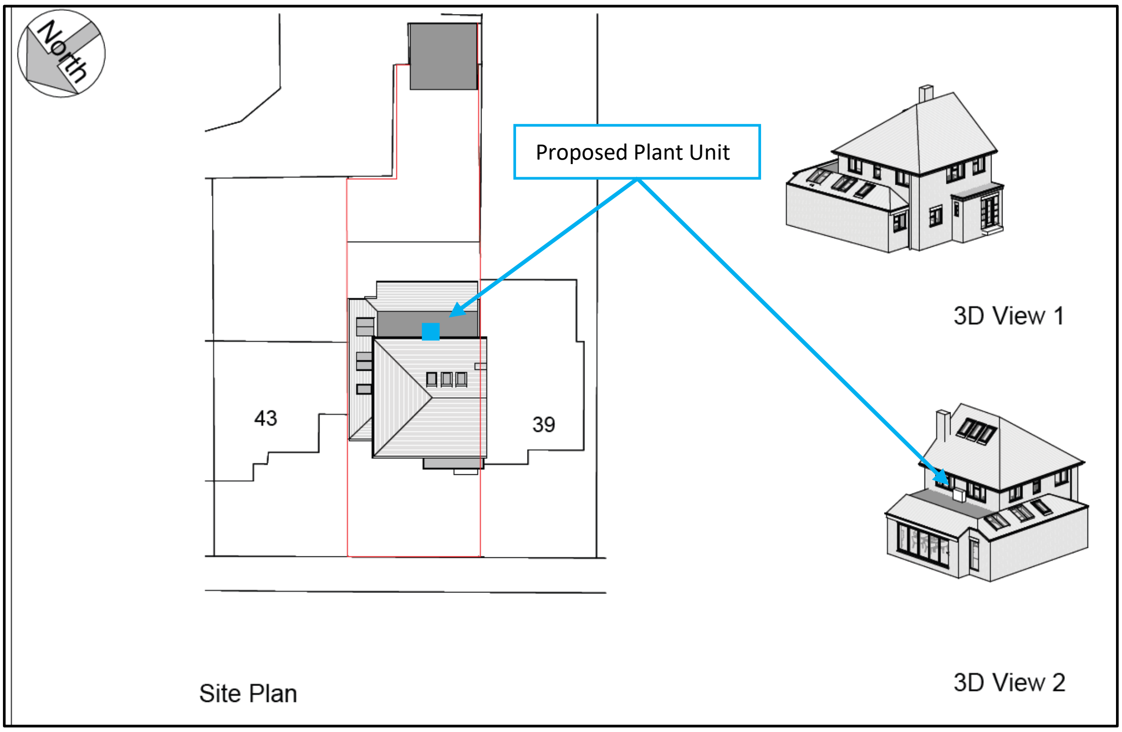


Table 5.1 Proposed Daikin 5MXS90E location (Image Source: Fluent Architectural Design Services)

The closest noise sensitive receivers to the proposed installation location have been identified as being the rear first floor residential windows of 43 Sheen Park located approximately 10 metres and 39 Sheen Park located approximately 4 metres from the proposed Daikin 5MXS90E Heat pump unit installation location, as shown in Figure 2.2.

5.2 Calculations

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest residential window from the Daikin 5MXS90E Heat pump would be as shown in Table 5.2. Detailed calculations are shown in Appendices B1-2.

Receiver	Criteria	Noise Level at 1m From the Closest Noise Sensitive Window
1st Floor Window of 43 Sheen Park	≤26dB(A) Night-time	19 dB(A)
1st Floor Window of 39 Sheen Park	≤26dB(A) Night-time	26 dB(A)

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

As shown in Appendices B1-2 and Table 5.2, the predicted noise levels from the proposed Daikin 5MXS90E Heat pump should meet the requirements of the London Borough of

Richmond upon Thames equating to a "minimal noise significance risk", provided that the mitigation measures outlined in Section 6 are implemented.

6.0 NOISE CONTROL MEASURES

In order to achieve the noise level shown in the assessment above, the following noise control strategy should be adopted.

6.1 Acoustic Enclosure

To control the noise emissions from the plant installation, we would recommend that an acoustic enclosure is installed according to the insertion loss specification below.

Unit Ref.	Insertion Loss Levels (dB) in each octave frequency band (Hz)							
	63	125	250	500	1k	2k	4k	8k
Daikin 5MXS90E Heat Pump	2	7	12	22	26	24	24	24

Table 6.1 Insertion loss figures to be provided by acoustic enclosure

The relevant plant units must be completely enclosed for optimal noise reduction (including a top panel/weather hood). Ventilation openings for cooling must not compromise sound insulation. Doors, access panels, windows, ducts, and cable penetrations shall be treated so as to maintain the proposed acoustic specification when fully assembled.

The manufacturer/supplier will need to ensure that the enclosure can achieve the above specifications in-situ.

In instances where a manufacturer/supplier proposes an enclosure that deviates from this specification, KPA should be informed so that we may comment upon the acceptability.

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 41 Sheen Park, Richmond, TW9 1UN, by KP Acoustics Ltd between 12:00 on 09/04/2024 and 12:00 on 10/04/2024. The results of the survey have enabled criteria to be set for noise emissions.

Manufacturer's noise data of proposed plant unit has been used to predict the expected noise Level at the nearest noise sensitive receivers in accordance with British Standard BS4142:2014 for compliance with London Borough of Richmond upon Thames requirements.

The predicted plant noise level was compared with the representative background noise level to assess the likelihood of impact considering the environmental noise context of the area.

The predicted noise levels from the proposed Daikin 5MXS90E Heat pump should meet the requirements of the London Borough of Richmond upon Thames equating to a "*minimal noise significance risk",* provided that the mitigation measures outlined in Section 6 are implemented.

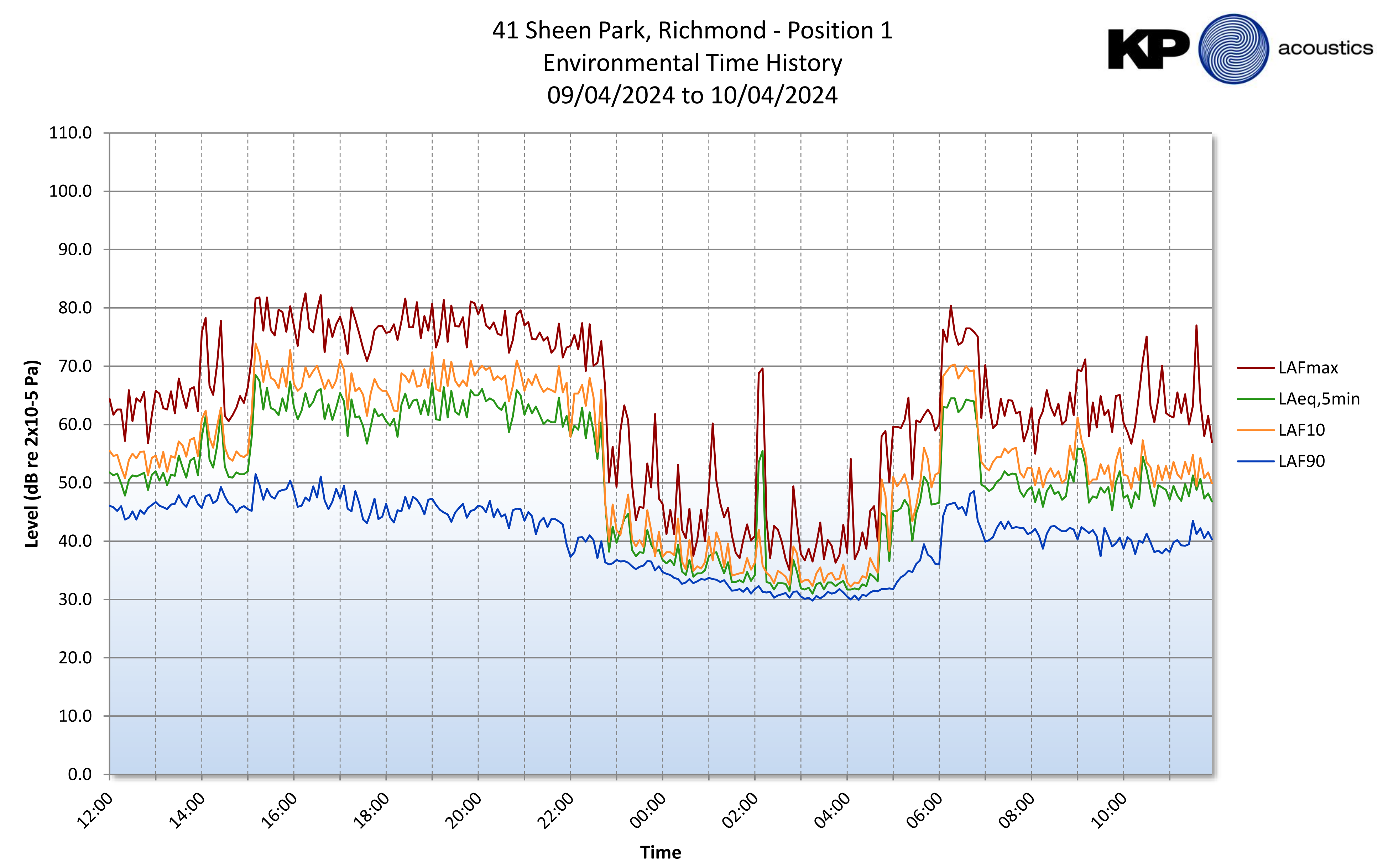


Figure 28321.TH1

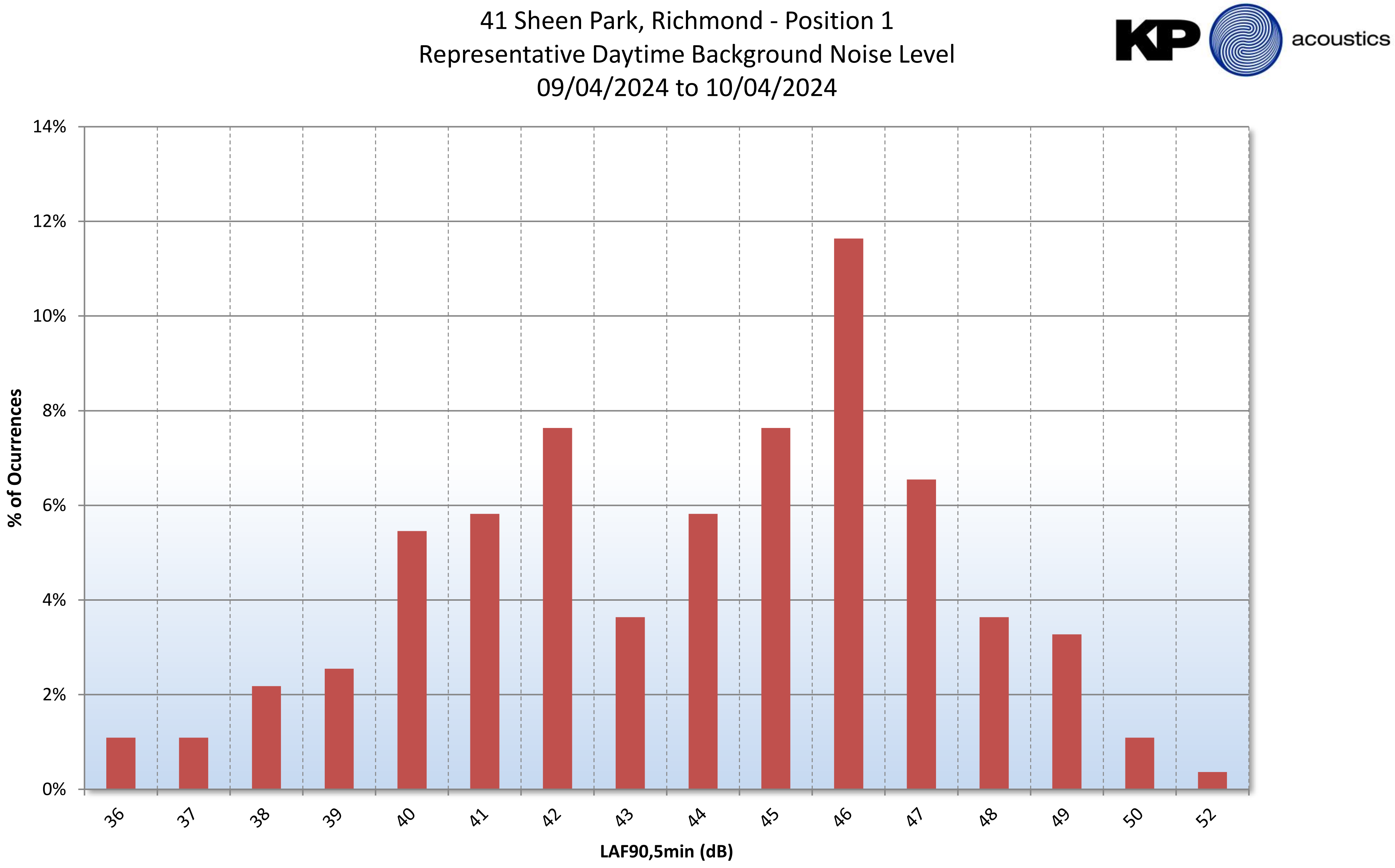


Figure 28321.Daytime L90.TH1

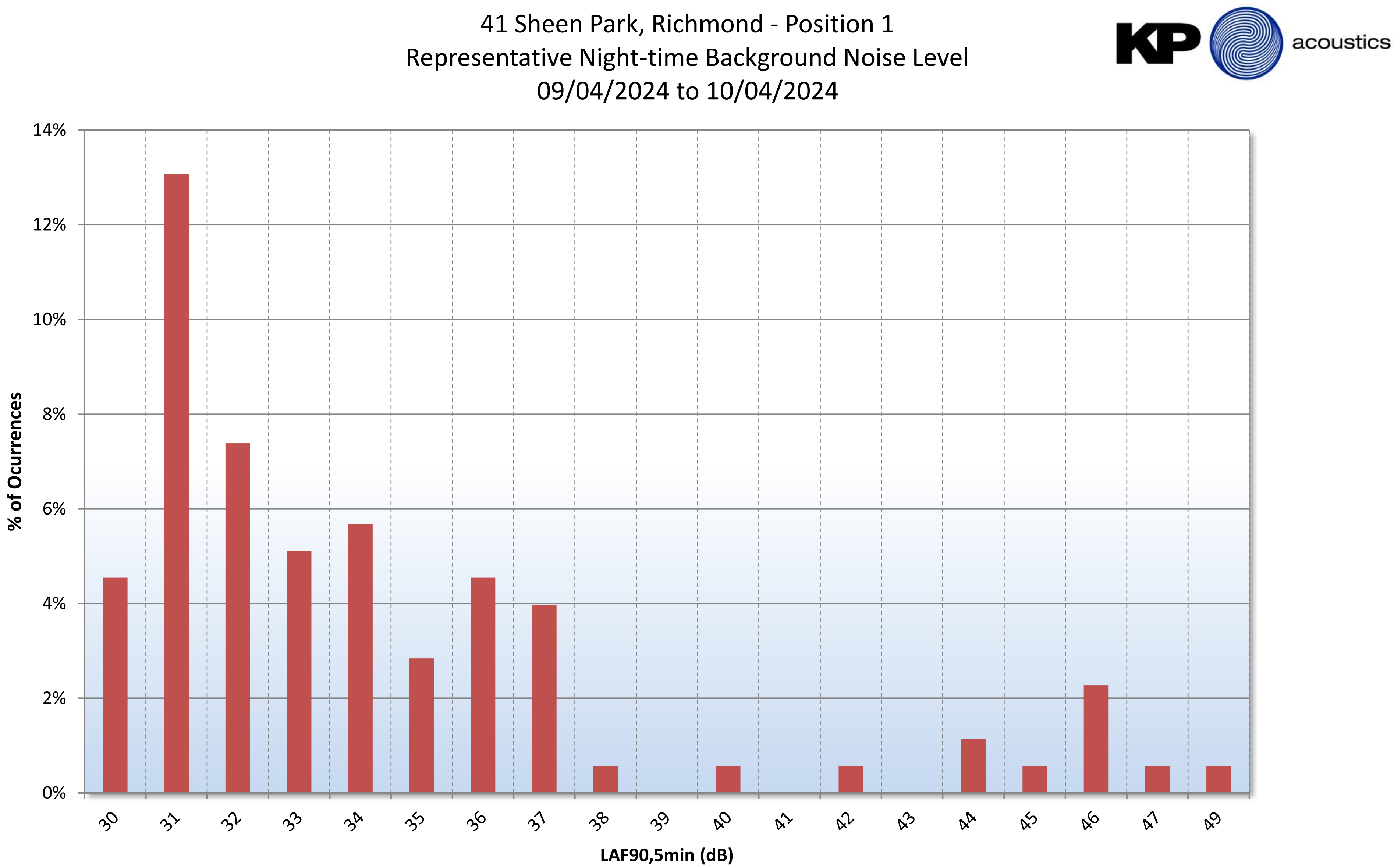


Figure 28321.Night-time L90.TH1

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 for 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 B1

41 Sheen Park, Richmond

PLANT NOISE EMISSIONS CALCULATIONS

Source: Rear Daikin 5MXS90E Heat Pump **Receiver: Rear windows of 43 Sheen Park, Richmond**	***Frequency, Hz*** ***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Daikin 5MXS90E Heat Pump (Sound Pressure Level @1m)	**56**	**53**	**52**	**50**	**48**	**42**	**38**	**31**	**52**
Correction due to surface reflections, dB	3	3	3	3	3	3	3	3	
Minimum attenuation required by proposed acoustic enclosure, dB	-2	-7	-12	-22	-26	-24	-24	-24	
Minimum attenuation provided by distance (10m), dB	-20	-20	-20	-20	-20	-20	-20	-20	
Total Rating Noise Level of Plant Unit Installation at Receiver	**37**	**29**	**23**	**11**	**5**	**1**	**-3**	**-10**	**19**

Design Criterion Night-time (23:00-07:00)	**≤26**

Source: Rear Daikin 5MXS90E Heat Pump **Receiver: Rear windows of 39 Sheen Park, Richmond**	***Frequency, Hz*** ***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Daikin 5MXS90E Heat Pump (Sound Pressure Level @1m)	**56**	**53**	**52**	**50**	**48**	**42**	**38**	**31**	**52**
Correction due to surface reflections, dB	3	3	3	3	3	3	3	3	
Minimum attenuation required by proposed acoustic enclosure, dB	-2	-7	-12	-22	-26	-24	-24	-24	
Minimum attenuation provided by distance (4m), dB	-12	-12	-12	-12	-12	-12	-12	-12	
Total Rating Noise Level of Plant Unit Installation at Receiver	**45**	**37**	**31**	**19**	**13**	**9**	**5**	**-2**	**26**

Design Criterion Night-time (23:00-07:00)	**≤26**

APPENDIX C

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.