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25 Glenmore Road
Belsize Park, London

Planning Compliance Report
Report 27080.PCR.01 Rev C

Yen Sum

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Report 27080.PCR.01 Rev.C Revision History			
First Issue Date: 09/08/2023			
A	09/08/2023 - Amendments to Table 4.1 - Amendments to Section 5.2	D	
B	10/08/2023 - Addition of assessment to garden	E	
C	14/08/2023 - Clarification of unit type	F	

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KP Acoustics Ltd. 2023

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List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Yen Sum, to undertake a noise impact assessment of the air source heat pump installation serving the house at 25 Glenmore Road, Belsize Park, London, NW3 4BY.

A 24-hour environmental noise survey has been undertaken on site in order to prepare a noise impact assessment in accordance with BS4142:2014 '*Method for rating and assessing industrial and commercial sound'* as part of the planning requirements of the London Borough of Camden. Further manual measurements were also undertaken.

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 plant unit installation having an adverse impact on the closest noise sensitive receiver.

2.0 SITE SURVEYS

2.1 Site Description

As shown in Figure 2.1, the site is bounded by residential properties to the north, south, east and 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 environment, with the dominant source being road traffic noise from the surrounding roads.

2.2 Environmental Noise Survey Procedure

Continuous automated monitoring was undertaken for the duration of the noise survey between 14:30 on 04/08/2023 and 12:00 on 07/08/2023.

The environmental noise measurement position, 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.

During the collection of the survey on 07/08/2023, 5-minute manual measurements were also taken of the newly installed air conditioning unit in operation, with the microphone installed approximately 1.5m from ground floor level and approximately 1m from the unit casing. Results are given in Table 3.2.

Icon	Descriptor	Location Description
	Noise Measurement Position	The microphone was installed on a tripod at 1.5m above the ground floor level in the rear garden, as shown in Figure 2.2. The microphone was positioned within free-field conditions at approximately 1.5 metres from the nearest surface.
	Closest Noise Sensitive Receiver 1	Rear façade. 1st Floor window. Residential house to the south.
	Closest Noise Sensitive Receiver 2	Rear façade. Main garden amenity space.
	Plant Location	Plant details are outlined in Section 5.1.

Table 2.1 Measurement position and description

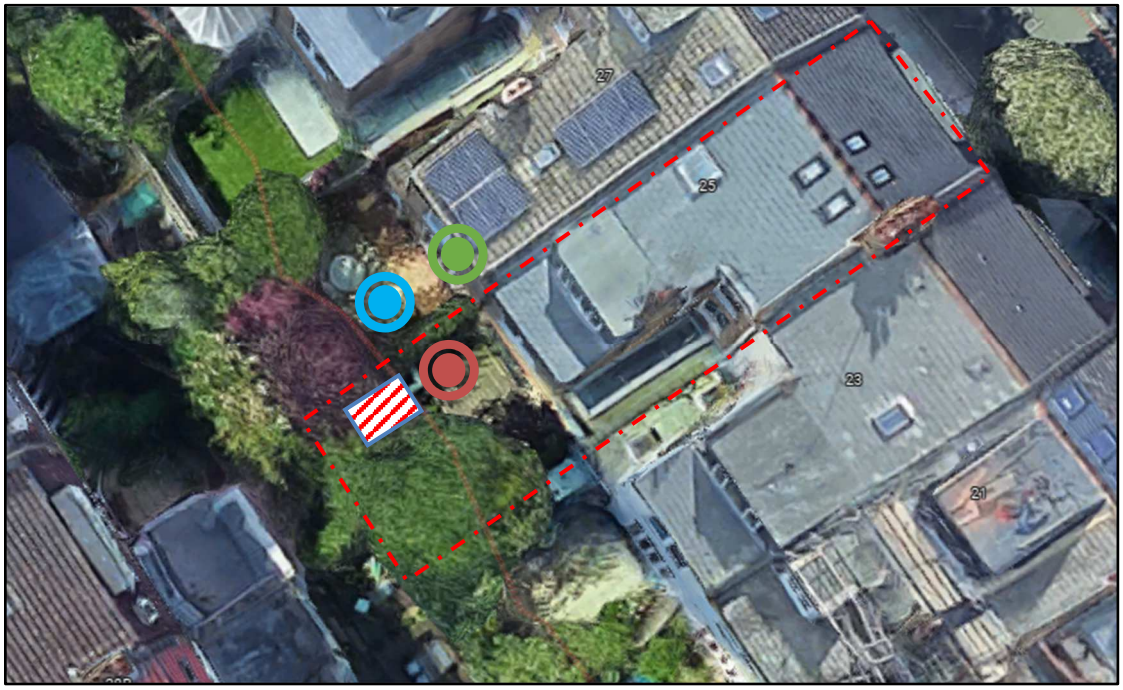

Figure 2.2 Site measurement position, identified receiver and plant unit location (Image Source: Google Maps)

The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver and the 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*'.

2.3 Equipment

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

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 21	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21099-E0	21/07/2022	UK-22-064
	Free-field microphone NTI Acoustics MC230A	A23571		
	Preamp NTI Acoustics MA220	10996		
	NTI Audio External Weatherproof Shroud	-	-	-
Larson Davis CAL200 Class 1 Calibrator		17148	21/03/2023	UCRT23/1363

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 27080.TH1.

Representative background noise levels are shown in Table 3.1 for daytime and night-time. Noise levels obtained from the manual measurements are shown in Table 3.2.

It should be noted that the representative background noise level has been derived from the most commonly occurring $L_{A90,5\ min}$ levels measured during the environmental noise survey undertaken on site, as shown in 27080.Daytime L90.TH1 and 27080.Daytime L90.TH1 attached.

Upon inspecting the noise time history, it was noted that there were periods of the survey in which a continuous elevated background noise was evident. It is unknown whether this is due to the plant installed or a neighbouring dwelling. However, for a robust assessment, periods in which the background noise level is elevated have been discounted before determining the representative background noise levels.

Time Period	Representative background noise level L_{A90} dB(A)
Daytime (07:00-23:00)	40
Night-time (23:00-07:00)	40

Table 3.1 Representative background noise levels

Measurement	Noise Level $L_{Aeq,5min}$ dB(A)
Air Source Heat Pump in Enclosure @ 1m	45

Table 3.2 Manual measurement 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

The guidance provided by The London Borough of Camden for noise emissions of new plant in this instance is as follows:

The noise criteria, as per the Local Plan 2017 of London Borough of Camden, British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' should be considered as the main reference document for the assessment. The resultant 'Rating Level' would be considered as follows:

Period	Assessment Location	Rating Level Acceptability Range		
		Green: noise is considered to be at an acceptable level	**Amber:** noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development	**Red:** noise is observed to have a significant adverse effect.
Daytime (7:00-23:00)	Garden used for main amenity (free field) and Outside living or dining or Bedroom window (façade)	10dB below background	9dB below and 5dB above background	5dB above background
Night-time (23:00-7:00)	Outside bedroom window (façade)	10dB below background and no events exceeding 57dB L_{Amax}	9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	5dB above background and/or events exceeding 88dB L_{Amax}

Table 4.1 Camden noise criteria for plant and machinery

***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.**

5.0 NOISE IMPACT ASSESSMENT

5.1 Plant Installations

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

- 1 No. Daikin REYQ8U7Y1B Air Source Heat Pump

The location of the Daikin unit is in the corner of the rear garden, as shown in Figure 2.2 above. The unit is placed within a wooden enclosure.

The noise emission level as measured on site for the unit is shown in Table 5.1. The unit has been measured in its most onerous setting, heating mode.

Unit	Descriptor	Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Daikin REYQ8U7Y1B	SPL @ 1m (dBA)	51	46	49	41	36	34	34	32	45

Table 5.1 Plant units noise emission levels as measured on site

The first closest noise sensitive receiver to the installation location has been identified as being a residential window of 27 Glenmore Road located approximately 7 metres from the plant installation location, as shown in Figure 2.2. The second has been identified as being the rear garden of 27 Glenmore Road located approximately 5 metres from the plant installation location.

5.2 Calculations

The noise level contribution expected at the closest receivers from the Daikin 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 Receiver
27 Glenmore Road First Floor Bedroom Window	30dB(A)	28dB(A)
27 Glenmore Road Garden	30dB(A)	25dB(A)

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

It can be seen from Appendix B that the noise does not contain tonal elements and therefore it is not necessary to include a +5dB correction. As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive receivers due to the effects of the unit installation satisfies the emissions criterion of the London Borough of Camden.

5.3 BS8233:2014 Assessment

Further calculations have been undertaken to assess whether the noise emissions from the plant unit would be expected to meet the recognised British Standard recommendations internally within the closest residence, in order to further ensure the amenity of nearby noise sensitive receivers.

The calculated noise emission value of 28dB(A) is to be considered externally at 1m from the receiving window. Windows may be closed or partially closed leading to further attenuation, as follows.

British Standard 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' provides recommendations for acceptable internal noise levels in residential properties, as shown in Table 5.3.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB(A)	-
Dining	Dining Room/area	40 dB(A)	-
Sleeping (daytime resting)	Bedrooms	35 dB(A)	30 dB(A)

Table 5.3 BS8233 recommended internal background noise levels

Assuming worst case conditions, of the closest window being for a bedroom, BS8233 recommends 35dB(A)/30dB(A) for internal resting/sleeping conditions during daytime/night-time hours.

With a calculated external level of 28dB(A), the residential window itself would not need to provide any additional attenuation in order for the recommended internal noise conditions to be achieved.

According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level as shown in Table 5.4.

Receiver	BS8233 Criterion for Daytime/Night-time	Noise Level Inside Nearest Residential Receiver
27 Glenmore Road First Floor Bedroom Window	35dB(A)/30dB(A)	13-18dB(A)

Table 5.4 Noise levels and criteria inside nearest residential space

Predicted levels are shown in Table 5.4, with detailed calculations shown in Appendix B. It can therefore be stated that, as well as complying with the requirements of the London Borough of Camden, the noise emissions from the plant unit installation would be expected to comfortably meet the most stringent recommendations of BS8233.

6.0 CONCLUSION

An environmental noise survey has been undertaken at 25 Glenmore Road, Belsize Park, London, NW3 4BY by KP Acoustics Ltd between 14:30 on 04/08/2023 and 12:00 on 07/08/2023 and further manual measurements were taken on 07/08/2023. The results of the survey have enabled criteria to be set for noise emissions.

Measured noise data of the plant unit has been used to obtain Specific and Rated Noise Level at the nearest noise sensitive receiver in accordance with British Standard BS4142:2014 for compliance with the London Borough of Camden requirements.

The rating level was compared with the representative background noise level to assess the likelihood of impact considering the environmental noise context of the area as per the requirements of BS4142:2014.

It has been concluded that noise emissions from the plant units would not have an adverse impact on the nearest residential receivers.

25 Glenmore Road, Belsize Park, London, NW3 4BY - Position 1
Environmental Time History
04/08/2023 to 07/08/2023

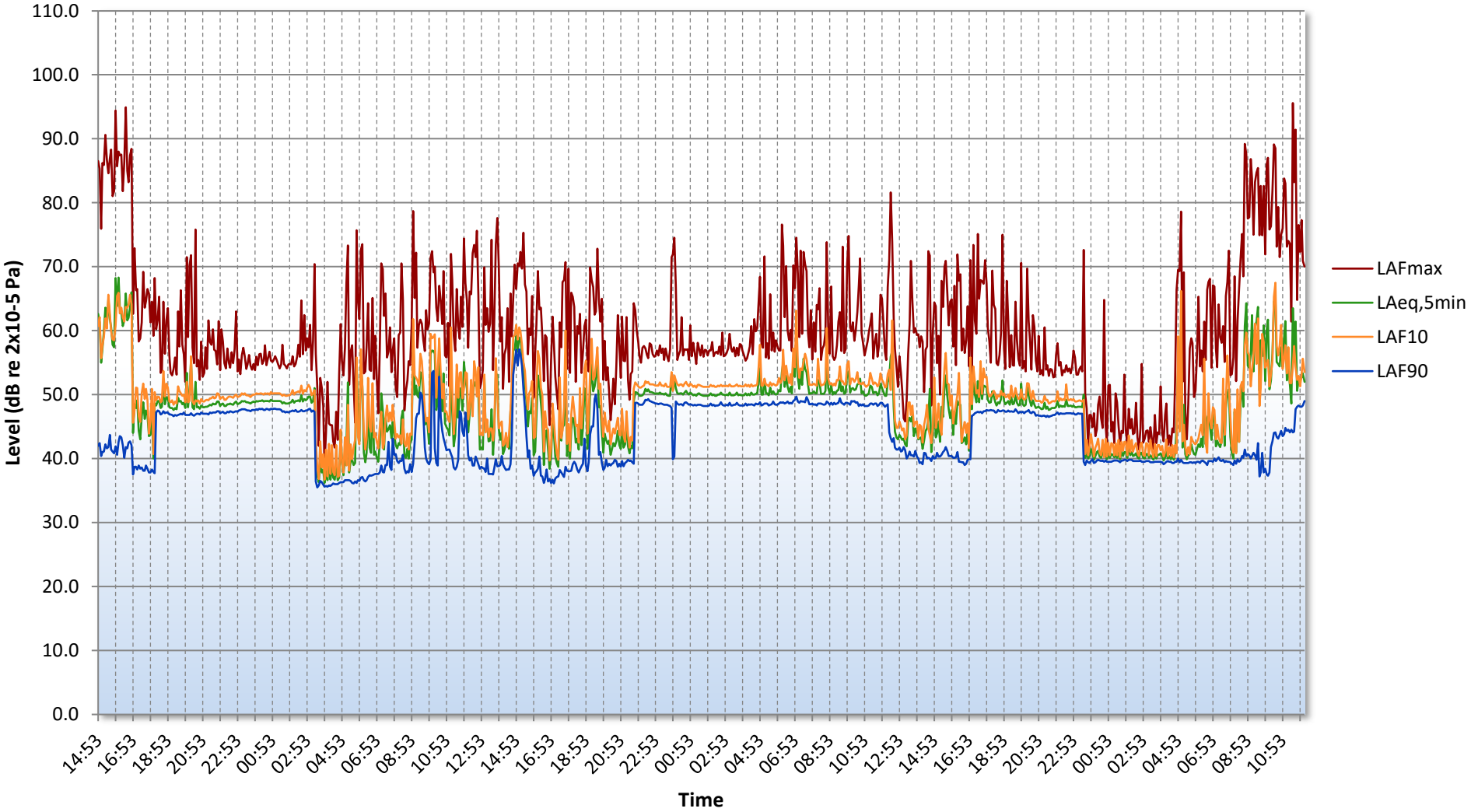

Figure 27080.TH1

25 Glenmore Road, Belsize Park, London, NW3 4BY - Position 1
Representative Daytime Background Noise Level
04/08/2023 to 07/08/2023

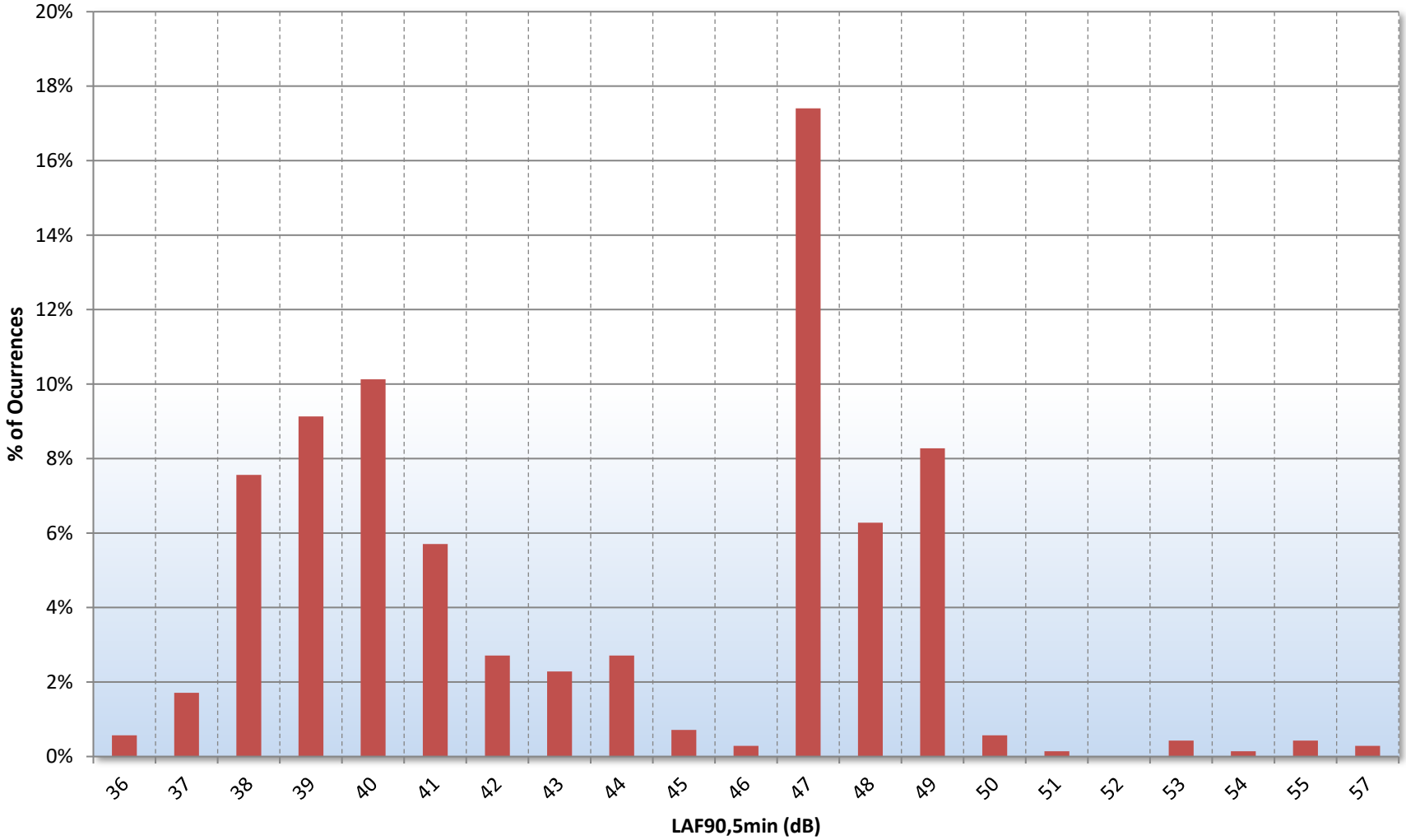

Figure 27080.Daytime L90.TH1

25 Glenmore Road, Belsize Park, London, NW3 4BY - Position 1
Representative Night-time Background Noise Level
04/08/2023 to 07/08/2023

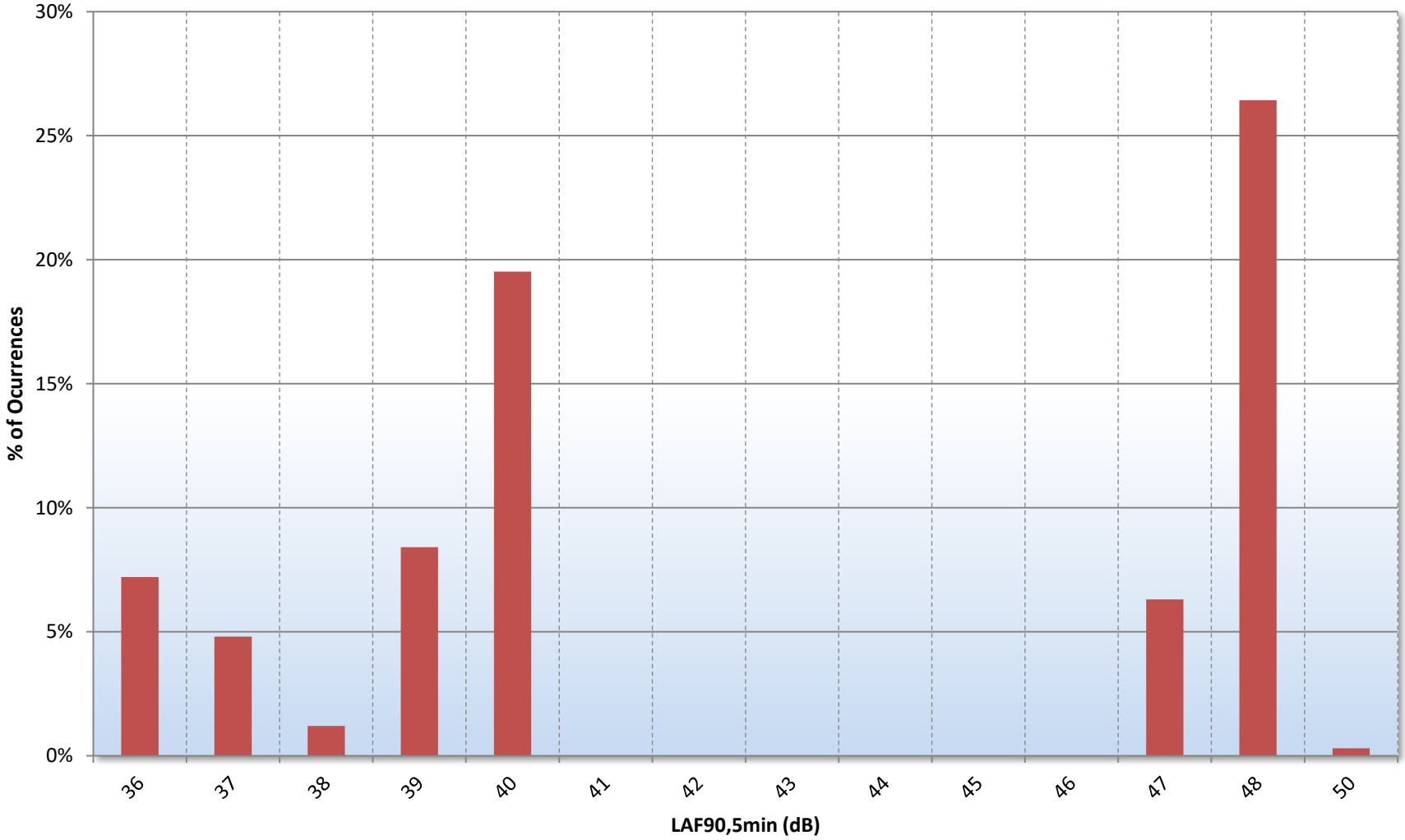

Figure 27080.Night-time L90.TH1

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 B

25 Glenmore Road, Belsize Park, London, NW3 4BY

PLANT NOISE EMISSIONS CALCULATIONS

Source: 25 Belsize Park Receiver: 27 Belsize Park Bedroom Window	Frequency, Hz 63	125	250	500	1k	2k	4k	8k	dB(A)
Daikin REYQ8U7Y1B (Measured Sound Pressure Level @1m)	51	46	49	41	36	34	34	32	45
Minimum attenuation provided by distance (7m), dB	-17	-17	-17	-17	-17	-17	-17	-17	
Sound Pressure Level at Receiver due to All Units, dB	**34**	**29**	**32**	**24**	**19**	**17**	**17**	**15**	**28**

Design Criterion	30

Source: 25 Belsize Park Receiver: 27 Belsize Park Garden	Frequency, Hz 63	125	250	500	1k	2k	4k	8k	dB(A)
Daikin REYQ8U7Y1B (Measured Sound Pressure Level @1m)	51	46	49	41	36	34	34	32	45
Minimum attenuation provided by distance (5m), dB	-14	-14	-14	-14	-14	-14	-14	-14	
Minimum attenuation provided by building envelope, dB	-5	-5	-5	-6	-6	-8	-10	-12	
Sound Pressure Level at Receiver due to All Units, dB	**32**	**27**	**30**	**21**	**16**	**12**	**10**	**6**	**25**

Design Criterion	30

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.