

THE FORUM, 74–80 CAMDEN STREET, LONDON

PLANNING COMPLIANCE REVIEW

Report 15572.PCR.01.Rev C

For:

Morgan Lovell PLC

16 Noel Street

Team Valley

London

W1F 8DA

Site Address	Report Date	Revision History
The Forum, 74 – 80 Camden Street, NW1 0EG	20/03/2017	Rev. A – 23/03/2017 Rev. B – 24/03/2017 Rev. C – 31/05/2017

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1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by Morgan Lovell PLC, 16 Noel Street, Team Valley, London, W1F 8DA to undertake an environmental noise survey at The Forum, 74 – 80 Camden Street, NW1 0EG.

The background noise levels measured will be used to determine daytime and night-time noise emission criteria for a proposed installation of plant units, in agreement with the planning requirements of The London Borough of Camden.

This report presents the overall methodology and results from the environmental survey followed by calculations to demonstrate the feasibility of the plant installations to satisfy the emissions criterion at the closest noise-sensitive receivers and outline mitigation measures as appropriate.

2.0 ENVIRONMENTAL NOISE SURVEY AND EQUIPMENT

2.1 Procedure

Automated noise monitoring was undertaken on the proposed site as shown in Site Plan 15572.SP1. The choice of this position was based on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver. The duration of the survey was between 11:30am on 07th March 2017 and 11:30am on 08th March 2017.

Initial inspection of the site revealed that the background noise profile at the monitoring location was dominated by the road traffic noise from the surrounding roads and noise from existing plant units.

The weather during the course of the survey was generally dry with wind speeds within acceptable tolerances and therefore suitable for the measurement of environmental noise. The measurement procedure generally complied with ISO 1996-2:2007 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 was as follows.

- 1 No. Svantek Type 957 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

3.0 RESULTS

The results from the continuous noise monitoring are shown as a time history of L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} averaged over 5 minute sample periods in Figure 15572.TH1 at Top Roof Level.

Minimum background noise levels are shown in Table 3.1.

Minimum background noise level	
$L_{A90: 5min}$ dB(A)	
Daytime (07:00am-11:00pm)	50
Night-time (11:00pm-07:00am)	47

Table 3.1: Minimum measured background noise levels

Measured ambient noise levels are shown in Table 3.2.

Levels dB(A)	
Daytime $L_{Aeq,16hour}$	59
Night-time $L_{Aeq,8hour}$	58

Table 3.2 Site average noise levels for daytime and night time

4.0 NOISE CRITERIA

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

“The proposed plant and machinery shall be operated so as to ensure that any noise generated is “not audible” outside the nearest residential premises. To demonstrate inaudibility, you will need to provide calculations that show that the plant noise level is 10dBA below the lowest background level (L_{A90} (15minutes)) 1m from the nearest residential window, over the proposed operating hours. Tonality must also be taken into consideration.”

We therefore propose to set the noise criterion as shown in Table 4.1 in order to comply with the above requirement.

Top Roof Level	
Noise criterion at nearest receivers (as shown in SP2)	40 dB(A)

Table 4.1: Proposed Noise Emissions Criterion

As the plant units proposed to be installed on the Top Roof level will be used during the Offices opening hours, we would recommend the adoption of the daytime criterion of 40 dB(A) to ensure the amenity of the closest receivers (as shown in Site Plan 15572.SP2), will be protected.

5.0 DISCUSSION

It is understood that two options for the plant units installations are proposed to the top Roof Level and are comprised of the following units:

Option “Day 1”

- 1 No. Daikin REYQ12T
- 3 No. Daikin REYQ16T

The Daikin REYQ12T plant unit (1 No.) is proposed to be installed to the North East of the property, at Top Roof level (as shown in SP2). The closest noise sensitive receiver (as shown in Site Plan 15572.SP2) to this location will be the residential window located at East of the property and approximately 30 meters (min.) away.

The Daikin REYQ16T plant units (3 No.) are proposed to be installed to the South West of the property, at Top Roof level (as shown in SP1). The closest noise sensitive receiver (as shown in Site Plan 15572.SP1) to this location will be the residential window located to the West of the property and approximately 6 meters (min.) away.

Option “Day 2”

- No. 4 Daikin REYQ12T
- No. 4 Daikin REYQ16T

No. 4 Daikin REYQ12T plant unit are proposed to be installed to the North West of the property, at Top Roof level (as shown in SP2). The closest noise sensitive receiver (as shown in Site Plan 15572.SP2) to this location will be the residential window located at West of the property and approximately 30 meters (min.) away.

No. 4 Daikin REYQ12T plant unit are proposed to be installed to the South East of the property, at Top Roof level (as shown in SP1). The closest noise sensitive receiver (as shown in Site Plan 15572.SP1) to this location will be the residential window located at East of the property and approximately 6 meters (min.) away.

The sound pressure levels at 1m as provided by the manufacturer for the unit is shown in Table 5.1.

Unit	Sound Pressure Level (dB) in each Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Daikin REYQ12T	59	66	60	62	53	50	44	37
Daikin REYQ16T	66	65	67	64	59	55	50	44

Table 5.1 Manufacturer’s Sound Pressure Levels.

5.1 Objective overview

Taking all acoustic corrections into consideration, including distance corrections, the noise level expected at the closest residential window would be as shown in Table 5.2. Detailed calculations are shown in Appendix B1-4.

Receiver - Nearest Noise Sensitive Window	Criterion	Noise Level at closest Receiver
Closest noise sensitive receiver 1 - Option “Day 1”	40 dB(A)	32 dB(A)
Closest noise sensitive receiver 1 - Option “Day 2”		34 dB(A)
Closest noise sensitive receiver 2 - Option “Day 1”		Non-significant
Closest noise sensitive receiver 2 - Option “Day 2”		Non-significant

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

As shown in Appendices B1-4 and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the plant unit installations fully satisfies the emissions criteria set based on the requirements of The London Borough of Camden.

5.2 BS8233 Assessment

Furthermore, the predicted noise levels as shown in Table 5.2 at nearest noise sensitive receivers are to be considered outside of the nearest residential windows. Windows may be closed or partially closed leading to further attenuation, as follow. Further calculations have been undertaken to assess whether the noise emissions from the plant units installations would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 ‘*Sound insulation and noise reduction for buildings – Code of Practice*’ gives recommendations for acceptable internal noise levels in residential properties. Assuming worst

case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 30 dB(A) as being the value for internal resting/sleeping conditions in night-time and 35 dB(A) as being the value for internal resting/sleeping conditions in daytime.

With the calculated external levels shown in Table 5.2 at nearest noise sensitive receivers, the residential window itself would need to provide an additional nominal attenuation in order for the 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.

Receiver	Design Range – For resting/sleeping conditions in a bedroom, in BS8233:2014	Noise Level at Receiver
Receiver 1 - Option “Day 1”	35 dB(A)	22 dB(A)
Receiver 1 - Option “Day 2”		24 dB(A)
Receiver 2 - Option “Day 1”		Non-significant
Receiver 2 - Option “Day 2”		Non-significant

Table 5.3 Noise levels and criteria inside nearest residential spaces.

Predicted levels are shown in Table 5.3, with detailed calculations shown in Appendices B1-4. 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 units installations would be expected to comfortably meet the most stringent recommendations of the relevant British Standard.

6.0 CONCLUSION

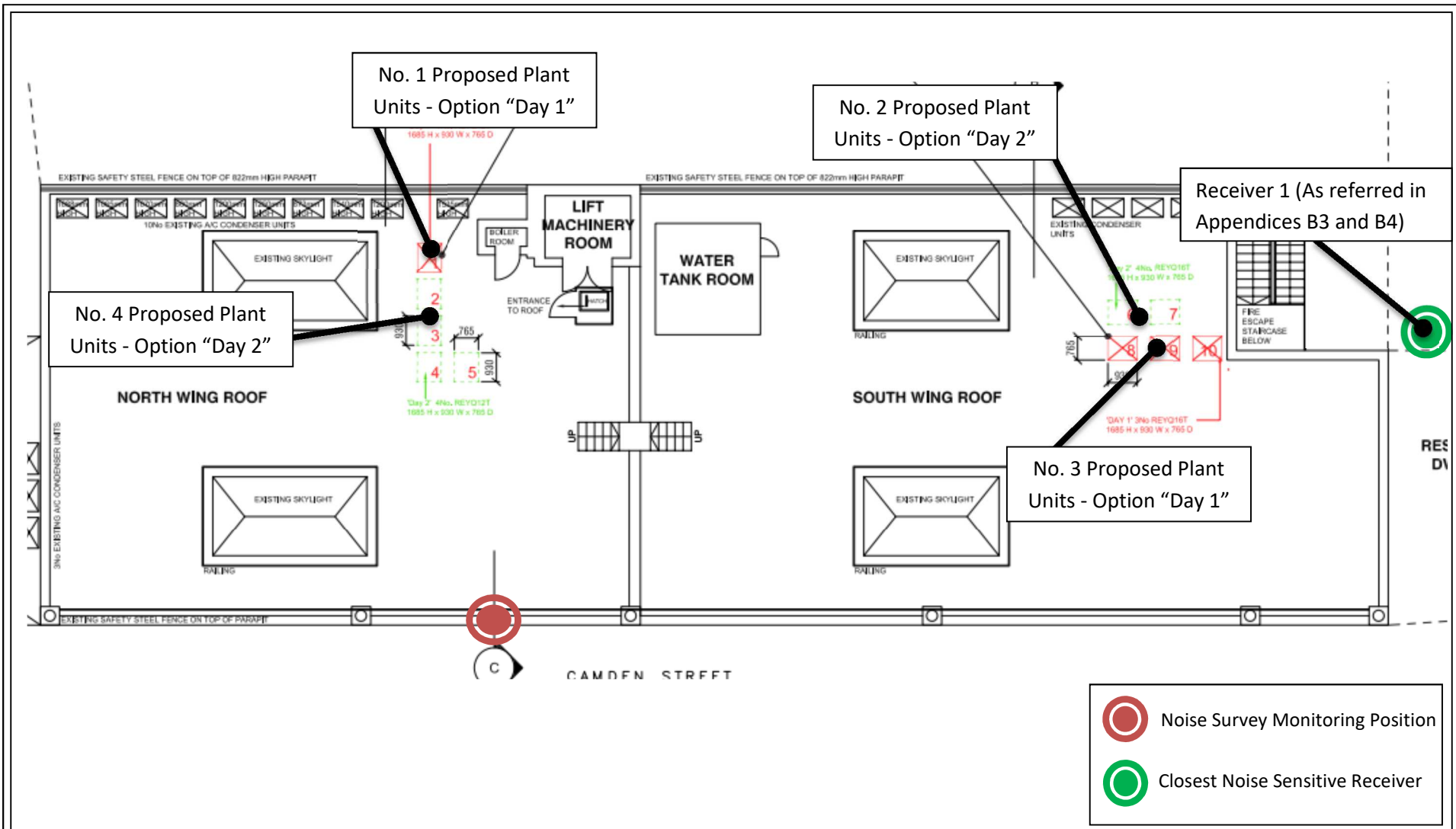
An environmental noise survey has been undertaken at The Forum, 74 – 80 Camden Street, NW1 0EG by KP Acoustics Ltd between 11:30am on 07th March 2017 and 11:30am on 08th March 2017. The results of the survey have enabled criteria to be set for noise emissions from proposed plant units.



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 proposed plant units installations would meet the requirements of The London Borough of Camden.

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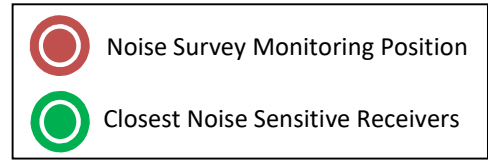
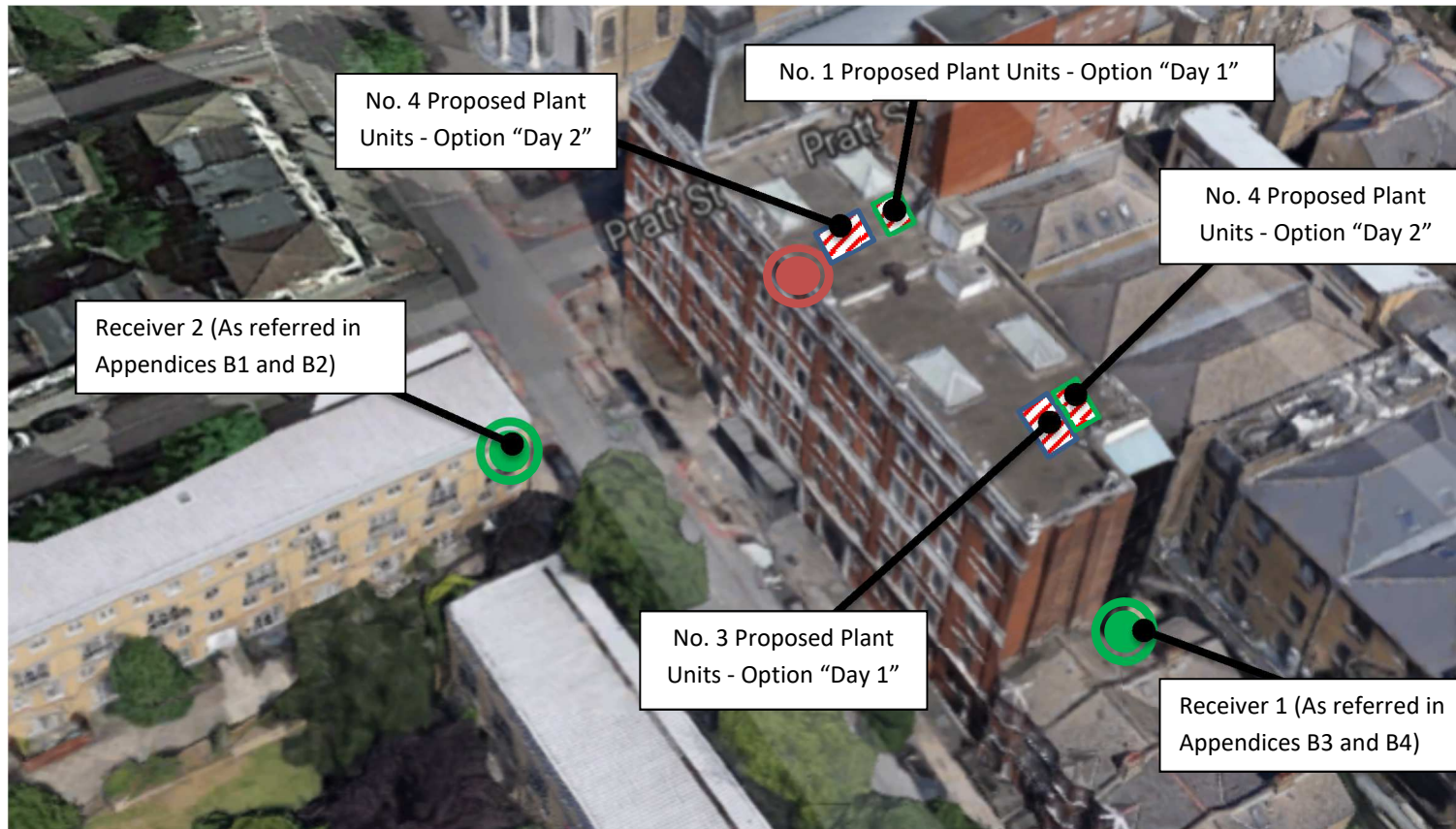
 Noise Survey Monitoring Position
 Closest Noise Sensitive Receiver

Title:
 Indicative site plan showing noise monitoring position and closest noise sensitive receiver

Date: 24 March 2017

FIGURE 15572.SP1





Title:

Indicative site plan showing noise monitoring position and closest noise sensitive receivers

Date: 24 March 2017

FIGURE 15572.SP1



The Forum, 74 – 80 Camden Street, London
Environmental Noise Time History
07th March to 08th March 2017

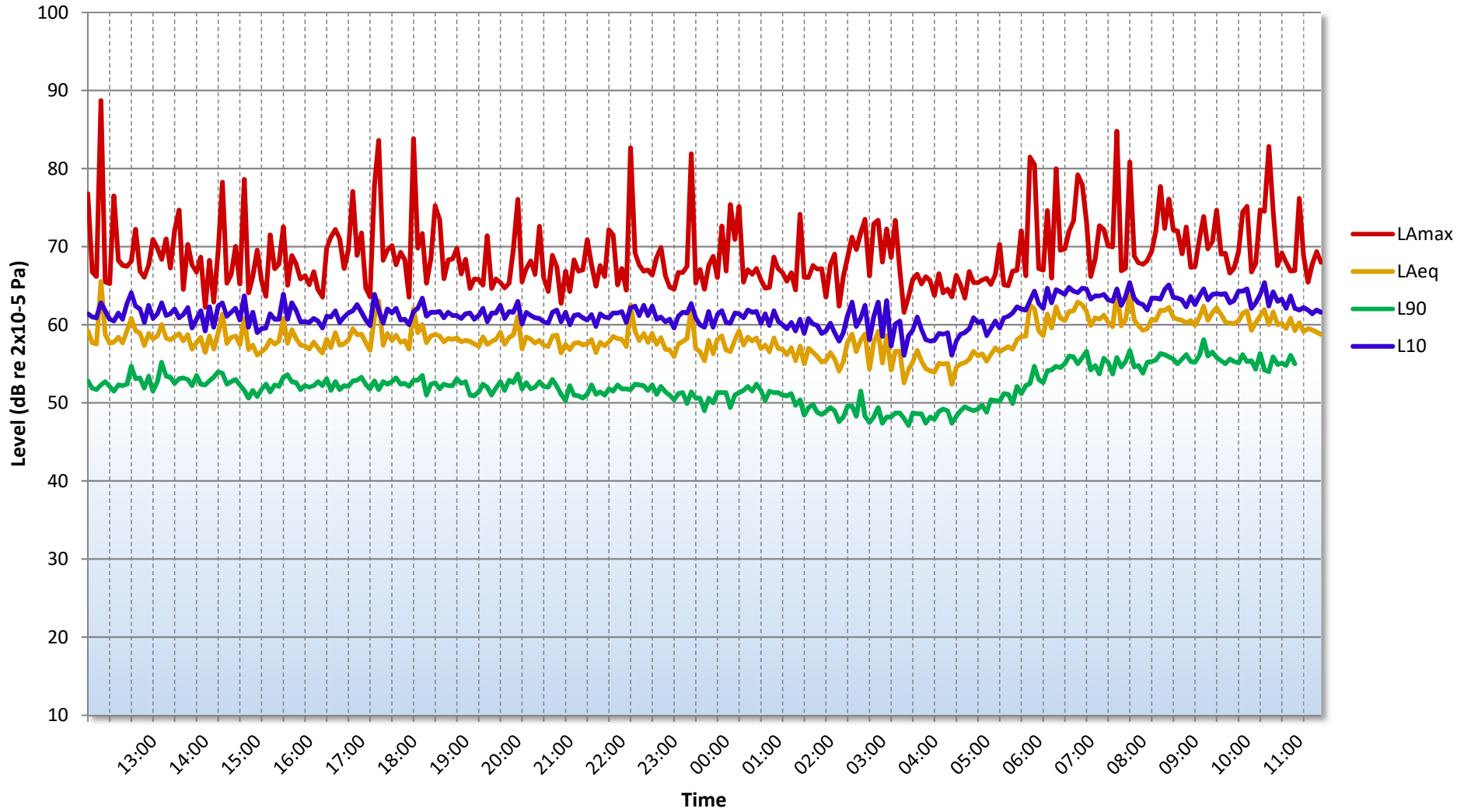


Figure 15572.TH1

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*.

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

The Forum, 74 – 80 Camden Street, NW1 0EG

PROPOSED PLANT UNIT EMISSIONS CALCULATIONS -OPTION "DAY 1"

Source: Proposed Plant Units located to the North East, at Top Roof Level Receiver: Nearest Noise Sensitive Window - Receiver 2	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Manufacturers Sound Pressure Levels at 1m									
No. 1 Daikin REYQ12T (Sound Pressure Level)	59	66	60	62	53	50	44	37	
Attenuation provided by distance (min. 30m)	-30	-30	-30	-30	-30	-30	-30	-30	
Attenuation Provided by building's envelope	-16	-19	-22	-25	-28	-30	-33	-33	
Sound pressure level 1m from closest noise sensitive receiver	13	17	8	7	0	0	0	0	10

Design Criterion	40
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Receiver: Inside Nearest Residential Window

Source: Proposed plant installation	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Sound pressure level outside window	13	17	8	7	0	0	0	0	
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level inside nearest residential window	3	7	0	0	0	0	0	0	7

Design Criterion	30
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APPENDIX B2

The Forum, 74 – 80 Camden Street, NW1 0EG

PROPOSED PLANT UNIT EMISSIONS CALCULATIONS - OPTION "DAY 1"

	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Source: Proposed Plant Units located to the South West, at Top Roof Level									
Receiver: Nearest Noise Sensitive Window - Receiver 1									
Manufacturers Sound Pressure Levels at 1m									
No. 3 Daikin REYQ16T (Sound Pressure Level)	66	65	67	64	59	55	50	44	
Correction due to number of units (3 No.)	5	5	5	5	5	5	5	5	
Attenuation provided by distance (min. 6m)	-16	-16	-16	-16	-16	-16	-16	-16	
Attenuation Provided by building's envelope	-12	-16	-19	-23	-25	-29	-30	-30	
Sound pressure level 1m from closest noise sensitive receiver	43	38	37	30	23	15	9	3	32

Design Criterion	40
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	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Receiver: Inside Nearest Residential Window - Receiver 1									
Source: Proposed plant installation									
Sound pressure level outside window	43	38	37	30	23	15	9	3	
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level inside nearest residential window	33	28	27	20	13	5	0	0	22

Design Criterion	30
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APPENDIX B3

The Forum, 74 – 80 Camden Street, NW1 0EG

PROPOSED PLANT UNIT EMISSIONS CALCULATIONS - OPTION "DAY 2"

Source: Proposed Plant units located to the North West of the Roof Level Receiver: Nearest Noise Sensitive Window - Receiver 2	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Manufacturers Sound Pressure Levels at 1m									
No. 4 Daikin REYQ12T (Sound Pressure Level)	59	66	60	62	53	50	44	37	
Correction due to number of units (4 No.)	6	6	6	6	6	6	6	6	
Attenuation provided by distance (min. 30m)	-30	-30	-30	-30	-30	-30	-30	-30	
Attenuation Provided by building's envelope	-16	-19	-22	-25	-28	-30	-33	-33	
Sound pressure level 1m from closest noise sensitive receiver	19	23	14	13	1	0	0	0	14

Design Criterion	40
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Source: Proposed Plant units located to the West of the Roof Level Receiver: Inside Nearest Residential Window - Receiver 2	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Sound pressure level outside window	19	23	14	13	1	0	0	0	
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level inside nearest residential window	9	13	4	3	0	0	0	0	8

Design Criterion	30
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APPENDIX B4

The Forum, 74 – 80 Camden Street, NW1 0EG

PROPOSED PLANT UNIT EMISSIONS CALCULATIONS - OPTION "DAY 2"

Source: Proposed Plant Units located to the South East of the Roof Level. Receiver: Nearest Noise Sensitive Window - Receiver 1	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Manufacturers Sound Pressure Levels at 1m									
No.4 Daikin REYQ16T (Sound Pressure Level)	66	65	67	64	59	55	50	44	
Correction due to number of units (4 No.)	6	6	6	6	6	6	6	6	
Attenuation provided by distance (min. 6m)	-16	-16	-16	-16	-16	-16	-16	-16	
Attenuation Provided by building's envelope	-12	-16	-19	-23	-25	-29	-30	-30	
Sound pressure level 1m from closest noise sensitive receiver	44	39	38	31	24	16	10	4	34

Design Criterion	40
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Source: Proposed Plant Units located to the South East of the Roof Level. Receiver: Inside Nearest Residential Window - - Receiver 1	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Sound pressure level outside window	44	39	38	31	24	16	10	4	
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level inside nearest residential window	34	29	28	21	14	6	0	0	24

Design Criterion	30
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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/m³) 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.