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24 HEATH DRIVE,
HAMPSTEAD, LONDON

NOISE IMPACT ASSESSMENT

Report **12935-NIA-01 RevC**

Prepared on 20 April 2018

Issued For:

Kyson

28 Scrutton Street

London

EC2A 4RP

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics has been commissioned by Kyson to measure existing background noise levels at 24 Heath Drive, Hampstead, London. The measured noise levels have been used to determine noise emission criteria for a proposed plant installation in agreement with the planning requirements of the London Borough of Camden.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

Current proposals are to install a Daikin condenser, a Nuaire Mechanical Ventilation and Heat Recovery (MVHR) unit and a Menerga Air Handling Unit (AHU). The condenser will be located in the rear garden. The MVHR and AHU will be located within the building, however, these items of plant have both intake and discharge atmospheric grilles located at the rear and front of the building.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Procedure

Measurements were undertaken at one position as shown on indicative site drawing 12935-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the site.

The microphone was mounted on a tripod at ground floor level to the rear of the adjacent building (23 Heath Drive). The microphone was positioned 3.5 m in front of the window and as such the monitoring position is considered free-field according to the guidance of BS 8233:2014. Noise levels at the monitoring position were dominated by traffic noise from Heath Drive during the installation and collection of equipment.

Continuous automated monitoring was undertaken for the duration of the survey between 18 April 2018 and 20 April 2018.

Weather conditions were generally dry with light winds, therefore suitable for the measurement of environmental noise.

The measurement procedure generally complied with BS 7445:1991: '*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*'.

3.2 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 977 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.0 RESULTS

The $L_{Aeq:\ 5min}$, $L_{Amax:\ 5min}$, $L_{A10:\ 5min}$ and $L_{A90:\ 5min}$ acoustic parameters were measured at the location shown in site drawing 12935-SP1.

The measured noise levels are shown as a time history in Figure 12935-TH2, with ambient and background noise levels summarised in Table 4.1.

	Average ambient noise level $L_{eq:\ T}$ dB(A)	Minimum background noise level $L_{90:\ 5min}$ dB(A)
Daytime (07:00 - 23:00)	46 dB(A)	30 dB(A)
Night-time (23:00 - 07:00)	44 dB(A)	30 dB(A)

Table 4.1: Average ambient and minimum background noise levels

5.0 NOISE CRITERIA

The London Borough of Camden general plant noise criteria is understood to be as follows:

> *"The 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the minimum external background noise, at a point 1 metre outside any window of any residential property."*

It is understood that the proposed plant units could be operational 24 hours a day. We therefore propose to set the noise criteria at 20 dB(A), the value 10 dB below the minimum measured background noise level during the day and night time hours.

6.0 DISCUSSION

6.1 Proposed Installation

The proposed plant installation comprises the following:

- Daikin Condenser RXYSQ10TY1
- Nuaire MVHR XBOXER (intake and exhaust)
- Menerga 18-20-21 AHU (intake and exhaust)

Noise emissions for the proposed plant units, as provided by the manufacturer, are shown in Table 6.1.

	Sound Power Levels (dB) in each Frequency Band								
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Daikin RXYSQ10TY1	74	76	72	73	69	64	60	52	74
Nuaire MVHR intake (in-duct)	77	71	69	71	66	62	54	53	72
Nuaire MVHR exhaust (in-duct)	83	84	78	81	72	72	70	71	81
Menerga AHU intake (in-duct)	81	81	78	75	74	71	66	61	79
Menerga AHU exhaust (in-duct)	81	81	79	75	74	71	66	61	79

Table 6.1: Manufacturer Noise Emissions Levels

The proposed plant location for the condenser and the atmospheric duct terminations for the MVHR unit are shown on indicative site plans 12935-SP1 and 12935-SP2.

The closest receivers have been identified as the properties adjacent to the east and west. These nearest noise sensitive receivers are indicated on the site plans. The following describes which item of plant potentially affects each receiver and the approximate distance from each unit.

- Receiver 1:
    - Daikin Condenser, approximately 30 m from receiver
- Receiver 2:
    - Daikin Condenser, approximately 25 m from receiver, line of sight partially blocked by a storage shed
    - MVHR intake grille, approximately 7 m from receiver
    - MVHR exhaust grille, approximately 6 m from receiver
    - AHU intake grille, approximately 8 m from receiver
- Receiver 3:
    - AHU exhaust grille, approximately 12 m from receiver

This nearest noise sensitive receivers were identified through observations on-site. If there are any receivers closer to that identified within this report then a further assessment will need to be carried out. Therefore, the closest noise sensitive receivers should be confirmed by Kyson before the plant is installed or any noise mitigation measures are implemented.

6.2 Proposed Mitigation Measures

In order to meet the proposed criteria stated in Section 5.0, it is recommended that a louvred acoustic enclosure is installed around the condenser. The enclosure should provide sufficient attenuation to achieve a maximum sound pressure level of 50 dB(A) when measured at 1 m in all directions.

Based on the information provided, an enclosure meeting the sound reduction indices as stated in Table 6.2 should be suitable to achieve this.

	Required Attenuation (dB) in each Frequency Band							
Mitigation	**63Hz**	**25Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Louvred Enclosure	5	7	12	16	24	25	22	20

Table 6.2: Required Attenuation from Mitigation

In addition to the acoustic enclosure for the condenser, attenuators will need to be installed onto the atmospheric connections of the MVHR and AHU units. Attenuators providing the insertion loses as stated in the attached attenuator schedule 12935-AT1 should to be installed.

6.3 Noise Impact Assessment

Taking into account all necessary acoustic corrections, the resulting noise level at the identified residential windows should be as shown in Table 6.3. Detailed calculations are shown in Appendix B1-3.

Receiver	Night Time Hours Criterion	Noise Level at Receiver (due to proposed plant)
Receiver 1	20 dB(A)	19 dB(A)
Receiver 2	20 dB(A)	20 dB(A)
Receiver 3	20 dB(A)	20 dB(A)

Table 6.3: Noise levels and criteria at noise sensitive receivers

As presented in Table 6.3 and Appendix B1-3, the proposed plant installation with acoustic enclosure would be expected to meet the requirements of the proposed criteria.

6.4 British Standard Requirements

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

British Standard 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS 8233:2014 recommends 30dB(A) as being acceptable internal resting/sleeping conditions during night-time.

With loudest external levels of 20dB(A), acceptable internal conditions would be met without taking the attenuation of the window itself into consideration. According to BS 8233:2014, a typical building facade with a partially open window offers 15 dB attenuation.

It can therefore be predicted that, in addition to meeting the requirements of the set criteria, the emissions from the proposed plant would be expected to meet the most stringent recommendations of the relevant British Standard, with neighbouring windows partially open. Predicted levels are shown in Table 6.4.

Receiver	Recomended Target – *For resting/sleeping conditions in a bedroom, in BS8233:2014*	Noise Level at Receiver (due to plant installation)
Inside Residential Window	30 dB(A)	9 dB(A)

Table 6.4: Noise levels and criteria inside nearest residential space

7.0 CONCLUSION

An environmental noise survey has been undertaken for 24 Heath Drive, Hampstead, London. The results of the survey have enabled criteria to be set for noise emissions from the proposed plant units in accordance with the requirements of the London Borough of Camden.

A noise impact assessment has then been undertaken using manufacturer noise data to predict the noise levels, due to the proposed plant, at the nearby noise sensitive receivers.

Calculations show that noise emissions from the proposed plant units should meet the requirements of the London Borough of Camden with the recommended mitigation installed as stated herein.

Report by

Kenny Macleod AMIOA

Checked by

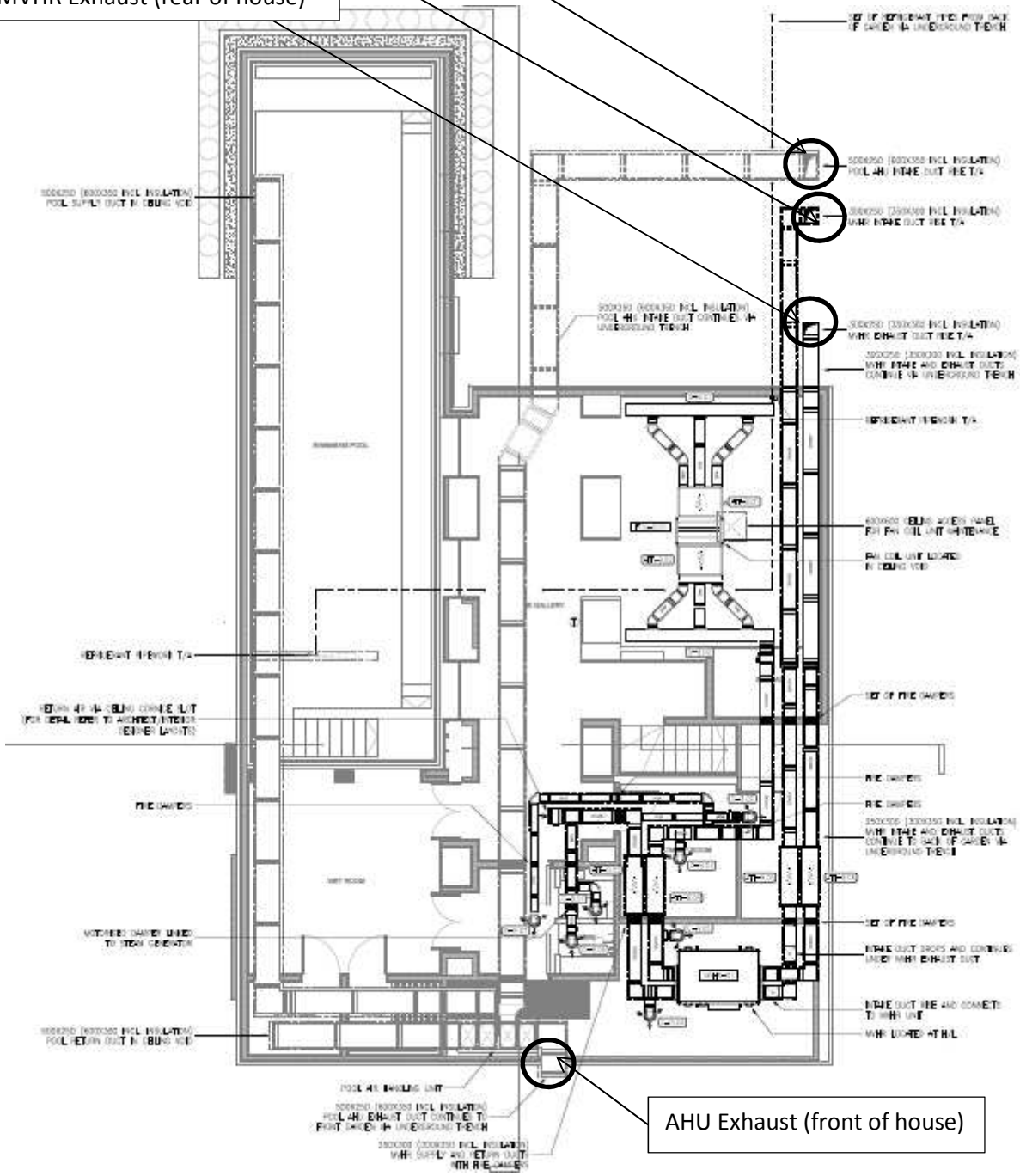
Duncan Martin MIOA

12935-SP1 Indicative site plan indicating noise monitoring position and nearest noise sensitive receiver **Date:** 20 April 2018

AHU Intake (rear of house)

MVHR Intake (rear of house)

MVHR Exhaust (rear of house)

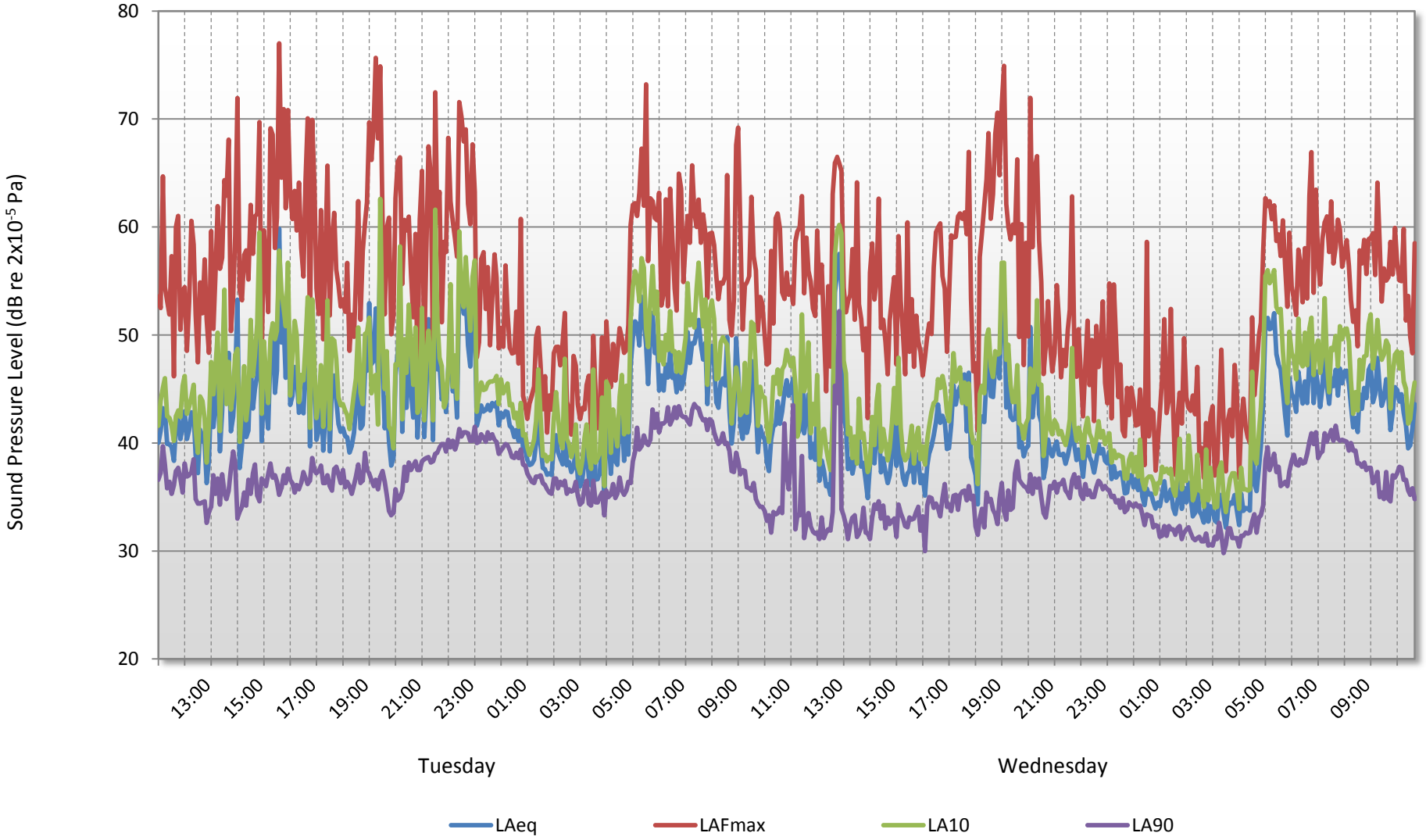


AHU Exhaust (front of house)

12935-SP2 Site plan showing plant locations **Date:** 20 April 2018

24 Heath Drive, Hampstead, London

Environmental Noise Time History
18 April 2018 to 20 April 2018



12935: 24 Heath Drive
ATTENUATOR SCHEDULE

Revision: 0	Date: 19/01/2018	Comments: None											
Attenuator Ref.	Description	No. Off	Dimensions (mm)			Max Pressure Drop Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
			W	H	L		63	125	250	500	1k	2k	4k	8k
01	Nuaire MVHR intake	1	Sized to not exceed maximum pressure drop		1500*	60	4	9	17	28	34	32	21	14
02	Nuaire MVHR exhaust	1	Sized to not exceed maximum pressure drop		2400*	60	10	21	37	50	50	50	47	26
03	Menerga AHU intake	1	Sized to not exceed maximum pressure drop		2100*	60	6	11	23	36	43	41	29	18
04	Menerga AHU exhaust	1	Sized to not exceed maximum pressure drop		2400*	60	7	12	25	40	46	45	33	20

*Indicative Lengths

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and 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 not 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 not 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 10 such octave bands whose centre frequencies are defined in accordance with international standards.

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 one alone and 10 sources produce a 10dB 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

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception 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 reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B-1 (Receiver 1)

12935

24 Heath Drive, Hampstead, London

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound power levels, dB									
Daikin RXYSQ10TY1	74	76	72	74	68	64	60	53	74
Correction to sound pressure, accounting for reflections, dB	-8	-8	-8	-8	-8	-8	-8	-8	
Proposed mitigation	-5	-7	-12	-16	-24	-25	-22	-20	
Distance correction to receiver, dB (30m)	-30	-30	-30	-30	-30	-30	-30	-30	
Sound pressure level at receiver	**31**	**31**	**22**	**20**	**6**	**1**	**0**	**-5**	**20**

Design Criterion	**20**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	31	31	22	20	6	1	0	-5	20
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**16**	**16**	**7**	**5**	**0**	**0**	**0**	**0**	**9**

Design Criterion	**30**

APPENDIX B-2 (Receiver 2)

12935

24 Heath Drive, Hampstead, London

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound power levels, dB									
Daikin RXYSQ10TY1	74	76	72	74	68	64	60	53	74
Correction to sound pressure, accounting for reflections, dB	-8	-8	-8	-8	-8	-8	-8	-8	
Proposed mitigation	-5	-7	-12	-16	-24	-25	-22	-20	
Screening due to storage shed	-1	-3	-6	-9	-11	-12	-15	-15	
Distance correction to receiver, dB (25m)	-28	-28	-28	-28	-28	-28	-28	-28	
Sound pressure level at receiver	**32**	**30**	**18**	**13**	**-3**	**-9**	**-13**	**-18**	**17**

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
MVHR Intake									
Manufacturer provided in-duct sound power levels, dB	77	71	69	71	66	62	54	53	72
System Losses, dB	-8	-11	-8	-8	-10	-13	-13	-13	
End Reflection, dB	-12	-7	-3	-1	0	0	0	0	
Sound power at grille, dB	57	53	58	62	56	49	41	40	61
Radiating correction, dB	-8	-8	-8	-8	-8	-8	-8	-8	
Distance loss, dB (7m)	-17	-17	-17	-17	-17	-17	-17	-17	
Proposed mitigation	-4	-9	-17	-28	-34	-32	-21	-14	
Sound Pressure Level at receiver	**28**	**19**	**16**	**9**	**0**	**0**	**0**	**1**	**12**

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
MVHR Exhaust									
Manufacturer provided in-duct sound power levels, dB	83	84	78	81	72	72	70	71	81
System Losses, dB	-7	-9	-7	-8	-9	-12	-12	-12	
End Reflection, dB	-12	-7	-3	-1	0	0	0	0	
Sound power at grille, dB	64	68	68	72	63	60	58	59	71
Radiating correction, dB (6m)	-8	-8	-8	-8	-8	-8	-8	-8	
Distance loss, dB (6m)	-16	-16	-16	-16	-16	-16	-16	-16	
Proposed mitigation	-10	-21	-37	-50	-50	-50	-47	-26	
Sound Pressure Level at receiver	**30**	**23**	**7**	**0**	**0**	**0**	**0**	**9**	**13**

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
AHU Intake									
Manufacturer provided in-duct sound power levels, dB	81	81	78	75	74	71	66	61	79
System Losses, dB	-20	-16	-11	-10	-13	-13	-13	-13	
End Reflection, dB	-7	-3	-1	0	0	0	0	0	
Sound power at grille, dB	54	62	66	65	61	58	53	48	67
Radiating correction, dB	-8	-8	-8	-8	-8	-8	-8	-8	
Distance loss, dB (8m)	-18	-18	-18	-18	-18	-18	-18	-18	
Proposed mitigation	-6	-11	-23	-36	-43	-41	-29	-18	
Sound Pressure Level at receiver	**22**	**25**	**17**	**3**	**0**	**0**	**0**	**4**	**13**

Combined sound pressure level at receiver	**35**	**32**	**22**	**15**	**5**	**5**	**5**	**11**	**20**

Design Criterion	**20**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	35	32	22	15	5	5	5	11	20
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**20**	**17**	**7**	**0**	**-10**	**0**	**0**	**0**	**8**

Design Criterion	**30**

APPENDIX B-3 (Receiver 3)

12935

24 Heath Drive, Hampstead, London

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
AHU Exhaust									
Manufacturer provided in-duct sound power levels, dB	81	81	79	75	74	71	66	61	79
System Losses, dB	-3	-2	-2	-3	-4	-4	-4	-4	
End Reflection, dB	-7	-3	-1	0	0	0	0	0	
Sound power at grille, dB	71	76	76	72	70	67	62	57	75
Radiating correction, dB	-8	-8	-8	-8	-8	-8	-8	-8	
Distance loss, dB (12m)	-22	-22	-22	-22	-22	-22	-22	-22	
Proposed mitigation	-7	-12	-25	-40	-46	-45	-33	-20	
Sound Pressure Level at receiver	**34**	**34**	**21**	**2**	**0**	**0**	**0**	**7**	**20**

Design Criterion	**20**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	34	34	21	2	0	0	0	7	20
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**19**	**19**	**6**	**0**	**0**	**0**	**0**	**0**	**9**

Design Criterion	**30**