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39-40 EAGLE STREET,
LONDON

NOISE IMPACT ASSESSMENT

Report **17679-NIA-01 RevB**

Prepared on 16 August 2022

Issued For:

OR Media

Executive Summary

This noise impact assessment has been undertaken in order to assess a proposed plant installation for commercial use at 39-40 Eagle Street.

The proposed plant installation comprises the following plant units:

- 12 No. Daikin Air Source Heat Pumps
- 2 No. Daikin Air Conditioning Condenser Units
- 9 No. Mitsubishi MVHR Units

A background noise survey has been undertaken as detailed in the report, in order to determine an appropriate noise emission criterion, in accordance with the requirements of the London Borough of Camden.

Calculations were undertaken for the nearest identified receivers, identified as Flat 4, 42 Eagle Street and 64 Red Lion Street. It should be noted that if there are closer receivers that Clement Acoustics is not aware of, a reassessment will be necessary, and this should therefore be confirmed by the Client.

It has been demonstrated that compliance with the established criterion is feasible, dependant on the following material considerations:

- The plant is understood to have two modes of operation. Daytime operation (07:00 to 23:00), which will comprise all units; and night time operation (23:00 to 07:00), which will comprise one air conditioning condenser.
- The noise emissions data for the proposed units as obtained from available manufacturer information
- Plant and receiver locations are as established in this report and marked on the attached site plan
- Mitigation is applied as recommended in this report, in the form of an acoustic enclosure and acoustic attenuators

If there is any deviation from the above, Clement Acoustics must be informed, in order to establish whether a reassessment is necessary.

Clement Acoustics has used all reasonable skill and professional judgement when preparing this report. The report relies on the information as provided to us at the time of writing and the assumptions as made in our assessment.

This report is designed to be suitable to discharge typical plant noise planning conditions, as per our original scope of work. The report should not be relied upon for further reasons, such as the detailed design of mitigation measures.

Contents

List of Attachments

Document Revision	Date of Revision	Reasons for Revision	Revision By
0	15/07/2022	First Issue	Andy Thomas MIOA
RevA	25/07/2022	Updated report with revised plant	Kenny Macleod MIOA
RevB	16/08/2022	Reselection of plant	Andy Thomas MIOA

1.0 INTRODUCTION

Clement Acoustics has been commissioned by OR Media to measure existing background noise levels at 39-40 Eagle Street, London. Measured noise levels have been used to determine noise emissions 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.

An acoustic terminology glossary is provided in Appendix A.

2.0 SITE DESCRIPTION

The site is located on the north side of Eagle Street, a short distance north of High Holborn and Holborn Underground Station. The property has a 10 m wide street frontage facing Eagle Street and a vehicular access to the rear via Red Lion Street, which is shared with the Sierra Leone High Commission at 41 Eagle Street who use it for car parking. The area is primarily urban, with mixed commercial and residential units in the immediate area.

Proposals are to install two air conditioning condensers on the first floor flat roof, and twelve air source heat pumps located on the main roof to serve heating and cooling for the building. The building will be ventilated by mechanical ventilation and heat recovery units [MVHR]. The atmospheric ducts for the MVHR will be vented to the rear façade of the building. The plant is understood to have two modes of operation. Daytime operation (07:00 to 23:00), which will comprise all units; and night time operation (23:00 to 07:00), which will comprise one air conditioning condenser.

Flat 4, 42 Eagle Street and 64 Red Lion Street have been identified as the nearest affected receiver. Other residential receivers were noted to be a similar distance to the plant area; however, these residents will benefit from screening from the building envelope and will therefore experience a greater level of attenuation of noise from the proposed plant scheme. The 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 receiver should be confirmed by the client before the plant is installed or any noise mitigation measures are implemented.

Locations are shown in attached site plans 17679-SP1 & SP2.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Unattended Noise Survey Procedure

Measurements were undertaken at one position as shown on indicative site drawing 17679-SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest affected receiver.

The surroundings and position used for the monitoring location are described in Table 3.1.

Position No.	Description
1	The microphone was mounted on a sixth floor window at the rear of the building. The microphone was positioned 1 m in front of the window. [1]

Table 3.1: Description of unattended monitoring locations

Note [1]: The position was not considered to be free-field according to guidance found in BS 4142: 2014, and a correction for reflections has therefore been applied. Based on the presence of the reflective surface and the nature of surrounding noise sources, a correction for reflections of 3 dB has been applied, in line with the recommendations of the standard.

Continuous automated monitoring was undertaken for the duration of the survey between 17:00 on 04 July 2022 and 17:00 on 06 July 2022.

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 Weather Conditions

Weather conditions were observed and noted during the set-up and collection of the monitoring equipment.

Wind speeds and temperatures were measured using a digital anemometer and thermometer, while other weather elements were determined through subjective observations.

The noted weather conditions are summarised in Table 3.2.

Position No.	Wind Speed	Wind Direction	Temperature	Cloud Cover	Comments
Meter Set-Up [04/07/2022]					
1	1.3 m/s	W	22 °C	50 %	No precipitation noted
Meter Collection [06/07/2022]					
1	1.0 m/s	W	23 °C	50 %	No precipitation noted

Table 3.2: Noted weather conditions during surveys

It is understood that the weather conditions during the unattended survey remained dry with light winds.

It is considered that the weather conditions were suitable for the measurement of environmental noise.

3.3 Equipment

The equipment calibration was verified, by means of a field verification check, 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
- Rion Type NC-74 Class 1 Calibrator

4.0 RESULTS

4.1 Unattended Noise Survey 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 17679-SP1.

Measured noise levels are shown as a time history in Figure 17679-TH1, with average ambient and typical background noise levels summarised in Table 4.1.

It should be noted that the guidance of the latest revision of British Standard 4142: 2014 +A1 2019 *'Methods for rating and assessing industrial and commercial sound'*, as detailed in Section 8.1 of the standard is as follows:

'The objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.'

Therefore, the typical background noise level will be used for the purpose of this assessment. As per BS 4142 the daytime reference period will be 1 hour, and the night time reference period will be 15 minutes.

Time Period	Average ambient noise level $L_{eq:\,T}$	Typical background noise level $L_{90:T}$
Daytime (07:00 - 23:00)	55 dB(A)	45 dB(A)
Night-time (23:00 - 07:00)	44 dB(A)	41 dB(A)

Table 4.1: Average ambient and typical background noise levels

5.0 NOISE CRITERIA

5.1 Relevant Local Policy

The assessment and recommendations in this report have been undertaken in accordance with Policy D14 of the London Plan 2021, which contains the following relevant sections:

"*D14. In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

> *5) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses*".

5.2 Local Authority Criteria

The London Borough of Camden's general criteria for noise emissions from fixed plant is as follows:

> *"It is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."*

It is understood that all the proposed plant units will be operational during day time hours, whereas only 1 air conditioning condense will be operating during night time hours.

No tonal components are expected to be present at the receiver locations due to the plant.

Based on the results of the environmental noise survey and requirements of the London Borough of Camden, Table 5.1 presents the proposed plant noise emission criteria to be achieved at 1 m from the nearest noise sensitive receiver.

Period	Plant Noise Emission Limit $L_{eq;T}$
Daytime (07:00 - 23:00)	35 dB(A)
Night-time (23:00 - 07:00)	31 dB(A)

Table 5.1: Plant noise emission limits

6.0 PLANT NOISE IMPACT ASSESSMENT

6.1 Proposed Installation

Noise emissions for the proposed plant units, as provided by the manufacturer, are shown in the attached plant noise schedule 17679-PS1. Loudest modes of operation have been used in order to present a robust worst-case assessment.

British Standard 4142: 2014 +A1 2019 *'Methods for rating and assessing industrial and commercial sound'* provides guideline penalties that can be applied to noise emissions to account for tonality, impulsivity and intermittency. Where a sound source is neither tonal nor impulsive, but is still distinctive against the residual acoustic environment, a penalty may still be applied.

The available penalties for different characteristics are summarised in Table 6.1.

Characteristic	Comments	Maximum Penalty
Tonality	Can be converted to 2 dB for a tone which is just perceptible, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible	+6 dB
Impulsivity	Can be converted to 3 dB for impulsivity which is just perceptible, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible	+9 dB
Intermittency	When the sound has identifiable on/off conditions	+3 dB
Distinctiveness	Intended for sources that are neither tonal nor impulsive, but distinctive against background noise sources	+3 dB

Table 6.1: Available penalties according to BS 4142: 2014

The proposed plant units will be generally broadband and continuous in nature and therefore no penalty has been applied.

two condensers are located on the first-floor flat roof to the rear of the building, while twelve air source heat pumps are located on the main roof. The atmospheric ducts of the MVHR are ventilated to the east side of the rear façade. Plant locations are shown on site plan 17679-SP2.

Distances from the plant to the receiver are presented in Table 6.2.

Item of Plant	Receiver 1 Distance (m)	Receiver 2 Distance (m)
Daikin RXYQ14T	17	10
Daikin RXYSCQ4TV1	13	16
Daikin RXYSCQ5TV1	13	16
LGH150RVXT-E	17	7
LGH200RVXT-E	17	7
LGH250RVXT-E	17	7

Table 6.2: Distance from Plant to Receivers

6.2 Proposed Mitigation Measures

It is recommended that an enclosure is installed around the two RXYSQ12TY1 plant units. The enclosure should provide sufficient attenuation to achieve a maximum cumulative sound pressure level of 54 dB(A) when measured at 1 m in all directions with both units running.

Based on the information provided, an enclosure meeting the sound reduction indices as stated in Table 6.3 should be suitable to achieve this.

Mitigation	*Required Attenuation (dB) in each Frequency Band*							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Louvred Enclosure	4	4	6	8	12	16	14	13

Table 6.3: Required attenuation from mitigation

Note: The required sound reduction could either be achieved using a single enclosure to house all units, or by using individual enclosures.

Attenuators should also be fitted on all MVHR atmospheric ductwork to suitably reduce the atmospheric noise levels. The required attenuators are presented in attenuator schedule 17679-AS1 attached.

6.3 Noise Impact Assessment

The closest receiver has been identified as the window on the rear façade of 42 Eagle Street and64 Red Lion Street, neighbouring residential properties. Distances from the items of plant to the receivers are stated in Table 6.2.

Taking into account all necessary acoustic corrections, the resulting noise level at the identified residential windows would be as shown in Table 6.4. Detailed calculations are shown in Appendix B.

Receiver	Assessment Period	Criteria	Noise Level at Receiver (due to proposed plant)
Flat 4, 42 Eagle Street	Day Time	35 dB(A)	35 dB(A)
	Night Time	31 dB(A)	26 dB(A)
64 Red Lion Street	Day Time	35 dB(A)	35 dB(A)
	Night Time	31 dB(A)	31 dB(A)

Table 6.4: Noise levels and project criterion at noise sensitive receivers

As presented in Table 6.4 and Appendix B, the proposed plant installation with the acoustic enclosure and attenuators, 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 30 dB(A) as being acceptable internal sleeping conditions during night-time and 35 dB(A) as being acceptable internal resting conditions during the day time.

With loudest external levels of 35 dB(A) during the day and 30 dB(A) during the night, 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 6.5.

Receiver	Assessment Period	Recommended Target as per *BS 8233: 2014*	Noise Level at Receiver (due to plant installation)
Inside Residential Window of 42 Eagle Street	Day Time	35 dB(A)	19 dB(A)
	Night Time	30 dB(A)	11 dB(A)
Inside Residential Window of 64 Red Lion Street	Day Time	35 dB(A)	20 dB(A)
	Night Time	30 dB(A)	16 dB(A)

Table 6.5: Noise levels and BS 8233: 2014 criteria inside nearest residential spaces

7.0 CONCLUSION

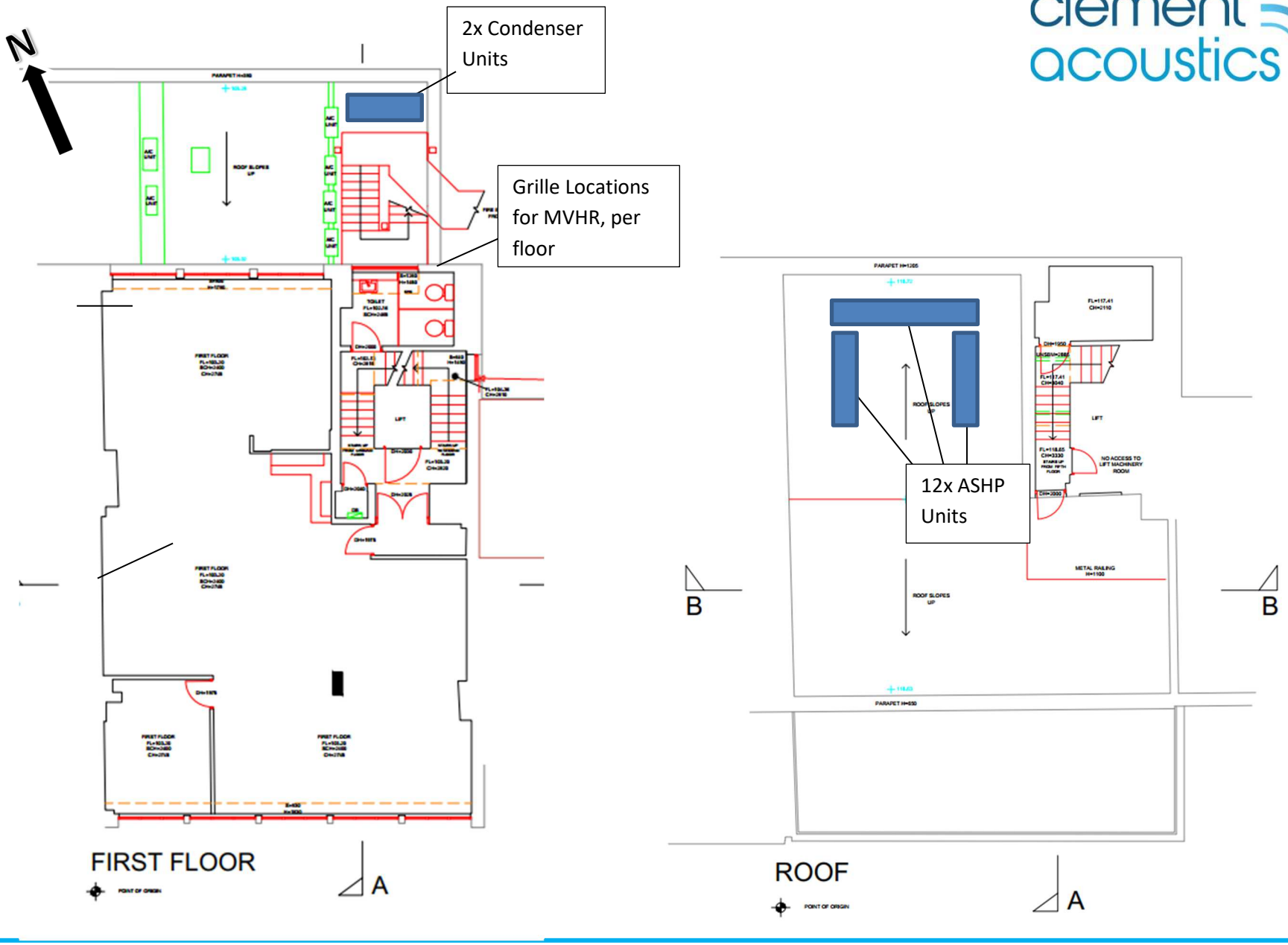
An environmental noise survey has been undertaken at 39-40 Eagle Street. The results of the survey have enabled criteria to be set for noise emissions from the proposed plant in accordance with the requirements of the London Borough of Camden.

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 units should meet the requirements of the London Borough of Camden with the recommended mitigation installed as stated herein.

Author	**Andrew Thomas** Principal Consultant BSc (Hons) MIOA		16 August 2022
Reviewed & approved	**John Smethurst** Director BSc (Hons) MIOA		16 August 2022

17679-SP1 Indicative site plan indicating noise monitoring position and nearest noise sensitive receiver **Date:** 16 August 2022

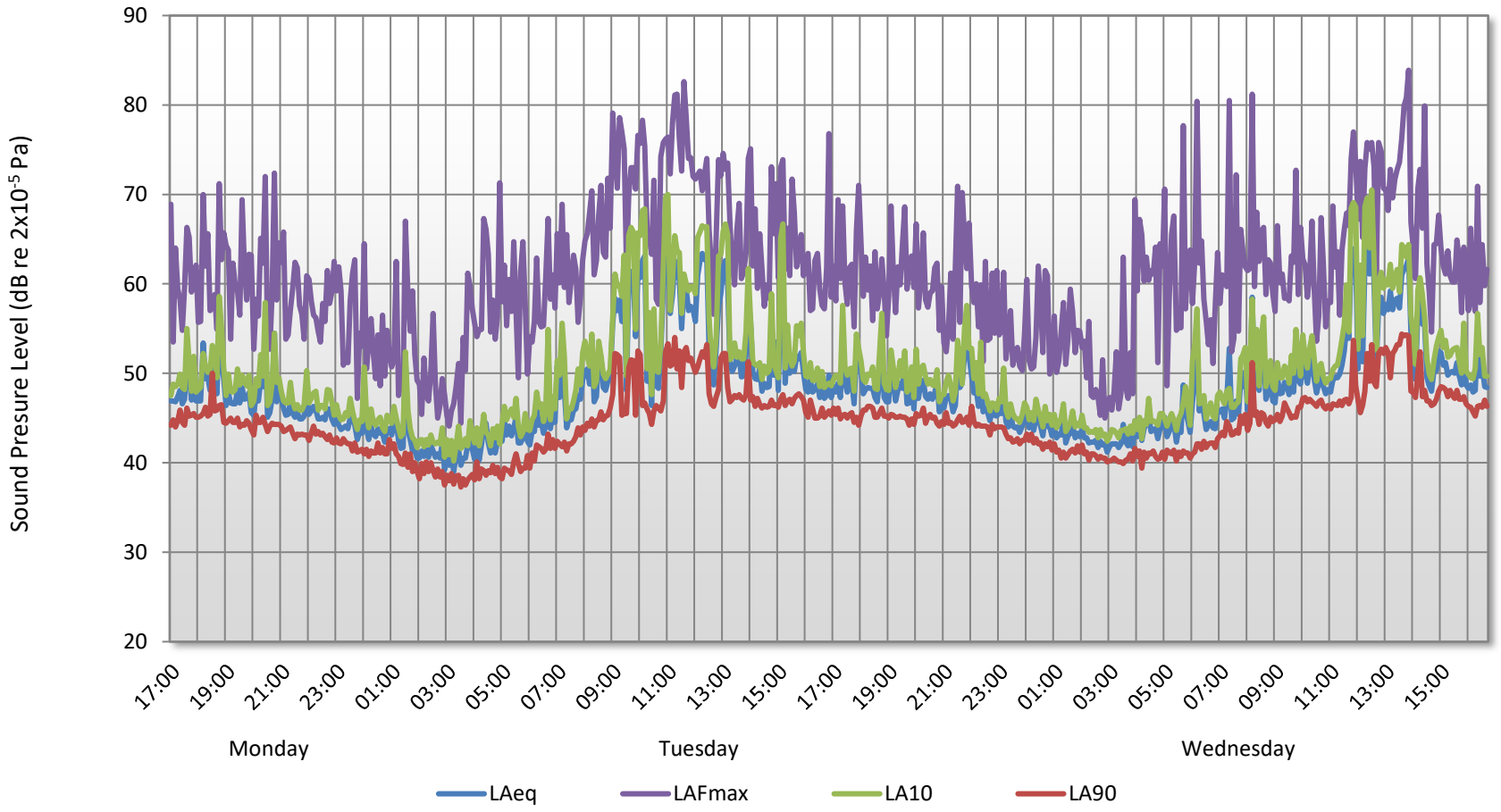


17679-SP2 RevA Indicative site plan indicating plant locations **Date:** 16 August 2022

39-40 Eagle Street

Position 1

Environmental Noise Time History
04 July 2022 to 06 July 2022



Project Name:	**39-40 Eagle Street**
Project Number:	**17679**
Date:	**16/08/2022**
Ref:	**17679-PS1**

Fan Noise Schedule

Revision: B	Date: 16/08/22				Comment: None											
Plant Description	No.	Location	Make / Model	Comments	Plant Ref.	Duty		L_w/L_p	Octave Band Centre Frequency (Hz)								A
						m^3/s	Pa		63	125	250	500	1k	2k	4k	8k	
Induct Level	3	Ground, First and Fourth Floor	LGH250RVXT-E	Note 2	MVHR1	Note 1		Lw	78	78	76	70	67	71	63	48	75.6
Induct Level	3	Basement, Second and Third Floor	LGH200RVXT-E	Note 2	MVHR2	Note 1		Lw	75	75	73	67	64	68	60	45	72.6
Induct Level	3	Fifth, Sixth and Seventh Floor	LGH150RVXT-E	Note 2	MVHR3	Note 1		Lw	76	74	72	67	65	65	63	46	71.8

Note 1: Loudest Operation

Note 2: Manufacturer does not provide the induct sound power for these particular units. The sound power has been estimated by taking the manufacturer provided SPL 1.5 m from the casing and then using a transfer function to induct sound power level. The transfer function was derived by taking a similar unit from the same range of Mitsubishi products that does have manufacturer provided SPL and Lw, and then calculating the difference between the in duct sound power and the SPL at 1.5 m from the casing. This difference was used as the transfer function.

Condenser Noise Schedule

Revision: B	Date: 16/08/22				Comment: None												
Plant Description	No.	Location	Make / Model	Comments	Plant Ref.	Duty		L_w/L_p	Octave Band Centre Frequency (Hz)								A
						Kw Cooling	Kw Heating		63	125	250	500	1k	2k	4k	8k	
VRV Heat Pump	8	Main Roof	Daikin RXYSCQ4TV1	-	-	12.0	12.0	Lp@1 m	49	53	49	51	46	40	33	25	51
VRV Heat Pump	4	Main Roof	Daikin RXYSCQ5TV1	-	-	14.0	14.0	Lp@1 m	51	53	51	53	46	41	34	26	53
Air-to-air Heat Pump	2	First Floor Roof	Daikin RXYSQ12TY1	-	-	33.5	33.5	Lp@1 m	67	60	56	54	52	49	43	36	57

Project Name:	**39-40 Eagle Street**
Project Number:	**17679**
Date:	**22/07/2022**
Ref:	**17679-AS1**

Attenuator Schedule

Revision: N/a	Date: 16/08/22		Comments:											
Attenuator Ref.	Description	Fan Side	Qty.	Dimensions (mm)			Maximum Pressure Drop Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
				W	H	L		63	125	250	500	1k	2k	4k	8k
Att.AS.01	Fit to all ducts that terminate to atmopshere	Atmopsheric Side	1	Note 1		2100	60	7	15	28	45	50	45	35	22

Notes

1. To not exceed maximum pressure drop
2. Attenuators should be fitted as close to the fans as possible
3. In instances where two attenuators are required to achieve the insertion losses, they should be spaced by 5 duct diameters
4. Length dimension is indicative and may vary

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 10 dB 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 3 dB 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 B1 - DAYTIME ASSESSMENT

17679

39-40 Eagle Street

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Flat 4, 42 Eagle Street
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1m									
Daikin RXYSCQ4TV1 ASHP (roof)	49	53	49	51	46	40	33	25	51
Quantity correction (8)	9	9	9	9	9	9	9	9	
Correction for reflections	3	3	3	3	3	3	3	3	
Screening correction due to building envelope	-5	-7	-9	-12	-14	-17	-21	-22	
Distance correction to receiver, dB (13 m) [1]	-22	-22	-22	-22	-22	-22	-22	-22	
Sound pressure level at receiver	**34**	**36**	**30**	**29**	**22**	**13**	**2**	**-7**	**29**
Manufacturer provided sound pressure level at 1m									
Daikin RXYSCQ5TV1 ASHP (roof)	51	53	51	53	46	41	34	26	53
Quantity correction (4)	6	6	6	6	6	6	6	6	
Correction for reflections	3	3	3	3	3	3	3	3	
Screening correction due to building envelope	-5	-7	-9	-12	-14	-17	-21	-22	
Distance correction to receiver, dB (13 m) [1]	-22	-22	-22	-22	-22	-22	-22	-22	
Sound pressure level at receiver	**33**	**33**	**29**	**28**	**19**	**11**	**0**	**-9**	**28**
Manufacturer provided sound pressure level at 1m									
Daikin RXYSQ12TY1 Air conditioning condenser (first floor roof)	67	60	56	54	52	49	43	36	57
Quantity correction (2)	3	3	3	3	3	3	3	3	
Enclosure	-4	-4	-6	-8	-12	-16	-14	-13	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (17 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver	**44**	**37**	**31**	**27**	**21**	**14**	**10**	**4**	**29**
Esimtated induct sound power level									
LGH250RVXT-E MVHR	78	78	76	70	67	71	63	48	76
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Distance correction to receiver, dB (17 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver	**40**	**37**	**24**	**3**	**-5**	**5**	**7**	**5**	**23**
Esimtated induct sound power level									
LGH200RVXT-E MVHR	75	75	73	67	64	68	60	45	73
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Distance correction to receiver, dB (17 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver	**37**	**34**	**21**	**0**	**-8**	**2**	**4**	**2**	**20**
Esimtated induct sound power level									
LGH150RVXT-E MVHR	76	74	72	67	65	65	63	46	72
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Distance correction to receiver, dB (17 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver	**38**	**33**	**20**	**0**	**-7**	**-1**	**7**	**3**	**19**
Combined Sound pressure level at receiver	**47**	**43**	**36**	**33**	**26**	**18**	**14**	**10**	**34**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**35**

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	47	43	36	33	26	18	14	10	34
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**32**	**28**	**21**	**18**	**11**	**3**	**-1**	**-5**	**19**

Design Criterion	**35**

APPENDIX B1 - NIGHT-TIME ASSESSMENT

17679

39-40 Eagle Street

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Flat 4, 42 Eagle Street
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1m									
Daikin RXYSQ12TY1 Air conditioning condenser (24 hour use)	67	60	56	54	52	49	43	36	57
Quantity correction (1)	0	0	0	0	0	0	0	0	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Enclosure	-4	-4	-6	-8	-12	-16	-14	-13	
Distance correction to receiver, dB (17 m) [1]	-25	-25	-25	-25	-25	-25	-25	-25	
Sound pressure level at receiver	**41**	**34**	**28**	**24**	**18**	**11**	**7**	**1**	**26**
Combined Sound pressure level at receiver	**41**	**34**	**28**	**24**	**18**	**11**	**7**	**1**	**26**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**31**

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	41	34	28	24	18	11	7	1	26
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**26**	**19**	**13**	**9**	**3**	**-4**	**-8**	**-14**	**11**

Design Criterion	**30**

APPENDIX B2 - DAYTIME ASSESSMENT

17679

39-40 Eagle Street

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: 64 Red Lion Street
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1m									
Daikin RXYSCQ4TV1 ASHP (roof)	49	53	49	51	46	40	33	25	51
Quantity correction (8)	9	9	9	9	9	9	9	9	
Correction for reflections	3	3	3	3	3	3	3	3	
Screening correction due to building envelope	-9	-12	-14	-17	-20	-22	-22	-22	
Distance correction to receiver, dB (16 m) [1]	-24	-24	-24	-24	-24	-24	-24	-24	
Sound pressure level at receiver	**28**	**29**	**23**	**22**	**14**	**6**	**-1**	**-9**	**22**
Manufacturer provided sound pressure level at 1m									
Daikin RXYSCQ5TV1 ASHP (roof)	51	53	51	53	46	41	34	26	53
Quantity correction (4)	6	6	6	6	6	6	6	6	
Correction for reflections	3	3	3	3	3	3	3	3	
Screening correction due to building envelope	-9	-12	-14	-17	-20	-22	-22	-22	
Distance correction to receiver, dB (16 m) [1]	-24	-24	-24	-24	-24	-24	-24	-24	
Sound pressure level at receiver	**27**	**26**	**22**	**21**	**11**	**4**	**-3**	**-11**	**20**
Manufacturer provided sound pressure level at 1m									
Daikin RXYSQ12TY1 Air conditioning condenser (first floor roof)	67	60	56	54	52	49	43	36	57
Quantity correction (2)	3	3	3	3	3	3	3	3	
Enclosure	-4	-4	-6	-8	-12	-16	-14	-13	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (10 m) [1]	-20	-20	-20	-20	-20	-20	-20	-20	
Sound pressure level at receiver	**49**	**42**	**36**	**32**	**26**	**19**	**15**	**9**	**34**
Esimtated induct sound power level									
LGH250RVXT-E MVHR	78	78	76	70	67	71	63	48	76
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Screening from the building envelope	-4	-6	-8	-10	-13	-16	-19	-22	
Distance correction to receiver, dB (7 m) [1]	-17	-17	-17	-17	-17	-17	-17	-17	
Sound pressure level at receiver	**43**	**39**	**24**	**1**	**-9**	**-3**	**-4**	**-9**	**25**
Esimtated induct sound power level									
LGH200RVXT-E MVHR	75	75	73	67	64	68	60	45	73
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Screening from the building envelope	-4	-6	-8	-10	-13	-16	-19	-22	
Distance correction to receiver, dB (7 m) [1]	-17	-17	-17	-17	-17	-17	-17	-17	
Sound pressure level at receiver	**40**	**36**	**21**	**-2**	**-12**	**-6**	**-7**	**-12**	**22**
Esimtated induct sound power level									
LGH150RVXT-E MVHR	76	74	72	67	65	65	63	46	72
Quantity correction (3 units each with inlet and outlet)	8	8	8	8	8	8	8	8	
Attenuator, dB	-7	-15	-28	-45	-50	-45	-35	-22	
Grille End Reflections (assumes max. 0.25 m²)	-7	-3	-1	0	0	0	0	0	
Lw to Spl + Reflections	-8	-8	-8	-8	-8	-8	-8	-8	
Directivity (45 degrees Horizontal)	1	2	2	3	3	4	4	4	
Screening from the building envelope	-4	-6	-8	-10	-13	-16	-19	-22	
Distance correction to receiver, dB (7 m) [1]	-17	-17	-17	-17	-17	-17	-17	-17	
Sound pressure level at receiver	**41**	**35**	**20**	**-2**	**-11**	**-9**	**-4**	**-11**	**21**
Combined Sound pressure level at receiver	**51**	**45**	**37**	**33**	**26**	**19**	**15**	**9**	**35**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**35**

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	51	45	37	33	26	19	15	9	35
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**36**	**30**	**22**	**18**	**11**	**4**	**0**	**-6**	**20**

Design Criterion	**35**

APPENDIX B2 - NIGHT-TIME ASSESSMENT

17679

39-40 Eagle Street

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: 64 Red Lion Street
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturer provided sound pressure level at 1m									
Daikin RXYSQ12TY1 Air conditioning condenser (24 hour use)	67	60	56	54	52	49	43	36	57
Quantity correction (1)	0	0	0	0	0	0	0	0	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Enclosure	-4	-4	-6	-8	-12	-16	-14	-13	
Distance correction to receiver, dB (10 m) [1]	-20	-20	-20	-20	-20	-20	-20	-20	
Sound pressure level at receiver	**46**	**39**	**33**	**29**	**23**	**16**	**12**	**6**	**31**
Combined Sound pressure level at receiver	**46**	**39**	**33**	**29**	**23**	**16**	**12**	**6**	**31**

[1] Distance loss caluculated assuming Point Source attenuation (*typically used where distance is more than 3x the largest source dimension*)

Design Criterion	**31**

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	46	39	33	29	23	16	12	6	31
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**31**	**24**	**18**	**14**	**8**	**1**	**-3**	**-9**	**16**

Design Criterion	**30**