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CHURCHGATE HOUSE, OXFORD STREET, MANCHESTER

NOISE IMPACT ASSESSMENT

Report **15350-NIA-02 RevB**

Prepared on 29 April 2020

Issued For:
Helical (Churchgate) Limited
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1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Helical (Churchgate) Limited to measure existing ambient and background noise levels at Churchgate House, Oxford Street, Manchester.

Measured noise levels will be used to determine noise emission criteria for a proposed plant installation in agreement with the planning requirements of the Local Authority, and to establish whether suitable internal noise levels can be achieved, to accommodate the proposed office use at basement level.

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

2.0 SITE DESCRIPTION

Proposals are to redevelop the basement level within Churchgate House for use as an office space. Existing car parking spaces in a covered basement level area will be removed, and the space renovated and upgraded to form office accommodation and ancillary spaces.

Renovation works will see the relocation of some existing plant, as well as new plant installations to service the proposed office space.

The relocated existing plant comprises large number of condenser units which are currently situated in the basement level of the car park at the front of the building, currently ventilated naturally through louvres in the building façade. This will be relocated to a central car park, also at basement level, which is a sealed space, with mechanical ventilation. This will see the existing condenser units moved further away from identified residential receivers, to a sealed space, which will significantly reduce this source of noise.

Proposed new external plant comprises three heat recovery units ducted to the external building façade via existing louver locations, and two condenser units which will be located in a plant room, behind an existing atmospheric louver.

Residential receivers have been located across the Rochdale Canal, at first floor and above.

Locations are shown on indicative site plan 15350-NIA-02-SP1.

3.0 ENVIRONMENTAL NOISE SURVEYS

3.1 Unattended Survey

In order to assess existing background noise levels in the area, an environmental noise survey was undertaken at the position marked on indicative site plan 15350-NIA-02-SP1. The microphone was mounted on a tripod, on an area of land beside the Rochdale Canal.

Continuous automated monitoring was undertaken for the duration of the survey between 11:00 on Friday 18 October 2019 and 11:00 on Wednesday 23 October 2019.

Weather during the survey was dry with light winds, therefore suitable for measurement of environmental noise.

Noise levels at the noise monitoring position were predominately influenced by surrounding commercial uses, as well as road traffic and pedestrian noise from Oxford Street.

The measurement procedure generally complied with BS7445:1991. *Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use.*

3.2 Attended Surveys

In order to assess ambient noise levels on the noisier facades of the proposed development, attended measurements were undertaken in the locations shown on indicative site plan 15350-NIA-02-SP1.

The microphone was mounted on a tripod at street level, approximately 1 m in front of the building façade.

Continuous automated monitoring was undertaken for the duration of the survey between 12:00 and 13:30 on 11 March 2020. The period chosen for the measurements was considered to be representative of typical worst-case daytime noise levels, when the proposed office will be in use.

Noise levels at the noise monitoring position were predominately influenced by surrounding commercial uses, as well as road traffic and pedestrian noise from Oxford Street, and occasional traffic movements on Great Bridgewater Street.

The measurement procedure generally complied with BS7445:1991. *Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use.*

3.3 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
- 1 No. Svantek Type 957 Class 1 Sound Level Meter
- Norsonic Type 1251 Class 1 Calibrator

4.0 RESULTS

4.1 Unattended Noise Survey

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured and are shown as a time history in Figure 15350-TH1.

In order to protect the amenity of nearby noise sensitive receivers, minimum existing background noise levels were calculated for daytime and night-time periods.

Minimum measured background levels for these periods are shown in Table 4.1.

Minimum background noise level $L_{A90: 5min}$ dB(A)	
Daytime [07:00 - 23:00]	56
Night-time [23:00 - 07:00]	56

Table 4.1: Minimum background noise levels

In order to ensure existing external noise levels are sufficiently reduced to provide a suitable internal office working environment, the ambient noise levels during typical working periods have been calculated as shown in Table 4.2.

	Average Ambient noise level
	LA90: 5min dB(A)
Typical Daytime Working Hours [08:00 - 18:00, Monday 21 October 2019]	61

Table 4.1: Average Ambient noise levels

4.2 Attended Noise Surveys

The LAeq: 5min, LAmax: 5min, LA10: 5min and LA90: 5min acoustic parameters were measured at the two positions shown in the attached site plan.

In order to ensure existing external noise levels are sufficiently reduced to provide a suitable internal office working environment on the noisier facades, the ambient noise levels during the monitoring periods have been calculated as shown in Table 4.3.

	Average Ambient noise level
	LA90: 5min dB(A)
Typical Daytime Period – Position 1 [12:00 - 13:30, Wednesday 11 March 2020]	71
Typical Daytime Period – Position 2 [12:00 - 13:30, Wednesday 11 March 2020]	68

Table 4.3: Average Ambient noise levels

5.0 NOISE CRITERIA

5.1 Plant Noise Criteria for Residential Receivers

The noise emissions criteria, typically set by the local authority are as follows:

“The noise level from any plant or activities shall be 10dB or more below the lowest measured external background noise LA_{90T} at the closest residential window. The equipment shall be installed and constructed in accordance with any approved scheme and be permanently maintained thereafter.”

In order to provide a robust assessment, we propose to set the noise criteria at 46 dB(A), the value 10dB below the minimum measured background noise at any time.

5.2 Plant Noise Criteria for Office Receivers

British Standard 8233:2014 “Sound insulation and noise reduction for buildings” describes recommended acceptable internal noise levels for commercial spaces during daytime hours. Relevant levels are summarised in Table 5.1.

Objective	Location	Design range $L_{Aeq,T}$ dB
Typical noise level for acoustic privacy in shared spaces	Open plan office	45-50 dB(A)
Typical noise level for work requiring concentration	Meeting Room	35-45 dB(A)

Table 5.1: BS8233 recommended internal background noise levels

In order to ensure a robust assessment, the more onerous design range of 35-45 dB(A) for a meeting room will be used for the closest office windows.

According to BS 8233: 2014, a typical building facade with a partially open window offers 15 dB attenuation.

Therefore, assuming the closest offices to the plant could have an open window, the recommended limit for plant noise is 50-60 dB(A) outside the office window.

5.3 Internal Noise Criteria for Offices

British Standard 8233:2014 “*Sound insulation and noise reduction for buildings*” describes recommended acceptable internal noise levels for commercial spaces during daytime hours. Relevant levels are summarised in Table 5.2.

Objective	Location	Design range $L_{Aeq,T}$ dB
Typical noise level for acoustic privacy in shared spaces	Open plan office	45-50 dB(A)
Typical noise level for work requiring concentration	Meeting Room	35-45 dB(A)

Table 5.2: BS8233 recommended internal ambient noise levels

Glazing will be recommended in order to ensure the design ranges shown in Table 5.2 can be achieved on each façade. In order to present a robust assessment, it will be assumed that each façade could house a meeting room.

6.0 NOISE IMPACT ASSESSMENT – PROPOSED PLANT

6.1 Proposed Installation

Proposed plant units to service the new basement office space are as shown below, grouped by the location of external elements:

- Internal Units with Atmospheric Ducting:
 - 3 No. Mitsubishi Heat Recovery Units type LGH-150RVX-E
- Units Located in Plant Room Behind Ventilation Louvres:
 - 1 No. Mitsubishi Condenser type PUHY-P300YSW-A
 - 1 No. Mitsubishi Condenser type PUHY-P500YSNW-A

Noise emissions for the proposed plant units, as provided by the manufacturer, are shown in Table 6.1. Loudest modes of operation have been used in order to present a robust worst-case assessment.

Manufacturer noise emission data for the heat recovery units is only available as whole unit noise breakout levels. In the absence of any available induct data, it will be assumed that the stated whole unit breakout levels could be apparent at all atmospheric duct terminations.

Unit	Sound Pressure Levels (at stated distance, dB) in each Frequency Band								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Stated Breakout Sound Pressure Levels at 1.5 m									
Mitsubishi Heat Recovery Units type LGH-150RVX-E	57	50	42	37	33	29	22	12	41
Stated Sound Pressure Levels at 1 m									
Mitsubishi Condenser type PUHY-P300YSW-A	75	69	66	63	58	54	50	47	65
Mitsubishi Condenser type PUHY-P500YSNW-A	73	66	65	63	57	53	53	47	64

Table 6.1: Manufacturer noise emissions levels

For the Heat Recovery Units, the stated breakout sound pressure level is assumed to be apparent at each supply inlet and extract outlet duct on the façade overlooking Rochdale Canal.

For the Condenser Units, the cumulative reverberant level in the plant room has been calculated, assuming hard internal surfaces, and the breakout through the louvre overlooking Rochdale Canal assessed.

6.2 Noise Impact Assessment – Residential Windows

The closest identified residential window, identified as Receiver 1 on attached site plan 15350-NIA-02-SP2, is the first-floor window in a block of flats located across Rochdale Canal. The closest window is immediately opposite the ducted terminations of the Heat Recovery Units, at a distance of 13 m. The plant room louvre is further down the canal, at a minimum distance of 22 m from the receiver.

Taking into account all necessary acoustic corrections, the resulting noise level at the identified residential windows would be as shown in Table 6.2. Detailed calculations are shown in Appendix B1.

Receiver	Night-Time Hours Criterion	Noise Level at Receiver (due to proposed plant)
Receiver 1 [Nearest Residential Property]	46 dB(A)	42 dB(A)

Table 6.2: Noise levels and criterion at noise sensitive receivers

As presented in Table 6.2 and Appendix B1, the proposed plant installation would be expected to meet the requirements of the proposed criteria.

6.3 Noise Impact Assessment – Office Windows

Further calculations have been undertaken to assess whether the noise emissions from the proposed plant unit would be expected to meet the recommended criteria for office windows.

The closest identified office window, identified as Receiver 2 on attached site plan 15350-NIA-02-SP2, is a window to the proposed office area itself. The closest window is in the same façade as the ducted terminations of the Heat Recovery Units and plant room louvre, at a distance of approximately 3 m from the closest point of each plant group.

Taking into account all necessary acoustic corrections, the resulting noise level at the identified office window would be as shown in Table 6.3. Detailed calculations are shown in Appendix B2.

Receiver	Recommended Criterion	Noise Level at Receiver (due to proposed plant)
Receiver 2 [Nearest Office Window]	50-60 dB(A)	57 dB(A)

Table 6.3: Noise levels and criterion at noise sensitive receivers

As presented in Table 6.3 and Appendix B2, the proposed plant installation would be expected to meet the requirements of the proposed criteria, even when assuming an open office window.

7.0 NOISE EXPOSURE ASSESSMENT FOR OFFICE WINDOWS

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed elements in order to achieve recommended internal noise levels shown in Table 5.2 for office spaces.

Calculations have sought to achieve an internal ambient noise level of 35-45 dB(A) in offices, thereby achieving compliance with the design range for more sensitive spaces.

The minimum sound reduction index (SRI) value required for all glazed elements to be installed is shown in Table 7.1. The performance is specified for the whole window unit, including the frame and other design features such as the inclusion of trickle vents as required.

The recommended location for each glazing type is shown in attached site plan 15350-NIA-02-SP2.

Glazing Type	Required Sound Insulation for Glazed Elements
Type A [Oxford Street Facade]	Required Sound Reduction: R _w 36 dB Typical Glazing Configuration ¹ : 6.8 mm glass / 12 mm air / 6 mm glass
Type B [Great Bridgewater Street Facade]	Required Sound Reduction: R _w 34 dB Typical Glazing Configuration ¹ : 4 mm glass / 12 mm air / 8 mm glass
Type C [Rochdale Canal Facade]	Required Sound Reduction: R _w 31 dB Typical Glazing Configuration ¹ : 4 mm glass / 12 mm air / 4 mm glass

Table 7.1: Required glazing performance

¹ The typical configurations shown are for indicative purposes only. Certificated performances should be sought from the manufacturer(s). Where existing frames or glazing must be retained for conservation reasons, we would recommend a minimum secondary glazing specification as follows:

- Existing Glazing retained, with frames restored to be airtight
- Minimum 50 mm cavity
- Minimum 6 mm secondary glass pane

All major building elements should be tested in accordance with BS EN ISO 140-3:1995. Sole glass performance data would not necessarily demonstrate compliance with this specification.

8.0 CONCLUSION

A noise survey has been undertaken at Churchgate House, Oxford Street, Manchester. 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 Local Authority.

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 Local Authority at residential receivers, and the recommendations of the relevant standard at proposed office windows.

Further calculations have demonstrated the required performance of glazing in order to achieve suitable internal noise levels in proposed offices.

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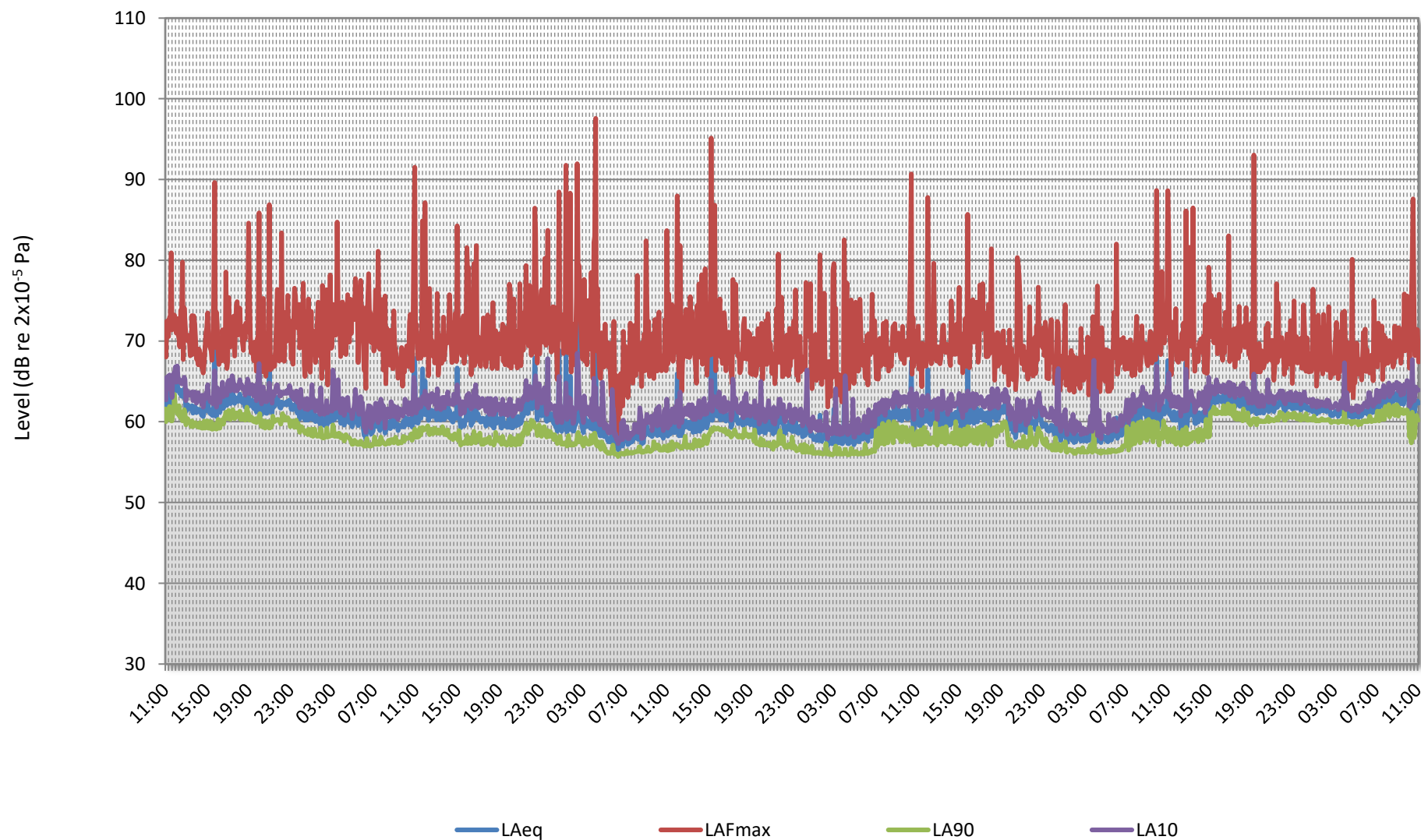


Churchgate House, Oxford Street, Manchester - Rochdale Canal

Facade

Environmental Noise Time History

18 October 2019 to 23 October 2019



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

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Churchgate House, Manchester

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Appendix B1: Residential Window

Receiver: Receiver 1 - Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Manufacturer provided sound pressure levels at 1.5m									
Mitsubishi LGH150RVX-E Lossnay Unit	57	50	42	37	33	29	22	12	41
Correction for total number of atmospheric ducts (6), dB	8	8	8	8	8	8	8	8	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Distance correction to receiver, dB (total distance 13 m)	-19	-19	-19	-19	-19	-19	-19	-19	
Sound pressure level at receiver due to Heat Recovery Units	49	42	34	29	25	21	14	4	33
Manufacturer provided sound pressure levels at 1m									
Mitsubishi Condenser type PUHY-P300YSW-A	75	69	66	63	58	54	50	47	65
Mitsubishi Condenser type PUHY-P500YSNW-A	73	66	65	63	57	53	53	47	64
Calculated Reverberant Sound Pressure Level in Plant Room	85	79	75	72	67	62	60	55	74
Correction for area of louvres (8m ²), dB	9	9	9	9	9	9	9	9	
Calculated Sound Power Level of Plant Room Louvre	94	88	84	81	76	71	69	64	83
Radiating correction	-5	-5	-5	-5	-5	-5	-5	-5	
Indoor to outdoor correction	-6	-6	-6	-6	-6	-6	-6	-6	
Correction for directivity	-1	-1	-3	-3	-3	-3	-3	-3	
Distance correction to receiver, dB (total distance 22 m)	-27	-27	-27	-27	-27	-27	-27	-27	
Sound pressure level at receiver due to Condenser Units	55	49	43	40	35	30	28	23	42
Cumulative sound pressure level at receiver due to all units	56	50	44	40	35	31	28	23	42

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Appendix B2: Office Window

Receiver: Receiver 2 - Nearest Office Receiver

Source: Proposed plant installation

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Manufacturer provided sound pressure levels at 1.5m									
Mitsubishi LGH150RVX-E Lossnay Unit	57	50	42	37	33	29	22	12	41
Correction for total number of atmospheric ducts (6), dB	8	8	8	8	8	8	8	8	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Directivity correction to receiver in same façade	0	0	0	0	-4	-7	-7	-7	
Distance correction to receiver, dB (total distance 3 m)	-6	-6	-6	-6	-6	-6	-6	-6	
Sound pressure level at receiver due to Heat Recovery Units	62	55	47	42	34	27	20	10	45
Manufacturer provided sound pressure levels at 1m									
Mitsubishi Condenser type PUHY-P300YSW-A	75	69	66	63	58	54	50	47	65
Mitsubishi Condenser type PUHY-P500YSNW-A	73	66	65	63	57	53	53	47	64
Calculated Reverberant Sound Pressure Level in Plant Room	85	79	75	72	67	62	60	55	74
Correction for area of louvres (8m2), dB	9	9	9	9	9	9	9	9	
Calculated Sound Power Level of Plant Room Louvre	94	88	84	81	76	71	69	64	83
Radiating correction	-5	-5	-5	-5	-5	-5	-5	-5	
Indoor to outdoor correction	-6	-6	-6	-6	-6	-6	-6	-6	
Correction for directivity	-1	-1	-4	-7	-7	-7	-7	-7	
Distance correction to receiver, dB (total distance 3 m)	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level at receiver due to Condenser Units	72	66	59	53	48	43	41	36	57
Cumulative sound pressure level at receiver due to all units	72	66	59	53	48	43	41	36	57

Design Criterion	50-60
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