

12-16 Piccadilly Manchester



Noise Impact Assessment Report (RIBA Stage 2)
Report 25720.NIA.01

Northside (Manchester) Ltd
and Lamington Group

Report 25720.NIA.01			
Revision History			
First Issue Date: 31/05/2023			
A	09/06/2022 Small amendments and corrections	D	
B	22/06/2022 Small amendments and combination of NIA and PCR reports	E	
C		F	
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List of Attachments

25720.TH1	Environmental Noise Time History
25720.Daytime L90.TH1	Statistical analysis for representative daytime L_{A90}
25720.Night-time L90.TH1	Statistical analysis for representative night-time L_{A90}
Appendix A	Glossary of Acoustics Terminology
Appendix B	Acoustic Calculations
Appendix C	Anti-Vibration Mounting Specification Reference Document

1.0 INTRODUCTION

This report has been prepared at RIBA Stage 2 by KP Acoustics on behalf of Northside (Manchester) Ltd and Lamington Group) to support a full planning application and Listed Building Consent for an aparthotel development (hereafter referred to as the Proposed Development) at 12-16 Piccadilly, Manchester, M1 3AN (hereafter referred to as The Site).

KP Acoustics Ltd has been commissioned to assess the suitability of the site in accordance with the provisions of the National Planning Policy Framework and the Noise Policy Statement for England (NPSE).

This report presents the results of the environmental survey undertaken in order to measure prevailing background noise levels and outlines any necessary mitigation measures. This report also presents calculations in accordance with BS4142 to provide an indication as to the likelihood of the noise emissions from the proposed plant unit installation having an adverse impact on the closest noise sensitive receiver. Mitigation measures will be outlined as appropriate.

2.0 SITE SURVEYS

2.1 Site Description

The site is bounded by Chatham Street to the north, Roby Street to the west, Gore Street to the south, and Piccadilly to the east. It adjoins an existing building to the southwest. The site encompasses the vacant Grade II Listed former Union Bank building and adjacent vacant land; the Waldorf Public House and Indemnity House (7 Chatham Street) immediately adjoin the site but do not form part of the proposal. At the time of the survey, the background noise climate was dominated by road traffic noise from surrounding roads.

2.2 Environmental Noise Survey Procedure

A noise survey was undertaken on the proposed site as shown in Figure 2.1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources.

Continuous automated monitoring was undertaken for the duration of the survey between 14:47 on 14/03/2023 and 12:57 on 15/03/2023.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Measurement Positions

The environmental noise measurement position, proposed plant installation locations, and the closest noise sensitive receiver relative to the plant installations are described within Table 2.1 and shown within Figure 2.2. Further plant location information is seen in Figures 2.3 and 2.4.

Icon	Descriptor	Location Description
	Noise Measurement Position 1 (24-hour)	The microphone was installed on a window on the 3 rd floor of the façade overlooking Piccadilly, as shown in Figure 2.2. The microphone was located within 1.5 metres of the nearest surface and therefore includes local reflections.
	Noise Measurement Position 2 (5-minute)	The microphone was installed on a tripod at approximately 1.5m height, on the pavement of Chatham Street, as shown in Figure 2.2. The microphone was positioned within free-field conditions at least 1.5 metres from the nearest surface.
	Noise Measurement Position 3 (5-minute)	The microphone was installed on a tripod at approximately 1.5m height, on the pavement of Gore Street, as shown in Figure 2.2. The microphone was positioned within free-field conditions at least 1.5 metres from the nearest surface.
	Closest Noise Sensitive Receiver 1	6 th Floor window on the northwest façade, above the external plant area.
	Closest Noise Sensitive Receiver 2	26 th Floor windows on the southwest façade, below the 27 th floor plant room.
	Closest Noise Sensitive Receiver 3	26 th Floor windows on the northwest façade, below the 27 th floor plant room.
	Proposed Plant Installation Location 1	Level 5 External Plant Area - Proposed plant installations are outlined in Section 5.1.
	Proposed Plant Installation Location 2	Level 27 Kitchen VRF Plant Room (Southwest) - Proposed plant installations are outlined in Section 5.1.
	Proposed Plant Installation Location 3	Level 27 Restaurant VRF Plant Room (Northeast) - Proposed plant installations are outlined in Section 5.1.

Table 2.1 Measurement position and description

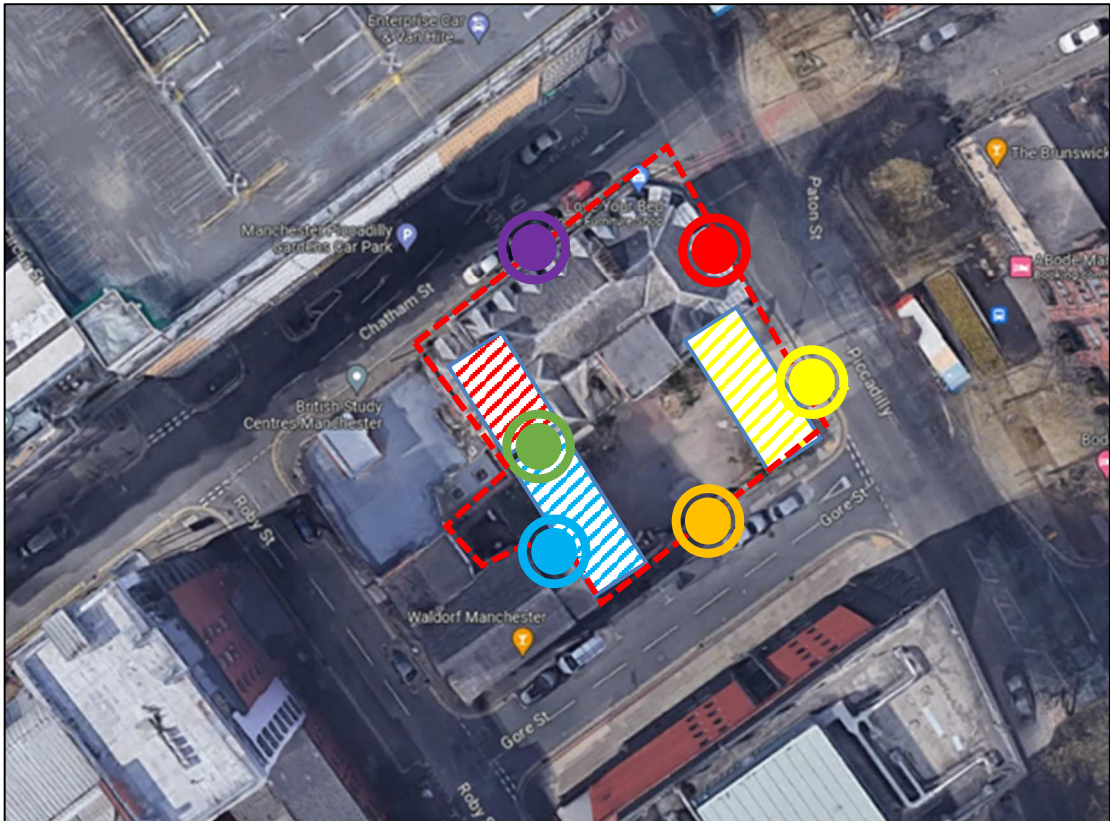


Figure 2.2 Site measurement position, identified receivers and proposed plant unit installations (Image Source: Google Maps)

The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver relative to the proposed plant installation.

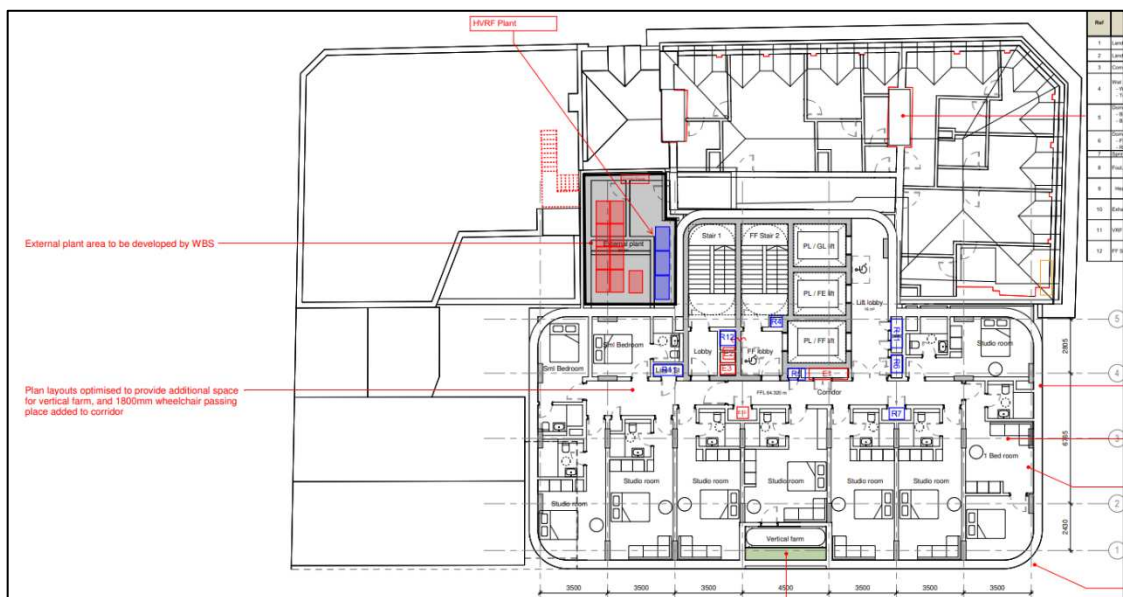


Figure 2.3 Plan of Level 5, showing HVRF units highlighted in dark blue (Image Source: Bennetts Associates) – Top of picture is northwest.

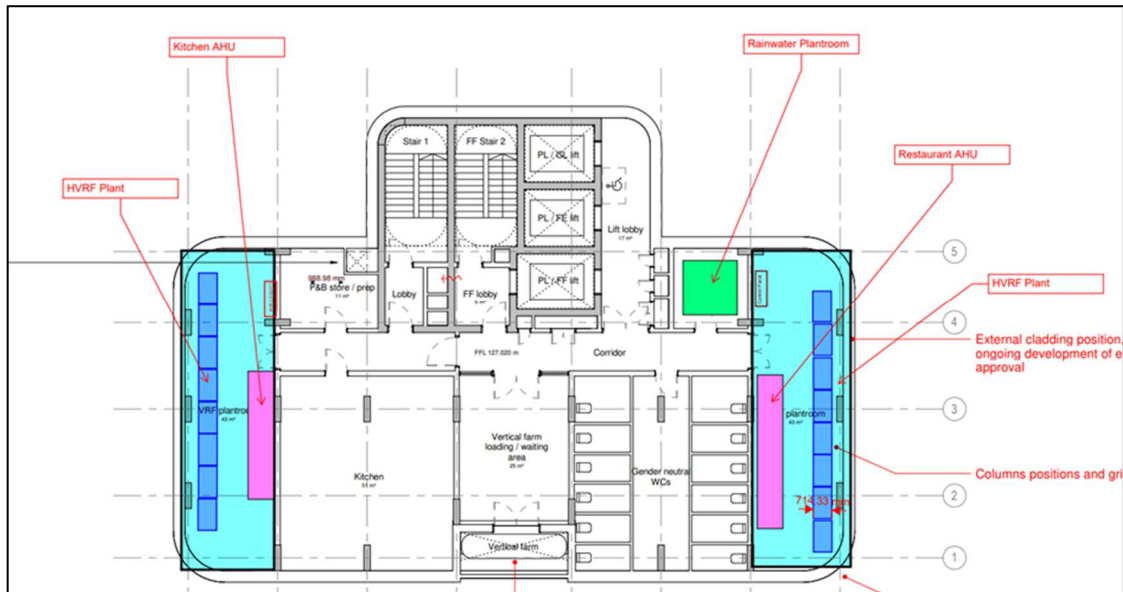


Figure 2.4 Plan of Level 27, showing HVRF units highlighted in dark blue and AHUs in pink (Image Source: Bennetts Associates) – Top of picture is northwest.

2.4 Equipment

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

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 25	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21141-E0	21/07/2022	UK-22-069
	Free-field microphone NTI Acoustics MC230A	A23583		
	Preamp NTI Acoustics MA220	10992		
	NTI Audio External Weatherproof Shroud	-	-	-
Noise Kit 26	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21130-E0	21/07/2022	UK-22-067
	Free-field microphone NTI Acoustics MC230A	A23541		
	Preamp NTI Acoustics MA220	11023		
	NTI Audio External Weatherproof Shroud	-	-	-
Larson Davis CAL200 Class 1 Calibrator		17148	21/03/2023	UCRT23/13 63

Table 2.2 Measurement instrumentation

3.0 RESULTS

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as a time history in Figure 25720.TH1.

Measured noise levels are representative of noise exposure levels expected to be experienced by all facades of the proposed development, and are shown in Table 3.1. Noise levels at positions 2 and 3 have been derived from the difference between noise levels at the unattended noise measurement position, and the manual noise measurement positions in the same periods. As there is no significant difference, it is predicted that the noise environment at the three sides measured will be similar.

Time Period	Noise Measurement Position 1 (Measured Noise level – dBA)	Noise Measurement Position 2 (Derived Noise level – dBA)	Noise Measurement Position 3 (Derived Noise level – dBA)
Daytime $L_{Aeq,16hour}$	65		
Night-time $L_{Aeq,8hour}$	60		

Table 3.1 Site average noise levels for daytime and night time

Further manual measurements have been undertaken to derive the expected noise levels for the individual facades of the proposed development. The results of these measurements are as follows:

Measurement Location	Measurement Period	Manned Noise Level Measurement (dBA)	
		$L_{Aeq,T}$	L_{A90}
1 (from 24-hour)	14:43-14:58	67	60
2	14:43-14:48	67	60
3	14:53-14:58	65	60

Table 3.2 Manned noise measurements

Representative background noise levels are shown in Table 3.3 for daytime and night-time.

It should be noted that the representative background noise level has been derived from the most commonly occurring $L_{A90,5 min}$ levels measured during the environmental noise survey undertaken on site, as shown in 25720.Daytime L90.TH1 and 25720.Daytime L90.TH1 attached.

Time Period	Representative background noise level L_{A90} dB(A)
Daytime (07:00-23:00)	63
Night-time (23:00-07:00)	52

Table 3.3 Representative background noise levels

Please note that measurements at the unattended noise measurement position 1 are located at a distance less than 1.5 metres from the nearest reflective surface and therefore a 3dB correction has been applied to the results in Table 3.1 to obtain a free-field measurement as per ISO1996 Part 2.

4.0 NOISE ASSESSMENT GUIDANCE

4.1 Noise Policy Statement for England 2021

The National Planning Policy Framework (NPPF) has superseded and replaces Planning Policy Guidance Note 24 (PPG24), which previously covered issues relating to noise and planning in England. Paragraph 174 of NPPF 2021 states that planning policies and decisions should aim to:

- preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

In addition, Paragraph 185 of the NPPF states that *‘Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should’:*

- Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the aim to ‘Promote good health and good quality of life through the

effective management of noise within the context of Government policy on sustainable development.’

Noise Policy Statement England (NPSE) noise policy aims are as follows:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life*

The Noise Policy Statement England (NPSE) outlines observed effect levels relating to the above, as follows:

- NOEL – No Observed Effect Level
 - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level
 - This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level
 - This is the level above which significant adverse effects on health and quality of life occur.

As stated in The Noise Policy Statement England (NPSE), it is not currently possible to have a single objective based measure that defines SOAEL that is applicable to all sources of noise in all situations. Specific noise levels are not stated within the guidance for this reason, and allow flexibility in the policy until further guidance is available.

4.2 Planning Practice Guidance – Noise (PPG-N)

Planning Practice Guidance – Noise (PPG) was introduced by the Ministry of Housing, Communities & Local Government in March 2014 and revised in July 2019. It is an online digital resource that “advises on how planning can manage potential noise impacts in new development”. It gives guidance on establishing whether noise will likely cause a concern,

factors of influence on noise impact and methods by which planning can address adverse effects of noise sources.

A noise exposure hierarchy table is provided within the guidance that follows the same observed effect descriptors given within the NPSE guidance, i.e. NOEL, NOAEL and LOAEL and SOAEL.

For a NOAEL descriptor: “A noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it. The noise may slightly affect the acoustic character of an area but not to the extent there is a change in quality of life”

4.3 ProPG: Planning and Noise

As outlined above, the National Planning Policy Framework encourages improved standards of design, although it provides no specific noise levels which should be achieved on site for varying standards of acoustic acceptability, or a prescriptive method for the assessment of noise.

ProPG: Planning and Noise was published in May 2017 in order to encourage better acoustic design for new residential schemes in order to protect future residents from the harmful effects of noise. This guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development, but without the nuance of ‘good acoustic design’ as outlined in ProPG.

ProPG allows the assessor to take a holistic approach to consider the site’s suitability, taking into consideration numerous design factors which previously may not have been considered alongside the noise level measured on site, for example the orientation of the building in relation to the main source of noise incident upon it.

It should be noted this document is not an official government code of practice, and neither replaces nor provides an authoritative interpretation of the law or government policy, and therefore should be seen as a good practice document only.

4.4 BS8233:2014

BS8233:2014 ‘*Sound insulation and noise reduction for buildings*’ describes recommended internal noise levels for residential spaces. These levels are shown in Table 4.1.

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

Table 4.1 BS8233 recommended internal background noise levels

It should be noted that the recommended internal noise levels outlined above are not applicable under “purge ventilation” conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally (e.g. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods.

The external building fabric would need to be carefully designed to achieve these recommended internal levels.

4.5 WHO Guidelines for Community Noise (1999)

WHO Guidelines for Community Noise (1999) recommends that internal noise levels for individual events should not exceed 45dB L_{Amax} more than 10-15 times per night.

It should be noted that this impact is increasingly being regarded as ‘LOAEL’ for this number of exceedances, as described in Section 4.1.

The external building fabric would need to be carefully designed to ensure that the above guidance is achieved.

4.6 Approved Document O (ed. 2021)

Approved Document O (ADO) supports Part O of Schedule 1 to the Building Regulations 2010. ADO introduces requirements for residential premises in order to prevent overheating from occurring. There are two specific requirements from ADO:

Requirement O1 (1):

To limit unwanted solar gains in summer and to provide adequate means to remove heat from the indoor environment.

Requirement O1 (2):

- (a) Account must be taken of the safety of the occupant, and their reasonable enjoyment of the residence.
- (b) Mechanical cooling may only be used where sufficient heat cannot be removed from the indoor environment without it.

The statutory guidance to support Requirement O1(2)(a) contains requirements relating to noise at night.

4.6.1 Application

The guidance within ADO applies to new residential buildings only and are defined within the following table:

Title	Purpose for which the building is intended to be used.
Residential (dwellings)	Dwellings, which includes both dwellinghouses and flats.
Residential (institutions)	Home, school or other similar establishment, where people sleep on the premises. The building may be living accommodation for the care or maintenance of any of the following. <ul style="list-style-type: none"> A. Older and disabled people, due to illness or other physical or mental condition. B. People under the age of 5 years.
Residential (other)	Residential college, hall of residence and other student accommodation, and living accommodation for children ages 5 years or older.

Table 4.2 Residential buildings within the scope of ADO (ref. Table 0.1 of Approved Document O)

Paragraphs 3.2 and 3.3 of ADO specifically refer to noise within bedrooms at night. Whilst any habitable room could be used as a bedroom, it is proposed that the scope is confined to those rooms specifically designated as bedrooms.

4.6.2 Internal Noise Level Targets

ADO sets internal noise level targets within Paragraph 3.3 of the document:

“Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. 40dB L_{Aeq,T_r} averaged over 8 hours (between 11pm and 7am)*
- b. 55dB L_{AFmax} more than 10 times a night (between 11pm and 7am).”*

Where an openable window for the removal of excess heat is predicted to result in the above internal noise levels to be exceeded, then the overheating mitigation strategy must adopt one of the alternative means listed within Paragraph 2.10 of ADO (presented within Section 4.7.3 of this report). This constraint applies regardless of which method is used to demonstrate compliance with Requirement O1 (1).

4.6.3 Methods to Remove Excess Heat

Paragraph 2.10 of ADO lists the means for removing excess heat from dwellings according to the following:

- Openable windows
- Ventilation louvres in external walls
- A mechanical ventilation system
- A mechanical cooling system

4.7 BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'

British Standard BS4142:2014 'Methods for rating and assessing industrial and commercial sound' describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes
- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

This Standard compares the Rating Level due to the noise source/s under assessment for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) with the existing background noise level in terms of an L_{A90} when the noise source is not operating.

It should be noted that the Rating Level is the Specific Sound Level in question ($L_{Aeq, Tr}$), including any relevant acoustic feature corrections, as follows:

- **Tonality** – *'For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible'*
- **Impulsivity** – *'A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for*

impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible'

- **Intermittency** – *'If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied'*
- **Other sound characteristics** – *'Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied'*

Once the Rating Level has been obtained, the representative background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact, as follows:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5 dB could be an indication of an adverse impact, depending on the context
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context

NOTE: Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

4.8 Local Authority Guidance

The guidance provided by Manchester City Council for noise emissions of new plant in this instance is as follows:

The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that: 'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

5.0 EXTERNAL BUILDING FABRIC SPECIFICATION

Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed and non-glazed elements in order to achieve the recommended internal noise levels shown in Table 4.1, taking into account average and maximum noise levels monitored during the environmental noise survey.

As a more robust assessment, L_{Amax} spectrum values of night-time peaks have also been considered and incorporated into the glazing calculation in order to cater for the interior limit of 45 dB L_{Amax} for individual events, as recommended in WHO Guidelines.

Please note that the glazed and non-glazed element calculations would need to be finalised once all design proposals are finalised.

5.1 Non-Glazed Elements

It is currently understood that the non-glazed building façade is comprised of the elements similar to shown within Table 5.1 based on the construction detail provided. The anticipated sound reduction index has been calculated, and would be expected to provide the minimum figures shown in Table 5.1 when tested in accordance with the BS EN ISO 10140 series of standards.

Element	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Tile cladding 18mm cement particle board 100mm metsec studs with 100mm mineral wool insulation (density 60kg/m3) Internal lining of 2 layers of plasterboard	27	38	45	49	50	50

Table 5.1 Assumed sound reduction performance for non-glazed elements

5.2 Glazed Elements

Minimum octave band sound reduction index (SRI) values required for all glazed elements to be installed are shown in Table 5.2. The performance is specified for the whole window unit, including the frame, seals, etc. as appropriate. Sole glass performance data would not demonstrate compliance with this specification.

Glazing performance calculations have been based both on average measured night-time noise levels as well as verified against the L_{Amax} spectrum of individual events in order to comply with a maximum internal noise level of 45dB(A) in bedrooms as recommended by

World Health Organisation Guidelines. The combined most robust results of these calculations are shown in Table 5.2.

Floor Level	Octave band centre frequency SRI, dB						$R_w(C;C_{tr})$, dB
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Ground to 5 th	26	27	34	40	38	46	37 (-1;-4)
6 th and Above	24	20	25	34	37	35	31 (-2;-4)

Table 5.2 Required glazing performance

The nominated glazing supplier should verify that their proposed window system meets the attenuation figures shown at each centre frequency band as shown in Table 5.2.

Example glazing types that would be expected achieve the above spectral values are shown in Table 5.3.

Floor Level	Example glazing type
Ground to 5 th	4/12/4
6 th and Above	10/12/6

Table 5.3 Example glazing types

All major building elements should be tested in accordance with the BS EN ISO 10140 series of standards.

Independent testing at a UKAS accredited laboratory will be required in order to confirm the performance of the chosen system for an 'actual' configuration.

6.0 VENTILATION AND OVERHEATING

6.1 Ventilation Strategy

Based on the noise levels measured on site, appropriate ventilation systems are outlined in Table 6.1 below in order to ensure the internal noise environment is not compromised. It is understood that openable windows are not proposed at this development.

Ventilation System	Whole Dwelling Ventilation	Extract Ventilation
ADF System 4	Continuous mechanical supply and extract (low rate)	Continuous mechanical supply and extract (high rate)

Table 6.1 Ventilation systems

In the case of mechanical ventilation, systems should be designed to meet the internal noise levels as defined in CIBSE Guide A (2015), as shown in Table 6.2.

Room Type	L _{Aeq} , dB	NR
Bedrooms	30	25
Living Rooms	35	30
Kitchen	45-50	40-45

Table 6.2 CIBSE Guide A 2015 guidance levels for mechanical building services

In all cases, purge ventilation would be provided by openable windows. As outlined in Section 4.5, the internal noise level requirement would not be applicable during purge conditions as this would only occur occasionally.

7.0 PLANT NOISE IMPACT ASSESSMENT

7.1 Proposed Plant Installations

It is understood that the proposed plant installation is comprised of the following units:

- 3 No. Mitsubishi PURY M450YNW-A1 Units – Plant Location 1
- 8 No. Mitsubishi PURY M450YNW-A1 Units – Plant Location 2
- 8 No. Mitsubishi PURY M450YNW-A1 Units – Plant Location 3

The proposed installation locations for the proposed plant will be as shown in Figure 2.2 above, and described below:

- Plant location 1 – An external area housing plant. Open on all sides and top.
- Plant location 2 and 3 – Internal plant rooms. Louvred on all external sides.

The plans include AHU units at 27th floor level at a shell and core stage, but no details have been received at the time of writing. Noise from fans within these are not included in the calculations in this report for this reason, and should be controlled with silencers at a later stage (subject to further assessment). Assumed casing breakout noise levels for the AHUs are included in the calculations.

The noise emission levels as provided by the manufacturer for the units are shown in Table 7.1.

Unit	Descriptor	Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Mitsubishi PURY M450YNW-A1	SPL@1m (dB)	74	64	67	65	60	55	50	46	66
Assumed AHU casing breakout (from Systemair AHU)	SWL (dB)	60	56	50	46	49	46	40	27	53

Table 7.1 Plant Units Noise Emission Levels as provided by the manufacturer

The closest noise sensitive receivers to the proposed installation locations have been identified as:

- Plant location 1 - 6th Floor window on the northwest façade, above the external plant area, located approximately 5 metres from the closest point of the proposed plant installation location, as shown in Figure 2.2.
- Plant location 2 - 26th Floor windows on the southwest façade, below the 27th floor plant room, located approximately 5 metres from the closest point of the proposed plant installation location, as shown in Figure 2.2.
- Plant location 3 - 26th Floor windows on the northwest façade, below the 27th floor plant room, located approximately 5 metres from the closest point of the proposed plant installation location, as shown in Figure 2.2.

It should be noted the some of the proposed plant would be out of line of site of the receiving windows due to screening from the building envelope.

7.2 Calculations

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest residential window from the proposed plant would be as shown in Table 7.2. Detailed calculations are shown in Appendix B. Receivers 2 and 3 have been grouped together as they are very similar, but on opposite sides of the building.

Receiver	Criterion	Noise Level at 1m From the Closest Noise Sensitive Window
Receiver 1	47dB(A)	47dB(A)
Receiver 2 & 3		44dB(A)

Table 7.2 Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B and Table 7.2, transmission of noise to the nearest sensitive windows due to the effects of the proposed plant unit installation satisfies the emissions criterion of Manchester City Council, providing that the mitigation measures outlined in Section 8 are implemented.

8.0 NOISE CONTROL MEASURES

In order to achieve the specific sound level and subsequent rating level shown in the assessment above, the following noise control strategy should be adopted.

8.1 Plant Location 1

To control the noise emissions from the proposed units at plant location 1, we would recommend that a plant enclosure is installed around the units which should provide the minimum insertion loss levels shown in Table 8.1.

Unit	Insertion Loss Levels (dB) in each Octave Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Louvres of acoustic enclosure	5	8	11	13	15	18	16	10

Table 8.1 Insertion loss figures to be provided by acoustic enclosure at Plant Location 1

8.2 Plant Locations 2 & 3

To control the noise emissions from the proposed units at plant locations 2 & 3, we would recommend that the louvres through which the VRF units discharge should provide the minimum insertion loss levels shown in Table 8.2.

Unit	Insertion Loss Levels (dB) in each Octave Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Louvres of acoustic enclosure	7	8	12	14	15	18	15	12

Table 8.2 Insertion loss figures to be provided by acoustic enclosure at Plant Locations 2 & 3

It is also recommended to provide treatment to the plant room surfaces to reduce noise levels within. Acoustic panels with an acoustic performance of at least Class B should cover a surface area at least equal to that of the soffit, and spread around the room as evenly as possible.

8.3 Suitable Suppliers

We would recommend the following suppliers of the aforementioned louvres and enclosures:

- Environmental Equipment Corporation
- IAC
- Noico Ltd
- Waterloo Acoustics
- Allaway Acoustics
- Wakefield Acoustics
- Caice
- Environ

We would recommend the following suppliers of acoustic panels

- CMS Danskin
- Environmental Equipment Corporation
- IAC
- Noico Ltd
- Allaway Acoustics
- Wakefield Acoustics

8.4 Anti-Vibration Mounting Strategy

In the case of all plant units, appropriate anti-vibration mounts should be installed in order to ensure that vibrations do not give rise to structure-borne noise. Appendix C outlines detailed advice in order to ensure that the system installer selects the appropriate anti-vibration mount for the installation.

It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail.

9.0 CONCLUSION

An environmental noise survey has been undertaken at 12-16 Piccadilly, Manchester allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development. The results of the survey have enabled criteria to be set for plant noise emissions.

Measured noise levels allowed a robust glazing specification to be proposed which would provide internal noise levels for all residential environments of the development commensurate to the design range of BS8233:2014.

No further mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

Manufacturer's noise data of proposed plant units has been used to obtain Specific and Rated Noise Level at the nearest noise sensitive receiver in accordance with British Standard BS4142:2014 for compliance with Manchester City Council requirements.

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

It has been concluded that noise emissions from the proposed plant units would not have an adverse impact on the nearest residential receivers provided that the noise control strategy provided is followed.

Room 2 Hometel, 12-16 Piccadilly, Manchester - Position 1
Environmental Time History
14/03/2023 to 15/03/2023

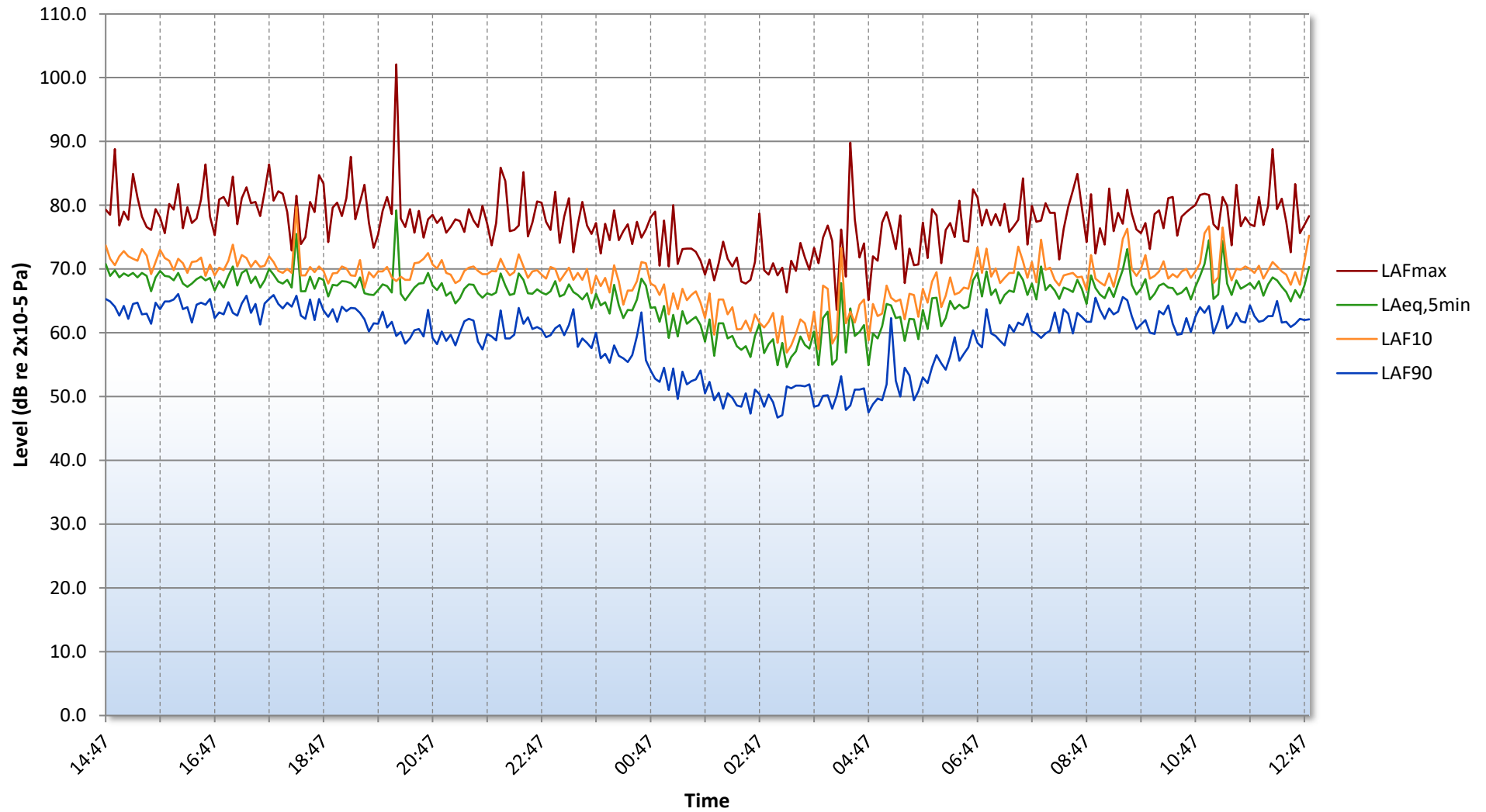


Figure 25720.TH1

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

Room 2 Hometel, 12-16 Piccadilly, Manchester

PLANT NOISE EMISSIONS CALCULATIONS

Source: All Plant Locations Receiver: Receiver 1	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Level 5 External Plant Area									
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66
Correction for number of units (3),dB	5	5	5	5	5	5	5	5	
Correction due to surface reflections (1), dB	3	3	3	3	3	3	3	3	
Minimum attenuation provided by distance (5m), dB	-14	-14	-14	-14	-14	-14	-14	-14	
Minimum attenuation required by proposed acoustic enclosure, dB	-5	-8	-11	-13	-15	-18	-16	-10	
Sound Pressure Level at Receiver due to All Units in Level 5 External Plant Area, dB	62	50	49	45	38	31	27	29	46
Level 27 Kitchen VRF Plant Room (Southwest)									
VRF Fans (ducted to atmosphere)									
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66
Correction to isolate fan noise	-4	-3	-4	-4	-2	-1	-2	-2	
Correction for number of units (8),dB	9	9	9	9	9	9	9	9	
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11	
Minimum attenuation required by louvred sides, dB	-7	-8	-12	-14	-15	-18	-15	-12	
Minimum attenuation provided by distance (63m), dB	-36	-36	-36	-35.99	-35.99	-35.99	-35.99	-36	
Sound Pressure Level at Receiver due to VRF fans in above Plant Room, dB	37	25	20	9	5	-2	-5	-7	16
VRF Compressors and assumed AHU casing breakout									
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66
Correction to isolate compressor noise	-2	-3	-2	-3	-5	-6	-5	-4	
Correction for number of units (8),dB	9	9	9	9	9	9	9	9	
Correction to SWL	11	11	11	11	11	11	11	11	
Total contribution to SWL of units in plant room from VRF Compressors, dB	91	81	84	82	75	69	64	61	
Typical sound power level from AHU casing breakout (from Systemair AHU), dB	60	56	50	46	49	46	40	27	53
Total sound power level of VRF Compressors and assumed AHU casing breakout, dB	91	81	84	82	75	69	65	61	82
Reverberation time correction (0.35s), dB	-5	-5	-5	-5	-5	-5	-5	-5	
Room volume correction (151m³), dB	-8	-8	-8	-8	-8	-8	-8	-8	
Reverberant Sound Pressure Level in Plant Room	79	68	72	70	62	57	52	49	70
Area of louvre correction (67m³), dB	14	14	14	14	14	14	14	14	
Minimum attenuation provided by acoustic louvre, dB	-7	-8	-12	-14	-15	-18	-15	-12	
Sound Power Level at Louvre	86	75	74	70	61	53	51	51	71
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11	
Minimum attenuation provided by distance (63m), dB	-36	-36	-36	-35.99	-35.99	-35.99	-35.99	-36	
Sound Pressure Level at Receiver due to VRF Compressors and assumed AHU casing breakout, in above plant room, dB	51	38	34	23	14	6	4	4	30
Sound Pressure Level at Receiver due to All Units in above Plant Room, dB	51	38	34	23	15	7	5	5	30
Sound Pressure Level at Receiver due to All Units, dB	63	50	49	45	38	31	27	29	47

Design Criterion

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APPENDIX B2

Room 2 Hometel, 12-16 Piccadilly, Manchester

PLANT NOISE EMISSIONS CALCULATIONS

Source: All Plant Locations Receiver: Receiver 2	Frequency, Hz								dB(A)	
	63	125	250	500	1k	2k	4k	8k		
Level 5 External Plant Area										
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66	
Correction for number of units (3),dB	5	5	5	5	5	5	5	5		
Correction due to surface reflections (1), dB	3	3	3	3	3	3	3	3		
Minimum attenuation provided by distance (63m), dB	-36	-36	-36	-35.99	-35.99	-35.99	-35.99	-36		
Minimum attenuation required by proposed acoustic enclosure, dB	-5	-8	-11	-13	-15	-18	-16	-10		
Sound Pressure Level at Receiver due to All Units in Level 5 External Plant Area, dB	40	28	27	23	16	9	5	7	24	
Level 27 Kitchen VRF Plant Room (Southwest)										
VRF Fans (ducted to atmosphere)										
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66	
Correction to isolate fan noise	-4	-3	-4	-4	-2	-1	-2	-2		
Correction for number of units (half quantity) (4),dB	6	6	6	6	6	6	6	6		
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11		
Minimum attenuation required by louvred sides, dB	-7	-8	-12	-14	-15	-18	-15	-12		
Minimum attenuation provided by distance (closer units) (5m), dB	-14	-14	-14	-14	-14	-14	-14	-14	35	
Minimum attenuation provided by distance (further units) (10m), dB	-20	-20	-20	-20	-20	-20	-20	-20		
Sound Pressure Level at Receiver due to VRF fans in above Plant Room (closer units), dB	56	44	39	28	24	17	14	12		
Sound Pressure Level at Receiver due to VRF fans in above Plant Room (further units), dB	50	38	33	22	18	11	8	6		29
Sound Pressure Level at Receiver due to VRF fans in above Plant Room, dB	57	45	40	29	25	18	15	13		36
VRF Compressors and assumed AHU casing breakout										
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66	
Correction to isolate compressor noise	-2	-3	-2	-3	-5	-6	-5	-4		
Correction for number of units (half quantity) (4),dB	6	6	6	6	6	6	6	6		
Correction to SWL	11	11	11	11	11	11	11	11		
Total contribution to SWL of units in plant room from VRF Compressors, dB	88	78	81	79	72	66	61	58		79
Typical sound power level from AHU casing breakout (from Systemair AHU), dB	60	56	50	46	49	46	40	27	53	
Total sound power level of VRF Compressors and assumed AHU casing breakout, dB	88	78	81	79	72	66	62	58	79	
Reverberation time correction (0.35s), dB	-5	-5	-5	-5	-5	-5	-5	-5	67	
Room volume correction (151m³), dB	-8	-8	-8	-8	-8	-8	-8	-8		
Reverberant Sound Pressure Level in Plant Room	76	65	69	67	59	54	49	46		
Area of louvre correction (67m³), dB	14	14	14	14	14	14	14	14		
Minimum attenuation provided by acoustic louvre, dB	-7	-8	-12	-14	-15	-18	-15	-12		
Sound Power Level at Louvre	83	72	71	67	58	50	48	48	68	
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11		
Minimum attenuation provided by distance (closer units) (4m), dB*	-20	-20	-20	-20	-20	-20	-20	-20		
Minimum attenuation provided by distance (further units) (10m), dB*	-28	-28	-28	-28	-28	-28	-28	-28		
Sound Pressure Level at Receiver due to VRF Compressors and assumed AHU casing breakout, in above plant room (closer units) (4m), dB	64	51	47	36	27	19	17	17		43
Sound Pressure Level at Receiver due to VRF Compressors and assumed AHU casing breakout, in above plant room (further units) (10m), dB	56	43	39	28	19	11	9	9	35	

Sound Pressure Level at Receiver due to VRF Compressors and assumed AHU casing breakout, in above plant room, dB	65	51	48	37	28	20	18	18	43
Sound Pressure Level at Receiver due to All Units in above Plant Room, dB	65	52	48	37	30	22	20	19	44
Level 27 Restaurant VRF Plant Room (Northeast)									
VRF Fans (ducted to atmosphere)									
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66
Correction to isolate fan noise	-4	-3	-4	-4	-2	-1	-2	-2	
Correction for number of units (8),dB	9	9	9	9	9	9	9	9	
Minimum attenuation provided by distance (63m), dB	-36	-36	-36	-35.99	-35.99	-35.99	-35.99	-36	
Minimum attenuation due to building envelope, dB	-24	-25	-25	-25	-25	-25	-25	-25	
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11	
Minimum attenuation required by louvred sides, dB	-7	-8	-12	-14	-15	-18	-15	-12	
Sound Pressure Level at Receiver due to VRF fans in above Plant Room, dB	13	0	-5	-16	-20	-27	-30	-32	-9
VRF Compressors and assumed AHU casing breakout									
Mitsubishi PURY M450YNW-A1 (Sound Pressure Level @1m)	74	64	67	65	60	55	50	46	66
Correction to isolate compressor noise	-2	-3	-2	-3	-5	-6	-5	-4	
Correction for number of units (8),dB	9	9	9	9	9	9	9	9	
Correction to SWL	11	11	11	11	11	11	11	11	
Total contribution to SWL of units in plant room from VRF Compressors, dB	91	81	84	82	75	69	64	61	82
Typical sound power level from AHU casing breakout (from Systemair AHU), dB	60	56	50	46	49	46	40	27	53
Total sound power level of VRF Compressors and assumed AHU casing breakout, dB	91	81	84	82	75	69	65	61	82
Reverberation time correction (0.35s), dB	-5	-5	-5	-5	-5	-5	-5	-5	
Room volume correction (151m ³), dB	-8	-8	-8	-8	-8	-8	-8	-8	
Reverberant Sound Pressure Level in Plant Room	79	68	72	70	62	57	52	49	70
Area of louvre correction (67m ³), dB	14	14	14	14	14	14	14	14	
Minimum attenuation provided by acoustic louvre, dB	-7	-8	-12	-14	-15	-18	-15	-12	
Sound Power Level at Louvre	86	75	74	70	61	53	51	51	71
Directivity correction, dB	1	-1	-4	-11	-11	-11	-11	-11	
Minimum attenuation provided by distance (63m), dB*	-44	-44	-44	-44	-44	-44	-44	-44	
Sound Pressure Level at Receiver due to VRF Compressors and assumed AHU casing breakout, in above plant room, dB	43	30	26	15	6	-2	-4	-4	22
Sound Pressure Level at Receiver due to All Units in above Plant Room, dB	43	30	26	15	7	-2	-4	-4	22
Sound Pressure Level at Receiver due to All Units, dB	65	52	48	37	30	22	20	19	44

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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.