AŁN
acoustic design

8 GATE STREET

PLANT NOISE ASSESSMENT

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CONTENTS

1 INTRODUCTION

ALN Acoustic Design has been appointed to carry out a noise assessment in relation to a proposed plant equipment installation at 8 Gate Street, London WC2A 3HP in the London Borough of Camden.

This report presents the results of a background noise survey at the site and assesses the noise generated by the proposed equipment with regard to the Camden Council plant noise criteria and BS4142:2014 guidance.

This report has been prepared by Arthur Lewis-Nunes MSc who is a full member of the Institute of Acoustics.

A glossary of technical terminology used in this report is provided in Appendix A.

2 THE SITE

8 Gate Street is in an existing 5-storey office building. The surrounding buildings are predominantly offices, although the upper floors of the adjacent building (10 Gate Street) have recently undergone a change of use to residential. These are the nearest noise-sensitive receptors.

An aerial image of the site and surrounding area is provided in Figure 1.

It is proposed to install new ventilation equipment at roof level and to replace a number of existing air-conditioning condenser units (see Section 5.1 for details).

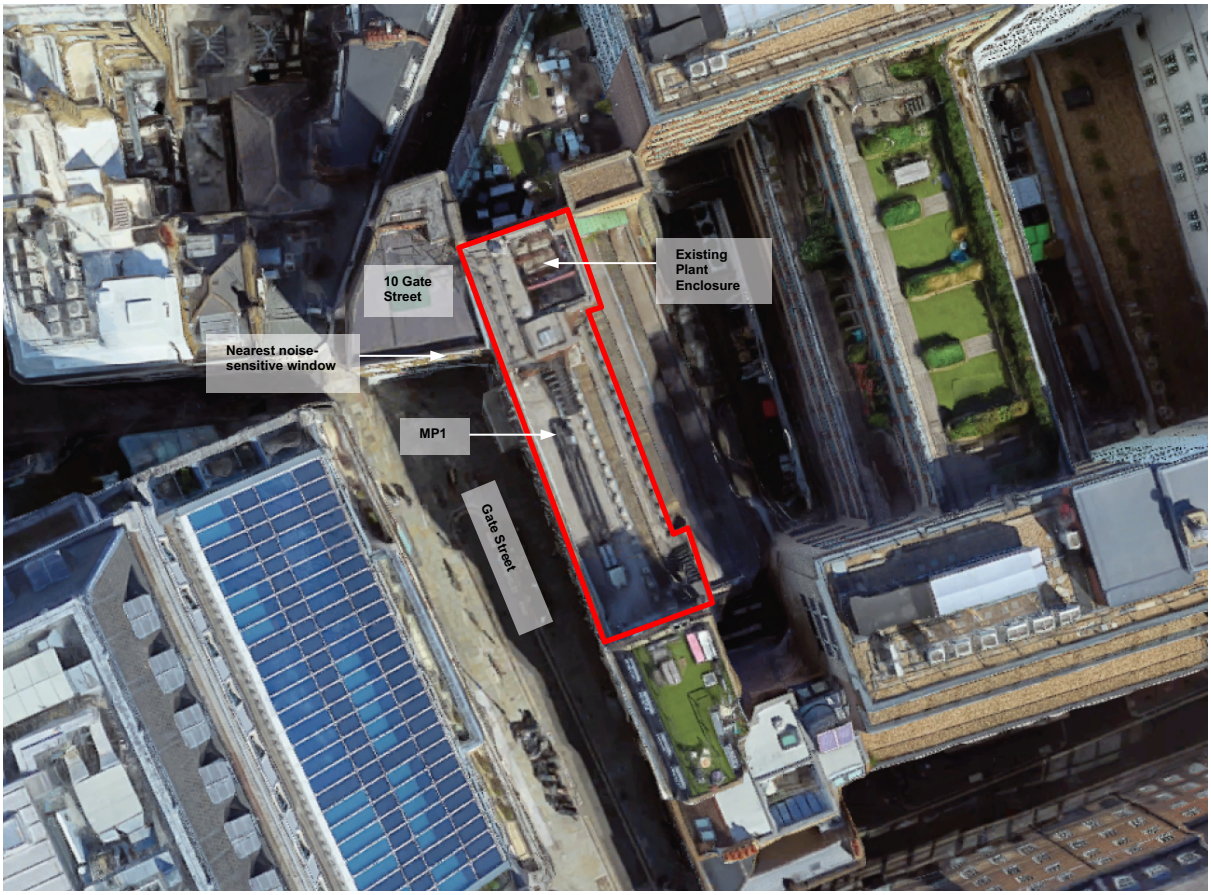


Figure 1: Aerial image of site and surrounding area

3 ASSESSMENT CRITERIA

3.1 Camden Local Plan

The site is located within the London Borough of Camden. The Camden Council Local Plan (2017) sets out the criteria for noise and vibration used to determine applications for planning permission.

Policy A4: Noise and Vibration is reproduced below:

> The Council will seek to ensure that noise and vibration is controlled and managed.
>
> Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:
>
> a. development likely to generate unacceptable noise and vibration impacts; or
> b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.
>
> We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

Appendix 3 of the Local Plan sets out the thresholds that will be considered by the council when assessing applications. The relevant section which is applicable to the assessment of plant and machinery noise at dwellings is reproduced below:

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dB L_{Amax}

The thresholds evaluate impact in terms of various 'effect levels' as described in the National Planning Policy Framework and Planning Practice Guidance. There are corresponding design criteria which guide applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The thresholds and design criteria are as set out below:

- Green – where noise is considered to be at an acceptable level.
- Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.
- Red – where noise is observed to have a significant adverse effect.

Appendix 3 of the Local Plan indicates that it is expected that the BS4142:2014 assessment methodology will be used.

3.2 BS4142

BS4142:2014 'Methods for rating and assessing industrial and commercial sound' is the current British Standard which provides an established methodology for the assessment of the impact of noise from fixed mechanical and electrical plant and equipment.

The degree of adverse impact for a particular noise source is dependent upon factors including the extent by which it exceeds the background noise level, the character of the noise and its time of occurrence.

A ‘Rating Level’ for the specific source is established, which has been corrected to account for the characteristics of the sound, including having noticeable tonality, being intermittent / impulsive, or having any other distinct characteristics which would make it more noticeable.

Levels of impact are defined in terms of the Rating Level relative to the background noise level, as set out in Table 1 below.

Rating Level relative to background level	Assessment
0dB or less than background	‘An indication of the specific sound source having a low impact, depending on context’
5dB or more than background	‘Likely to be in indication of an adverse impact, depending on context’
10dB or more than background	‘Likely to be in indication of a significant adverse impact, depending on context’

Table 1: BS4142 defined levels of impact

4 NOISE SURVEY

4.1 Methodology

A survey of background noise levels was carried out from Thursday 4th to Friday 5th November 2021. A weather-protected Class 1 sound level meter and tripod-mounted microphone were installed on the roof of 8 Gate Street in the position marked ‘MP1’ in Figure 1 (further details of the instrumentation used are provided in Appendix B).

The sound level meter was set up to record noise levels at consecutive 15-minute intervals throughout the survey period.

The measured noise levels are considered to be representative of those occurring at the nearest façade of 10 Gate Street. It was observed at the start and end of the survey period that environmental noise levels were dominated by various items of plant equipment serving the adjacent buildings. Existing plant equipment which serves 8 Gate Street was not operational during the survey and the building was not in use.

Local weather station records indicate that there were light winds and no precipitation throughout the survey period. The weather conditions are not considered to have had any significant effect on the survey results.

4.2 Survey Results

The time history plot of the noise survey data from MP1 is presented below in Figure 2.

From an analysis of the noise survey data, the characteristic background noise levels are considered to be:

Daytime (07:00-23:00): **53dB $L_{AF90,15min}$**

Night-time (23:00-07:00): **50dB $L_{AF90,15min}$**

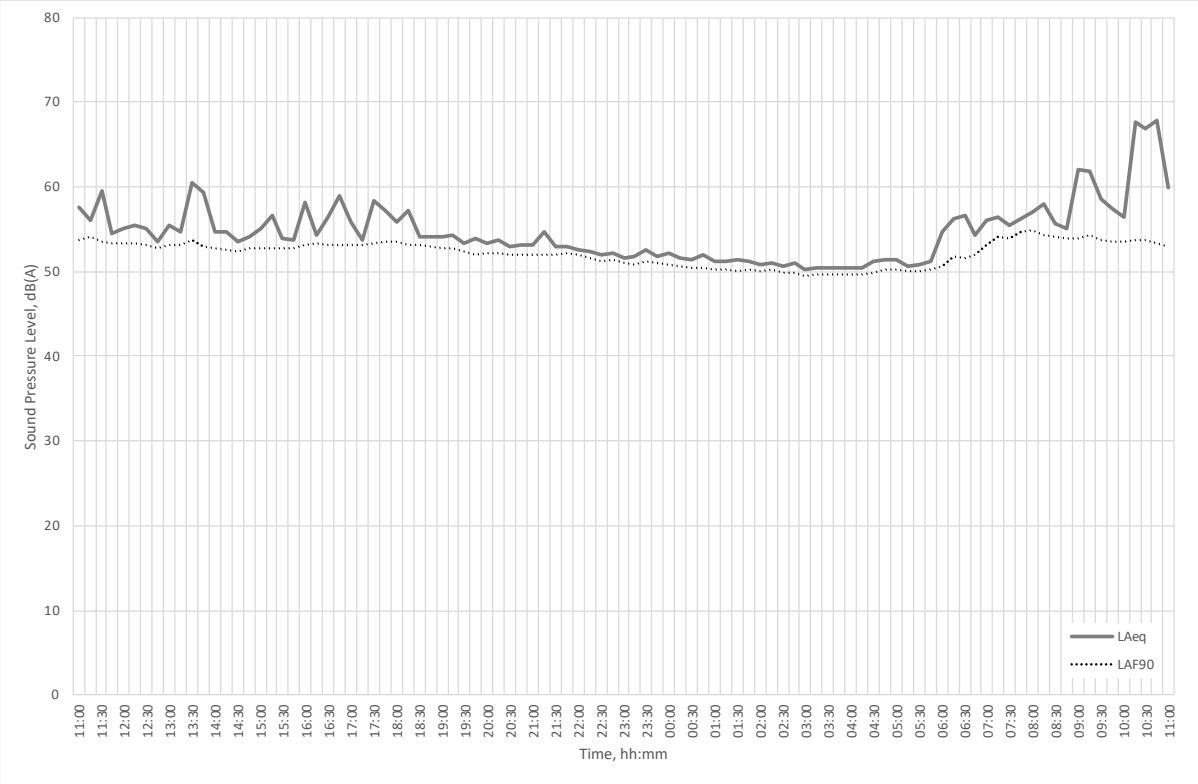


Figure 2: Noise survey data (free-field)

5 PLANT NOISE ASSESSMENT

5.1 Proposed Plant Equipment

Information provided by the M&E consultant indicates that it is proposed to install a new ventilation unit with heat recovery, plus 6no. air-conditioning condenser units which will replace a number of existing units in the same location.

The proposed equipment is listed below. The plant equipment layout is reproduced in Appendix C. Noise data provided by the manufacturers is reproduced in Appendix D.

Description	**Manufacturer & Model**
VRV condenser	Daikin REYQ8U
VRV condenser	Daikin REYQ12U
VRV condenser	Daikin REYQ14
VRV condenser (x2)	Daikin REYQ16U
Split Unit	Daikin RZAG71
Ventilation Unit	Daikin VAM1500

The VRV units are to be located in a sunken plant enclosure at the upper roof level, replacing the units currently in that location. They will be mounted on roof slabs and anti-vibration 'Tico Pads'.

The ventilation unit will mounted on a Big Foot system and located in a weather-enclosure, in a central position on the lower roof level.

5.2 Plant Noise Calculation

The nearest noise-sensitive receptors are the apartments at 10 Gate Street. There are apartments at the 1st to 6th floors, which only have south and west-facing windows (see Figure 1).

The nearest windows are at a distance of approximately 7.5m from the ventilation unit and will have a direct line of sight to it (see roof layout in Appendix C).

The VRV units are to be located within an open-topped plant room which is sunken below the surrounding roof level. There are currently a number of old condenser units in this area which will be replaced by the new units. The windows of 10 Gate Street are at t distance of 6-7m from the plant enclosure but face away from it so there is no line of sight.

The incident noise level at the nearest window at 10 Gate Street has been calculated using the manufacturer's noise data, with corrections applied to account for distance attenuation and screening effects of the plant room and window orientation (ISO 9613-2 method). The calculation has been carried out in octave-bands as set out in Table 2. A calculation has also been carried out in the SoundPLAN noise mapping software which predicts very similar levels.

The calculations assume as a worst-case scenario that all units are operating simultaneously and at full duty.

Frequency, Hz			63	125	250	500	1000	2000	4000	8000	A
3rd/4th VRV (C-3-P1)											
REYQ14											
SWL, dB			88	83	80	80	74	70	70	68	81
Distance attenuation:	9.0	m	-30	-30	-30	-30	-30	-30	-30	-30	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
SPL @ receptor			48	40	35	32	23	16	13	8	33
Basement/Ground VRV (C-0-P1)											
Daikin REYQ8U											
SWL, dB			87	81	79	78	71	68	64	60	78
Distance attenuation:	6.8	m	-28	-28	-28	-28	-28	-28	-28	-28	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
SPL @ receptor			49	41	36	32	23	17	10	3	33
Daikin REYQ16U											
SWL, dB			95	90	85	85	78	75	73	71	86
Distance attenuation:	6.8	m	-28	-28	-28	-28	-28	-28	-28	-28	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
SPL @ receptor			57	50	42	39	30	24	19	14	41
1st/Ground VRV (C-2-P1)											
Daikin REYQ12U											
SWL, dB			90	85	83	81	76	75	76	68	84
Distance attenuation:	5.6	m	-26	-26	-26	-26	-26	-26	-26	-26	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
SPL @ receptor			54	47	42	37	29	25	23	12	39
Daikin REYQ16U											
SWL, dB			95	90	85	85	78	75	73	71	86
Distance attenuation:	5.6	m	-26	-26	-26	-26	-26	-26	-26	-26	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
Reflections											
SPL @ receptor			59	52	44	41	31	25	20	15	42
Reception Split Unit (C-0-P1)											
Daikin RZAG71											
SWL, dB			73	72	66	63	57	52	47	44	64
Distance attenuation:	9.0	m	-30	-30	-30	-30	-30	-30	-30	-30	
Barrier attenuation:			-10	-12	-15	-18	-21	-24	-27	-30	
SPL @ receptor			33	29	21	15	6	-2	-10	-16	18
Ventilation Unit											
Daikin VAM1500											
SWL total, dB			61	61	56	53	51	46	40	30	
Distance attenuation:	7.5	m	-26	-26	-26	-26	-26	-26	-26	-26	
Barrier attenuation:											
SPL @ receptor			35	35	30	27	25	20	14	4	30
Total SPL at receptor, dB			62	55	48	45	36	30	27	19	**46**

Table 2: Plant noise calculation details (dB)

Units	Noise Level
Condenser Units (x6)	46 dB(A)
Ventilation Unit	30 dB(A)
Combined	46 dB(A)

Table 3: Calculated plant noise levels at nearest residential window

5.3 Assessment

The assessed plant equipment will be serving office space, therefore it is reasonable to assume that the main demand will be during normal office working hours. If the equipment is required to run outside of these times (e.g. for after-hours working), it is likely to be at a much lower duty. This assessment therefore considers the noise impact between 07:00 and 23:00 when the characteristic background noise level is 53dB L_{AF90}.

The noise level emitted by the ventilation heat recovery unit is calculated to be approximately 30dB(A), i.e. significantly lower than the background noise level at the nearest residential window.

Based on the manufacturer's data, the noise level emitted by the new condenser units is calculated to be 46dB(A), i.e. 7dB less than the background noise level. The noise data provided by the manufacturer does not indicate that there will be significant tonality. It is expected that the noise from the proposed equipment will be similar in character to the background noise which itself mainly comprises plant equipment noise. The existing condenser units which are being replaced are made by the same manufacturer, but further details are unknown.

The noise level from the condenser units exceeds the lowest observable adverse effect level by 3dB but is well below the significant observable adverse effect level (as defined in Policy A4: Noise and Vibration of Camden's Local Plan).

BS4142:2014 *Methods for rating and assessing industrial and commercial sound* provides a well-established methodology for assessing plant noise which is a widely accepted industry standard and is referred to in Camden's Local Plan. The standard advises that "*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*."

The plant noise level is predicted to be at least 7dB below the background noise level, i.e. less than the level at which BS4142 indicates there will generally be a low impact. It can therefore

be concluded from this guidance that the proposed level would have minimal impact on the residential receptors.

6 SUMMARY

An assessment has been carried out of the noise impact of a proposed plant equipment installation comprising a ventilation heat recovery unit, plus six condenser units which will replace a number of existing units.

The noise emitted by the proposed condenser units and ventilation unit has been calculated from the manufacturers' data. The total combined noise level at the nearest noise-sensitive receptor is calculated to be 46dB(A). It is not expected that the noise will have significant tonal components.

A noise survey has been carried out to establish existing background noise levels at noise sensitive receptors near to the proposed plant equipment installation. This indicates that when the proposed equipment is operating the typical background noise level would be 53dB $L_{AF90.}$

The total plant noise rating level is therefore expected to be approximately 7dB below the background noise level. Based on guidance set out in BS4142:2014, it is concluded that there would be minimal impact on the residential receptors.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMINOLOGY

SOUND PRESSURE LEVEL, SPL or L_P

A measure of the pressure caused by a sound wave at a point in space, given by:

$SPL(dB)=20.\log_{10}(\text{Sound Pressure (Pa)}/P_0)$

P_0 is the reference sound pressure of 20μPa, which corresponds to the approximate threshold of hearing at 1kHz.

SOUND POWER LEVEL, SWL or L_W

A measure of is the total sound energy radiated by a source in all directions, given by

$SWL(dB)=10.\log(\text{Sound Power(W)}/W_0)$

W_0 is the reference sound power of 1pW.

EQUIVALENT CONTINUOUS A-WEIGHTED, $L_{Aeq,T}$

The level of a notional continuous sound that contains the same sound energy as the actual fluctuating sound over the time period, T. Weighted over frequencies to approximate the sensitivity curve of human hearing (A-weighted).

BACKGROUND NOISE LEVEL, $L_{AF90,T}$

The A-weighted sound pressure level of a fluctuating sound that is exceed for 90% of the time interval, T.

A-WEIGHTED MAXIMUM NOISE LEVEL, L_{AFmax}

The maximum A-weighted sound pressure level in a given period, measured using the “fast” time constant.

SOUND REDUCTION INDEX, R

The quantity which describes the level by which a material or building element reduces noise transmission at a given frequency, derived from laboratory measurement.

WEIGHTED SOUND REDUCTION INDEX, R_W

Single Integer number found by comparing the measured Sound Reduction Index spectrum with the 'standard' curves for airborne sound insulation, according to a weighting method described in BS EN ISO 717-1.

ELEMENT NORMALIZED LEVEL DIFFERENCE, $D_{n'e'w}$

A measure of the sound reduction of a particular element, with the equivalent area of acoustic absorption in the receiver room normalized to the reference absorption area ($10m^2$).

SPECTRUM ADAPTATION TERMS, C and C_{tr} (dB)

These are the values to be added to D_w, R_w or $D_{n'e'w}$ values to take account of the characteristics of a particular sound spectra. C corresponds to pink noise spectra and C_{tr} corresponds to typical urban traffic noise spectra.

APPENDIX B - NOISE MONITORING EQUIPMENT DETAILS

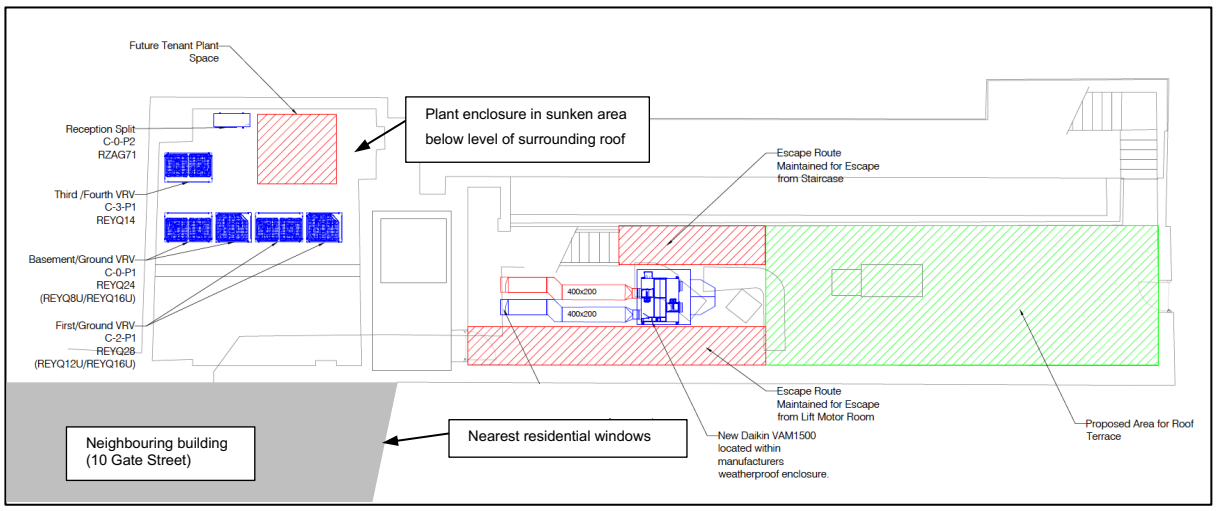
The measurements were made with an NTi XL2 acoustic analyser, using a GRAS weather protection kit. This equipment complies with BS EN IEC 61672 class 1. The meter used a NTi MC230 free-field response microphone and NTi MA220 microphone pre-amplifier.

The calibration of the sound level meter was checked at the beginning and end of measurements with a Larson David CAL200 sound calibrator, complying with BS EN IEC 60942 class 1. No significant calibration deviation occurred.

The table below lists the serial numbers and last calibration dates of the equipment used.

Description	Serial No.	Calibration Date
NTi XL2 Sound Level Meter	A2A-16249-E0	25/06/2021
NTi MC230A Condenser Microphone	A17342	25/06/2021
NTi MA220 Pre-Amplifier	8450	25/06/2021
Larson David CAL200 Sound Calibrator	16795	25/06/2021

APPENDIX C - PLANT EQUIPMENT LAYOUT

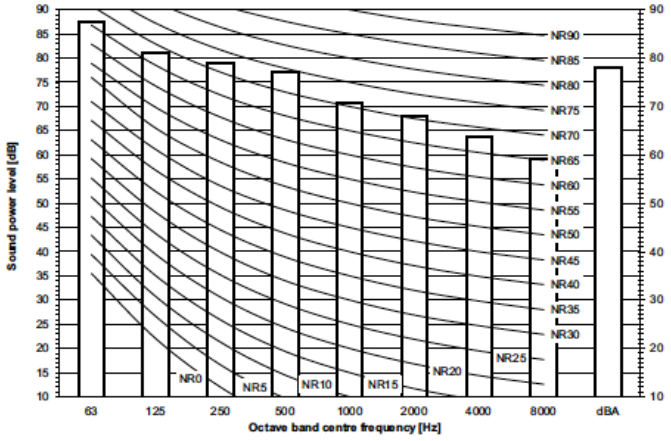


APPENDIX D - MANUFACTURER'S NOISE DATA

11 Sound data

11 - 1 Sound Power Spectrum

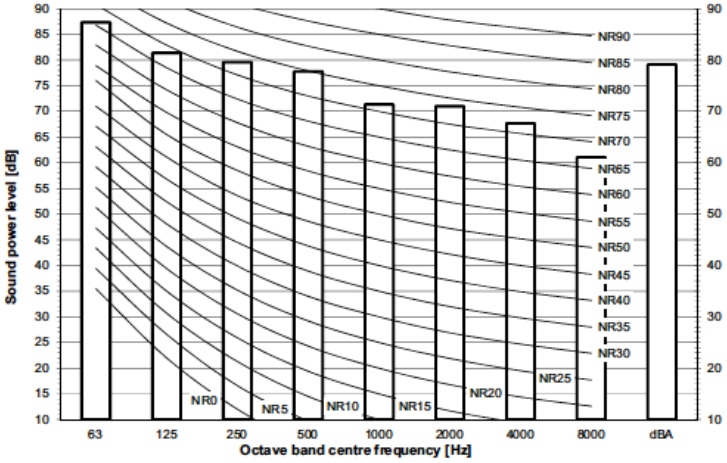
REMQ5U
REYQ8U
RXYQQ8U
RXYQ8U
RXYTQ8UYF
RYYQ8U
RYMQ8U



Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119528

REYQ10U
RXYQQ10U
RXYQ10U
RYYQ10U
RYMQ10U



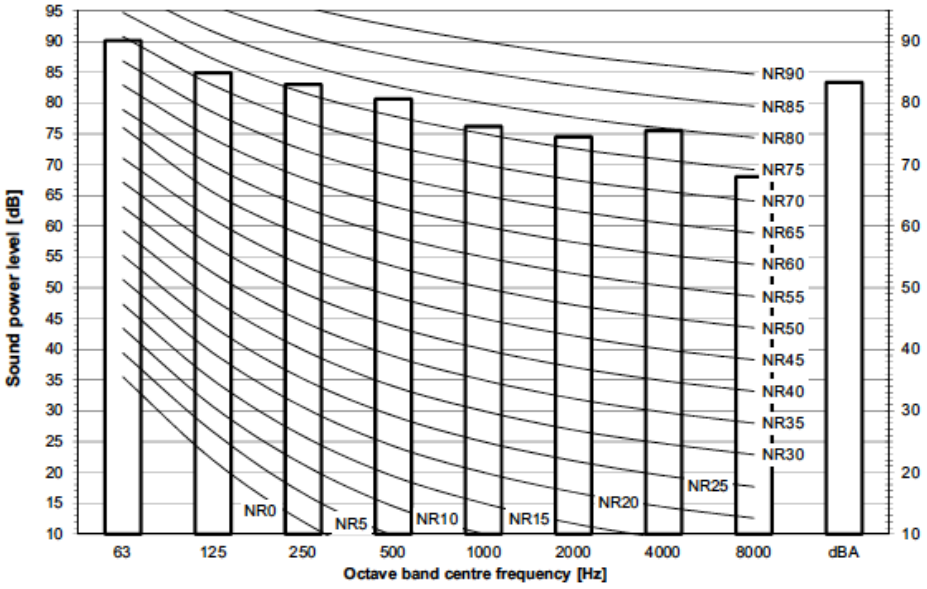
Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119529

11 Sound data

11 - 1 Sound Power Spectrum

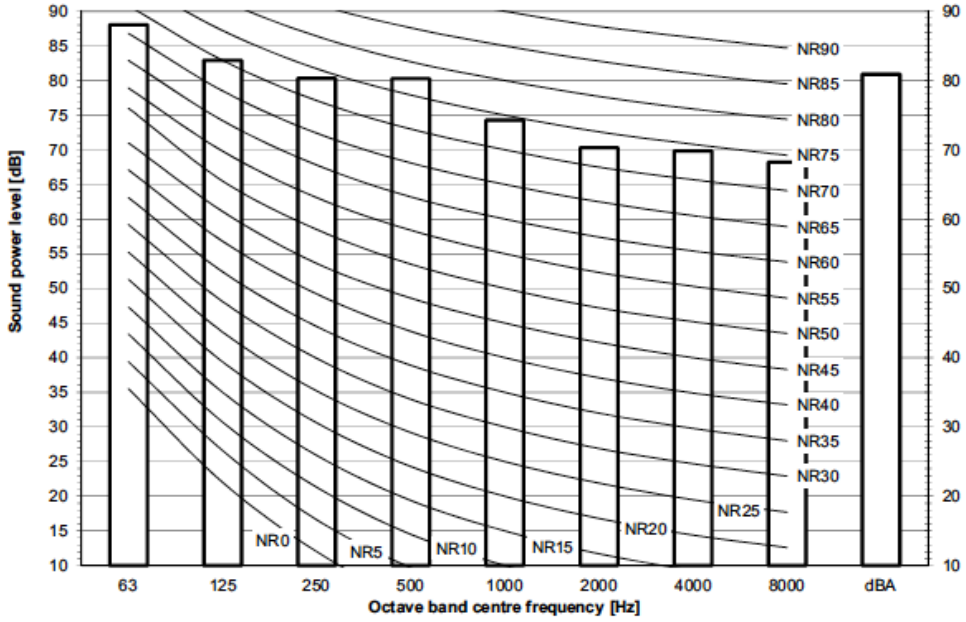
REYQ12U
RXYQQ12U
RXYQ12U
RYYQ12U
RYMQ12U



Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119530

REYQ14U
RXYQQ14U
RXYQ14U
RYYQ14U
RYMQ14U



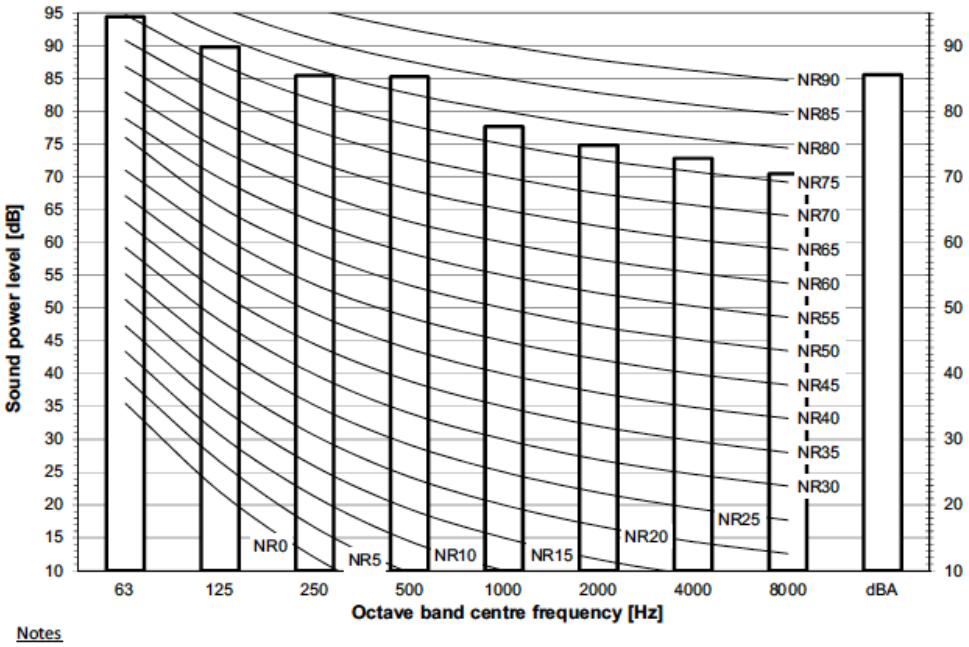
Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119531

11 Sound data

11 - 1 Sound Power Spectrum

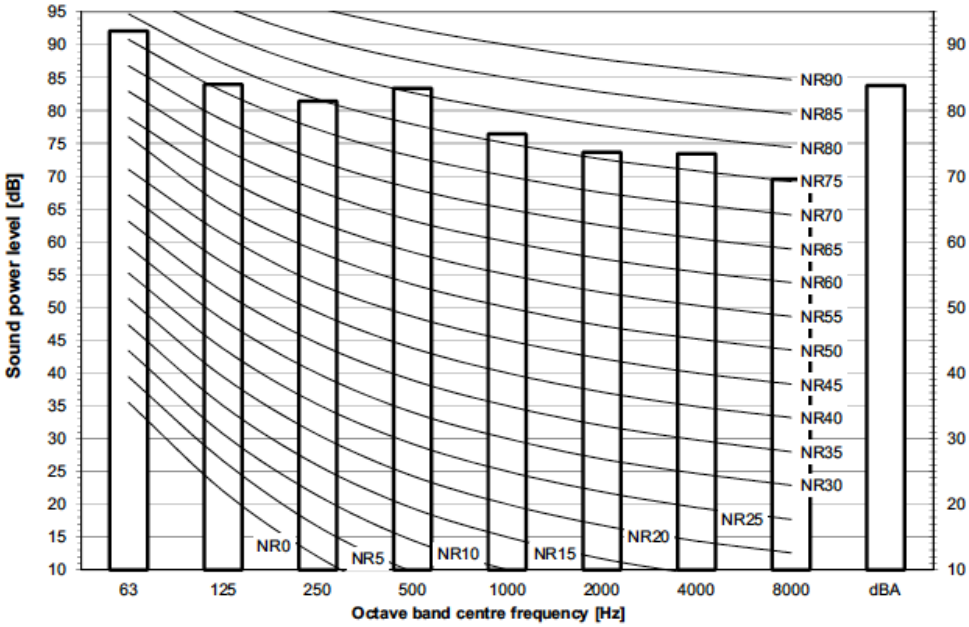
REYQ16U
RXYQQ16U
RXYQ16U
RYYQ16U
RYMQ16U



Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119532

REYQ18U
RXYQQ18U
RXYQ18U
RYYQ18U
RYMQ18U



Notes
dBA = A-weighted sound power level (A scale according to IEC).
Reference acoustic intensity 0dB = 10E-6µW/m²
Measured according to ISO 3744

3D119533

8 Sound data

8 - 1 Sound Power Spectrum

VAM800FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM800FB	U-H	58.0	58.0	52.5	49.5	48.5	41.5	33.5	26.0	53
	H	58.5	57.0	51.5	49.5	47.0	40.5	31.0	27.5	52
	L	54.5	54.5	47.5	44.5	43.0	35.5	24.5	23.5	47

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6μW/m²
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082467

VAM1000FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM1000FB	U-H	62.0	58.5	54.0	50.5	49.0	42.0	36.5	28.0	53
	H	61.0	57.0	52.0	50.0	48.0	38.5	31.0	25.5	52
	L	58.0	55.0	49.0	45.5	43.5	36.5	27.5	24.0	48

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6μW/m²
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082468

VAM1500FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM1500FB	U-H	60.5	61.0	55.5	52.5	50.5	46.0	39.5	29.5	55
	H	60.5	60.0	53.5	51.5	49.5	44.5	37.0	31.0	54
	L	58.5	58.0	51.0	49.0	47.0	39.5	30.5	31.0	51

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6μW/m²
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082469

VAM2000FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM2000FB	U-H	65.0	61.5	57.0	54.0	53.0	45.0	39.5	32.5	57
	H	64.0	60.0	55.0	53.0	51.0	41.5	34.5	30.5	55
	L	62.0	58.0	51.5	50.0	48.5	40.5	32.5	30.5	53

NOTES

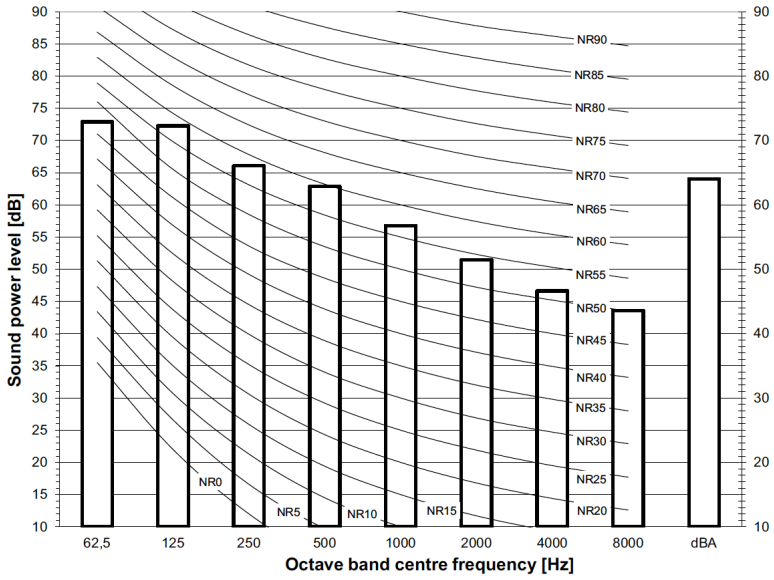
1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6μW/m²
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082470

11 Sound data

11 - 1 Sound Power Spectrum

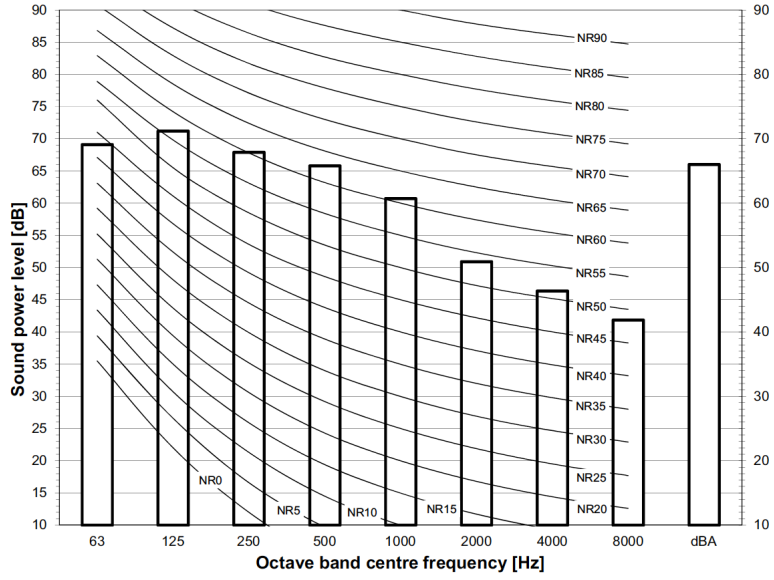
RZAG71MV1



Notes
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = 10E-6µW/m²
- Measured according to ISO 3744

3D110029

RZAG100MV1



Notes
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = 10E-6µW/m²
- Measured according to ISO 3744

3D110030