*dBx Acoustics Ltd, 2J Beehive Mill, Jersey Street, Manchester M4 6JG*

*0161 711 0320*

**24065-L01A-BT**

Nigel Aldridge

Parkeray Interiors Ltd

24 King William Street

London, EC4R 9AT

**30/10/2024**

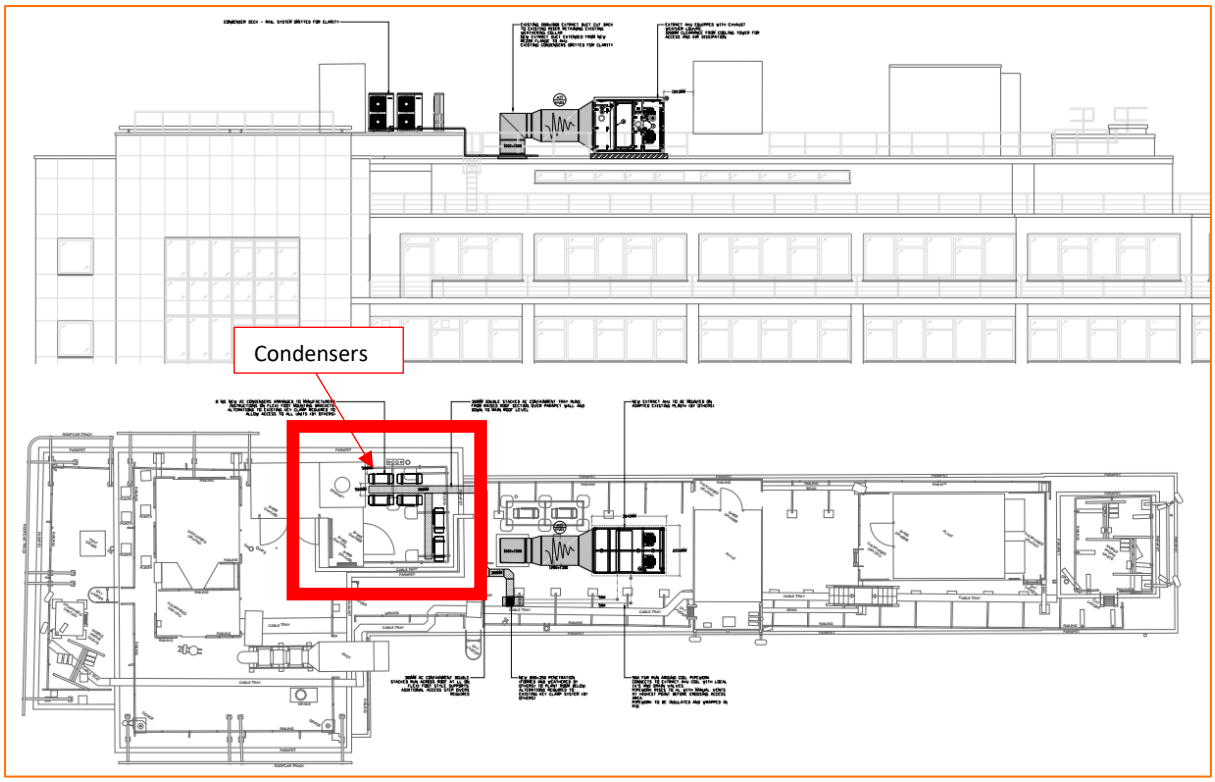
Dear Nigel,

## UCL TORRINGTON PLACE – ROOF MOUNTED CONDENSERS

Further to recent correspondence, we have assessed the acoustic implication of the proposed roof mounted condensers, as detailed below.

There are 6no. Toshiba RAV-GM2801AT8-E1 condensers to be installed on the 11th floor roof at UCL, Torrington Place, as indicated in Figure 1, below

**Figure 1 – Proposed Condenser Location**




These units have a sound pressure level of 61dB$L_{Aeq,T}$ @ 1m at full duty.

However, based on information provided by Tony Dhaliwal of Sovereign Air Management, at the design duty, this will reduce to 45dB$L_{Aeq,T}$ @ 1m.

The nearest noise sensitive locations are Woburn Mansions, around 60m to the southeast of the condensers; the Premier Inn hotel on Tottenham Court Road (around 45m to the west), and Gordon Mansions, around 60m to the east. Gordon Mansions are also only 7 storeys high, and hence benefit from significant acoustic screening from the roof og the UCL building. These locations are shown in Figure 2, below.

**Figure 2 – Noise Sensitive Receptors**


On this basis, calculations indicate that the noise level at would be around 16dB$L_{Aeq,T}$ at NSR 1, and 26dB$L_{Aeq,T}$ at NSRs 2 and 3, with all units running simultaneously. As there is no indication of acoustic character, this therefore relates to a rating level of 16-26dB$L_{Ar,Tr}$.

The noise limits identified in the Adnitt Acoustics Stage 3 Acoustic Design Report are 37dB$L_{Ar,Tr}$ in the day at Woburn Mansions, and 41dB$L_{Ar,T}$ at the Premier Inn, reducing to 32/36dB$L_{Ar,Tr}$ at night, respectively. No limit is stated for Gordon Mansions, but as background noise levels at this location will be very similar to those at Woburn Mansions, the limits would be the same.

The required limits are therefore comfortably achieved, and no mitigation measures (e.g. acoustic screens) are therefore required.

I trust this meets with your requirements, but if you have any further queries, please do not hesitate to contact me.

**Yours Sincerely,**

**Ben Tomlin**

**Associate, dBx Acoustics Ltd**



dBx Acoustics Ltd, Beehive Mill, Jersey Street, Manchester M4 6JG

Registered in England and Wales, Number 08371474

ADNITT ACOUSTICS
Renaissance House
32 Upper High Street
Epsom, Surrey
KT17 4QJ

T: +44 (0)20 7099 9735
F: +44 (0)845 127 5121
E: enquiry@adnitt.com
W: www.adnitt.com



**Report** E24030 240805 Torrington Stage 3 MEP R3-02
**Issue Date** 06 August 2024

**Project** **UCL Small Leases Project**
**1-19 Torrington Place, London**

**Title** **Stage 3 MEP Review**

**Sub Title**

**Client** Introba
150 Holborn
London
EC1N 2NS

**Case No**

**Author** Robert Adnitt MEng FIOA

**Checked** Graham Shaw BSc(Hons) MSc MIOA MInstP

Signatories acknowledge their responsibility for the current revision only.

| Revision | Reason | Author | Checked | Date |
|---|---|---|---|---|
| 00 | First Issue | Robert Adnitt | Graham Shaw | 5/6/2024 |
| 01 | Include R1 & R11 condensers | Robert Adnitt | Graham Shaw | 18/6/24 |
| 02 | Update references | Robert Adnitt | Graham Shaw | 6/8/24 |

# CONTENTS



**List of Tables**



**List of Attachments**

# 1. INTRODUCTION

1.1 Adnitt Acoustics has been commissioned by Introba on behalf of University College London (UCL) small leases project, to provide Stage 3 MEP design advice.

1.2 The project comprises of the installation of condensers and Air Handling Units to Levels 2, 6 and 12 of the building at Torrington Place.

1.3 An acoustic study is required to comply with the terms of the local authority planning guidance.

1.4 The following tasks have been undertaken as a part of the acoustic study.

- Unattended long-term environmental noise survey
- Impact assessment and feasibility study for the existing noise climate.

1.5 As this is a technical report it will refer to some technical terms. To assist the reader a glossary has been included in Appendix A.

***Statement of Qualification***

1.6 The assessment was undertaken by Robert Adnitt who is a Fellow of the Institute of Acoustics (FIOA).

1.7 He has worked in the acoustics industry since graduating with MEng (Merit) from the Southampton University Institute of Sound and Vibration Research (ISVR) in 1989.

1.8 He specialises in acoustics of the built environment and has been the lead consultant on a large number of major projects including leisure and entertainment, healthcare, residential and commercial, uses.

1.9 He is currently honorary treasurer of the Association of Noise Consultants (ANC) and was previously a board member from 2006-2012, he also chaired the Improvement Committee of the ANC.

1.10 The assessment was checked by Graham Shaw BSc(Hons) MSc MIOA MInstP for and on behalf of Adnitt Acoustic Services Ltd.

1.11 Graham has a BSc(Hons) in Physics with Music from the University of Edinburgh (2010) and an MSc (Distinction) in Architectural and Environmental Acoustics from London South Bank University (2012).

1.12 He has over ten years post-graduate experience as an Acoustical Consultant working as a Consultant for Adnitt Acoustics since January 2012.

1.13 Graham is a corporate member of both the Institute of Acoustics and Institute of Physics.

1.14 On this basis, Robert Adnitt and Graham Shaw are considered to be Suitably Qualified Persons for the purposes of this assessment.

## 2. SITE DESCRIPTION

2.1 The site address is 1-19 Torrington Place WC1E 7HB in the London Borough of Camden (LBC).

2.2 The site is located within a mixed commercial and residential area of central London, directly to the north of Torrington Place and to the east of Tottenham Court Road.

2.3 The development comprises of the installation of three new condenser units within the Level 6 rooftop plant area, shown in Figure 1.

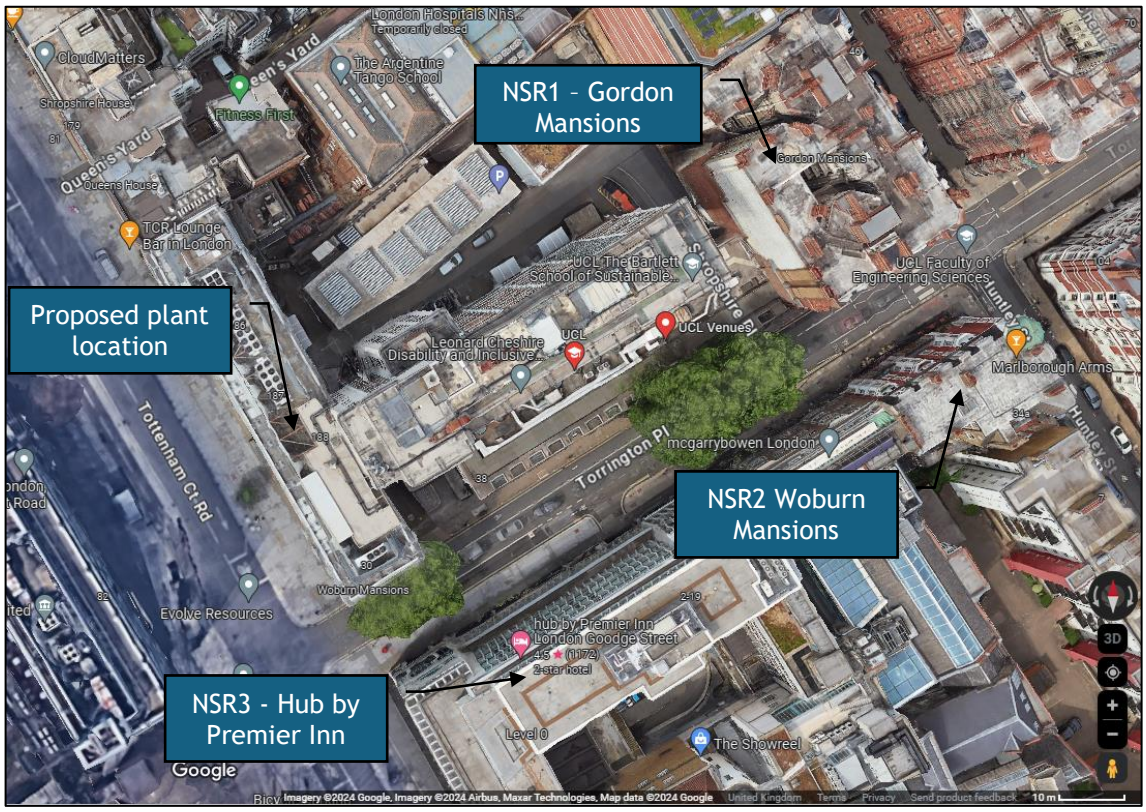



**Figure 1 - Aerial view of the existing site and surroundings**

2.4 Ther nearest potential noise sensitive receptors have been identified as:

i. NSR1 – Gordon Mansions residential,
ii. NSR2 - Woburn Mansions residential, and
iii. NSR3 - Hub by Premier Inn hotel

all located on Torrington Place.

2.5 The existing noise climate has been found to be dominated by road traffic noise mainly from Tottenham Court Road but also from Torrington Place.

2.6 A site plan has been produced and is appended to this report: Figure E24030/ SP 1 : Site Plan.

# 3. CRITERIA

3.1 Noise criteria for the assessment have been taken from Camden Local Plan 2017 Policy A4 Noise and vibration Appendix 3: Noise thresholds

3.2 This sets out that

*The significance of noise impact varies dependent on the different noise sources, receptors and times of operation presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:*

- *NOEL – No Observed Effect Level*
- *LOAEL – Lowest Observed Adverse Effect Level*
- *SOAEL – Significant Observed Adverse Effect Level*

*Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:*

- *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.*

*Industrial and Commercial Noise Sources*

*A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise.*

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

3.3 The criteria are set out in Table C of Appendix 3, reproduced in Figure 2, The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night.

| 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$L_{Amax}$ |

**Figure 2 - Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)**

3.4 Rating Level as defined in BS4142:2014 is the specific sound level of the equipment plus any required adjustment for the characteristic features of the sound, e.g. tonality, and so the phrasing of the guidance is potentially unclear including tones twice.

3.5 We believe the requirements of LBC will be satisfied if the predicted rating noise level (including any tonal acoustic feature correction, applied at the receiver as per the guidance of BS4142:2014) emitted from the new plant is lower than the typical existing background noise level by at least 10dBA.

3.6 There are office windows on Torrington Place overlooking the plant area and these should be taken into account in the noise assessment.

3.7 The rooms may be meeting rooms and British Standard 8233:2014 recommends noise levels in meeting rooms to be 35 - 45 dBA and if we assume a partially open window giving a typical level difference of 12 dBA, then the external noise level from the plant should not exceed 57 dBA.

# 4. NOISE SURVEY

4.1 To establish the environmental noise climate an ambient noise survey was undertaken between 15th May – 22nd May 2024.

4.2 The survey consisted of two sound level meters monitoring long-term unattended measurements.

4.2.1 Position 1 – The meter was located at the front of the site, at the edge of the second floor rooftop plant area overlooking Torrington Place. The microphone was positioned an estimated 8 metres above ground and less than a metre from other acoustically reflective surfaces. Therefore, the measurements are façade affected.

4.2.2 Position 2 – The meter was located at the rear of the site, on the rooftop of the 6th Floor plant area overlooking Tottenham Court Road. The microphone was positioned an estimated 18 metres above ground and less than a metre from other acoustically reflective surfaces. Therefore, the measurements are façade affected.

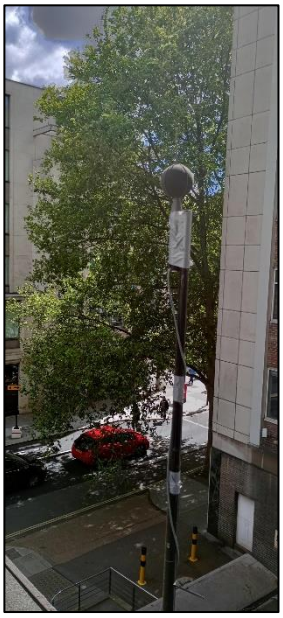


**Figure 3 - Automated Monitoring Position 1**

**Figure 4 - Automated Monitoring Position 2**

4.3 Survey measurements were carried out in accordance with guidelines laid down in BS 7445:1991 Part 2, and other relevant standards.

4.4 The approximate location of the noise survey equipment is shown on the appended site plan, Figure E24037 /SP 1.

4.5 The acoustic parameters $L_{Aeq,T}$, $L_{A90,T}$, $L_{AFMax}$ and octave band levels were measured automatically every 15 minutes during the survey.

4.6 An audio trigger was set up to allow for retrospective source identification if required.

### *Building Site Noise*

4.7 During the noise survey there was an active building site located across the street from Position 2 on Tottenham Court Road.

4.8 This site was generating noise between 07:00-19:00 during the weekday measurements, and thus measurements at Position 2 during these periods have been discounted.

4.9 Position 1, located on Torrington Place, is shielded from noise on this construction site so we consider that daytime data at this position is still valid.

### *Rear Courtyard*

4.10 A measurement location in the rear courtyard was originally chosen to be included within the noise survey. However, the rooftop of the building seen below in Figure 5 could not be safely accessed as there are no guardrails around its perimeter.

4.11 Noise generated by the plant located to the left of Figure 5 could also have affected any measurements taken at this position.

4.12 For these reasons there was no measurement location to the rear and the lowest results from position 1 are assumed to apply here.


**Figure 5 – Rear Courtyard**

### *Equipment and Weather Conditions*

4.13 Unfortunately, our portable weather station failed during the survey and so a local weather station was used to has been used for reference[1]. The weather conditions throughout the survey were generally dry, with some periods of light rain. Wind speeds were generally below 5 m/s as advised by BS 4142:2014.

[1] https://www.wunderground.com/dashboard/pws/ILONDO440/graph/2024-05-31/2024-05-31/monthly

4.14 An on-site calibration check was carried out on the meter at the start and end of the survey with no significant drift.

The schedule of noise survey equipment is presented together with calibration dates in Table E24037/T1. Copies of the associated calibration certificates are available upon request.

| Description | Manufacturer/Model | Serial Number | Calibration Date | Certificate Number |
|---|---|---|---|---|
| Integrating sound level meter | Cirrus Optimus Green CR:171A | G061849 | 04 November 2022 | 182660 |
| Microphone | Cirrus MK224 | 214828D | 28 October 2022 | 182662 |
| Acoustic Calibrator | Cirrus CR:515 | 64545 | 11 April 2023 | 190426 |
| Integrating sound level meter | Cirrus Optimus Green CR:171A | G061850 | 16 December 2022 | 184984 |
| Microphone | Cirrus MK224 | 216535B | 03 October 2022 | 184978 |
| Acoustic Calibrator | Cirrus CR:515 | 64548 | 19 December 2022 | 184985 |

Table E24030/T1 – Survey Equipment Schedule

# 5. NOISE SURVEY RESULTS

5.1 The measured noise levels are summarised in table E24030/T2, appended Figures E24030 /TH1 and E24030 /TH2 show time-history graphical representations of these results.

| Position | Measurement Period | Ambient Noise Level ($L_{Aeq,T}$, dB) | Typical Maximum Noise Level ($L_{AFMax}$ dB) | Typical Background Noise Level ($L_{A90,\ 15min}$, dB) |
|---|---|---|---|---|
| Position 1 | Daytime (07:00 – 23:00) | 58 | - | 50 |
| | Night-time (23:00 – 07:00) | 54 | 73 | 45 |
| Position 2 | Daytime (07:00 – 23:00) | 65 | - | 54 |
| | Night-time (23:00 – 07:00) | 62 | 83 | 49 |

**Table E24030/T2 – Summary of Automated Noise Measurement Results**

All values shown in this table are façade affected values.
* - Typical $L_{AFmax}$ value is the value not normally exceeded more than 10 times a night
** - Visual estimation based on time history chart

5.2 Typical maximum sound levels have been established based upon the criteria given in the clarifications to Note 4 of Table 4 of British Standard BS 8233:2014 found in the ProPG.

5.3 Typical background sound levels ($L_{A90,T}$) have been established based upon the 'line-of-best-fit' method which is considered a valid method under British Standard BS 4142:2014.

# 6. MECHANICAL PLANT ASSESSMENT

***Requirements***

6.1 The nearest noise sensitive receptors, other than the development itself, have been identified to be:

i. NSR1 – Gordon Mansions residential,

ii. NSR2 - Woburn Mansions residential, and

iii. NSR3 - Hub by Premier Inn hotel

all located on Torrington Place.

6.2 As discussed in section 3, the predicted rating noise level emitted from the new plant, including any tonal acoustic feature correction, applied at the receiver (as per the guidance of BS4142:2014) shall be lower than the typical existing background noise level by at least 10dBA.

6.3 On the basis that condenser noise when attenuated to 10 dB below background is not perceptibly tonal at the receiver, the following cumulative mechanical plant noise emission limits at the nearest noise sensitive receivers are proposed:

| Noise sensitive Location | Measurement Period | Typical Background Noise Level ($L_{A90,\ 15min}$, dB)[1] | Proposed Cumulative Mechanical Plant Criteria ($L_{Aeq,T}$, dB), not tonal at receiver |
|---|---|---|---|
| Location 1 – Torrington Place | Daytime (07:00-23:00) | 47 | 37 |
| | Night-time (23:00-07:00) | 42 | 32 |
| Location 2 – Tottenham Court Road | Daytime (07:00-23:00) | 51 | 41 |
| | Night-time (23:00-07:00) | 46 | 36 |
| Location 3 Gordon Mansions Lightwell | Daytime (07:00-23:00) | Assumed as Location 1 – 5 dB[2] | 32 |
| | Night-time (23:00-07:00) | | 27 |

Table E24030/T3 - External Mechanical Plant Noise Criteria

[1] **Corrected to free field values**

[2] **See explanation in 4.10 to 4.12**

6.4 As discussed in 3.6 to 3.7, There are office windows on Torrington Place overlooking the plant area and these should be taken into account in the noise assessment, external noise level from the plant should not exceed 57 dBA.

### *Proposed Equipment*

6.5 The proposed condenser equipment and location (Level 6) are shown in Figure 6.

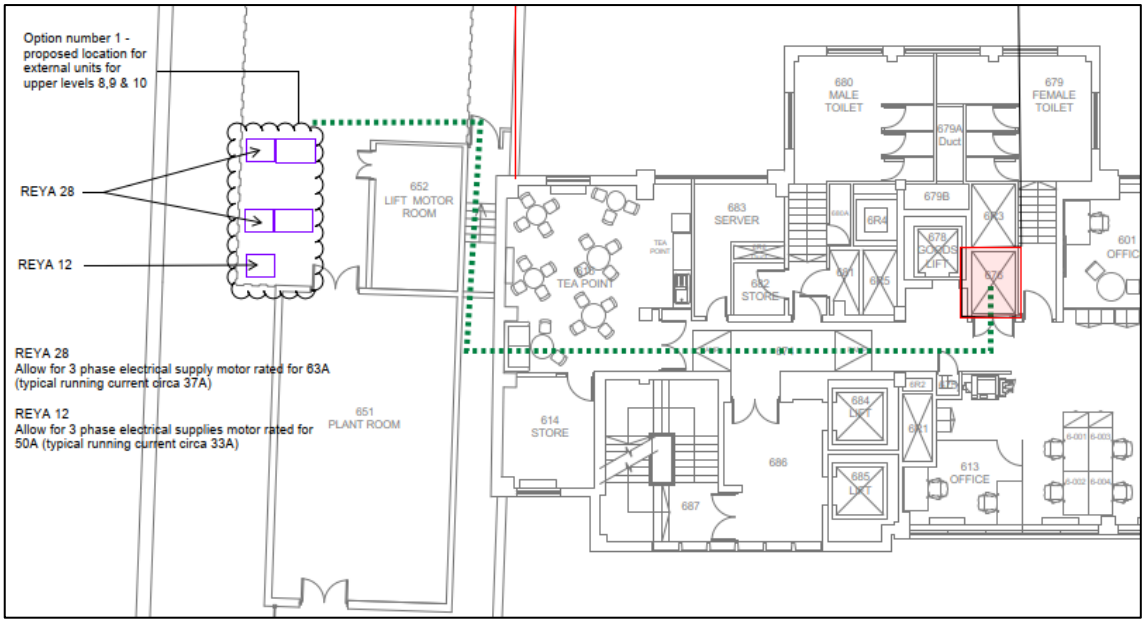



**Figure 6 - Proposed plant and location - Level 6**

6.6 The proposed condenser equipment and location (Level 12) are shown in Figure 7.

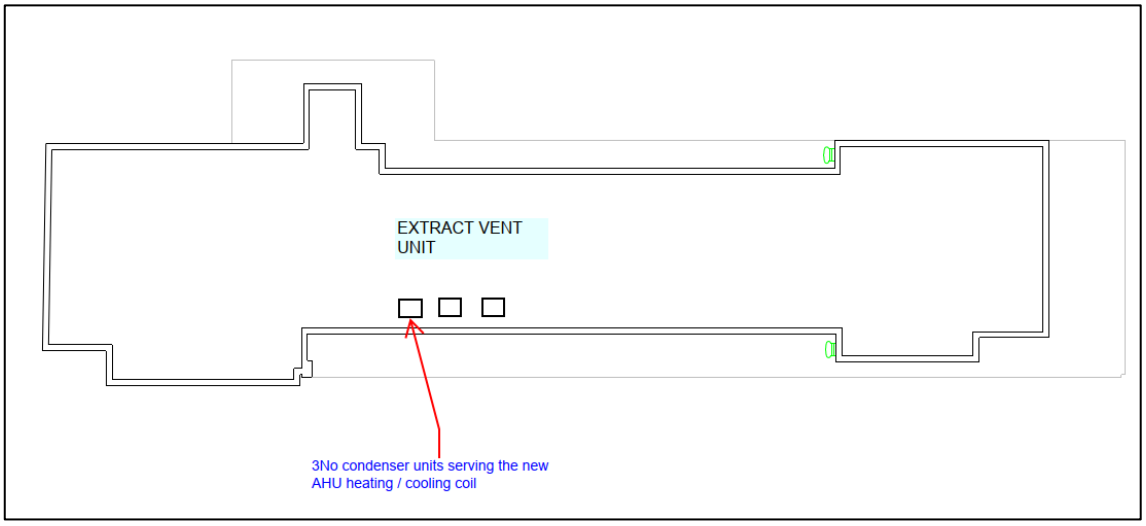



**Figure 7 - Proposed plant and location - Level 12**

6.7 The proposed condenser equipment and location (Level 2) are shown in Figure 8.

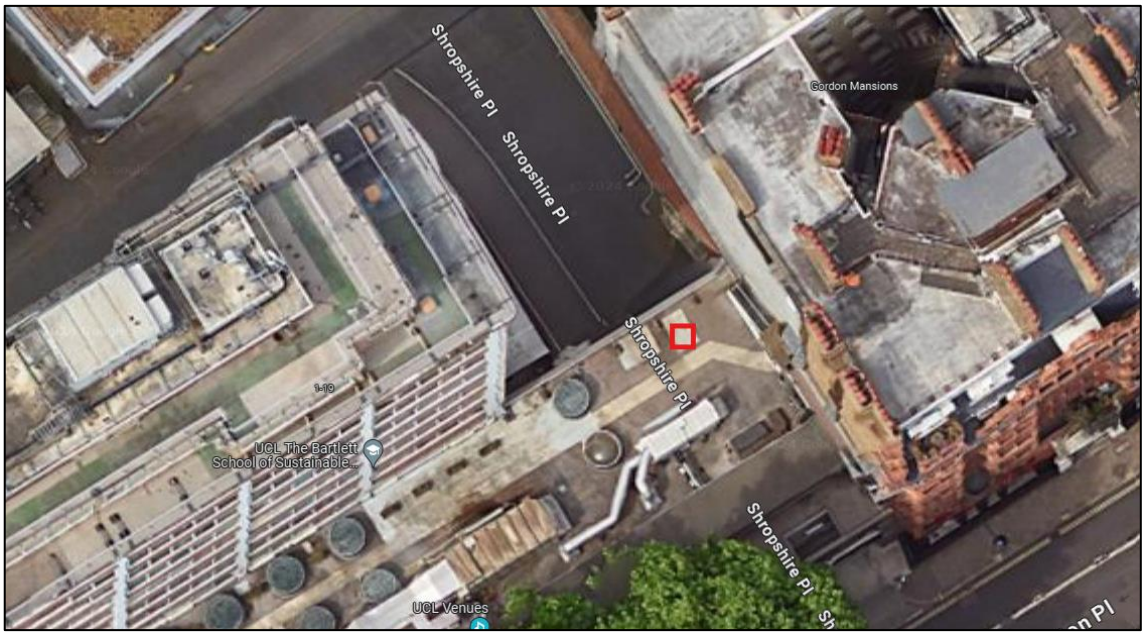



**Figure 8 – Proposed plant and location – Level 2**

6.8 Plant noise data has been taken from the Manufacturer's plant catalogue sheets given in Appendix B: summarised in Table E24030/T4.

| | Sound Power Level, dB @ Octave Band Centre Frequency, Hz | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Plant reference | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dBA |
| AHU 1 Supply In | 74 | 86 | 81 | 80 | 78 | 73 | 71 | 85 |
| AHU 1 Supply In | 62 | 72 | 70 | 61 | 57 | 47 | 45 | 69 |
| AHU 2 Extract Out | 66 | 75 | 73 | 68 | 64 | 62 | 61 | |
| AHU 2 Extract In | 71 | 81 | 77 | 77 | 75 | 70 | 68 | |
| Level 6 Roof | | | | | | | | |
| REYA12A | 85 | 82 | 82 | 78 | 73 | 72 | 71 | 84 |
| REYA16A | 86 | 84 | 86 | 79 | 76 | 76 | 74 | 86 |
| REYA28A | 89 | 86 | 87 | 82 | 78 | 77 | 76 | 88 |
| Level 12 Roof | | | | | | | | |
| RAV GM2801AT8 E1 | 85 | 79 | 79 | 74 | 70 | 68 | 65 | 80 |
| Level 2 Roof | | | | | | | | |
| REYQ20U | 87 | 87 | 88 | 81 | 76 | 74 | 70 | 88 |
| REYQ20U – Quiet Mode | 79 | 78 | 80 | 70 | 67 | 64 | 62 | 79 |

Table E24030/T4 – Plant Sound Power Data

6.9 We have assumed that plant operates during daytime only, potentially including weekends, i.e. between 07:00 – 23:00hrs.

6.10 Plant noise levels have been predicted at neighbouring and overlooking buildings using proprietary acoustic software Cadna A Version 2024.

### *Level 6*

6.11 Predicted noise levels with no acoustic treatment are shown in Figure 9.

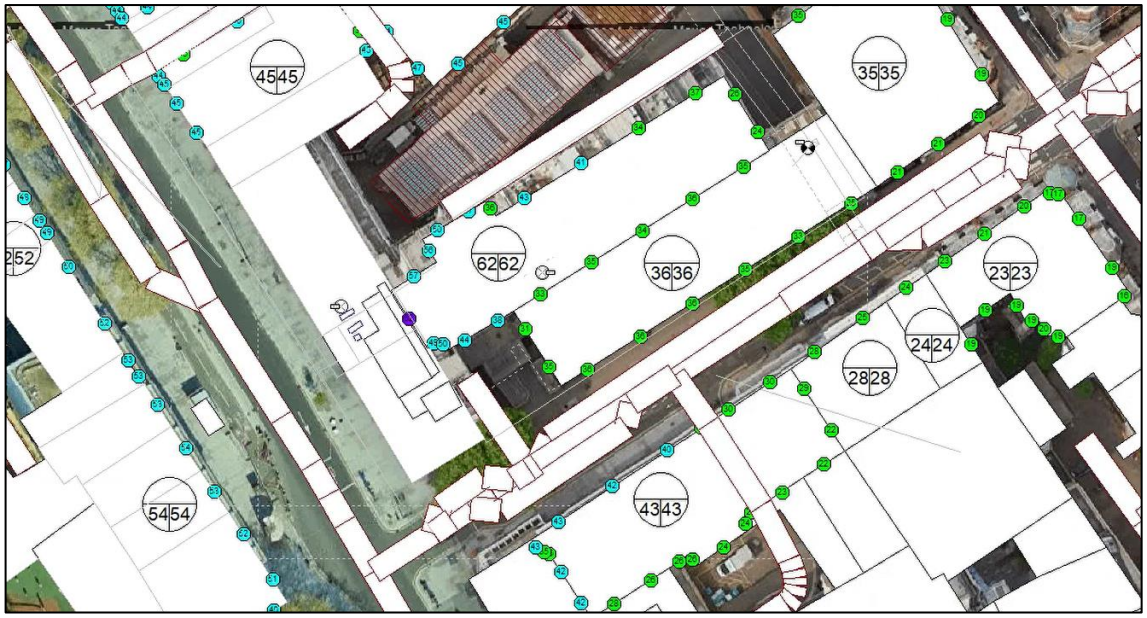



**Figure 9 – Predicted noise levels with no acoustic treatment – Level 6 Plant**

6.12 Predicted noise levels are 3 dBA above the planning noise limit of 32 dBA at NSR1 Gordon Mansions.

6.13 Predicted noise levels are below the planning noise limit of 37 dBA at NSR2 Woburn Mansions.

6.14 Predicted noise levels are 6 dBA above the planning noise limit of 37 dBA at NSR3 the hotel façade.

6.15 Predicted noise levels are 5 dBA above the recommended office window noise limit of 57 dBA at the overlooking Torrington Place building.

6.16 The estimated uncertainty for the prediction method is ±3 dBA and the following recommendations make due allowance for this.

6.17 On the basis of the predictions, acoustic treatment is recommended to the level 6 condensers consisting of either:

i. an acoustic enclosure to provide an overall sound reduction of at least 9 dBA, or

ii. manufacturer's supplied noise reduction kits for the condensers to include inlet and discharge attenuation to provide at least 9 dBA benefit.

***Level 12***

*Condensers*

6.18 Predicted noise levels with no acoustic treatment are shown in Figure 10.

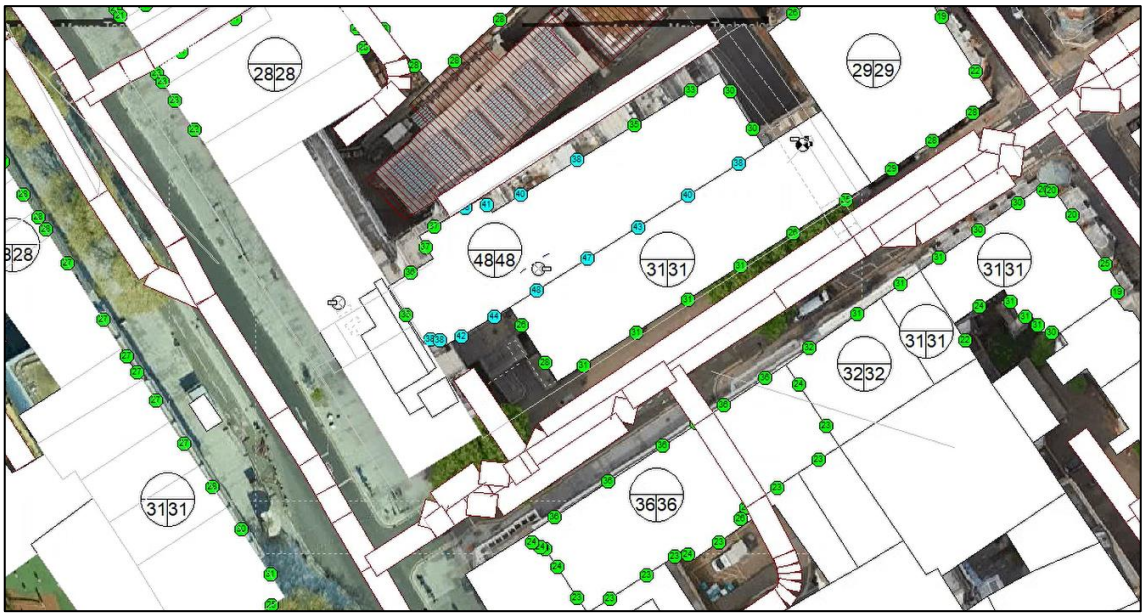



**Figure 10 – Predicted noise levels with no acoustic treatment – Level 12 Plant**

6.19 Predicted noise levels are below the planning noise limit of 32 dBA at NSR1 Gordon Mansions.

6.20 Predicted noise levels are below the planning noise limit of 37 dBA at NSR2 Woburn Mansions.

6.21 Predicted noise levels are below the planning noise limit of 37 dBA at NSR3 the hotel façade.

6.22 Predicted noise levels are below the recommended office window noise limit of 57 dBA at the overlooking Torrington Place building.

6.23 The estimated uncertainty for the prediction method is ±3 dBA and the following recommendations make due allowance for this.

6.24 On the basis of the predictions, no further acoustic treatment is recommended to the Level 12 condensers.

*AHU*

6.25 The proposed location of the extract AHU is shown in Figure 11.

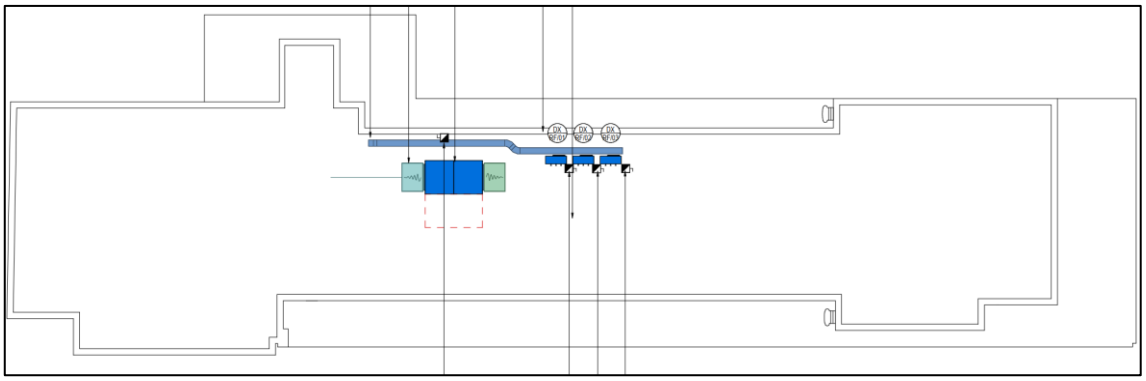


**Figure 11 – Extract AHU proposed location**

6.26 We recommend the following acoustic performance for the Inlet and discharge silencers to meet the noise limits at the noise sensitive receptors.

| Location | No. off | Dimension (mm) | | | Vol $m^3/s$ | Max PD Pa | Insertion Loss, dB @ Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | W | H | L | | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Extract AHU - inlet from room | 1 | 1250 | 1150 | 1500 | 3.4 | 25 | 8 | 15 | 25 | 50 | 46 | 47 | 43 | 32 |
| Extract AHU - exhaust to atmosphere | 1 | 1250 | 1150 | 1200 | 3.4 | 10 | 4 | 9 | 17 | 26 | 31 | 30 | 23 | 16 |

**Table E24030/T5 – AHU Silencer Acoustic Data**

***Level 2***

6.27 Predicted noise levels with the condenser in Quiet Mode and no acoustic treatment are shown in Figure 12.

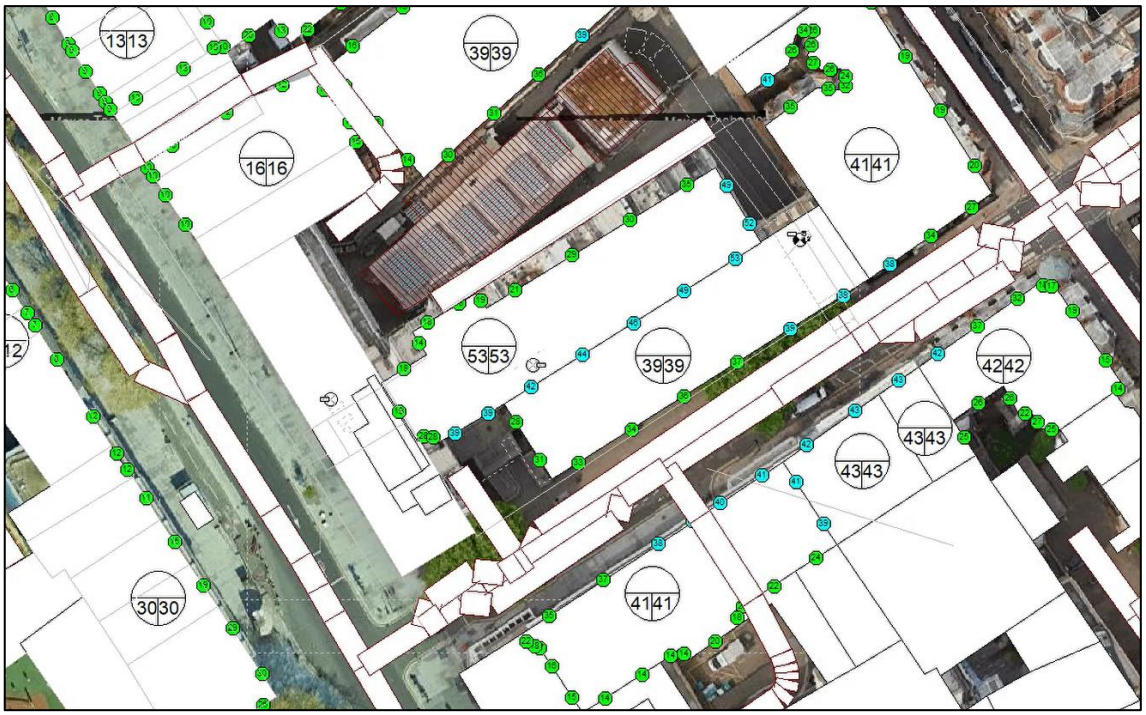



**Figure 12 – Predicted noise levels with no acoustic treatment – Level 2 Plant – Quiet Mode**

6.28 Predicted noise levels are 9 dBA above the planning noise limit of 32 dBA at NSR1 Gordon Mansions.

6.29 Predicted noise levels are 5 dBA above the planning noise limit of 37 dBA at NSR2 Woburn Mansions.

6.30 Predicted noise levels are 4 dBA above the planning noise limit of 37 dBA at NSR3 the hotel façade.

6.31 Predicted noise levels are below the recommended office window noise limit of 57 dBA at the overlooking Torrington Place building.

6.32 The estimated uncertainty for the prediction method is ±3 dBA and the following recommendations make due allowance for this.

6.33 On the basis of the predictions, acoustic treatment is recommended to the Level 2 condenser consisting of either:

i. an acoustic enclosure to provide an overall sound reduction of at least 12 dBA, or

6.34 Manufacturer's supplied noise reduction kits for the condensers to include inlet and discharge attenuation to provide at least 12 dBA benefit.

### *Acoustic Treatment*

6.35 Daikin have provided a typical arrangement for an enclosure, shown in Figure 13.

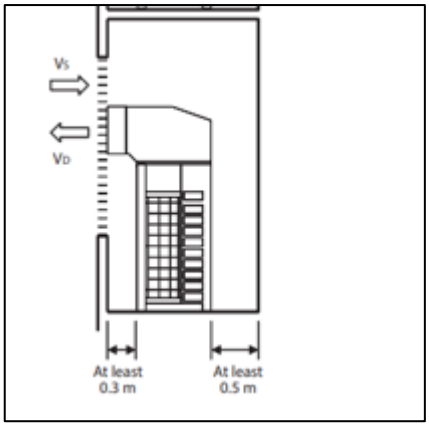



**Figure 13 – Daikin indicative enclosure**

6.36 Alternative enclosures could be supplied subject to Daikin approval, a typical example is shown in Figure 14[2], alternative equal and approved maybe used.

**Figure 14 – Typical condenser enclosure**

6.37 Details of the enclosure and/or noise reduction kit shall be developed at RIBA Stage 4, suppliers shall be required to submit independently verified acoustic data for the products and assurance that the warranties for the equipment shall not be affected.

6.38 Based on the recommended acoustic treatment being provided, the predicted cumulative noise levels for the L2, L6 & L12 condensers are at least 10 dBA below the typical existing background noise level at the noise sensitive receivers. BS4142:2014 considers perceived tonality at the receiver and at a specific noise level 10 dBA below background any tonality from condensers is not likely to be audible.

[2] Sound Enclosures, Noise & Vibration Control For HVAC Systems - Environ

6.39 On this basis, the proposals meet the LBC planning requirement and the recommended office window external noise levels.

# 7. CONCLUSION

7.1 An acoustic assessment of the proposed installation of condensers to the Level 2, 6 and 12 of 1-19 Torrington Place has been carried out.

7.2 Noise levels in the local area are relatively high being in Central London, however, there are potentially noise sensitive receivers nearby, including a hotel and residential buildings, existing offices of the same building overlook the proposed Level 2 and 6 plant areas.

7.3 The proposed plant locations benefit from some screening but predicted noise levels at the receptors exceed the requirements of the local authority with no acoustic treatment.

7.4 Acoustic treatment is recommended to the condensers (including an allowance for uncertainty) consisting of either:

i. Acoustic enclosures to provide an overall sound reduction of at least 12 dBA (Level 2) & 9 dBA (level 6) & not required for level 12, or

ii. manufacturer's supplied noise reduction kits for the condensers to include inlet and discharge attenuation to provide at least 12 dBA & 9 dBA benefit.

7.5 Details of the enclosures and/or noise reduction kit shall be developed at RIBA Stage 4, suppliers shall be required to submit independently verified acoustic data for the products and assurance that the warranties for the equipment shall not be affected.

7.6 AHU locations and acoustic requirements are given in 6.26.

7.7 On the basis of the recommended acoustic treatment being provided, the predicted noise levels meet the LBC planning requirement and the recommended office window external noise levels.

**Robert Adnitt MEng FIOA**

**for ADNITT ACOUSTICS**

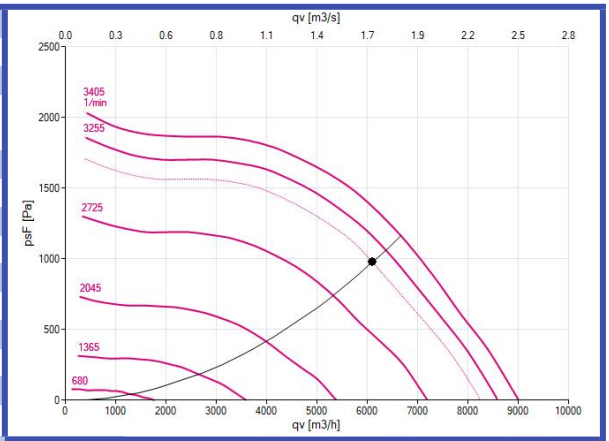
# APPENDIX A: GLOSSARY OF ACOUSTIC TERMS

| | | |
|---|---|---|
| **Ambient Noise** | The noise climate heard over a period of time due to all normal sources, in the absence of extraneous or atypical sounds. Used to describe noise in the absence of the introduced sound, generally. | |
| **Ambient Noise Level** | Describes the average noise level of the ambient noise over a stated period of time, e.g. hourly noise | |
| | Parameter: A-weighted Continuous Equivalent Sound Pressure Level determined over the time period T. | $L_{eq,T}$ or $L_{Aeq,T}$ |
| | Expressed in decibels / A-weighted decibels | dB(A) or dB |
| **Decibel scale dB** | A linear numbering scale used to define a logarithmic amplitude scale, thereby compressing a wide range of amplitude values to a small set of numbers | |
| **dB(A)** | An electronic filter in a sound level meter, which approximates under defined conditions the frequency response of the human ear. | |
| $L_{Aeq,T}$ | The equivalent continuous sound level. The steady dB(A) level which would produce the same A-weighted sound energy over a stated period of time as the measured sound pressure level. | |
| $L_{Amax}$ | The maximum dB(A) level measured during a survey period. | |
| $L_{A10}$ | The dB(A) level exceeded for 10% of the survey period, often used as a quantifier of traffic noise level. | |
| $L_{A90}$ | The dB(A) level exceeded for 90% of the survey period. Used in BS 4142:1997/2014 as being representative of the background noise level. | |
| **Acoustic screening** | Physical barrier to sound formed by fence, wall, building or other structure, which has the effect of reducing the sound transmitted. | |
| **Individual Event Noise** | The noise of a distinctive event with the varying noise climate, usually a transient activity, such as a vehicle pass-by, aircraft flyover or similar, rather than an isolated impulsive noise. | |
| **Individual Event Noise Level** | Describes the highest noise level during the event as measured under particular conditions of time-weighting | |
| | Parameter: A-weighted Maximum Sound Pressure Level with FAST or SLOW time weighting | $L_{Amax,FAST}$ or $L_{Amax,F}$<br>$L_{Amax,SLOW}$ or $L_{Amax,S}$ |
| | Expressed in decibels / A-weighted decibels | dB(A) or dB |
| ***Sound Reduction Index $R_w$*** | Single number rating used to describe the sound insulation of building elements as defined in BS EN ISO 717 1997. | |
| ***Weighted element-normalized level difference $D_{n,e,w}$*** | Single number rating used to describe the sound insulation of building elements as defined in BS EN ISO 717 1997. | |

# APPENDIX B: MANUFACTURER'S PLANT NOISE DATA

## *007 SUPPLY PLENUM FAN*

| Fan Type | Wheel Type | Drive Type |
|---|---|---|
| EC | Backward Curve | DirectDrive |
| **Model** | **Impeller Diam.** | **Abs Power** |
| GR35I-ZID.DG.CR-116893/A01 | 355 mm | 1.70 kW |
| **Quantity** | **Duty % Per Fan** | **Poles** |
| 2 | Dual Fan (50%-50%) | |
| **Air Flow Volume** | **Outlet Velocity** | **Motor Speed** |
| 3.400 m³/s | 0.840 m/s | 3410 rpm |
| **Ext Static Pressure** | **Fan Speed** | **Power** |
| 500 Pa | 2722 rpm | 3.3 kW |
| **Unit Static Pressure** | **Static Efficiency** | **FLC** |
| 932 Pa | 93.1% | 4.2 A |
| **Fan Total Pressure** | **VSD** | **Volts/Ph/Hz** |
| 979.6 Pa | Inbuilt | 400/3/50 |




| Frequency | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1k Hz | 2k Hz | 4k Hz | 8k Hz |
|---|---|---|---|---|---|---|---|---|
| Inlet (1) | 71 | 66 | 76 | 74 | 68 | 65 | 62 | 61 |
| Outlet (2) | 75 | 71 | 83 | 78 | 77 | 75 | 70 | 68 |

(1) SWL INSIDE The Inlet Duct (dB)

(2) SWL INSIDE The Outlet Duct (dB)

## *007 PLENUM FAN NOTES*

**This fan cannot be controlled with a variable frequency drive**

## *007 ACCESSORIES*

Bulkhead Light A

Light Switch

Isolator 20A RH A

## *007 ACCESS DOOR*

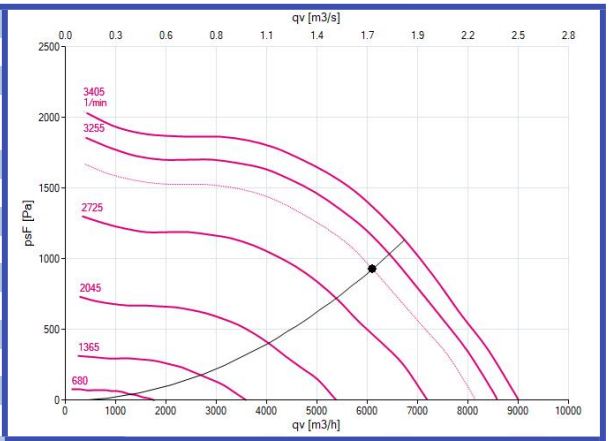
| Dimension | Type |
|---|---|
| 650 X 1300 mm | Hinged door |

## *008 OUTLET SECTION*

| Air Flow | Air Velocity | Pressure Drop | Depth | Dimension |
|---|---|---|---|---|
| 3.400 m³/s | 1.690 m/s | 0 Pa | None | 1550 x 1300 mm |
| **Damper** | **Damper Class** | **Damper Material** | **Damper Blades** | **Product** |
| None | None | None | None | Spigot 75 |

## *005 SUPPLY PLENUM FAN*

| Fan Type | Wheel Type | Drive Type |
|---|---|---|
| EC | Backward Curve | DirectDrive |
| **Model** | **Impeller Diam.** | **Abs Power** |
| GR35I-ZID.DG.CR-116893/A01 | 355 mm | 1.64 kW |
| **Quantity** | **Duty % Per Fan** | **Poles** |
| 2 | Dual Fan (50%-50%) | |
| **Air Flow Volume** | **Outlet Velocity** | **Motor Speed** |
| 3.400 $m^3/s$ | 0.870 m/s | 3410 rpm |
| **Ext Static Pressure** | **Fan Speed** | **Power** |
| 500 Pa | 2687 rpm | 3.3 kW |
| **Unit Static Pressure** | **Static Efficiency** | **FLC** |
| 883 Pa | 91.6% | 4.2 A |
| **Fan Total Pressure** | **VSD** | **Volts/Ph/Hz** |
| 930.6 Pa | Inbuilt | 400/3/50 |




| Frequency | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1k Hz | 2k Hz | 4k Hz | 8k Hz |
|---|---|---|---|---|---|---|---|---|
| Inlet (1) | 72 | 66 | 75 | 73 | 68 | 64 | 62 | 61 |
| Outlet (2) | 75 | 71 | 81 | 77 | 77 | 75 | 70 | 68 |

(1) SWL INSIDE The Inlet Duct (dB)

(2) SWL INSIDE The Outlet Duct (dB)

## *005 PLENUM FAN NOTES*

**This fan cannot be controlled with a variable frequency drive**

## *005 ACCESSORIES*

| |
|---|
| Bulkhead Light A |
| Light Switch |
| Isolator 20A RH A |

## *005 ACCESS DOOR*

| Dimension | Type |
|---|---|
| 600 X 1300 mm | Hinged door |

## *006 OUTLET SECTION*

| Air Flow | Air Velocity | Pressure Drop | Depth | Dimension |
|---|---|---|---|---|
| 3.400 $m^3/s$ | 2.390 m/s | 73 Pa | 120 mm | 1250 x 1140 mm |
| **Damper** | **Damper Class** | **Damper Material** | **Damper Blades** | **Product** |
| Internal | Standard | Aluminum | Opposed | WL75 |

TOSHIBA Leading Innovation

# Toshiba Air Conditioning - RAV-GM Data Sheet

## RAV-GM2801AT8-E1
## Outdoor Unit

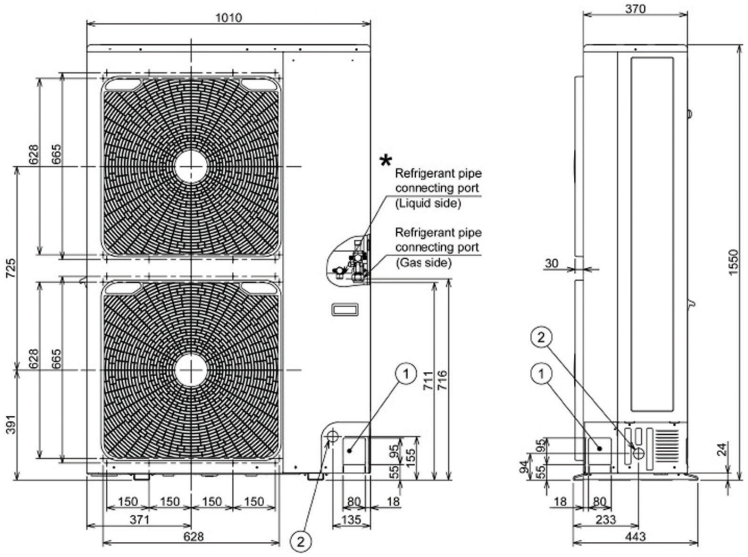

### Features

- R32 and R410A replacement technology
- Wide operating range (cooling mode -15°C to +52°C)
- Extended pipe runs up to 100 m (1104/1404)
- Flexible, can be utilised for single, twin, triple indoor applications
- Increased energy efficiency/cost saving

### Technical Data

| Model reference | | RAV-GM2801AT8-E1 |
|---|---|---|
| Nominal cooling | kW | 27.0 |
| Nominal heating | kW | 31.5 |
| Maximum air flow | $m^3/h$ | 10890 |
| Maximum air flow | l/s | 3025 |
| Sound power (cool/heat) | dB(A) | 78/80 |
| Sound pressure (cool/heat) | dB(A) | 61/63 |
| Dimensions (H x W x D) | mm | 1550 x 1010 x 370 |
| Unit weight | kg | 142 |
| Power supply | V-ph-Hz | 380/415-3-50 |
| Interconnecting cable | | 3 core + earth |
| Suggested fuse size | A | 20 |
| Maximum operating current (cooling) | A | 15.06 |
| Operating range, cooling | °C | -15 to 52 |
| Operating range, heating | °C | -27 to 15 |
| Pipe sizes (liquid - suction) | inch | 1/2 - 1-1/8 |
| Minimum/maximum pipe length | m | 5/100 |
| Maximum height difference | m | 30 |
| Pre-charge pipe length | m | 30 |

### Dimensional Drawings

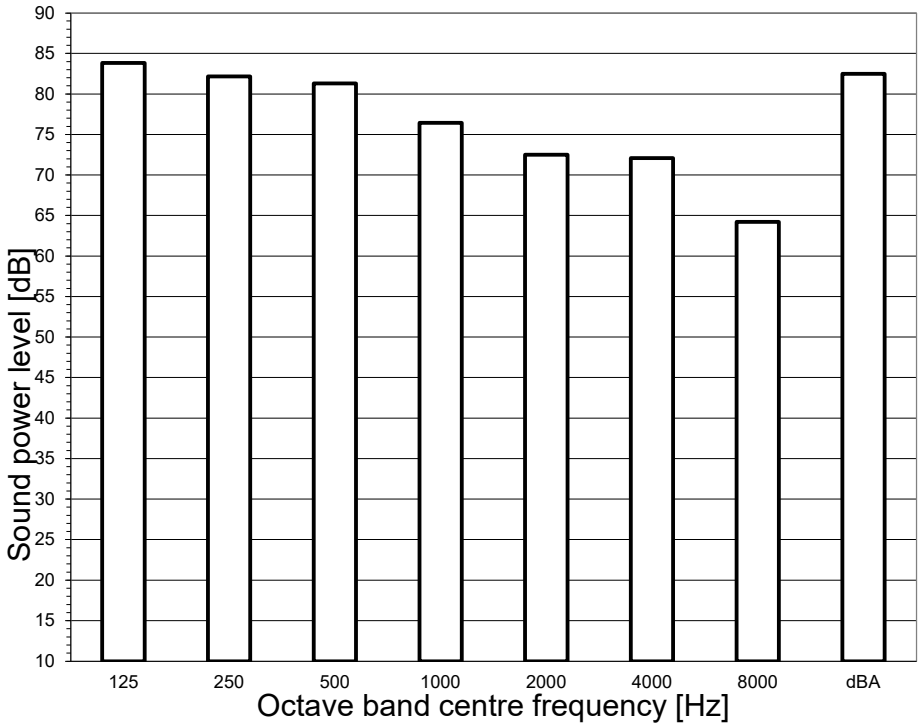



All UK duties are based on Cooling Indoor air temperature 22°C DB/16°C WB Outdoor air temperature 28°C DB 50% RH, high fan speed, 5 m pipe run.
Heating Indoor air temperature 20°C DB Outdoor air temperature -5°C DB 100% RH, high fan speed, 5 m pipe run. Values are based on the maximum compressor output.
Data obtained from Toshiba Air Conditioning Published Data September 2023.

# 11 Sound data

## 11 - 1 Sound Power Spectrum - Cooling

**REYA12A**

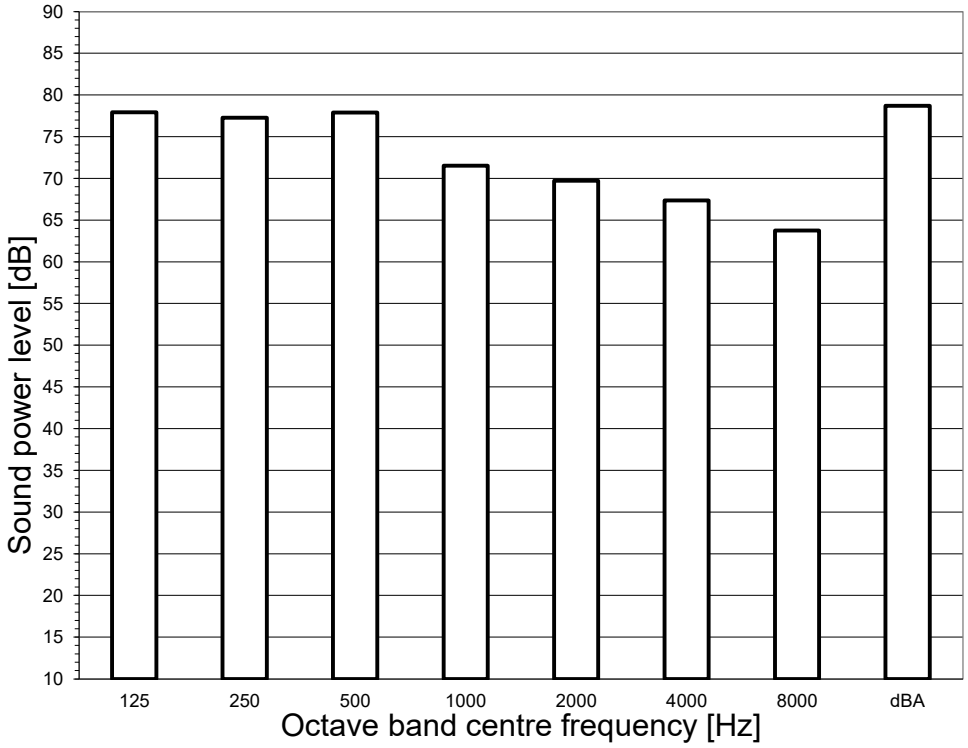



Notes

- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141171**

**REYA14A**




Notes

- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

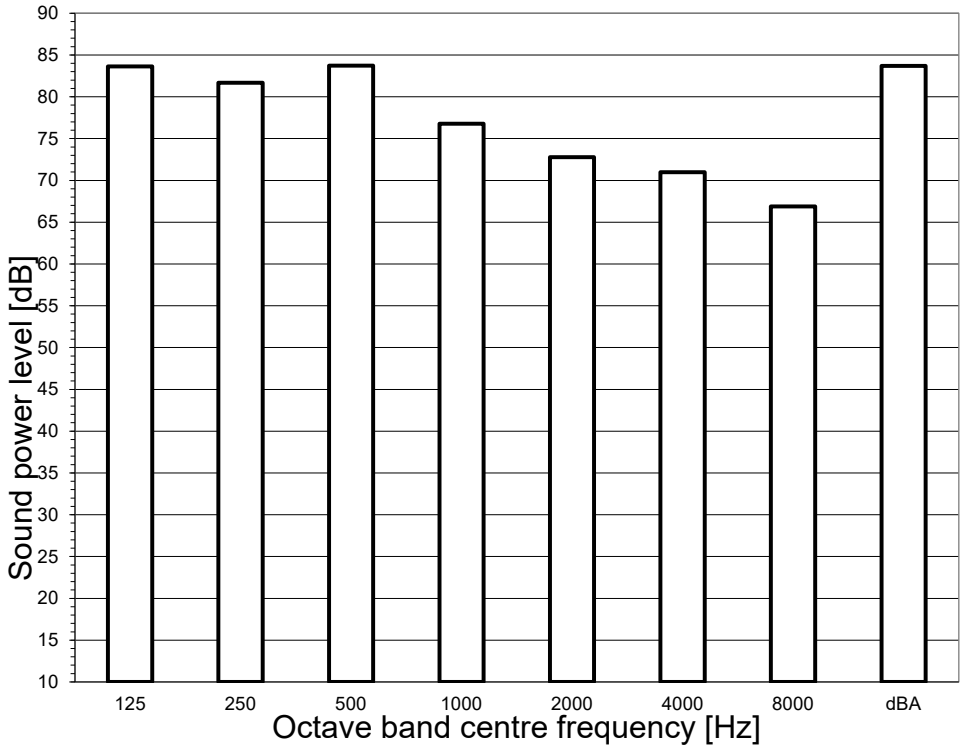
**3D141172**

# 11 Sound data

## 11 - 1 Sound Power Spectrum - Cooling



**REYA16A**

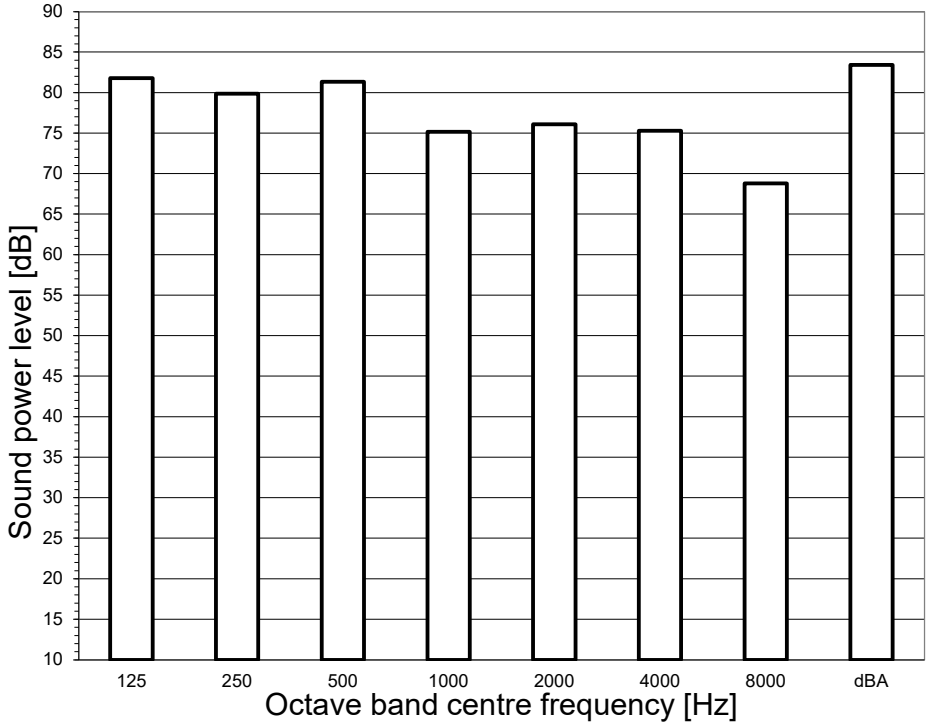



Notes

- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141173**

**REYA18A**




Notes

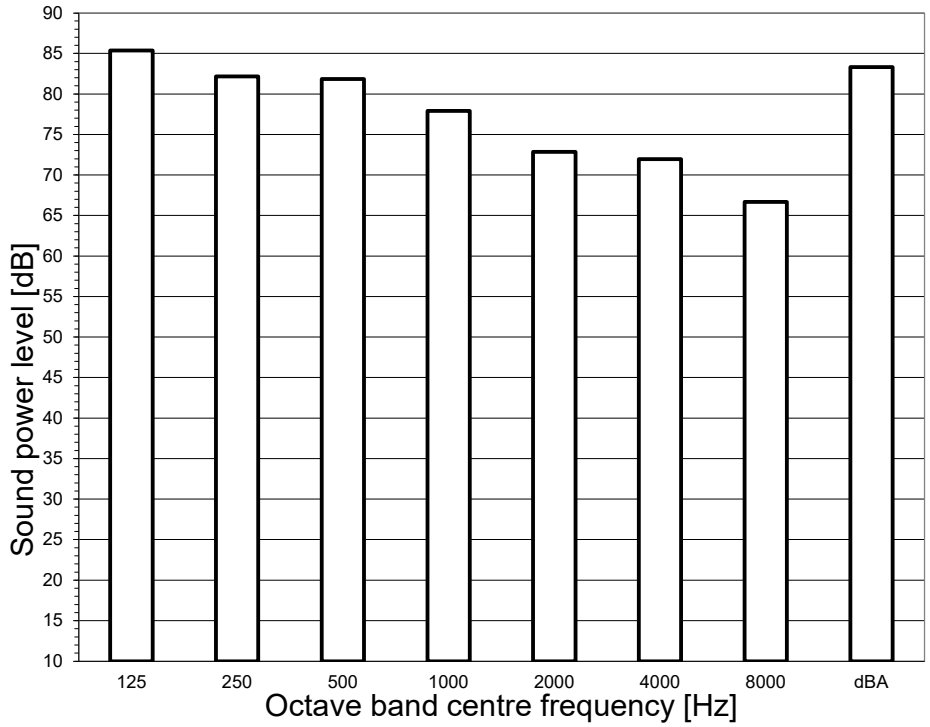
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141174**

# 11 Sound data

## 11 - 2 Sound Power Spectrum - Heating

**REYA12A**

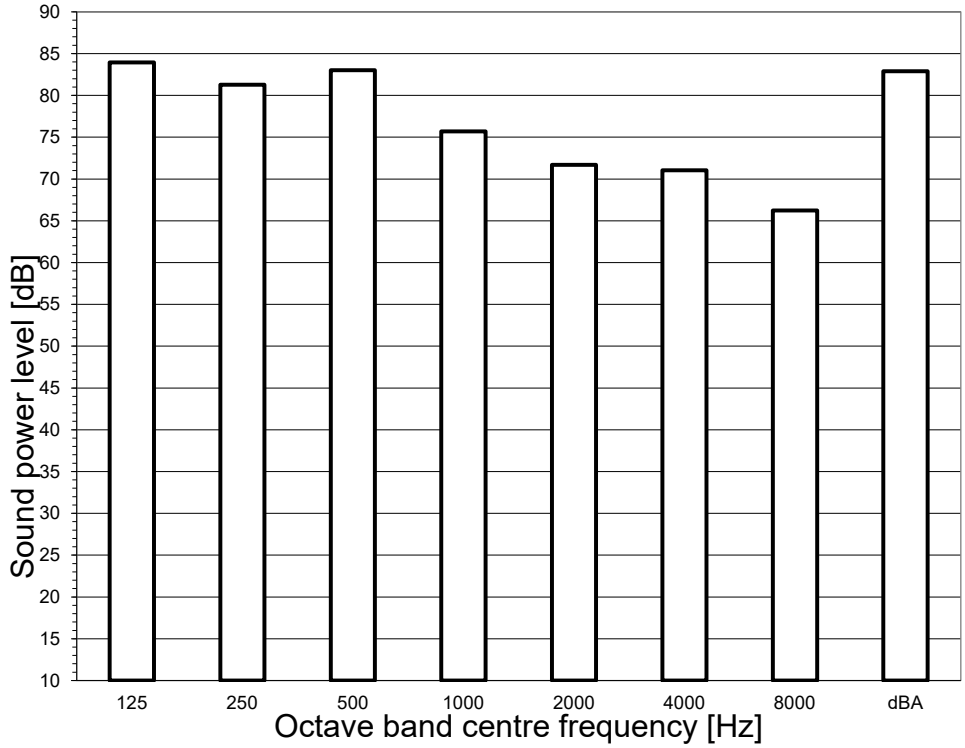



Notes

- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141171**

**REYA14A**




Notes

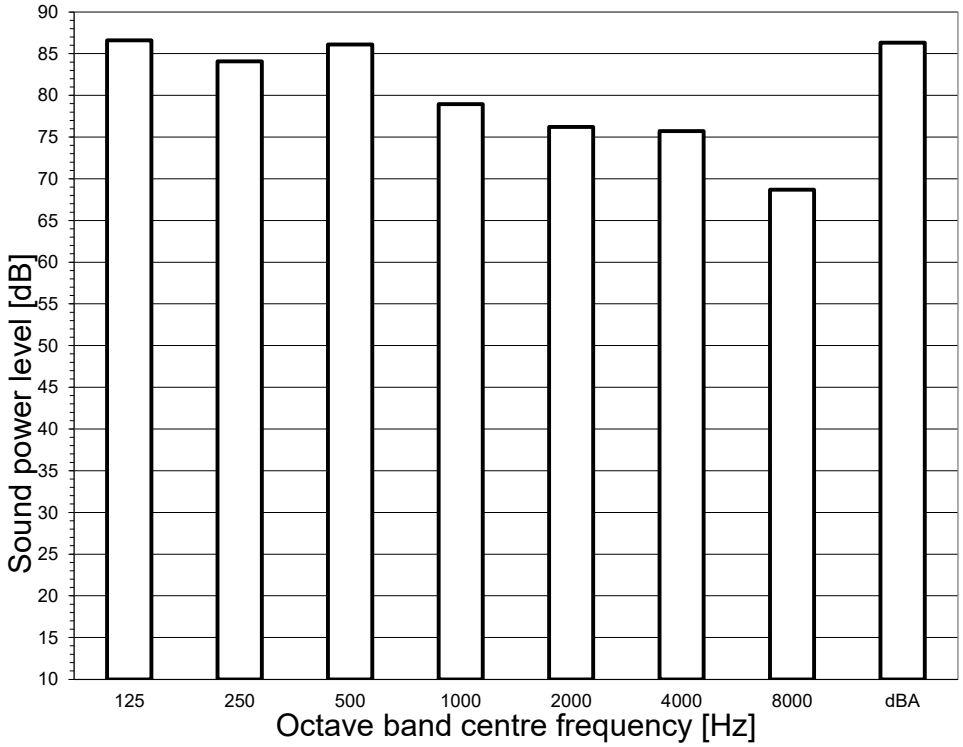
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141172**

# 11 Sound data

## 11 - 2 Sound Power Spectrum - Heating

**REYA16A**

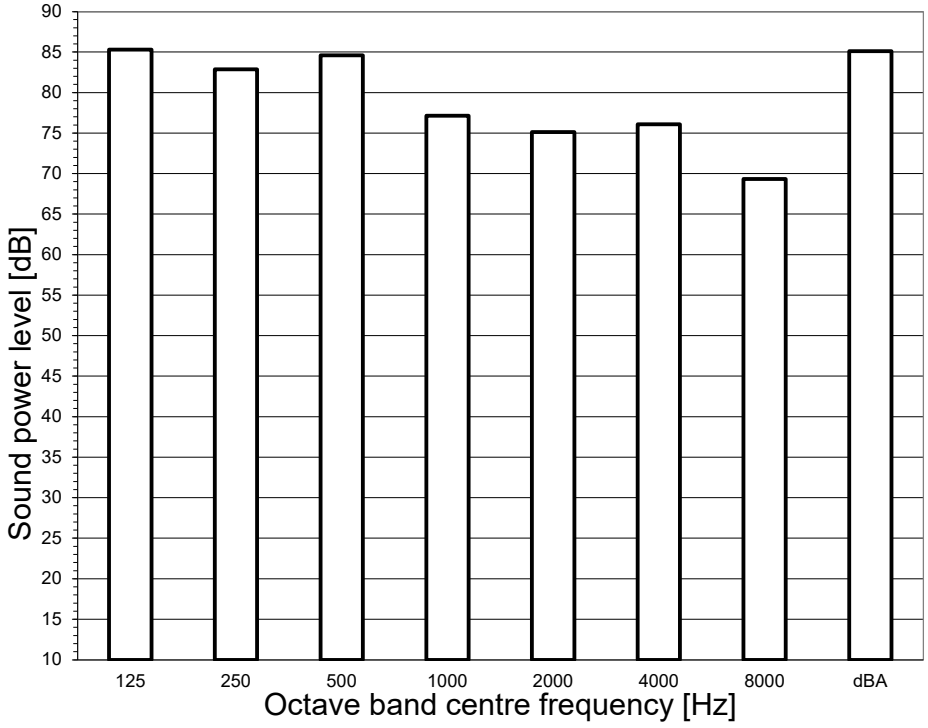



Notes

- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

**3D141173**

**REYA18A**




Notes

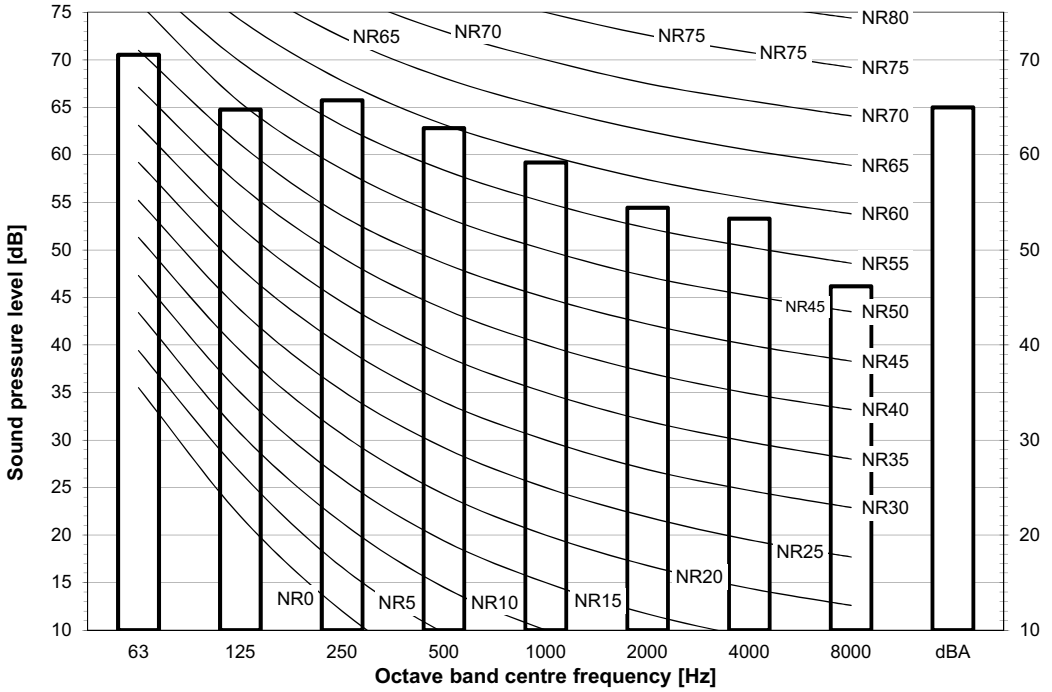
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = ·10^ -12 W·
- Measured according to ISO 3744

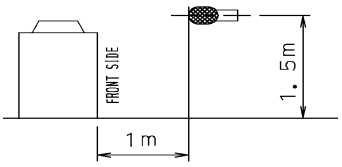
**3D141174**

# 11 Sound data

## 11 - 2 Sound Pressure Spectrum

**REYQ20U**
**RXYQQ20U**
**RXYQ20U**
**RYYQ20U**
**RYMQ20U**



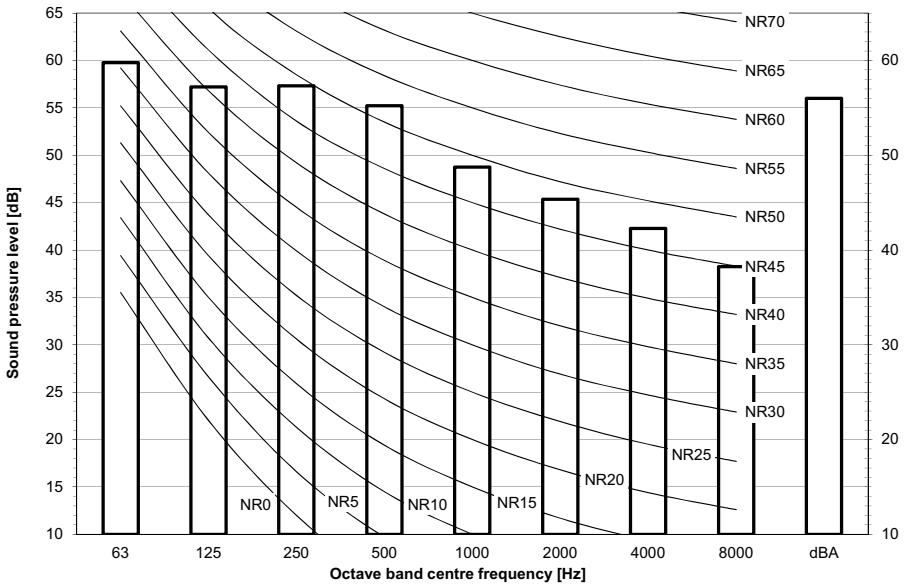

Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa

3D119527

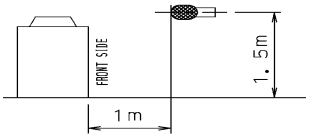
# 11 Sound data

## 11 - 3 Sound Pressure Spectrum Quiet Mode

**REYQ18-20U**
**RXYQQ18-20U**
**RXYQ18-20U**
**RYYQ18-20U**
**RYMQ18-20U**

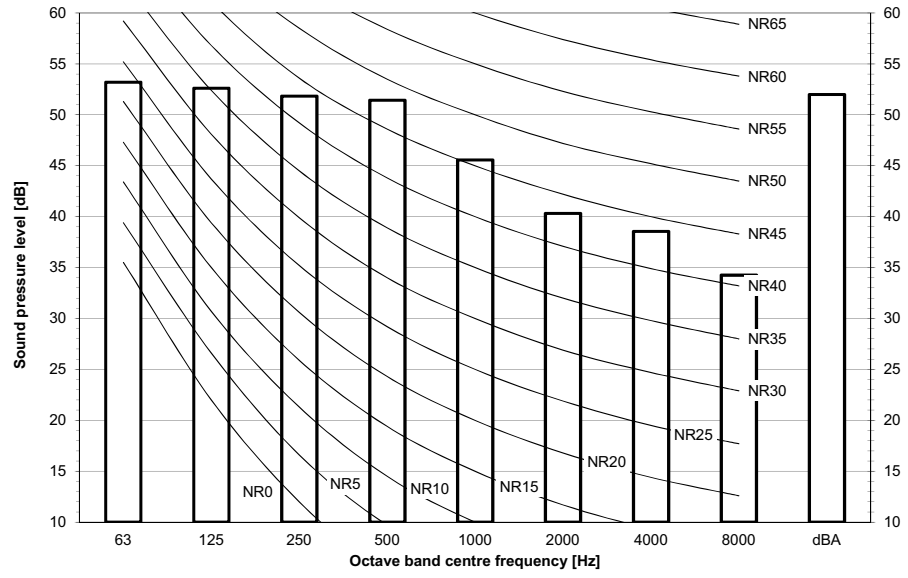



Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa
Data is valid under the following conditions
Cooling operation
Outdoor Ta: 35°C
Full load (maximum fan rps and maximum compressor rps for the dedicated low noise mode)

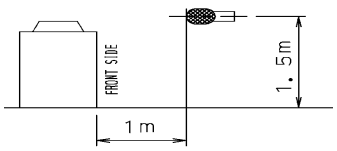



**3D119541**

**REYQ18-20U**
**RXYQQ18-20U**
**RXYQ18-20U**
**RYYQ18-20U**
**RYMQ18-20U**




Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa
Data is valid under the following conditions
Cooling operation
Outdoor Ta: 35°C
Full load (maximum fan rps and maximum compressor rps for the dedicated low noise mode)



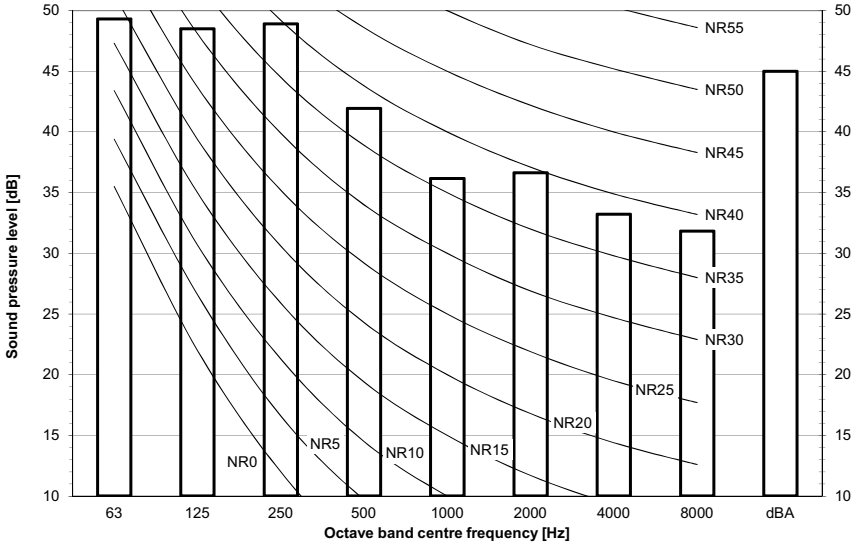

**3D119542**

# 11 Sound data

## 11 - 3 Sound Pressure Spectrum Quiet Mode

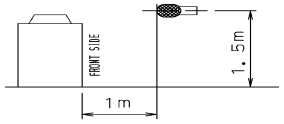
**REYQ18-20U**
**RXYQQ18-20U**
**RXYQ18-20U**
**RYYQ18-20U**
**RYMQ18-20U**






Notes
Data is valid at free field condition.
Data is valid at nominal operation condition.
dBA = A-weighted sound pressure level (A scale according to IEC).
Reference acoustic pressure 0 dB = 20 µPa

Data is valid under the following conditions
Cooling operation
Outdoor Ta: 35°C
Full load (maximum fan rps and maximum compressor rps for the dedicated low noise mode)




**3D119543**

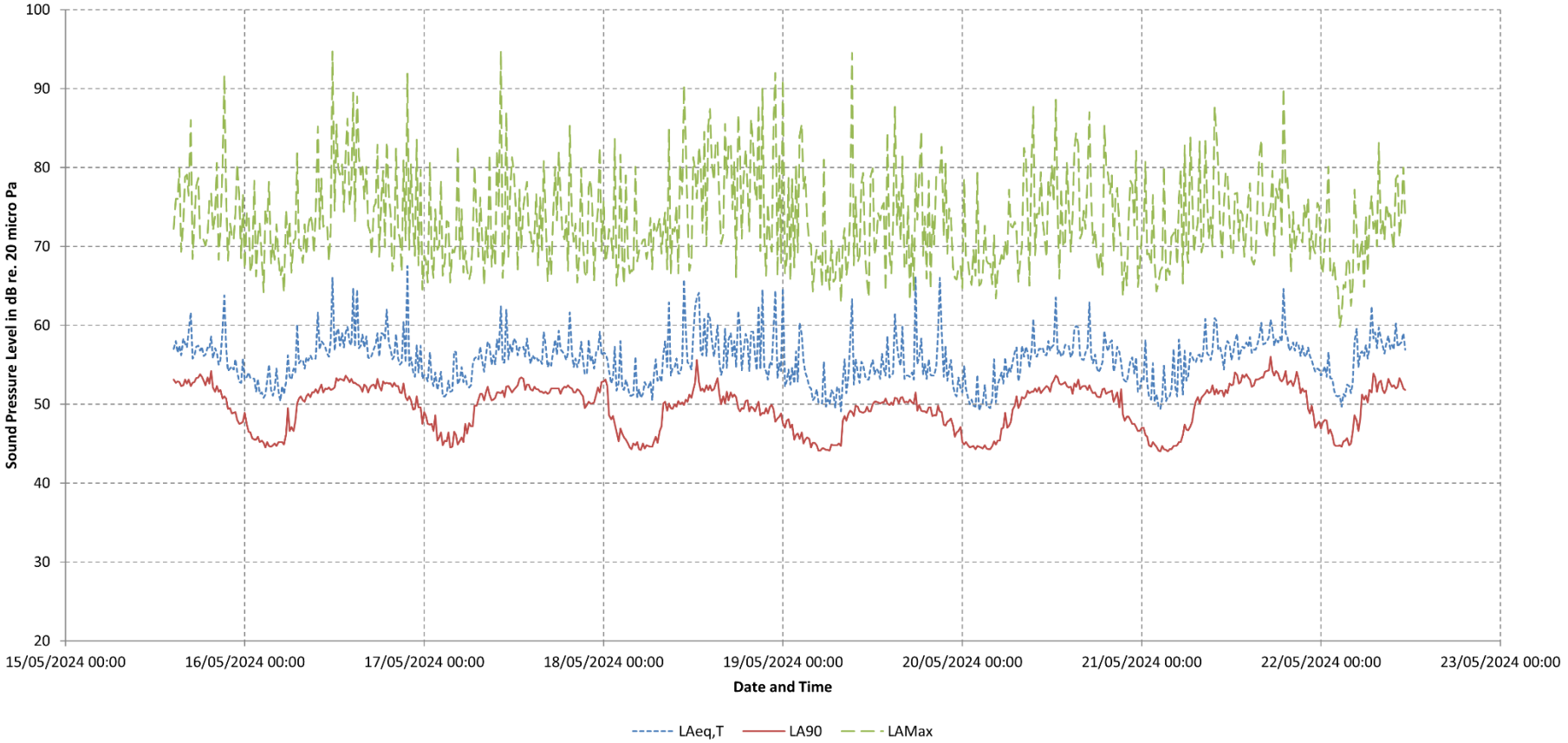
## Figure E24030 / SP 1 : Site Plan


Legend

- Points of interest
- Monitoring Locations
- Site Boundary

| | | | |
|---|---|---|---|
| CLIENT: Introba | | SIZE: A4 | TITLE: Site Plan |
| Adnitt Acoustics<br>Renaissance House<br>32 Upper High Street<br>Epsom<br>Surrey, KT17 4QJ<br>Tel: 020 7099 9735<br>Fax: 0845 127 5121 | | | |
| DATE: 31/05/2024 | CHECKED: RA | PROJECT: E24030 | |
| DRAWN: JS | APPROVED: RA | SCALE: 1:1200 | |
| © Google 2024 | | DRAWING: E24030/240531/SP1 | REV: - |

## Figure E24030 / TH 1 : Time History of Automated Measurements at Position 1



## Figure E24030/ TH 2 : Time History of Automated Measurements at Position 2