

**Proposed Installation of
Mechanical Plant**

**52 Redington Road
London, NW3 7RS**

Environmental Noise Assessment



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| Proposed Installation of Mechanical Plant | |
|---|---|
| Project Address: | 52 Redington Road Hampstead London NW3 7RS |
| Project Reference: | 103707 |

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|-----------|---|-------------|----------------------|------------|
| Author: |  | Andy Dodd | Senior Consultant | 17/12/2018 |
| Reviewer: |  | Phil Huffer | Principal Consultant | 17/12/2018 |

1. INTRODUCTION

- 1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients. APL is a registered member of The Association of Noise Consultants (ANC) and the author is a corporate member of The Institute of Acoustics (IOA).
- 1.2 APL has been instructed by the applicant's architect, Robert Hirschfield Architects, to consider and advise upon the noise implications of the proposed installation of a climate control system. The climate control system will consist of 2No. external condenser units located in the rear garden of the property.
- 1.3 It is understood the Local Planning Authority (LPA) require further information on noise levels from the proposed installation in order to fully assess the noise impact upon the surrounding neighbourhood. This report provides the response to the LPA, on behalf of the Applicant.
- 1.4 This report has been prepared by Acoustics Plus Limited (APL) with all reasonable skill, care, and diligence in accordance with generally accepted acoustic consultancy principles and taking account the services and terms agreed between APL and our client.
- 1.5 Any information provided by third-parties and referred to herein may not have been checked or verified by APL unless expressly stated otherwise. Certain statements made in the report are predictions based on reasonable assumptions and good industry practice.
- 1.6 Such statements involve risk and uncertainty which could cause measured and predicted results to differ materially. APL does therefore not guarantee or warrant any prediction contained in this report.

2. BASELINE SITUATION

- 2.1 The Application Site (the “site”) is situated at 52 Redington Road. The site is a detached house on the eastern side of Redington Road in Hampstead. The rear garden is relatively level. The property comprises a single family house consisting of basement, ground floor, first floor and second floor. It is intended to refurbish the existing property as a family house.
- 2.2 As part of the refurbishment it is the intention to install a mechanical climate control system which will require the siting of external condenser units in the rear garden.
- 2.3 The external condenser units associated with the climate control system will be located within acoustic enclosures at the end of the rear garden (as highlighted). The proposed location of the units can be seen in Diagram 1 below.

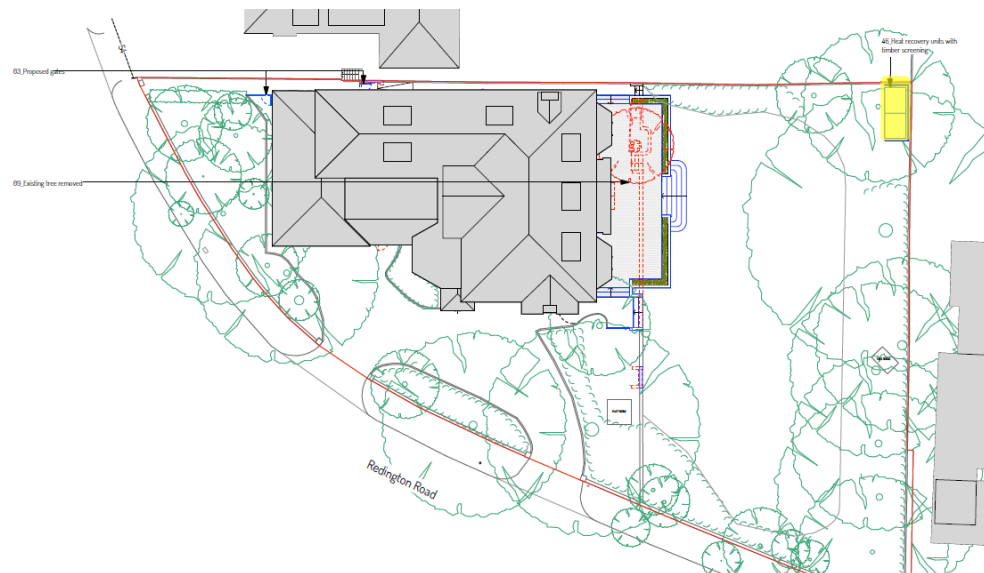


Diagram 1

- 2.4 The nearest noise sensitive façade to the condenser enclosure belongs to the rear windows of the property located at 50 Redington Road (see Figure 1). The distance from the nearest noise sensitive façade to the location of the proposed condenser units was determined from scaled drawings and determined to be approximately 12m.
- 2.5 For the purposes of this report it has been assumed that the acoustic enclosures will be proprietary as manufactured and supplied by Environ. Alternative proprietary acoustic enclosures are available from a number of suppliers and tend to have similar acoustic transmissibility due to the ventilation requirements.

3. NOISE OUTLINE

- 3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise in the locality of the installation.
- 3.2 Measurements of background noise were obtained over a 24 hour period at a location deemed representative of background noise levels experienced at the nearest noise sensitive façade. The data obtained during the exercise was captured at ground floor level at the rear of the property, adjacent to the noise sensitive façade.
- 3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date: 30th – 31st October 2018
Start Time: 12:00 hrs
Location: rear garden level

Weather conditions

| Date | Wind speed | Precipitation | Temperature |
|----------|------------|---------------|-------------|
| 30/10/18 | 11km/h | 0.0mm | 9 °C |
| 31/10/18 | 7km/h | 0.0mm | 8 °C |

- 3.4 Minimum background and average noise levels are shown in Table 1 below with the full 24 hour level vs time history shown in Diagram 2 (L_{Aeq} and L_{A90}).

| Time period | Lowest $L_{A90,15min}$ | Average $L_{Aeq,T}$ |
|----------------|------------------------|---------------------|
| 07:00-23:00hrs | 33 | 52 |
| 23:00-07:00hrs | 28 | 37 |

Table 1

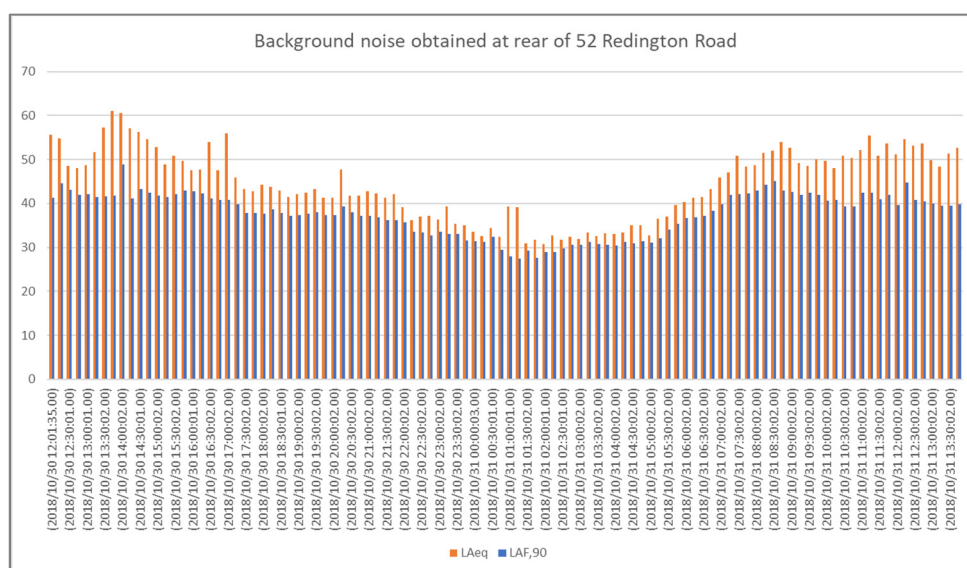


Diagram 2

4. DESIGN CRITERIA

- 4.1 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the LPA (London Borough of Camden) Local Plan Adopted version June 2017 (Appendix 3 Noise thresholds).

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).

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

| 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 LAmax | 'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax | 'Rating level' greater than 5dB above background and/or events exceeding 88dB LAmax |

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

4.2 The procedure contained in BS4142 is to quantify the “specific sound level”, which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

4.3 The procedure contained in BS4142 is to quantify the “specific sound level”, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

4.4 The specific sound level is converted to a rating level by adding penalties to account for either tonality or impulsivity. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

4.5 The penalty for tonal elements is between 0dB and 6dB, and the standard notes:

“Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.”

4.6 The penalty for impulsive elements is between 0dB and 9dB, and the standard notes:

“Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.”

4.7 The background sound level should be established in terms of the LA90 noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15 minute intervals. The standard states that:

“A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.”

4.8 And goes on to note:

“In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.

Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes. Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods.”

4.9 The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. 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.
- Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

4.10 The standard also notes that:

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

4.11 In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

4.12 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram can be seen in Diagram 3. The quieter more noise sensitive night period has been considered.

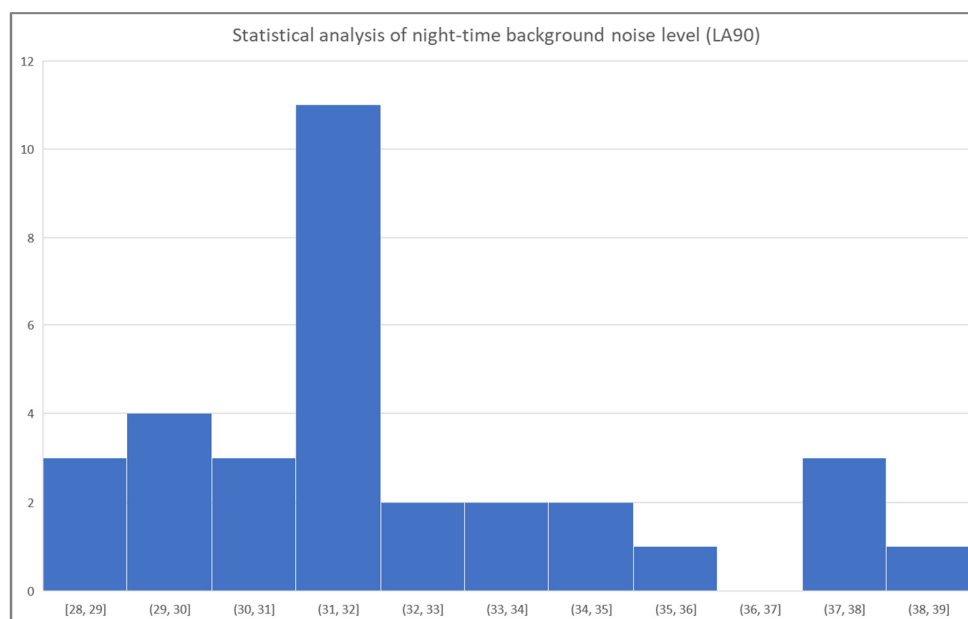


Diagram 3

- 4.13 The background noise levels vary significantly during the night period. The most commonly occurring background noise level during the night time period was 31dB $L_{A90,15min}$. Given the condenser unit could provide heating or cooling during the night period, in this instance it is considered that a representative background sound level of 31dB L_{A90} is deemed appropriate for the assessment.
- 4.14 The plant noise emission criteria that should not be exceeded is therefore based on Table 1 and is shown in Table 2 below. This level should not be exceeded at the nearest noise sensitive façade and is indicative of being 10dB less than the considered measured background noise. At such a level, there is an indication that the specific sound source will have a low impact.

| Noise emission limit for mechanical plant |
|---|
| $L_{Aeq} \leq 21dB$ |

Table 2

- 4.15 The condenser units that are proposed to be installed are listed below (data sheet provided in Appendix A):
- 2 No. Daikin REYQ12T

5. EQUIPMENT

- 5.1 All background noise measurements were obtained using the following equipment:
- Norsonic NOR140 Class 1 Serial No. 1403466
 - Rion Calibrator Type NC-74 Class 1 Serial No. 00410215
- 5.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

6. CALCULATIONS

- 6.1 A prediction exercise was undertaken. The calculation exercise utilised information provided by equipment manufacturers. As it is proposed to locate the external condenser units within acoustic enclosures, an Environ selection matrix was utilised to predict the noise output from the condensers following attenuation by the enclosure. The matrix is shown in Appendix A.
- 6.1 In order to predict the noise impact of the operation of the condenser, consideration has been given to noise egress to the nearest noise sensitive façade.
- 6.2 In considering the propagation of noise from the condensers, consideration was given to point source propagation and attenuation provided by the acoustic enclosures.
- 6.3 Noise leaving the condenser units was propagated over 12m to the nearest noise sensitive façade.
- 6.4 The following corrections were accounted for to determine a rating level:

| Results | Correction | Relevant clause | Commentary |
|------------------------------|------------|-----------------|---|
| On time correction | -3dB | 7.3.14 | The condenser is likely to switch on and off as required on a demand for heating/cooling basis. The condenser is assumed to be operating for half the 15min assessment period overnight |
| Acoustic feature corrections | +2dB | 9.2 | Just perceptible tonality |
| | +3dB | 9.2 | Just perceptible impulsivity |

Table 3

- 6.5 The calculation exercise is shown in Table 4.

| Calculation steps | L _p dBA |
|--|--------------------|
| 2no. Daikin REYQ12T units within acoustic enclosures | 44 |
| Distance attenuation | -22 |
| BS4142 corrections | +2 |
| TOTAL noise at nearest noise sensitive façade | 24dBA |

Table 4

- 6.6 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 21 dBA at 1m from the nearest noise sensitive façade.
- 6.7 The calculated noise impact is 24dBA. The calculation exercise (Table 4) demonstrates that the proposed installation does not meet the LPA criteria.

7. CONCLUSION & MITIGATION MEASURES

- 7.1 The foregoing assessment indicates that the proposed installation will not meet the requirements imposed by the LPA. Additional mitigation measures will be required.
- 7.2 The Daikin REYQ12T has a quieter set back mode than enables the unit to run at approximately 5dB lower, so would have a noise output of 36dBA rather than the published noise output of 41dBA.
- 7.3 In order to predict the noise impact of the operation of the condensers in set back mode (during the hours of 00:00 and 05:00 when demand from the units will be minimal), consideration has been given to noise egress to the nearest noise sensitive façade.
- 7.4 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram during the set back hours can be seen in Diagram 4.

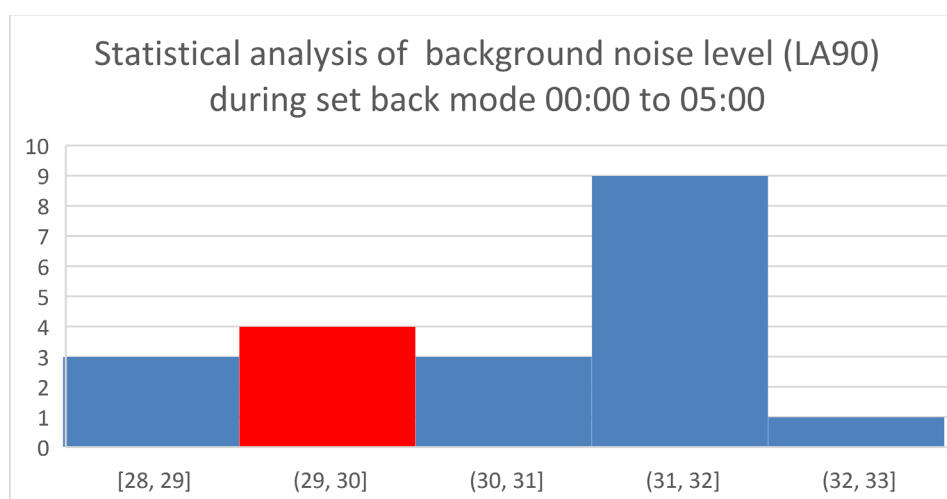


Diagram 4

- 7.5 Given the units could provide heating or cooling during the set back period, in this instance it is considered that a representative background sound level of 29dB LA90 is deemed appropriate for the assessment.
- 7.6 The plant noise emission criteria that should not be exceeded is shown in Table 5 below. This level should not be exceeded at the nearest noise sensitive façade and is indicative of being 10dB less than the considered measured background noise during the set back mode. At such a level, there is an indication that the specific sound source will have a low impact.

| Noise emission limit for mechanical plant |
|---|
| $L_{Aeq} \leq 19\text{dB}$ |

Table 5

- 7.7 In considering the propagation of noise from the condensers, consideration was given to point source propagation and attenuation provided by the acoustic enclosures.
- 7.8 Noise leaving the condenser units was propagated over 12m to the nearest noise sensitive façade.
- 7.9 The following corrections were accounted for to determine a rating level:

| Results | Correction | Relevant clause | Commentary |
|------------------------------|------------|-----------------|---|
| On time correction | -3dB | 7.3.14 | The condenser is likely to switch on and off as required on a demand for heating/cooling basis. The condenser is assumed to be operating for half the 15min assessment period overnight |
| Acoustic feature corrections | +2dB | 9.2 | Just perceptible tonality |
| | +3dB | 9.2 | Just perceptible impulsivity |

Table 6

- 7.10 The calculation exercise is shown in Table 4.

| Calculation steps | L_p dBA |
|--|-----------|
| 2no. Daikin REYQ12T units within acoustic enclosures (set back mode) | 39 |
| Distance attenuation | -22 |
| BS4142 corrections | +2 |
| TOTAL noise at nearest noise sensitive façade | 19dBA |

Table 7

- 7.11 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 19 dBA at 1m from the nearest noise sensitive façade.
- 7.12 The calculated noise impact is 19dBA. The calculation exercise (Table 7) demonstrates that the proposed installation meets the LPA criteria.
- 7.13 The calculation exercises are based on the use of an acoustic enclosures supplied by Environ. The transmission loss of the Environ enclosure has been provided by the manufacturer in their selection matrix which is enclosed in Appendix A.

Figures

Rear of 52 Redington Road, London, NW3 and surrounding neighbours



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8

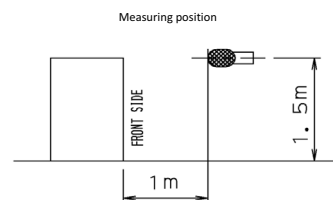
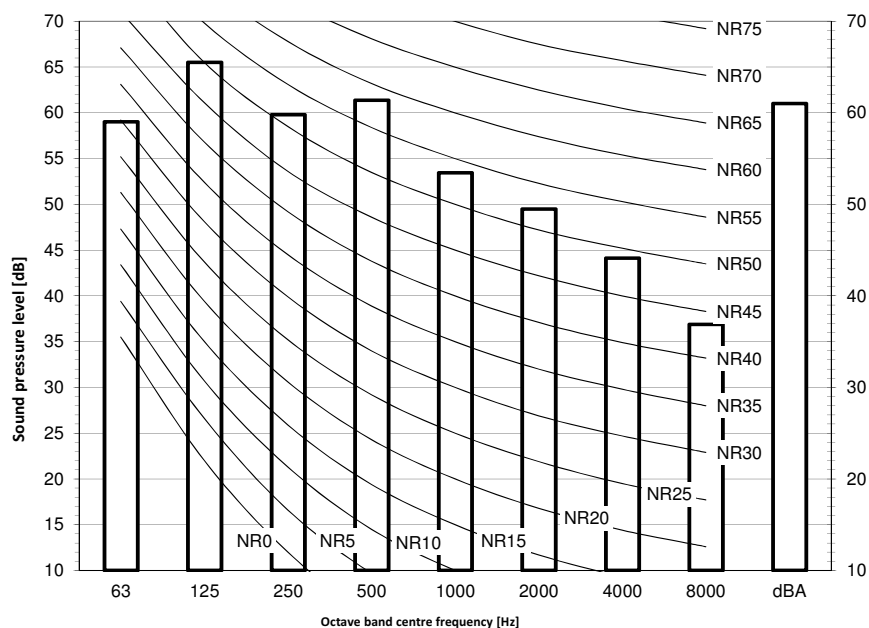
Appendix A

11 Sound data

11 - 2 Sound Pressure Spectrum

11

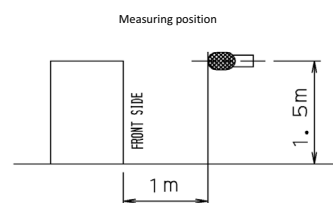
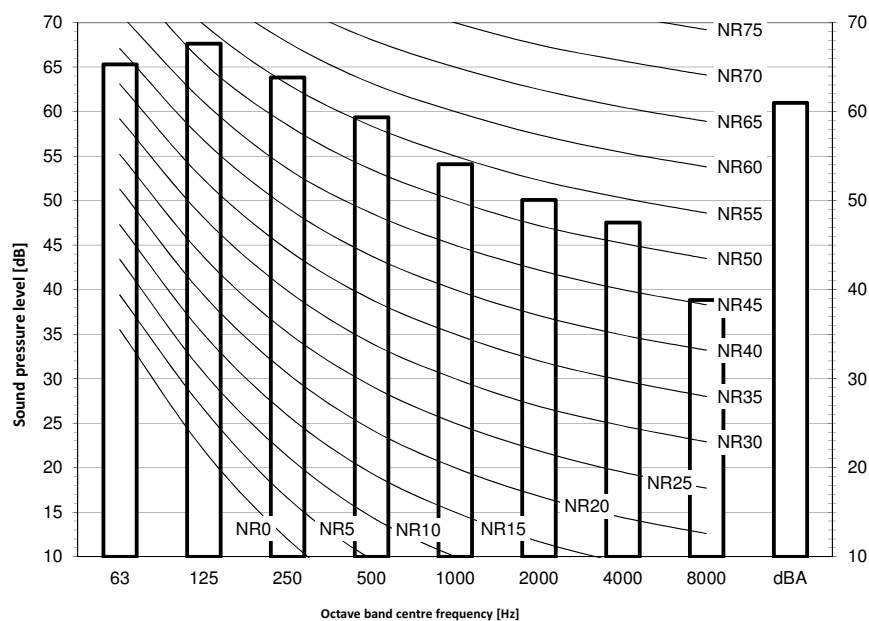
REYQ12T



- Notes :
1. Data is valid at free field condition.
 2. Data is valid at nominal operation condition.
 3. dBA = A-weighted sound pressure level (A scale according to IEC).
 4. Reference acoustic pressure 0 dB = 20 μ Pa

3D079903B

REYQ14T



- Notes :
1. Data is valid at free field condition.
 2. Data is valid at nominal operation condition.
 3. dBA = A-weighted sound pressure level (A scale according to IEC).
 4. Reference acoustic pressure 0 dB = 20 μ Pa

3D079904B

SELECTION MATRIX

environmodula 2.2.25AC DVRV4 S2

25 November 2015

Acoustic enclosures for Daikin VRV IV Applications

| CUSTOMER: | SITE / LOCATION / REFERENCE |
|-----------|-----------------------------|
| | |

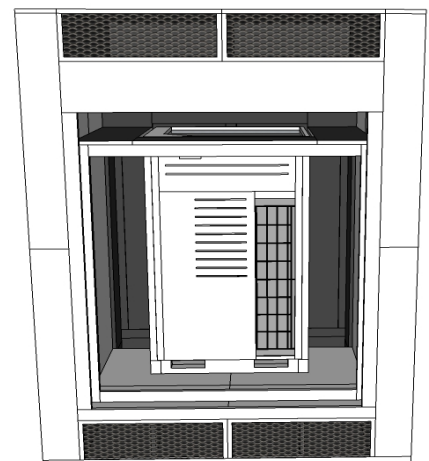
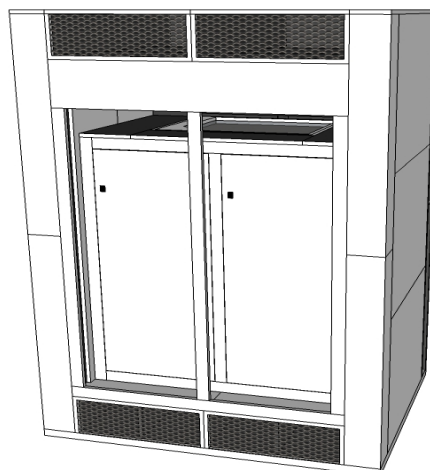
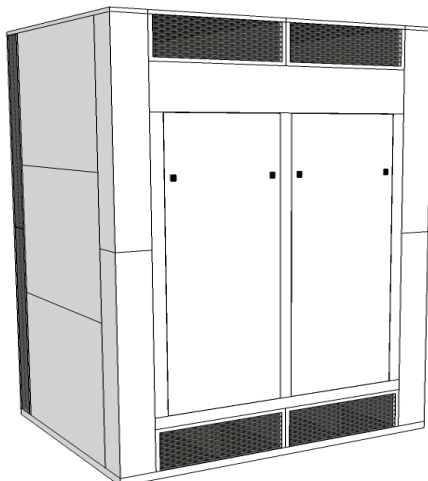
| ORIGINAL EQUIPMENT MANUFACTURERS PUBLISHED DATA | | | | | |
|---|------------|-------------|---|-------------|--------------|
| MAKE, MODEL, DIMENSIONS, AIR FLOW & SOUND PRESSURE LEVEL @1.0M FREE FIELD | | | | | |
| MAKE: | | MODEL: | | AIR IN | AIR OUT |
| Daikin | | REYQ12T | | H - 4 Sides | V |
| WIDTH (MM) | DEPTH (MM) | HEIGHT (MM) | AIRFLOW (M ³ S ⁻¹) | SPL dB(A) | DISTANCE (M) |
| 930 | 765 | 1685 | 3.08 | 61 | 1 |

| INNER CUBE DIMENSIONS | | | ENCLOSURE DETAIL | | |
|---|--------------|-------------|---|----------------------------|---------------------------|
| 1600 | 1100 | 2525 | 2000 | 1650 | 3100 |
| WIDTH (MM) | DEPTH (MM) | HEIGHT (MM) | WIDTH (MM) | DEPTH (MM) | HEIGHT (MM) |
| 3.08 | 1.0 | 61 | 3.08 | 1.0 | 35-41 |
| AIRFLOW (M ³ S ⁻¹) | DISTANCE (M) | SPL dB(A) | AIRFLOW (M ³ S ⁻¹) | DISTANCE (M) | SPL dB(A) |
| | | | | | |
| INLET AIRWAYS | | | DESIGN CRITERIA | | |
| 1600 | 250 | 2 | OK | OK | OK |
| WIDTH (MM) | HEIGHT (MM) | NO. | UNIT SIZE | OUTLET | INLET |
| | | | | | |
| OUTLET AIRWAYS | | | AIRFLOW INFORMATION | | |
| 150 | 3075 | 2 | 18 | 3.3 | 3.9 |
| WIDTH (MM) | HEIGHT (MM) | NO. | PD (NM ⁻²) | OUTLET (MS ⁻¹) | INLET (MS ⁻¹) |
| | | | | | |

Select Inlet & Outlet Duct Sizes to Ensure Airflows are kept Below 6.0m/s

| ENCLOSURE INFORMATION | | | WIDTH (MM) | DEPTH (MM) | HEIGHT (MM) |
|---|--|--|------------|--------------------------|-------------|
| INLET AIRWAY | | | 1600 | | 250 |
| OUTLET AIRWAY | | | 150 | | 3075 |
| EXTERNAL SIZE | | | 2000 | 1650 | 3150 |
| INDICATIVE SOUND LEVEL RANGE@ 1.0m (Free Field) | | | 35-41 | SPL dB(A) SOUND PRESSURE | |

NOTES CONCERNING ENCLOSURE DESIGN



Environ acoustic designs are protected under patent

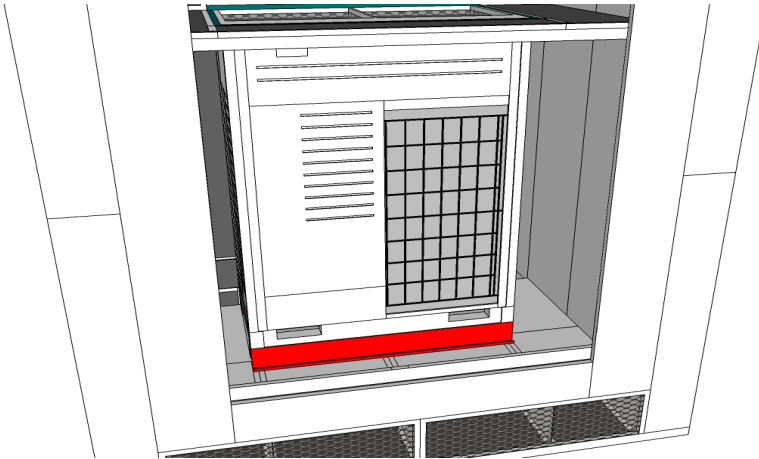
The information contained in this Selection Matrix is Confidential and shall not be disclosed or used for any unauthorised purposes

SELECTION MATRIX

environmodula 2.2.25AC DVRV4 S2

Acoustic enclosures for Daikin VRV IV Applications

25 November 2015



Service/Maintenance Access

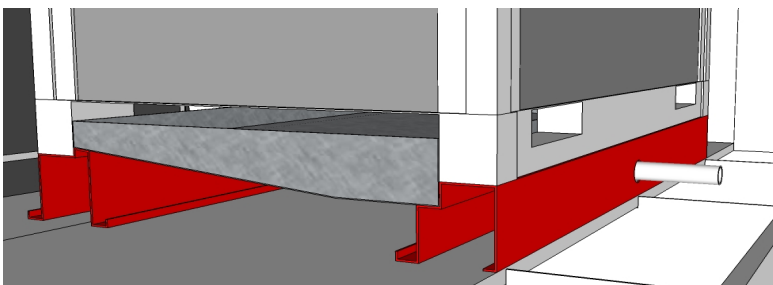
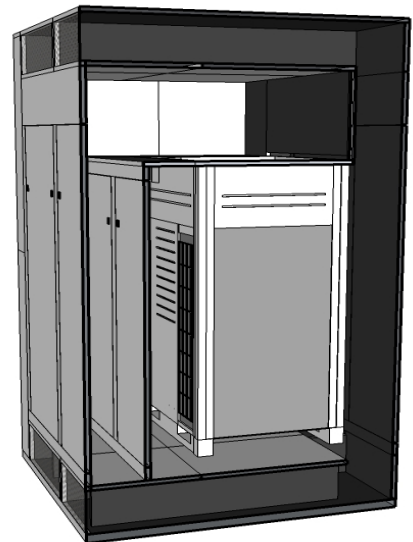
Front Elevation via lift off security doors

Patented Acoustic Design

Internal plenums maintain fully separated air flow within the enclosure

Ambient **Air In** via the 2# horizontal ducts to the front elevation

Air Discharge via the 2# vertical discharge ducts the RH & LH Rear/Sides



Options

Condensate drain tray & Fittings

Drain Pan Heater

Anti Vibration Mounts

Environ acoustic designs are protected under patent

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