Consultants in Noise and Vibration

Acoustic Consultancy Report
4336-ENV-ATN-1

Report on: 20 South Villas, London, N1 9BT

Client: Absolute Project Management

14th February 2019

Analysis of Condenser Noise to Residential Property

Report prepared by:

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1 Introduction

Sound Analysis Ltd was appointed to calculate the airborne noise transmitted from the proposed Daikin Condenser Model RXG50L unit to atmosphere, at 20 South Villas, London, N1 9BT

2 General Arrangement

The Condenser Unit is to be located at Ground Floor Level as shown in the Drawing in Appendix B

3 Analysis Method.

The Sound Pressure level data provided was used to calculate the resultant noise level at the nearest residential property at a distance of 5m from the proposed Daikin Unit location

4 Background Noise Survey

In order to produce a design target, background noise measurements were taken from 10:55 hrs on 4th February 30th to 09:21 hrs on 10th February 2019 the full results of which are in Appendix D

Equipment

- Svantek 959 Sound Level Meter S/N:11259
- Svantek pre-amplifier SV12L S/N: 11484 with GRAS microphone capsule 40AE S/N: 82239

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10890 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

The general background noise was due to local traffic, the weather report is in Appendix E

The measurement periods were considered sufficient to establish the highest noise levels impinging upon the façade, allowing internal levels to be used to appraise future noise levels..

5 Measurement Results

The lowest background levels measured over the period of measurement are as show in the following table.

Location	Lowest Measured Background Noise Level – LA90		
	Day Time	Evening	Night Time
Outside	40dB	36dB	31dB

6 Design Target

Local Council requirements would normally call for the design level to be at least 5dB below the measured lowest background level.

This results in the following design noise levels.

Location	Design Target Noise Level – LAeq		
	Day Time	Evening	Night Time
Outside Unit 17	35dB	31dB	26dB

7 Data Provided.

Drawing No: 415-20-NW19BS-P02.2 has been used in our analysis, together with the Daikin Sound Data confirmed in Appendix A

8 Conclusion.

The noise emitted from the Daikin Unit at the nearest residential property at a distance of 5m from the unit is calculated as 37dB(A) for Night Time operation and 40dB(A) for Day and Evening operation.

In both cases these noise levels are not compliant with the Design Target.

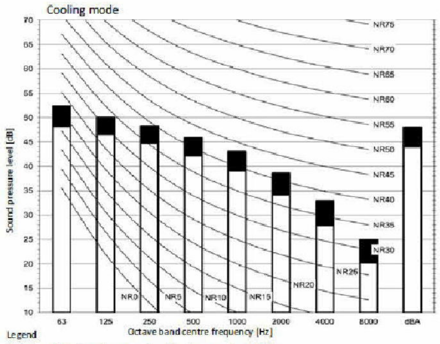
The DAIKIN unit will need to be enclosed with air inlet and outlet routed via Acoustic Louvres which should have the following minimum insertion loss.

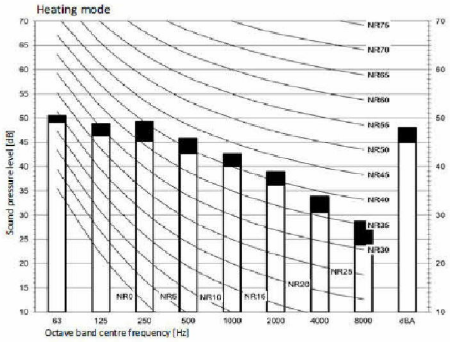
The noise emanating from the unit will then be compliant with the Design Target.

	Sound Insertion Loss for Acoustic Louvres								
	63	125	250	500	1k	2k	4k	8k	Hz
Insertion Loss	5	5	5	8	14	18	14	12	dB

Appendix A: Sound Data provided

RXG50L





Legend

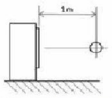
dBA = A-weighted sound pressure level (A scale according to IEC).

A Scale

B ■ High-tap

□ Low-tap

Location of microphone



The operation noise measuring method is in accordance with JISC9612.

Measuring location: anechoic chamber

Cooling Total dB

A	B
dBA	48

Background noise already taken into account.

Operating conditions: power source 220-240 V/220 V 50/60 Hz; JIS standard

Heating Total dB

A	B
dBA	48

Background noise already taken into account.

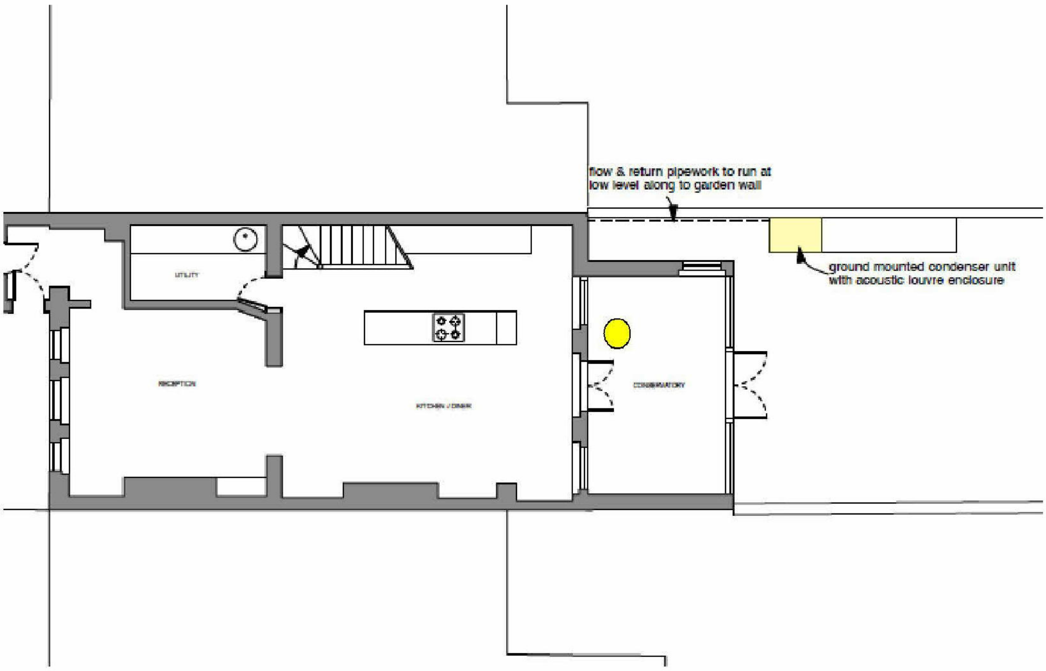
Operating conditions: power source 220-240 V/220 V 50/60 Hz; JIS standard

Notes

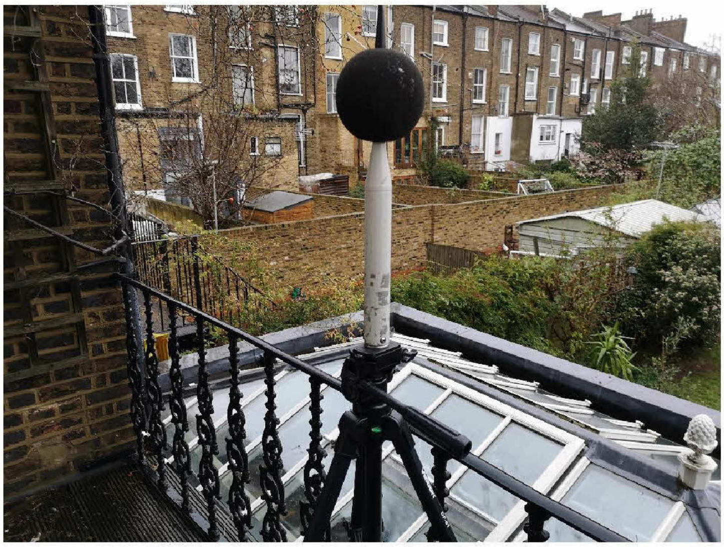
Operating noise varies depending on operation and ambient conditions.

Daytime Noise Level 48dB(A) and Night time noise level 45dB(A) at 2m from the unit.

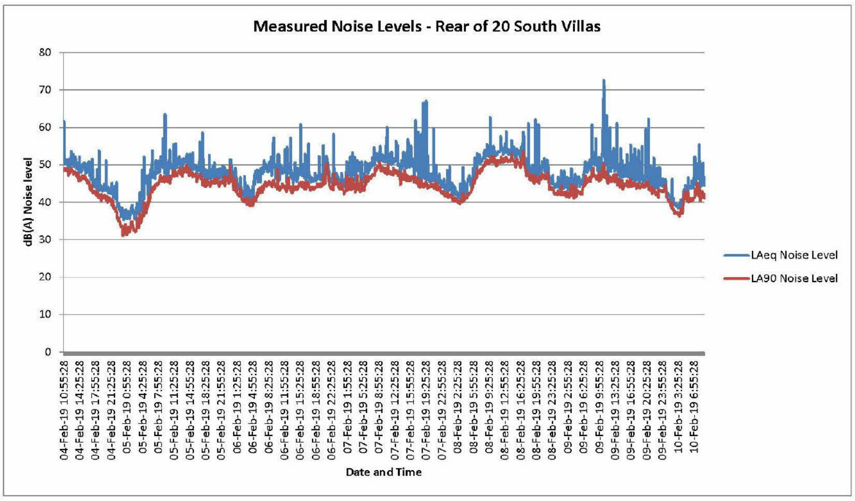
Appendix B: Layout Drawing



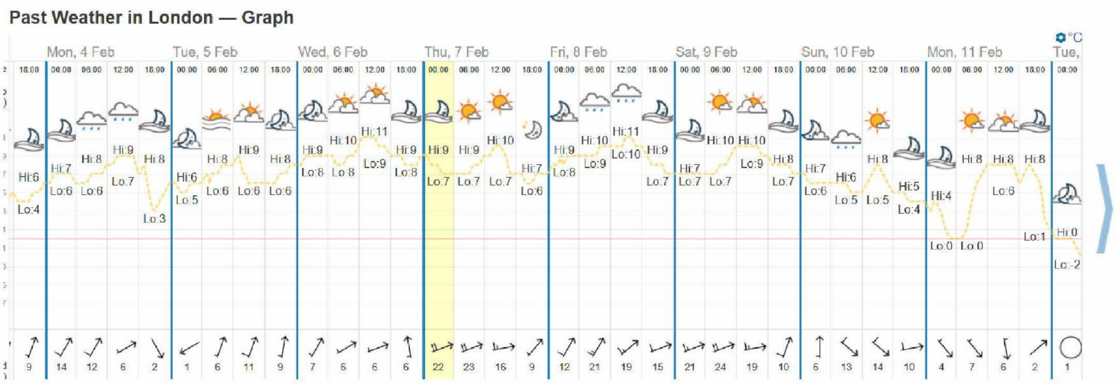
Appendix C: Measuring Position



Appendix D: Measured Background Noise Levels



Appendix E: Weather Report



Appendix F: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

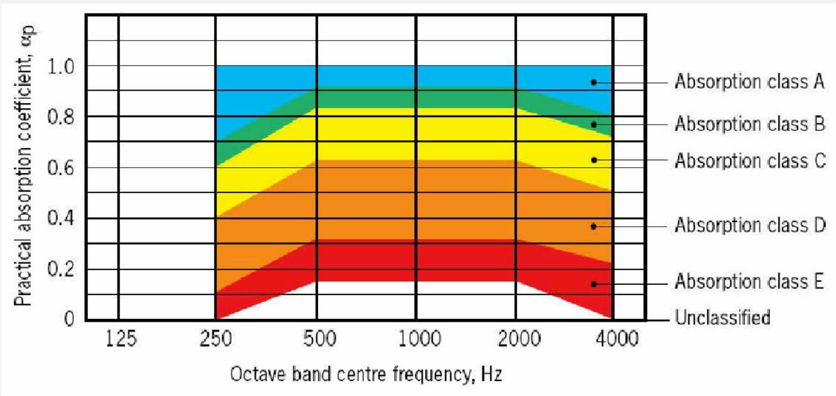
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB

D_{nTw}+C_{tr}

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw}.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90,T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq,T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

A basic example to illustrate the assessment of difference in noise levels follows.

A background noise survey is undertaken that yields a lowest background noise level of L_{A90} 30 dB.

As the existing background noise level is low, a rating level for new plant noise of $L_{Aeq,\,T}$ 30 dB is set.

After calculation, the plant noise is predicted to achieve $L_{Aeq,T}$ 30 dB at the nearest residential property.

After the addition of the plant predicted noise level (or Rating Level), the new overall ambient noise level will be 33 dB. The background noise level measured originally will therefore be increased by 3 dB. In terms of the subjective impression of an increase of this order, the change in levels will be 'just perceptible'.

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.