Capital Noise
Acoustic Consultants

Noise Assessment

Report

3-Space UK Limited

A report giving an assessment of the noise impact of two proposed condenser units at
21 Farringdon Road, London, EC1M 3HA

Assessment dates: 5-6 September 2018

Prepared for 3-Space UK Ltd.

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1 Introduction

It is proposed to install two air conditioning condenser units on the roof of 21 Farringdon Road, London, EC1M 3HA. This report assesses the noise impact of the units.

2 Specification of the condenser units

There would be two units:

Daikin RXYSQ5T8V mini-VRB Condensing Unit. This would run for 24 hours a day and would emit a sound pressure level of 51 dB $L_{Aeq,T}$ at 1.0 m. When the unit is in operation the sound emitted is constant and so it is assumed that it would emit a sound pressure level of 51 dB $L_{A90,T}$ at 1.0 m.

Daikin RZQSG71L3V1 split condensing unit. This would run for during office hours only and would emit a sound pressure level of 49 dB $L_{Aeq,T}$ at 1.0 m. When the unit is in operation the sound emitted is constant and so it is assumed that it would emit a sound pressure level of 49 dB $L_{A90,T}$ at 1.0 m.

3 Measurement of the existing sound levels

The existing sound levels were measured on the roof of the building over a 24 hour period.

The ambient level during the day was 63 dB $L_{Aeq\ (16\ hours)}$ and the background sound level during the day was 59 dB $L_{A90,(16\ hours}$.

The ambient level during the night was 59 dB $L_{Aeq\ (8\ hours)}$ and the background sound level during the night was 51 dB $L_{A90,(8\ hours}$.

See Appendix I on page 2.

4 Assessment of the future sound levels

For the full calculations see Appendix II on page 3.

4.1 Assessment of the future ambient sound pressure level

During the day the units would not increase the existing ambient sound at a distance of 1.0 m and would be inaudible at a distance of 1.8 m.

During the night the units would not increase the existing ambient sound at a distance of 1.3 m and would be inaudible at a distance of 2.3 m.

4.2 Assessment of the future background sound pressure level

During the day the unit would not increase the existing background sound at a distance of 1.6 m and would be inaudible at a distance of 2.9 m.

During the night the unit would not increase the existing background sound at a distance of 3.2 m and would be inaudible at a distance of 5.7 m.

Appendix I: 24 hour sound monitoring survey results

The following results were obtained over a 24 hour perio Wednesday 5 September 2018 - Thursday 6 Septembrr 2018:

Time	Measured sound pressure levels	
	Ambient sound levels $L_{Aeq\ (1\ hour)}$	Background sound levels $L_{A90,(1\ hour)}$
	dB	dB
2:00 pm - 3:00 pm	61	58
3:00 pm - 4:00 pm	60	58
4:00 pm - 5:00 pm	63	60
5:00 pm - 6:00 pm	62	59
6:00 pm - 7:00 pm	61	58
7:00 pm - 8:00 pm	61	57
8:00 pm - 9:00 pm	60	57
9:00 pm - 10:00 pm	60	56
10:00 pm - 11:00 pm	59	54
11:00 pm - 12:00 am	55	48
12:00 am - 1:00 am	52	45
1:00 am - 2:00 am	52	44
2:00 am - 3:00 am	50	44
3:00 am - 4:00 am	51	44
4:00 am - 5:00 am	56	44
5:00 am - 6:00 am	57	51
6:00 am - 7:00 am	67	59
7:00 am - 8:00 am	66	57
8:00 am - 9:00 am	67	60
9:00 am - 10:00 am	67	61
10:00 am - 11:00 am	64	59
11:00 am - 12:00 pm	62	59
12:00 pm - 1:00 pm	64	61
1:00 pm- 2:00 pm .	63	60

The ambient level during the day was 63 dB $L_{Aeq\ (16\ hours)}$ and the background sound level during the day was 59 dB $L_{A90,(16\ hours}$.

The ambient level during the night was 59 dB $L_{Aeq\ (8\ hours)}$ and the background sound level during the night was 51 dB $L_{A90,(8\ hours}$.

Appendix II: Calculation of predicted sound pressure levels

The future ambient sound pressure levels are from the manufacturer of the condensing units. These are assumed to be equal to the background sound pressure levels. There would be two units:

Daikin RXYSQ5T8V mini-VRB Condensing Unit. This would run for 24 hours a day and would emit a sound pressure level of 51 dB $L_{Aeq,T}$ at 1.0 m. When the unit is in operation the sound emitted is constant and so it is assumed that it would emit a sound pressure level of 51 dB $L_{A90,T}$ at 1.0 m.

Daikin RZQSG71L3V1 split condensing unit. This would run for during office hours only and would emit a sound pressure level of 49 dB $L_{Aeq,T}$ at 1.0 m. When the unit is in operation the sound emitted is constant and so it is assumed that it would emit a sound pressure level of 49 dB $L_{A90,T}$ at 1.0 m.

Ambient Sound Pressure Levels during the day

Distance from the new condensing units	1.0 m	1.8 m
Future ambient sound pressure level at 1.0 for the Daikin RXYSQ5T8V mini-VRB Condensing Unit	51 dB $L_{Aeq,(16\ hours)}$	51 dB $L_{Aeq,(16\ hours)}$
Add the future ambient sound pressure level at 1.0 for the Daikin RZQSG71L3V1 split condensing unit	49 dB $L_{Aeq,(16\ hours)}$	49 dB $L_{Aeq,(16\ hours)}$
Total future ambient sound pressure level due to the two new units at 1.0 m	53 dB $L_{Aeq,(16\ hours)}$	53 dB $L_{Aeq,(16\ hours)}$
Deduct reduction in sound for distance	0 dB	5 dB
Total future ambient sound pressure level due to the two new units at the distance under consideration	53 dB $L_{Aeq,(16\ hours)}$	48 dB $L_{Aeq,(16\ hours)}$
Add the existing measured ambient pressure level	63 dB $L_{Aeq,(16\ hours)}$	63 dB $L_{Aeq,(16\ hours)}$
Total future ambient sound pressure level due to the new and existing units at the distance under consideration	63 dB $L_{Aeq,(16\ hours)}$	63 dB $L_{Aeq,(16\ hours)}$
Difference between the existing total (or due to the new condensers alone) and future ambient sound pressure levels	0 dB $L_{Aeq,(16\ hours)}$	(-15 dB $L_{Aeq,(16\ hours)}$)
Remarks	The future ambient sound pressure level does not exceed the existing ambient sound pressure level at this distance	The new condenser units would be completely inaudible at this distance

Ambient Sound Pressure Levels during the night

Distance from the new condensing units	1.0 m	1.26 m	2.3 m
Future ambient sound pressure level at 1.0 for the Daikin RXYSQ5T8V mini-VRB Condensing Unit	51 dB $L_{Aeq,(8\ hours)}$	51 dB $L_{Aeq,(8\ hours)}$	51 dB $L_{Aeq,(8\ hours)}$
Deduct reduction in sound for distance . .	0 dB	2 dB	7 dB
Total future ambient sound pressure level due to the two new units at the distance under consideration	51 dB $L_{Aeq,(8\ hours)}$	49 dB $L_{Aeq,(8\ hours)}$	44 dB $L_{Aeq,(8\ hours)}$
Add the existing measured ambient pressure level	59 dB $L_{Aeq,(8\ hours)}$	59 dB $L_{Aeq,(8\ hours)}$	59 dB $L_{Aeq,(8\ hours)}$
Total future ambient sound pressure level due to the new and existing units at the distance under consideration	60 dB $L_{Aeq,(8\ hours)}$	59 dB $L_{Aeq,(8\ hours)}$	59 dB $L_{Aeq,(8\ hours)}$
Difference between the existing total (or due to the new condensers alone) and future ambient sound pressure levels	1 dB $L_{Aeq,(8\ hours)}$	0 dB $L_{Aeq,(8\ hours)}$	(-15 dB $L_{Aeq,(8\ hours)}$)
Remarks	The future background sound pressure level exceeds the existing background sound pressure level at this distance	The future ambient sound pressure level does not exceed the existing ambient sound pressure level at this distance	The new condenser unit would be completely inaudible at this distance

Background Sound Pressure Levels during the day

Distance from the new condensing units	1.0 m	1.6 m	2.9 m
Future background sound pressure level at 1.0 for the Daikin RXYSQ5T8V mini-VRB Condensing Unit	51 dB $L_{A90,(16\ hours)}$	51 dB $L_{A90,(16\ hours)}$	51 dB $L_{A90,(16\ hours)}$
Add the future background sound pressure level at 1.0 for the Daikin RZQSG71L3V1 split condensing unit	49 dB $L_{A90,(16\ hours)}$	49 dB $L_{A90,(16\ hours)}$	49 dB $L_{A90,(16\ hours)}$
Total future background sound pressure level due to the two new units at 1.0 m . .	53 dB $L_{A90,(16\ hours)}$	53 dB $L_{A90,(16\ hours)}$	53 dB $L_{A90,(16\ hours)}$
Deduct reduction in sound for distance .	0 dB	4 dB	9 dB
Total future background sound pressure level due to the two new units at the distance under consideration	53 dB $L_{A90,(16\ hours)}$	49 dB $L_{A90,(16\ hours)}$	44 dB $L_{A90,(16\ hours)}$
Add the existing measured background pressure level	59 dB $L_{A90,(16\ hours)}$	59 dB $L_{A90,(16\ hours)}$	59 dB $L_{A90,(16\ hours)}$
Total future background sound pressure level due to the new and existing units at the distance under consideration	60 dB $L_{A90,(16\ hours)}$	59 dB $L_{A90,(16\ hours)}$	59 dB $L_{A90,(16\ hours)}$
Difference between the existing total (or due to the new condenser alone) and future background sound pressure levels	1 dB $L_{A90,(16\ hours)}$	0 dB $L_{A90,(16\ hours)}$	(-15 dB $L_{A90,(16\ hours)}$)
Remarks	The future background sound pressure level exceeds the existing background sound pressure level at this distance	The future background sound pressure level does not exceed the existing background sound pressure level at this distance	The new condenser units would be completely inaudible at this distance

Background Sound Pressure Levels during the night

Distance from the new condensing units	1.0 m	3.2 m	5.7 m
Future background sound pressure level at 1.0 for the Daikin RXYSQ5T8V mini-VRB Condensing Unit	51 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$
Deduct reduction in sound for distance	0 dB	10 dB	15 dB
Total future background sound pressure level due to the new unit at the distance under consideration	51 dB $L_{A90,(8\ hours)}$	41 dB $L_{A90,(8\ hours)}$	36 dB $L_{A90,(8\ hours)}$
Add the existing measured background pressure level	51 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$
Total future background sound pressure level due to the new and existing units at the distance under consideration	54 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$	51 dB $L_{A90,(8\ hours)}$
Difference between the existing total (or due to the new condenser alone) and future background sound pressure levels	3 dB $L_{A90,(8\ hours)}$	0 dB $L_{A90,(8\ hours)}$	(-15 dB $L_{A90,(8\ hours)}$)
Remarks	The future background sound pressure level exceeds the existing background sound pressure level at this distance	The future background sound pressure level does not exceed the existing background sound pressure level at this distance	The new condenser unit would be completely inaudible at this distance

Appendix III: Derivation of the equation predicting the reduction of sound with distance

Consider the case of sound radiating spherically. The sound intensity decreases with the square of the distance from the source.

I is proportional to $\frac{1}{r^2}$

where I is sound intensity &
r is the distance from source to receiver.

$$\frac{I_r}{I_R} = \frac{R^2}{r^2}$$

where I_r = intensity at a distance r from the source & I_R = intensity at a distance R from the source.

If L_r = sound pressure level in decibels at distance r from the source, then, for spherical radiation:

$$L_r - L_R = 10 \log_{10} \frac{I_r}{I_R}$$
$$= 10 \log_{10} \frac{R^2}{r^2}$$
$$= 20 \log_{10} \frac{R}{r} \text{ dB}$$

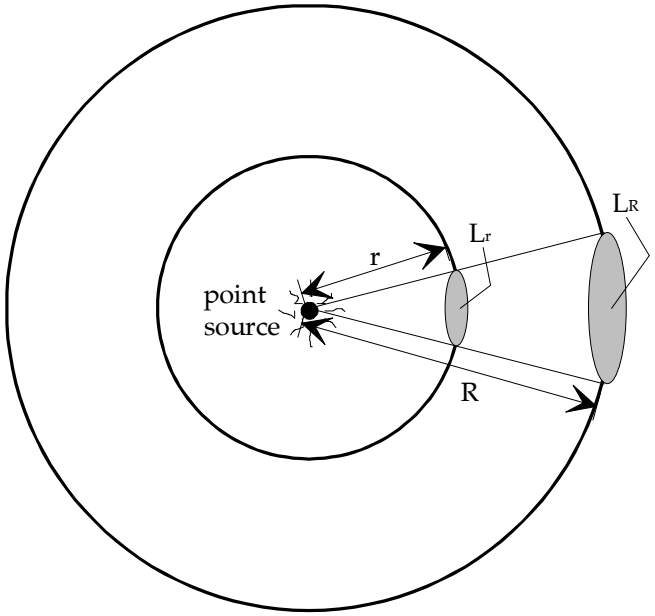
From the above equation, to calculate the reduction of sound from the measurement location to the assessment location, or, in other words, the noise correction to be deducted from the value measured at the measurement location:

$= 20 \log r_a/r_m$ dB

where

r_a is the distance from the noise source to the assessment location (m)

r_m is the distance from the noise source to the measurement location, a distance sufficiently close to the source for the effect of residual noise on the measurement to be taken into account or discounted, yet far enough away for the source to be considered to be a point source (m)



Appendix IV: Measurement equipment

Sound Level Meter

The background and ambient sound levels were measured using a Norsonic Nor-116 (conforming to class 1 of BS EN 61672-1:2003 *Electroacoustics. Sound Level Meters. Specifications* & type 1 of the former standard BS EN 60804) real time sound analyser, with a GRAS-41AL-S weather protected microphone.

The meter was calibrated before & after usage using a type 1 Norsonic Nor-1251 Acoustic calibrator.

All levels are measured by the meter accurate to one decimal place of a decibel, however, they have been reported to the nearest decibel.

Item	Date of calibration
Meter	30 January 2018
Preamplifier	26 January 2018
Microphone	26 January 2018
Calibrator	26 January 2018

Appendix V: The author and acoustic consultant

John Waring, Acoustic Consultant

Qualifications of the Acoustic Consultant

B.Sc. in Civil Engineering.
M.Sc. in Acoustics, Vibration and Noise Control.
MIOA full member of the Institute of Acoustics.

Brief Curriculum Vitae of the Acoustic Consultant

The acoustic consultant has been practising since 1989 following a career in the building industry. John Waring was a civil engineer with Gallifords, a technical adviser at Torvale Woodcemair Ltd., and was the technical manager at Kingspan Insulation Ltd.

He currently is, or has been, the acoustic consultant for Hugo Boss, the Wahaca chain of restaurants, Jaguar LandRover, Gala Coral Group bingo halls and casinos, Westons Cider, Hobsons Brewery, Tyrrells Potato Chips, Bentley Motor Cars, Dixons Stores Group, West Midlands Safari Park, GlaxoSmithKline, Ladbrokes, A.D.A.S., Hyder Industrial Limited (now United Green Energy), ThyssenKrupp GmbH, Wiggin Special Metals (Hereford), Interserve, Beacon Radio, Harper Builders, South Shropshire District Council, South Shropshire Housing Association, Wrekin Construction, Somerfield stores, Mowlem Midlands, Costains, Pubmaster, Marston plc brewers, Kendrick Construction, Ladbrokes, Perkins Engines and William Hill bookmakers amongst others.

He has made television appearances as a consultant for both BBC and ITV. He operates from Ludlow, covering the entire country.

Appendix VI: Revision history

Issue No.	Date	Details
1	20 September 2018	First issue

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