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Project:	J 04451 Noise Impact Assessment: External AC Equipment 43 Nottingham Place NW1
Consultants:	Sound Planning Ltd 25a Vicarage Hill Lower Bourne, Farnham Surrey GU10 3QS
Client:	Echlin
Prepared by:	D. M. Thomas
Signed:	 D. M. Thomas MSc M.I.O.A Acoustic Consultant
Dated:	Monday 14th June, 2021

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CONTENTS

1.0 BACKGROUND

1.1 Proposal:

The introduction of an air conditioning system to 43 Nottingham Place, London NW1 including the installation of an external condenser unit to the front lower ground floor lightwell.

See APPENDIX 2 - Site Location/Plans and APPENDIX 3 – Site Photographs

1.2 The location falls under the jurisdiction of Westminster City Council who has requested a noise impact assessment and noise mitigation strategy.

1.2.1 A noise assessment and acoustic report should adhere to Westminster's Unitary Development Plan (UDP) - Policies ENV 6 & 7.

1.2.2 The appropriate sections of Westminster's UDP are C46 to C50 – New Noise Planning Conditions – January 2007, revised May 2007.

1.3 Sound Planning has been retained to evaluate potential noise impact on the nearest noise sensitive receivers using appropriate methodologies and assessment criteria and design a suitable noise mitigation strategy if required.

1.3.1 Participating Acoustic Consultant

Dan Thomas is a Member of the Institute of Acoustics (M.I.O.A) having attained appropriate qualifications in acoustics and experience within the workplace.

1.3.2 Qualifications

Dan has been working within the noise and vibration industry for fourteen years and has attained the following qualifications within the field of acoustics:

- Institute of Acoustics (IOA) Diploma
- Post Graduate Diploma in Applied Acoustics and Noise Control (University of Surrey)
- Masters Degree in Applied Acoustics and Noise Control (University of Surrey)

2.0 ASSESSMENT CRITERIA

2.1 WCC - New Noise Planning Conditions[1]

2.1.1 The replacement UDP[2] Noise policies (ENV 6 & 7) are intended to protect noise sensitive properties from excessive levels and to contribute to the objectives of STRA 17 by reducing ambient noise levels where they exceed World Health Organisation (WHO) Guidelines. The previous distinction between inside and outside CAZ/CAZ Frontages/Stress Areas has therefore been replaced by a distinction between areas with noise level above WHO Guidelines (most of the City) and areas below. The conditions also provide protection from structural transmission of noise and vibration within and between properties.

2.1.2 It will often be appropriate to use more than one of these conditions for an individual proposal.

2.1.3 Noise sensitive properties are defined in the replacement UDP as: "all residential properties; educational establishments; hospitals; hotels; hostels; concert halls; theatres; broadcasting and recording studios." However, the standard conditions refer to the nearest residential window, as this is by far the most common situation. You will need to alter these references in the rare cases when another noise sensitive use is the nearest affected.

2.1.4 A preliminary noise report (acoustic and vibration report) is required with a planning application where a proposed development or change of use might affect noise sensitive properties.

2.1.5 The conditions allow applicants the option of applying subsequently (after completion of the development) for a fixed maximum noise level. For this they will need to produce a further noise report.

2.1.6 Selection of appropriate Noise Conditions is to be made on the advice of the Environmental Health Consultations Team (in Community Protection Department).

[1] Westminster City Council - Noise Requirements C46 to C50 - *New Noise Planning Conditions*.
[2] Unitary Development Plan.

2.1.7 There are five sets of noise conditions. The first two sets (C46 and C47) are for plant and internal activity respectively, with the appropriate version to be selected according to whether the proposed development is in an area in which ambient noise levels exceed WHO Guidelines. If the locality of the proposed development exceeds WHO levels at any time of day or night C46AB or C47AB is to be applied. Evidence of the 2003 Westminster Noise Study indicates that there are very few areas of Westminster can be expected to be below WHO Guideline Levels; in the few instances where this is the case, conditions C46BB or C47BB are to be applied. Part (3) in both C46 conditions and both C47 conditions provides the opportunity referred to in (5) above for applicants to apply to the City Council at a later stage for approval of a fixed maximum noise level.

2.1.8 A distinction is made within parts (1) and (2) of conditions sets C46 and C47 between developments that will or will not contain tones or be intermittent. Tonal noise is relevant where sound emitted will include prominent levels of particular frequencies. These may be intrusive high-pitched or low-pitched noise. Intermittent sounds may be regular or irregular, but tend to be percussive.

2.1.9 'Plant and machinery' includes equipment such as: air conditioning; heating and chilling plant; lifts; etc. With associated ducting and outlets. 'Internal activity' covers noise such as that from amplified and unamplified music and human voices.

2.1.10 It will often be appropriate to impose two 'hours conditions' – one for plant operation (C46CA, adapted if necessary), and one for internal activity (C12), but the hours included may often be different in these two conditions.

2.1.11 C48AA 'Vibration' should be applied in all cases in which there is any possibility of structural transmission of noise and/or vibration through the structure of the proposed development or any other property.

2.1.12 C49 conditions are entirely new. C49AA is to protect new residential developments from existing noise in the vicinity. It should be applied to all residential applications that have been determined capable of achieving internal noise levels below those specified in the condition, despite being in areas in which ambient noise levels that are above the specified noise exposure levels. Where the specified maximum internal noise levels cannot be achieved, an application for residential development would not generally be approved.

2.1.13 C49BA protects existing or proposed residential from transmission of noise or vibration within the same or an adjoining building, caused by a development or change of use.

2.1.14 C50AB 'Noise from emergency plant and generators' should be applied in all cases in which it is proposed that such equipment is installed.

2.2 WCC - New Noise Planning Conditions – Commercial Receivers

"Additionally it is recommended that reference be made to BS 8233: 2014 which contains guidance for noise limits for commercial premises that may be affected."

2.3 BS 8233: 2014 – Design Standards

Activity	Location	Design Range dB $L_{Aeq, T}$
Speech or telephone communications	Department Store, Cafeteria, canteen, kitchen	50 - 55
	Concourse Corridor, circulation space	45 - 55
Study and work requiring concentration	Library, gallery museum	40 - 50
	Staff/meeting room, training room	35 - 45
	Executive Office	35 - 40
Listening	Place of worship, counselling, meditation, relaxation	30 - 35

3.0 METHODOLOGY

3.1 The air conditioning system will serve a residential property and will therefore be operational any time during a 24 hour period.

3.2 Background Noise Monitoring

3.2.1 Noise monitoring equipment was installed at 13:15 hours on Wednesday 2nd June and collected at 14:15 hours on Thursday 3rd June, 2021.

3.2.2 The microphone was positioned in the front lower ground floor lightwell (where the proposed external condenser unit is to be located); the position should be deemed representative of the nearest noise sensitive receiver i.e. 1st floor window 45 Nottingham Place[3].

See APPENDIX 3 – Site Photographs

3.3 Measurements were undertaken in accordance with BS 7445[4] and BS 4142[5]. The A-weighted L_{eq} and L_{90} parameters were measured with the Fast (F) setting for each 15 minute measurement period during the extended assessment.

3.4 Noise levels at the nearest noise sensitive façade (residential windows) will be calculated using the manufacturers' sound pressure level (L_p) data.

3.5 Propagation corrections for distance, directivity and screening will be carried out in accordance with BS 7445 and BS 4142.

3.6 Instrumentation

3.6.1 Equipment

Equipment	Make	Model	Class	Serial Number	UKAS Calibration
SLM	Casella	CEL 490	1	077856	U31974 (4/6/19)
Field Calibrator	Casella	CEL 110/1	1	077948	U34831 (27/5/20)
Environmental Tripod Kit					
Laser Measurer	Leica	Disto A5		1073750838	
Digital Camera	Samsung				

3.6.2 The Sound Level Meter (SLM) is Class 1 with real time octave measurement capability; and compliant to IEC 61672[6].

[3] Ground floor window is similar distance and screened from proposed external condenser units position.
[4] British Standard 7445-1: 2003 – *Description and measurement of environmental noise.*
[5] British Standard 4142: 2014 – *Method for rating and assessing industrial and commercial sound.*
[6] International Standard IEC 61672-1: 2002. Electroacoustics – Sound level meters – Part 1: Specifications.

3.6.3 The Sound Level Meter (SLM) was field calibrated before and after the on-site noise assessment. No deviation was detected (1 kHz). UKAS accredited calibration certificates are available on request.

3.7 External Equipment

The air conditioning system will be supported by an external condenser unit - The proposed unit is a Daikin 5MXM.

Further details in APPENDIX 6

3.8 Noise mitigation calculations will utilise sound reduction indices or transmission loss data from manufacturer's specification data sheets.

3.9 Weather conditions were generally dry with light winds in accordance with BS 4142: 2014 and BS 7445:2003.

See APPENDIX 8 – Meteorological Conditions

4.0 RESULTS

4.1 Background Noise Levels

Day/Night	Time Period (hours)	Lowest Background Noise Level dB $L_{A90, 15mins}$
Day	07:00 - 23:00	50
Night	23:00 - 07:00	49

4.2 Existing Ambient Noise Levels

4.2.1 Daytime: > 55 dB $L_{Aeq, 16hrs}$

4.2.2 Night Time: > 45 dB $L_{Aeq, 8hrs}$

5.0 DISCUSSION

5.1 The proposed external condenser unit is a Daikin 5MXM. The external condenser unit is to be positioned underneath the (open metal) staircase in the front elevation lower ground floor lightwell.

See APPENDIX 2 - Site Location/Plans & APPENDIX 3 – Site Photographs

5.2 Nearest Noise Sensitive Window Distances

5.2.1 The nearest noise sensitive windows belong to 45 Nottingham Place.

5.2.2 The worst affected noise sensitive window (nearest with direct line of sight) is the 1st floor window at 45 Nottingham Place at a distance of 6 metres.

See APPENDIX 2 - Site Location/Plans and APPENDIX 3 – Site Photographs

6.0 CRITERIA ASSESSMENT

6.1 A design target of 10 dB below the existing lowest background noise level should satisfy Westminster's noise target design criteria.

6.2 Target Noise Level at Nearest Noise Sensitive Window

The target noise level is the representative background level minus 10 dB:

Background Level	49 dB L_{A90}
Target Noise Level	49 - 10
	39dB L_{Aeq}

6.3 Nearest Noise Sensitive Window

Daikin 5MXM @ 1m	52 dB L_{Aeq}
Directivity Index	+9 dB (walls behind and to the sides Q = 8)

Distance to NSR	6 metres
Sound Level @ NSR (-1m)	52 - 20 log (5/1) + 9
	= 47 dB(A)
Screening	No
Corrected Level @ NSR	47 dB(A)
Target Noise Level (see para 6.2)	39 dB(A)
Excess	+ 8

7.0 NOISE MITIGATION STRATEGY

7.1 Noise Evaluation

7.1.1 The noise calculation in paragraph 6.3 (worst case) shows that the predicted sound level is 8 dB(A) over Westminster's target noise level.

7.1.2 In order to achieve a sound reduction of 8 dB(A) the external condenser unit should be fully enclosed within an acoustic enclosure.

7.1.3 The acoustic enclosure should achieve a minimum insertion loss of 8 dB(A) and provide adequate ventilation into and out of the enclosure (enclosed space).

7.1.4 Suitable acoustic enclosures include acoustic louvre enclosures[7]. See APPENDIX 7 – Noise Mitigation Options

8.0 CONCLUSIONS

8.1 A background noise assessment was carried out in a position representative of the nearest noise sensitive receivers to the proposed condenser unit's position.

[7] Acoustic louvre enclosures will comprise of acoustic louvres and acoustic panels, with removable panels for service and maintenance access.

8.2 The lowest background noise level was measured at 49 dB $L_{A90,\ 15mins}$ (night time).

See RESULTS section 5.0

8.3 The target noise level at the nearest noise sensitive receiver (in accordance with Westminster's requirements) is 39 dB L_{Aeq} (49 - 10).

Please refer to section 6.0 - CRITERIA ASSESSMENT

8.4 The noise evaluation calculations showed that a sound reduction of 8 dB(A) is required to meet Westminster's target noise levels.

Please refer to section 6.0 - CRITERIA ASSESSMENT

8.5 An acoustic enclosure is required to achieve the sound reduction requirement of 8 dB(A).

Please refer to section 7.0 - NOISE MITIGATION

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APPENDIX 1

Glossary of Acoustic Terms

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} pascals) and the threshold of pain is around 120 dB. The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

Noise Rating

The Noise Rating (NR) system is a set of octave band sound pressure level curves used for specifying limiting values for building services noise. The Noise Criteria (NC) and Preferred Noise Criteria (PNC) systems are similar.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

$L_{Aeq, T}$ *The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq, T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.*

L_{AE} *Where the overall noise level over a given period is made up of individual noise events, the $L_{Aeq, T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). It is defined as the level that, if maintained constant for a period of one second, would deliver the same A-weighted sound energy as the actual noise event.*

L_{Amax} *The maximum A-weighted sound pressure level that was measured during the measurement period.*

L_{A10} *The level exceeded for 10% of the time is often used to describe road traffic noise.*

L_{A90} *The level exceeded for 90% of the time is normally used to describe background noise.*

Sound Transmission Descriptors

D_{nT} Standardised level difference

$D_{nT, w}$ Weighted standardised level difference

L_1 The average sound pressure level in the source room

L_2 The average sound pressure level in the receiving room

T Reverberation time (receiving room)

T_0 Reference reverberation time = 0.5s

C_{tr} Adaption spectrum which takes account for low to medium speed road/rail/air traffic; disco music; and factory noise (medium to low frequency noise).

C Adaptation spectrum which takes account of domestic activities including speech, music, radio and television.

Frequency Analysis

Octave Band	*A band of frequencies the upper limit of which is twice the lower limit. They are known by their centre frequency, e.g., 63, 125, 250, 500, 1000, 2000 Hz…*
One Third Octave	*The logarithmic frequency interval between a lower frequency f_2, when f_2/f_1 equals $2^{1/3}$ apart. Frequencies include: 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000Hz.*

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law.

In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB. Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and Diffraction

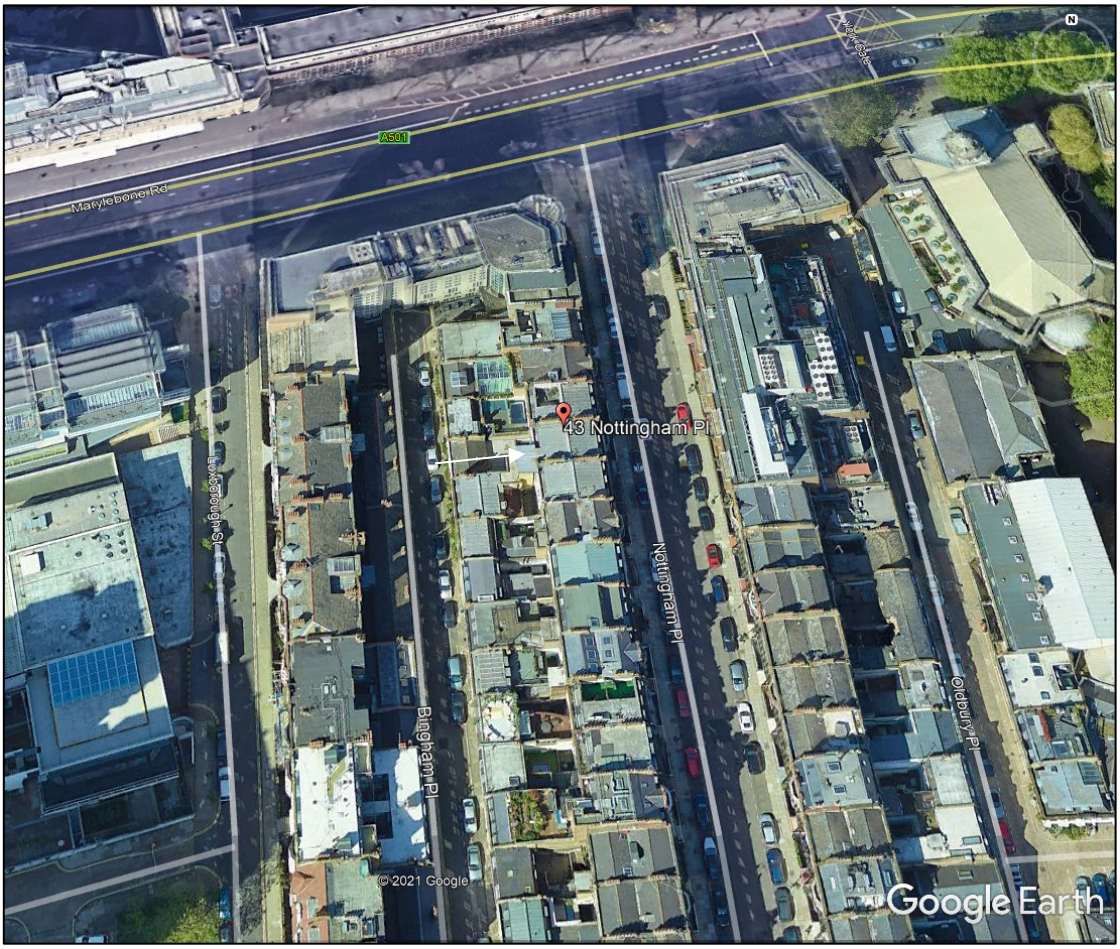
If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradient are variable and difficult to predict.

APPENDIX 2

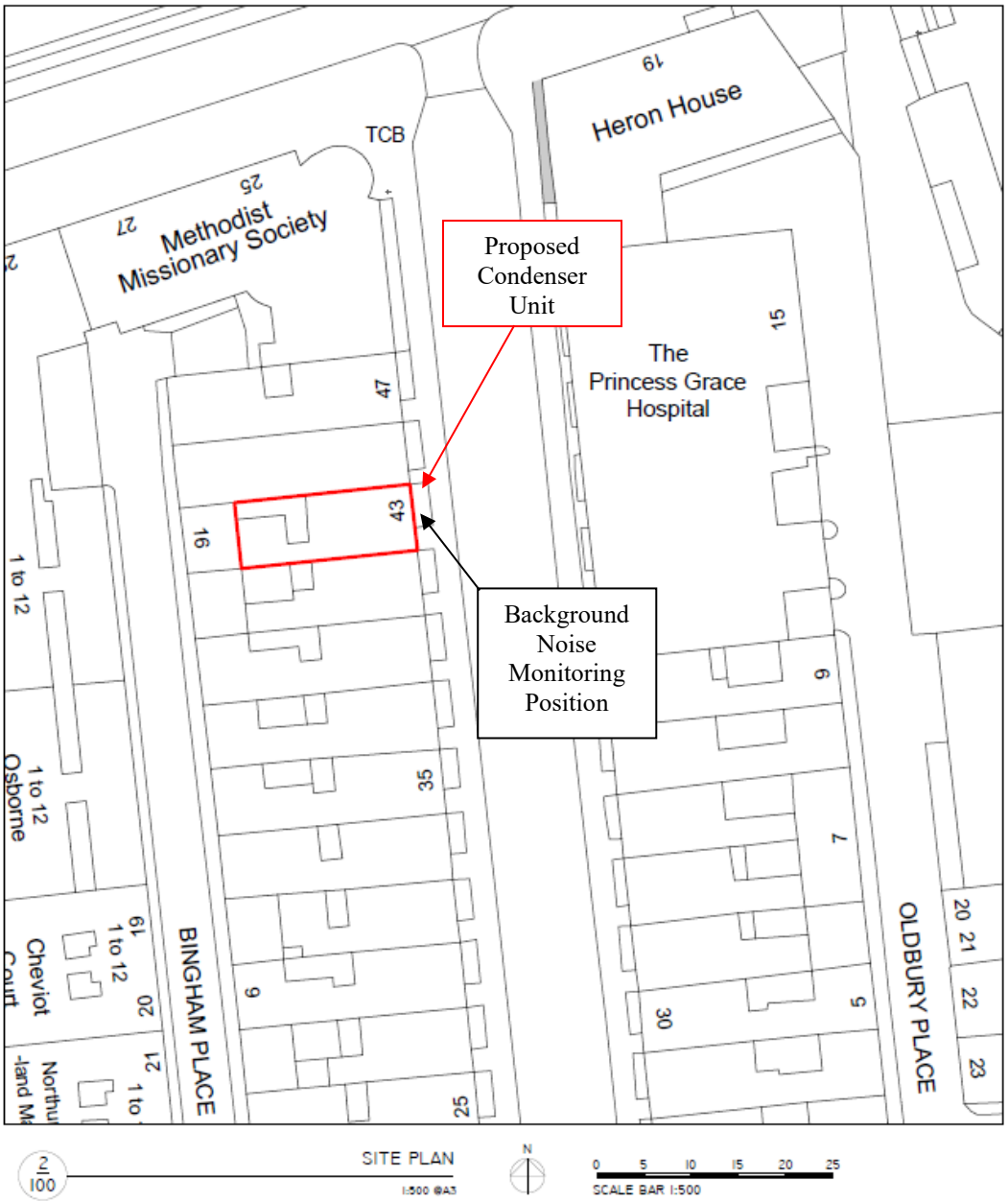
Site Location/Plans



Google Earth Plan View – 43 Nottingham Place

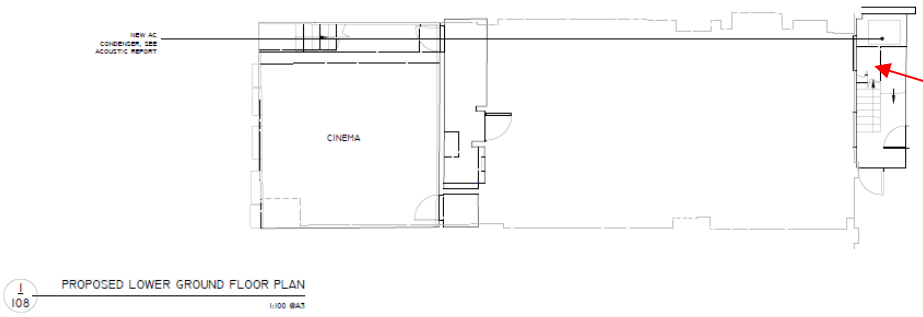
Site Location/Plans

Site Plan

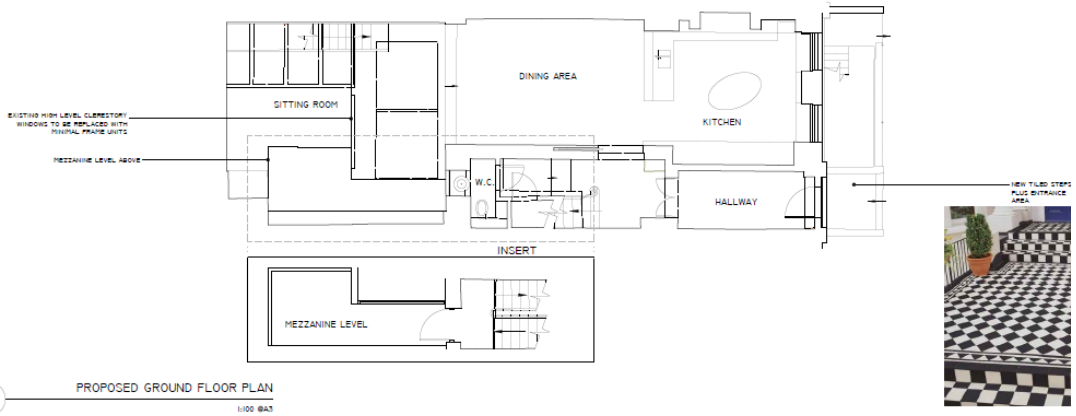


Site Location/Plans

Plans



1/108 PROPOSED LOWER GROUND FLOOR PLAN
1:100 @A3



2/108 PROPOSED GROUND FLOOR PLAN
1:100 @A3

108 PROPOSED LOWER AND GROUND FLOOR PLAN
1:100 @A3

SCALE: 1:100

Site Location/Plans

Front Elevation

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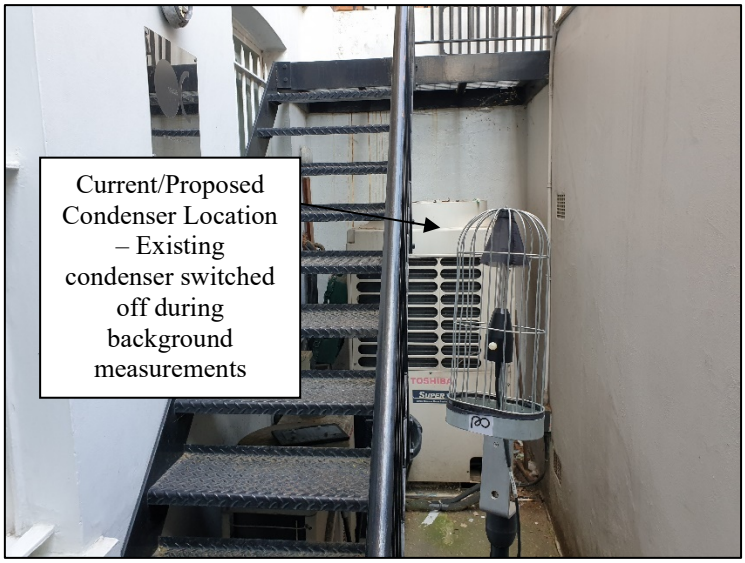
APPENDIX 3

Site Photographs:

Background Measurements - Microphone Position



Background Measurements - Microphone Position

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APPENDIX 4

Noise Standard: C46 – Plant and Machinery; noise and hours

C46AB: *Noise from plant & machinery for areas above WHO Guideline levels, where the existing external ambient noise level exceeds WHO Guideline levels of either $L_{Aeq,\ 16hrs}$ 55dB daytime (07.00-23.00 hrs) or $L_{Aeq,\ 8hrs}$ 45dB night-time (23.00-07.00hrs)*

Where noise emitted from the proposed plant and machinery will not contain tones or will not be intermittent, the 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 10dB below the minimum external background noise, at a point 1 metre outside any window of any residential property, unless and until a fixed maximum noise level is approved by the City Council. The background level should be expressed in terms of the lowest $L_{A90,\ 15\ mins}$ during the proposed hours of operation. The plant-specific noise level should be expressed as $L_{AeqTm,}$ and shall be representative of the plant operating at its maximum.

Where noise emitted from the proposed plant and machinery will contain tones or will be intermittent, the 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 15dB below the minimum external background noise, at a point 1 metre outside any window of any residential property, unless and until a fixed maximum noise level is approved by the City Council. The background level should be expressed in terms of the lowest $L_{A90,\ 15\ mins}$ during the proposed hours of operation. The plant-specific noise level should be expressed as $L_{AeqTm,}$ and shall be representative of the plant operating at its maximum.

C46BB: *Noise from plant & machinery for areas <u>below</u> WHO Guideline levels, where the existing external ambient noise level <u>does not exceed</u> WHO Guideline levels of either $L_{Aeq,\ 16hrs}$ 55dB daytime (07.00-23.00 hrs) or $L_{Aeq,\ 8hrs}$ 45dB night-time (23.00-07.00hrs)*

Where noise emitted from the proposed plant and machinery will not contain tones or will not be intermittent, the 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 5dB below the minimum external background noise, at a point 1 metre outside any window of any residential property, unless and until a fixed maximum noise level is approved by the City Council. The background level should be expressed in terms of the lowest $L_{A90,\ 15\ mins}$ during the proposed hours of operation. The plant-specific noise level should be expressed as $L_{AeqTm,}$ and shall be representative of the plant operating at its maximum.

Where noise emitted from the proposed plant and machinery will contain tones or will be intermittent, the 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 10dB below the minimum external background noise, at a point 1 metre outside any window of any residential property, unless and until a fixed maximum noise level is approved by the City Council. The background level should be expressed in terms of the lowest $L_{A90,\ 15\ mins}$ during the proposed hours of operation. The plant-specific noise level should be expressed as $L_{AeqTm,}$ and shall be representative of the plant operating at its maximum.

Following installation of the plant and equipment, you may apply in writing to the City Council for a fixed maximum noise level to be approved. This is to be done by submitting a further noise report confirming previous details and subsequent measurement data of the installed plant, including a proposed fixed noise level for approval by the City Council. Your submission of a noise report must include: (See 3.1.3).

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APPENDIX 5

Noise Measurements

Table

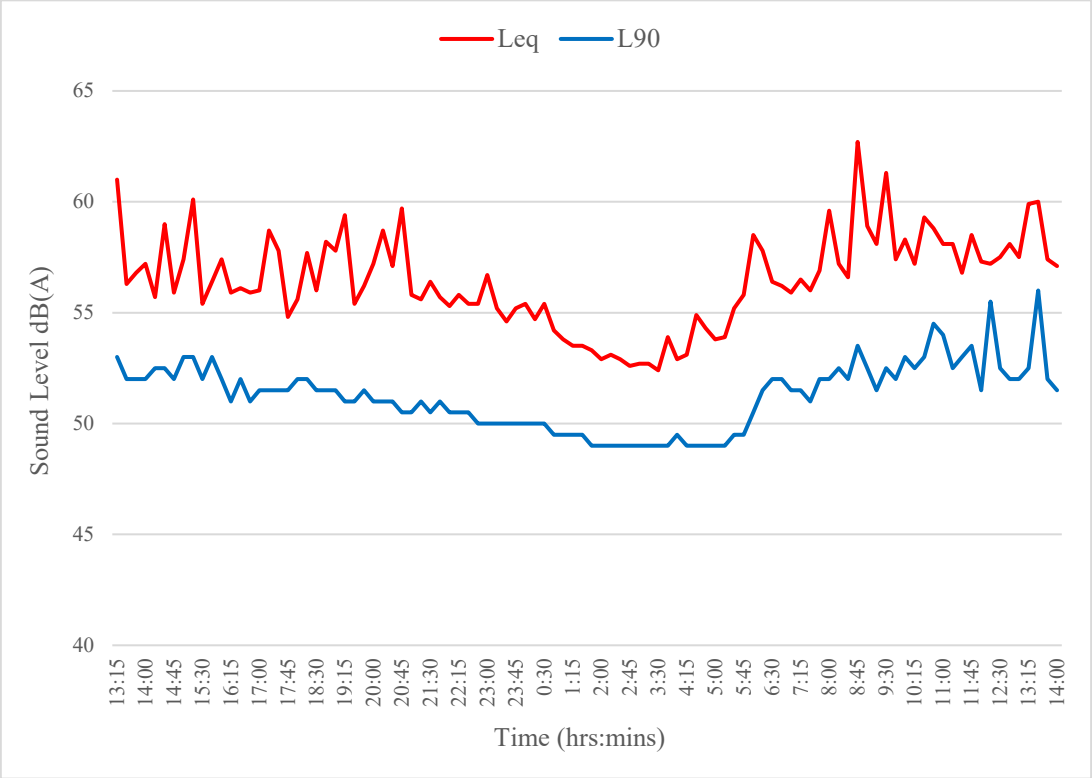
Period	Date	Time	L_{Fmax}	L_{Fmin}	L_{eq}	L_{F50}	L_{F90}
	d/m/yyyy	(hrs:mins)	dB, (A)	dB, (A)	dB, (A)	dB, (A)	dB, (A)
1	6/2/2021	13:15	87.1	50.6	61	55.5	53
2	6/2/2021	13:30	73.8	49.7	56.3	54.5	52
3	6/2/2021	13:45	74.3	50.1	56.8	54	52
4	6/2/2021	14:00	77.3	50	57.2	54	52
5	6/2/2021	14:15	71.6	50.7	55.7	54.5	52.5
6	6/2/2021	14:30	84.4	50.9	59	54.5	52.5
7	6/2/2021	14:45	73	50.8	55.9	54	52
8	6/2/2021	15:00	76	51.1	57.4	54.5	53
9	6/2/2021	15:15	72.6	50.8	60.1	55	53
10	6/2/2021	15:30	71.7	50.2	55.4	54	52
11	6/2/2021	15:45	73.6	50	56.4	55	53
12	6/2/2021	16:00	81.1	49.8	57.4	54	52
13	6/2/2021	16:15	82.3	49.2	55.9	53.5	51
14	6/2/2021	16:30	71.3	49.9	56.1	54.5	52
15	6/2/2021	16:45	76.3	48.9	55.9	54	51
16	6/2/2021	17:00	76.7	49.7	56	54	51.5
17	6/2/2021	17:15	80.8	49.6	58.7	54.5	51.5
18	6/2/2021	17:30	79.8	49.7	57.8	53.5	51.5
19	6/2/2021	17:45	69.3	49.5	54.8	53.5	51.5
20	6/2/2021	18:00	75.6	50.1	55.6	54	52
21	6/2/2021	18:15	80.4	50	57.7	53.5	52
22	6/2/2021	18:30	77	49.9	56	53.5	51.5
23	6/2/2021	18:45	81.8	50	58.2	54.5	51.5
24	6/2/2021	19:00	78.4	49.5	57.8	55.5	51.5
25	6/2/2021	19:15	82	49.6	59.4	55.5	51
26	6/2/2021	19:30	67.2	49.2	55.4	55	51
27	6/2/2021	19:45	68	49.4	56.2	55	51.5
28	6/2/2021	20:00	75.7	49.2	57.2	55	51
29	6/2/2021	20:15	84.2	49.5	58.7	55.5	51
30	6/2/2021	20:30	77.6	49.6	57.1	55	51
31	6/2/2021	20:45	84.4	49	59.7	55	50.5
32	6/2/2021	21:00	70.1	49.2	55.8	54.5	50.5
33	6/2/2021	21:15	68.5	49.3	55.6	54.5	51
34	6/2/2021	21:30	72.5	49.2	56.4	54.5	50.5
35	6/2/2021	21:45	71.2	49.1	55.7	54.5	51
36	6/2/2021	22:00	69.8	48.9	55.3	55	50.5
37	6/2/2021	22:15	69.4	49	55.8	55	50.5
38	6/2/2021	22:30	64.3	49	55.4	55	50.5

39	6/2/2021	22:45	68.4	48.4	55.4	54.5	50
40	6/2/2021	23:00	79	48.5	56.7	54.5	50
41	6/2/2021	23:15	65.9	48.6	55.2	54.5	50
42	6/2/2021	23:30	68	48.4	54.6	54	50
43	6/2/2021	23:45	67	48.5	55.2	54.5	50
44	6/3/2021	0:00	70.6	48.1	55.4	54.5	50
45	6/3/2021	0:15	66.7	48.4	54.7	54	50
46	6/3/2021	0:30	76.1	48.4	55.4	53.5	50
47	6/3/2021	0:45	65.3	48.4	54.2	53.5	49.5
48	6/3/2021	1:00	62.6	47.9	53.8	53	49.5
49	6/3/2021	1:15	64	48	53.5	52.5	49.5
50	6/3/2021	1:30	68.8	48.1	53.5	52.5	49.5
51	6/3/2021	1:45	63.7	47.9	53.3	52	49
52	6/3/2021	2:00	61.7	48.1	52.9	52	49
53	6/3/2021	2:15	62.3	47.8	53.1	52.5	49
54	6/3/2021	2:30	64	47.7	52.9	51.5	49
55	6/3/2021	2:45	66	47.7	52.6	51	49
56	6/3/2021	3:00	67.4	48.1	52.7	52	49
57	6/3/2021	3:15	64.4	47.8	52.7	51.5	49
58	6/3/2021	3:30	61.1	47.9	52.4	51	49
59	6/3/2021	3:45	73.1	47.8	53.9	52	49
60	6/3/2021	4:00	61.2	48	52.9	51.5	49.5
61	6/3/2021	4:15	69.2	48.1	53.1	52	49
62	6/3/2021	4:30	83.7	47.9	54.9	52.5	49
63	6/3/2021	4:45	73.9	47.6	54.3	52	49
64	6/3/2021	5:00	66.6	48	53.8	52.5	49
65	6/3/2021	5:15	66.8	47.8	53.9	52.5	49
66	6/3/2021	5:30	66.7	48.1	55.2	53.5	49.5
67	6/3/2021	5:45	71.1	47.8	55.8	54.5	49.5
68	6/3/2021	6:00	82.8	47.8	58.5	55.5	50.5
69	6/3/2021	6:15	72.5	48.8	57.8	55.5	51.5
70	6/3/2021	6:30	71.3	49.4	56.4	55.5	52
71	6/3/2021	6:45	70	50.3	56.2	54.5	52
72	6/3/2021	7:00	80.9	49.8	55.9	54	51.5
73	6/3/2021	7:15	78.2	49.4	56.5	54	51.5
74	6/3/2021	7:30	78	48.9	56	53.5	51
75	6/3/2021	7:45	75.8	49.7	56.9	54.5	52
76	6/3/2021	8:00	84.2	49.9	59.6	54.5	52
77	6/3/2021	8:15	79.4	50.1	57.2	54.5	52.5
78	6/3/2021	8:30	72.3	49.4	56.6	54.5	52
79	6/3/2021	8:45	87.4	49.8	62.7	56	53.5
80	6/3/2021	9:00	82.5	50.5	58.9	55.5	52.5
81	6/3/2021	9:15	75.5	49.4	58.1	55.5	51.5
82	6/3/2021	9:30	83.8	49.8	61.3	56	52.5
83	6/3/2021	9:45	73.1	49.8	57.4	55	52
84	6/3/2021	10:00	78.2	49.7	58.3	56	53
85	6/3/2021	10:15	80.1	49.6	57.2	55	52.5
86	6/3/2021	10:30	81	50.5	59.3	55.5	53
87	6/3/2021	10:45	76.2	51.5	58.8	57	54.5

88	6/3/2021	11:00	74.3	50.3	58.1	57	54
89	6/3/2021	11:15	75.8	50.2	58.1	55.5	52.5
90	6/3/2021	11:30	71.5	50	56.8	56.5	53
91	6/3/2021	11:45	77.9	49.9	58.5	56.5	53.5
92	6/3/2021	12:00	77.2	49.4	57.3	54	51.5
93	6/3/2021	12:15	75.3	54.5	57.2	56.5	55.5
94	6/3/2021	12:30	77.7	50.4	57.5	55	52.5
95	6/3/2021	12:45	82.1	49.6	58.1	54	52
96	6/3/2021	13:00	77.5	49.1	57.5	54.5	52
97	6/3/2021	13:15	82.9	49.8	59.9	56	52.5
98	6/3/2021	13:30	75.4	51.5	60	58.5	56
99	6/3/2021	13:45	76.8	50.4	57.4	54.5	52
100	6/3/2021	14:00	79.7	50.1	57.1	54	51.5

Noise Measurements

Graph



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APPENDIX 6

Equipment - Sound Levels

Daikin 5MXM

1 Features

- Seasonal efficiency values up to A+++
- Seasonal efficiency values up to A+++ in cooling and A++ in heating thanks to its up-to-date technology and built-in intelligence
- Up to 5 indoor units can be connected to 1 multi outdoor unit; all indoor units are individually controllable and do not need to be installed in the same room or at the same time. They operate simultaneously within the same heating or cooling mode.
- Choosing for an R-32 product, reduces the environmental impact with 68% compared to R-410A and leads directly to lower energy consumption thanks to its high energy efficiency
- Different types of indoor units can be connected: e.g. wall mounted, ceiling mounted cassette corner, concealed ceiling unit
- Outdoor units are fitted with a swing compressor, renowned for its low noise and high energy efficiency

1

Inverter

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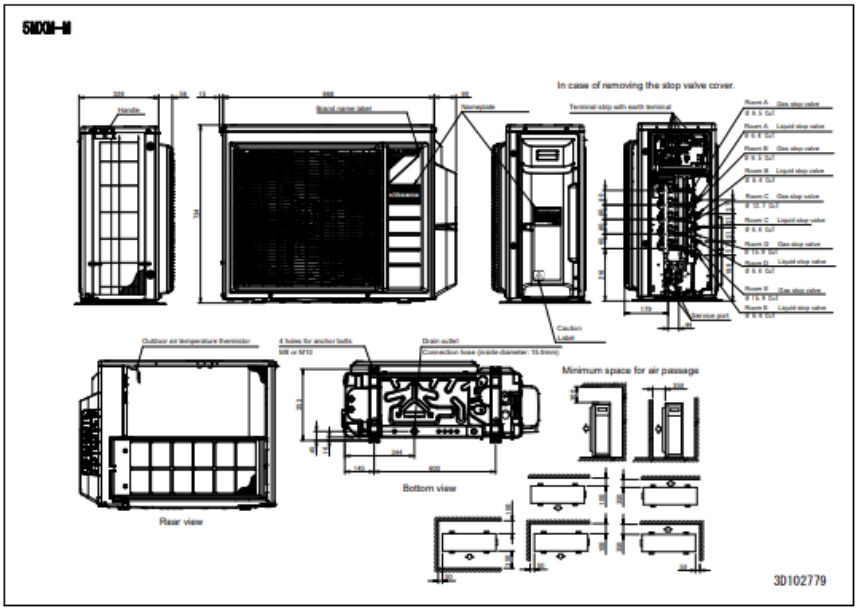
Equipment - Sound Levels

Daikin 5MXM[8]

6 Dimensional drawings

6 - 1 Dimensional Drawings

6



[8] Source: Daikin Technical Data Sheet.

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Equipment - Sound Levels

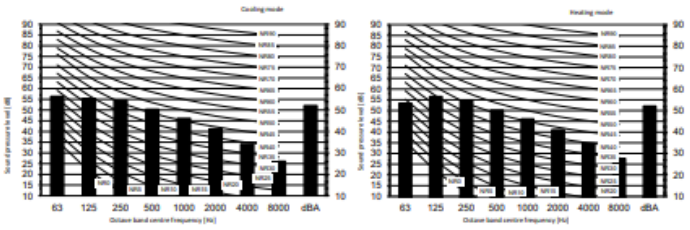
Daikin 5MXM[9]

10 Sound data

10 - 1 Sound Pressure Spectrum

10

5MXM-M



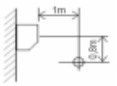
Legend
dBA = A-weighted sound pressure level (A-scale according to IEC).

A Scale
B High-tap

Cooling	Total dB
A	B
dBA	52

Heating	Total dB
A	B
dBA	52

Location of microphone



Notes
1. Operating conditions: power source 220-240 V/220 V 50/60 Hz, JIS standard
2. Background noise already taken into account.
3. Operating noise varies depending on operation and ambient conditions.
4. The operation noise measuring method is in accordance with ISO9614.
5. Measuring location: anechoic chamber

3D103030

[9] Source: Daikin Technical Data Sheet.

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APPENDIX 7

Noise Mitigation Options

Acoustic Louvre Enclosure

External Condenser Unit

Condenser inside an Acoustic Louvre Enclosure

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Noise Mitigation

Acoustic Louvre

Acoustic Louvre
Single Blade
150mm deep

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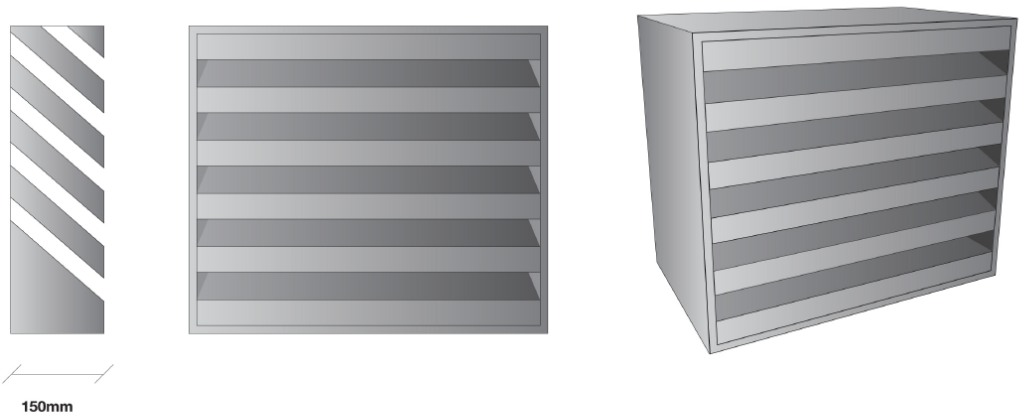

CONSTRUCTION DETAIL:

- 1.2mm folded galvanised sheet steel frame
- 0.9mm folded galvanised sheet steel blade section
- Birdmesh/insect mesh guard where required
- 0.9mm blanking to rear of dummy bottom blade
- Material Options: Stainless Steel 316 & 304 Grade, and Aluminium
- 0.9mm galvanised perforated sheet retaining controlled density mineral wool infill
- Modules to be bolt fixed together on site by others
- Suitable, non-hardening sealant by others around the perimeter on louvre

CONTACT:

Sound Planning Ltd
Farnham
Surrey
Tel: 01252 711972
E: enquiries@soundplanning.co.uk

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Noise Mitigation

Acoustic Louvre

Acoustic Performance Certificate (10 dB R_w + C_{tr})

SRL

UKAS TESTING 0444

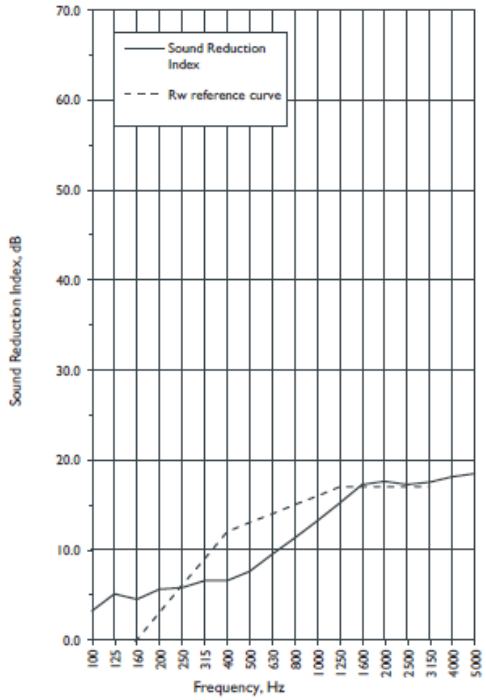
Test Report No: 24567-SRL-RP-XT-002-P1
Page 10 of 40
Date: 12/05/2020

Data Sheet 1

			Source	Receiving
Test Number:	2	**Test Room:**		
Client:	Sound Planning Ltd	**Air Temperature:**	10.2 °C	11.1 °C
Test Date:	17/02/2020	**Air Humidity:**	59 %	55 %
Sample Height:	1.1 m	**Volume:**	55 m³	50 m³
Sample Width:	1.1 m			
Sample Weight:	N/A kg/m²	**Air Pressure:**		998 mbar

Product Identification: Louvre AL150 50/50 P45

Freq, f Hz	Sound Reduction Index, dB	
	⅓ Oct	Octave
50+	17.1	11.3
63+	20.4	
80+	7.2	
100	3.2	4.2
125	5.1	
160	4.5	
200	5.6	6.0
250	5.8	
315	6.6	
400	6.6	7.7
500	7.6	
630	9.5	
800	11.3	12.9
1000	13.2	
1250	15.2	
1600	17.3	17.4
2000	17.6	
2500	17.3	
3150	17.5	18.0
4000	18.1	
5000	18.5	
6300+	18.6	17.8
8000+	18.0	
10000+	17.0	
Average 100-3150	10.2	Version v3.1



Rating according to BS EN ISO 717-1:2013

$R_w(C;C_{tr})$= 13 (-1 ; -3) dB

* shows measurement corrected for background
> shows measurement limited by background
+ shows Frequency beyond standard and not UKAS accredited

Template Ref: Lab Edition 3 – 14/10/2019

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Noise Mitigation

Acoustic Panel

Panel
50mm deep

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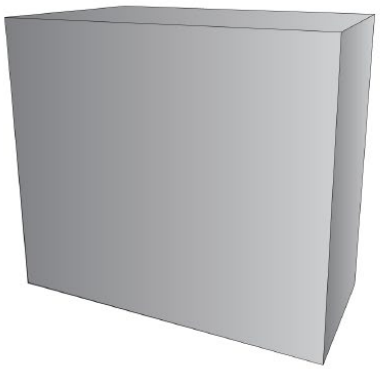
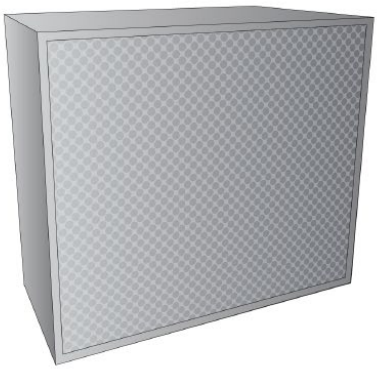
50mm



Front



Back

CONSTRUCTION DETAIL:

- 1.2mm folded galvanised sheet steel frame
- 0.9mm galvanised steel perforated sheet retaining controlled density mineral wool infill
- Stainless Steel (grade 316 & 304) and Aluminium options
- Suitable, non-hardening sealant around the perimeter, by others

CONTACT:

Sound Planning Ltd
Farnham
Surrey
Tel: 01252 711972
E: enquiries@soundplanning.com

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Noise Mitigation

Acoustic Panel

Laboratory measurements of airborne sound insulation of building elements
Octave bands
ISO 140-3 (1995)

Client: Sound Planning Limited
48 Windermere Way
Farnham
Surrey
GU9 0DE

Object: "50mm Panel"

Size (m^2): 1.01
Thickness (mm): 50
Mass per unit area (kg/m^2): 16.3

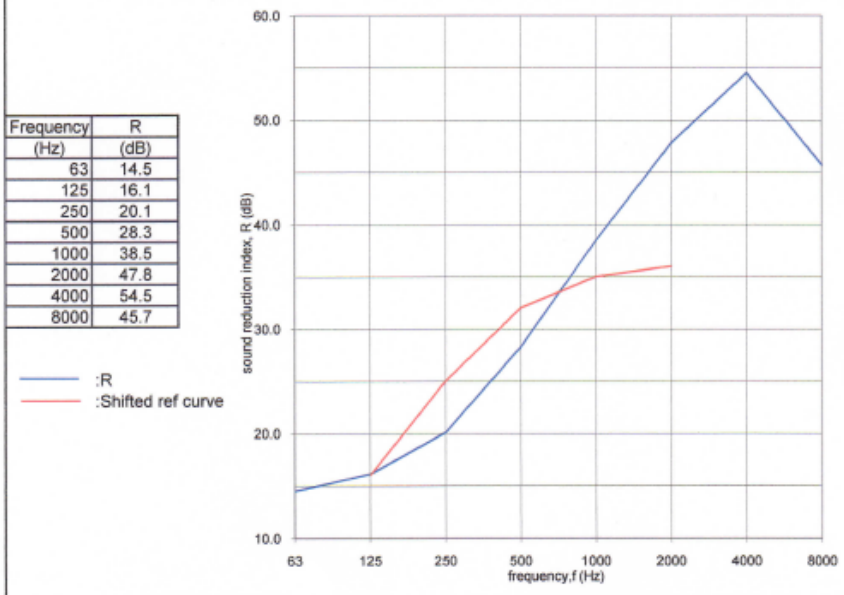
Source room:		Receiving room:	
Volume (m^3):	136	Volume (m^3):	217
Temperature [°C]:	20.3	Temperature [°C]:	19.8
Humidity [%]:	36.2	Humidity [%]:	35.7

Rating according to ISO 717-1 (1996):

R_W 32 dB

f range (Hz)	125-2000	63-4000
C (dB)	-1	-1
C_{tr} (dB)	-6	-7

Frequency (Hz)	R (dB)
63	14.5
125	16.1
250	20.1
500	28.3
1000	38.5
2000	47.8
4000	54.5
8000	45.7



Test reference No.: 254-173
University of Salford, School of Computing, Science & Engineering

Date: 21/02/2011
Signature:
SSV1

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APPENDIX 8

Meteorological Conditions

Weather History for ILONDO343

Daily Mode | June | 2 | 2021 | View

Previous

Summary
June 2, 2021

	High	Low	Average
Temperature	95.1 °F	58.2 °F	71.6 °F
Dew Point	58.8 °F	44.7 °F	50.0 °F
Humidity	71 %	20 %	50 %
Precipitation	0.00 in	--	--

	High	Low	Average
Wind Speed	3.3 mph	0.0 mph	0.0 mph
Wind Gust	3.8 mph	--	0.0 mph
Wind Direction	--	--	South
Pressure	29.76 in	29.65 in	--

Weather History for ILONDO343

Daily Mode | June | 3 | 2021 | View

Previous

Summary
June 3, 2021

	High	Low	Average
Temperature	91.7 °F	64.7 °F	71.9 °F
Dew Point	60.4 °F	51.0 °F	56.6 °F
Humidity	82 %	28 %	61 %
Precipitation	0.00 in	--	--

	High	Low	Average
Wind Speed	5.5 mph	0.0 mph	0.4 mph
Wind Gust	5.8 mph	--	0.5 mph
Wind Direction	--	--	ESE
Pressure	29.94 in	29.73 in	--