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24-HOUR NOISE LEVEL SURVEY CARRIED OUT ON THE
ROOF OF 108 GREAT RUSSELL STREET, LONDON WC1
AND A REPORT ON THE NOISE CONTROL MEASURES
REQUIRED TO MINIMISE THE NOISE IMPACT
OF THE PROPOSED NEW EXTERNAL PLANT

Test Engineer : J R Tait

Report Author :

J R Tait

Authorised for
Release by

M G Roberts

Client : TMD Building Consulting Ltd.
Project : 108 Great Russel Street, London WC1
Emtec Ref. : QF6967/PF4568/RP2
Issue Date : 12th March 2012



Reg. No. 3164658. VAT Reg. No. GB675017042
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1.0. INTRODUCTION

This report details the results of a 24-hour noise survey carried out at roof level of 108 Great Russel Street, London WC1.

The objectives of this survey were as follows:

- To establish the existing background noise level in the vicinity of the nearby residential and commercial premises.
- To assess the proposed new external condensers that are to be located on the roof of the building and to recommend noise limits and measures to ensure that the operation of the new plant does not disturb the occupants of the neighbouring residential and commercial properties.

This report has been divided into the following sections for ease of analysis:

- 1.0. INTRODUCTION
- 2.0. TEST INSTRUMENTATION
- 3.0. TEST PROCEDURE
- 4.0. RESULTS
- 5.0. DISCUSSION OF RESULTS

2.0. TEST INSTRUMENTATION

All measurement equipment used during the survey complied with the requirements of BS4142:1997 "Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas". Details of the equipment are as follows:

Integrating Sound Level Meters : Bruel & Kjaer type 2231 fitted with a Bruel & Kjaer type 4155 ½ inch condenser microphone.

Statistical Analysis Modules : Bruel & Kjaer type BZ 7115 capable of computing the percentile levels L1, L10, L50, L90 and L99 and also the Leq level.

Acoustic Calibrator : Bruel & Kjaer type 4231 electronic calibrator.

Calibration was performed before and after the surveys and found to be, in all cases, +/- 0.1 dB from the reference source.

3.0. TEST PROCEDURE

The survey was conducted during a continuous 24-hour period from 08.12am on Wednesday the 30th of November 2011 to 08.12am on Thursday the 1st of December 2011.

Data was continuously acquired throughout the measurement period with the individual averaging time for statistical noise data set to 20 minutes. The following statistical measurements were recorded concurrently:

- LA1 - The Sound Pressure Level exceeded for 1% of the measurement period.
- LA10 - The Sound Pressure Level exceeded for 10% of the measurement period.
- LA50 - The Sound Pressure Level exceeded for 50% of the measurement period.
- LA90 - The Sound Pressure Level exceeded for 90% of the measurement period.
LA90 is considered to represent the "background noise level" during the measurement period and is used for the assessment of noise to determine the likelihood of complaints (See BS 4142).
- LA99 - The Sound Pressure Level exceeded for 99% of the measurement period.
- LAeq - The continuous steady state Sound Pressure Level that has the same acoustic energy as the real fluctuating level.

All noise levels recorded were filtered using a standard 'A' Weighting filter.

3.1. Measurement Positions

The noise levels were measured at roof level, and the position was considered equivalent to the closest receptor properties in order to enable noise predictions from the proposed plant to be compared and assessed against.

The microphone was positioned so that it was pointing towards the front of the building and was approximately 1.2 metres above the roof level. The rest of the measurement equipment was located in a weatherproof enclosure with a low impedance cable running from the microphone to the instrumentation.

3.2. Weather Conditions

The weather conditions prevailing during the measurement period were generally in line with those recommended in BS 4142:1997. The weather was drizzling during the first two hours of the test, then overcast throughout the daytime and night time periods. Wind was light throughout the test period.

The microphone was protected throughout the tests by an acoustically transparent wind balloon.

4.0. RESULTS

The raw test data, gathered during the 24-hour noise survey, is given in Appendix 'A' of this report.

The 'A' Weighted Leq levels measured over each 20 minute interval throughout the 24-hour periods (denoted by LAeq, (20 mins) are displayed as a bar graph on the attached Sketch No QF/6967/T1 at the back of this report.

The 'A' Weighted percentile levels measured over each 20 minute interval denoted by LA10 (20 mins), LA50 (20 mins) and LA90 (20 mins) are displayed as a line graph on the attached Sketch No QF/6967/T2 at the back of this report.

4.1. Summary of Results

The table QF/6967/D1 below summarises the noise levels taken over the 24-hour period in terms of the maximum and minimum Sound Pressure Levels recorded.

Table QF/6967/D1A – Summary of Maximum and Minimum Noise Levels

	LA1	LA10	LA50	LA90	LA99	LAeq
Min.	51.3dBA	49.3dBA	48.3dBA	47.3dBA	46.8dBA	48.5dBA
Max.	72.3dBA	61.3dBA	55.3dBA	53.8dBA	52.8dBA	61.6dBA

5.0. DISCUSSION OF RESULTS

108 Great Russell Street is a four storey mid-terrace building. The ground floor premise is a café and the floors above are all commercial offices.

To the west side of the property there is a hotel and to the east side there is a restaurant with residences above. The buildings behind 108 Great Russell Street were inspected and all appeared to be a mixture of commercial and residential premises.

Residential and Commercial design criteria

To comply with Camden's current Unitary Development Plan, noise from the condenser must be at least 5dB less than the lowest measured LA90 when measured at 1 metre external to the nearest sensitive façade. (Assuming inverter controlled condenser emitting noise that does not contain a distinguishable discrete continuous note / whine / hiss /screech / hum).

The lowest recorded LA₉₀ level measured during the 24-hour period was 47.3dBA, which occurred in nine separate measurement periods between 01.12am and 04.52am.

All proposed external plant that is to operate on a 24-hour basis should therefore be designed to achieve a noise level 5dB below the lowest LA₉₀ level, ie: 42.3 dBA, at 1 metre from the nearest noise sensitive property's window.

The lowest recorded LA₉₀ level measured during the daytime period 07.00am to 19.00pm was 50.3dBA, which occurred in once during the measurement period ending at 17.52pm.

All proposed external plant that is to operate on a daytime basis between 07.00am and 19.00pm should therefore be designed to achieve a noise level 5dB below the lowest LA₉₀ level, ie: 45.3 dBA, at 1 metre from the nearest noise sensitive property's window.

Design noise limits

Based upon the above we summarise the actual design rating levels to be adopted for this project in table QF/ 6967/D2 below: -

Table QF/6967/D2A – recommended design rating levels L_{Ar,T}

Type of premises	L _{Ar,T} (24-hour)	L _{Ar,T} (07.00-19.00)
Residential and Commercial	42.3 dBA	45.3 dBA

Description of Equipment and Predicted Noise Levels

The proposed external plant comprises 2 No. Mitsubishi MXZ-2C52VA air cooled condensers and 2 No. Mitsubishi MXZ-3C54VA air cooled condensers that are to be located on the roof of the property. Based on the manufacturer's published data, the condensers will have a combined noise level of 56 dBA at 1 metre in free-field conditions.

There are two noise sensitive windows to consider.

The first noise sensitive window belongs to the adjacent hotel to the west of the plant. This window overlooks the plant and is approximately 10 metres away. There are other windows overlooking the plant that belong to commercial properties and another hotel, but these are all further away.

Allowing for a 19dB reduction in noise due to distance ($-20 \log d$, where d =distance in metres), a 5dB increase in noise due to the semi-reflective nature of the surroundings we predict the noise level at 1 metre outside the overlooking hotel window will be in the order of 42.0 dBA.

The second noise sensitive window is on the top floor of the adjoining property to the east of the plant. This window is a floor below the plant and is approximately 4 metres away.

Allowing for a 7dB reduction in noise due to distance ($-10 \log d$, where d =distance in metres), a 10dB reduction in noise due to the screening effect of the roof and 3dB increase in noise due to the semi-reflective nature of the surroundings we predict the noise level at 1 metre outside the upper floor window of the neighbouring building will be in the order of 42.0 dBA.

Measures to mitigate noise

The predicted noise level of the condensers at 1 metre from both the nearest affected noise sensitive windows is just below the recommended design limits. Theoretically it will therefore be unnecessary to apply acoustic treatment to the condensers in order to meet the recommended design noise limits for daytime and 24-hour operation.

Our recommendation is to acoustically shroud the condensers. The condensers should be arranged in banks of two, with each pair fitted inside a shroud that extends behind, above and to the sides of each pair of condensers and with an open front for the passage of air. The shroud should be manufactured from plywood having a minimum thickness of 12mm and dressed on the outside with lead having a minimum mass of 5kg/m^2 . The inside of the shrouds should be acoustically lined with 50mm thick acoustic absorption comprising 50mm thick 45kg/m^3 tissue faced mineral wool mechanically protected by 33% free area punched perforated galvanised steel. This arrangement will provide an additional 2 to 3dB reduction in noise outside the nearest affected windows and ensure the design noise limits are met at all times. The overall dimensions of the shrouds should be designed in conjunction with the condenser manufacturer to ensure sufficient airflow to the machines is maintained for efficient operation.

As a matter of good practice, we would recommend that all the condensers are effectively isolated from the building using double deflection neoprene-in-shear anti-vibration mounts to prevent the transmission of structure borne noise.

Summary

A 24-hour noise survey has been undertaken on the roof of 108 Great Russell Street, London WC2.

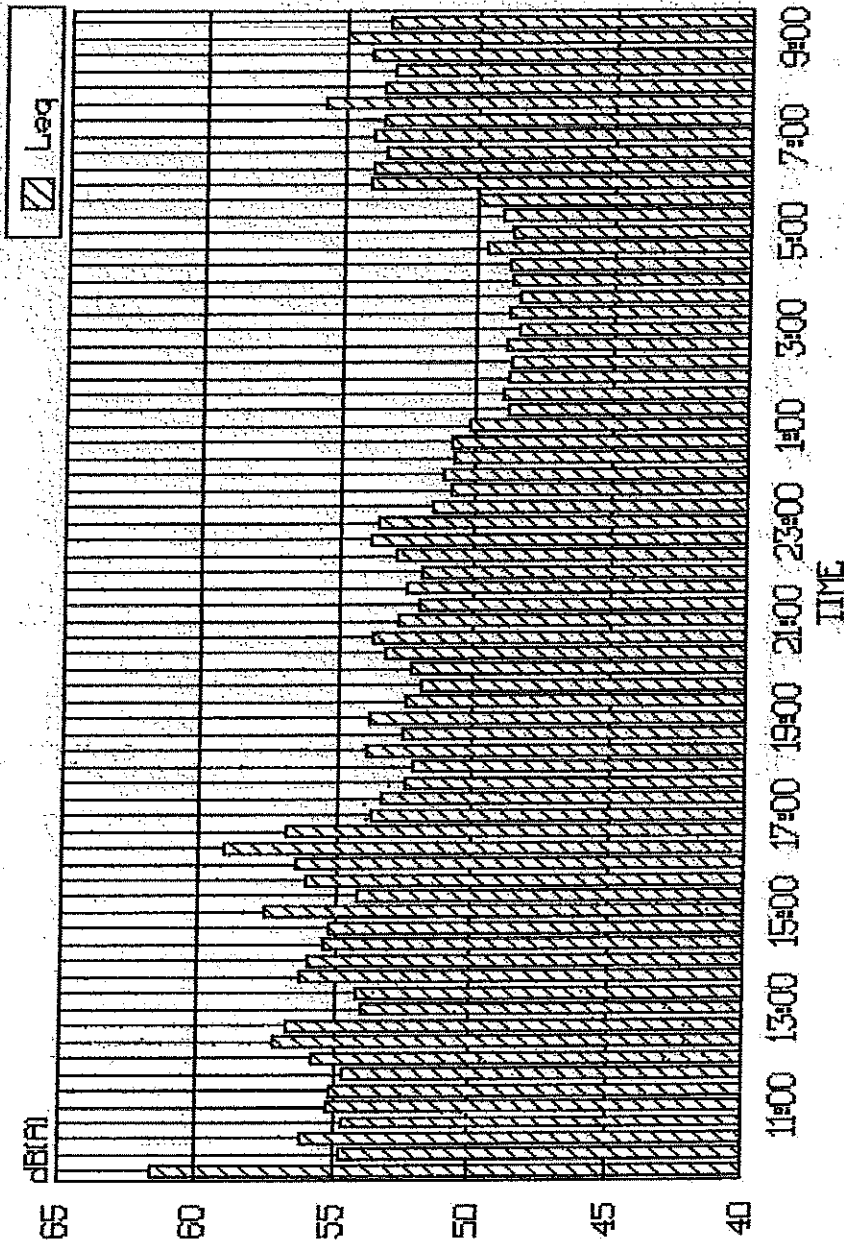
Design noise limits have been recommended based on the results of the survey and the local authority's planning criteria.

If the suggested design noise limits are adopted then the operation of the new condenser should attract no justifiable complaints under the guidelines of Camden's current Unitary Development Plan.

Our analysis predicts that it will be unnecessary to acoustically treat the proposed condensers in order to meet all the recommended design noise limits; although we have recommended installing the units inside acoustic shrouds to further reduce noise and provide a 2 to 3dB safety margin in our analysis.

EMTEC PRODUCTS LTD
12th March 2012

108 Great Russell Street, London WC1 7th March to 8th March 2012



TITLE: LAeq Levels

ISSUE DATE:
13/3/12

DRAWN BY:
JRT

A B C D E F G H

CLIENT: TMD Building Consulting Ltd

PF No: 4568

APPROVED BY:
JRT

REVISION

PROJECT: 108 Great Russell Street, London

Q A M I

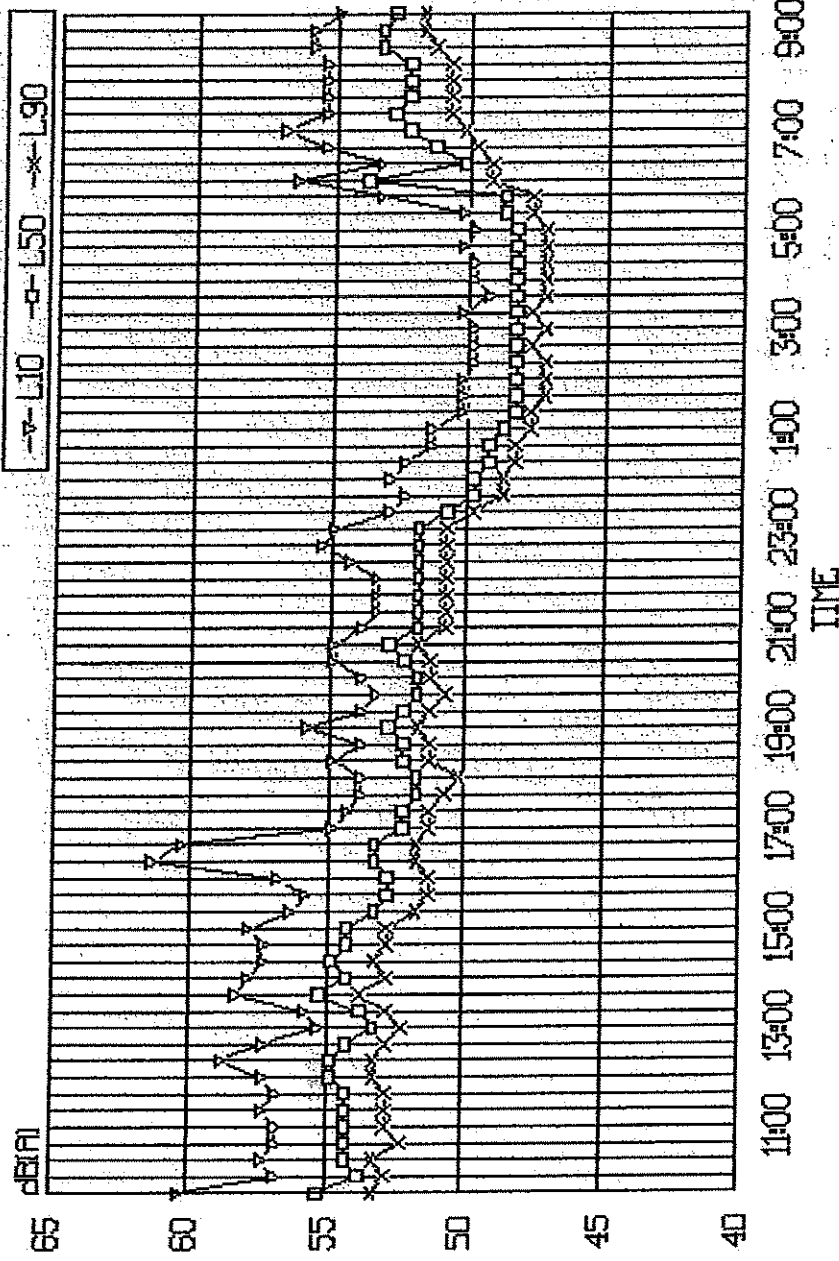
DESIGN AUTH:
JRT

SKETCH No. QF/6967/T1



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108 Great Russell Street, London WC1 7th March to 8th March 2012



TITLE: LA10, LA50 and LA90 Levels

ISSUE DATE:
13/3/12

DRAWN BY:
JRT

A	B	C	D	E	F	G	H
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CLIENT: TMD Building Consulting Ltd

PF No: 4568

APPROVED BY:
JRT

REVISION

PROJECT: 108 Great Russell Street, London

Q A M I

DESIGN AUTH:
JRT

SKETCH No. QF/6967/T2



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APPENDIX A

Raw Data – Noise Survey

7th March 2012 to 8th March 2012

NOISE SURVEY DATA FROM BACKGROUND NOISE LEVEL SURVEY CARRIED OUT
ON THE ROOF OF 108, GREAT RUSSELL STREET, LONDON WC1.

Project : 108 Great Russell Street, London WC1.
Client : TMD Building Consultancy Ltd.
Ref : QF6967
Date : 12th March 2012

Measure No.	End Time	MaxP (dBA)	L1 (dBA)	L10 (dBA)	L50 (dBA)	L90 (dBA)	L99 (dBA)	Leq (dBA)
1	09:32	95.7	72.3	60.3	55.3	53.3	52.3	61.6
2	09:52	85.2	60.3	56.8	53.8	52.8	52.3	54.8
3	10:12	90.2	65.8	57.3	54.3	53.3	52.3	56.2
4	10:32	84.5	59.3	56.8	54.3	52.3	51.8	54.7
5	10:52	90.1	60.8	56.8	54.3	52.8	52.3	55.2
6	11:12	90.8	60.3	57.3	54.3	52.8	52.3	55.1
7	11:32	87.4	58.8	56.8	54.3	52.8	51.8	54.7
8	11:52	93.9	62.8	57.3	54.8	53.3	52.3	55.8
9	12:12	92.4	66.8	58.8	54.8	53.3	52.3	57.2
10	12:32	86.8	67.3	57.3	54.3	52.8	52.3	56.7
11	12:52	78.8	59.3	55.3	53.3	52.3	51.8	54
12	13:12	78.6	59.8	55.8	53.8	52.8	52.3	54.2
13	13:32	89.4	63.3	58.3	55.3	53.8	52.8	56.3
14	13:52	90	63.8	57.8	54.3	52.8	52.3	55.9
15	14:12	86.6	60.8	57.3	54.8	53.3	52.8	55.4
16	14:32	78.4	60.8	57.3	54.3	52.8	52.3	55.2
17	14:52	85.8	68.8	57.8	54.3	52.8	51.8	57.5
18	15:12	81.2	59.8	56.3	53.3	51.8	50.8	54.2
19	15:32	89.7	68.3	55.8	52.8	51.3	50.8	56
20	15:52	84.3	68.8	56.8	52.8	51.3	50.3	56.5
21	16:12	92.8	69.8	61.3	53.3	51.8	50.8	59.1
22	16:32	81.4	65.8	60.3	53.3	51.8	50.8	56.8
23	16:52	79.5	61.8	54.8	52.3	51.3	50.3	53.7
24	17:12	77.6	61.8	54.3	52.3	51.3	50.3	53.4
25	17:32	82.3	57.3	53.8	51.8	50.8	50.3	52.5
26	17:52	93.9	57.8	53.8	51.8	50.3	49.8	52.2
27	18:12	95.7	62.8	54.8	52.3	51.3	50.3	53.9
28	18:32	78.7	56.3	53.8	52.3	51.3	50.8	52.6
29	18:52	74.7	59.8	55.8	52.8	51.8	51.3	53.8
30	19:12	76.8	56.3	53.8	52.3	51.3	50.8	52.5
31	19:32	73.8	55.3	53.3	51.8	50.8	50.3	52
32	19:52	74.1	56.3	53.8	51.8	51.3	50.8	52.3
33	20:12	79.6	59.8	54.8	52.3	51.3	50.3	53.3
34	20:32	78.7	61.3	54.8	52.8	51.8	50.8	53.7
35	20:52	77.7	60.3	53.8	51.8	50.8	50.3	52.8
36	21:12	74.6	55.8	53.3	51.8	50.8	50.3	52.1
37	21:32	87	59.3	53.3	51.8	50.8	50.3	52.5
38	21:52	72.6	56.3	53.3	51.8	50.8	50.3	52
39	22:12	76.8	59.3	54.3	51.8	50.8	50.3	52.9
40	22:32	83.2	62.8	55.3	51.8	50.8	50.3	53.8
41	22:52	81.8	62.8	54.8	51.8	50.8	50.3	53.6
42	23:12	75.3	57.8	52.8	50.8	49.8	48.8	51.5
43	23:32	76.6	57.3	52.3	49.8	48.8	48.3	50.9
44	23:52	75.7	59.8	52.8	49.8	48.8	48.3	51.2
45	00:12	75.9	58.3	52.3	49.3	48.3	47.8	50.8
46	00:32	79.7	55.3	51.3	49.3	48.3	47.8	50.9
47	00:52	76.6	58.3	51.3	48.8	47.8	47.3	50.2
48	01:12	69.2	53.3	50.3	48.3	47.8	47.3	48.9
49	01:32	73.3	56.3	50.3	48.3	47.3	46.8	49.1
50	01:52	69.4	52.8	50.3	48.3	47.3	46.8	48.8
51	02:12	69.5	53.3	49.8	48.3	47.3	46.8	48.7
52	02:32	77.4	54.3	49.8	48.3	47.8	47.3	49
53	02:52	71.1	51.3	49.8	48.3	47.3	47.3	48.5
54	03:12	71.1	53.3	50.3	48.3	47.8	46.8	48.8
55	03:32	66.7	52.3	49.3	48.3	47.3	46.8	48.5
56	03:52	75.5	53.8	49.8	48.3	47.3	46.8	48.7
57	04:12	75.2	53.8	49.8	48.3	47.3	46.8	48.8
58	04:32	79.9	54.3	50.3	48.3	47.3	46.8	49.7
59	04:52	71.7	53.3	49.8	48.3	47.3	46.8	48.7
60	05:12	72.9	53.8	50.3	48.8	47.8	47.3	49.2
61	05:32	70	55.3	53.3	48.8	47.8	47.3	50
62	05:52	72.9	57.8	56.3	53.8	49.3	48.3	54
63	06:12	83.5	66.8	53.3	50.3	49.3	48.8	53.9
64	06:32	78.6	62.3	55.3	51.3	49.8	49.3	53.5
65	06:52	80.1	60.3	56.8	52.3	50.3	49.8	53.8
66	07:12	76.4	60.3	55.3	52.8	50.8	49.8	53.6
67	07:32	86.1	68.3	55.3	52.3	50.8	50.3	55.7
68	07:52	74.9	62.3	55.3	52.3	50.8	50.3	53.6
69	08:12	79.3	59.8	55.3	52.3	50.8	50.3	53.2
70	08:32	80.5	60.8	55.8	53.3	51.3	50.8	54
71	08:52	82.9	64.3	55.8	53.3	51.8	51.3	55
72	09:12	83.8	58.3	54.8	52.8	51.8	50.8	53.4

APPENDIX B

- Photograph of measurement position.



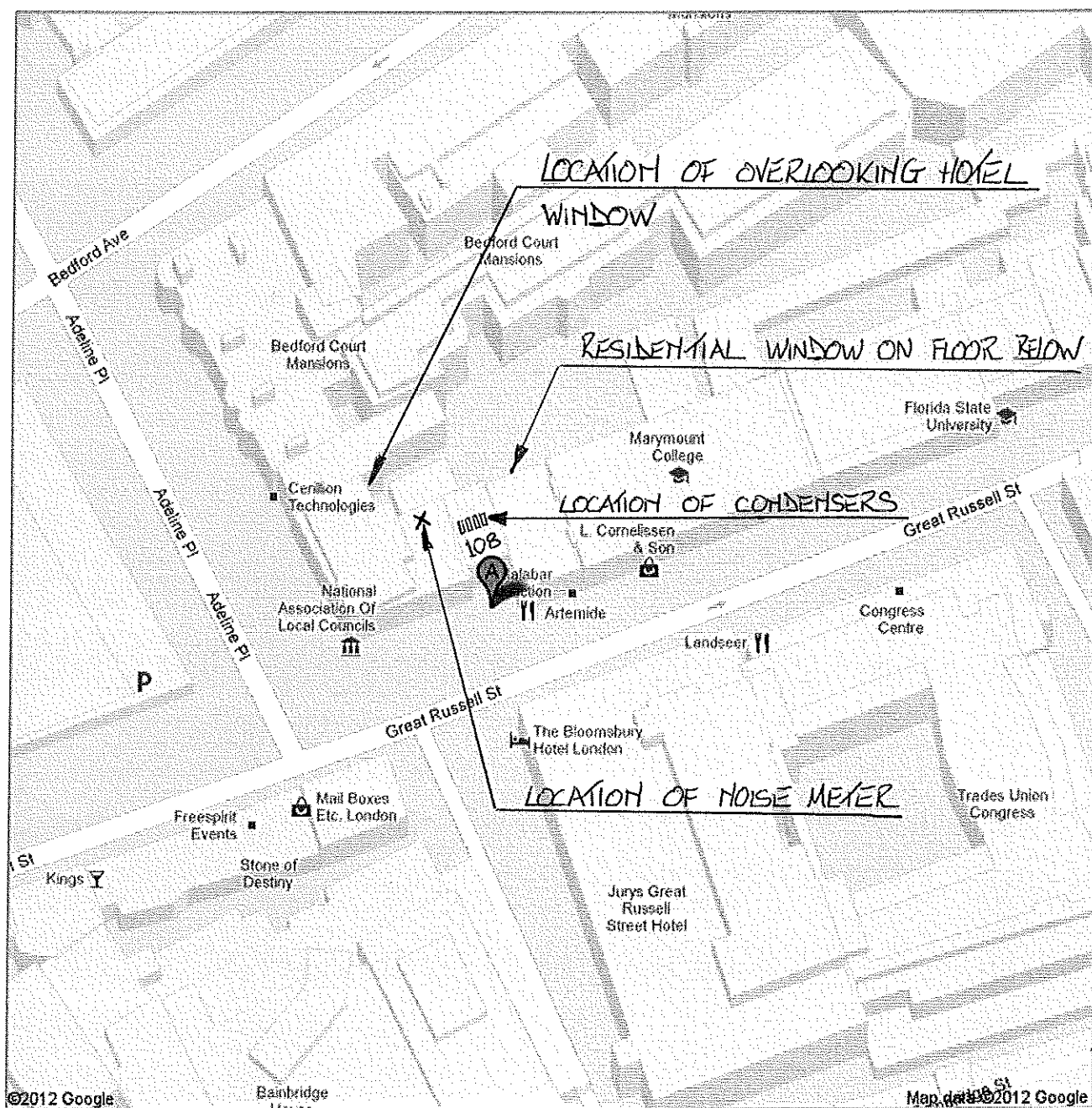
PHOTO A: Photo showing location of microphone with hotel windows in background.

APPENDIX C

- Plan of site showing location of survey and nearest noise sensitive properties.



Address 108 Great Russell St
London Borough of Camden,
London WC1B 3NA, UK



APPENDIX D

- Plant manufacturer's data

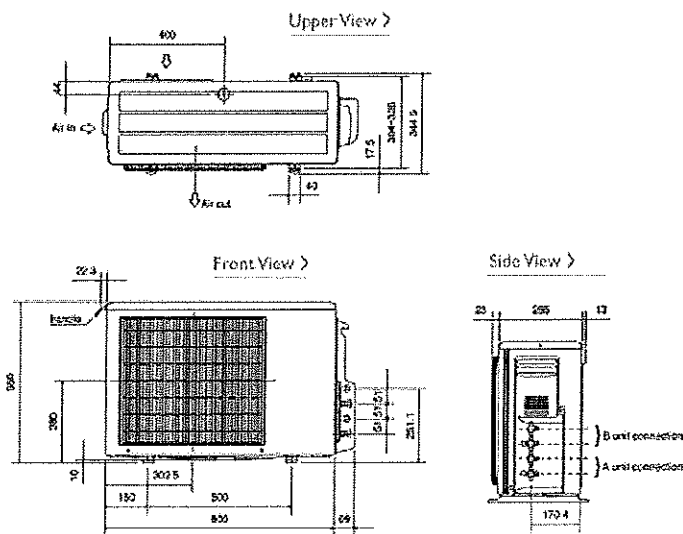
Product Details

MXZ-2C52VA	
Capacity (kW):	
Heating (Nominal) (Low - High)	6.4 (1.0 - 7.0)
Cooling (Nominal) (Low - High)	5.2 (1.1 - 6.0)
Heating (UK) (Low - High)	5.3 (0.85 - 5.8)
Cooling (UK) (Low - High)	5.15 (1.1 - 5.95)
COP / EER (Nominal)	3.98 / 4
Energy Label Heating / Cooling	A / A
Width - mm	800
Depth - mm	285
Height - mm	550
Weight - kg	38
Airflow (m ³ /min) (Heating / Cooling)	33.3 / 32.9
Noise (dBA) (Heating / Cooling) - Lo-Hi	49-50 / 46-49
Electrical Supply	220-240v, 50Hz
Fuse Rating (BS88) - HRC (A)	16
Interconnecting Cable No. Cores	4
Power Input (kW) - Heating (Nominal)	1.61
Power Input (kW) - Cooling (Nominal)	1.3
Power Input (kW) - Heating (UK)	1.47
Power Input (kW) - Cooling (UK)	1.04
Starting Current (A)	7.22
Running Current (A) - Heating / Cooling	7.22 / 5.83
Charge R410A (kg) - 20m	1.3

Piping Restrictions	
Total Pipe Length (m)	30
Max Pipe Length per Indoor Unit (m)	20
Indoor to Outdoor Height (m)	15

Dimensions

MXZ-2C52VA



MXZ-2C52VA



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Tel:
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Mitsubishi Electric reserves the right to make any variation in technical specification to the equipment described, or to withdraw or replace products without prior notification or public announcement.



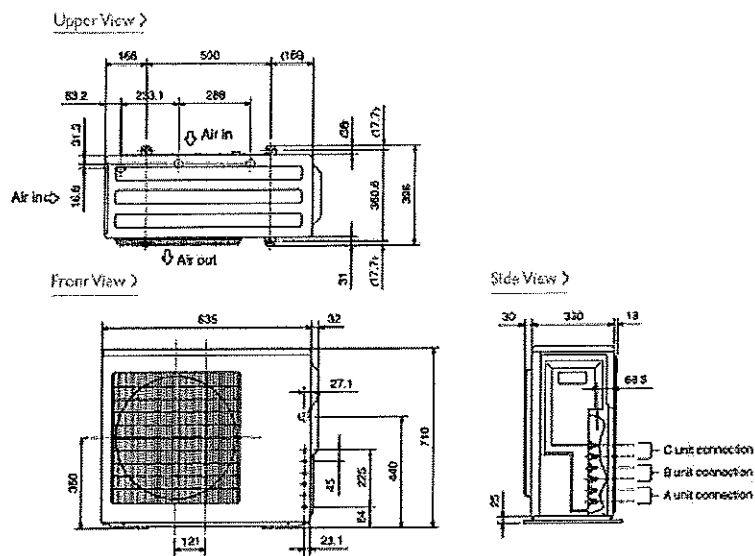
Product Details

MXZ-3C54VA	
Capacity (kW):	
Heating (Nominal) (Low - High)	7.0 (2.6 - 9.0)
Cooling (Nominal) (Low - High)	5.4 (2.9 - 6.8)
Heating (UK) (Low - High)	5.8 (2.15 - 7.5)
Cooling (UK) (Low - High)	5.35 (2.9 - 6.75)
COP / EER (Nominal)	5.04 / 4.23
Energy Label Heating / Cooling	A / A
Width - mm	840
Depth - mm	330
Height - mm	710
Weight - kg	57
Airflow (m3/min) (Heating / Cooling)	43 / 42.1
Noise (dBA) (Heating / Cooling) - Lo-Hi	48-51 / 45-47
Electrical Supply	220-240v, 50Hz
Fuse Rating (BS88) - HRC (A)	25
Interconnecting Cable No. Cores	4
Power Input (kW) - Heating (Nominal)	1.465
Power Input (kW) - Cooling (Nominal)	1.19
Power Input (kW) - Heating (UK)	1.33
Power Input (kW) - Cooling (UK)	0.95
Starting Current (A)	6.43
Running Current (A) - Heating / Cooling	6.43 / 5.23
Charge R410A (kg) - 40m	2.7

Piping Restrictions	
Total Pipe Length (m)	50
Max Pipe Length per Indoor Unit (m)	25
Indoor to Outdoor Height (m)	15

Dimensions

MXZ-3C54VA



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Tel:
Fax:

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