235 HIGH HOLBORN, LONDON WC1

Plant Noise Assessment

REPORT 6574/PNA
Prepared: 24 April 2015
Revision Number: 1

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LONDON WC1

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Revision	Comment	Date	Prepared By	Approved By
Zero	First issue of report	9 December 2014	Robert Barlow	Richard Keeble
One	Revised plant selections	24 April 2015	Robert Barlow	Andrew Heath

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1.0 INTRODUCTION

In order to support the planning application for the location of replacement building services equipment at 235 High Holborn, the London Borough of Camden requires consideration be given to atmospheric noise emissions from the proposed equipment at the nearest noise sensitive properties.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with the Local Authority's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment (following equipment reselection).

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

In accordance with the requirements of the Local Authority, monitoring of the prevailing background noise was undertaken over the following period:

11:00 hours Monday 8 December to 11:00 hours Tuesday 9 December 2014

During the survey period the weather conditions were appropriate for the noise measurement exercise, it being dry with little wind.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration.

2.2 Measurement Locations

The microphone was positioned in free-field conditions on the roof of 235 High Holborn. This measurement position was considered as being representative of the noise climate as experienced at the closest windows to the proposed plant. The measurement position is also illustrated on the attached Site Plan 6574/SP1 and in Photograph 6574/P1.

The measurement position was predominantly affected by noise from traffic along High Holborn and existing plant from the surrounding area. The plant currently installed at roof level of the 235 High Holborn was not in operation as the building is vacant.

2.3 Instrumentation

The following equipment was used for the measurements:

Table 6574/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Calibration Date
Larson Davis Type 1 Sound Level Meter	SLM824	3153	01913/1	2 July 2016
Larson Davis Pre Amplifier	PRM902	4467		
Larson Davis ½" Microphone	2541	8177		
01dB-Stell Calibrator	Cal 21	50442073	01797/3	30 April 2016

The sound level meter was calibrated both prior to and on completion of the survey with no calibration drift observed.

3.0 RESULTS

The noise levels at the measurement position are shown as time-histories on the attached Graphs 6574/G1-2.

In order to ensure a worst case assessment, the lowest background L_{A90} noise levels measured have been used in our analyses. The lowest L_{A90} and the period averaged L_{Aeq} dB noise levels measured are summarised below.

Table 6574/T2 – Measured Sound Pressure Levels

Measurement Period	Measured Sound Pressure Levels	
	L_{90} (dBA)	L_{eq} (dBA)
Daytime (07:00 – 23:00)	57	63
Night-time (23:00 – 07:00)	57	63
Office Hours (08:00 – 20:00)	55	62

4.0 CRITERIA

The requirements of the London Borough of Camden for noise levels from new plant and machinery are detailed in Development Policy 28 (DP28) of the Core Strategies document. These requirements are repeated below.

Table 6574/T3 – London Borough of Camden Plant Noise Criteria

Noise Description and Location of Measurement	Period	Time	Noise Level
Noise at 1 metre external to a sensitive facade	Day, evening and night	00:00 - 24:00	5dB < L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade	Day, evening and night	00:00 - 24:00	10dB < L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade	Day, evening and night	00:00 - 24:00	10dB < L_{A90}
Noise at 1 metre external to sensitive façade where L_{A90} > 60dB	Day, evening and night	00:00 - 24:00	55dB L_{Aeq}

Based upon the above, the following noise emission limits at the nearest noise sensitive window would be appropriate (assuming the noise does not contain any of the characteristics detailed above):

- Daytime (07:00 – 23:00) 52 dB
- Night-time (23:00 – 07:00) 52 dB
- Office Hours (08:00 – 20:00) 50 dB

A noise sensitive window is typically associated with residential buildings. There are no residential dwellings in the immediate vicinity with the surrounding buildings being predominantly commercial. We have therefore assessed to the nearest commercial windows which would naturally constitute a worst case situation.

5.0 ASSESSMENT

Our assessment has been based upon the following information:

5.1 Proposed Units and Locations

The following equipment is proposed at the site:

Table 6574/T4 – Proposed Plant and Locations

System Reference	Model	Location
1	Daikin REYQ10T	Roof level
2	Daikin REYQ10T	Roof level
3	Daikin REYQ10T	Roof level
4	Daikin REYQ10T	Roof level
5	Daikin REYQ8T	Roof level
6	Daikin REYQ8T	Roof level
Reception	Mitsubishi PUHZ-ZRP-71VHA	Roof level
AHU DX Units	Mitsubishi PUHZ-RP200 YKAR	Roof level
AHU	Dalair MA50/8/S	Roof level

The equipment positions are indicated on the attached Site Plan 6574/SP1.

5.2 Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturers of the units. The octave band sound levels are detailed in the following Table 6574/T5.

Table 6574/T5 – Manufacturer's Noise Levels

System	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
1-4	Lp at 1m	62	65	57	58	52	48	41	35	59
5-6	Lp at 1m	60	58	58	57	52	46	48	37	58
Reception	Lp at 1m	52	49	48	44	42	38	31	25	47
AHU DX	Lp at 1m	60	64	58	55	53	50	45	37	58
AHU Supply*	Lw	75	76	70	59	45	41	51	52	-
AHU Extract*	Lw	71	72	65	54	39	35	45	45	

Review of the octave band data concludes that there are no tonal characteristics associated with the proposed plant.

* The following (atmospheric) attenuators are included in the data detailed above (as specified by the manufacturer):

Table 6574/T6 – Attenuator Insertion Losses

System	Insertion Losses (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Supply	7	10	21	32	43	43	28	24
Extract	7	10	21	32	43	43	28	24

5.3 Location of Nearest Window

The closest windows to the plant are identified as being the top floor of 242-246 High Holborn (Weston House). These office windows are between 13 to 22m from the proposed plant locations, with direct line of sight of the equipment as indicated on the attached Photographs 6574/P1-2.

5.4 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels from the proposed plant at the nearest residential window, based on the information stated above, is summarised below.

Non Ducted Systems

- SPL
- Distance attenuation (each unit to receiver)

The above method predicts a noise level of 44dBA at the nearest residential window. This is within the target criteria required by the Local Authority.

Ducted Systems

- SWL in-duct
- Grille end reflection
- SWL to SPL correction
- Distance Loss

The above method predicts the following discharge noise levels from the fans at the nearest residential receptor:

- Supply 28dBA
- Extract 30 dBA

A cumulative noise level of 32dBA is therefore predicted at the nearest residential window. This is within the target criteria required by the Local Authority.

Calculation sheets are attached for further information in Appendix B.

The results of the calculations predict a combined noise level of 42dBA at the nearest window. This cumulative total is within the criterion to allow 24 hour use of the equipment.

6.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that equipment is isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures, the mounts should ideally have greater static deflection than the standard manufacturers' recommendations.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7.0 CONCLUSION

Measurements of the existing background noise levels at 235 High Holborn, London WC1 have been undertaken. The results of the measurements have been used in order to determine the required criteria for atmospheric noise emissions from the future replacement plant installations.

The results of the assessment indicate atmospheric noise emissions from the plant are within the criteria required by the London Borough of Camden (DP28) to allow 24 hour operation.

As such, the proposed plant application should be considered acceptable in terms of noise.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Calculation Sheets*

Condensers

Detail	Unit	Distance to Receiver (m)	Sound Level (dB) at Receiver at Octave Band Centre Frequency (Hz)								dBA
			63	125	250	500	1k	2k	4k	8k	
1	REYQ10T	22	35	38	30	31	25	21	14	8	32
2	REYQ10T	20	36	39	31	32	26	22	15	9	33
3	REYQ10T	19	36	39	31	32	26	22	15	9	33
4	REYQ10T	16	38	41	33	34	28	24	17	11	34
5	REYQ8T	15	36	34	34	33	28	22	24	13	35
6	REYQ8T	13	38	36	36	35	30	24	26	15	36
Reception	RZQG71L8	20	25	24	20	19	17	13	11	7	22
AHU DX	RYYQ20	19	40	40	42	40	35	31	28	21	41
Total			**46**	**47**	**44**	**43**	**38**	**34**	**31**	**23**	**44**

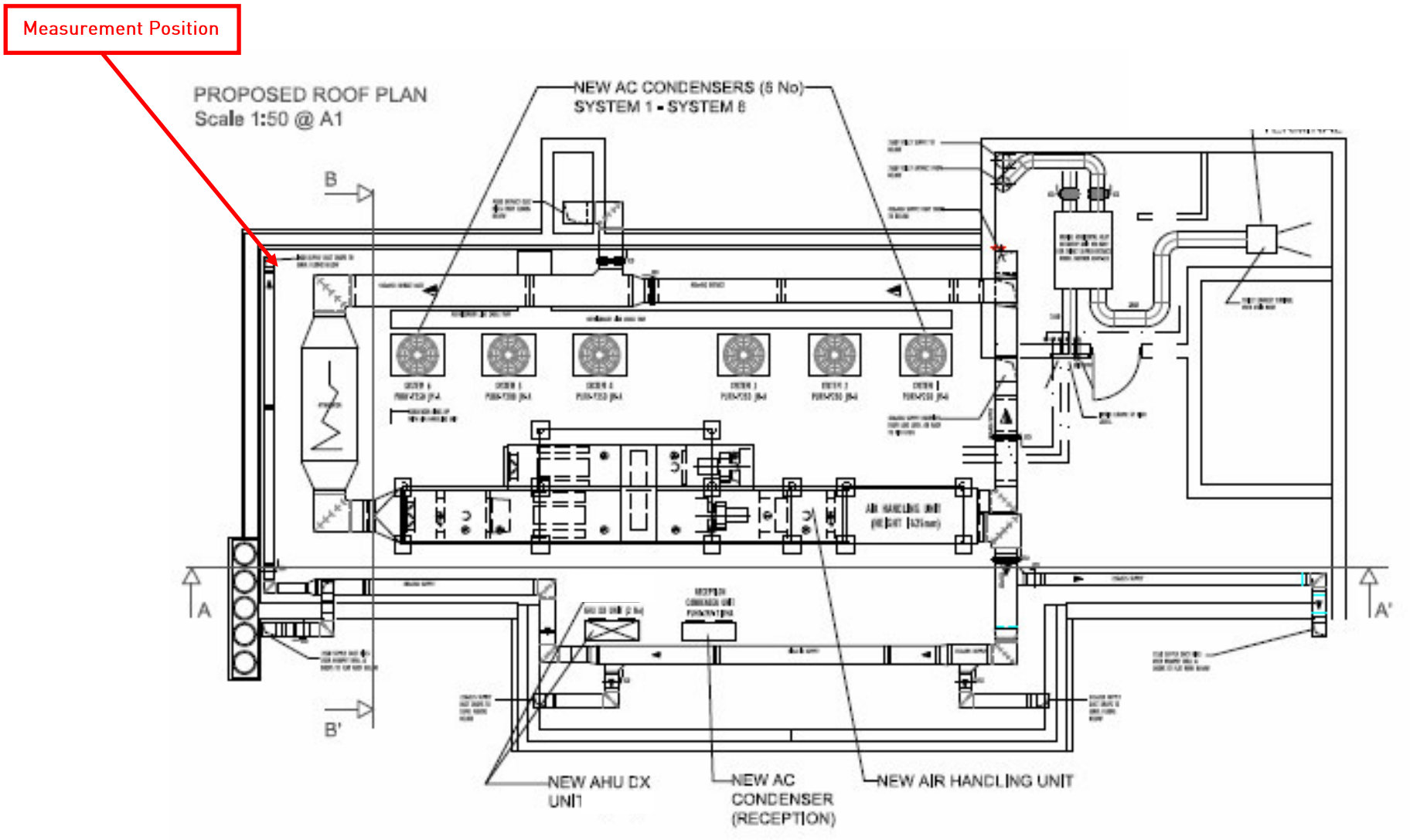
Supply

Detail	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
AHU Supply*	75	76	70	59	45	41	51	52	-
End Reflection	-5	-2	0	0	0	0	0	0	-
Distance Loss	-26	-26	-26	-26	-26	-26	-26	-26	-
Directivity	-1	-1	-2	-4	-9	-8	-8	-8	-
Hemispherical Radiation	-8	-8	-8	-8	-8	-8	-8	-8	-
Total	35	39	34	21	2	-1	9	10	28

Extract

Detail	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
AHU Extract*	71	72	65	54	39	35	45	45	-
End Reflection	-5	-2	0	0	0	0	0	0	-
Distance Loss	-24	-24	-24	-24	-24	-24	-24	-24	-
Directivity	1	2	2	3	3	4	4	4	-
Hemispherical Radiation	-8	-8	-8	-8	-8	-8	-8	-8	-
Total	35	40	35	25	10	7	17	17	30

* Numbers in the tables have been rounded to the nearest dB whereas the actual calculations are not. This explains any discrepancy in the numbers in the 'Totals' above.



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Site Plan detailing Measurement and Plant Location

Site Plan 6574/SP1

24 April 2015

Not to Scale

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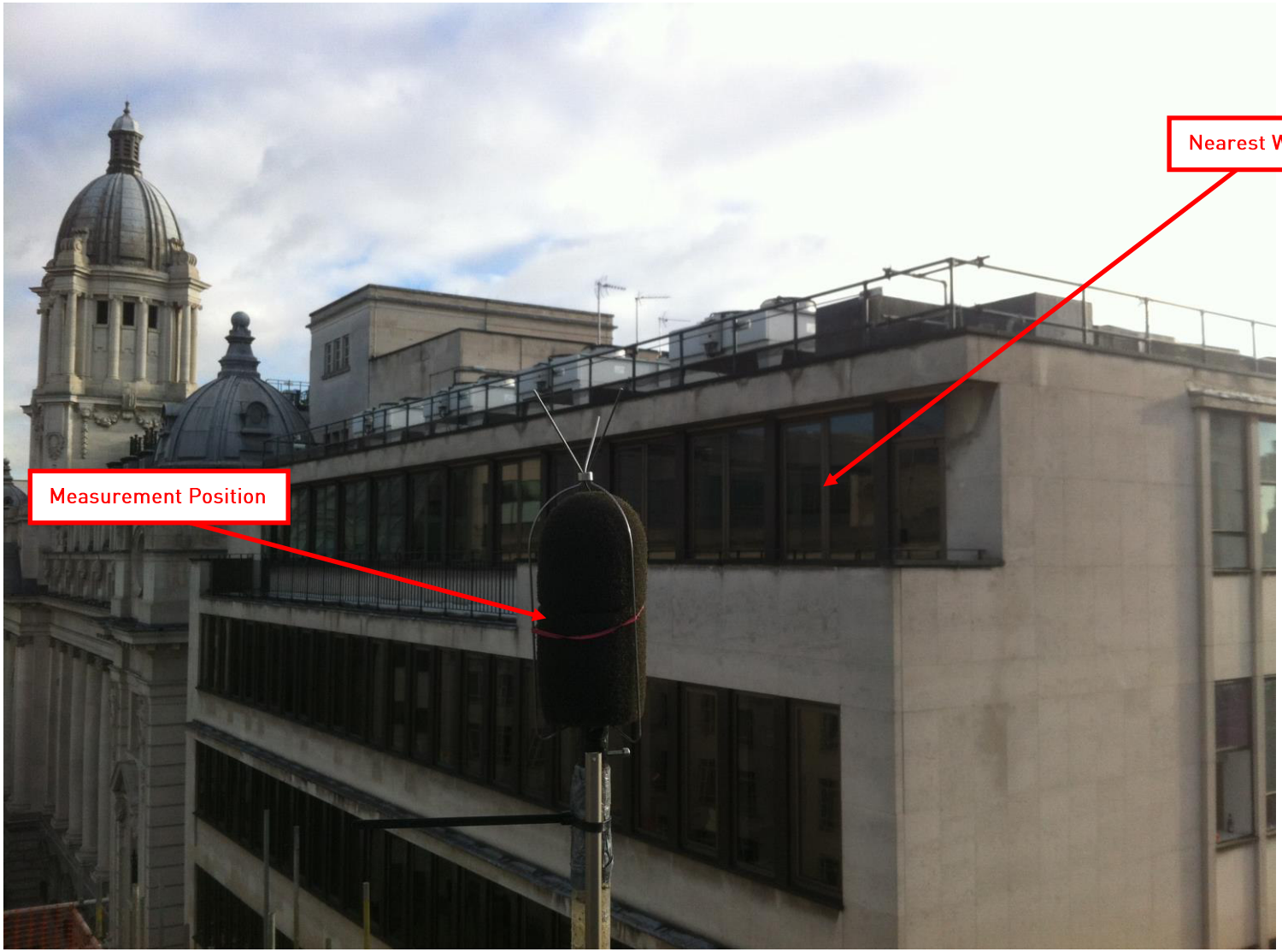

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Site Photograph of Measurement Position

Photographs 6574/P1

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235 HIGH HOLBORN, LONDON WC1

Photograph of Existing Roof Installations

Sketch 6574/P2

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Not to Scale

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235 High Holborn, London WC1
L_{Aeq} Time History
Monday 8 December to Tuesday 9 December 2014

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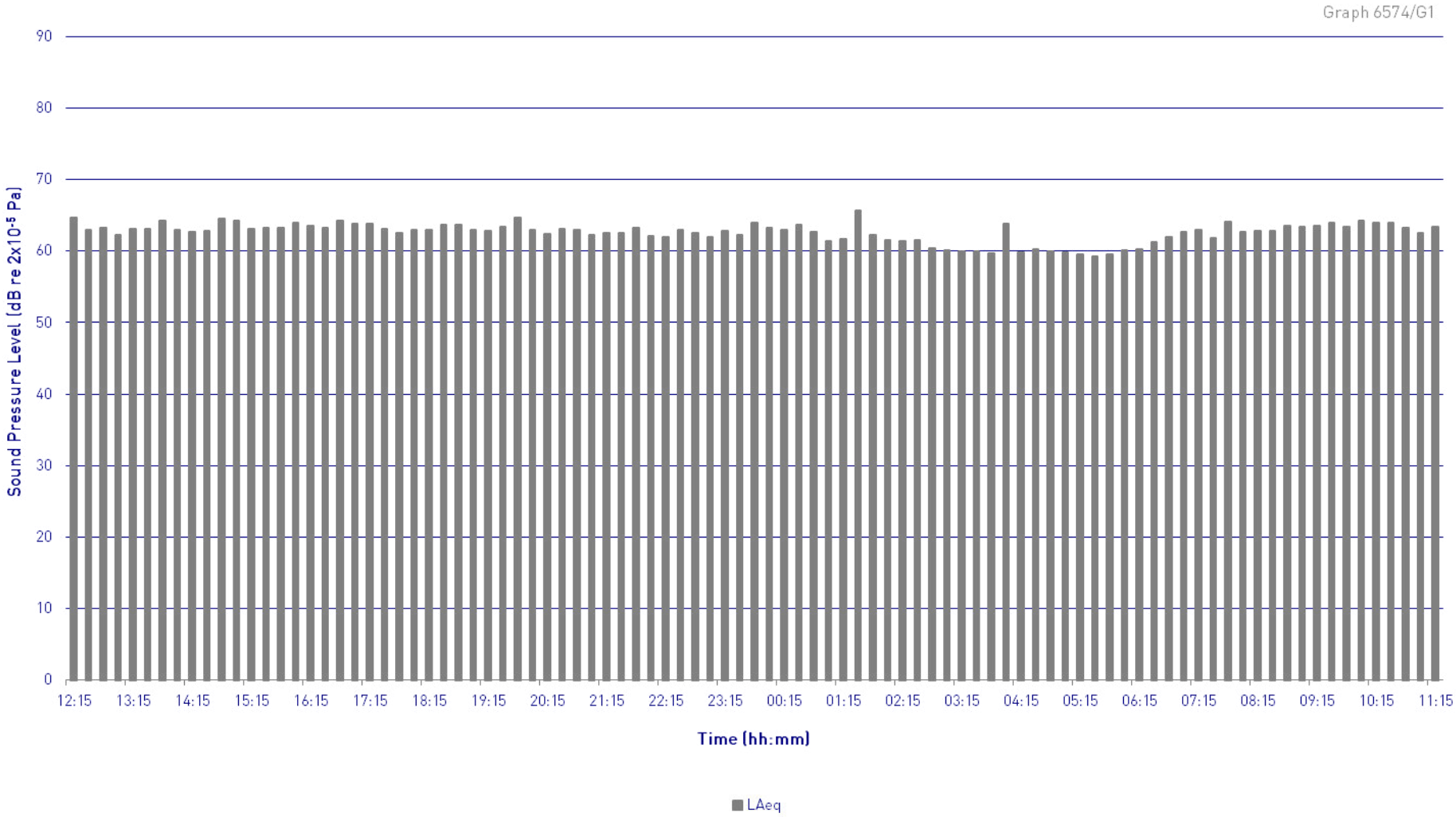
Graph 6574/G1



235 High Holborn, London WC1
L_{Amax} and L_{A90} Time History
Monday 8 December to Tuesday 9 December 2014

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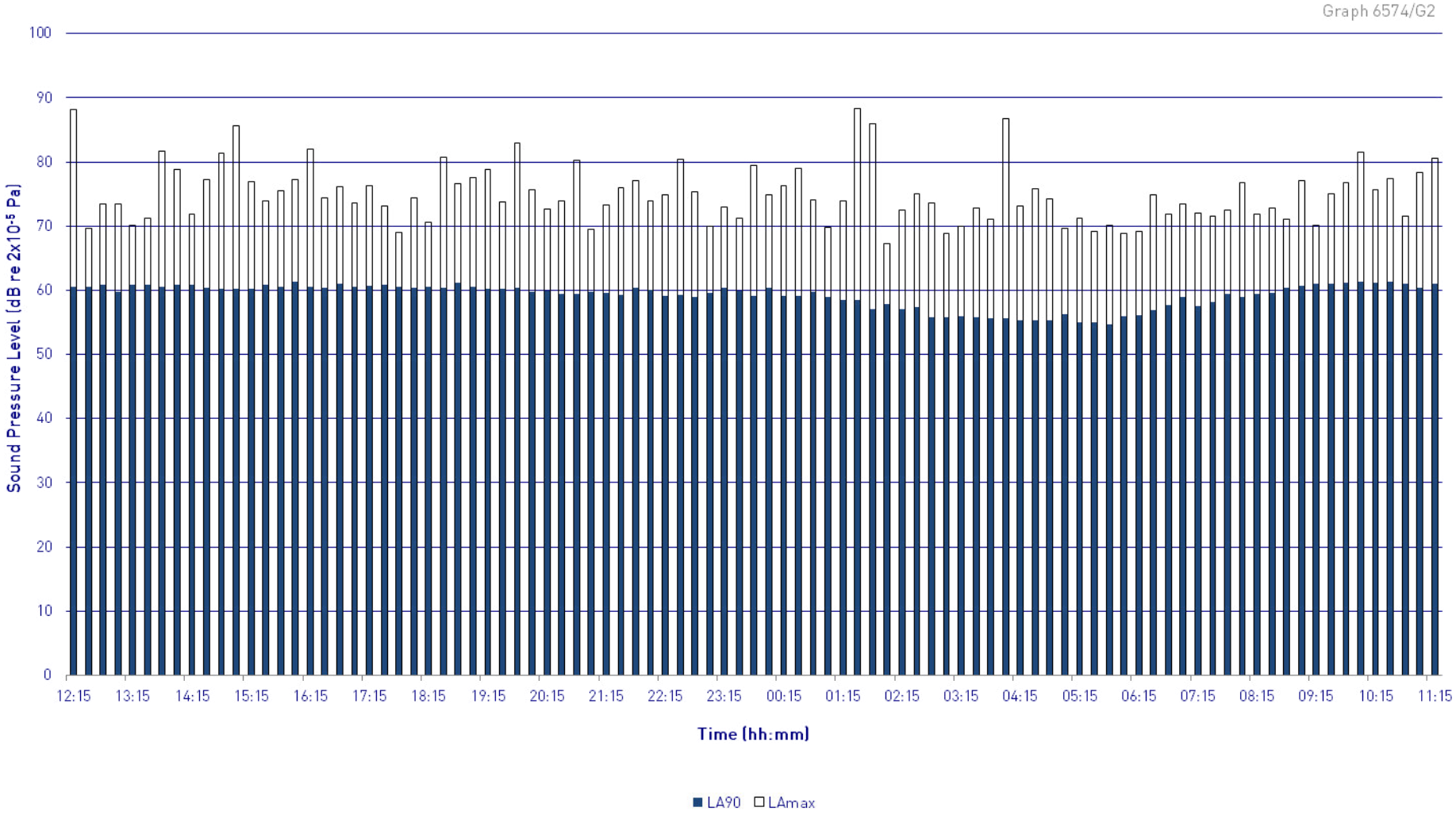
Graph 6574/G2



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