Cole Jarman

TUC Congress House, Camden

Plant Noise Assessment

Report 16/0190/R1

TUC Congress House, Camden

Plant Noise Assessment

Report 16/0190/R1

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Issue	Description	Date	Prepared by	Checked by
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Attachments

1 Introduction

1.1 It is proposed to install new items of external mechanical services plant in connection with the refurbishment and modernisation of TUC Congress House, Camden.

1.2 Cole Jarman have been instructed to undertake a noise survey at the site to quantify the existing background noise levels, set noise limits for mechanical services at the nearest noise sensitive properties, and carry out a plant noise assessment of the proposed scheme to confirm that it meets planning requirements.

1.3 This report presents the methodology and results of the noise survey, defines appropriate criteria in accordance with Local Authority requirements, and details the plant noise assessment and any mitigation measures that may be required.

2 Site Description

2.1 The TUC Congress House is located within a mixed residential, retail and office area in the London Borough of Camden. The site and surrounding area are shown on the attached site plan 16/0190/SP1.

2.2 The building is bound by smaller roads but further to the east and west is the A400 and to the south is the A40.

2.3 The nearest residential receivers are located to the east on the opposite side of Dyott Street and to the north on the opposite side of Great Russell Street.

3 Environmental Noise Survey

3.1 **Methodology and Instrumentation**

3.1.1 An unattended noise survey was undertaken at the site, commencing at 13:00 on 12th April and concluding at 11:00 on 13th April 2016.

3.1.2 Measurements were made at three locations, chosen to be representative of the nearest noise sensitive locations. The positions are illustrated as MP1, MP2 and MP3 on the attached site plan 16/0190/SP1 and described as follows:

- MP1 – Overhanging 1m from the roof edge on the eastern side of the TUC building
- MP2 – Overhanging 1m from the roof edge on the southern side of the TUC building
- MP3 – Overhanging 1m from the roof edge on the northern side of the TUC building

3.1.3 Measurements of the L_{Aeq}, L_{Amax} and L_{A90} indices were made over consecutive 15 minute periods (see the glossary of Acoustic Terms for an explanation of noise units used).

3.1.4 Noise measurements were made using the equipment listed in table T1.

Item	Manufacturer	Type
Sound Level Analyser (x3)	Norsonic	118
Acoustic Calibrator (x3)	Norsonic	1251
Weatherproof windshield (x3)	Norsonic	1212

T1 Equipment used during unattended noise survey.

3.1.5 The microphones were fitted with windshields and the sound level analysers were calibrated before and after the survey to ensure a consistent and acceptable level of accuracy was maintained throughout.

3.1.6 The weather conditions during the setup and collection of the equipment were warm, dry and clear with little breeze.

3.2 Results

3.2.1 The results of the unattended monitoring are shown in the attached time history figures 16/0190/TH01-03 for positions MP1, MP2 and MP3 respectively.

3.2.2 The daytime and night time representative background levels recorded are as set out in the following table. These typical levels have been devised by way of statistical analysis and represent the noise levels during the key periods in accordance with BS 4142: 2014.

Location	Representative Background Noise Levels Measured, dB $L_{A90,15min}$	
	Daytime (0700-2300 only)	Night time (24-hour)
MP1 East side at roof level	55	49
MP2 South side at roof level	59	56
MP3 North side at roof level	55	46

T2 Representative background noise levels measured

3.2.3 The noise climate at MP1 and MP2 was controlled by mechanical services on the roof of a neighbouring building on the other side of Bainbridge Street. The time history graphs suggest that the unit was running throughout the night at a lower duty. Road traffic noise also contributed to the overall climate at these positions. MP3 was mostly controlled by road traffic noise. Some mechanical service noise will have also contributed to the climate, particularly during office opening hours.

4 Plant Noise Limits

4.1 In accordance with Camden Council planning policy DP28, noise from plant shall be at least 5 dB(A) below the existing background noise levels. Where the noise from plant is either tonal or impulsive in character, the differences in these levels shall be at least 10 dB(A).

4.2 The nearest noise sensitivities are labelled on the attached site plan 16/0190/SP1. The derived plant noise limits for the proposed mechanical services plant in order to comply with the council requirements are shown in the table below at each assessment position.

Location	**Plant Noise Limits, dB**	
	Daytime (0700-2300 only)	**Night time (24-hour)**
AP1 Parnell House Apartments to the East	50	44
AP2 Residential Apartments to the North	50	42

T3 Plant noise emission limits at the nearest residential properties

5 Plant Noise Assessment

5.1 Proposed Installation

5.1.1 The proposed installation includes a number of ducted units which either terminate at louvres in the façade or on the roof and a number of heat pump condensing units; ten located on the roof and two in a ground floor service yard area.

5.1.2 A list of the proposed plant and associated noise levels used in the assessment can be found in the attached schedule 16/0190/PNS1.

5.2 Assessment

5.2.1 Our calculations have taken into account duct losses, end reflection, grille directivity, radiation losses, distance losses and a façade correction. Where relevant, screening effects of the building have been allowed for in our calculations.

5.2.2 Outline mitigation for the plant units have been considered to achieve suitable external noise levels.

Heat Pumps

5.2.3 Acoustic enclosures will be required for the heat pumps located closer to the residences to the east, specifically the heat pumps labelled:

- HP06
- HP07
- HP08
- HP09
- HP10
- Two heat pumps in ground floor service yard

5.2.4 The enclosure should be designed for the units to meet the insertion losses specified in the following table.

	Octave Band Centred Frequency (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Minimum Transmission Loss (dB)	12	13	20	29	36	37	39	39

T4 Minimum octave band transmission losses to be achieved by enclosure

5.2.5 Manufactures data shows that these transmission losses can be typically achieved with an *Environ* enclosure. It must be ensured that any enclosure used meets the performance provided within the table above and provides adequate airflow to the units.

Ducted Units

5.2.6 An atmospheric side silencer will be required for the extract fan proposed on the sixth floor. The silencer should be designed to meet the insertion losses specified in the following table.

	Octave Band Centred Frequency (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Minimum Transmission Loss (dB)	4	8	14	21	27	27	21	16

T5 Minimum octave band transmission losses to be achieved by silencer

5.2.7 It is expected that these losses would be achieved with a silencer 0.9m long with 35% free area. However, the insertion losses should be taken as the design criteria, and not the silencer length. Any proposed silencer should be confirmed to achieve the stated insertion losses at a minimum. The silencer should comply with the specification as set out in the attached 16/0190/SPC1.

Resultant Noise Levels

5.2.8 Based on the mitigation measures described above, we predict noise levels at the assessment positions as presented in the table below, alongside the plant noise limit we have provided. Appendix A shows a summary of the contributions from each of the plant items to the assessment positions. Calculation sheets can be provided if necessary.

	Predicted Noise Level, dB(A)	**24-Hour Plant Noise Emission Limit, dB(A)**
AP1 Parnell House Apartments to the East	43	44
AP2 Residential Apartments to the North	34	42

T6 Plant noise emission limits at the nearest residential properties

5.2.9 The above table shows, with the previously stated mitigation in place, that the noise levels are predicted to be within the Local Authority noise emission requirements.

6 Conclusions

6.1 It is proposed to install new items of external mechanical services plant in connection with the refurbishment and modernisation of TUC Congress House, Camden.

6.2 An environmental noise survey has been undertaken at the site in order to quantify the sources and nature of the existing noise climate.

6.3 Based upon the results of the survey, suitable noise emission limits for new mechanical services plant have been proposed in accordance with the Local Authority requirements.

6.4 An assessment of noise from the proposed new plant items has been undertaken to help specify the following mitigation measures:

- Acoustic enclosures for seven heat pumps
- Silencer for the atmospheric side of sixth floor extract fan

6.5 With the mitigation measures in place, it has been shown that noise levels from the proposed items can comply with the Local Authority noise emission requirements.

End of Section

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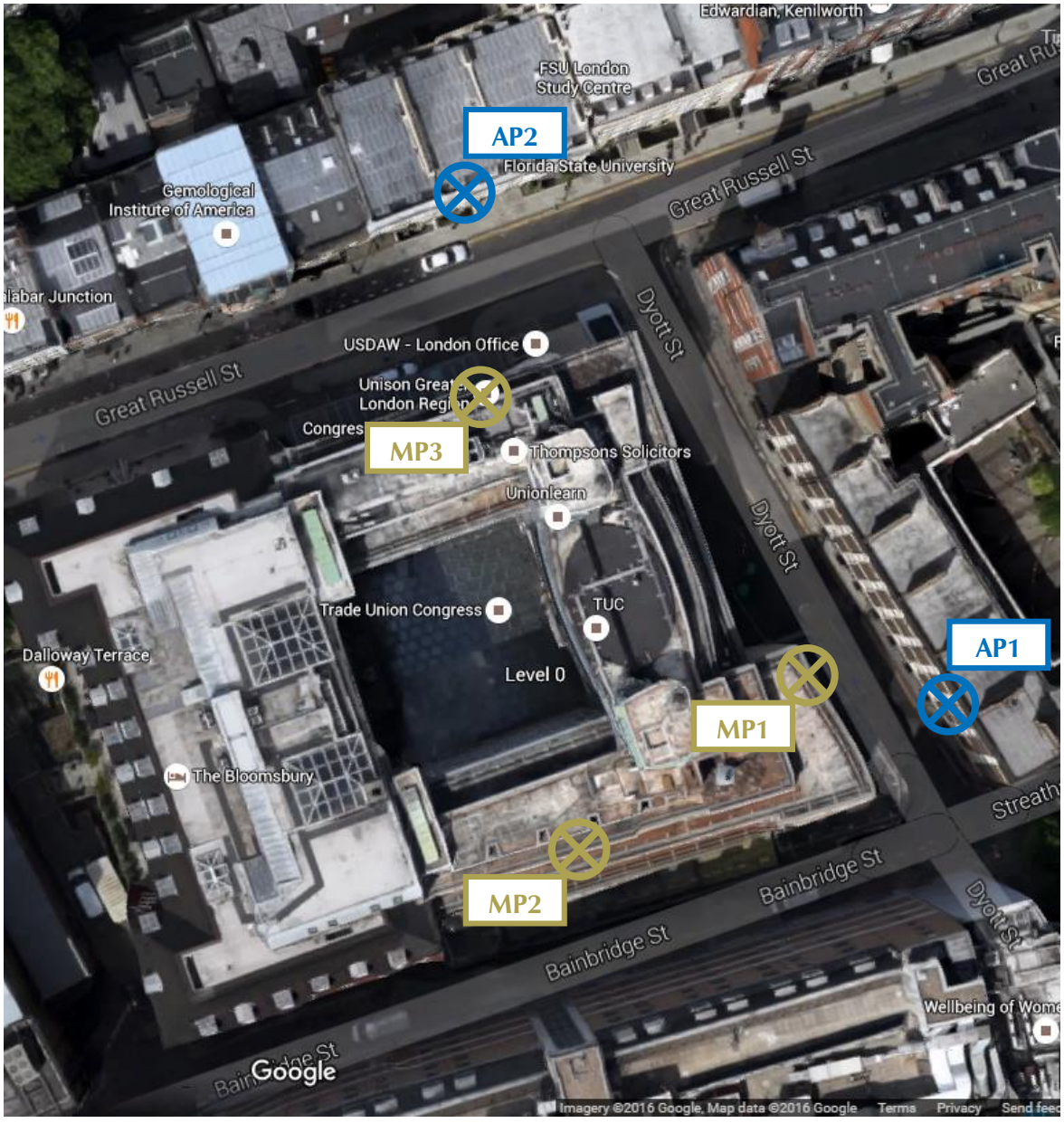
Figure 16/0190/SP1



Title: Site plan showing measurement and assessment positions

Project: TUC Congress House, Camden

Date: April 2016

Scale: Not to scale

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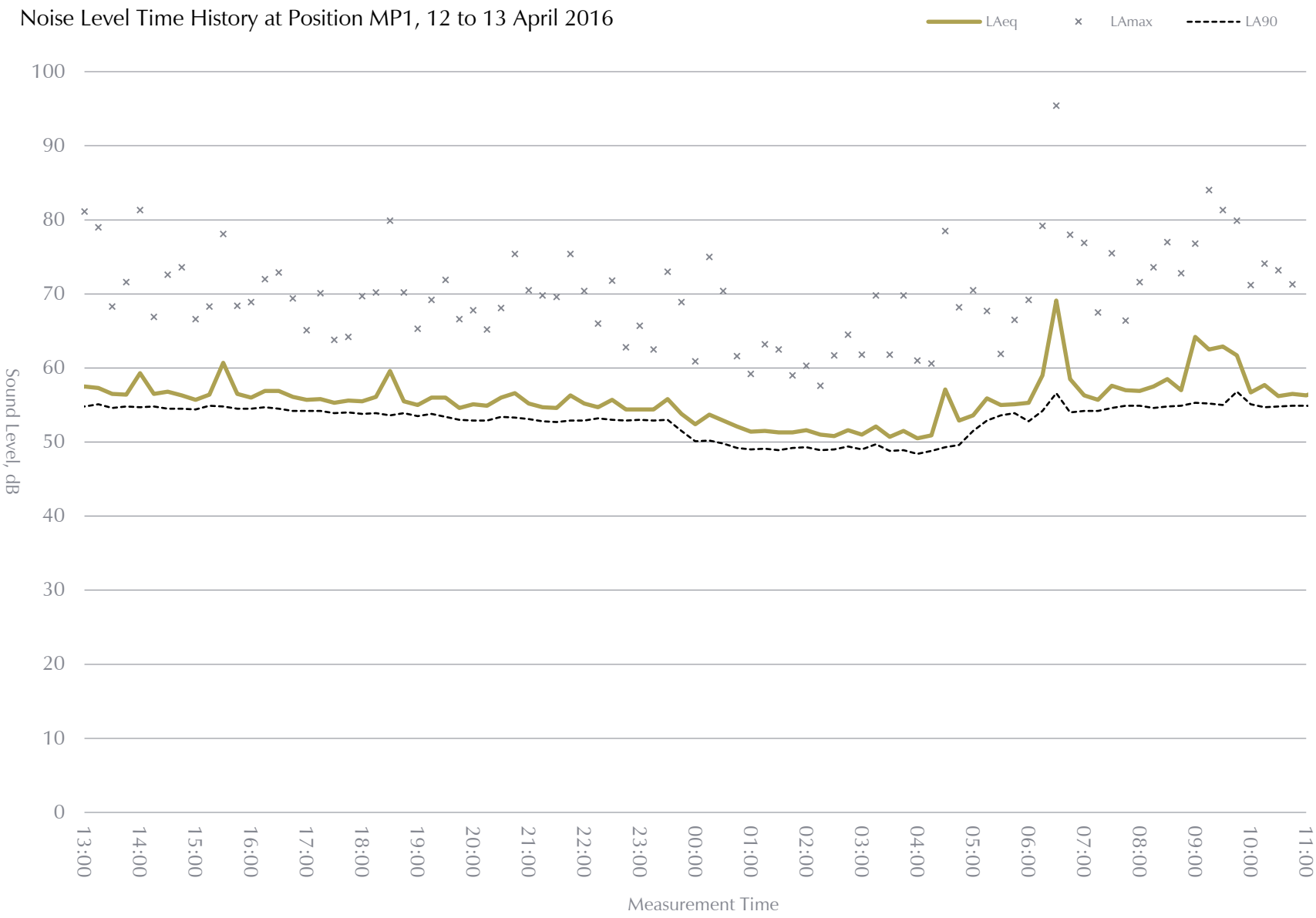


Figure 16/0190/TH01

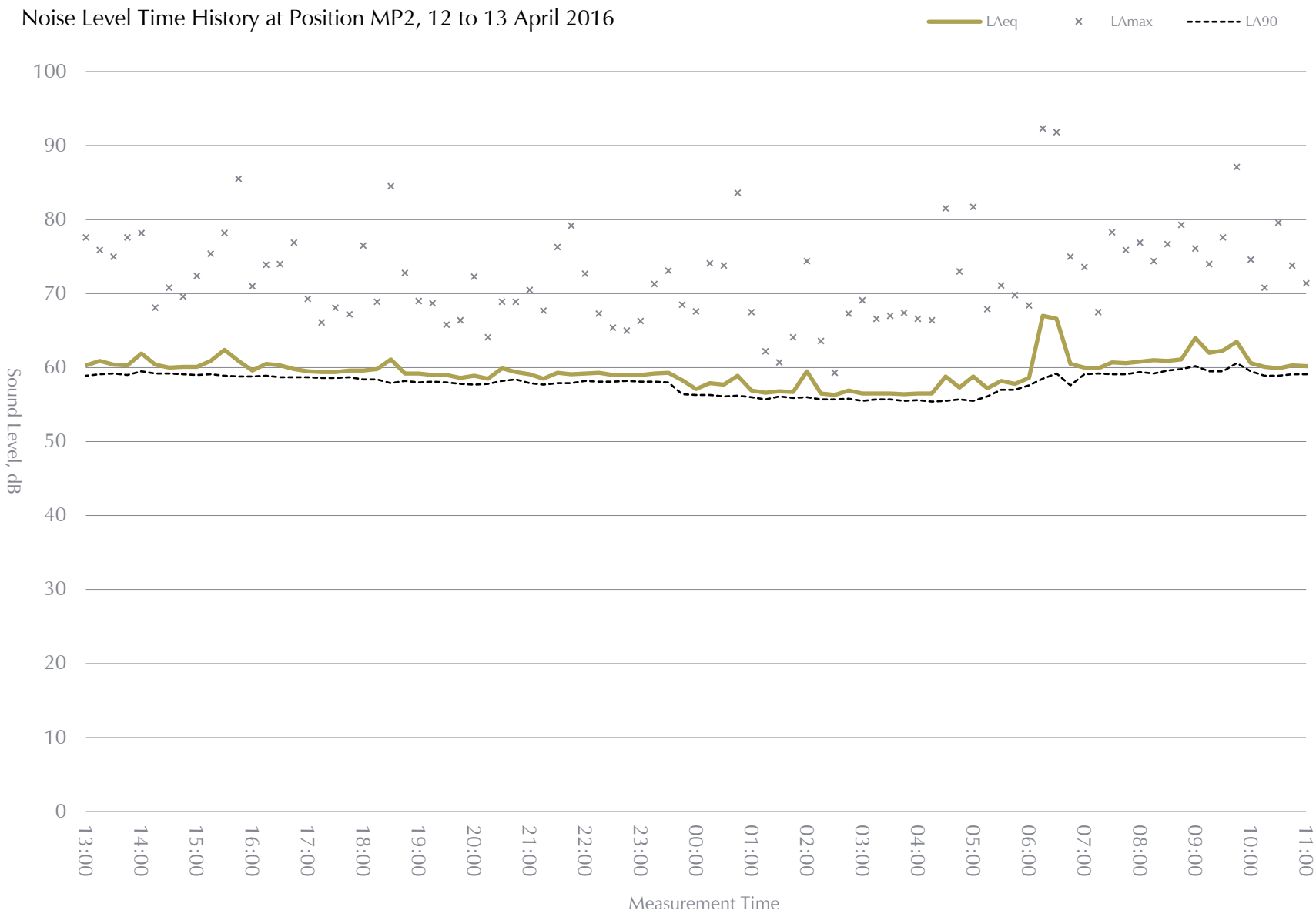


Figure 16/0190/TH02

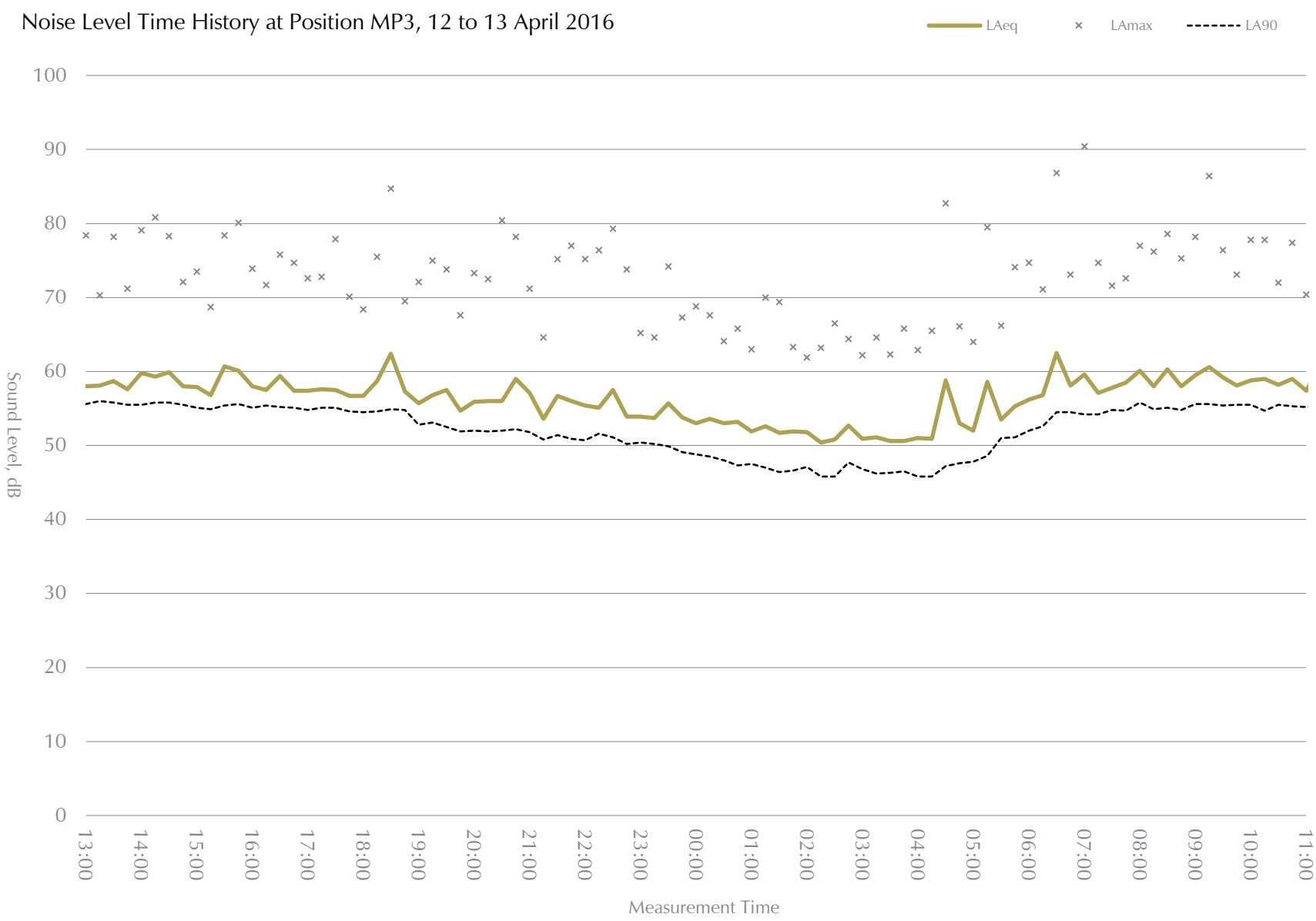


Figure 16/0190/TH03

Schedule of Plant and Air Handling Equipment Sound Levels, dB

Reference	Description	Data Source[1]	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
HP01	CXA 115	Man	Sound Pressure, Lp @ 10m	58.8	54.8	50.2	46	43.6	58.8	41.3	30.3
HP02	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP03	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP04	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP05	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP06	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP07	CXA 115	Man	Sound Pressure, Lp @ 10m	58.8	54.8	50.2	46	43.6	58.8	41.3	30.3
HP08	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP09	Daikin REYQ-T	Man	Sound Power, Lw	86	86	85	85	81	75	71	67
HP10	CXA 115	Man	Sound Pressure, Lp @ 10m	58.8	54.8	50.2	46	43.6	58.8	41.3	30.3
Extract Fan Outlet	AVT7	Man	Sound Power, Lw	81	77	74	75	74	71	67	61
Extract Fan Casing	AVT7	Man	Sound Power, Lw	67	59	54	46	36	33	37	27
Extract Fan Outlet	AVS7	Man	Sound Power, Lw	81	77	74	75	74	71	67	61
AHU1 Inlet	Sixth Floor	Man	Sound Power, Lw	55.2	63.8	67.5	60.9	53.6	45.5	41.7	35.6

Reference	Description	Data Source	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
AHU Inlet 6F	Sixth Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
AHU Inlet 5F	Fifth Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
AHU Inlet 4F	Fourth Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
AHU Inlet 3F	Third Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
AHU Inlet 2F	Second Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
AHU Inlet GF	Ground Floor	Man	Sound Power, Lw	57.6	60.6	69.6	61.4	53.7	50.3	44.5	35.9
Heat Pump	Daikin VRV RXYSQ6P8Y1	Man	Sound Power, Lw	70	70	68	70	62	58	49	45
Heat Pump	Daikin VRV RXYSQ6P8Y1	Man	Sound Power, Lw	70	70	68	70	62	58	49	45
Extract Fan Outlet	Nuaire Twin Extract Fan	Man	Sound Power, Lw	81	77	74	75	74	71	67	61

Notes

1 - Man refers to data supplied by the equipment manufacturer or supplier, Emp refers to data calculated using empirical formulae, and Meas refers to data measured by Cole Jarman

Specification 16/0190/SPC1

Project: **TUC Congress House, Camden**
Subject: **Acoustic specification of duct silencers**
Date: **April 2016**

1 General

1.1 Description

1.1.1 Furnish and install duct silencers of the types and sizes shown in the report.

1.1.2 Transitions and support or suspension systems are not included.

1.2 Quality Assurance

1.2.1 The dynamic insertion loss shall meet or exceed the values given in the schedules.

1.2.2 The static pressure drop shall not exceed the value given in the silencer schedules.

1.2.3 The levels of airflow noise generated by the silencers themselves at the operating conditions shall be provided by the supplier, if requested.

1.2.4 Performance data relating to dynamic insertion loss, static pressure drop and self-noise shall be obtained in accordance with BS 4718:1971 or BS EN ISO 7235 : 1996.

1.3 Submittals

1.3.1 Data sheets on the specific silencers utilised.

1.3.2 An itemised list showing the specific silencer utilised, its size, pressure drop at the required airflow volume, certified test data on dynamic insertion loss and self-noise power levels.

2 Materials and Construction

2.1 Outer casings and interior construction

2.1.1 Outer casings of rectangular silencers shall be made of 18 gauge galvanized steel or thicker in accordance with the HVCA recommended construction for high pressure rectangular ductwork. Seams shall be lock formed and mastic sealed.

2.1.2 Interior partitions for rectangular silencer splitters shall be made of not less than 26 gauge galvanized perforated steel.

2.1.3 Interior construction of tubular silencers shall be compatible with the outside casings.

2.1.4 Splitters in rectangular silencers of length not less than 900mm shall have aerodynamically shaped leading and trailing edges. Square or blunt ends are not acceptable.

2.1.5 Silencers shall be fitted with drilled angle flange connections unless other forms of connection are specified by the Mechanical Services Consultant or Contractor.

2.2 Configuration

2.2.1 Splitters within the silencer should generally be aligned with half width splitters affixed to each side wall of the casing. Splitters shall preferably be aligned vertically, and there shall be a regular splitter/airway dimension across the full width of the silencer. Horizontal splitters, where this orientation is required, shall be suitably supported and stiffened to prevent sagging and restriction of the airways. It is of particular importance that the supplier ensures that parallel splitter elements are orientated to suit the aerodynamic conditions arising from the adjacent duct geometry, particularly in the vicinity of bends and other transitions.

2.2.2 For silencers manufactured in modules, this specification shall apply to the unit as a whole.

2.2.3 The supplier shall comply with the cross-sectional sizes as shown in the schedule, unless alternative dimensions are agreed and approved by the Mechanical Services Contractor and the Acoustic Consultant. Silencers which are constructed to alternative cross-sectional dimensions must achieve the dynamic insertion loss and pressure drop requirements as set out in the schedule.

2.3 Standard silencers

2.3.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; not vermin and moisture proof; non-combustible and non-hygroscopic.

2.3.2 The filler material shall be retained in the splitters in such a manner that there is no egress of the fibres into the air stream at the prevailing flow conditions. Splitters will normally be faced with perforated galvanised sheet steel: any other facing material must be approved by the Acoustic Consultant.

2.4 Silencers with non-porous fibre protection membrane

2.4.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; not vermin and moisture

proof; non-combustible and non hygroscopic. Filler material shall be totally encapsulated and sealed with Melinex film of a thickness no less than 0.03mm.

2.5 **Special silencers with no acoustical fill**

2.5.1 No acoustic fill material: glass fibre, mineral wool, foam, etc., are not permitted.

2.5.2 Insertion loss provided by broadly tuned resonators and impedance membranes.

2.6 **Special Operating Conditions**

2.6.1 Where corrosive or toxic gases are contained in the air stream, special constructions and materials may be specified as an addendum to this specification.

2.6.2 Silencers which are expected to operate at high temperatures (e.g. turbine exhausts, boiler flues etc.) shall be constructed of a suitable gauge material, with precautions taken to allow for thermal expansion and shock. The filler material inside the splitters shall generally comply with the provisions outlined in Paragraph 2.1.C, with modifications as required to accommodate the high operating temperature. For very high temperatures, steel wool or equivalent approved may be used as the filler material.

3 Execution

3.1 Silencer units shall be delivered to site with blocked ends to prevent the ingress of rubble prior to installation and to reduce the risk of damage. The silencer identification shall be clearly marked on the casing, as shall the direction of airflow.

3.2 The silencers shall be installed in accordance with the manufacturer's recommendations to obtain the published acoustic and air flow performance.

3.3 The silencers shall be located as shown in the drawings.

3.4 Orientate the internal silencer splitters as follows for rectangular silencers:

- Silencer splitters be oriented so as to be parallel to the plane of the turn if the silencer is located in a position less than 3 duct diameters in distance from the elbow. The duct diameter shall be based upon the maximum duct cross sectional dimension of the silencer.
- If the silencer is located greater than 3 duct diameters away from an elbow, the orientation is not critical.

3.5 Locate no rectangular or circular silencers within one duct diameter from elbows, fan suction or discharge openings takeoffs, etc., unless indicated on the drawings and/or approved by the Acoustic Consultant.

4 Potential Product Suppliers

4.1 Allaway Acoustics

- Contact: Jim Grieve
- Telephone: 01992 550825
- enquiries@allawayacoustics.co.uk
- Address
  Old Police Station
  1 Queens Road, Hertford,
  Hertfordshire, SG14 1EN
- www.allawayacoustics.co.uk

4.2 Caice Acoustic Air Movement Ltd

- Telephone: 0118 9186470
- enquiries@caice.co.uk
- Head Office Address
  Riverside House
  3 Winnersh Fields
  Gazelle Close, Winnersh
  Wokingham, RG41 5QS
- www.caice.co.uk

4.3 Environmental Equipment Corporation

- Contact: Tim Meed
- Telephone: 01932 230940
- info@eecnoisecontrol.co.uk
- Address
  Richmond House
  Churchfield Road
  Walton-on-Thames,
  Surrey, WV13 3RS
- www.eecnoisecontrol.co.uk

4.4 IAC Ltd

- Contact: Mike Jackson
- Telephone: 01962 873000
- info@iacl.co.uk
- Head Office Address
  IAC House
  Moorside Road, Winchester
  Hampshire, SO23 7US
- www.industrialacoustics.com/uk

4.5 Noico Ltd

- Telephone: 01256 766207
- sales@noico.co.uk
- Address
  Patrick House
  Station Road, Hook
  Hampshire, RG27 9HU
- www.noico.co.uk

4.6 TEK Limited

- Contact: Paul Virgo
- Telephone: 0121 766 5005
- sales@tek.ltd.uk
- Address
  Seeleys Road, Greet
  Birmingham B11 2LQ
- www.tek-ltd.com

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

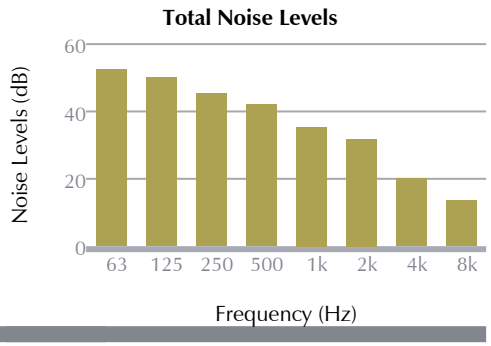
If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

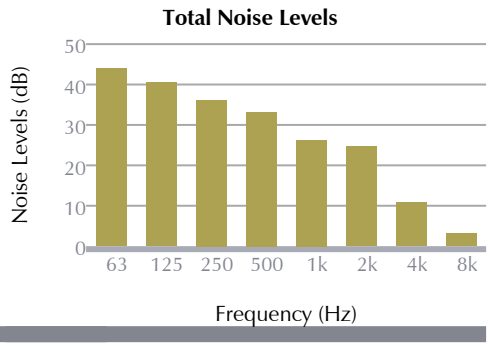
Project Name	TUC Congress House, Camden
Project Reference	16/0190
Receiver Reference	AP1 - Night time
Description	Parnell House
Noise Limit	44
dBA	43.3



Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
HP01	41.5	35.9	29.2	22.6	17.5	29.8	9.4	-4.6
HP02	40.2	38.6	35.6	33.2	26.5	17.6	10.7	3.8
HP03	41.5	40.1	37.2	34.9	28.3	19.5	12.6	5.6
HP04	42.1	40.8	38	35.7	29.2	20.4	13.5	6.5
HP05	42.4	41.2	38.4	36.2	29.6	20.9	14	7
HP06	32.2	30.2	20.8	9.9	-3.5	-13.1	-21.9	-28.8
HP07	44.8	39.8	28.2	15	5.6	19.8	0.3	-10.7
HP08	43	42	34	25	14	7	1	-3
HP09	43	42	34	25	14	7	1	-3
HP10	33.2	27.2	14	-1.3	-13.1	-1.6	-24	-37.9
Extract Fan Outlet	37.7	32.6	27.8	26.3	16.7	5.9	-3	-11.9
Extract Fan Casing	20.8	11.6	4.8	-5.4	-18	-23.7	-22.6	-35.6
Extract Fan Outlet	41.8	34.5	26.4	20.6	8.6	1.6	2.6	1.6
AHU1 Inlet	19.6	27.5	32.1	26.2	13.5	0.4	-5.4	-11.2
AHU Inlet 6F	14.2	16.5	26.4	18.9	6.8	-0.6	-7.4	-15.7
AHU Inlet 5F	14.2	16.5	26.4	18.9	6.8	-0.6	-7.4	-15.7

Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
AHU Inlet 4F	14.2	16.5	26.4	18.9	6.8	-0.6	-7.4	-15.7
AHU Inlet 3F	14.2	16.5	26.4	18.9	6.8	-0.6	-7.4	-15.7
AHU Inlet 2F	14.2	16.5	26.4	18.9	6.8	-0.6	-7.4	-15.7
AHU Inlet GF	13.2	14.8	23.2	11.9	2.3	-1.6	-8.4	-16.7
Heat Pump	35.7	34.7	25.7	18.7	3.7	-1.3	-12.3	-16.3
Heat Pump	35.7	34.7	25.7	18.7	3.7	-1.3	-12.3	-16.3
Extract Fan Outlet	30.1	20.3	23.3	30.1	26.1	17.1	10.1	6.1

Project Name	TUC Congress House, Camden
Project Reference	16/0190
Receiver Reference	AP2 - Night time
Description	Residences to the North
Noise Limit	42
dBA	34.4



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
HP01	37.4	31.1	23.8	16.8	11.5	23.8	3.3	-10.7
HP02	35.6	33.3	29.6	26.8	19.9	10.9	4	-3
HP03	35.6	33.3	29.6	26.8	19.9	10.9	4	-3
HP04	35.6	33.3	29.6	26.8	19.9	10.9	4	-3
HP05	35.6	33.3	29.6	26.8	19.9	10.9	4	-3
HP06	23.6	20.3	9.6	-2.2	-16.1	-26.1	-35	-42
HP07	25.4	18.1	3.8	-12.2	-24.5	-13.2	-35.7	-49.7
HP08	23.6	20.3	9.6	-2.2	-16.1	-26.1	-35	-42
HP09	23.6	20.3	9.6	-2.2	-16.1	-26.1	-35	-42
HP10	25.4	18.1	3.8	-12.2	-24.5	-13.2	-35.7	-49.7
Heat Pump	17.3	16.3	7.3	0.3	-14.7	-19.7	-30.7	-34.7
Heat Pump	17.3	16.3	7.3	0.3	-14.7	-19.7	-30.7	-34.7
Extract Fan Outlet	34.5	28.6	23.1	21.1	11.2	0.3	-8.7	-17.7
Extract Fan Casing	17.5	7.4	-0.2	-10.9	-23.8	-29.7	-28.7	-41.7
Extract Fan Outlet	24.3	14.7	4	-4.6	-19.5	-29.5	-31.5	-35.5
Extract Fan Outlet	12.6	0.5	0.9	4.8	-2.1	-14.1	-24	-31

Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
AHU1 Inlet	2.1	7.7	9.7	0.9	-14.7	-30.8	-39.5	-48.3

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