Acoustic Consultancy Report

03842/3/1/7

Acoustic Commissioning Report

Report Prepared For

Butler And Young Associates
Alexandra Road Estate
29 July 2022

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i) Executive Summary

Acoustic testing has been performed at Alexandra Road Estate, London Borough of Camden.

Internal testing of the Heat Interface Units in two flats was carried out in accordance with ANC-9701, ANC guidelines: ‘Noise measurement in buildings - Part 1: Noise from building services’.

Results are displayed in Table 5 and discussed in section 5.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	29/07/2022	Initial Issue	JT	MB

1 Introduction

The testing of Heat Interface Units in two pilot flats was undertaken to establish the suitability of installing into bedrooms throughout the estate.

Acoustic commissioning testing has been carried out to confirm the following noise aspects of the design have been achieved:

Commissioned Aspect(s)
Airborne noise levels from internally located mechanical plant.

This report details all measurement results and data obtained during the testing period and sets out all findings following comparison of the obtained data with the project design criteria.

2 Testing Programme

The testing was carried out on the Heat Interface Units within flats 26a and 46a.

Testing was carried out by Jasmin Turner of LCP. David Manuell and David Wadsworth were in attendance to witness the testing.

All plant had been balanced and commissioned prior to acoustic testing.

2.1 Calibration

The measurement equipment (as detailed at the end of Appendix B) was calibrated prior to and after obtaining measurements. As required, the equipment was also calibrated under the circumstances outlined in paragraph 4.3 of ANC-9701-1 (if they arose during the testing period).

The recorded calibration gain adjustment levels were as follows:

Table 1: Calibration gain adjustment levels (114 dB at 1 kHz), dB re $2x10^{-5}$ Pa

Before	After
1.92	1.94

2.2 Internal Measurements of Noise Due to Building Services

All internal measurements of building services noise were made in accordance with ANC-9701, ANC guidelines: ‘Noise measurement in buildings - Part 1: Noise from Building Services’.

The noise sources tested have been categorised using the following definitions as described in ANC-9701-1, and the respective parameters assigned:

Table 2: Preferred measurement parameters (from ANC-9701-1)

Type of Noise	Continuous	Intermittent
Steady	$L_{eq,T}$ or $L_{90,T}$. T not less than 10 seconds	As for continuous steady noise - measure both with plant on (or high) and off (or low).
Non-steady or impulsive	$L_{eq,\ 30\ Sec}$ and Highest $L_{eq,\ 1\ Sec}$ over a 30 second period. Where the noise cycles over a period of more than 30 seconds, measure both when the noise is at the highest and lowest points of the cycle.	As for continuous non-steady noise - measure both with plant on (or high) and off (or low).

2.3 Operational Equipment

The following internally located equipment was operational at the time of testing:

Table 3: Internal Plant Operation

Operational Internal Plant	Tested Duty	Description of Noise Output	Measurement Parameter
HIU	Normal Operation	Continuous and steady	$L_{eq,10s}$ and $L_{90,10s}$

2.4 Site Conditions

Testing was undertaken at a time when external noise sources (predominantly vehicular traffic) were operating under normal conditions (i.e. no road works etc).

Weather conditions were of no influence on internal noise levels.

3 Design Criteria

Guidance is provided in BS8233:2014, this is shown in the table below:

Table 4: Internal design criteria

Space	Criteria	
	07:00 to 23:00	**23:00 to 07:00**
Bedrooms	35 $L_{Aeq,\ 16\ hour}$	30 $L_{Aeq,\ 8\ hour}$

4 Internal Noise Measurement Results

4.1 Adjustments for Tonality or Impulsivity

No adjustments have been made to the measurement results to account for either the effects of tonality or impulsivity, as all measured noise sources were continuous and steady while testing. As the plant was running at normal duty, it is expected that these running conditions will be 'normal' for day-to-day operation.

4.2 Results

The table below shows the summary of the noise measurements. The spectral data is shown in Appendix B.

Table 5: Summary of internal noise measurement results, dB re $2x10^{-5}$ Pa

	Location	Doors Open/Closed	Notes	Result dB L_{A90}
Pilot Flat 26a	Bedroom 1	Closed	Heating only	26
		Open	Heating only	31
	Bedroom 2	Closed	Heating only	26
		Open	Heating only	29
	Bedroom 3	Closed	Heating only	26
		Open	Heating only	29
	In HIU Cupboard	Closed	Heating and hot water	44
	Bedroom 1	Open	Heating and hot water	31
	Bedroom 1 Background	-	-	19
Pilot Flat 46a	0.5m from HIU	Open	Hot water/tap on. Mostly tap/water noise.	40
	Bedroom 1	HIU Cupboard Open	Hot water/tap on. Mostly tap/water noise.	37
		HIU Cupboard Closed	Hot water/tap on. Mostly tap/water noise.	34
		HIU Cupboard Closed	Hot water/tap off.	21
		HIU Cupboard Closed	Higher operational duty	39
		HIU Cupboard Closed	Pump kicking in. Nearest to typical duty.	40
		Background	-	22

5 Comments and Notes

While the flats were unoccupied during the testing there was still an element of disruption from neighbouring properties. For this reason, the L_{A90} results have been used to negate as much as possible any influence from neighbours or movement within the flat.

It should be noted that for the HIU to run in pilot flat 26a a pump was necessary, this was subjectively much louder than the HIU itself.

To test the HIU at full duty, the hot water taps were run, however due to the size and layout of the flats the noise of running water from the taps was again subjectively louder than the HIU.

Measurements taken in flat 46a are at different duties as there was difficulty in getting the HIU to run as typical, these have all been summarised below.

A desktop assessment could also be carried out based on manufacturer noise data.

Appendix A: Measurement Data

				LEQ										L90									Description
No.	Date & time	Filename	Time	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	Total A	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	Total A	
1	26/07/2022 11:03:38	@ARE0001	00:00:10	34	32	31	26	22	21	18	18	29	29	26	28	21	19	15	14	14	26	Flat 26- Bedroom 1 - Doors closed
2	26/07/2022 11:03:48	@ARE0002	00:00:10	35	36	35	29	25	21	19	16	32	28	26	27	22	19	16	14	15	26	
3	26/07/2022 11:03:58	@ARE0003	00:00:10	50	47	38	37	33	30	28	23	39	30	27	30	25	20	18	15	15	28	
4	26/07/2022 11:04:40	@ARE0004	00:00:10	37	36	36	30	28	24	18	17	33	32	31	33	27	26	22	17	15	31	Flat 26- Bedroom 1- Doors open
5	26/07/2022 11:04:50	@ARE0005	00:00:10	34	34	35	28	27	23	18	16	32	29	29	32	26	25	21	17	15	31	
6	26/07/2022 11:05:00	@ARE0006	00:00:10	35	34	35	29	27	24	18	16	32	31	30	32	27	26	22	17	15	31	
7	26/07/2022 11:06:12	@ARE0007	00:00:10	37	34	30	24	20	19	16	17	27	32	28	27	21	17	15	14	15	25	Bedroom 2- Doors closed
8	26/07/2022 11:06:22	@ARE0008	00:00:10	37	34	34	26	21	18	16	15	29	30	27	28	22	18	15	14	14	26	
9	26/07/2022 11:06:32	@ARE0009	00:00:10	38	35	33	26	21	20	19	17	29	30	29	29	22	18	15	14	15	26	
10	26/07/2022 11:08:26	@ARE0015	00:00:10	38	37	33	28	25	20	16	16	30	33	32	29	26	22	18	15	14	29	Bedroom 2- Doors open
11	26/07/2022 11:08:36	@ARE0016	00:00:10	39	36	33	28	25	21	17	15	31	32	32	29	26	22	18	15	14	29	
12	26/07/2022 11:08:46	@ARE0017	00:00:10	38	36	32	28	24	20	16	15	30	33	31	29	26	22	18	15	14	29	
13	26/07/2022 11:10:12	@ARE0018	00:00:10	33	39	38	36	35	29	20	16	39	27	33	34	28	26	19	16	14	32	Living area Doors open
14	26/07/2022 11:10:22	@ARE0019	00:00:10	33	39	40	38	36	30	23	20	40	26	33	34	29	27	21	18	16	34	
15	26/07/2022 11:10:32	@ARE0020	00:00:10	33	40	41	40	35	29	26	20	40	27	33	34	28	26	22	19	16	33	
16	26/07/2022 11:12:28	@ARE0022	00:00:10	37	36	36	31	24	21	17	16	32	30	32	33	26	21	17	15	15	30	
17	26/07/2022 11:12:38	@ARE0023	00:00:10	37	37	36	28	24	19	16	16	31	30	32	33	26	21	17	14	15	29	
18	26/07/2022 11:12:48	@ARE0024	00:00:10	39	36	35	28	23	18	15	15	30	32	32	33	25	21	16	14	15	29	
19	26/07/2022 11:15:16	@ARE0025	00:00:10	59	37	37	33	32	31	30	27	39	50	31	33	27	23	21	18	16	31	Living area Doors closed
20	26/07/2022 11:15:26	@ARE0026	00:00:10	43	36	36	28	25	20	16	15	31	36	32	32	25	21	17	15	15	29	
21	26/07/2022 11:15:36	@ARE0027	00:00:10	44	37	36	30	28	25	19	17	34	34	33	33	26	23	18	15	15	31	
22	26/07/2022 11:18:04	@ARE0028	00:00:10	32	35	34	38	36	31	30	24	40	26	25	27	23	21	19	18	16	28	Bedroom 3- Doors Closed
23	26/07/2022 11:18:14	@ARE0029	00:00:10	35	32	31	31	32	26	21	17	34	28	27	26	21	18	15	15	15	25	
24	26/07/2022 11:18:24	@ARE0030	00:00:10	38	36	33	27	21	21	18	17	30	30	29	26	21	18	16	15	15	26	
25	26/07/2022 11:19:50	@ARE0033	00:00:10	36	37	36	30	25	20	17	16	32	29	29	31	25	22	17	15	15	29	Bedroom 3- Doors open
26	26/07/2022 11:20:00	@ARE0034	00:00:10	37	34	35	29	26	23	22	19	32	29	28	32	25	22	18	15	15	29	
27	26/07/2022 11:20:10	@ARE0035	00:00:10	38	35	36	30	24	20	17	16	32	30	29	32	25	22	17	15	15	29	
28	26/07/2022 11:23:56	@ARE0036	00:00:10	44	45	44	43	39	37	29	22	44	38	40	41	41	37	36	28	21	44	In HIU cupboard hot water and heating on
29	26/07/2022 11:24:06	@ARE0037	00:00:10	52	47	45	43	39	38	29	22	45	41	42	42	41	37	36	27	21	44	
30	26/07/2022 11:24:16	@ARE0038	00:00:10	54	48	45	44	40	38	29	22	45	41	42	42	41	38	36	28	21	44	
31	26/07/2022 11:25:52	@ARE0039	00:00:10	34	33	35	29	28	30	33	30	38	27	29	32	27	25	22	17	16	31	Bedroom 1- Doors open
32	26/07/2022 11:26:02	@ARE0040	00:00:10	34	34	35	28	27	24	21	18	33	27	30	32	26	25	21	17	15	31	
33	26/07/2022 11:26:12	@ARE0041	00:00:10	34	34	35	28	26	24	21	18	32	28	29	32	26	25	21	17	15	31	
34	26/07/2022 11:26:26	@ARE0042	00:00:10	38	39	36	35	33	34	33	26	40	30	32	32	27	25	22	18	16	32	
35	26/07/2022 11:26:36	@ARE0043	00:00:10	36	40	35	28	26	22	19	17	32	27	32	32	26	25	21	17	15	31	
36	26/07/2022 11:26:46	@ARE0044	00:00:10	34	39	35	28	26	23	18	16	32	26	30	32	26	25	21	17	15	31	
37	26/07/2022 11:50:46	@ARE0045	00:00:10	53	39	35	40	37	32	29	20	41	44	36	32	38	35	30	28	19	40	Flat 46a 0.5m from HIU Tap on
38	26/07/2022 11:50:56	@ARE0046	00:00:10	50	39	36	40	37	32	29	20	41	43	36	33	37	34	31	28	19	40	
39	26/07/2022 11:51:06	@ARE0047	00:00:10	51	38	35	39	37	32	28	20	41	40	34	32	37	35	31	27	19	40	
40	26/07/2022 11:51:30	@ARE0048	00:00:10	31	32	36	37	34	29	27	19	38	25	27	32	35	32	28	26	17	37	Cupboard open Tap on
41	26/07/2022 11:51:40	@ARE0049	00:00:10	33	34	36	37	34	30	28	20	39	26	28	33	35	32	28	26	17	38	
42	26/07/2022 11:51:50	@ARE0050	00:00:10	31	31	36	37	33	29	27	18	38	26	27	33	35	32	28	26	17	37	
43	26/07/2022 11:52:50	@ARE0051	00:00:10	31	29	31	32	31	26	24	17	35	25	25	28	30	29	25	23	16	34	Cupboard closed Tap on
44	26/07/2022 11:53:00	@ARE0052	00:00:10	30	29	32	33	31	27	24	17	35	24	24	28	31	29	25	23	16	34	
45	26/07/2022 11:53:10	@ARE0053	00:00:10	29	31	32	33	31	27	25	18	36	24	25	28	31	29	25	23	16	34	
46	26/07/2022 11:54:10	@ARE0054	00:00:10	33	46	41	34	28	26	23	20	37	22	25	23	21	16	17	15	15	23	Cupboard closed Tap off
47	26/07/2022 11:54:20	@ARE0055	00:00:10	29	24	22	21	15	16	15	15	22	22	20	17	16	13	14	14	15	20	
48	26/07/2022 11:54:30	@ARE0056	00:00:10	33	36	33	31	28	24	22	17	33	26	23	20	17	14	15	14	15	21	
49	26/07/2022 12:00:54	@ARE0057	00:00:10	35	39	45	39	32	26	21	18	40	31	35	42	36	31	23	17	16	38	Cupboard close Noisier
50	26/07/2022 12:01:04	@ARE0058	00:00:10	38	38	46	41	32	25	19	16	41	34	33	42	38	31	23	17	15	40	
51	26/07/2022 12:01:14	@ARE0059	00:00:10	38	38	46	39	32	25	19	17	40	35	34	42	36	30	24	17	16	39	
52	26/07/2022 12:06:04	@ARE0060	00:00:10	33	38	45	41	32	26	21	18	41	26	33	41	38	31	23	18	16	39	Cupboard closed Pump kicking in
53	26/07/2022 12:06:14	@ARE0061	00:00:10	35	40	45	43	32	26	20	17	42	29	34	42	40	31	24	19	16	41	
54	26/07/2022 12:06:24	@ARE0062	00:00:10	39	40	46	42	33	26	21	17	42	35	36	42	39	31	24	18	16	40	
55	26/07/2022 12:09:38	@ARE0063	00:00:10	35	30	26	24	30	27	18	17	32	27	23	19	18	14	15	14	15	22	Flat 46 Background
56	26/07/2022 12:25:10	@ARE0071	00:00:10	32	30	29	22	20	19	16	16	26	22	18	17	15	13	13	13	14	19	Flat 26 background

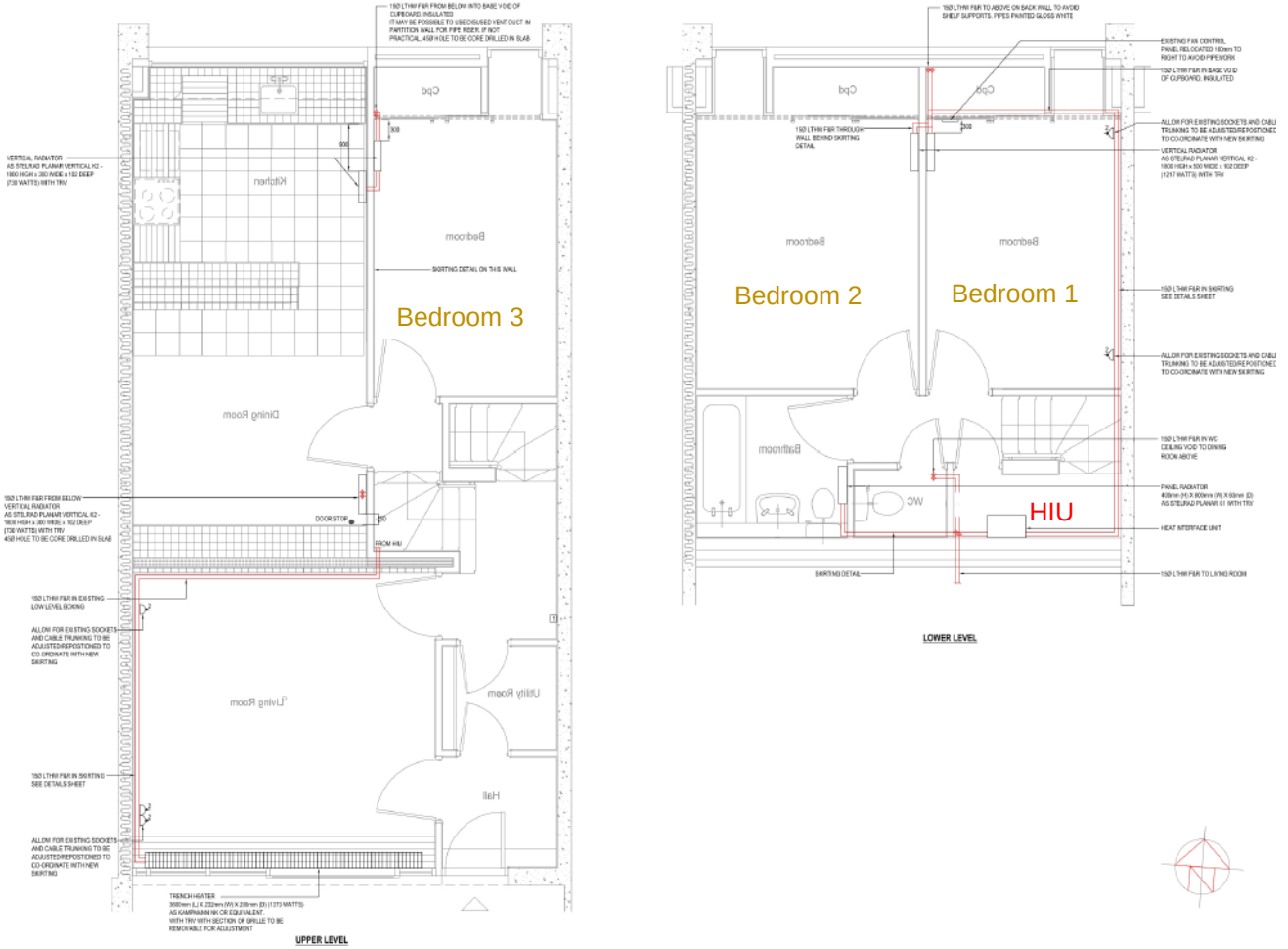
Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11207
- Svantek pre-amplifier SV12L S/N: 49860 with GRAS microphone capsule 40AE S/N: 215511

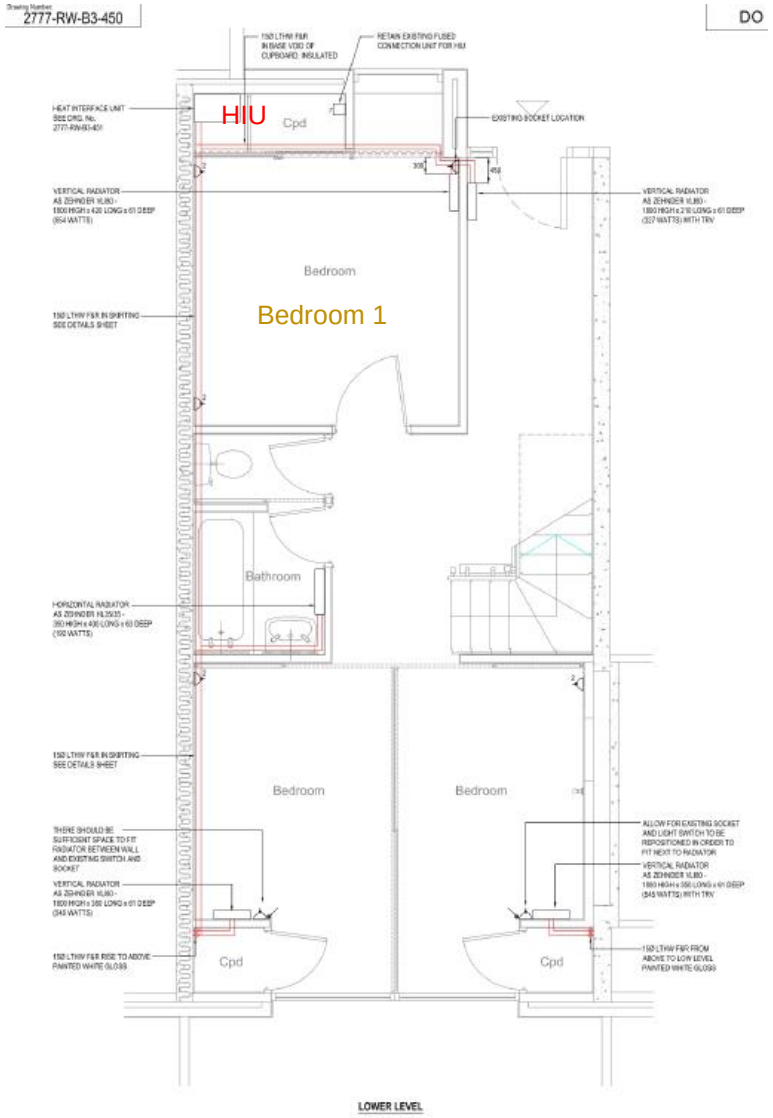
Calibration checks were made prior to and after completion of measurements using a Svantek SV33 calibrator, S/N: 43066 complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance, copies of which are available on request.

Appendix B: Floor Plans

Flat 26a



Flat 46a


2777-RW-B3-450
DO
HIU
Cpd
Bedroom
Bedroom 1
Bathroom
Bedroom
Bedroom
Cpd
Cpd
LOWER LEVEL

Appendix C: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting
Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).
Airborne Noise
Noise transmitted through air.
dB or Decibel
Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB

$D_{nTw}+C_{tr}$	
The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.	
D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.
Frequency (Hz)	

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The ‘A’ weighted noise level exceeded for 90% of the time period T, described or measured. The ‘90’ can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The ‘A’ weighted ‘equivalent’ noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The ‘A’ weighted maximum measured noise level. Can be measured with a ‘slow’ (1 sec) or ‘fast’ (0.125 sec) time weighting.

L_{Amin}

The ‘A’ weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	

	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

W

Watts, the SI unit to describe power, after engineer James Watt.