

**THE HOXTON, HOLBORN  
NEWTON STREET EXTENSION  
NOISE IMPACT ASSESSMENT**

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# 1 INTRODUCTION

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- 1.1 Proposals are in place for an extension to the Hoxton Hotel in Holborn, to be built alongside the existing building on Newton Street. The extension will consist of two new ground floor rooms accessed from the hotel and an open courtyard area incorporating a weatherproof retail kiosk.
- 1.2 As part of their pre-application advice prior to the submission of an application for planning permission, the local authority have recommended that a noise impact assessment is undertaken. This report presents that assessment.
- 1.3 Chapter 2 of this report details an external noise survey undertaken as part of the assessment and Chapter 3 contains the results, assessment, and commentary. Conclusions are presented in Chapter 4. Measurement data from the noise survey are presented in Appendix A and a glossary of terminology used in this report is included in Appendix C.

## 2 EXTERNAL NOISE SURVEY

### 2.1 SITE DESCRIPTION

- 2.1.1 The Hoxton, Holborn is located on the corner between High Holborn and Newton Street. The proposed extension is to be built in Newton Street some 20m from the intersection with High Holborn, in front of the existing meeting rooms on the eastern elevation of the hotel.
- 2.1.2 Newton Street is a one way street with traffic passing the site heading north towards the traffic light controlled junction with High Holborn. In the immediate vicinity of the hotel there is no on street parking provision and nearby buildings include residential accommodation and commercial office buildings with delivery access from Newton Street.

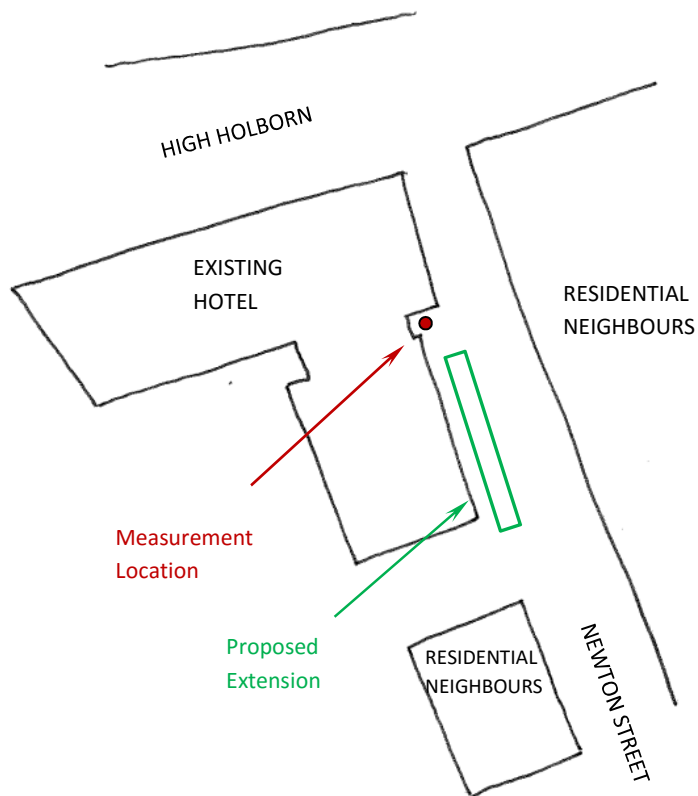
### 2.2 MEASUREMENT METHODOLOGY

- 2.2.1 Continuous, unattended noise level measurements were conducted at a single location, at roof level directly above the area of the proposed extension. The measurement microphone was in semi-free field conditions and screened from road traffic noise coming from High Holborn. Noise levels measured at this location are considered to be representative of the prevailing background noise at neighbouring residential properties.
- 2.2.2 The measurements were undertaken between 14:50 on Monday 21<sup>st</sup> September 2015 and 12:50 on Tuesday 22<sup>nd</sup> September 2015. Statistical and spectral data were recorded continuously throughout the measurement period in 10-minute samples.
- 2.2.3 The following equipment was used for the noise survey:

Equipment	Type	Serial No.
Norsonic 131	Precision sound analyser	1312766
Norsonic 1218	Microphone protection system	12182517
Brüel & Kjaer 4231	Calibrator	2291098

**Table 2.1: Noise measurement equipment**

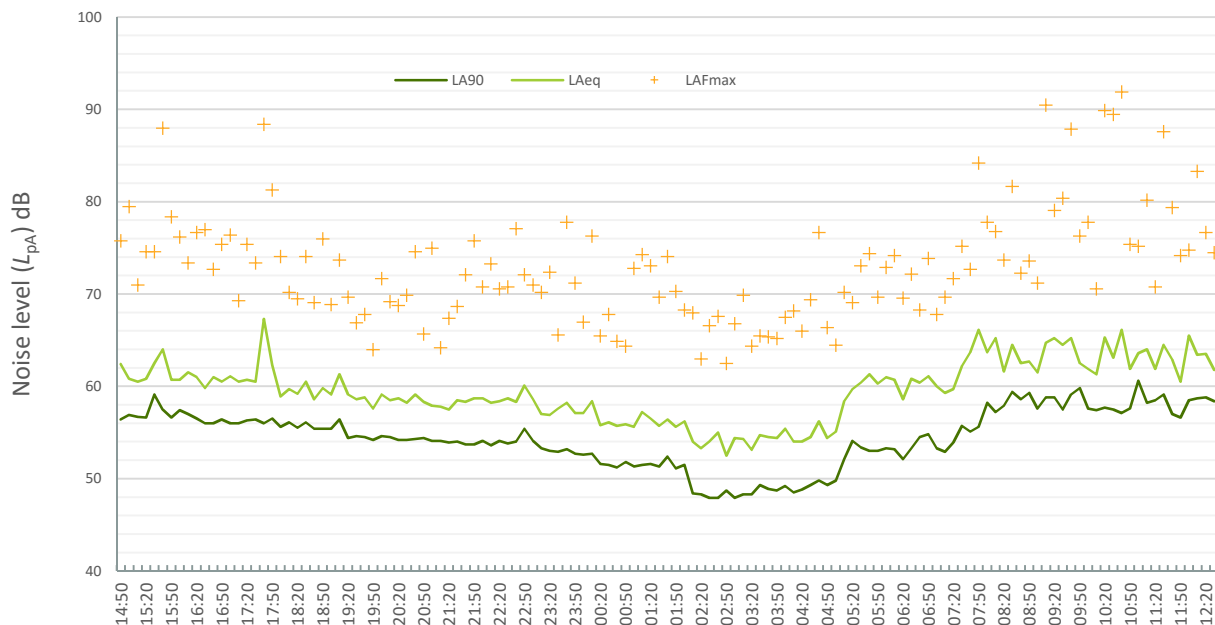
- 2.2.4 A calibration check of the sound level meter and associated microphone was undertaken prior to and on completion of the measurement period in accordance with recommended practice. No significant drift in calibration occurred during the measurement period. The accuracy of the calibrator can be traced to National Physical Laboratory Standards.
- 2.2.5 The measurement location is shown in Figure 2.1.
- 2.2.6 The weather conditions throughout the measurement period were calm with light rain, however this is not considered to have had a detrimental influence on the measurement results.



**Figure 2.1: Measurement Location**

**2.3 MEASUREMENT RESULTS**

2.3.1 The measurement results are presented in Appendix A. A graph showing the time history of the measurements is given in Figure 2.2.



**Figure 2.2: External noise levels, 21-22 September 2015**

2.3.2 The lowest measured background noise levels typically expected to occur during the daytime, evening and night-time are set down in Table 2.2. These levels have been determined based on the measured data and have assumed that the lowest levels measured at the measurement location are representative of those likely to normally be experienced at the nearest noise sensitive properties on Newton Street.

Time Period	Lowest background noise level
Daytime (07:00-19:00)	53dB $L_{A90,10min}$
Evening (19:00-23:00)	54dB $L_{A90,10min}$
Night-time (23:00-07:00)	48dB $L_{A90,10min}$

All values are sound pressure levels in dB re:  $2 \times 10^{-5}$ Pa

**Table 2.2: Summary of lowest background noise levels**

2.3.3 Subjective assessments of the prevailing ambient and background noise whilst on site indicated that the acoustic environment is dominated by noise from traffic and pedestrian activity both on Newton Street and High Holborn. The data shows noise levels increase from about 05:30 and then start to decrease again into the evening although they don't reach their lowest until after 1:30 am.

## 3 ASSESSMENT

### 3.1 LOCAL AUTHORITY GUIDANCE

3.1.1 The London Borough of Camden have provided pre-application advice concerning the extension in their letter of 22 July 2015. As part of this advice they recommended that:

*a noise report, carried out by a suitably qualified professional, is also submitted with the application to clearly demonstrate that the proposed mechanical plant would fully comply with our noise requirements.*

3.1.2 The London Borough of Camden has specific limits regarding noise emission from building services which, if exceeded, will result in planning permission not being granted. These limits taken from *Policy DP28 - Noise and Vibration* within the *Camden Development Policies, Adoption Version 10*, are presented in Table 3.1. These limits apply during the daytime and overnight.

Noise description and location of measurement	Maximum permitted noise level
Noise at 1 metre external to a sensitive façade.	5 dB < $L_{A90}$
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre, external to a sensitive façade.	10 dB < $L_{A90}$
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre, external to sensitive façade.	10 dB < $L_{A90}$
Noise at 1 metre external to sensitive façade where $L_{A90} > 60$ dB.	55 dB $L_{Aeq}$

**Table 3.1: London Borough of Camden plant noise limits**

3.1.3 Although not specifically referenced, the manner in which the Authority require any acoustic character of the noise to be accounted for is similar to the methodology set down in BS4142 : 1997. Consequently, other aspects of the methodology in BS4142 have also been used in the assessment.

### 3.2 BUILDING SERVICES EQUIPMENT

3.2.1 The principal items of noise generating plant associated with the proposed extension to the hotel are a heat pump unit to provide heating and cooling for the internal spaces and a ventilation system which serves the kiosk. The heat pump unit is intended to be located within screened enclosures on the top of the extension and the ventilation plant is intended to be contained within the kiosk.

3.2.2 Final plant selections have not yet been undertaken at this stage of the design and so an approach of establishing a maximum noise level limit at the nearest noise sensitive neighbours has been adopted. As long as plant selections do not exceed these specific limits, the potential for noise disturbance to the neighbouring residents will be satisfactorily minimised.

### 3.3 BACKGROUND NOISE LEVELS

3.3.1. The measurement data obtained from the survey was recorded in 10 minute samples as this provides a good balance between detail and quantity of data over an 18 hour measurement period. The methodology in BS 4142 : 1997, however, requires that a 5 minute assessment period be used at night and an hourly period be used during the daytime. In practice it is expected that the difference in noise level between these two sample periods at night is negligible and unlikely to be more than 1dB. During the daytime the lowest  $L_{A90,10min}$  will be lower than the lowest  $L_{A90,1hr}$  and so using this lower value in any assessment will give a more conservative estimate of the likely noise impact.

3.3.2 The lowest background noise level of 48dB  $L_{A90,10min}$ , as reported in Table 2.2 has therefore been used as the basis for establishing the necessary noise emission limits.

### 3.4 NEAREST NOISE SENSITIVE NEIGHBOURS

3.4.1 The nearest noise sensitive façade to the proposed extension is considered to be Aria House and the other neighbouring properties on the opposite side of Newton Road. These residential properties will overlook the new extension and the location of plant on its roof. At its closest, plant associated with the extension is likely to be about 12m from these facades.

### 3.5 NOISE EMISSION LIMITS

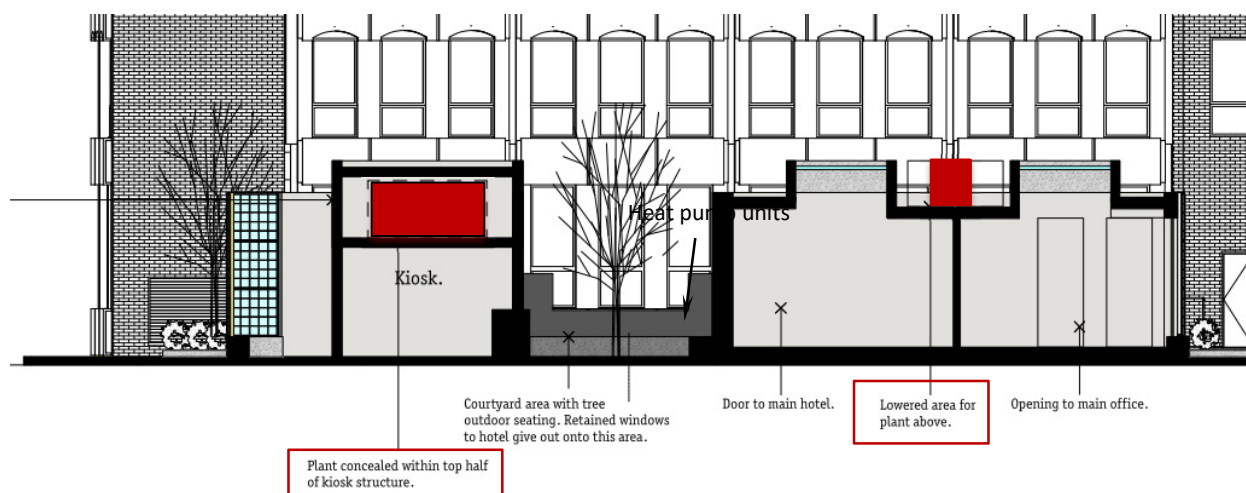
3.5.1 The London Borough of Camden require noise emission to be controlled in line with the limits set down in Table 3.1. For non-specific building services plant the noise emission should be controlled to 5dBA below the background noise level however if this plant noise includes some acoustic feature such as a distinctive tone or impulsive character then the limit is made more onerous and reduced to 10dB below the underlying background noise level.

3.5.2 The data presented in Appendix B for the current preliminary plant selections show the noise level is generally quite smooth. Normally this type of plant, given its lack of tonal characteristics and soft start-up when operating is considered not to include any acoustic features and so a limit of 5dB below the prevailing background noise level has been considered appropriate. Should it be established that particular plant will have an acoustic feature as the design develops, the noise emission limit will be revised to be 5dB more onerous.

3.5.3 Based on the lowest measured background noise level presented in 3.2.2 and the limitation of 5dB below the underlying background noise level, a noise emission limit of 43dB  $L_{pA}$  at 1m in front of the windows of any neighbouring residential property in Newton Street is proposed.

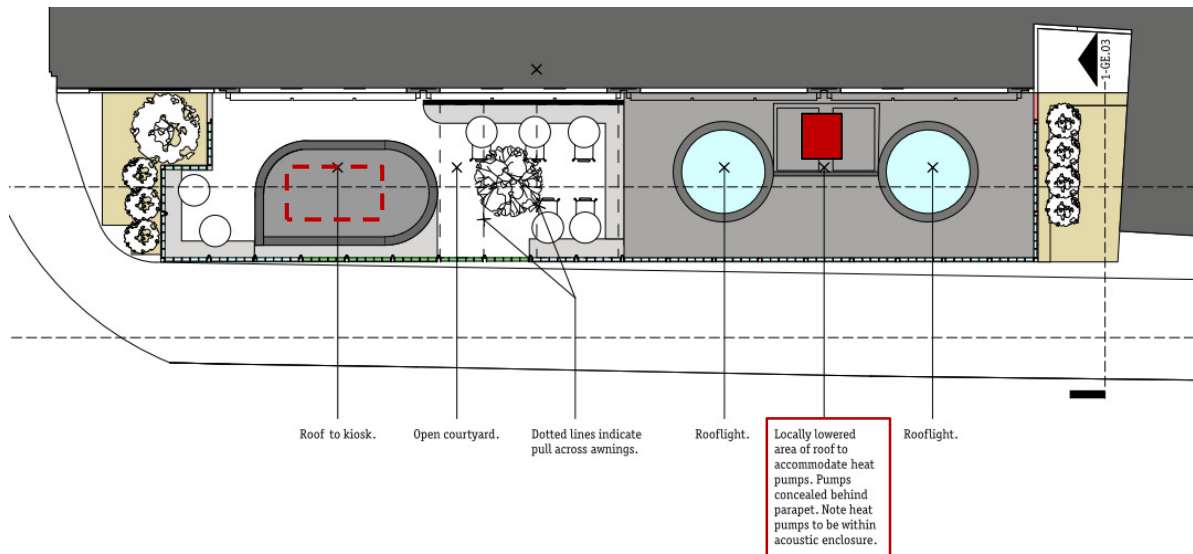
### 3.6 ANALYSIS

3.6.1 The location of the proposed building services plant on the new extension is shown in Figures 3.1 and 3.2.



**Figure 3.1: Proposed plant locations**





**Figure 3.2: Proposed plant locations**

3.6.2 The current plant proposals are for a Reco-air extraction unit to serve the kiosk and an air conditioning heat pump unit to serve the other parts of the extension. The assumed emitted noise level for these units based on free field unobstructed propagation at 1m from each unit are given below. More detailed noise level data of this equipment is included in Appendix B.

- Reco-Air extraction unit: 57 dB  $L_{pA}$  at 1m
- Mitsubishi PUHZ-SW75VHA heat pump: 51 dB  $L_{pA}$  at 1m

3.6.3 On the basis of a 12m propagation distance to the nearest neighbours; allowance for all of the plant to operate simultaneously; and taking account of reflections from the hotel and other elements of the extension; the predicted noise level at the nearest noise sensitive façade is 46dB  $L_{pA}$ . This is without any corrections for tonality, impulsivity, or intermittency as described in London Borough of Camden’s noise emission limits or as defined in BS 4142 : 1997.

3.6.4 It will therefore be necessary to apply attenuation to the plant, in particular the heat pump, in order to achieve the limit proposed in Section 3.5.3.

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## 4 CONCLUSIONS

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- 4.1 An assessment has been undertaken of the noise impact of building services associated with a proposed extension at the Hoxton Holborn Hotel. The extension will be on Newton Street opposite residential neighbours.
- 4.2 Based upon the results of a noise level survey at the site, background noise levels have been determined for the purposes of setting noise emission limits in accordance with the requirements of the London Borough of Camden. The resulting limit which has been determined based on the lowest measured background noise levels is a limit of 43dBA at 1m from the nearest residential façade. This limit assumes the plant has no acoustic character or feature. If an acoustic feature is deemed to be present then a limit 5dB more onerous would be appropriate.
- 4.3 In the absence of detailed plant selections, an assessment of the likely noise emission from preliminary selections associated with the new extension has been made. This indicates a level of 46dB  $L_{pA}$  would be achieved at the nearest noise sensitive property. In order to comply with the noise emission limit determined from the survey it will be necessary to include some form of attenuation to the heat pump units. This can be readily achieved by the introduction of an enclosure around this equipment. It is therefore concluded that plant noise from the proposed extension can be readily controlled in line with the Local Authority's anticipated requirements.
- 4.4 Further assessments will be required once final equipment and attenuation selections are made to take account of any acoustic character of the noise as well as its total noise level.

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## APPENDIX A - NOISE LEVEL DATA

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A selection of the measured noise level data is presented in the tables in this appendix. The full set of data are available in electronic form on request.

All values are sound pressure levels in dB re  $2 \times 10^{-5}$  Pa.

Time	L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>	L <sub>Amin</sub>	Time	L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A10</sub>	L <sub>A90</sub>	L <sub>Amin</sub>
14:50 - 15:00	75.8	62.4	64.9	56.4	54.6	00:00 - 00:10	67.0	57.1	60.0	52.6	51.1
15:00 - 15:10	79.5	60.8	63.6	56.9	54.3	00:10 - 00:20	76.3	58.4	60.6	52.7	51.1
15:10 - 15:20	71.0	60.5	62.9	56.7	54.7	00:20 - 00:30	65.5	55.8	59.3	51.6	50.0
15:20 - 15:30	74.6	60.8	63.2	56.6	54.1	00:30 - 00:40	67.8	56.1	59.8	51.5	50.1
15:30 - 15:40	74.6	62.5	64.6	59.1	56.4	00:40 - 00:50	64.9	55.7	59.8	51.2	50.1
15:40 - 15:50	88.0	64.0	63.9	57.5	55.6	00:50 - 01:00	64.4	55.9	59.4	51.8	50.1
15:50 - 16:00	78.4	60.7	63.6	56.6	54.9	01:00 - 01:10	72.8	55.6	58.6	51.3	49.0
16:00 - 16:10	76.2	60.7	62.8	57.4	54.6	01:10 - 01:20	74.3	57.2	60.0	51.5	49.7
16:10 - 16:20	73.4	61.5	63.7	57.0	54.9	01:20 - 01:30	73.1	56.5	59.4	51.6	50.1
16:20 - 16:30	76.7	61.0	63.7	56.5	54.6	01:30 - 01:40	69.7	55.7	59.1	51.3	49.6
16:30 - 16:40	77.0	59.8	62.3	56.0	54.7	01:40 - 01:50	74.1	56.4	59.7	52.4	50.8
16:40 - 16:50	72.7	61.0	63.3	56.0	53.9	01:50 - 02:00	70.3	55.6	58.9	51.1	49.6
16:50 - 17:00	75.4	60.5	63.2	56.4	54.1	02:00 - 02:10	68.3	56.2	59.3	51.5	50.1
17:00 - 17:10	76.4	61.1	63.8	56.0	54.5	02:10 - 02:20	68.0	54.0	57.5	48.4	46.7
17:10 - 17:20	69.3	60.5	63.5	56.0	53.6	02:20 - 02:30	63.0	53.3	57.1	48.3	46.1
17:20 - 17:30	75.4	60.7	63.3	56.3	54.0	02:30 - 02:40	66.6	54.0	58.0	47.9	46.4
17:30 - 17:40	73.4	60.5	62.9	56.4	54.8	02:40 - 02:50	67.6	55.0	58.8	47.9	46.3
17:40 - 17:50	88.4	67.3	64.3	56.0	54.2	02:50 - 03:00	62.5	52.5	56.0	48.7	46.6
17:50 - 18:00	81.3	62.3	63.7	56.5	54.9	03:00 - 03:10	66.8	54.4	58.3	47.9	46.8
18:00 - 18:10	74.1	58.9	61.2	55.6	53.9	03:10 - 03:20	69.9	54.3	57.5	48.3	46.6
18:10 - 18:20	70.2	59.7	62.3	56.1	53.6	03:20 - 03:30	64.4	53.1	57.1	48.3	46.8
18:20 - 18:30	69.5	59.2	62.4	55.5	53.4	03:30 - 03:40	65.5	54.7	58.8	49.3	48.1
18:30 - 18:40	74.1	60.5	62.8	56.1	54.0	03:40 - 03:50	65.4	54.5	58.1	48.9	47.5
18:40 - 18:50	69.1	58.6	61.2	55.4	53.6	03:50 - 04:00	65.2	54.4	58.0	48.7	47.3
18:50 - 19:00	76.0	59.8	62.5	55.4	53.6	04:00 - 04:10	67.5	55.4	59.5	49.2	47.8
19:00 - 19:10	68.9	59.1	61.8	55.4	53.4	04:10 - 04:20	68.2	54.0	57.5	48.5	47.2
19:10 - 19:20	73.7	61.3	64.0	56.4	53.5	04:20 - 04:30	66.0	54.0	58.0	48.8	47.7
19:20 - 19:30	69.7	59.1	61.9	54.4	52.7	04:30 - 04:40	69.4	54.5	57.5	49.3	48.1
19:30 - 19:40	66.9	58.6	61.5	54.6	52.4	04:40 - 04:50	76.7	56.2	59.5	49.8	48.1
19:40 - 19:50	67.8	58.8	61.9	54.5	52.9	04:50 - 05:00	66.4	54.4	58.3	49.3	47.9
19:50 - 20:00	64.0	57.6	60.5	54.2	52.7	05:00 - 05:10	64.5	55.1	59.3	49.8	48.1
20:00 - 20:10	71.7	59.1	61.8	54.6	52.7	05:10 - 05:20	70.2	58.4	62.1	52.1	50.5
20:10 - 20:20	69.2	58.5	61.0	54.5	52.3	05:20 - 05:30	69.1	59.7	63.7	54.1	52.7
20:20 - 20:30	68.8	58.7	62.1	54.2	52.6	05:30 - 05:40	73.1	60.4	63.8	53.4	51.6
20:30 - 20:40	69.9	58.2	61.1	54.2	52.1	05:40 - 05:50	74.4	61.3	64.9	53.0	51.4
20:40 - 20:50	74.6	59.1	61.5	54.3	52.9	05:50 - 06:00	69.7	60.3	63.9	53.0	50.5
20:50 - 21:00	65.7	58.3	61.0	54.4	52.6	06:00 - 06:10	72.9	61.0	64.2	53.3	50.5
20:00 - 21:10	75.0	57.9	60.5	54.1	52.6	06:10 - 06:20	74.2	60.7	64.2	53.2	51.0
21:10 - 21:20	64.2	57.8	60.7	54.1	51.8	06:20 - 06:30	69.6	58.6	62.6	52.1	50.8
21:20 - 21:30	67.4	57.5	60.3	53.9	52.1	06:30 - 06:40	72.2	60.8	64.2	53.3	51.2
21:30 - 21:40	68.7	58.5	61.5	54.0	52.2	06:40 - 06:50	68.3	60.4	64.2	54.5	51.5
21:40 - 21:50	72.1	58.3	60.9	53.7	52.6	06:50 - 07:00	73.9	61.1	64.3	54.8	53.2
21:50 - 22:00	75.8	58.7	62.4	53.7	52.2	07:00 - 07:10	67.8	60.0	63.5	53.3	51.2
22:00 - 22:10	70.8	58.7	61.8	54.1	52.5	07:10 - 07:20	69.7	59.3	62.7	52.9	51.0
22:10 - 22:20	73.3	58.2	61.1	53.6	52.2	07:20 - 07:30	71.7	59.7	63.4	53.9	51.7
22:20 - 22:30	70.6	58.4	60.8	54.1	52.4	07:30 - 07:40	75.2	62.2	65.6	55.7	53.0
22:30 - 22:40	70.8	58.7	61.5	53.8	52.0	07:40 - 07:50	72.7	63.7	69.1	55.1	52.7
22:40 - 22:50	77.1	58.3	60.4	54.0	52.6	07:50 - 08:00	84.2	66.1	68.7	55.6	53.2
22:50 - 23:00	72.1	60.1	62.1	55.4	52.1	08:00 - 08:10	77.8	63.7	66.5	58.2	54.3
23:00 - 23:10	71.0	58.6	61.2	54.1	52.5	08:10 - 08:20	76.8	65.2	69.7	57.2	54.1
23:10 - 23:20	70.2	57.0	59.8	53.3	51.5	08:20 - 08:30	73.7	61.6	63.8	57.9	55.5
23:20 - 23:30	72.4	56.9	59.8	53.0	51.5	08:30 - 08:40	81.7	64.5	67.0	59.4	56.4
23:30 - 23:40	65.6	57.6	60.9	52.9	51.4	08:40 - 08:50	72.3	62.5	64.8	58.6	56.4
23:40 - 23:50	77.8	58.2	61.2	53.2	51.3	08:50 - 09:00	73.6	62.7	64.8	59.3	56.4
23:50 - 00:00	71.2	57.1	59.7	52.7	51.2	09:00 - 09:10	71.2	61.5	64.2	57.6	55.6
						09:10 - 09:20	90.5	64.7	65.1	58.8	56.2
						09:20 - 09:30	79.1	65.2	68.6	58.8	55.8
						09:30 - 09:40	80.4	64.5	67.5	57.5	55.5
						09:40 - 09:50	87.9	65.2	66.2	59.1	56.7
						09:50 - 10:00	76.3	62.5	64.3	59.8	58.2
						10:00 - 10:10	77.8	61.9	64.5	57.6	55.7
						10:10 - 10:20	70.6	61.3	63.6	57.4	55.3
						10:20 - 10:30	89.9	65.3	66.0	57.7	55.8
						10:30 - 10:40	89.5	63.1	64.8	57.5	55.0
						10:40 - 10:50	91.9	66.1	65.9	57.1	55.1
						10:50 - 11:00	75.4	61.9	64.5	57.6	55.1
						11:00 - 11:10	75.2	63.6	65.9	60.6	58.4
						11:10 - 11:20	80.2	64.0	66.0	58.2	57.0
						11:20 - 11:30	70.8	61.9	64.3	58.5	56.5
						11:30 - 11:40	87.6	64.5	65.5	59.1	55.8
						11:40 - 11:50	79.4	62.9	65.3	57.0	55.0
						11:50 - 12:00	74.2	60.5	63.1	56.6	55.0
						12:00 - 12:10	74.8	65.5	69.6	58.5	56.6
						12:10 - 12:20	83.3	63.4	66.3	58.7	56.1
						12:20 - 12:30	76.7	63.5	65.6	58.8	56.8
						12:30 - 12:40	74.5	61.8	64.3	58.4	56.4
						12:40 - 12:50	78.9	62.0	63.8	58.8	56.7

Table A1 Statistical data, 21-22 September 2015

	Frequency								Frequency							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
14:50 - 15:00	69.6	63.2	60.6	57.7	58.0	55.3	49.8	39.6	62.9	59.3	58.2	53.4	50.6	46.7	39.6	28.3
15:00 - 15:10	68.7	62.5	60.1	56.5	56.0	53.9	48.2	38.5	63.0	59.1	58.2	53.4	51.1	48.2	42.3	31.1
15:10 - 15:20	69.9	61.8	60.4	56.5	55.6	53.1	47.2	36.7	63.1	58.9	58.4	53.8	50.9	47.1	40.4	29.3
15:20 - 15:30	70.6	64.4	60.7	57.2	56.0	53.1	46.5	36.9	63.5	59.5	58.6	53.8	50.8	46.5	39.1	27.8
15:30 - 15:40	70.0	63.5	61.2	58.7	58.1	55.2	48.9	38.4	64.1	59.8	58.9	55.7	54.2	50.5	42.9	32.3
15:40 - 15:50	69.7	62.2	60.4	59.8	59.5	58.1	50.1	38.7	63.3	59.3	58.2	54.6	52.0	48.7	41.3	29.8
15:50 - 16:00	68.4	61.9	59.7	57.0	55.9	53.5	47.9	36.9	62.4	58.6	57.6	53.4	51.0	47.9	40.9	30.1
16:00 - 16:10	69.9	61.8	59.5	56.4	55.7	54.0	48.9	37.4	63.7	59.3	57.8	53.8	51.7	48.9	43.6	31.3
16:10 - 16:20	69.7	62.5	61.3	59.8	55.7	53.5	48.4	39.0	63.6	59.5	58.1	54.0	50.9	47.6	40.6	29.9
16:20 - 16:30	69.1	63.0	60.6	57.3	55.9	53.8	48.2	39.6	63.2	59.2	57.9	53.6	50.9	47.2	39.3	28.3
16:30 - 16:40	68.4	61.8	59.6	55.9	55.0	52.5	46.4	35.8	63.0	59.0	57.8	53.1	50.2	46.5	39.7	29.4
16:40 - 16:50	69.4	63.3	61.4	57.2	55.9	53.7	47.9	37.5	63.3	59.4	57.9	53.2	50.3	46.4	39.3	28.6
16:50 - 17:00	69.1	62.5	59.9	56.6	55.8	53.2	47.1	36.8	63.2	59.1	57.9	53.6	50.7	46.9	39.9	29.6
17:00 - 17:10	70.0	63.6	61.2	57.3	56.0	53.8	47.7	37.4	63.2	59.4	58.0	53.4	50.1	45.9	38.7	28.2
17:10 - 17:20	69.3	62.7	59.9	56.4	56.1	52.9	46.4	35.6	63.1	59.4	57.7	53.4	50.1	46.0	38.6	27.7
17:20 - 17:30	69.7	63.9	60.5	57.2	55.8	52.8	47.0	36.8	63.6	60.0	58.0	53.4	50.6	46.5	39.6	28.3
17:30 - 17:40	70.3	65.8	60.9	57.4	55.5	51.8	45.2	35.0	62.9	59.5	58.1	54.1	50.7	46.2	38.8	27.9
17:40 - 17:50	67.5	62.9	60.7	60.4	66.1	54.8	45.0	33.9	62.5	59.3	57.9	53.6	50.3	45.3	38.0	27.8
17:50 - 18:00	70.9	67.8	64.0	59.1	56.8	53.5	45.6	35.7	63.5	60.4	58.5	54.0	50.5	45.7	38.0	27.4
18:00 - 18:10	67.8	62.2	59.3	55.8	54.2	50.2	43.5	33.5	62.1	59.1	57.5	53.2	49.6	45.1	37.4	26.7
18:10 - 18:20	69.0	62.6	60.1	56.7	55.1	51.1	43.9	33.8	62.6	58.8	57.8	53.7	50.3	45.8	38.1	27.8
18:20 - 18:30	68.2	61.3	59.2	55.6	54.5	51.5	45.0	34.4	62.4	58.6	57.3	52.6	49.6	45.8	38.5	28.0
18:30 - 18:40	69.5	64.8	62.1	57.2	54.9	52.1	46.2	35.9	63.0	59.4	57.7	53.3	50.0	45.9	38.5	27.7
18:40 - 18:50	68.7	60.7	59.2	55.7	53.6	50.2	43.5	32.9	62.4	58.2	57.4	52.9	49.4	45.1	37.7	27.0
18:50 - 19:00	68.9	63.9	60.3	56.4	54.7	51.5	46.3	34.2	62.8	58.7	57.5	52.7	49.4	45.3	37.9	26.9
19:00 - 19:10	68.6	61.4	59.6	55.8	54.3	50.8	43.9	33.3	62.6	58.3	57.3	52.7	49.9	45.7	38.0	26.7
19:10 - 19:20	69.2	61.5	59.6	56.7	57.7	53.6	46.3	34.8	62.1	58.2	57.5	53.2	50.5	48.2	40.9	29.4
19:20 - 19:30	69.3	62.1	60.0	55.9	54.6	50.3	42.9	32.5	61.7	58.0	57.2	51.7	48.0	43.6	35.8	25.0
19:30 - 19:40	68.8	61.0	59.3	55.5	54.0	50.1	43.1	32.3	62.3	58.0	57.2	51.9	48.5	44.2	36.8	25.8
19:40 - 19:50	68.5	62.4	59.5	55.5	54.2	50.2	43.1	32.1	62.1	57.9	57.1	51.7	48.3	43.9	36.4	25.5
19:50 - 20:00	66.8	60.6	59.0	54.3	53.0	48.6	40.4	29.8	61.4	58.1	57.2	51.6	47.7	43.2	35.1	24.2
20:00 - 20:10	68.8	60.6	59.5	55.6	54.6	50.8	43.1	33.3	61.9	57.8	57.5	52.0	48.5	43.9	36.1	25.3
20:10 - 20:20	67.6	60.7	59.1	55.0	53.8	50.3	42.8	32.7	61.6	58.0	57.2	51.8	48.3	43.8	36.0	25.2
20:20 - 20:30	68.4	61.9	59.8	55.5	54.1	49.9	42.1	31.6	61.9	58.3	57.2	51.3	48.1	43.6	35.5	24.8
20:30 - 20:40	67.8	61.2	59.0	55.2	53.6	49.4	41.7	31.1	61.4	57.8	56.7	51.5	48.2	43.4	35.1	24.0
20:40 - 20:50	67.9	61.6	61.4	56.1	54.0	50.5	42.3	31.9	61.6	58.1	56.9	51.8	48.2	43.5	35.7	25.3
20:50 - 21:00	68.6	61.2	59.0	55.1	53.8	49.5	41.7	32.7	61.7	58.3	56.9	51.7	48.2	43.6	35.9	25.5
20:00 - 21:10	67.1	60.5	58.9	54.9	53.4	49.0	41.0	33.0	61.5	58.0	57.0	51.4	47.8	43.1	35.0	24.1
21:10 - 21:20	66.8	60.7	58.7	54.6	53.3	48.8	40.7	29.5	61.0	57.5	56.8	51.5	47.9	43.0	34.6	23.6
21:20 - 21:30	66.9	60.1	58.6	54.7	52.9	48.1	40.0	30.2	60.5	57.5	56.8	51.2	47.7	42.7	34.5	23.4
21:30 - 21:40	66.9	60.5	59.5	56.2	54.0	48.7	39.9	28.6	61.1	57.4	57.1	51.4	48.0	42.6	34.1	23.1
21:40 - 21:50	66.8	61.0	59.0	55.0	54.3	49.0	39.8	27.9	61.1	57.6	56.9	51.0	47.3	42.3	33.9	22.8
21:50 - 22:00	67.2	60.0	58.9	55.0	54.9	50.2	41.3	30.3	61.0	57.3	56.8	51.0	47.5	42.6	34.3	23.8
22:00 - 22:10	67.5	60.6	59.2	56.5	54.1	49.0	40.5	28.7	61.4	57.7	56.9	51.1	48.3	43.1	34.8	23.6
22:10 - 22:20	67.0	60.0	58.6	55.3	54.1	49.1	39.7	28.0	60.9	57.3	56.6	50.7	47.5	42.4	34.0	22.8
22:20 - 22:30	68.8	60.6	59.2	55.5	53.9	49.5	41.4	32.9	61.1	57.7	56.9	51.4	47.8	42.7	34.4	23.4
22:30 - 22:40	67.4	61.4	59.1	55.3	54.6	49.7	41.1	30.3	61.2	57.5	56.9	51.0	47.6	42.7	34.5	23.3
22:40 - 22:50	66.7	59.9	58.5	55.0	54.7	48.7	39.6	28.0	61.1	57.4	56.9	51.0	47.8	43.1	34.7	23.1
22:50 - 23:00	68.6	62.0	61.8	56.6	55.4	51.5	43.5	31.4	62.0	58.3	57.7	52.1	50.0	46.1	36.8	24.8
23:00 - 23:10	66.8	59.8	59.1	54.4	55.4	48.4	39.4	27.3	61.2	57.6	57.2	51.1	47.7	42.8	34.6	23.0
23:10 - 23:20	66.3	60.3	58.7	53.7	52.5	47.1	38.1	27.1	60.5	56.9	56.7	50.4	47.0	41.6	33.3	22.4
23:20 - 23:30	67.3	60.0	58.6	53.5	52.2	47.7	38.8	26.6	60.8	57.0	56.5	50.1	46.3	41.2	33.1	22.2
23:30 - 23:40	67.3	60.1	58.5	54.2	53.7	48.3	38.5	27.0	60.3	56.8	56.2	49.9	46.5	41.5	33.3	22.3
23:40 - 23:50	65.9	59.1	58.3	55.3	54.3	49.1	40.0	29.8	60.2	56.4	56.2	49.9	47.0	41.9	33.5	22.0
23:50 - 00:00	66.7	60.4	58.6	53.4	52.8	47.6	38.2	26.6	60.8	56.4	56.3	49.3	46.2	41.1	33.0	22.2

Table A2  $L_{eq}$  and  $L_{90}$  frequency data, 21 September 2015



# APPENDIX B - PLANT DETAILS

Noise level data for the preliminary heat pump unit selection is given in the graph highlighted.

## Heating

### Product Information

**PUHZ-SW50-120VKA/VHA(-BS)**  
Ecodan Split Air Source Heat Pumps

Making a  
World of  
Difference

OUTDOOR UNIT		PUHZ-SW50VKA(-BS)	PUHZ-SW75VHA(-BS)	PUHZ-SW120VHA(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++	A++	A++
	$\eta_{hp}$	125%	127%	125%
	SCOP	3.20	3.26	3.21
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A++	A++	A++
	$\eta_{hp}$	163%	154%	162%
	SCOP	4.16	3.92	4.13
HEAT PUMP COMBINATION HEATER - Large Profile <sup>1</sup>	ErP Rating	A	A	A
	$\eta_{hp}$	98%	93%	99%
	Capacity (kW)	5.25	7.0	11.2
HEATING <sup>2</sup> (A-3/W35)	Power input (kW)	1.84	2.24	3.71
	COP	2.85	3.12	3.02
	OPERATING AMBIENT TEMPERATURE (°C DB) <sup>3</sup>	-15 ~ +35°C	-20 ~ +35°C	-20 ~ +35°C
SOUND PRESSURE LEVEL AT 1M (dBA) <sup>3,4</sup>		46	51	54
LOW NOISE MODE (dBA) <sup>3</sup>		42	48	51
WATER DATA - Water connections made at indoor hydrobox	Flow Rate (l/min)	11.8	22.9	45.9
	DIMENSIONS (mm)	809+62 <sup>5</sup>	950	950
WEIGHT (kg)	Width	300	330+30 <sup>6</sup>	330+30 <sup>6</sup>
	Depth	630	943	1350
	Height	43	75	118
	REFRIGERANT	Type	R410A	R410A
ELECTRICAL DATA	Charge (kg) - 10m pipe length	1.4	3.2	4.6
	Pipe Size - Gas/Liquid (mm (in))	12.7 (1/2") / 6.35 (1/4")	15.88 (5/8") / 9.52 (3/8")	15.88 (5/8") / 9.52 (3/8")
	Connection Type	Flared	Flared	Flared
	Max Pipe Length (m)	40	40	75
	Min Pipe Length (m)	2	5	5
	Max Height Difference (m)	30	10	30
	Electrical Supply	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
Phase	Single	Single	Single	
Nominal Running Current (MAX) (A)	3.8 [13]	8.1 [19]	17.5 [29.5]	
Fuse Rating - MCB Sizes (A) <sup>8</sup>	16	25	40	

<sup>1</sup> Combination with E-H57300(V)G-MHCW Cylinders  
<sup>2</sup> Under normal heating conditions at outdoor temp: -3°CDB / -1°CMB, outlet water temp 35°C, inlet water temp 30°C  
<sup>3</sup> Under normal heating conditions at outdoor temp: 7°CDB / 6°CMB, outlet water temp 35°C, inlet water temp 30°C, as tested to BS EN14511  
<sup>4</sup> Sound power level of the PUHZ-SW50VKA is 62dBA, PUHZ-SW75VHA is 65.6dBA, PUHZ-SW120VHA is 68.6dBA, as tested to BS EN12102  
<sup>5</sup> Galle  
<sup>6</sup> MCB Sizes BS EN60898-2 & BS EN60947-2  
<sup>7</sup> Heating maximum ambient temperature -21°CDB, DHW Hot water maximum ambient temperature -35°CDB  
<sup>8</sup> Electrical cover  
 $\eta_{hp}$  is the seasonal space heating energy efficiency (SEHE)     $\eta_{hp}$  is the water heating energy efficiency

Noise level data for the Reco-air ventilation plant is provided in a report prepared by Applied Acoustic Design. The conclusion of their report is that noise levels are typically 54-57dB  $L_{pA}$  @1m.

## ACOUSTIC SURVEY NOTE

Ref : 14176/001/mb

Date : 28 May 2014



**PROJECT : Reco-Air**

**SUBJECT : Noise Assessment**

### 1.0 Introduction

- 1.1 Applied Acoustic Design have been appointed to measure and report on operational noise levels associated with typical Reco-Air units. The aim is to develop a statement on noise emission that can be included within publicity material.
- 1.2 Noise levels of two operational units were measured at two different Ed's Easy Diner locations; at Watford (size 2.0) on 25<sup>th</sup> April 2014, and at Milton Keynes (size 1.5) on 16<sup>th</sup> May 2014.
- 1.3 In addition to unit noise measurement, noise levels were also recorded beneath the kitchen extract hood, for information and future use, if necessary.

### 2.0 Noise Measurements

#### 2.1 Watford – size 2.0

- 2.1.1 This unit is located within a dedicated plantroom. This makes accurate noise level measurement difficult, due to the confined space and the reverberant room contribution. In addition, it was observed that there was a primary noise breakout contribution from the high level supply and return air ductwork leading from/to the unit – this is only single skin, compared to the double skin unit, and produces more noise. It was not possible within the confines of the measurement space to separate the two elements.
- 2.1.2 The measured room noise levels are therefore affected by both the plantroom reverberant effect, and the contribution from ductwork noise breakout. It is not possible to accurately correct for these issues, although an estimate can be made.
- 2.1.3 The (un-corrected) measured results were as follows;

Item	octave band centre frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
	sound pressure level, dB re 2x10 <sup>-5</sup> Pa							
AHU, within plantroom	70	69	67	58	57	52	51	63



## Reco-Air Noise Assessment

### 2.2 Milton Keynes – size 1.5

2.2.1 This unit is located behind a "mobile" diner unit, within a large volume shopping centre area (roofed over external area). There is a 2.0m high Perspex screen around the rear of the diner, which provides an enclosed area for the plant. This means that a true "free-field" noise measurement could not be made. In addition, there was a background noise level contribution due to other sources within the shopping centre, i.e. plant and pedestrian activity noise.

2.2.2 It is possible to accurately correct for the effect of background noise, but a correction for the reverberant effect of the enclosure screen can only be an estimate.

2.2.3 The (un-corrected) measured results were as follows;

Item	octave band centre frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
	sound pressure level, dB re $2 \times 10^{-5}$ Pa							
Background noise level	58	56	52	52	49	44	42	54
AHU, Lp at 0.5m	68	69	58	55	52	47	45	57

### 2.3 Extract Hood Noise Levels

2.3.1 The measured extract hood noise levels (microphone approximately 0.5m from grease filters) were as follows;

Location	octave band centre frequency (Hz)							dBA
	63	125	250	500	1k	2k	4k	
	sound pressure level, dB re $2 \times 10^{-5}$ Pa							
Watford	57	60	63	56	56	50	48	60
Milton Keynes	64	61	59	60	60	56	47	63

### 3.0 Assessment – Reco-Air Units

3.1 Taking account of background noise, room correction and reflection effects, and making an allowance for duct noise breakout, the corrected (estimated) Reco-Air unit noise levels are as follows, referenced to a point 1m from the unit;

Unit	octave band centre frequency (Hz)							dBA at 1m
	63	125	250	500	1k	2k	4k	
	sound pressure level at 1m, dB re $2 \times 10^{-5}$ Pa							
Size 2.0 : Watford	66	64	62	51	49	44	43	57
Size 1.5 : Milton Keynes	65	66	54	49	47	42	40	54

3.2 For the reasons noted, these noise levels can only be estimates at this stage. More accurate data would require further testing in a more controlled environment – this could be in the factory, although some care would be needed with the set-up, including provision of attenuated and treated ductwork, size of test space or provision of sound absorptive treatment to avoid acoustic reflections, and ensuring background

Reco-Air  
Noise Assessment

applied acoustic design

noise levels are sufficiently low. Further investigation will be needed to establish if this is possible.

- 3.3 N.B. There is a greater level of uncertainty in the individual octave band noise levels than there is in the overall A-weighted value. At this stage, pending more accurate testing, it is recommended that only A-weighted noise levels are published to third parties.

#### 4.0 Statement For Publicity Material

- 4.1 It is not clear how much technical detail is required to be included in the noise level statement designed for use in publicity material. At this stage, the following simple statement is suggested as a basis for discussion going forward;

*Reco-Air unit noise levels are very low. Casing radiated noise from standard units are between 54 to 57 dBA when measured at 1m (free field), depending upon the size of unit and exact configuration.*

- 4.2 This statement can be reviewed and more information provided as necessary.

REPORT ENDS

## APPENDIX C - TERMINOLOGY

This appendix provides an explanation of some of the acoustics terms used in this report.

<p>A-weighting <math>L_A</math> or <math>L_{pA}</math>, <math>L_{WA}</math>,</p>	<p>The human ear does not sense all frequencies of sound equally. Our sensitivity is at a maximum at around 2 kHz and steadily decreases above and below. Below 20 Hz and above about 20 kHz we can't hear at all.</p> <p>Within its operating limits a precision measurement microphone measures all frequencies the same so the output it produces does not reflect what we would actually hear. The A-weighting is an electronic filter that matches the response of a sound level meter to that of the human ear. When A-weighted the Sound Pressure Level <math>L_p</math> becomes <math>L_{pA}</math> (or <math>L_A</math>) and the Sound Power Level <math>L_W</math> becomes <math>L_{WA}</math>.</p>
<p><math>L_p</math> <math>L_{pA}</math> (or <math>L_A</math>)  <math>L_{AF}</math>, <math>L_{AS}</math></p>	<p><i>The instantaneous sound pressure level (<math>L_p</math>)</i> <i>The A-weighted instantaneous sound pressure level (<math>L_{pA}</math> or <math>L_A</math>)</i></p> <p>This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant).</p> <p>The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.</p>
<p><math>L_{max}</math> <math>L_{Amax}</math> <math>L_{AFmax}</math>  <math>L_{min}</math>, <math>L_{Fmin}</math></p>	<p><i>The maximum instantaneous sound pressure level (<math>L_{max}</math>),</i> <i>The A-weighted maximum instantaneous sound pressure level (<math>L_{Amax}</math>)</i> <i>The A-weighted maximum instantaneous sound pressure level with a FAST time constant (<math>L_{AFmax}</math>).</i></p> <p>This is the highest instantaneous sound pressure level reached during a measurement period.</p> <p>The opposite of the <math>L_{max}</math> is the <i>minimum instantaneous sound pressure level</i> or <math>L_{min}</math> etc. It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.</p>
<p><math>L_{N,T}</math> <math>L_{AN,T}</math> <math>L_{AFN,T}</math> <math>N</math> = %age value, 0-100 <math>T</math> = measurement time eg. <math>L_{A90}</math>, <math>L_{A10}</math>, <math>L_{AF90}</math>, 5 min</p>	<p><i>The percentage exceedence sound pressure level (<math>L_{N,T}</math>),</i> <i>The A-weighted percentage exceedence sound pressure level (<math>L_{AN,T}</math>), the A-weighted percentage exceedence sound pressure level with a FAST time constant (<math>L_{AFN,T}</math>).</i></p> <p>This is the sound pressure level exceeded for <math>N\%</math> of time period <math>T</math>. eg. If an A-weighted level of <math>x</math> dB is exceeded for a total of 6 minutes within one hour, the level will have been above <math>x</math> dB for 10% of the measurement period. This is written as <math>L_{A10,1hr} = x</math> dB.</p> <p><math>L_{A0}</math> (the level exceeded for 0 % of the time) is equivalent to the <math>L_{Amax}</math> and <math>L_{A100}</math> (the level exceeded for 100 % of the time) is equivalent to the <math>L_{Amin}</math>.</p> <p>It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.</p>
<p><math>L_{eq,T}</math> <math>L_{Aeq,T}</math> <math>T</math> = measurement time eg. <math>L_{Aeq,5min}</math></p>	<p><i>The equivalent continuous sound pressure level over period <math>T</math> (<math>L_{eq,T}</math>),</i> <i>The A-weighted equivalent continuous sound pressure level over period <math>T</math> (<math>L_{Aeq,T}</math>).</i></p> <p>This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the <math>L_{eq}</math> is not a simple arithmetic mean value.</p> <p>The <math>L_{eq}</math> is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation</p>

Date Created: 28 September 2015

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