

HORIBA MIRA Plots 6, 8 & 9

BREEAM HEA05 & POL05 Acoustic Design Review

2061391-RSKA-RP-001-(02)

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Swanvale Development

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Revision	Description	Date	Prepared	Approved
1	First issue	28 February 2023	George Baker	Robert Bungay
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1 Introduction

1.1 Instruction

RSK Acoustics Ltd (RSKA) has been instructed by Swanvale Development Ltd to undertake a noise assessment to provide evidence for the HEA05 'Acoustic Performance' and POL05 'Noise Pollution' credits as part of the BREEAM scheme, New Construction 2018 (UK) for the construction of two new office units as part of the proposed development on Plots 6 (one office block), 8 & 9 (the other office block), HORIBA MIRA, Watling Street (A5), Nuneaton, CV10 0TU. The office block proposed within Plots 8 & 9 contains a workshop, which is not considered within this assessment.

A glossary of acoustic terms used throughout this report are appended to this document.

1.2 Site Description

The site is bounded by Watling Street (A5) to the south, Wood Lane to the east, the A444 to the west and Fenn Lanes to the north/north-east. It is situated approximately 3 km north of Nuneaton and 5.5 km west of Hinckley.

The development is situated in a predominantly agricultural area and the site is comprised of office units along its centre, south and south-west perimeter, with vehicle testing tracks and testing facilities occupying the majority of its north and north-eastern area.

Units 6, 8 & 9 are located approximately 350 metres north of Watling Street (A5) and 600 metres west of Wood Lane.

The site layout is provided in **Appendix 1**.

1.3 Author

The report has been authored by George Baker. George holds a diploma in acoustics and noise control from the Institute of Acoustics and has two years' experience in acoustic consultancy. The report is reviewed by Robert Bungay, BEng MIOA, who has eight years' experience in acoustic consultancy.

1.4 Objectives

The aim of the noise assessment is to:

- Ensure the buildings acoustic performance of the proposed units meets the appropriate standards for its purpose; and
- Reduce the likelihood of noise arising from fixed installations associated with the development affecting nearby noise-sensitive buildings.



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2 Standards and Guidance

BREEAM is an international sustainability assessment and certification scheme used to demonstrate sustainability performance of buildings where credits can be gained from meeting set standards in different parts of the construction. The number of awarded credits then determine the overall BREEAM rating. BREEAM is locally adapted, operated and applied through a network of scheme operators, assessors and industry professionals.

2.1 BREEAM UK New Construction, 2018

The BREEAM New Construction 2018 scheme can be used to assess the environmental life cycle impacts of new non-domestic buildings at the design and construction stages. 'New Construction' is defined as a development that results in a new standalone structure, or new extension to an existing structure, which will come into operation or use for the first time upon completion of the works.

This BREEAM New Construction 2018 scheme version is applicable to new non-domestic buildings in the United Kingdom only. The following industrial building types are covered under the scheme:

- Industrial unit – warehouse storage or distribution;
- Industrial unit – process, manufacturing or vehicle servicing.

POL 05 Reduction of noise pollution (1 Credit)

The BREEAM pollution category seeks to avoid or reduce the impact of external noise from the building by reducing the likelihood of noise arising from fixed installations on the new development affecting nearby noise-sensitive buildings.

One credit is automatically awarded when there are, or will be, no noise-sensitive areas or buildings within 800 m radius of the assessed site.

Alternatively, where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800 m radius of the assessed site, a noise impact assessment compliant with BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' is commissioned. Noise levels must be measured or determined for:

- Existing background noise levels:
 - at the nearest or most exposed noise-sensitive development to the proposed assessed site;
 - including existing plant on a building, where the assessed development is an extension to the building.



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- The noise impact assessment must be carried out by a suitably qualified acoustic consultant.
- The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5 dB lower than the background noise throughout the day and night.
- If the noise sources from the assessed building are greater than the levels described in criterion, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.

At the design stage of assessment, where noise-sensitive areas or buildings are present, actual measurement is unlikely to be possible due to the planned but non-existent installation. In such situations, compliance can be demonstrated through the use of acousticians' calculations or by scale model investigations.

For such cases, BS 4142 states '*Determine the specific sound level by calculation alone if measurement is not practicable, for example if the source is not yet in operation. In such cases, report the method of calculation in detail and give the reason for using it*'. Where prediction methods are not possible, measurement will be necessary using either a noise source similar to that proposed or measurement of the actual noise from the installation (once installed). Compliance with the latter approach requires a written commitment to appoint a suitably qualified acoustician to carry out the required measurements post-installation, and a further commitment to attenuate the noise source in compliance with criteria (if proved necessary by the measurements).

HEA 05 Acoustic performance (1 Credit)

The BREEAM Health and Wellbeing category seeks to reward building design and specification decisions that create a healthy, safe, and comfortable internal and external environment.

A suitably qualified acoustician (SQA) is appointed to define a bespoke set of performance requirements for all function areas in the building. The performance requirements for this development aims for the indoor ambient noise level credit.

2.2 BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

British Standard (BS) 8233 establishes internal ambient noise levels for dwellings based upon occupancy patterns and derived from World Health Organisation (WHO) guidelines for community noise.

Section 7.3 focuses on indoor ambient noise criteria for a variety of spaces which is considered to be acceptable depending on its use.

Guidance on indoor ambient noise levels are shown below in **Tables 1 and 2**. Values are reproduced from Table 2, and Table 6 in BS 8233:2014 respectively:



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Objective	Typical Situations	Design Range $L_{Aeq, T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 – 55
	Open plan office	45 – 50
	Night club, public house	40 – 45
	Ballroom, banqueting hall	35 – 40
	Living room	35 – 40

Table 1 Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important (taken from BS 8233:2014)

Objective	Typical Situations	Design Range $L_{Aeq, T}$ dB
Study and work requiring concentration	Library, gallery museum	40 – 50
	Staff/ meeting room, training room	35 – 45
	Executive office	35 – 40

Table 2 Typical noise levels in non-domestic buildings (taken from BS 8233:2014)

2.3 British Council for Offices (BCO) 'Guide to specification', 2019

The British Council for Offices' (BCO) mission is to research, develop and communicate best practice in all aspects of the office sector. It delivers this by providing a forum for the discussion and debate of relevant issues.

The Guide provides comments on best practice in the specification for offices. The specified BCO criterion for office spaces are consistent with the design range stated within BS 8233: 2014.

2.4 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

BS 4142:2014+A1:2019 describes the methods for rating and assessing sound of an industrial and/or commercial nature, including sound from fixed installations which comprise mechanical and electrical plant and equipment. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

Where certain acoustic features are audible at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment. The difference between the background level and the rating level (including any penalties) is then calculated.



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- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of adverse impact depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact depending on the context.



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3 Baseline Noise Survey Methodology

3.1 Overview

A baseline noise survey was undertaken between 5 and 11 January 2023 at representative locations of Rowden Lodge and the Development Site, with a following survey undertaken at a representative location for 1 & 2 Grange Cottage along Wood Lane between 31 January and 5 February 2023 to establish the existing sound levels for the assessment.

3.2 Noise Sensitive Receptors

The nearest noise sensitive receptors (NSR's) are situated to the east and west of the development site. Rowden Lodge is situated approximately 550 metres west of the development site, 1 & 2 Grange Cottage along Wood Lane is situated approximately 600 metres to the east. These are summarised in **Table 3** below:

Noise Sensitive Receiver	Receptor Type	Approximate Closest Distance to Site, m
Rowden Lodge	Residential	550
1 & 2 Grange Cottage	Residential	600

Table 3 Identified Noise Sensitive Receptors

3.3 Monitoring Locations

Unattended noise monitoring was installed along the boundary of Rowden Lodge, adjacent to the property's access driveway. A second noise monitor was installed on HORIBA MIRA's land, adjacent to the west façade of the proposed office at units 8 & 9.

Due to security concerns, it was not deemed possible to install a noise meter within the premises of 1 & 2 Grange Cottage and a proxy location was chosen based on the receptor's representative proximity to Watling Street (A5), deemed the dominant noise source affecting the local noise environment. This is summarised in **Table 4** and graphically presented in **Figure 1**. A photographic report is included in **Appendix 2**.



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ID	Location	Rationale	Observations
UL1	Rowden Lodge (west)	Representative of closest residential noise sensitive receptor (Rowden Lodge).	Noise environment dominated by constant road noise from A5; vegetation noise apparent due to monitor's location.
UL2	Development Area (centre)	Representative of expected noise levels at façade of office space within Units 6, 8 & 9.	Constant road traffic from A5. Distant plant noise from HORIBA MIRA activities.
UL3	1 & 2 Grange Cottage – Representative (west)	Representative of second closest residential noise sensitive receptor (1 & 2 Grange Cottage).	Constant road traffic from A5, occasional vehicle passings of HORIBA MIRA personnel and testing of electric vehicles on adjacent loop track and gradient track.

Table 4 Monitoring locations



Figure 1 Noise monitoring locations



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3.1 Monitoring Equipment

Noise monitoring was undertaken using the following equipment:

Equipment	Type	Serial Number
Class 1 Sound Level Meter	Rion NL-52	197728
		976250
		453835
Acoustic Calibrator	Rion NC-75	34291338

Table 5 Monitoring equipment

All measurements were undertaken in free field conditions with the microphone positioned away from reflecting surfaces and at 1.5 m above the ground height to the requirements of BS 7445- 1: 2003.

The calibration of each sound level meter was checked before and after the measurements, using the acoustic calibrator at 94 dB at 1 kHz; and calibration drift was within acceptable tolerances (+/- 0.5 dB). The sound level meters used conform to the requirements of BS EN 61672-1: 2013 and the calibrator used conforms to the requirements of BS EN 60942: 2018. The equipment used has a calibration history that is traceable to a certified calibration institution.

Measurements were logged in continuous 15-minute integration periods and obtained using a combination of broadband indices; L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} .

3.2 Weather Conditions

Representative weather conditions were obtained from www.wunderground.com (Station ID [IHINCK12](#)). Details are summarised in **Table 6 and 7**.



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Date	Average Temperature, °C	Average Wind Speed, ms ⁻¹	Dominant Wind Direction	Accumulative Precipitation, mm
Thursday 05/01/2023	10	4	SW	2.3
Friday 06/01/2023	8	3	SSW	1.8
Saturday 07/01/2023	9	4	S	7.9
Sunday 08/01/2023	6	3	SSW	0.3
Monday 09/01/2023	5	3	WSW	0.3
Tuesday 10/01/2023	8	4	SSW	9.7
Wednesday 11/01/2023	7	4	SW	7.1

Table 6 Weather conditions for Rowden Lodge and Development noise monitoring

Date	Average Temperature, °C	Average Wind Speed, ms ⁻¹	Dominant Wind Direction	Accumulative Precipitation, mm
Tuesday 31/01/2023	7	4	W	0
Wednesday 01/02/2023	7	3	W	0
Thursday 02/02/2023	9	2	W	0
Friday 03/02/2023	10	2	W	0
Saturday 04/02/2023	8	1	WSW	0
Sunday 05/02/2023	3	<1	NNW	0

Table 7 Weather conditions for 1 & 2 Grange Cottage

Notable rainfall was recorded during the first noise monitoring period. Reviewing the data indicates that although weather conditions were not suitable, data is still considered to be satisfactory and does not deviate significantly compared to the overall monitoring data recorded and is used within the assessment.



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4 Baseline Noise Survey Results

Measured noise levels at survey locations UL1 – UL3 are summarised in **Tables 8** to **10** below. Graphical output of the survey data is provided in **Appendix 3**.

Date	Time Period	Measured Noise Level, dB			
		$L_{Aeq, T}$	$L_{Amax}^{(a)}$	$L_{A90, T}$	$L_{A10, T}$
Thursday	13:45 – 23:00	52	80	48	54
05/01/2023	23:00 – 07:00	50	67	44	52
Friday	07:00 – 23:00	52	69	49	54
06/01/2023	23:00 – 07:00	51	71	43	53
Saturday	07:00 – 23:00	52	74	48	54
07/01/2023	23:00 – 07:00	44	70	38	47
Sunday	07:00 – 23:00	50	76	45	52
08/02/2023	23:00 – 07:00	49	67	41	50
Monday	07:00 – 23:00	52	76	49	53
09/02/2023	23:00 – 07:00	47	65	41	49
Tuesday	07:00 – 23:00	54	69	51	56
10/01/2023	23:00 – 07:00	49	81	43	51
Wednesday	07:00 - 13:30	54	89	51	55
11/01/2023					
Resultant Noise Level ^(b)	Daytime	52	89	49	54
	Night-time	48	81	42	50

(a) Highest individual L_{Amax} throughout the monitoring period.

(b) Resultant $L_{Aeq, T}$ values are the arithmetic average of $L_{Aeq, T}$ samples, and the $L_{A10, T}$ and $L_{A90, T}$ are the arithmetic average of $L_{A10, T}$ and $L_{A90, T}$ samples respectively. $L_{AFmax, 15min}$ is the highest sample within the period. All values rounded to the nearest whole number.

Table 8 Noise monitoring results – UL1 (Rowden Lodge)



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Date	Time Period	Measured Noise Level, dB			
		$L_{Aeq, T}$	$L_{Amax}^{(a)}$	$L_{A90, T}$	$L_{A10, T}$
Thursday	14:30 – 23:00	54	73	50	57
05/01/2023	23:00 – 07:00	50	71	44	51
Friday	07:00 – 23:00	53	81	49	55
06/01/2023	23:00 – 07:00	58	76	51	61
Saturday	07:00 – 23:00	56	79	51	57
07/01/2023	23:00 – 07:00	48	66	42	50
Sunday	07:00 – 23:00	51	77	46	53
08/02/2023	23:00 – 07:00	47	72	39	48
Monday	07:00 – 23:00	51	89	47	52
09/02/2023	23:00 – 07:00	47	70	40	49
Tuesday	07:00 – 23:00	58	79	53	59
10/01/2023	23:00 – 07:00	49	78	43	51
Wednesday	07:00 - 14:00	55	79	52	56
11/01/2023					
Resultant Noise Level ^(b)	Daytime	54	89	50	56
	Night-time	50	78	43	52

(a) Highest individual L_{Amax} throughout the monitoring period.

(b) Resultant $L_{Aeq, T}$ values are the arithmetic average of $L_{Aeq, T}$ samples, and the $L_{A10, T}$ and $L_{A90, T}$ are the arithmetic average of $L_{A10, T}$ and $L_{A90, T}$ samples respectively. $L_{AFmax, 15min}$ is the highest sample within the period. All values rounded to the nearest whole number.

Table 9 Noise monitoring results – UL2 (Development Site)



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Date	Time Period	Measured Noise Level, dB			
		$L_{Aeq, T}$	$L_{Amax}^{(a)}$	$L_{A90, T}$	$L_{A10, T}$
Tuesday	14:30 – 23:00	50	83	45	51
31/01/2023	23:00 – 07:00	46	64	41	47
Wednesday	07:00 – 23:00	52	85	46	52
01/02/2023	23:00 – 07:00	46	72	41	48
Thursday	07:00 – 23:00	53	87	46	52
02/02/2023	23:00 – 07:00	45	67	39	48
Friday	07:00 – 23:00	51	84	44	50
03/02/2023	23:00 – 07:00	43	76	37	45
Saturday	07:00 – 23:00	49	78	43	49
04/02/2023	23:00 – 07:00	39	69	32	40
Sunday	07:00 – 23:00	44	84	37	44
05/02/2023	23:00 – 00:15	42	59	36	45
Resultant Noise Level ^(b)	Daytime	50	87	44	50
	Night-time	43	76	37	45

(a) Highest individual L_{Amax} throughout the monitoring period.

(b) Resultant $L_{Aeq, T}$ values are the arithmetic average of $L_{Aeq, T}$ samples, and the $L_{A10, T}$ and $L_{A90, T}$ are the arithmetic average of $L_{A10, T}$ and $L_{A90, T}$ samples respectively. $L_{AFmax, 15min}$ is the highest sample within the period. All values rounded to the nearest whole number.

Table 10 Noise monitoring results – UL3 1 & 2 Grange Cottage – Representative

4.1 Derivation of Background Noise Levels

Given the development is assumed to operate 24 hours, for example M&E plant, the representative background noise levels are provided for day and night-time periods. The methodology detailed in BS 4142: 2014+A1: 2019 provides an example of statistical analysis to determine the representative background noise level during the daytime ($L_{A90, 1hr}$) and night-time ($L_{A90, 15min}$). The following analysis adopts the methodologies applied within the aforementioned standard.



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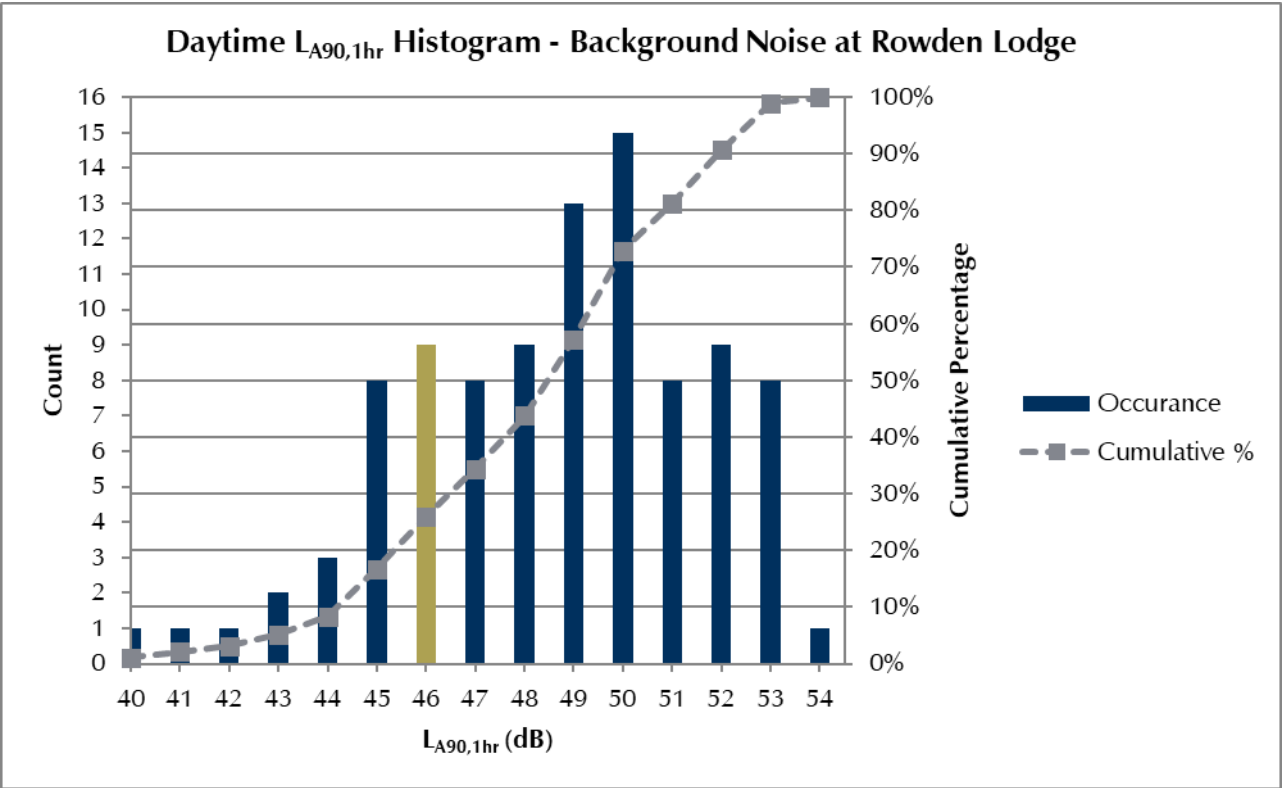


Figure 2 Daytime $L_{A90,1hr}$ Histogram at Rowden Lodge

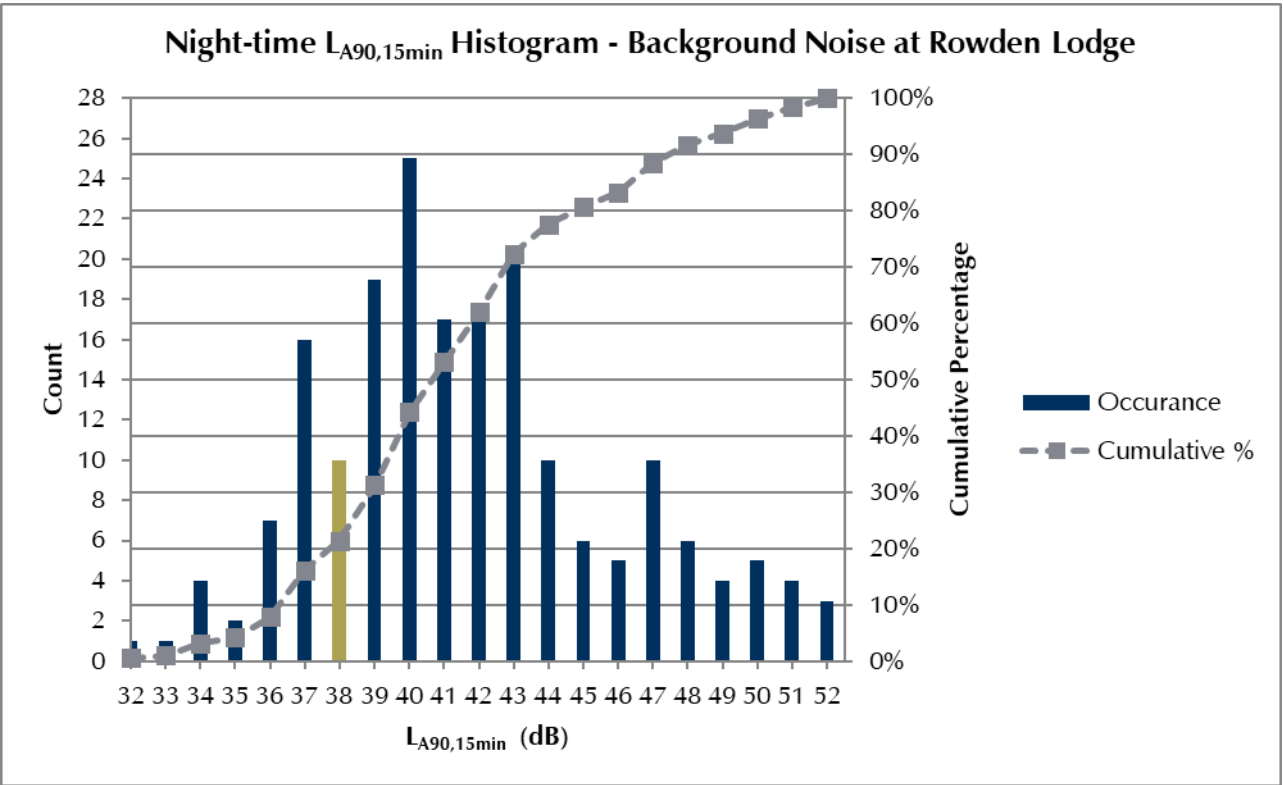


Figure 3 Night-time $L_{A90,15min}$ Histogram at Rowden Lodge



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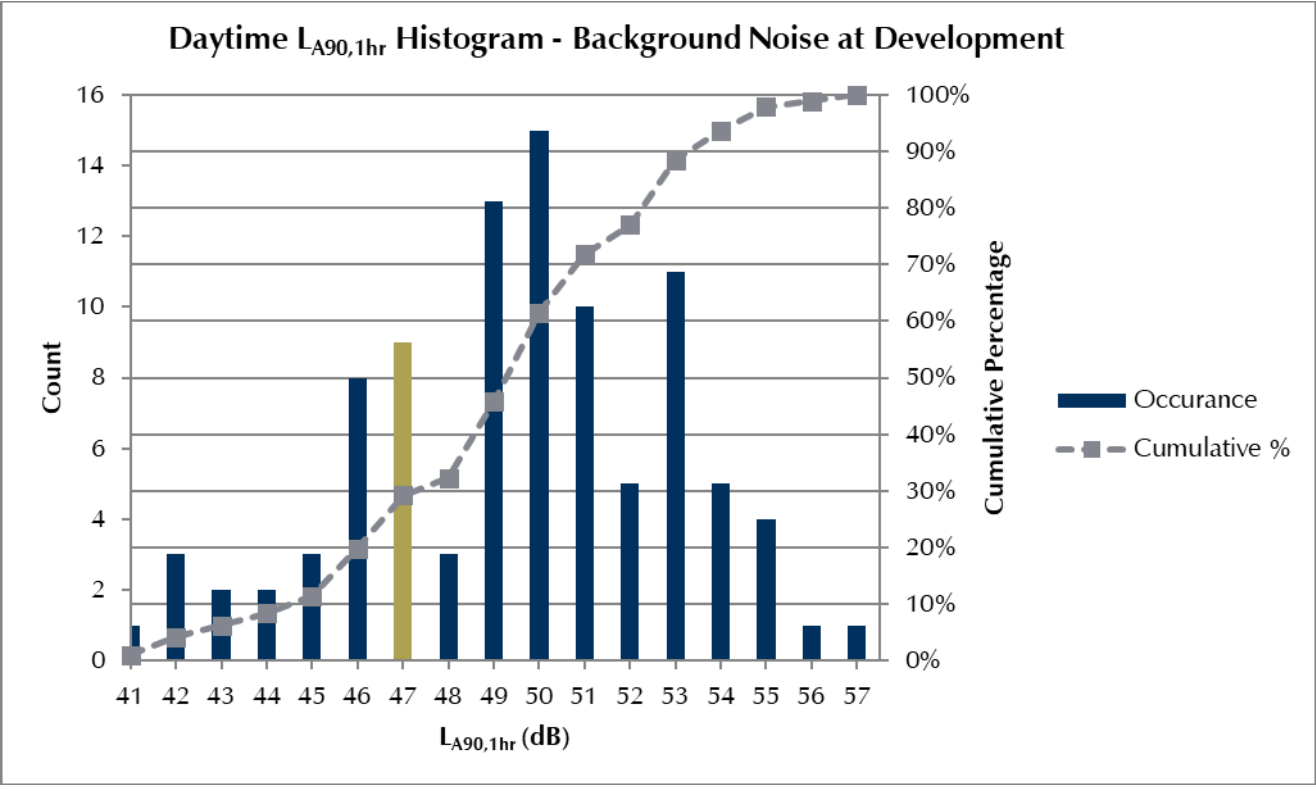


Figure 4 Daytime $L_{A90,1hr}$ Histogram at Development

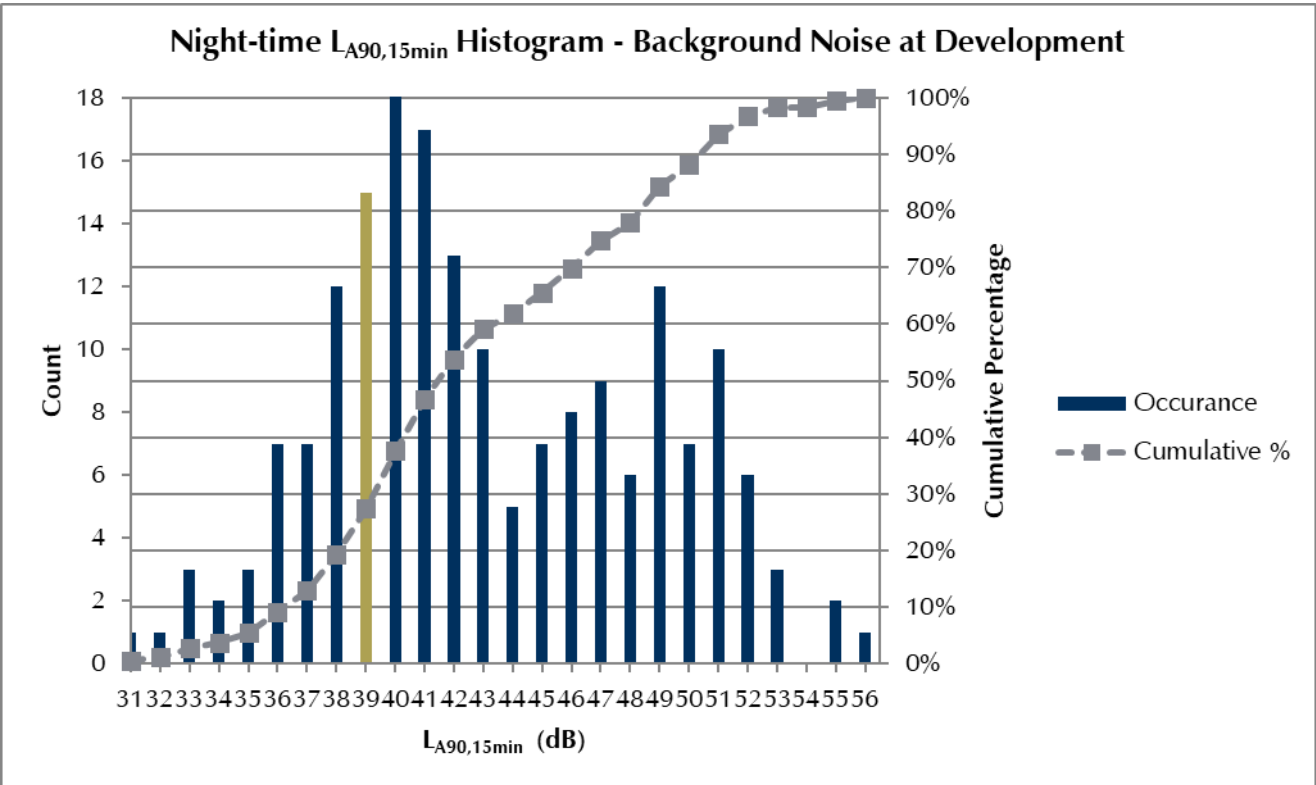


Figure 5 Night-time $L_{A90,15min}$ Histogram at Development



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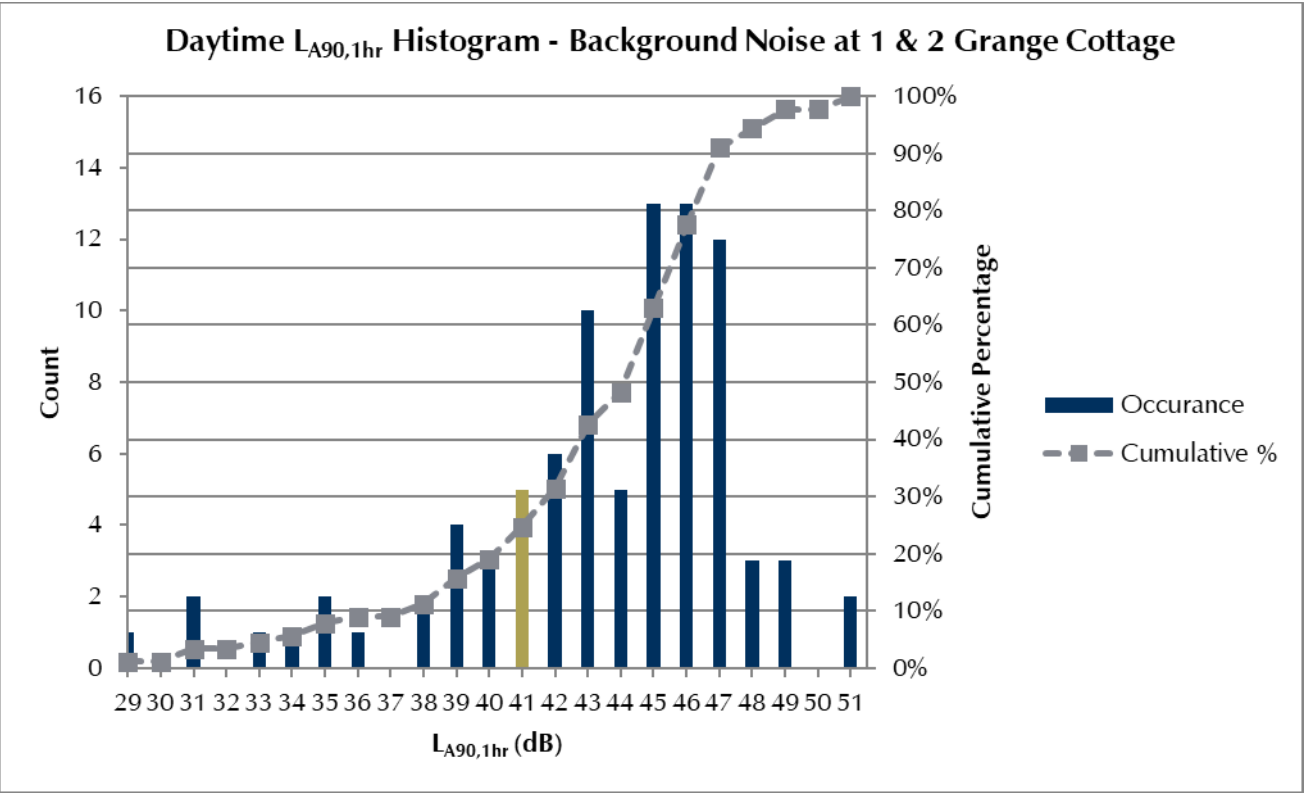


Figure 6 Daytime $L_{A90,1hr}$ Histogram at 1 & 2 Grange Cottage

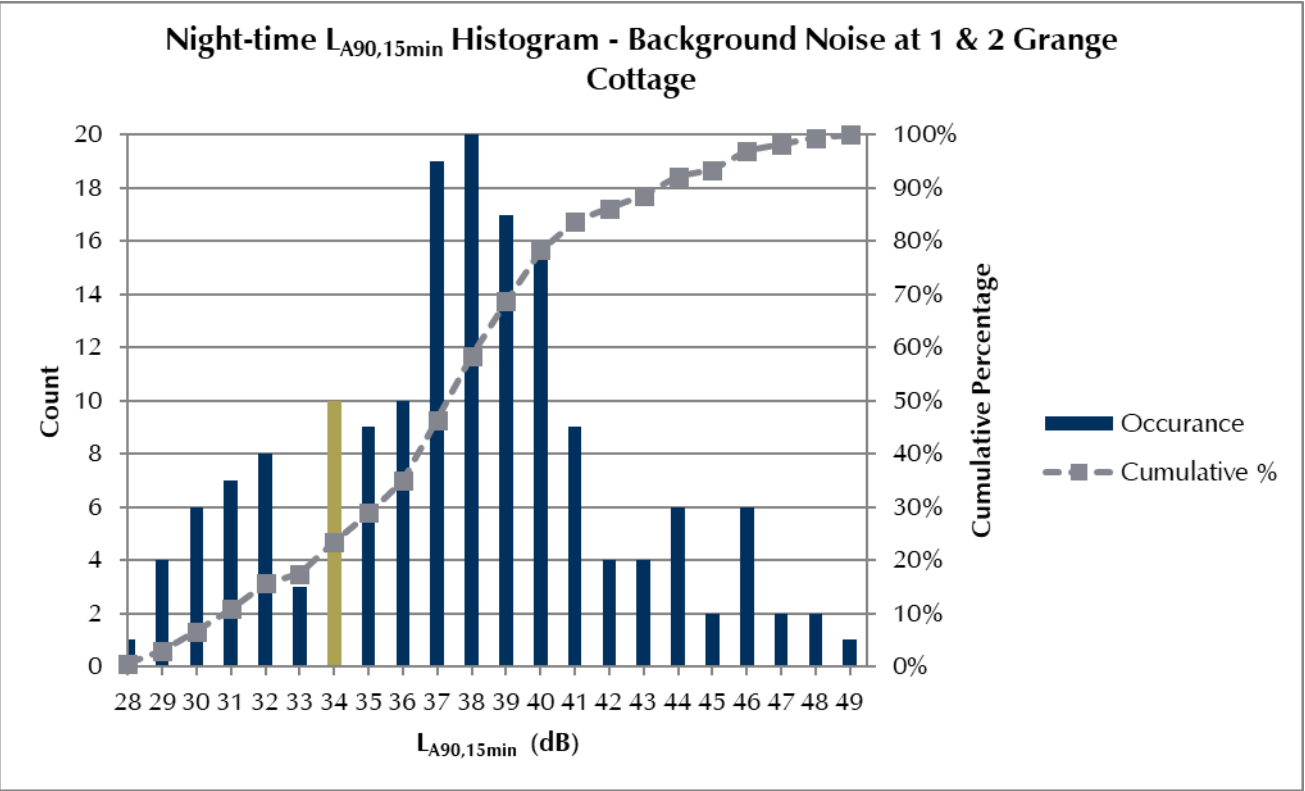


Figure 7 Night-time $L_{A90,15min}$ Histogram at 1 & 2 Grange Cottage



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Analysis of background noise levels is considered to be in line with the requirements of BS 4142 to suitably provide a representative value.

The BREEAM POL 05 assessment criteria discusses that ‘the noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5 dB lower than the background noise throughout the day and night’.

Based on the measured daytime and night-time background levels, the adopted criteria not to exceed at the assessment receptors to achieve BREEAM POL 05 requirements is summarised in **Table 11**.

Sensitive Receiver	Representative Monitoring Location	Daytime Noise Target, dB L_{Ar,Tr}	Night-time Noise Target, dB L_{Ar,Tr}
Rowden Lodge	UL1	41	33
1 & 2 Grange Cottage	UL3	36	29

Table 11 BREEAM Pol05 Criteria for the Development



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5 POL 05 Noise Assessment

Calculations of the cumulative noise levels at nearby sensitive receptors, as identified in **Table 3** have been based on the acoustic emission data and locations provided. Indicative noise data for proposed rooftop plant units is summarised in **Table 12** below, Data in *italics* is used for the POL05 assessment and those in **bold** are used for the HEA05 Indoor ambient noise level assessment.

Rooftop Plant - Sound Power Spectrum Data													
Plot No.	Supply Location	No. of Items	Plant	Plant Component	Frequency (Hz)								L _p at 1 metre
					63	125	250	500	1k	2k	4k	8k	
Plot 6	Office	2	AHU	Supply Inlet	29	52	56	56	55	54	51	45	62
		2		Supply Outlet	34	57	59	64	67	67	64	55	72
		2		Extract Inlet	27	48	53	55	53	52	49	43	60
		2		Extract Outlet	32	53	56	63	66	64	62	53	70
	Toilet	2	AHU	Supply Inlet	10	22	41	55	58	55	51	45	62
		2		Supply Outlet	10	26	47	59	60	61	57	49	66
		2		Extract Inlet	8	20	39	53	58	55	49	43	61
		2		Extract Outlet	8	26	45	57	60	61	55	47	65
	Office	2	CU	Cooling Unit	37	47	50	53	50	46	45	35	57
	Office	2		Cooling Unit	42	53	55	59	56	53	53	47	63
Plots 8 & 9	Office	2	AHU	Supply Inlet	35	42	52	57	56	54	51	48	62
		2		Supply Outlet	36	49	60	61	65	64	60	55	70
		2		Extract Inlet	36	44	51	57	56	53	51	48	62
		2		Extract Outlet	36	50	58	61	65	63	59	55	69
	Toilet	2	AHU	Supply Inlet	10	22	41	55	58	55	51	45	62
		2		Supply Outlet	10	26	47	59	60	61	57	49	66
		2		Extract Inlet	8	20	39	53	58	55	49	43	61
		2		Extract Outlet	8	26	45	57	60	61	55	47	65
	Office	4	CU	Cooling Unit	45	49	57	64	59	55	54	46	67

Table 12 Specified Fixed Plant Noise Sources



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Spreadsheet calculations were undertaken assuming hemispherical, point source propagation over flat ground. No consideration has been implemented for attenuation by ground effects, acoustic screening (as suggested in the site layout plan), or identifiable acoustic characteristics due to the high distance between receptors and proposed fixed plant items. As such, no penalty corrections have been applied or deemed appropriate to be incorporated to the assessment. It has also been assumed the items of plant will be in continuous operation during daytime and night-time hours. These predictions are considered to provide a worst-case scenario, and in reality, it is expected that noise levels will be lower than those predicted.

Noise calculations, predicting the rating noise levels at closest identified receptors are summarised in **Table 13** together with an assessment against BREEAM design targets.

Sensitive Receptor	Daytime BREEAM Noise Target (07:00-23:00),dB L_{Ar,Tr}	Predicted Cumulative Rating Level at Receptor (07:00-23:00), dB L_{Ar,Tr}	Night-time BREEAM Noise Target (23:00-07:00),dB L_{Ar,Tr}	Predicted Cumulative Rating Level at Receptor (23:00-07:00),dB L_{Ar,Tr}
Rowden Lodge	41	13	33	13
1 & 2 Grange Cottage	36	13	29	13

Table 13 BREEAM POL05 Assessment

A written confirmation at post-installation stage should be submitted by a suitably qualified acoustician based on final installed plant, with particular attention to the number, type and location of external plant assessed in this report to confirm post completion compliance. The report would comment on any deviations found, if any, and reassess where necessary. Any non-compliances should be addressed with the adoption of suitable mitigation measures.



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6 HEA 05 Noise Assessment

The assessment of compliance with HEA 05 Credit 2 – Indoor Ambient Noise Levels, has been undertaken based on the external noise levels at the proposed development and the calculated internal noise levels from mechanical plant associated with the air conditioning and ventilation systems.

The ability of the building to suitably attenuate noise from external sources depends on the sound insulation performance of the building façade (cladding and glazing). Based on the design documentation received, the following façade elements were adopted for assessment purposes, details are also shown in **Appendix 4**:

Element	Description	Sound insulation performance (dB R _w)
Cladding panel	ALUCABOND A2 (4mm Alucobond)	20
Double-glazed windows	Standard double glazing (assumed)	30

Table 14 Proposed façade elements

Based on the adopted mechanical ventilation strategy the building has been assessed with windows closed. The expected performance of the façade with the constructions shown in **Table 14** above indicates that suitable performance can be expected from the façade. It is assumed noise levels incident on the roof will be at least 10 dB below that on the wall, therefore its contribution is not considered.

Rooftop plant consists of four air handling entities (AHUs) and four air conditioning entities (CUs) per office block. The first floor of the proposed offices for Unit 6 & the office of Units 8 & 9 sits below the rooftop plant, with both the first and ground floors housing open plan offices and mixed-use toilet facilities. Indicative spectral noise data for these plant items has been provided by the project's engineers.

A summary of the equipment schedule for office space within Unit 6 and Units 8 & 9 is presented in **Tables 15 and 16** using the data presented in **Table 12** above.



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Item	Location	Plant
1	F1 – Open plan office	AHU – Intake
2		AHU – Exhaust
3	F1 – Toilets	AHU – Intake
4		AHU - Exhaust

Table 15 Unit 6 AHU equipment schedule used from Table 12

Item	Location	Plant
5	F1 – Open plan office	AHU – Intake
6		AHU – Exhaust
7	F1 – Toilets	AHU – Intake
8		AHU - Exhaust

Table 16 Units 8 & 9 AHU equipment schedule used from Table 12

Each room has been assessed as unfurnished and unoccupied with the following assumed reverberation times (T_{60}):

- Open plan office, 1 second; and
- All other rooms, 0.6 seconds.

In order to account for a conservative assessment, the highest operational noise level for the ventilation and air conditioning systems have been adopted. The closest duct termination for each unit has been considered due to its proximity to rooftop plant items. Predicted internal ambient noise levels are presented with and without the proposed acoustic attenuators fitted to the rooftop plant in **Tables 17 and 20** below, with detailed levels shown in **Tables 18 and 19**.



BREEAM HEA05 & POL05 Acoustic Design Review

Location	Floor	Room Type	Source	Design Target (NR)	Predicted internal ambient noise level (NR)
Unit 6	F1	Open Office Space	AHU (Intake)	<38	62
	F1	Open Office Space	AHU (Exhaust)	<38	48
	F1	Mixed-use Toilet	AHU (Intake)	<40	49
	F1	Mixed-use Toilet	AHU (Exhaust)	<40	52
Units 8 & 9	F1	Open Office Space	AHU (Intake)	<38	57
	F1	Open Office Space	AHU (Exhaust)	<38	48
	F1	Mixed-use Toilet	AHU (Intake)	<40	53
	F1	Mixed-use Toilet	AHU (Exhaust)	<40	46

Table 17 Predicted indoor ambient noise levels – without acoustic attenuators



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Location	Floor	Room Type	Source	Design Target (NR)	Internal noise level (before Attenuation)								Total L _p
					63	125	250	Frequency (Hz)				8k	
Unit 6	F1	Open Office Space	AHU (Intake)	NR 38	42.0	62.0	60.1	60.1	59.9	59.4	56.4	49.5	68
	F1	Open Office Space	AHU (Exhaust)	NR 38	35.7	53.7	54.5	50.7	45.4	43.9	40.9	37.0	59
	F1	Mixed-use Toilet	AHU (Intake)	NR 40	5.1	18.4	36.4	47.8	47.8	45.3	41.7	37.8	53
	F1	Mixed-use Toilet	AHU (Exhaust)	NR 40	4.6	17.2	35.8	48.2	51.3	48.8	43.1	39.3	55
Units 8 & 9	F1	Open Office Space	AHU (Intake)	NR 38	33.9	47.0	56.8	53.9	54.8	53.4	49.5	46.6	62
	F1	Open Office Space	AHU (Exhaust)	NR 38	42.1	47.9	50.3	50.7	46.1	42.6	40.6	39.7	56
	F1	Mixed-use Toilet	AHU (Intake)	NR 40	21.3	34.3	49.7	54.2	49.0	49.6	45.7	39.8	58
	F1	Mixed-use Toilet	AHU (Exhaust)	NR 40	15.5	25.1	39.1	46.7	45.8	42.5	36.6	32.7	51

Table 18 Predicted indoor ambient noise levels without attenuators



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Location	Floor	Room Type	Source	Design Target (NR)	Internal noise level (after Attenuation)								Total L _p
					Frequency (Hz)								
					63	125	250	500	1k	2k	4k	8k	
Unit 6	F1	Open Office Space	AHU (Intake)	NR 38	25.0	43.0	34.1	27.1	21.9	17.4	11.4	5.5	44
	F1	Open Office Space	AHU (Exhaust)	NR 38	18.7	34.7	28.5	17.7	7.4	1.9	-4.1	-7.0	36
	F1	Mixed-use Toilet	AHU (Intake)	NR 40	-11.9	-0.6	10.4	14.8	9.8	3.3	-3.3	-6.2	17
	F1	Mixed-use Toilet	AHU (Exhaust)	NR 40	-12.4	-1.8	9.8	15.2	13.3	6.8	-1.9	-4.7	18
Units 8 & 9	F1	Open Office Space	AHU (Intake)	NR 38	16.9	28.0	30.8	20.9	16.8	11.4	4.5	2.6	33
	F1	Open Office Space	AHU (Exhaust)	NR 38	25.1	28.9	24.3	17.7	8.1	0.6	-4.4	-4.3	32
	F1	Mixed-use Toilet	AHU (Intake)	NR 40	4.3	15.3	23.7	21.2	11.0	7.6	0.7	-4.2	26
	F1	Mixed-use Toilet	AHU (Exhaust)	NR 40	-1.5	6.1	13.1	13.7	7.8	0.5	-8.4	-11.3	17

Table 19 Predicted indoor ambient noise levels with proposed attenuators



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Location	Floor	Room Type	Source	Design Target (NR)	Highest predicted internal ambient noise level, dB L _{Aeq,T}
Unit 6	F1	Open Office Space	AHU (Intake)	<38	NR 25
	F1	Open Office Space	AHU (Exhaust)	<38	NR 18
	F1	Mixed-use Toilet	AHU (Intake)	<40	NR 11
	F1	Mixed-use Toilet	AHU (Exhaust)	<40	NR 14
Units 8 & 9	F1	Open Office Space	AHU (Intake)	<38	NR 21
	F1	Open Office Space	AHU (Exhaust)	<38	NR 14
	F1	Mixed-use Toilet	AHU (Intake)	<40	NR 18
	F1	Mixed-use Toilet	AHU (Exhaust)	<40	NR 10

Table 20 Predicted indoor ambient noise levels with proposed attenuators

As shown in Table 20, it can be seen that noise levels are expected to achieve the design criteria. Technical data relating to the proposed ventilation attenuator units is shown in **Appendix 5**.



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7 Conclusion

RSK Acoustics have undertaken a noise assessment for the proposed offices at Plot 6 and Plots 8 & 9 at HORIBA MIRA, Watling Street (A5), Nuneaton, CV10 0TU.

The purpose of the assessment is to provide evidence for POL05 'Reduction of Noise Pollution' and HEA05 'Acoustic Performance' credits as part of BREEAM scheme, New Construction 2018.

Internal noise levels for the proposed open plan office spaces and toilets are expected to be achieved with the recommended attenuator performance for the design criteria, and the façade construction is considered suitable to mitigate external ambient noise levels.

The credit for HEA05 can therefore be considered to be awarded with the implementation of the proposed attenuators. Post-construction testing may not be required subject to confirmation from the project team that the specifications have not changed from those used in this report.

A fixed plant noise assessment has been undertaken in accordance with the POL05 assessment criteria (BS 4142: 2014+A1: 2019). A maximum rating noise level for plant items associated with the development has been calculated at the nearest noise sensitive receptors in order to ensure that design targets will be met once the buildings are occupied. Noise calculations indicate compliance against the BREEAM design target. The credit for POL05 can also be considered to be awarded.

A letter from a suitably qualified acoustician would be required at post-installation stage confirming the installed number, type and location of fixed plant items as indicated in this report. Any non-compliances should be addressed with the adoption of suitable mitigation measures.



BREEAM HEA05 & POL05 Acoustic Design Review

8 References

1. BREEAM New Construction 2018. Reference: SD5078 – Issue 3.0. Issue date 31 July 2019 by BRE Global Ltd.
2. British Standard 4142:2014+A1 2019 'Methods for rating and assessing industrial and commercial sound. British Standards Institution, 2019
3. British Standard 8233: 2014, Sound insulation and noise reduction in buildings – code of practice. British Standards Institution, 2014
4. ISO 9613-2:1996 'Attenuation of sound during propagation outdoors – general method of calculation'. International Organization for Standardization, 1996
5. British Council for Offices (BCO) 'Guide to specification', 2019

 End of Section



BREEAM HEA05 & POL05 Acoustic Design Review

Glossary of Acoustic Terms

Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. 2×10^{-5} Pascal. A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include:
dB(A)	140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.
Time weighting	Sound level meters use various averaging times for the measurement of RMS sound pressure level. The most commonly used are Fast (0.125s averaging time), Slow (1s averaging time) and Impulse (0.035s averaging time).

End of Section



BREEAM HEA05 & POL05 Acoustic Design Review

Appendix 1 Site Plan

(Drawing ref. Polestar (SK)300 LocationPlan_RevA)





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Appendix 2 Photographic Report



UL1 (Rowden Lodge)



UL2 (Development Site) – East Facing



UL2 (Development Site) – South Facing

Photographs unavailable for monitoring location UL3 due to site photography constraints.



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Appendix 3 Noise Monitoring Results



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Swanvale

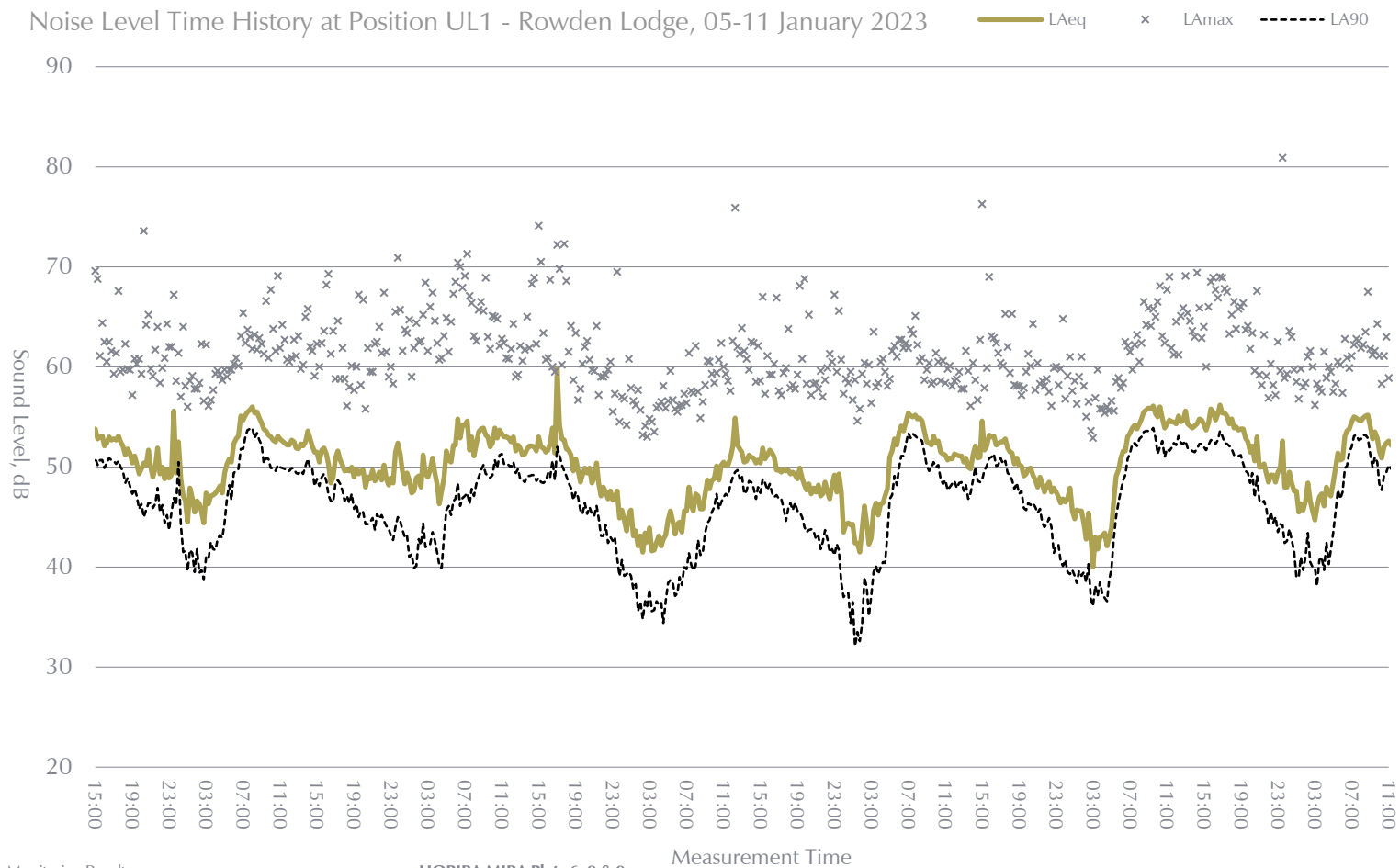


Figure 2061391/UL1



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Swanvale

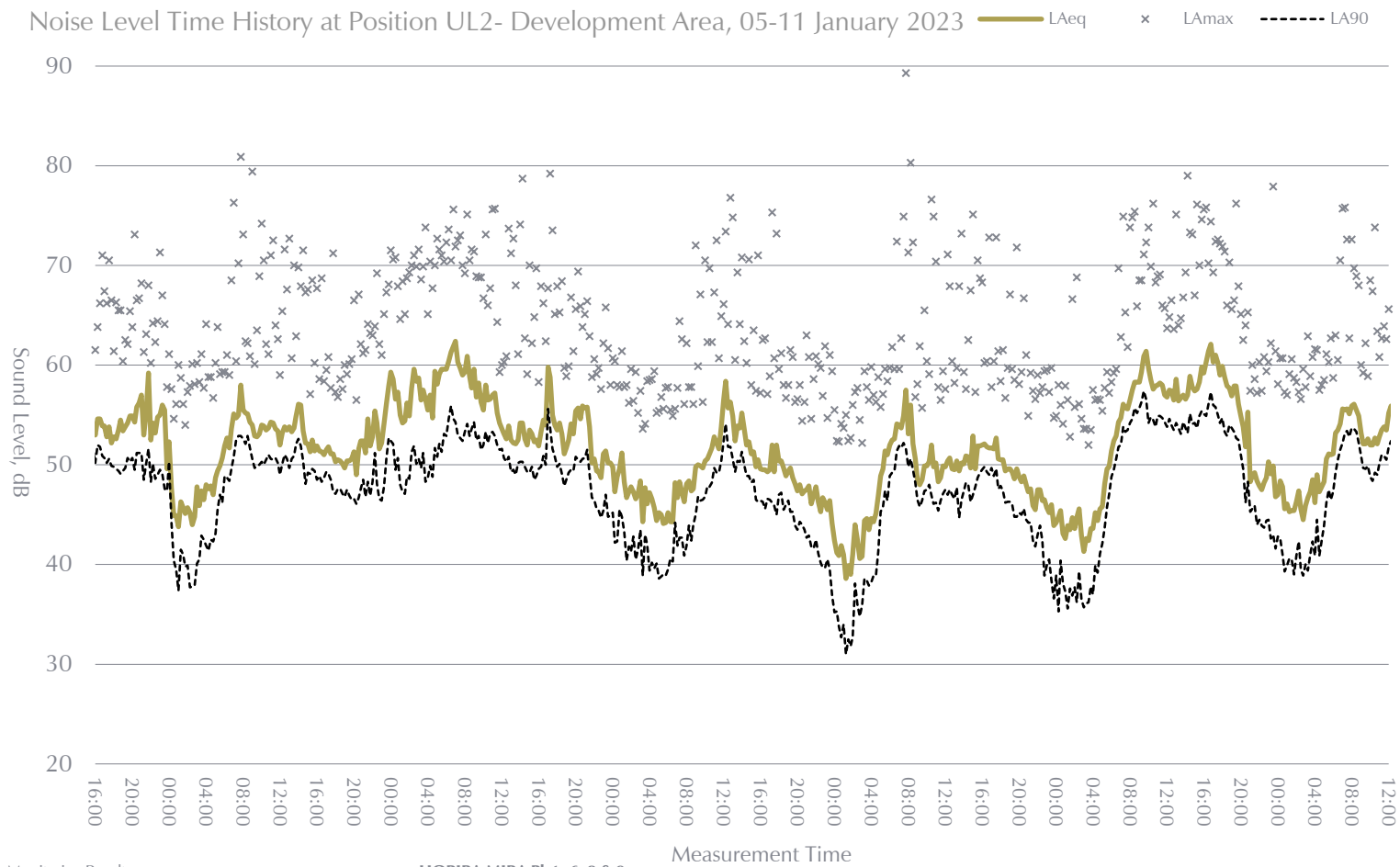


Figure 2061391/UL2



BREEAM HEA05 & POL05 Acoustic Design Review

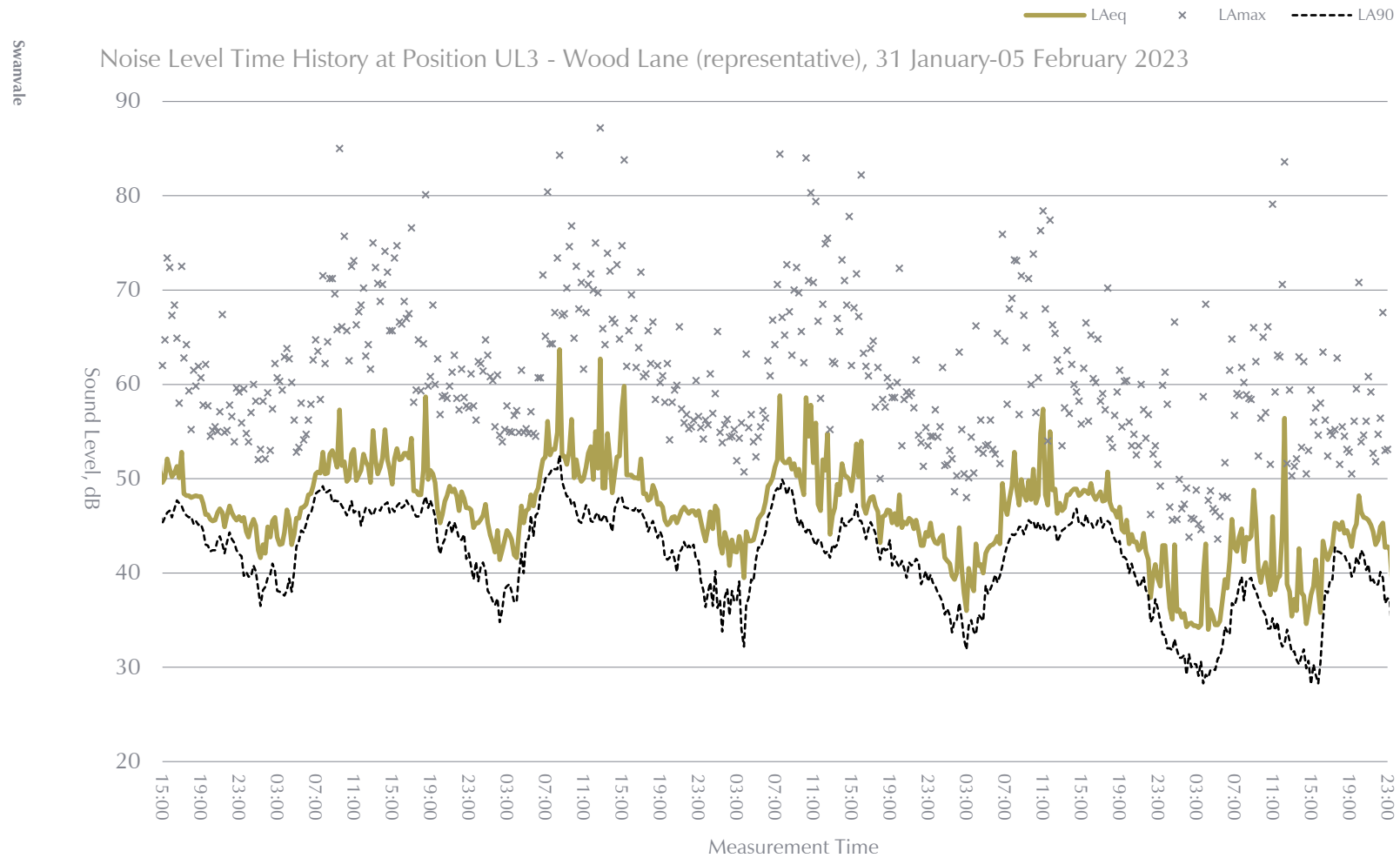


Figure 2061 391/UL3





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Appendix 4 Façade Specifications

TECHNICAL DATA

			ALUCORE® / ALUCORE® A2						ALUCORE® lite	
Standard thickness [mm]		Unit	6	10	10.5	15	20	25	6	10
Cover sheet thickness, front side		[mm]	1.0						0.5	
Cover sheet thickness, rear side		[mm]	0.5	0.5	1.0	1.0	1.0	1.0	0.5	
Weight		[kg/m²]	4.7	5.0	6.3	6.7	7.0	7.3	3.4	3.6
Technical properties										
Section modulus	W	[cm³/m]	2.5	4.5	8.63	13.1	18.1	23.1	2.5	4.5
Rigidity	EJ	[kNcm²/m]	7 100	21 900	34 800	75 500	138 900	221 600	5 800	17 300
Alloy of cover sheet (accord. to EN 485-2 / EN 1396:2007)			EN AW-5005A (AlMg1) H22/H42			EN AW-5005A (AlMg1) H28/H48 (H22 / H42)			EN AW 5005A (AlMg1)	
Modulus of elasticity	E	[N/mm²]	70 000						70 000	
Tensile strength of cover sheets	R _m	[N/mm²]	≥ 125			≥ 185 (125)			≥ 125	
0.2% Proof stress	R _{0.2}	[N/mm²]	≥ 80			≥ 160 (80)			≥ 80	
Elongation	A ₅₀	[%]	≥ 5			≥ 2 (5)			≥ 5	
Linear thermal expansion	α		2.4 mm/m at 100° C temperature difference						2.4 mm/m at 100° C temperature difference	
Core										
Bare compressive strength		[N/mm²]	approx. 2.5						approx. 2.6	
Cell size		[inch] [mm]	3/8 (9.5)						3/8 (9.5)	
Surface										
Lacquering			High-grade polymer coating system applied in coil coating						both sides mill finish	
Acoustical properties										
Sound absorption factor	α _s		0.05						0.05	
Air-borne sound insulation index (accord. to ISO 717-1, ISO 140-3)	R _w	[dB]	21	21	21	22	23	25	approx. 20	
Thermal properties										
Thermal conductivity (depends on total panel thickness incl. cover sheets)	λ	[W/mK]	0.95	1.35	1.42	1.78	2.25	2.70	0.90	1.30
Thermal resistance	R	[m²K/W]	0.0063	0.0074	0.0074	0.0084	0.0089	0.0093	0.006	0.008
Heat transition coefficient	U	[W/m²K]	5.67	5.64	5.64	5.61	5.59	5.58		
Temperature resistance		[°C]	-40 to +80						-40 to +80	

Table taken from Alucobond's ALUCORE aluminium composite panel product guide (document ref 'ALUCORE_ProductGuide_EN').



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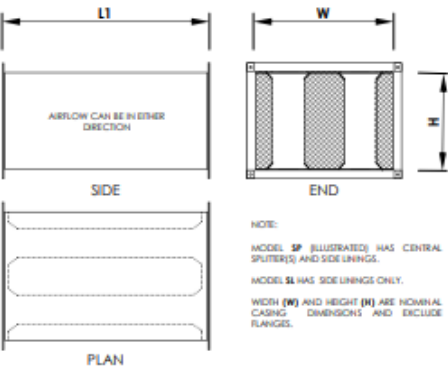
Appendix 5 Attenuator Specifications

DATA SHEET **A02g** RECTANGULAR ATTENUATOR FLANGED MODEL **SP** / MODEL **SL**

THIS IS NOT A STAND ALONE DOCUMENT AND UNLESS REFERRED TO IN A DATED EQUIPMENT SCHEDULE IS SUBJECT TO REVISION WITHOUT NOTICE.



DIMENSIONS



SPECIFICATION

ATTENUATORS ARE CONSTRUCTED IN ACCORDANCE WITH DW 144 SPECIFICATION FOR MEDIUM PRESSURE (CLASS B) DUCTWORK.
CASES ARE STIFFENED AND FITTED WITH PROPRIETARY FLANGES.
MODEL **SP** - HAS SOUND ABSORBENT SPLITTERS ARRANGED VERTICALLY WITHIN THE CASING TO FORM A SERIES OF CENTRAL ELEMENTS AND SIDE LININGS.
MODEL **SL** - HAS SOUND ABSORBENT SPLITTERS ARRANGED VERTICALLY WITHIN THE CASING TO FORM SIDE LININGS ONLY.
SPLITTERS AND SIDE LININGS CONTAIN A SOUND ABSORBENT INFILL THAT IS ENCAPSULATED WITH GLASS CLOTH AND PLAIN/PERFORATED STEEL.
SPLITTERS HAVE AERODYNAMIC FAIRINGS AT EACH END.

NOTES

THIS DATA SHEET IS TO BE READ IN CONJUNCTION WITH THE EQUIPMENT SCHEDULE.
LARGER ATTENUATORS WILL BE OF MODULAR CONSTRUCTION FOR EASE OF HANDLING AND MAY BE SPLIT ON THE LENGTH, WIDTH, HEIGHT OR COMBINATION THEREOF (SEE DATA SHEET A09 FOR DETAILS).
ATTENUATORS WILL BE SUPPLIED WITHOUT SUPPORT STEELWORK, BRACKETS, FIXINGS, GASKET, MASTIC OR OTHER SUCH ITEMS, UNLESS OTHERWISE STATED.
IT IS THE INSTALLERS RESPONSIBILITY TO PROVIDE THE FLANGE SEAL TO THE CONNECTING DUCT.
INSERTION LOSS, PRESSURE LOSS AND FLOW NOISE ARE DERIVED FROM TESTS CARRIED OUT IN ACCORDANCE WITH ISO 7235 AND MAY VARY DEPENDING ON INSTALLED CONDITIONS.
MANUFACTURING DIMENSIONAL TOLERANCE < 1.0 %.

SUFFIX

THE SUFFIX TO THE ATTENUATOR MODEL DEFINES THE MATERIAL OF FABRICATION AND ANY ADDITIONAL FEATURES OR SPECIAL CONSTRUCTIONAL DETAILS.
G - PRE-GALVANISED STEEL CONSTRUCTION.
S - GRADE 316 STAINLESS STEEL CONSTRUCTION.
H1 - HIGH TEMPERATURE APPLICATION (2 HOUR/300°C).
D - DOUBLE SKIN CASING (CASING SIZE W+50 x H+50).
C - HIGH PRESSURE APPLICATION (DW 144, CLASS C).
K - PROTECTIVE PAINT FINISH TO VISIBLE INTERNAL METAL SURFACES.
J - SPLITTERS AND/OR SIDE LININGS ARRANGED HORIZONTALLY.
M - MELINEX ENCAPSULATED INFILL.
Z(**)** - MODULAR CONSTRUCTION (SEE DATA SHEET A09 FOR DETAILS).
X - SPECIAL CONSTRUCTION, REFER TO EQUIPMENT SCHEDULE FOR DETAILS.

FLANGE DETAILS

ATTENUATORS ARE FITTED WITH 30 mm PROFILE FLANGES COMPLYING WITH DW144 AND DW/TM1.

STANDARD SIZES

LENGTH (**L1**) - 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, & 3000 mm.
WIDTH (**W**) - ANY DIMENSION ABOVE 149 mm.
HEIGHT (**H**) - ANY DIMENSION ABOVE 99 mm.
ALL ATTENUATORS ARE MADE TO ORDER.
NON STANDARD ATTENUATORS ARE AVAILABLE.

WEIGHT

WEIGHTS ARE GIVEN ON THE EQUIPMENT SCHEDULE.

MODULAR CONSTRUCTION

ATTENUATORS MANUFACTURED IN ONE SECTION WILL HAVE NO "Z" SUFFIX IN THE CODE.
WHEN ATTENUATORS ARE SUPPLIED IN MODULAR FORM, THE ACTUAL NUMBER OF SECTIONS IN THE LENGTH, WIDTH AND HEIGHT DEFINED BY THE "Z" SUFFIX, REFER TO DATA SHEET A09 FOR DETAILS.

Z	#	#	#
A "Z" SUFFIX IN THE ATTENUATOR CODE DENOTES THAT THE ATTENUATOR WILL BE SUPPLIED IN MODULES.	NUMBER OF MODULES IN LENGTH.	NUMBER OF MODULES IN WIDTH.	NUMBER OF MODULES IN HEIGHT.

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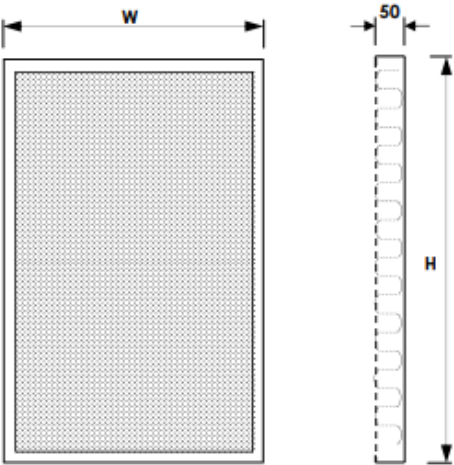
BREEAM HEA05 & POL05 Acoustic Design Review

DATA SHEET **E40b** ACOUSTIC ENCLOSURE PANEL MODEL **EP50/UF**

IMPORTANT : THIS IS NOT A STAND ALONE DOCUMENT AND SHALL REFERRED TO IN A DATED AND CERTIFIED EQUIPMENT SCHEDULE IS SUBJECT TO REVISION WITHOUT NOTICE.



DIMENSIONS



SPECIFICATION

THE ACOUSTIC ENCLOSURE PANEL COMPRISES A COMBINATION OF SOUND ABSORBENT MATERIALS AND HIGH MASS BARRIERS CONTAINED WITHIN A METAL CASING HAVING AN PLAIN OUTER AND PERFORATED INNER FACE. OFFERING EXCELLENT SOUND REDUCTION AND ABSORPTION PROPERTIES.

PANELS ARE CONSTRUCTED FROM PRE-GALVANISED SHEET STEEL AS STANDARD.

THE OUTER CASING IS FORMED FROM PLAIN SHEET METAL AND INSIDE FACE FROM PERFORATED METAL.

PANELS CONTAIN A FIBROUS SOUND ABSORBENT INFILL THAT IS NON-SHEDDING, NON-COMBUSTIBLE, NON-HYGROSCOPIC AND CHEMICALLY INERT. THE INFILL IS FACED WITH GLASS CLOTH TO PREVENT FIBRE MIGRATION.

THE CASING CAN BE SUPPLIED WITH A PERIMETER FLANGE FOR FIXING ADJACENT SECTIONS TOGETHER, FIXING THE PANELS INTO THE BUILDERSWORK OPENING OR FIXING INTO THE FRAMEWORK OF AN ACOUSTIC ENCLOSURE (OPTION F).

POLYESTER POWDER FINISH AVAILABLE (SUFFIX P)

SUFFIX

P - POLYESTER POWDER COAT

F - PERIPHERAL FIXING FRAME

X - SPECIAL CONSTRUCTION, REFER TO EQUIPMENT SCHEDULE FOR DETAILS.

BUILDERSWORK

THE W AND H DIMENSIONS GIVEN ON THE CERTIFIED EQUIPMENT SCHEDULE ARE AS MANUFACTURED.

ADEQUATE CLEARANCE MUST BE ALLOWED WHEN CONSTRUCTING THE BUILDERSWORK OPENING, MIN 10mm IS RECOMMENDED.

WEIGHT

ACTUAL WEIGHTS ARE GIVEN ON THE EQUIPMENT SCHEDULE.

APPROXIMATE WEIGHT: 18kg/M².

STANDARD SIZES

THERE ARE NO STANDARD SIZES. PANELS ARE MANUFACTURED TO ORDER

ACOUSTIC PERFORMANCE

SOUND REDUCTION INDEX BS EN ISO 10140/2 : 2010									
43	125	250	500	1000	2000	4000	8000	Hz	
17	19	26	33	38	42	45	44	dB	

SOUND ABSORPTION BS EN ISO 354 : 2003									
43	125	250	500	1000	2000	4000	8000	Hz	
.10	.25	.45	1.00	1.00	1.00	.95	.90	-	

NOTES

THIS DATA SHEET IS TO BE READ IN CONJUNCTION WITH THE EQUIPMENT SCHEDULE

PANELS WILL BE SUPPLIED WITHOUT SUPPORT STEELWORK, BRACKETS, FIXINGS OR MASTIC UNLESS OTHERWISE STATED.

PANELS MORE THAN 1800 WIDE OR 2500 HIGH MAY BE MANUFACTURED IN SECTIONS FOR ON SITE ASSEMBLY.

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