

BREEAM Pol 05 External Plant Noise Impact

Assessment

Unit 1 Watling Street

Hinkley

LE10 3ED

Stroma Built Environment Ltd.

SBE Ref: OP-C759 – AC - 2v1

I. Revision History

Revision	Date	Description	
2v1	29/01/2026	First Issue	
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1. Introduction

- 1.1 Stroma Built Environment (SBE) have been appointed by Winvic Construction Limited to undertake an external plant noise assessment of the new warehouse unit, Unit 1 located on Watling Street, Hinkley.
- 1.2 The purpose of this report is to assess the acoustic impact of fixed mechanical building services plant associated with the proposed development. The impact of the noise emissions will be assessed against the requirements for the BREEAM Pol 05 credit. The assessment is based on background noise data measured on site during a noise survey.
- 1.3 This document has been prepared for the sole use, benefit, and information of Winvic Construction Limited for the purposes set out in the document or instructions commissioning the works. The liability of SBE in respect of the information contained herein will not extend to any third party.
- 1.4 This report is limited to addressing the specific acoustic issues contained herein and is based on information and drawings provided by the client.
- 1.5 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature. A glossary of terminology has been included in Appendix III.

2. Relevant Acoustic Standards and Guidance

Nuneaton and Bedworth District Council

- 2.1 The site lies within the jurisdiction of Nuneaton and Bedworth District Council (NBC). NBC has had a chance to review the potential noise impacts of this development during the planning phase.
- 2.2 NBC have not imposed any planning conditions relating to noise emissions from the site. In addition, their supplementary planning documentation contains no quantitative guidance on noise impacts from fixed building services noise emissions.

BREEAM New Construction 2018

- 2.3 For control of mechanical services noise, BREEAM states that one credit may be awarded where:

“1. There are no noise-sensitive areas within the assessed building or within 800 m radius of the assessed site.

OR

2. Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800m radius of the assessed site, a noise impact assessment compliant with BS 4142:2014 is commissioned. Noise levels must be measured or determined for:

2.a. Existing background noise levels:

2.a.i. at the nearest or most exposed noise-sensitive development to the proposed assessed site

2.a.ii. including existing plant on a building, where the assessed development is an extension to the building

2.b. Noise rating level from the assessed building.

3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant.

4. 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 5dB lower than the background noise throughout the day and night.

5. If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.”

BS 4142:2014 *Methods for rating and assessing industrial and commercial sound*

- 2.4 BS 4142 describes a method for assessing the impact from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc.). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from the item, or items of plant being assessed (measured as an L_{Aeq}).
- 2.5 The rating level is then compared with the underlying background noise level (measured as an L_{A90}) in the absence of noise from the item or items of plant being assessed. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- 2.6 BS 4142 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive, or intermittent characteristics. A rating penalty for a sound may be applied based on a subjective assessment of its characteristics.

3. Site Baseline Conditions

Site Description

- 3.1 The development site lies on open countryside just outside of Hinkley to the southwest of the A5. Adjacent to the site, to the south east, is a metal recycling facility and a railway line that serves Hinkley Station. The rest of the site is surrounded by open countryside.
- 3.2 Unit 1 will consist of a large warehouse area, with office areas split over three storeys on all facades. The proposed site plan is shown in Figure 1.

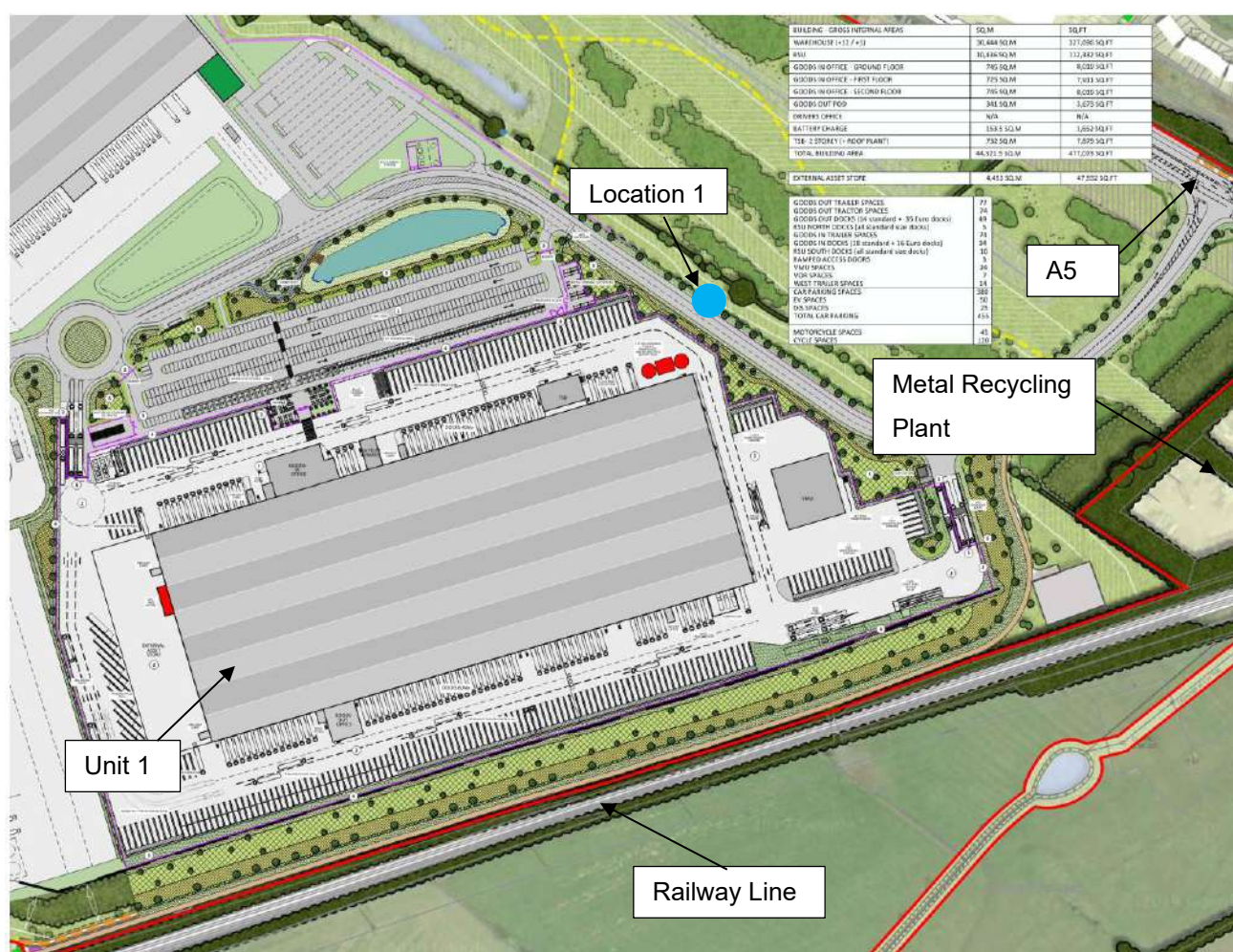


Figure 1: Site and Surrounding Area

Noise Sensitive Receptors

- 3.3 Figure 2 shows a satellite image of the site and surrounding area.



Figure 2: Satellite image of site area

- 3.4 As shown in Figure 2, there are residential dwellings located to the northeast of the site, on the opposite side of Watling Street, the A5. These dwellings will be considered as NSR Group A. Each receptor in this NSR Group will be considered individually in the assessment and the receptor with the loudest predicted building services noise emissions will be taken as representative of the whole NSR Group.
- 3.5 There are dwellings to the west of the site, however, these are more than 800m from the site's western boundary and so do not need a BREEAM assessment.
- 3.6 The farmhouse located within the site boundary has been demolished as part of the wider site development.

Baseline Noise Conditions

- 3.7 A baseline noise survey was conducted at site between approximately 10:00 on Wednesday 15th to 16:00 on Saturday 18th October 2025 by SBE. This long term monitoring was done at one location, as shown on Figure 1.
- 3.8 Location 1 was placed on the site boundary fence closest to the A5. The microphone was approximately 100m away from the centre line of the nearest carriageway and, at this location, there was a direct line of sight between the A5 and the facades of the warehouse.

-
- 3.9 The site is an active construction site as such construction noise dominated the measurements at both locations. Reviewing the audio collected during the survey, the site was active between 06:00 and 18:00 on weekdays and not operating at the weekends. Data where the construction noise dominated the measurements has been omitted from this assessment.
- 3.10 In the absence of construction noise, the noise climate is dominated by road traffic from the A5. Trains occasionally passed on the rail line to the southeast of the site, however, not enough to be considered as a major source of noise.
- 3.11 Noise levels were measured using a NTi XL2 Class 1 sound level meter fitted with a weather protection kit. The sound level meter was field calibrated before and after the survey periods with no significant drift detected. Broadband noise was measured A-weighted and third octave band measurements were taken un-weighted. Audio recordings of the noise climate were also taken.
- 3.12 The weather conditions during the survey were suitable for noise monitoring, with no precipitation and average wind speeds of less than 5 m/s. The temperature during the survey was between 10°C and 14°C.
- 3.13 A summary of the measured noise levels is shown in Table 1, below. The typical background noise levels were calculated using the histogram method outlined in BS4142:2014. The histograms are available upon request.

Table 1: Summary of measured noise levels

Date	Period (hh:mm)	Ambient Noise Level (dB $L_{Aeq,T}$)	Highest Maximum Noise Level (dB L_{AFmax})	Typical Background Noise Level (dB $L_{A90,T}$) ^[1]
15/10/2025	Day (10:00 – 23:00) ^[2]	52	69	48
	Night (07:00 – 23:00)	49	76	45
16/10/2025	Day (07:00 – 23:00) ^[2]	51	70	47
	Night (07:00 – 23:00)	49	66	46
17/10/2025	Day (12:00 – 23:00) ^[2]	52	72	48
	Night (07:00 – 23:00)	49	66	45
18/10/2025	Day (07:00 – 16:00)	53	85	50

Notes to Table 1:

[1] Typical background noise levels calculated using histogram method outlines in BS4142:2014. Histograms are available upon request.

[2] Periods where construction noise dominated have been removed from the noise survey data. The noise survey data presented was not affected by construction noise.

Building Services Noise Limits

- 3.14 The results of the noise survey can be used to set building services noise limits at NSR Group A. As there is no quantitative guidance from the local planning authority, the BREEAM 2018 New Construction requirements will be used.
- 3.15 BREEAM Pol 05 requires the building services noise emissions to be at 5 dB below the typical background noise level at the NSR. The lowest typical background noise level has been taken as representative as a 'worst case' assessment.

Table 2: Building Services Noise Limits

NSR Group	Period	Typical Background Noise Level (dB $L_{A90,T}$)	BREEAM Pol 05 Building Services Noise Limit (dB $L_{Ar,Tr}$)
A	Daytime (07:00 - 23:00)	47	42
	Night-time (23:00 – 07:00)	45	40

4. External Plant Noise Impact Assessment

Assessed Building Services Plant

- 4.1 Sources of externally located, or externally terminating, noise generating plant associated with the development that have been considered in this assessment are set out in Table 3. Ventilation drawings have been provided by the client to inform the assessment. All ventilation drawings and data used in the assessment can be found in Appendix I.
- 4.2 Building services plant is mainly located in the Main Office, also referred to as the 'Goods In Office'. The building services is mainly located at roof level with additional air source heat pumps and condensers located at ground level. Other air source heat pumps and condensers associated with other office spaces are located at ground level near to their respective office space.

Table 3: Plant Noise Sources Considered in the Assessment

Reference	Manufacturer	Model	Unit Type	Unit Location
AHU 01	Swegon	GOLD F RX	Air Handling Unit	Main Office
AHU 02	Swegon	GOLD F RX	Air Handling Unit	Main Office
AHU 03	Swegon	GOLD F RX	Air Handling Unit	Main Office
AHU 04	Swegon	GOLD F RX	Air Handling Unit	Main Office
KEF	SystemAir	MUB/T-S 062 560 EC	Extract Fan	Main Office
ASHP 1	Swegon BlueBox	Omicron Zero SLN S4 16.4	Air Source Heat Pump	Main Office
ASHP 2	Swegon BlueBox	Omicron Zero SLN S4 16.4	Air Source Heat Pump	Main Office
ASHP 3	Swegon	Zeta Zero hi HP 7.1	Air Source Heat Pump	Main Office
DX Split 1	Mitsubishi	PUZ-M71KA2	Condenser	Main Office
DX Split 2	Mitsubishi	PUZ-M71KA2	Condenser	Main Office
ASHP 1	Samsung	EHS Mono AE160CXYBEK/EU	Air Source Heat Pump	Goods Out Office
ASHP 2	Samsung	EHS Mono AE160CXYBEK/EU	Air Source Heat Pump	Goods Out Office
ASHP 3	Samsung	EHS Mono AE080CXYBEK/EU	Air Source Heat Pump	Goods Out Office
DX Split 1	Mitsubishi	PUZ-ZM50LA2	Condenser	Goods Out Office
DX Split 2	Mitsubishi	PUZ-ZM50LA2	Condenser	Goods Out Office
ASHP 1	Samsung	EHS Mono AE120CXYBEK/EU	Air Source Heat Pump	RSU Office
ASHP 2	Samsung	EHS Mono AE120CXYBEK/EU	Air Source Heat Pump	RSU Office

Reference	Manufacturer	Model	Unit Type	Unit Location
ASHP 3	Samsung	EHS Mono AE080CXYBEK/EU	Air Source Heat Pump	RSU Office
DX Split 1	Mitsubishi	PUZ-M35VAR2	Condenser	RSU Office
DX Split 2	Mitsubishi	PUZ-M35VAR2	Condenser	RSU Office
DX Split 3	Mitsubishi	PUZ-ZM50LA2	Condenser	Drivers Pod
ASHP 1	Samsung	EHS Mono AE080CXYBEK/EU	Air Source Heat Pump	VMU
DX Split 1	Mitsubishi	PUZ-M35VAR2	Condenser	VMU
DX Split 2	Mitsubishi	PUZ-M35VAR2	Condenser	VMU
DX Split 3	Mitsubishi	PUZ-M250YKA	Condenser	VMU
DX Split 4	Mitsubishi	PUZ-M100YKA	Condenser	VMU

Noise Impact Assessment

- 4.3 To accurately calculate the impact all the above noise sources would have on the NSRs, a noise model was made using the modelling software, *CadnaA*.
- 4.4 It has been assumed that the building services have the possibility of running throughout the daytime and night-time periods.
- 4.5 The noise model was based on the following assumptions and limitations:
- Noise propagation is calculated according to ISO 9613 (2024) methodology;
 - Sound reflections up to the 2nd order have been considered;
 - Ground absorption has been set to 0.8 to reflect the open environment around the site;
 - Building absorption has been set to 0.2;
 - The effect of topography has generally not been considered in the model as the site and surrounding area have little topographical features;
 - Receptor height has been set to 1.5 m to reflect ground floor level and 4 m to reflect first floor level and each 2.5m to represent each further storey of the identified NSRs;
 - Receptors are set to 1 m from facades of all NSRs;
 - Assessment has been undertaken on the basis that the plant included within the assessment will operate concurrently at any point during the day and at design duty; while this is unlikely to be the case in reality, this assumption presents a worst-case assessment;
 - BS 4142 acoustic feature corrections have not been included in the calculations as based on the type of plant equipment and manufacturer noise data provided, SBE does not expect impulsive or tonal characteristics, or distinctive intermittency to the noise emitted.
- 4.6 Table 4 presents the cumulative plant noise levels at the nearest identified NSRs, along with a comparison against the rating noise level criteria set out in Table 2.

Table 4: Calculated Plant Noise Levels at NSR

NSR	Period	Calculated Cumulative Noise Level at NSR (dB $L_{Ar,Tr}$)	Rating Level Limit (dB $L_{Ar,Tr}$)	Level Above Rating Level Limit (dB)	Compliant
NSR Group A	Daytime (07:00 – 2300)	34	42	-8	YES
	Night-time (23:00 – 07:00)		40	-6	YES

4.7 Table 4 shows that the calculated cumulative building services noise level at all the NSRs are below the rating level limit and is therefore compliant with the rating level criteria set out in Table 2.

4.8 On this basis, the noise emissions from fixed items of building services plant are not likely to disturb the nearest noise sensitive receptors. The BREEAM requirement for Pol 05 is therefore met and the credit can be awarded.

Estimate of Calculation Uncertainty

4.9 An assessment of uncertainty in measurement and calculation is undertaken following guidance in University of Salford document 'A good practice guide on the sources and magnitude of uncertainty arising in the practical measurement of environmental noise' (2007).

4.10 Assessment is undertaken against measured site background sound level measurements. The uncertainty of noise survey measurements is expected to be ± 1 dB based on the allowable uncertainty for a calibrated Class 1 precision integrating sound level meter, quoted by BS 61672-11:2003 as ± 1 dB at 1 kHz.

4.11 Sound data for plant equipment has been taken from manufacturer quoted noise. In accordance with BS EN ISO 3740:2001 the uncertainty of source measurement is expected to be ± 1 dB in each octave band.

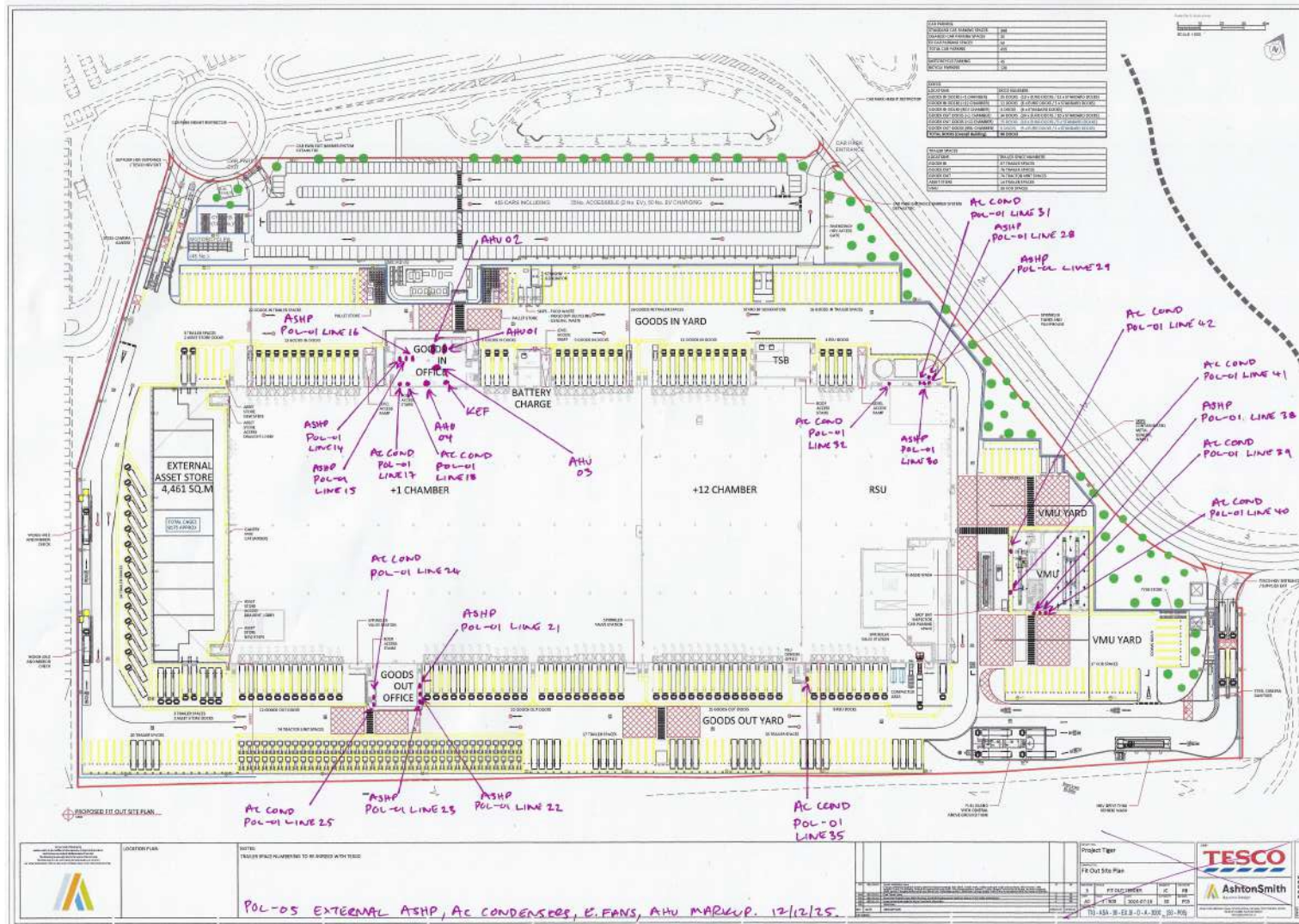
4.12 The uncertainty in a distance attenuation calculation is quoted by ISO 9613-2:2024 as ± 3 dB for sources < 5m from ground level.

4.13 It is therefore considered that the maximum uncertainty in measurement and calculation is ± 3 dB. The uncertainty in the assessment will not change the outcome and would still result in a low impact as per BS4142:2014.

5. Summary and Conclusion

- 5.1 Winvic Construction have commissioned Stroma Built Environment to carry out a building services noise impact assessment for Unit 1, Watling Street, Hinkley.
- 5.2 This report has considered the acoustic impact of the operation of mechanical building services plant associated with the proposed development at the nearest identified Noise Sensitive Receptors (NSRs) in relation to satisfying the requirements of BREEAM 2018 New Construction and Nuneaton and Bedworth District Council.
- 5.3 A noise survey has been conducted to establish typical background noise levels at the nearby noise sensitive receptors. This has been used as the basis of the assessment. BREEAM Pol 05 requires that the noise emissions from fixed items of building services plant be at least 5 dB below the typical background noise level at the nearby NSRs. This can be assessed by doing a BS 4142 assessment of the cumulative plant noise levels of all operational plant.
- 5.4 The assessment indicates that noise from mechanical building services plant associated with the development meet the requirements of BREEAM Pol 05 at the nearby noise sensitive receptors without any need for noise mitigation measures.
- 5.5 On this basis, the BREEAM Pol 05 credit may be awarded.

Appendix I. Ventilation layouts



Appendix II. Mechanical Services Noise Levels

AHU 01

Frequency band	63	125	250	500	1k	2k	4k	8k	All		
To supply air duct	78	75	76	76	73	71	67	66	dB	79	dB(A)
To outdoor air duct	79	78	78	67	59	56	52	55	dB	72	dB(A)
To extract air duct	78	77	78	66	58	56	55	58	dB	71	dB(A)
To exhaust air duct	83	78	80	82	79	78	76	76	dB	85	dB(A)
To surroundings	76	68	61	65	50	49	46	49	dB	63	dB(A)

AHU 02

Frequency band	63	125	250	500	1k	2k	4k	8k	All		
To supply air duct	78	73	73	74	71	69	67	67	dB	77	dB(A)
To outdoor air duct	75	74	74	63	55	52	48	51	dB	68	dB(A)
To extract air duct	75	72	66	64	53	52	49	48	dB	65	dB(A)
To exhaust air duct	81	77	74	74	75	73	69	66	dB	80	dB(A)
To surroundings	73	65	56	59	46	44	41	43	dB	58	dB(A)

AHU 03

Frequency band	63	125	250	500	1k	2k	4k	8k	All		
To supply air duct	78	73	74	76	73	71	69	69	dB	78	dB(A)
To outdoor air duct	74	73	73	62	54	51	47	50	dB	66	dB(A)
To extract air duct	76	75	76	64	56	54	53	56	dB	69	dB(A)
To exhaust air duct	81	76	78	80	77	76	74	74	dB	83	dB(A)
To surroundings	72	64	57	61	46	45	42	45	dB	59	dB(A)

AHU 04

Frequency band	63	125	250	500	1k	2k	4k	8k	All		
To supply air duct	79	74	74	75	72	70	68	68	dB	78	dB(A)
To outdoor air duct	80	78	80	69	62	60	57	61	dB	74	dB(A)
To surroundings	70	62	55	59	44	43	40	43	dB	58	dB(A)

Extract Fan Data

Sound power level		63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	63	83	84	87	88	85	81	75	93
Outlet	dB(A)	64	85	85	89	89	87	82	76	94
Surrounding	dB(A)	46	72	70	59	61	60	54	43	75
Sound pressure level at 3m (20m² Sabine)	dB(A)	-	-	-	-	-	-	-	-	68
Sound pressure level at 3m free field	dB(A)	-	-	-	-	-	-	-	-	54

Swegon Omicron Zero

SOUND DATA-OCTAVE	Hz	63	125	250	500	1000	2000	4000	8000
Unit global sound power	dB	90.0	101.2	91.2	83.9	80.3	76.5	69.8	67.0

Swegon Zeta Zero

Sound data (C2)		
Calculated sound power	dB(A)	83.5
Sound pressure ^(C0) [10.0 m]	dB(A)	51.7
Lw 813/2013 ^(C1)	dB(A)	70

Samsung EHS Mono

Outdoor Unit				AE160CXYBK/EU	AE080CXYBGK/EU	AE120CXYBGK/EU	AE160CXYBGK/EU
System							
Operation	Nominal Capacity	Heating A7/W35 ¹ / A7/W55 ²	kW	16.0/16.0	8.0/8.0	12.0/12.0	16.0/16.0
		Cooling A35/W18 ¹	kW	14.0	9.0	12.0	14.0
	Power Input (Nominal)	Heating A7/W35 ¹ / A7/W55 ²	kW	3.55/3.52	1.63/2.67	2.50/4.0	3.55/3.52
		Cooling A35/W18 ¹	kW	3.680	2.050	3.000	3.680
	COP (Nominal Heating) A7/W35 ¹ / A7/W55 ²		W/W	4.51/2.90	4.91/3.00	4.80/3.00	4.51/2.90
	EER (Nominal Cooling) A35/W18 ¹		W/W	3.80	3.90	4.00	3.80
	SCOP LWT 35°C/55°C		W/W	4.70/3.55	4.85/3.55	4.90/3.65	4.70/3.55
	Seasonal Space Heating enr. efficiency η _s LWT 35°C/55°C		ETA%	185 / 139	191 / 139	193 / 143	185 / 139
	Seasonal Space Heating Eff. Class* LWT 35°C/55°C			A+++ ** / A++ *	A+++ ** / A++ *	A+++ ** / A++ *	A+++ ** / A++ *
	Current	MCA	A	32.0	16.1	16.1	16.1
		MFA	A	35.2	17.7	17.7	17.7
Water Flow Rate	Nom	l/min	7.0/58.0	7.0/48.0	7.0/58.0	7.0/58.0	
	Leaving Water Temperature	Heating	°C	15-75	15-75	15-75	15-75
Cooling		°C	5-25	5-25	5-25	5-25	
Functions	Smart Grid Ready/PV Enabled		-	•	•	•	•
	3-Step Quiet Mode		-	•	•	•	•
	2-zone Control		-	•	•	•	•
Outdoor Unit							
Power Supply			Φ, V, Hz	1Φ, 2Line, 220-240V, 50Hz	3Φ, 4Line, 380-415V, 50Hz	3Φ, 4Line, 380-415V, 50Hz	3Φ, 4Line, 380-415V, 50Hz
Compressor	Type	-		Scroll	Twin Rotary	Scroll	Scroll
Base Heater	Capacity	kW		0.15	0.15	0.15	0.15
Sound	Sound Pressure ¹	Heating Std	dB(A)	51	43	47	51
		Cooling Std	dB(A)	51	43	47	51
	Sound Power		Heating Std	dB(A)	65	59	60

Mitsubishi PUZ Units

PURY-EM-YNW-A1 OUTDOOR UNITS		PURY-EM200YNW-A1	PURY-EM250YNW-A1	PURY-EM300YNW-A1
CAPACITY (kW)	Heating (nominal)	25.0	31.5	37.5
	Cooling (nominal)	22.4	28.0	33.5
	High Performance Heating (UK)	25.0	31.5	35.6
	COP Priority Heating (UK)	22.8	28.7	34.1
	Cooling (UK)	20.1	25.1	30.0
POWER INPUT (kW)	Heating (nominal)	5.23	7.30	9.37
	Cooling (nominal)	4.43	6.68	7.82
	High Performance Heating (UK)	6.59	9.20	12.46
	COP Priority Heating (UK)	5.23	7.30	9.37
	Cooling (UK)	2.57	3.87	4.54
COP / EER (nominal)		4.78 / 5.05	4.31 / 4.19	4.00 / 4.28
MAX NO. OF CONNECTABLE INDOOR UNITS		9 (8")	11 (10")	14 (12")
MAX CONNECTABLE CAPACITY		50~150% OU Capacity	50~150% OU Capacity	50~150% OU Capacity
AIRFLOW (m³/min)	High	170	185	240
PIPE SIZE mm (in)	Gas	19.05 (3/4")	22.2 (7/8")	22.2 (7/8")
	Liquid	15.88 (5/8")	15.88 (5/8")	15.88 (5/8")
SOUND PRESSURE LEVEL (dBA) @ 1m	Heating / Cooling	59.0 / 59.0	61.0 / 60.5	67.0 / 61.0
SOUND POWER LEVEL (dBA) @ 100% Capacity	Heating / Cooling	78.0 / 76.0	80.0 / 78.5	86.5 / 80.0

PUZ-ZM OUTDOOR UNITS		PUZ-ZM35VKA2	PUZ-ZM50VKA2	PUZ-ZM60VHA2	PUZ-ZM71VHAR2	PUZ-ZM100VDA	PUZ-ZM125VDA	PUZ-ZM140VDA
SOUND PRESSURE LEVEL (dBA)	Heating/Cooling	46 / 44	46 / 44	49 / 47	49 / 47	48 / 44	50 / 47	51 / 49
SOUND POWER LEVEL (dBA)	Cooling	65	65	67	67	63	66	68

Appendix III. Acoustic Glossary

Sound pressure level and the decibel, dB

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. The decibel is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Frequency and hertz, Hz

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

Different weighting networks can be applied to a given sound level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The most commonly used weighting network is the 'A' weighting, and the letter 'A' will be included within a descriptor to indicate that the value has been 'A' weighted, e.g. $L_{Aeq,T}$ or L_{A90} . An 'A' weighted noise level may also be written as dB(A). Other weightings less commonly used are 'C' and 'D' weighting.

Noise indices

When a noise level varies with time, the measured 'A' weighted dB level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple 'A' weighted dB value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The various indices used are described as below:

$L_{Aeq,T}$	The 'A' weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T
L_{Amax}	The maximum 'A' weighted noise level that was recorded during the monitoring period.
L_{A10}	The 'A' weighted noise level that was recorded for at least 10% of the monitoring period.
L_{A90}	The 'A' weighted noise level that was recorded for at least 90% of the monitoring period, usually taken as the underlying 'background' noise level.

Sound level difference, D

The sound level difference between two internal spaces, or between internal and external spaces. The ' D ' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to

describe an overall performance. Note that the 'D' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

D_w	Single figure weighted sound level difference, simply the measured source noise level minus receiver noise level, not adjusted to reference conditions
$D_{nT,w}$	Weighted normalised sound level difference – a single, weighted sound insulation value, normalised to a reference reverberation time using the measured reverberation time in the receive room
$D_{nT,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
$D_{nf,w}$	Overall flanking normalised level difference - A parameter that defines the flanking transmission of sound from room to room where a dividing partition or floor construction abuts a flanking building element common to both rooms, such as the building façade or ceiling
$D_{n,e,w}$	Element normalised level difference. A level difference level derived transmission through the small technical element only, irrespective of area. This value is used to represent the sound insulation of façade ventilators.
$D_{n,e,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise

Sound reduction index, R

This describes the sound transmitted through a material or building element, such as a wall, door or window. It is measured in a laboratory with suppressed flanking transmission. The 'R' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. All values are described using the decibel.

R_w	Weighted single figure sound reduction index
$R_w + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
R'_w	The 'apparent sound reduction index', a field measurement to obtain the sound reduction index of a material or element, with all effects of site installation accepted.

Standardised impact sound pressure level, $L'_{nT,w}$

$L'_{nT,w}$ is the single figure used to characterise the impact sound pressure level in a receiving room, normalised to a reference reverberation time. Impact noise can be classified as (but is not limited to) the result of footfall impact on a separating floor to a habitable space below. All values are described using the decibel.

Reverberation time, T and T_{mf}

The reverberation time of a space is a measure of the rate at which sound decays, measured in seconds. It is defined as the time taken for the sound pressure level to reduce by 60 dB from its original impulse level.

Reverberation time is commonly quoted in terms of the mid-frequency reverberation time, T_{mf} , the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands.

Absorption Coefficient

The acoustic absorption provided by a surface is defined as the sound absorption coefficient α , which denotes the fraction of sound energy absorbed between 0 (no absorption) and 1 (no reflection). The absorption coefficient of a material varies with the frequency of incident sound waves, therefore is considered for different frequencies.

Absorption Class

Based on the absorption coefficients, the overall sound absorption of a material is classified from Class A to Class E as defined in BS EN ISO 11654:1997, with Class A providing the highest level of acoustic absorption.

Noise rating, NR

The noise rating or NR system is commonly used in the design of noise emitted by internal building services systems. The system is frequency dependent, and was empirically derived to prevent disturbance to occupants in habitable or working areas from building services noise that exhibits 'tonal' elements, e.g. rumbles, whines, whistles etc. There is no direct relationship between the average 'A' weighted noise level in dB and the NR. However, as a guide, and assuming the absence of strong low frequency content in a given noise, the NR could generally be said to be 6 dB less than the average 'A' weighted dB value.

Privacy

Privacy is the addition of the level of sound insulation between two rooms and the background noise within a receiving room. It can be used to assess the level of privacy afforded in the 'receiving room' for speech from the 'source room'. The 'privacy factor' is a unit-less value that is the combination of the average 'A' weighted background noise level in dB and the weighted sound level difference (D_w) in dB.

Appendix IV. SBE Acoustic Credentials

SBE have specialised in providing the UK Construction Industry with a range of acoustics services since 2006. Specialising in Building Acoustics, all SBE acousticians are members of the Institute of Acoustics.

SBE is accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) (Testing Laboratory Number 2731).

SBE meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been authorised by Ben Reed, Senior Acoustic Consultant) who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds a BEng(Hons) degree in Acoustics from the University of Salford
2. Has been an Acoustic Consultant for more than three year's (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
3. Holds Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed and has been found to;

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

Appendix V. Report Conditions

This document has been prepared for the sole use, benefit and information of the Client. The liability of Stroma Built Environment Ltd. in respect of the information contained herein will not extend to any third party unless prior agreement is obtained in writing from Stroma Built Environment Ltd.

This report is limited to addressing the specific acoustic issues contained herein. Advice has been provided for acoustic reasons only and it is recommended that appropriate expert advice be sought on all the ramifications, e.g. safety, fire, structural, CDM etc., associated with any proposals contained herein.

The in-situ performance of acoustic measures is influenced to a large extent by the quality of workmanship and compliance with the specifications on-site during construction, as such, Stroma Built Environment Ltd. accepts no liability for issues with acoustic performance arising from such factors.

Acoustic survey and testing work carried out for the project is representative of the prevailing conditions at the time of the work. Conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

In particular, it should be noted that where calculations are carried out that are based on assumptions regarding certain aspects where information has not been supplied, these are provided for indicative purposes only and should be treated as such.