Noise Impact Assessment

Site Address: Interiors UK Limited, Wellington Street, Oakes, Huddersfield, HD3 3EP

Client Name: Insight Interior Design

Project Reference No: NP-009613

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01	--

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Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise impact assessment for the installation of 5 No. condenser units ('the Proposed Development') at Interiors UK Limited, Wellington Street, Oakes, Huddersfield, HD3 3EP ('the Site').

The applicant is preparing a planning application ('the Application') to be submitted to Kirklees Council. This technical report has been prepared to support the planning application to be submitted to Kirklees Council.

A noise survey has been undertaken to establish the prevailing background sound levels at the closest Noise Sensitive Receptors ('NSRs'). The report details the existing background sound climate and the predicted noise emissions associated with the proposed development. Measures required to mitigate noise impact from the proposed development have been recommended where necessary and assessed in accordance with the relevant performance standards, legislation, policy and guidance.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.1 Standards, Legislation, Policy & Guidance

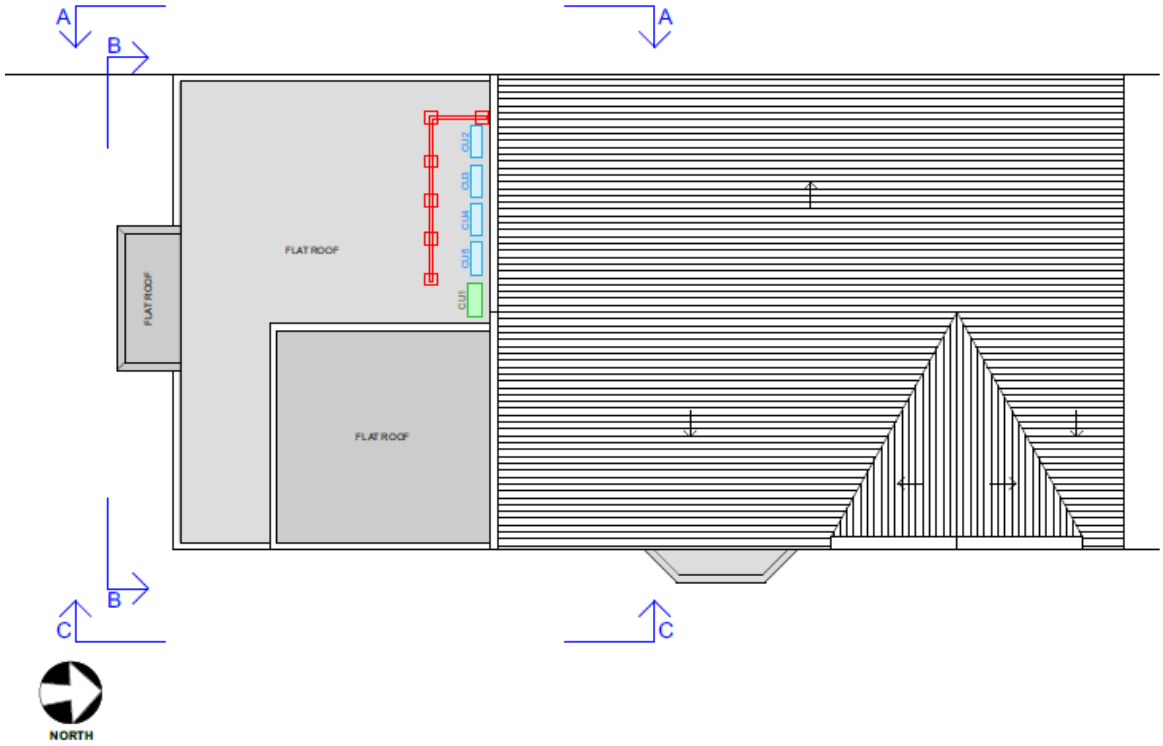
The following performance standards, legislation, policy and guidance have been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

Further information on the legislation can be found in Appendix B.

1.2 Proposal Brief

The proposal condenser units will be located on the flat roof section at the front of the site, partially enclosed by a 1.5m barrier. The client has informed NOVA Acoustics that the condenser units will only operate during the opening office hours at the site, 08:00 to 18:00. The figure below shows the proposed development.



Drawing Ref No. 2023-12-02 from 'Insight Interior Design'

Figure 1 – Proposed Development

2. Environmental Noise Survey

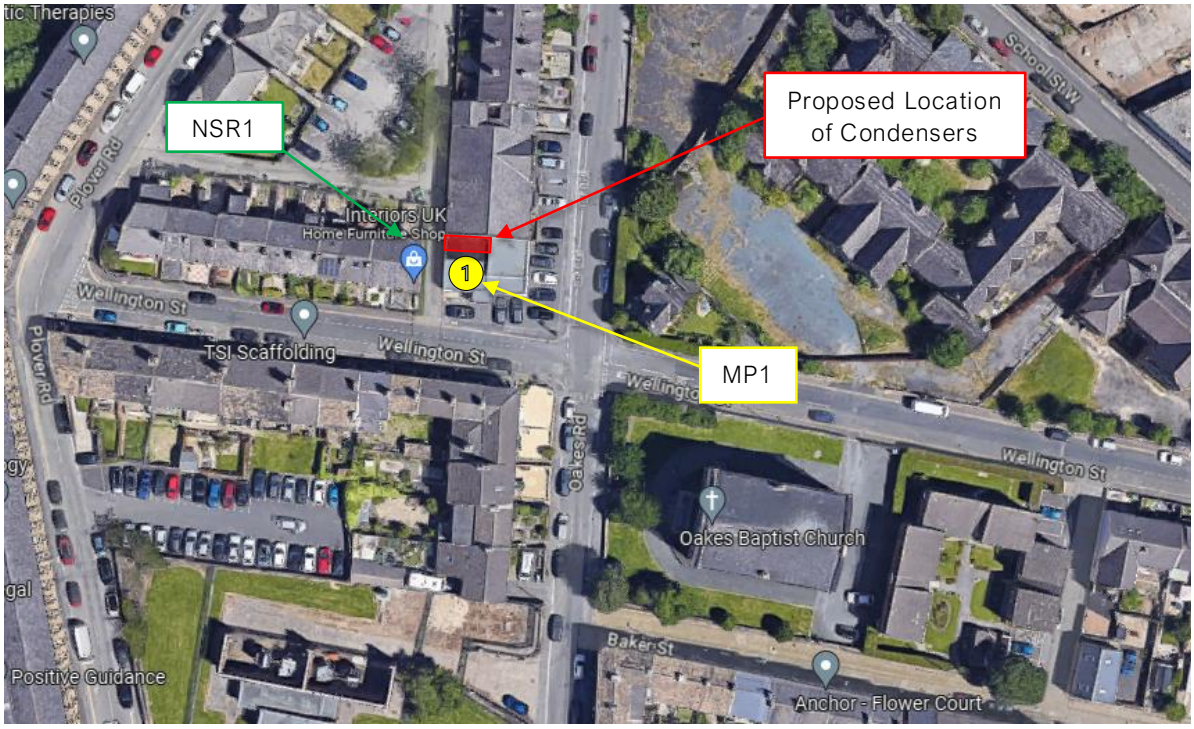
2.1 *Measurement Methodology*

The following table outlines the measurement dates and particulars.

Location	Survey Dates	Measurement Particulars
MP1	29/06/2023 – 30/06/2023	Equipment mounted on a tripod on the roof of Insight Interior Design.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



Imagery ©2023 Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2023

Figure 2 – Measurement Locations and Site Surroundings

2.2 *Context & Subjective Impression*

It is proposed to install the condenser units on the flat roof associated with the building.

The most affected NSR is considered to be the bedroom window associated with the nearest residential dwelling to the west. This is assumed to be located to the rear of the property and on the first-floor and will be least affected by the screening effects from the building envelope.

The acoustic environment is deemed to be low in level and the noise profile is dominated by road traffic noise emissions from New Hay Road to the south of the site.

2.3 Environmental Noise Survey Results

Background Sound Level Analysis

The following section outlines the measured background sound levels that have been used as the baseline for the subsequent BS4142 noise assessment. The figure below shows a histogram graph of the background sound levels measured during the proposed operational period of 08:00 – 18:00 hours throughout the entire measurement period. The time history results can be found in Appendix D.

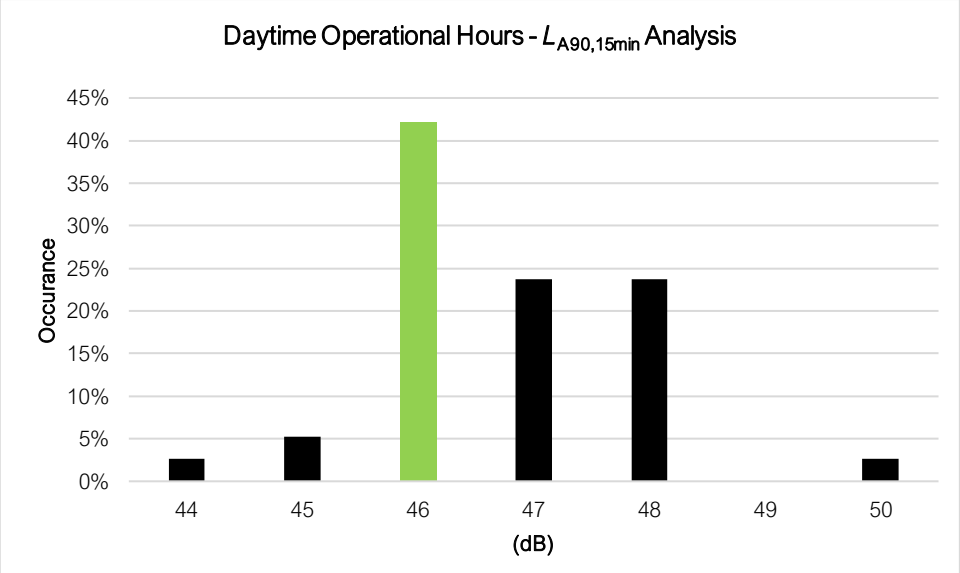


Figure 3 – MP1 Operational Hours Background Sound Level Analysis

As can be seen in the figure above, the modal $L_{A90,15min}$ value measured during the proposed operational hours is 46dB and is deemed to be the 'typical' background sound level and has therefore been used in the subsequent assessment.

3. BS4142 Noise Impact Assessment

In the following section of the report, the impact of the noise emissions generated by the proposed development is assessed.

3.1 Proposed External Fixed Plant

The following table shows the 1/1 octave frequency band sound power levels of the condenser units that will be used in the subsequent calculations. Manufacturers data sheets can be found in Appendix E.

Description	1/1 Octave Frequency Band (Hz, L_W dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Daikin ARXM71R (CU1)	64	70	66	63	60	55	49	49	65
Daikin AZAS100MV1 (CU2-4)	77	73	73	70	62	56	53	47	70

Table 2 – Sound Power Levels of Proposed Condenser Units

The distances from each item of plant and the nearest NSR are presented in the table below.

Plant Unit	Distance to NSR
CU1	14m
CU2	10m
CU3	11m
CU4	12m
CU5	13m

Table 3 – Distances to NSR

3.2 Specific Sound Level at NSR

The calculated specific sound levels at the NSR are presented in the table below. An example calculation is presented in Appendix E.

Plant Unit	1/1 Octave Frequency Band (Hz, L_p dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
CU1	31	37	33	29	25	18	9	7	31
CU2	46	40	38	33	22	13	8	2	34
CU3	46	41	39	34	24	15	9	1	35
CU4	45	40	40	35	25	17	11	2	36
CU5	45	41	40	36	27	18	13	4	36
Cumulative Noise Level	**52**	**47**	**46**	**41**	**32**	**24**	**17**	**11**	**42**

Table 4 – Specific Sound Level at NSR

3.3 BS4142 Noise Impact Assessment

The BS4142 noise impact assessment is presented in the table below.

Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Specific Sound Level at NSR	52	47	46	41	32	24	17	11	42
On-Time Correction	Continuous operation								0
Acoustic Feature Correction	Potential for audible hum at lower frequencies								+2
Rating Sound Level ($L_{Ar,T}$)									44
Background Sound Level (L_{A90})									46
Exceedance									-2
BS4142 Assessment Outcome	The assessment indicates low impact, dependent on context' in accordance with BS4142.								
NPPF & NPSE Outcome	The assessment indicates that the levels will be **below** the 'Lowest Observed Adverse Effect Level ('LOAEL') in accordance with the NPPF and NPSE.								
No further mitigation measures are required.									

Table 5 – BS4142 Noise Impact Assessment

4. Conclusion and Action Plan

The proposed development has been assessed against the requirements of BS4142 and a mitigation scheme has been provided to ensure the criteria can be achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed condenser units should be installed as per the supplied plans, including the 1.5m barrier around the plant area.
2. The makes and model of the condensers should not be altered. If alterations to the specification and location of the unit are required, then further assessment should be undertaken.

The findings of this report will require written approval from the Local Authority prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Background Sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for N% of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10\log_{10}(p/p_0)^{2.}$ Where: p is the root-mean-square sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 185 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life;
- Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

Overview

BS4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2dB is applicable for a tone which is "just perceptible", +4dB where a tone is "clearly perceptible", and +6dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3dB is applicable for impulsivity which is "just perceptible", +6dB where it is "clearly perceptible", and +9dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3dB can be applied."

d) Intermittency

BS4142 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142 states: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- "Typically, the greater this difference, the greater the magnitude of the impact."
- "A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."
- "A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."
- "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. 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."

Interpreting the guidance given in BS4142, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound 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. Where the rating sound level does not exceed the background sound level, this is an

indication of the specific sound source having a low impact and would therefore be classified as No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

Appendix C – Location Plans

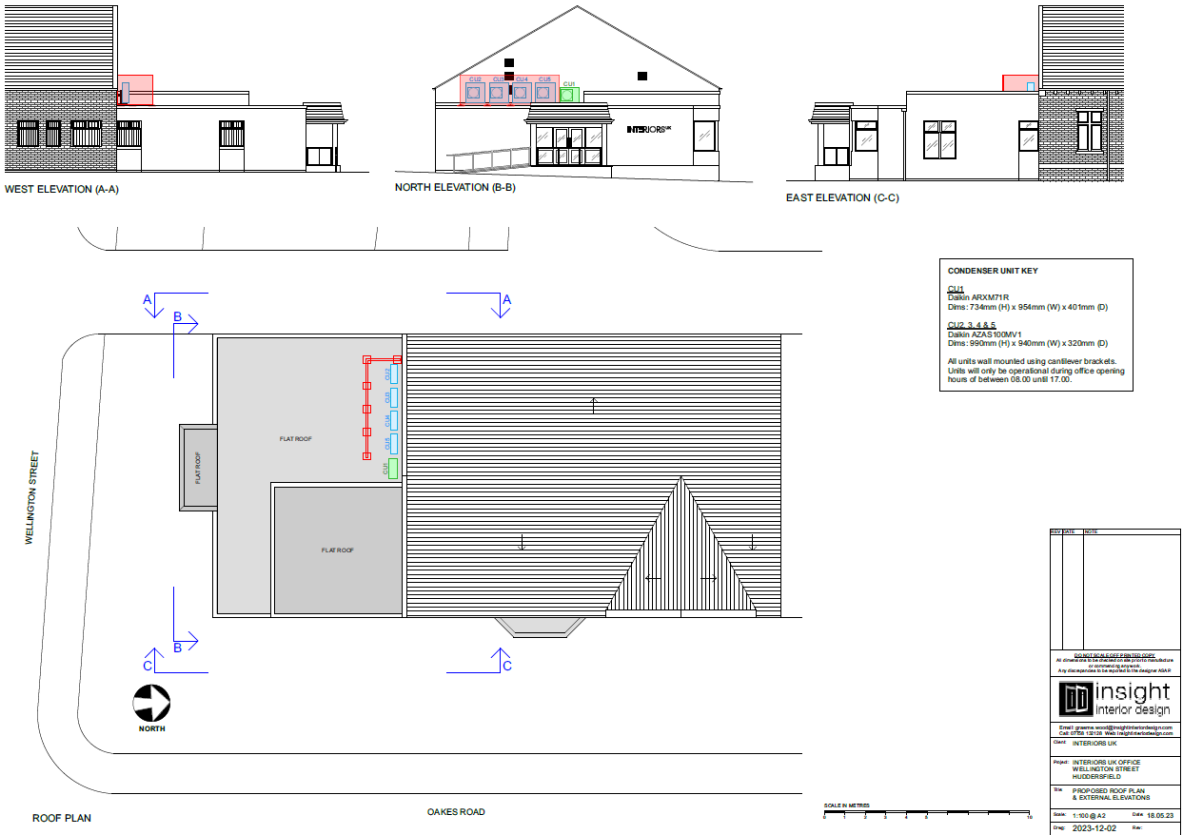


Figure 4 – Site Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

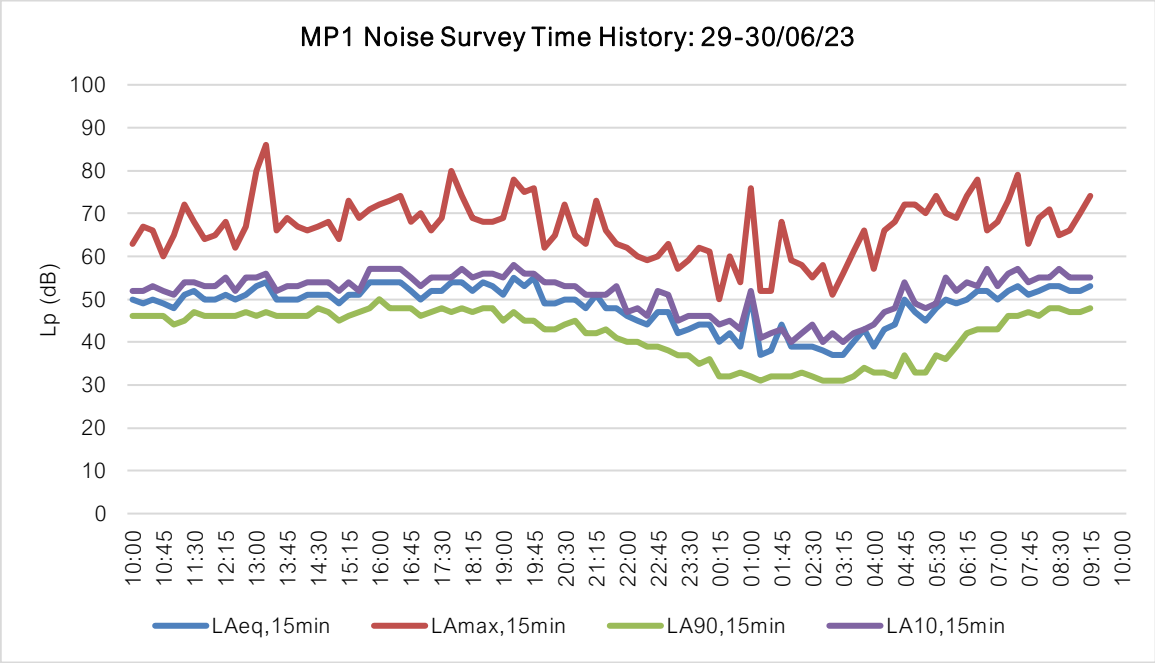


Figure 5 – MP1 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek 307 Class 1 Sound Level Meter	87871	≤0.1
Svantek SV36 Class 1 Calibrator	106876	

Table 6 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.1 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

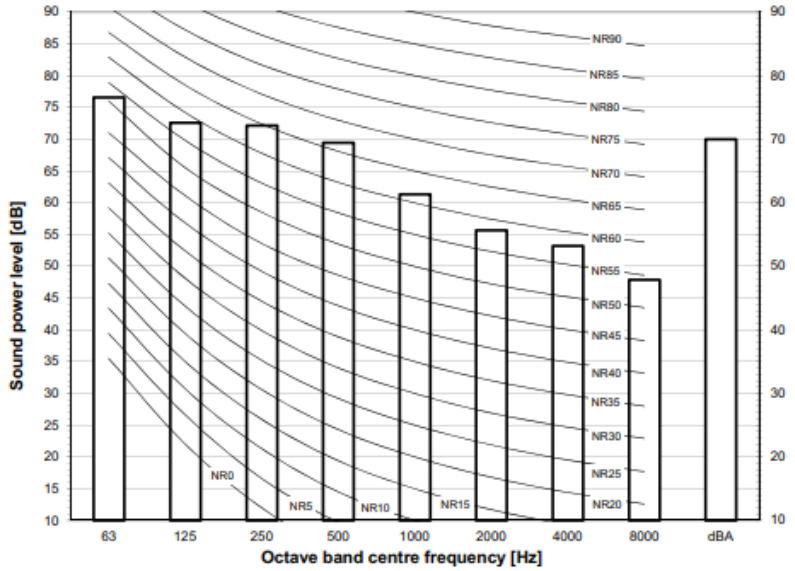
As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Reinwood (Approx. 0.4km S of Site)				
Time Period	Air Temp (ºC)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
29/06/23 – 00:00 – 23:59	11.7 – 18.3	0.0	NE	0.0 – 1.5
30/06/23 – 00:00 – 23:59	11.7 – 16.6	0.0 – 0.5	NNE	0.0 – 2.2

Table 7 – Weather Conditions

Appendix E – Manufacturers' Data Sheets & Example Calculations

AZAS100MV1
AZAS100MY1
RZASG100MV1
RZASG100MY1



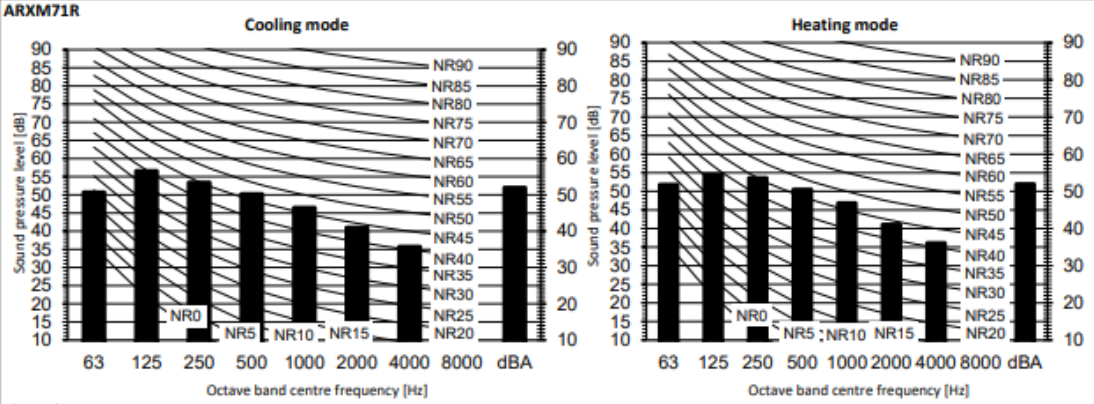
Notes
- dBA = A-weighted sound power level (A scale according to IEC).
- Reference acoustic intensity 0dB = 10E-6μW/m²
- Measured according to ISO 3744

3D110038

9 Sound data

9 - 1 Sound Pressure Spectrum

ARXM71R



Legend

dBA = A-weighted sound pressure level (A scale according to IEC).

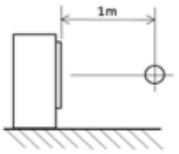
A Scale

B Fan speed: High

Cooling	Total dB
A	B
dBA	52

Heating	Total dB
A	B
dBA	52

Location of microphone



Notes

1. Operating conditions: power source 220-240 V/220 V 50/60 Hz; JIS standard
2. Background noise already taken into account.
3. Operating noise varies depending on operation and ambient conditions.
4. The operation noise measuring method is in accordance with JISC9612.
5. Measuring location: anechoic chamber

3D131756

The below table outlines an example calculation of condenser unit CU1 with the 1.5m barrier installed. The height of the unit is assumed to be 0.5m above the flat roof area and the NSR window is approximately 2m higher than the flat roof plant deck.

Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Sound Power Level (CU1)	64	70	66	63	60	55	49	49	65
Distance Attenuation (14m, Q=4)	-28								--
Shielding Correction	-5	-5	-5	-6	-7	-9	-12	-14	--
Specific Sound Level at NSR	**31**	**37**	**33**	**29**	**25**	**18**	**9**	**7**	**31**

Table 8 – Example Plant Noise Calculation – CU1


NOVA
ACOUSTICS