

Eastleigh Railway Depot: Units 200, 205 and 210

Fixed Plant Noise Assessment – Discharge of Condition 27

Report 2061902-RSK-RP-002-(01)

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Fixed Plant Noise Assessment – Discharge of Condition 27

1 Introduction

1.1 Overview

RSK Acoustics Ltd (RSKA) has been instructed by Systems adf Group Limited, to prepare a noise impact assessment to discharge planning Condition 27 relating to the installation of fixed plant associated with Units 200, 205 and 210 within the Eastleigh Rail Works site, Campbell Road, Eastleigh (SO50 5AD). The requirement is associated with the granted planning permission (Application No. F/20/87841).

Condition 27 states:

“No fixed plant or machinery shall be installed or operated outside of any building unless first approved in writing by the local planning authority. Details of any proposed plant or equipment submitted so as to obtain approval shall include evidence that the impact of noise from such plant or machinery will be satisfactory and the development shall accord with the approved details.”

A noise report with ref. 297519-06(04) was submitted in 2020 to support the planning application detailing the prevailing baseline conditions at the site, assessing the impacts from the proposals on existing sensitive receptors and detailing the positioning of an acoustic barrier along the southern boundary of the site.

1.2 Aims

This aim of the noise assessment is to:

- Predict the noise contribution from proposed fixed plant associated with units 200, 205 and 210 at nearest sensitive receptors;
- Assess predicted noise levels against the relevant standards and approved noise impact thresholds; and
- Specify noise mitigation measures where necessary.

2 Legislation and Guidance

2.1 Noise Policy Statement for England (NPSE): 2010

The Noise Policy Statement for England is published by the Department for Environment, Food and Rural Affairs (Defra) and sets out the approach to noise within the Government's sustainable development strategy.

The significance of impacts from noise within the NPSE are defined as follows:



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There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The three aims of the NPSE are stated as:

“Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.”

“Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.”

“Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.”

2.2 **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 noise of an industrial or commercial nature applicable for the purpose of assessing sound at existing dwellings, through the determination of a rating level of an industrial or commercial noise source. The standard includes the following:

- Sound for industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;



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- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from the premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

Where certain acoustic features are present 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 noise level and the noise rating (including any penalties) is then calculated.

- 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.

As indicated above, 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. BS4142 states that *'An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context'*.

Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into account, including:

- The absolute level;
- The character and level of the residual sound; and
- The sensitivity of the receptor and whether dwellings will already (or likely) to incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as: i) façade insulation treatments, ii) ventilation and/or cooling, and iii) acoustic screening.



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3 Activity Details

3.1 Site Location

Units 200, 205 and 210 are situated within the northern portion of the Eastleigh Railway Depot industrial area. A site location map is presented in **Figure 1** below.

The site is bounded to the north and east by rail tracks used for train maintenance purposes within the wider site and adjacent to the South West Main Line; to the west and south-west, by Campbell Road (adjoining the north portion of the site) and by the rear of residential dwellings situated on Campbell Road (1 – 169).

A large, grassed area extends beyond the east boundary of the site with further open land to the south of Campbell Road properties, which denotes the beginning of Southampton Airport.

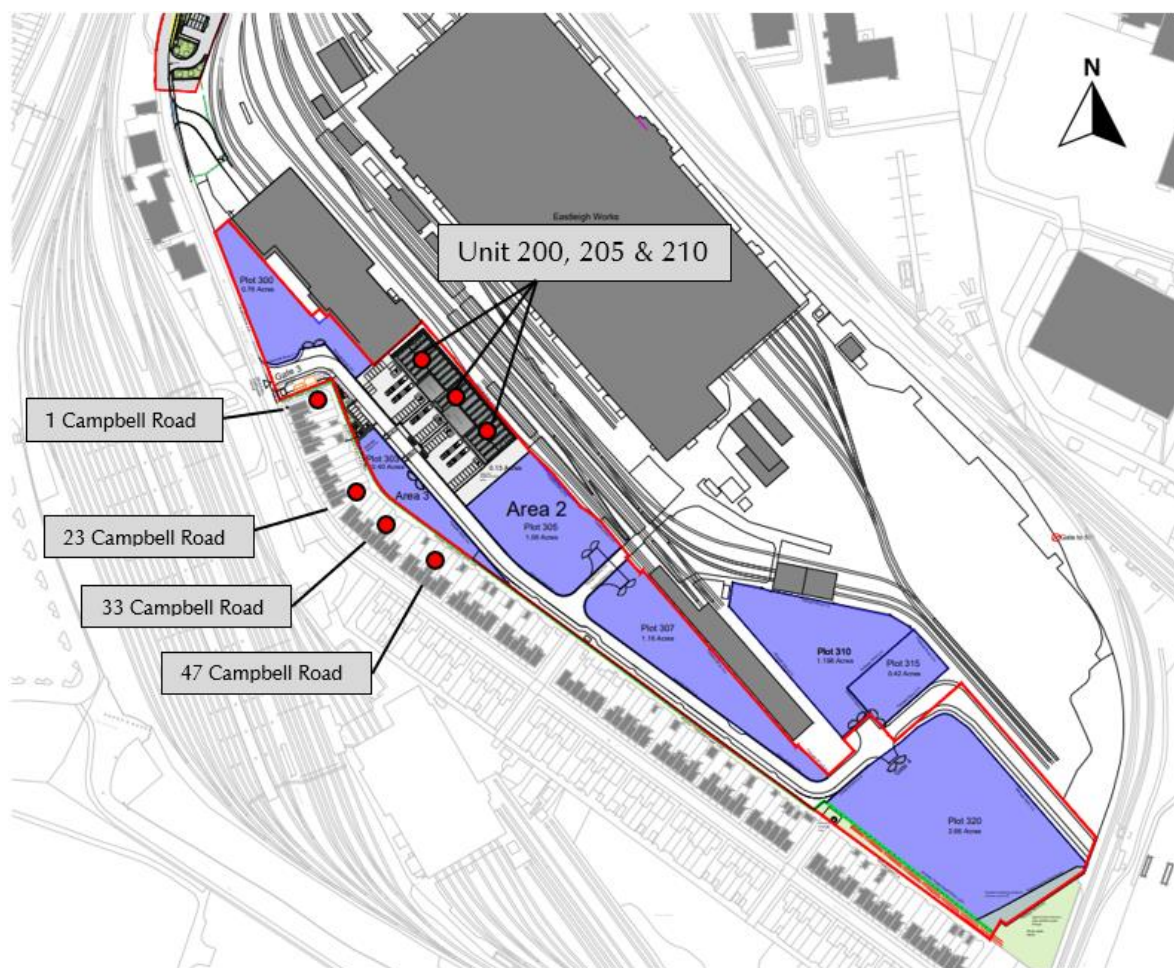


Figure 3.1 Site location plan



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3.2 Sensitive Receptors

The nearest existing residential sensitive receptors to units 200, 205 and 210 are situated along Campbell Road. For assessment purposes, the following residential receptors are considered representative of those nearest dwellings facing the units:

Dwelling	Distance to Unit's façade (metres)
1 Campbell Road	63
23 Campbell Road	79
33 Campbell Road	77
47 Campbell Road	72

Table 3.1 Receptor locations

The closest existing sensitive receptors to the development are situated along Campbell Road, with back gardens associated with these properties facing the site. Closest habitable rooms at ground floor level are positioned between 63 - 79 metres from the unit's boundary, with first floor rooms slightly retracted 5 metres distance.

3.3 Proposed Fixed Plant

A total of two air condenser units FUJITSU Model AOYG36KBTA5 are proposed to be installed to the rear (north-east façade) of the units, as illustrated in **Figure 3.2** below.

The outdoor units have a nominal cooling capacity of 9.5 kW and a nominal heating capacity of 10.6 kW. The declared sound power levels are 67 dB for the cooling mode and 68 dB for the heating mode.

A summary of the technical specifications is presented in **Appendix 2**.



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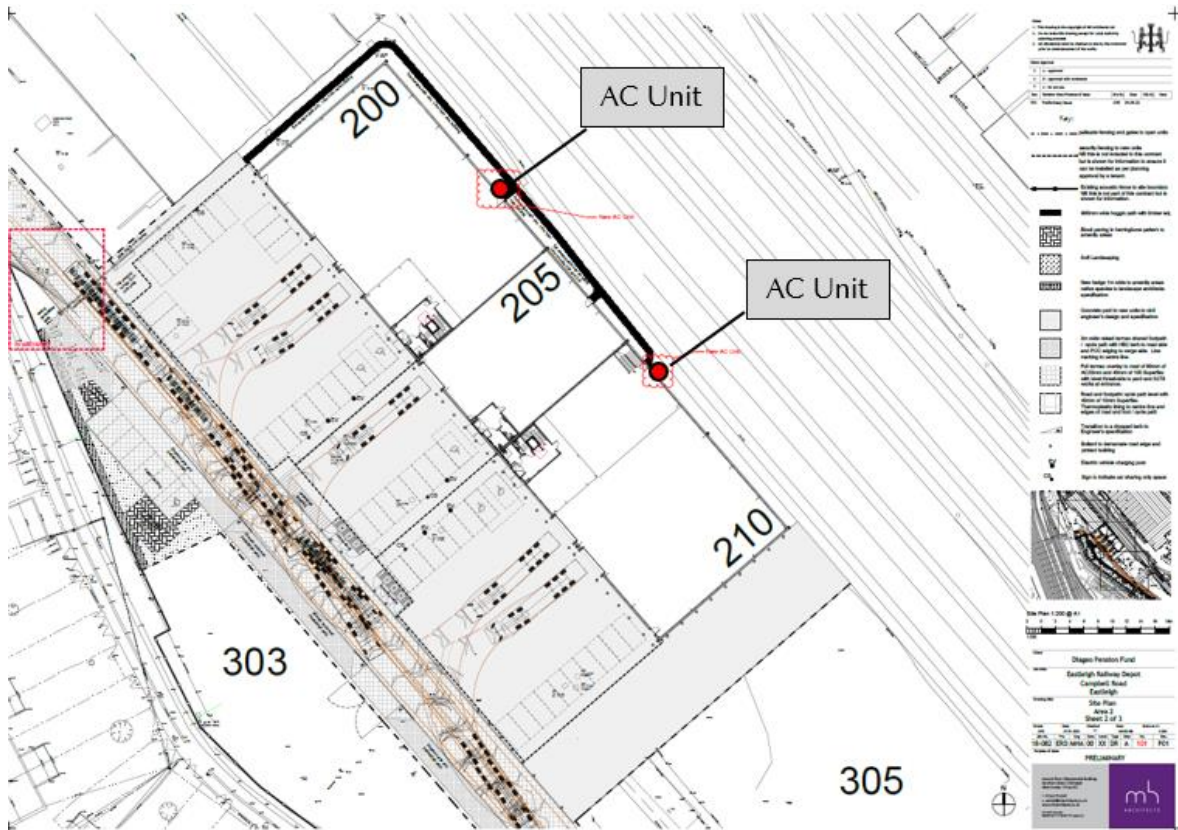


Figure 3.2 Air condenser units associated with Units 200, 205 and 210

3.4 Working Hours

Industrial units 200, 205 and 210 are permitted to operate daytime and night-time hours.



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4 Derivation of Noise Criteria

4.1 Adopted background noise levels

Background noise levels, representative of closest noise sensitive receptors to the development, were obtained by RSK as part of a baseline noise survey undertaken in April 2019. Full details of measured noise levels can be found in the RSK report with ref. 297519-RSK-RP-06(04), Section 5.

Analysis of the baseline data has informed appropriate receptor criteria considering the context of the most repeated hourly (statistical mode) noise level ($L_{A90,1hr}$) for the daytime period (07:00 – 20:00 excluding Sunday) and 15-minute samples ($L_{A90,15min}$) for the night-time period (23:00-07:00). Such an approach is in line with the requirements of BS 4142, and is considered to suitably provide a representative value for the background noise in the local environment.

A summary of the representative daytime and night-time background levels at the assessment receptors is provided in **Table 4.1**.

Receptor	Representative Daytime Noise Level, $L_{A90, 1hr}$	Representative Night-time Noise Level, $L_{A90, 15min}$
1 Campbell Road	48	40
23 Campbell Road	48	40
33 Campbell Road	48	40
47 Campbell Road	48	40

Table 4.1 Representative background levels at receptor locations



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5 Noise Prediction Model

5.1 Overview

A computer noise model has been produced using SoundPLAN v8.1 based on the most up to date site layout (see **Appendix 1**) with consideration of the positioning of the two air conditioning units to the north-east façade of units 200, 205 and 210 of the building.

Input data in the form of single band sound power level levels was used to characterise plant noise emissions. The highest declared sound power level of 68 dB (heating mode) has been assigned to the sources.

The noise predictions are based on International Standard ISO 9613-2:1996 '*Attenuation of sound during propagation outdoors – general method of calculation*'. ISO 9613 provides a method for the prediction of noise levels in the community from sources of known sound emission.

The noise prediction method described in ISO 9613 is suitable for a wide range of engineering applications where the noise level outdoors is of interest. The noise source(s) may be moving or stationary and the method considers the following major mechanisms of noise attenuation:

- Geometrical divergence (also known as distance loss or geometric damping);
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles, barriers and buildings.

The model was set up using the following parameters:



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Item	Setting
Algorithm	Source noise - ISO 9613-2:1996 'Attenuation of sound during propagation outdoors – general method of calculation'.
Ground Absorption	Acoustically hard (assumed 0.2 coefficient) – built-up areas.
Meteorological Conditions	10 degrees Celsius. 70% humidity.
Source Modelling	AC units modelled as point sources at 2 metres height from ground level and 30-50 cm at the rear of the building.
Barrier	Approved acoustic boundary fence introduced to the model
Terrain	LiDAR DTM with 1 metre resolution has been imported into the model.
Site Layout	Digitised based latest site layout 'Site Plan Area 2 Sheet 2 of 3' drawing 18-082 rev. P01 dated 25 May 2022 and issued by Mh Architects.

Table 5.1 Modelling parameters

A 3D representation of the noise model is presented in **Figure 5.1** below:



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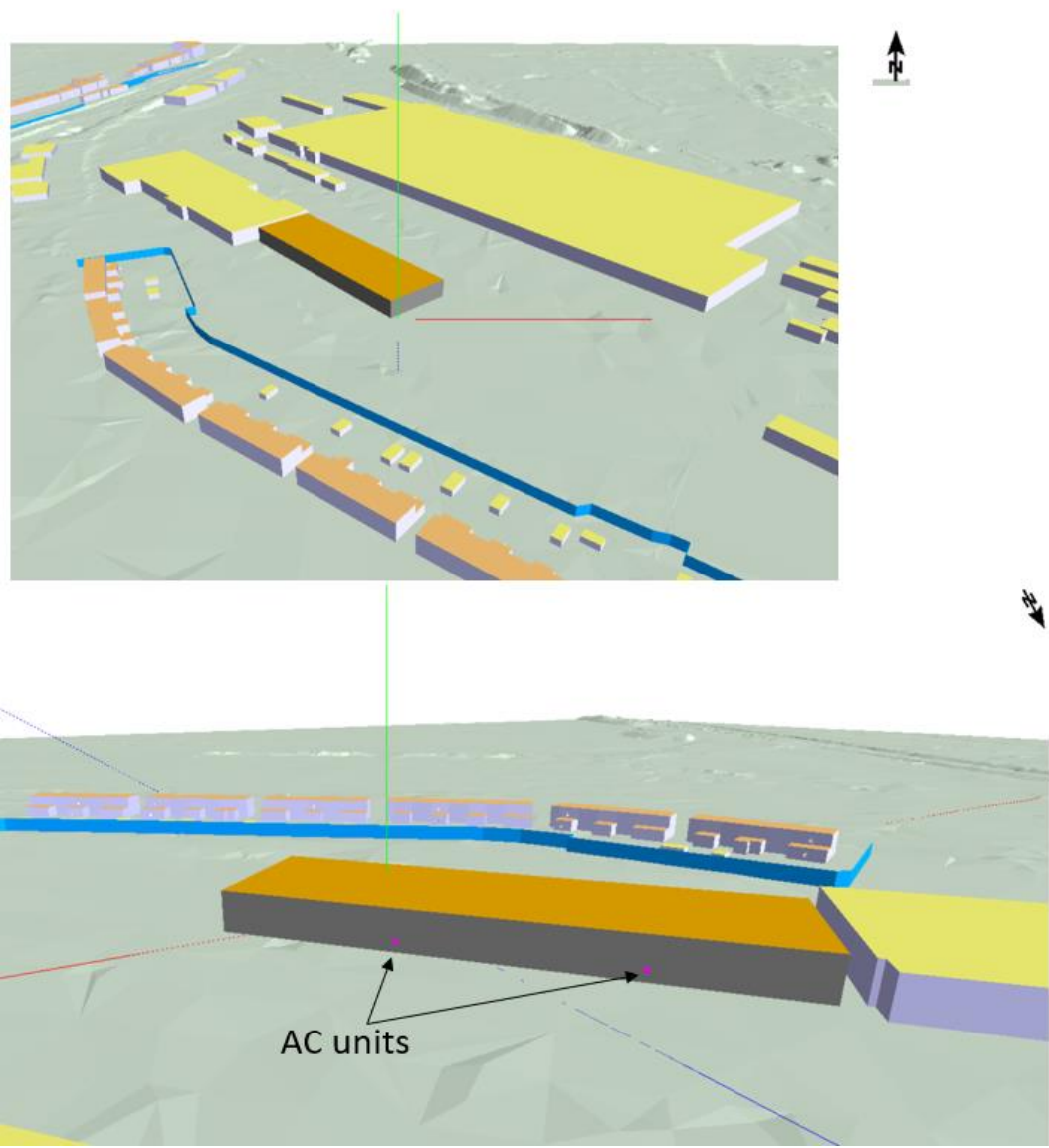


Figure 5.1 Noise model 3D screenshot



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6 Operational Noise Impact

6.1 Specific Noise

Predicted specific noise levels (excluding rating penalties) from the operation of both external outdoor AC units are provided in **Table 6.1**.

Levels are referenced to the evaluation at first floor height of 4 metres and at 1 metre distance from the most exposed façade.

Receptor	Fixed Plant Noise Level, dB, $L_{Aeq,T}$
1 Campbell Road	< 10 dB
23 Campbell Road	< 10 dB
33 Campbell Road	< 10 dB
47 Campbell Road	< 10 dB

Table 6.1 Specific AC unit noise levels at receptor locations

Given the declared emission levels for the AC units, their distance to those nearest sensitive receptors and the screening provided by the warehouse building, predicted noise levels are comfortably lower than 10 dB at most exposed sensitive façades.

Noise contours illustrating the predicted external noise levels as a result of the operation of the proposed external fixed plant is presented in **Appendix 3**.

6.2 Acoustic Correction

According to BS 4142:2014+A1: 2019, where certain features of the specific noise level can increase the significance of impact of a sound level, a character correction is applied to provide a rated noise level. The characteristics of a sound that are likely to cause an increase in the significance of impact are tonality, impulsivity, intermittency or other characteristic features such as an identifiable 'hiss'.

BS 4142 discusses the addition of rating penalties (to the specific noise) as a factor of 'perceptibility', where the prominence of tonal or impulsive sound from a source can be readily distinguishable over the residual sound. For this assessment, the addition of rating penalties has considered the numerical comparison of the specific noise against the background noise level at each receptor derived from the results presented in **Table 4.1 and 6.1** above.

Given the very low predicted levels at receptor from external fixed plant no acoustic corrections are deemed applicable.



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6.3 Operational Assessment

The rated noise level (inclusive of penalty corrections) has been predicted from the simultaneous operation of the two external AC units. This scenario provides a conservative interpretation of the resulting noise levels at receptor.

Receptor	Rated Noise Level, dB L _{Ar}	Representative Background Noise Level, dB L _{A90, 15min}	Excess of Rating Level over Background, dB
1 Campbell Road	<10	40	<-30
23 Campbell Road	<10	40	<-30
33 Campbell Road	<10	40	<-30
47 Campbell Road	<10	40	<-30

Table 6.2 Night-time fixed plant operational noise assessment

Given the negligible contribution from the proposed external fixed plant, cumulative levels from the site would remain within the consented site noise levels, specifically within the 40 dB criterion determined for the night period at closest residential dwellings on Campbell Road because of the noise breakout of units 200, 205 and 210 from internal activities.



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7 Conclusions

A noise impact assessment has been undertaken based on the proposed installation of two air condenser units to the rear of Units 200, 205 and 210 within the Eastleigh Rail Works site, Campbell Road, Eastleigh (SO50 5AD). The assessment focuses on the operational impact of the proposals to the requirements of BS 4142: 2014+A1: 2019 to discharge Planning Condition 27 in the context of the consented noise levels for the site by Eastleigh Borough Council set out in the granted planning permission issued on 22 June 2021.

A computer noise model has been developed which incorporates two air condenser units externally attached to the rear of units 200, 205 and 210. Predictions have been contextualised for the cumulative operation of all plant items during a worse-case night-time assessment period.

Due to the nature of the proposed fixed plant and considering the significant attenuation effects on calculated sound propagation due to distance and screening factors, predicted noise levels at receptor are negligible (i.e. lower than 10 dB(A)). As such, cumulative noise levels from site operations will remain as per those included within the noise assessment report with ref. 297519-RSK-RP-06(04) submitted in 2020 to support the planning application for the site.

Predicted rated noise levels during night-time operations of the two AC units attached to units 200, 205 and 210 would remain comfortably below the representative background sound level at nearby sensitive receptors. In accordance with BS 4142 and the contextual considerations of the site such as its locality, the existing baseline conditions and the magnitude of absolute noise levels predicted at receptor, this is a positive indication that noise from the proposed development would have a low impact.

In summary, the assessment concludes that the installation of the proposed air condenser units is considered feasible for the intended use and that no mitigation would be required to comply with approved site noise levels. It is therefore recommended that Planning Condition 27 be suitably discharged.

 End of Section



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Appendix 2: Air Condenser Specifications



Outdoor Unit:

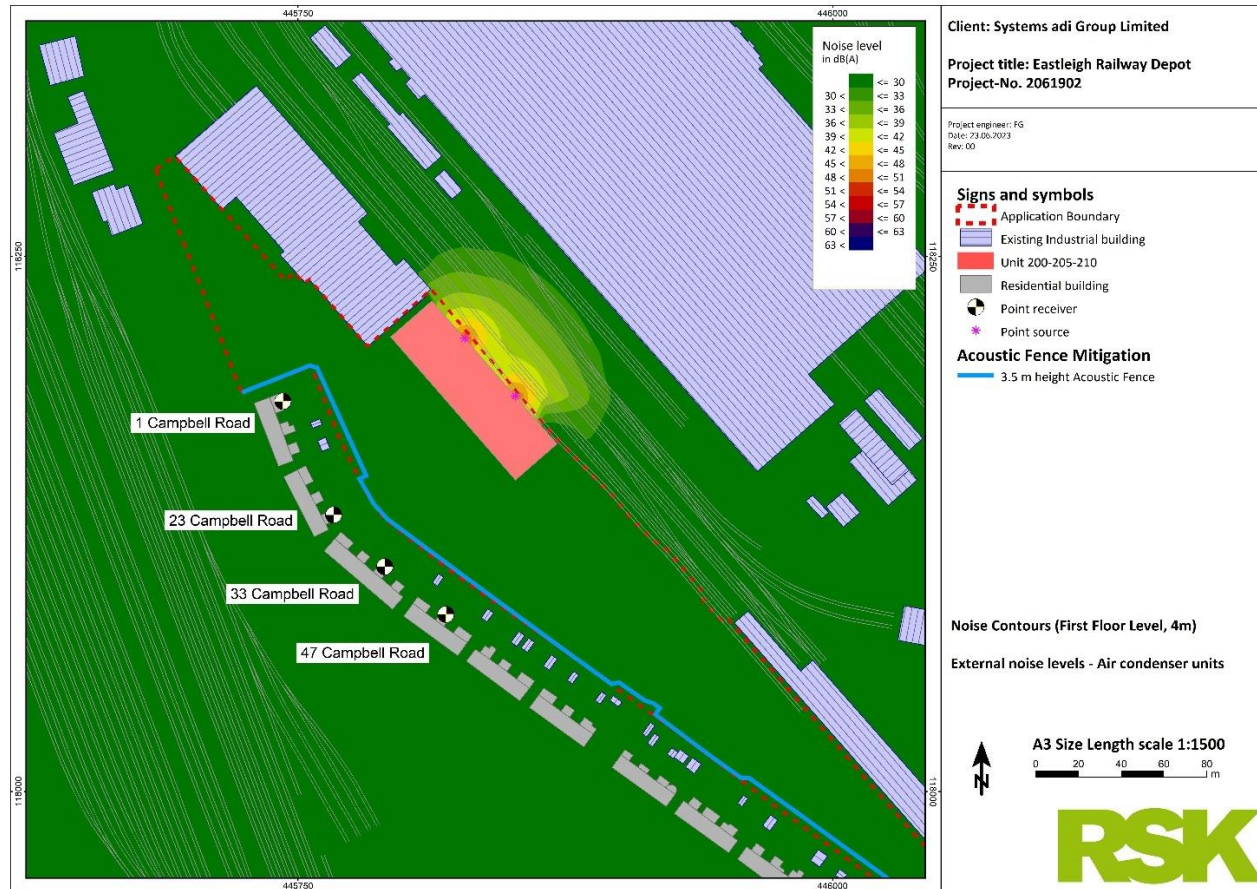
AOYG36KBT5

Power source	Phase	Single-phase
	Voltage	~ 230 V
	Frequency	50 Hz
Capacity	Cooling	9.5 (3.0-11.0)
	Heating	10.6 (3.5-12.0)
EER	Cooling	3.80
COP	Heating	4.5
Sound Pressure Level (High)	Cooling	53 dB(A)
	Heating	55 dB(A)
Sound Power Level (High)	Cooling	67 dB(A)
	Heating	68 dB(A)
Net Dimensions	Height	844 mm
	Width	820 mm
	Depth	315 mm
Net Weight		59 kg
Connection Pipe Diameter	Liquid	6.35×5 mm
	Gas	9.52 × 3, 12.7 × 2 mm
Max Pipe Length	Total	80 m
	Each	25 m
Max Height Difference	Between Outdoor Unit and Each Indoor Units.	15 m
	Between Indoor Units.	10 m
Operation Range	Cooling	-10 to 46 °CDB
	Heating	-15 to 24 °CDB
Refrigerant	Type	R32
	Global Warming Potential	675



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Appendix 3: External Fixed Plant Noise Contours (4m height)





Appendix 4: Glossary of Acoustic Terms

Frequency Weighting Networks:

Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e. unweighted) and other more specialised weighting networks. Variables such as L_p and L_{eq} that can be measured using such weightings are expressed as L_{pA} / L_{pC} , L_{Aeq} / L_{Ceq} etc.

L_p – Sound Pressure Level

The basic unit of sound measurement is the sound pressure level, which is measured on a logarithmic scale and expressed in decibels (dB). The logarithmic scale makes it easier to manage the large range of audible sound pressures, and also more closely represents the way the human ear responds to differences in sound pressure:

$$L_p = 20 \log_{10} (p/p_0)$$

where p = RMS (root mean square) sound pressure; and
 p_0 = reference sound pressure 2×10^{-5} Pa.

L_{Aeq} – A-weighted Equivalent Continuous Sound Pressure Level

Sound levels tend to fluctuate, and as such an ‘instantaneous’ measurement like sound pressure level cannot fully describe many real-world situations. A summation can be made of the measured sound energy over a certain period, and a notional steady level can be calculated which would contain the same total energy as the fluctuating sound. This notional level is termed the equivalent continuous sound level L_{eq} . L_{eq} can be determined over any time period, which is indicated as $L_{eq,T}$ where T is the time period (e.g. $L_{eq,24h}$).

In mathematical terms, for n discrete sound level measurements, L_{eq} is given by:

$$L_{eq,T} = 10 \log_{10} (t_1 \times 10^{L_1/10} + t_2 \times 10^{L_2/10} + \dots t_n \times 10^{L_n/10})/T$$

where t_1 = time at level L_1 dB;
 t_2 = time at level L_2 dB;
and T = total time.



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$L_{\max}$ – Maximum Sound Pressure Level

This is the maximum RMS sound pressure level occurring within a specified period. The time weighting is usually specified, such as in $L_{F\max}$.

L_N – Percentile or Statistical Levels

Sometimes it is useful to calculate the level which is exceeded for a certain percent of a total period. Background noise is often defined as the A-weighted sound pressure level exceeded for 90% of the specified period T, expressed $L_{A90,T}$.

L_{A,T_r} – Rating Level

Specific sound level plus any adjustment for the characteristic features of the sound.

$L_s = L_{Aeq,T_r}$ – Specific Sound Level

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r

Time Weighting

Sound level meters use various averaging times for the measurement of RMS sound pressure level. The most-commonly used are fast (F - 0.125s averaging time), slow (S - 1s averaging time) and impulse (I - 0.035s averaging time). Variables that are measures with time weightings are expressed as $L_{AF\max}$ etc.

■ End of Section

