ACOUSTIC DESIGN TECHNOLOGY
Noise and Vibration Consultants

ADT 3583

31 October 2023

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DEARNE RENAISSANCE CENTRE, BOULTON ON DEARNE

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

ACOUSTIC CONSULTANCY REPORT ADT 3583/ENIA

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1.0 SUMMARY

The proposal is to install 2 new air source heat pumps at the Dearne Renaissance Centre in Priory Road, Bolton upon Dearne.

The application site is surrounded by residential dwellings, so the noise emissions from the new units have the potential to impact on the occupants of these dwellings.

Acoustic Design Technology have undertaken a noise impact assessment of the proposals, details of which are presented in this report.

With the provision of an enclosure at least 250mm higher than the new units, the predicted noise levels are no more than 5 dB(A) above the representative background noise levels at the quietest time of the night.

The conclusion of this assessment is therefore that the noise impact of the proposed installation should be acceptable.

2.0 BASIS OF ASSESSMENT

2.1 Site Description

The application site is the Dearne Renaissance Centre, located in Priory Road, Bolton upon Dearne.

It is situated in a predominantly residential area, approximately 350 metres to the north-west of the railway station, and is in close proximity to houses on all sides.

2.2 Proposed Development

The proposal is to install two air source heat pumps (ASHP) at the location indicated on the attached site plan 3583/SP1.

2.3 Assessment Criteria

The development proposals have been discussed with Adam Catell in the Environmental Health Department. It was agreed that provided the 'rating' level, as defined in BS 4142:2014 does not exceed the typical background noise level by more than 5 dB outside the nearby residential properties, the noise impact should be acceptable.

2.4 Nearest Noise Sensitive Properties

The noise sensitive properties in the surrounding area have been grouped into two noise sensitive areas as described below and as indicated on the attached site plan 3583/SP1.

NSA	Location	Direction	approximate distance from ASHPs
1	houses Priory Road	west, north-west, south-west	25m
2	houses in Edna Street	east, north-east, north-west	25m

The above noise sensitive areas represent the closest noise sensitive properties, with others located further from the site and in some cases screened by the intervening buildings. A satisfactory noise impact at the defined noise sensitive areas should therefore ensure a satisfactory noise impact at other noise sensitive areas.

2.5 Strategy for Noise Impact Assessment

Based on the information in Sections 2.1 to 2.5 above, the strategy for the noise impact assessment has been broken down into the following stages:

i. undertake an environmental noise survey to obtain baseline noise data, as described in Section 3.0 below

ii. construct a 3D computer model of the site and surrounding houses in order to predict the noise egress to the nearby properties

iii. assess the impact of noise emissions of the proposed ASHPs on the neighbouring residential dwellings as described in Section 4.0 below

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Purpose

The purpose of the survey was to determine the existing ambient noise levels at locations representative of the surrounding noise sensitive areas, at the quietest time at which the proposed ASHPs would operate.

3.2 Scope of Survey

A fully attended environmental noise survey was undertaken between 02:00 and 05:00 hours on Friday 22 September 2023.

3.3 Instrumentation

The instrumentation used, and the field calibration values before and after the survey are detailed in Appendix A of this report.

3.4 Procedure

Two measurement positions were selected as indicated by numbers 1 and 2 on the attached site plan 3583/SP1.

Position 1 was chosen to be representative of the houses grouped as NSA 1, and position 2 to be representative of the houses grouped as NSA 2.

At each position, the noise levels were logged continuously using a Svan 958 four channel analyser set to store the octave band and A-weighted 100ms short-term L_{eq} levels for subsequent post processing.

3.5 Results

The logged data has been post processed to determine $L_{Aeq,T}$ $L_{A90,T}$ and L_{Amax} levels for each 1 minute period, and these have been plotted on the attached time history graphs 3583/TH1 and TH2 for positions 1 and 2 respectively.

Additionally, the 15 minute levels background (L_{A90}) levels have been calculated and are presented in the attached table 3583/T1.

Please refer to Appendix B for explanation of the noise units and the A-weighting term used in this report.

3.6 Weather Conditions

For the duration of the survey, the weather conditions were calm and dry, and were not judged to have adversely affected the measurements.

3.7 Description of Existing Acoustic Environment

In the absence of any plant noise or significant activity in the vicinity of the site, the noise levels throughout the survey were primarily controlled by distant environmental noise sources, and in particular, road traffic.

4.0 NOISE IMPACT ASSESSMENT

4.1 Basis of Assessment

The following assessment of the impact of noise from the proposed ASHPs has been undertaken in accordance with the methodology of BS 4142:2014+A2019.

The Standard provides a methodology for assessing the likely impact of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The assessment involves comparing the rating level of the sound source with the typical background levels for the period of interest. The Standard concludes that if the rating level does not exceed the background levels, the noise impact should be low, depending on the context.

Please refer to Appendix C for an explanation of the technical terms defined in the Standard.

4.2 Proposed Installation

The proposal is to install 2 no. Mitsubishi CAHV-R450YA-HPB air source heat pumps at the location indicated on the attached site plan 3583/SP1. The manufacturer's published noise data for the unit is provided in Appendix D. The unit has two possible operating modes; for this project they would run in COP Priority mode, so the applicable noise level is 63 dB(A) at 1 metre.

To provide some visual and acoustic screening to the surrounding properties, they would be installed within an enclosure, the top of which would be at least 250mm above the top of the ASHPs. The construction of the enclosure is yet to be determined, but from an acoustic point of view, either solid panels or acoustic louvres would be equally satisfactory.

4.3 Specific Sound Level

4.3.1 Computer Model

A computer model of the proposed installation has been constructed using Datakustik Cadna/A 2023 to predict how the sound would radiate from the proposed ASHPs to the surrounding area.

Within the model all buildings and barriers have been assumed to be acoustically reflective, with ground absorption taken into account as appropriate. The receiver height has been assumed to be 4 metres - the approximate height of the closest first floor windows.

4.3.2 Source Sound Levels

The source sound levels, taken from the graph provided in Appendix D, are as follows:-

	Octave Band Centre Frequency (Hz)								'A'
	63	125	250	500	1k	2k	4k	8k	
ASHP	64	66	67	60	54	52	52	47	63

4.3.3 Predicted Sound Levels

The levels tabulated above have been input into the Cadna/A computer model, and the attached noise map 3583/NM1 shows the predicted, resultant noise levels at the various residential properties in the vicinity.

The highest predicted level for each NSA is 35 dB(A), and the octave band levels are presented below:-

	Octave Band Centre Frequency (Hz)								'A'
	63	125	250	500	1k	2k	4k	8k	
NSA 1 and 2	37	40	41	33	24	19	18	11	35

4.4 Background Sound Level

In addition to the 15 minute background (L_{A90}) levels, Table 3583/T1 also presents the modal value for each set of measurements. These have been derived by a statistical analysis of the 15 minute levels, as suggested in Section 8.1.4 of BS 4142:2014 to determine representative background noise levels for the quietest part of the night-time period.

The calculated modal values have been used as the representative background levels for the nighttime period in the following assessment.

4.5 Rating Level

To convert the specific sound level into a rating level, corrections have to be applied for impulsivity, intermittency, tonality and other sound characteristics where such features are present.

4.5.1 Tonality

Using commonly accepted definitions of tonality, the predicted specific sound levels are not tonal except at NSA2, although as the specific sound level is at least 11 dB below the background level, any tonality would not be perceptible at the assessment location. Therefore, a tonal correction is not required.

4.5.2 Impulsivity

The noise emissions from the proposed units should not be impulsive in character, so no correction is required.

4.5.3 Intermittency

Both the fans and the compressors in the proposed heat pumps are inverter controlled, which means that they should respond to changes in demand by ramping up and down, rather than switching on and off. Consequently, no correction is required.

4.5.4 Other Sound Characteristics

There are no additional sound characteristics which would warrant the addition of an extra correction.

It is therefore not considered necessary to apply any corrections to the specific sound to obtain the rating level.

4.6 Initial Assessment of Impact

The initial assessment of impact for the nighttime period is presented in the table below:

Initial assessment of impact – night time period	NSA 1
specific sound level $L_{Aeq,\ 1\ hour}$ (dB)	35
character correction (dB)	0
predicted rating level $L_{Ar,1\ hour}$ (dB)	35
representative background level (dB)	30
excess of rating level over noise limit (dB)	+5

According to the Standard, *"… a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context"*.

4.7 Context

4.7.1 The Absolute Level of Sound

The specific sound levels and the background levels are low. Indeed, it is worthy of note that in the previous edition of BS 1412, it said that *"… the method is not suitable … when the background and rating levels are both very low. Note: For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low".*

This would therefore suggest that the very low predicted and background levels in this instance would serve to reduce the initial estimate of impact.

4.7.2 The Character and Level of the Specific and Residual Sound

The existing background noise climate was generally controlled by distant traffic noise. Although the character of plant noise is different to traffic noise, the predicted levels are very low, as explained above, so it is unlikely that the sound would be incongruous in this case. Thus, the character of the new sound does not adversely affect the impact.

4.7.3 The Sensitivity of the Receptor

The identified NSA appear to be a regular single storey and two storey houses, so there is nothing to suggest that the receptor would be any more or less sensitive to noise than usual, and no specific sound insulation measures or acoustic screening are present. On that basis it is not considered necessary to adjust the impact for the sensitivity of the receptor.

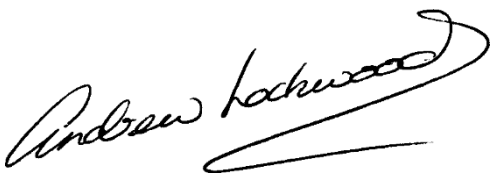
4.8 Conclusion

This assessment has demonstrated that when assessed following the methodology of BS 4142:2014, the initial estimate of impact of the proposed plant installations is adverse, depending on the context. However, the fact that both the predicted rating levels and the background levels are both very low serves to lessen the initial estimate of impact.

It should be noted that this is the worst-case scenario. It is based on both units running at full duty at the quietest time of the night outside the property at which the highest impact is predicted to occur.

Additionally, as the predicted rating levels are no more than 5 dB above the representative background levels at the quietest time of the night, they are consistent with the noise levels discussed and agreed with Adam Catrell in the Environmental Health Department.

The conclusion of this assessment is therefore that the noise impact of the proposed ASHP installation should be acoustically acceptable.



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Notes	**Description** Site Plan Showing Noise Monitoring Locations, Plant Location and NSAs	
	Project Dearne Renaissance Centre, Boulton on Dearne	
	Date 31 October 2023	**Drawing No.** 3583/SP1

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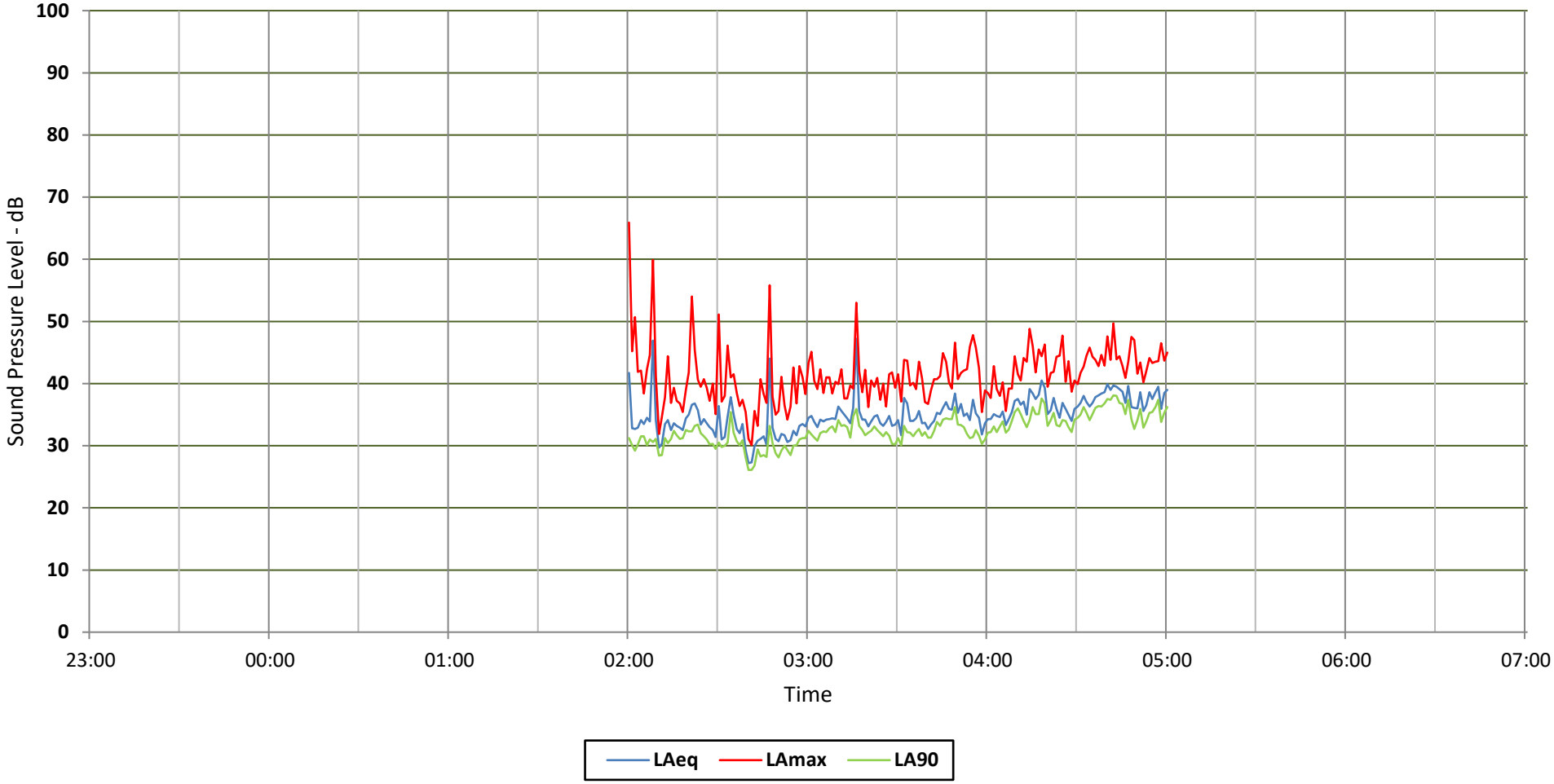

Notes	**Description** Time History Graph – Position 1	
	Project Dearne Renaissance Centre, Boulton on Dearne	
	Survey Date 22 September 2023	**Drawing No.** 3583/TH1

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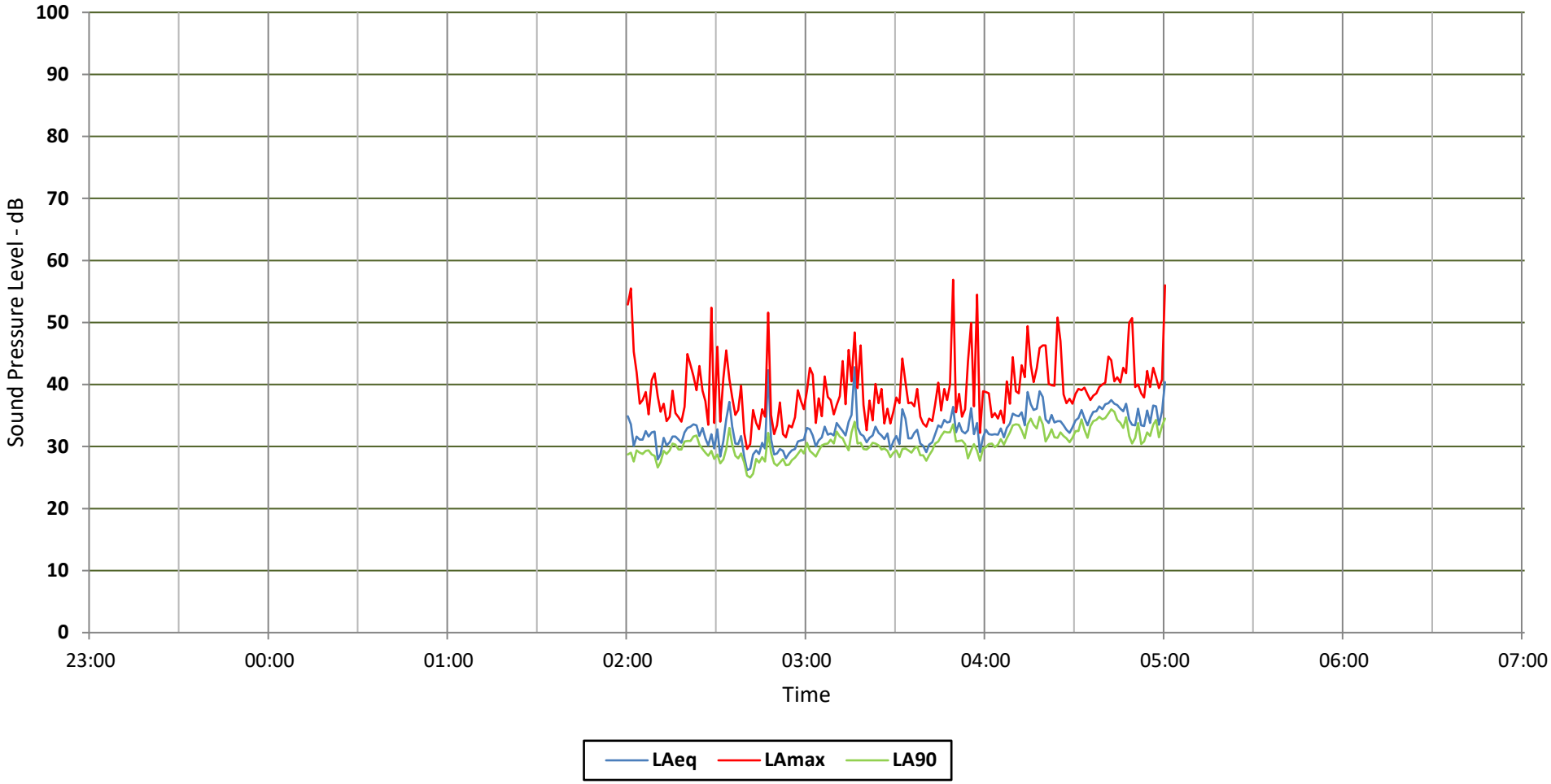

Notes	**Description** Time History Graph – Position 2	
	Project Dearne Renaissance Centre, Boulton on Dearne	
	Survey Date 22 September 2023	**Drawing No.** 3583/TH2

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SUMMARY OF BACKGROUND (L_{A90}) LEVELS

Position	02:00 02:15	02:15 02:30	02:30 02:45	02:45 03:00	03:00 03:15	03:15 03:30	03:30 03:45	03:45 04:00	04:00 04:15	04:15 04:30	04:30 04:45	04:45 05:00	Modal Value
1	28	30	26	28	30	30	29	30	31	32	33	32	30
2	30	31	28	29	32	32	32	32	33	34	36	34	32

TABLE 3583/T1

Notes

Description

Predicted Levels at Surrounding Residential Properties

Project

Dearne Renaissance Centre, Boulton on Dearne

Date

31 October 2023

Drawing No.

3583/NM1

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APPENDIX A - INSTRUMENTATION

Manufacturer	Type and / or Model	Serial Number	Last Laboratory Calibration	Calibrator Output (dB)	Free Field Correction (dB)	Initial reading (dB)	Final reading (dB)
Svantek	Svan 958 4 Channel Analyser	23430	March 2023				
Microtech Gefell	MK 250 Microphone (Mic 2)	9623			0.0	114.0	114.0
Svantek	SV12L Preamplifier	30255					
Microtech Gefell	MK 250 Microphone (Mic 3)	9615			0.0	114.0	113.9
Svantek	SV12L Preamplifier	30256					
Norsonic	Nor1251 Calibrator (Cal 4)	33453		113.98			

APPENDIX B

Acoustic Terminology

The annoyance produced by noise is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and any variations in its level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

A-weighting The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the A-weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average person. It is also possible to calculate the A-weighted noise level by applying certain corrections to an un-weighted spectrum.

When the noise being measured has variable amplitude, such as traffic noise, it is necessary to qualify the basic dB unit. This may be done using a statistical index L_n dB, where n is any value between 0 and 100, and is the percentage of the sample time for which the stated level is exceeded. In defining the use of the index, both the value of n and the length of the sample period must be stated.

L_{10} L_{10}, being the level exceeded for 10% of the time, has been shown to be a good indicator for traffic noise intrusion, and is used in assessing the effect of traffic noise on residential or commercial premises.

L_{90} L_{90} is the level exceeded for 90% of the time, and is used as a measure of background noise level, as it excludes the effects of occasional transient levels, such as individual passing cars or aircraft.

In addition to the statistical noise indices defined above, the following noise units are also used to define variable amplitude noise sources:

$L_{eq,T}$ $L_{eq,T}$ is defined as the notional steady sound pressure level which, over a stated period of time, would contain the same amount of acoustical energy as the actual fluctuating sound measured over the same period. In other words, it is a measure of the "average" noise level

L_{max} L_{max} is the maximum time-weighted sound pressure level recorded over the stated time period

APPENDIX C

Definitions from BS 4142 : 2014

reference time interval, T_r

specified interval over which the specific sound level is determined (1 h during the day, and 15 min during the night)

specific sound level, $L_{Aeq,Tr}$

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

rating level, $L_{At,Tr}$

specific sound level plus any adjustment for the characteristic features of the sound

background noise level, $L_{A90,T}$

see Appendix B

APPENDIX D

Extract From Mitsibishi CAHV-R450A-HPB Databook