

Acoustic assessment of proposed new mechanical services equipment

Whitley Wood Training Centre, Reading



Client: Royal Berkshire Fire and Rescue Service

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CONTENTS

0. SUMMARY	2
1. INTRODUCTION	3
2. ACOUSTIC CRITERIA	3
3. REVIEW OF SITE LOCATION	3
4. SOUND LEVEL SURVEY	4
5. ACOUSTIC ASSESSMENT	7
6. ACOUSTIC MITIGATION TREATMENTS	9
7. CONCLUSION	9
Appendix A	A
Appendix B	B

0. SUMMARY

- 0.1. ACA Acoustics Limited has been commissioned to assess the acoustic impact of proposed new mechanical services equipment associated with a new training centre to be installed at the Whitley Wood Training Centre, Reading.
- 0.2. The assessment is required to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby noise-sensitive properties and complies with the Local Authority's requirements.
- 0.3. A survey has been carried out in the vicinity to establish existing background sound levels. The background sound levels during the proposed opening hours of the training centre are LA90 45dB at the monitoring position. Overnight, background sound levels are LA90 41dB. Based on Reading Borough Council's criteria, the rating level from the new plant should not exceed the measured background sound level outside the closest noise-sensitive windows.
- 0.4. The most noise-sensitive residential receptor (NSR) has been assessed as rear windows of 87 Kingsley Close. This residential property overlooks the rear of the proposed development site and is the closest residential property to the proposed mechanical plant location.
- 0.5. Calculations using manufacturer's sound level data for the new equipment, allowing for the recommendations as set out in this report, confirm that the sound level from the new equipment at the receptor is LAr 34dB at the receptor during the training centre's opening hours, and LAr 19dB overnight.
- 0.6. Noise from the proposed equipment will not be disturbing or detrimental to the amenity of any nearby residential or other noise-sensitive receptors and complies with the planning requirements of Reading Borough Council.

1. INTRODUCTION

New mechanical services equipment associated with a new training centre is to be installed at Whitley Wood Fire Station.

ACA Acoustics Limited has been commissioned by Royal Berkshire Fire and Rescue Service to carry out an assessment of noise emissions from the proposed mechanical plant and, where necessary, to make recommendations for a mitigation scheme to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the sound level survey, computer modelling, and assessment.

2. ACOUSTIC CRITERIA

It is understood that Reading Borough Council will require the rating level of the new equipment, when assessed in accordance with BS 4142:2014+A1:2019, to achieve a sound level at least 10dB below the background sound level.

This criterion is applicable over a period of 60 minutes during the daytime (07:00 to 23:00 hours) and 15-minutes overnight (23:00 to 07:00 hours) and measured at a position 1m external to noise sensitive façades (typically outside residential windows).

At this level noise from the new equipment will be low, should not increase the prevailing background sound level and would not be detrimental to the amenity of nearby residents.

3. REVIEW OF SITE LOCATION

New mechanical equipment, comprising of two VRF condensing units, and a hot water heat pump, are being installed at the rear of the proposed new Whitley Wood Training Centre.

The most noise-sensitive residential receptor (NSR) has been assessed as 87 Kingsley Close, to the rear of the new training centre, indicated by the NSR1 label below.

A marked-up aerial image is included in Figure 1, identifying the location of the proposed equipment and sound level survey measurement position.

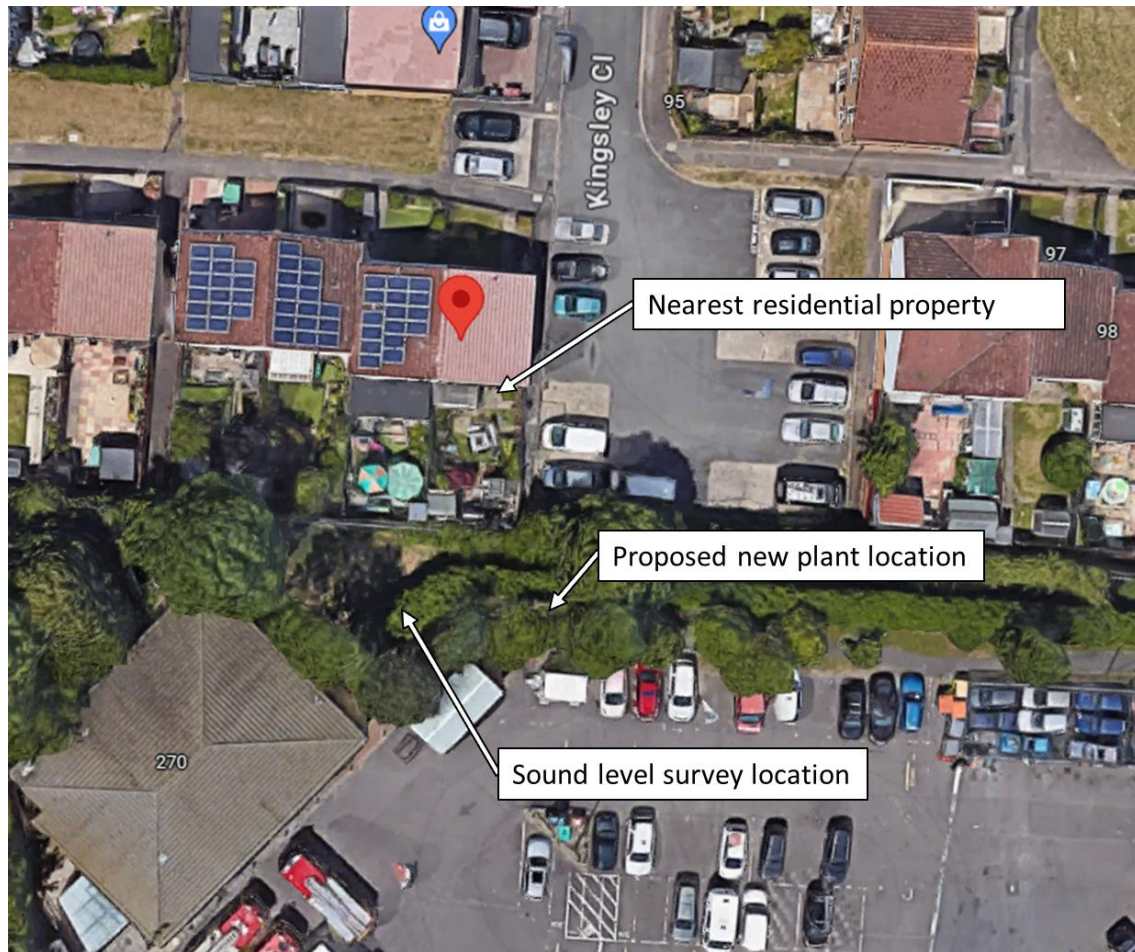


Figure 1: Equipment location, measurement position, and closest receptor (available at [google.com/maps](https://www.google.com/maps))

Proposed operating times of the AC condensers are during the proposed opening hours of the training centre, understood to be between 08:00 – 17:00 hours. The hot water heat pump will operate over a potential 24-hour period.

4. SOUND LEVEL SURVEY

To assess sound levels from the new mechanical equipment, it is necessary to establish representative background sound levels in the vicinity during the proposed plant operating times.

The background sound level was measured via an unattended survey at the position indicated in Figure 1. This position was considered as being representative of the NSR1 receptor. The survey was set up by Sam Thorpe of ACA Acoustics and conducted between the 25th and 26th July 2023.

The microphone was set up at the boundary of the car park, at a position equivalent to that of the nearest residential properties. The position was around 5 meters from the proposed plant location.

During the survey, the soundscape in the vicinity was influenced predominantly by road traffic in the vicinity.

The following equipment was used during the survey. An on-site calibration check was conducted on the sound level meter prior to the survey and repeated after with no deviation noted.

Equipment	Serial Number
NTi Audio Class 1 sound level meter type XL2 complete with weatherproof and lockable outdoor environmental kit	A2A-06294-E0
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003	83826

Table 1: Equipment used for the sound level survey

Weather conditions at the time of setting up the survey were bright, dry, and calm. Weather conditions have been reviewed at www.worldweatheronline.com, using the closest available commercial weather station. Weather conditions remained predominantly calm and dry with wind speeds below recommended limits during the proposed equipment operation times. Meteorological conditions are considered acceptable and will not have adversely impacted the survey results.

Results of the survey are shown in graphical form in Figure 2 below.

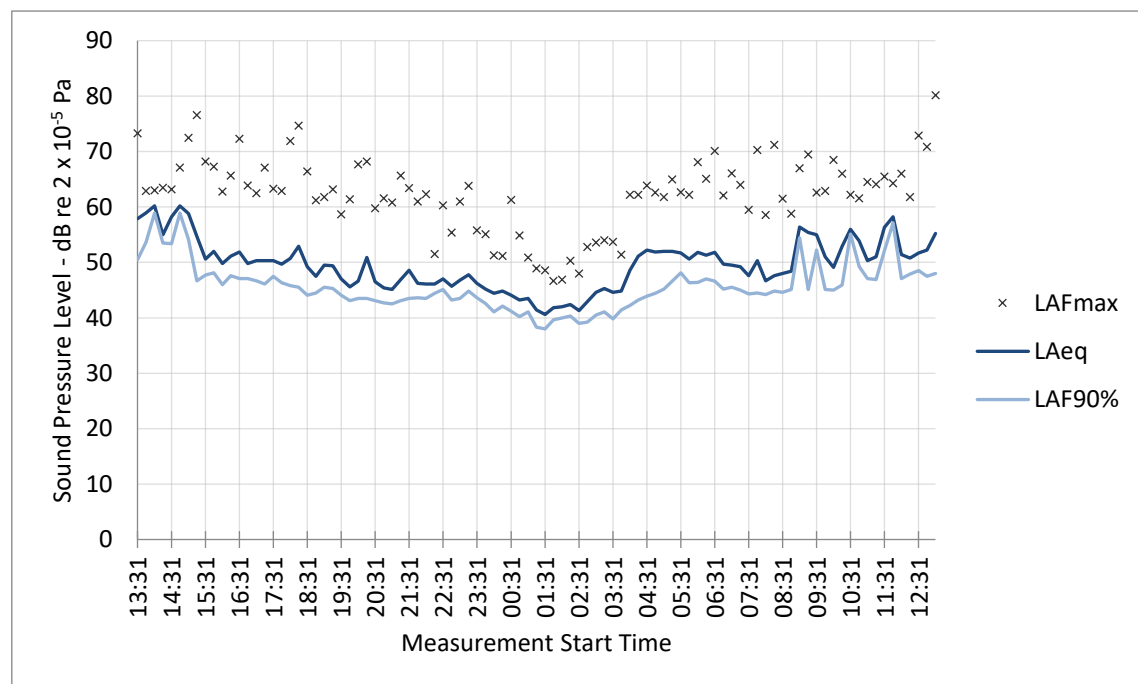


Figure 2: Sound level survey results – 25th – 26th July 2023

In accordance with the methodology set out in BS 4142:2014+A1:2019, the background sound level is not necessarily the lowest recorded value. Instead, the background sound level should be a level which is representative of the underlying soundscape at the receptor location.

A statistical analysis of the measured LA90 results during the proposed operating times of the training centre and overnight is shown in Figure 3 and below, following guidance set out in the Standard.

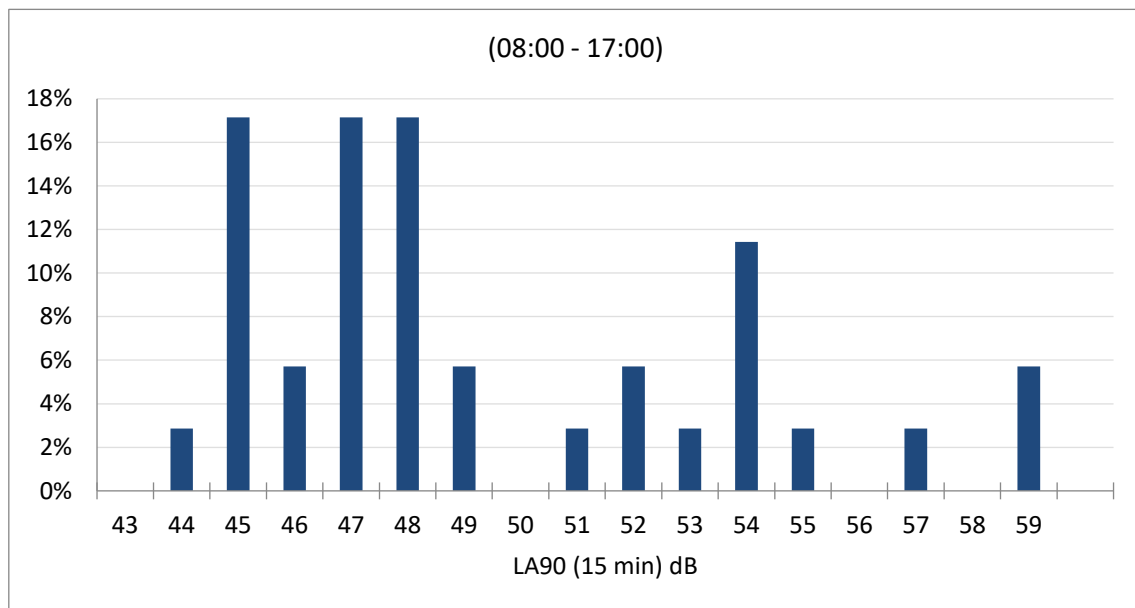


Figure 3: Statistical analysis of measured LA90 sound levels during the training centre opening hours period

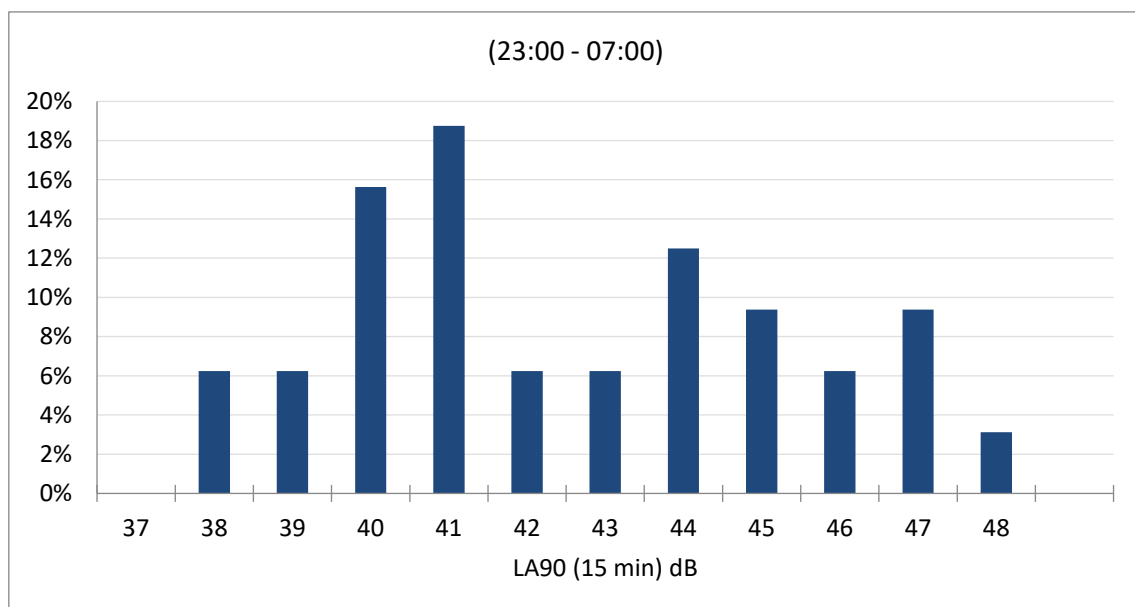


Figure 4: Statistical analysis of measured LA90 sound levels during the overnight assessment period

Based on the statistical analysis of the survey results, the author considers a level of LA90 45dB is representative of the background sound level in the vicinity while the training centre will be open. Overnight, a level of LA90 41dB is considered representative.

Summary results of the survey are provided in Table 2 below.

Receptor	Period	Representative Background Sound Level During Operating Period LA90
NSR1	08:00 – 17:00 hours	45dB
	23:00 – 07:00 hours	41dB

Table 2: Summary sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of new extract and supply fans. Confirmation of the equipment models used in the assessment is provided in Table 3 below.

Description	Equipment Model	Sound Level (LwA)	Quantity
Air Conditioning Condenser	Daikin REYA14A	79dB	2
Hot Water Heat Pump	Daikin Monobloc EDLA16D3V3	62dB	1

Table 3: Proposed new mechanical equipment used in the assessment

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows, using manufacturer's published sound data for the proposed new plant. Environmental corrections have been calculated in accordance with ISO 9613-2.

Mitigation recommendations outlined in Section 6 of this report are included in the computer model.

The cumulative calculated specific sound level to outside the most sensitive receptors with all equipment operating is shown in Table 4 below. Summary printouts from the calculation models are included in Appendix A.

Receptor Location	Calculated Equipment Sound Level (All plant operating)
NSR1 During training centre opening hours	40dBA
NSR1 Overnight	37dBA

Table 4: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Assessment of the calculated rating levels in accordance with BS 4142:2014+A1:2019 is provided in Table 5 below.

Description	Training centre opening hours assessment	Overnight assessment	Relevant Clause	Commentary
Calculated specific sound level to receptor	LAeq 34dB	LAeq 19dB	7.1 7.3.6	New equipment operating. Refer to calculation sheets in Appendix A.
Background sound level	LA90 45dB	LA90 41dB	8.1.3 8.3	Measured representative background sound level.
Residual sound level	LAeq 55dB	LAeq 48dB	7.3.3	Residual sound level measured during proposed operating times of the new plant.
Acoustic feature correction	0dB	0dB	9.2	The proposed equipment will be significantly below the measured background sound level and will be subjectively inaudible, therefore not acoustic feature corrections are applicable
Rating level	LAr 34dB	LAr 19dB	9.2	
Excess of rating level over background sound level	-11dB	-22dB	11	Assessment indicates low likelihood of adverse impact

Table 5: Assessment of results in accordance with BS 4142:2014+A1:2019

Table 5 shows that with benefit of acoustic mitigation measures as detailed within this report, the rating level of the proposed new equipment will be significantly below the background LA90 sound level to outside the closest noise-sensitive properties.

BS 4142:2014+A1:2019 requires an assessment to consider the context of the development, rather than simply adhering to numerical values. Considering the calculated numerical value of the specific sound, allowing a reduction through partially open windows of 15dBA, as recommended in BS 8233:2014, sound levels inside the neighbouring dwellings due to the proposed new equipment will be approximately 19dBA (34dBA – 15dBA) and 4dBA (19dBA – 15dBA). This is below guideline levels for sleeping in bedrooms of LAeq 30dB and resting in living rooms and bedrooms of LAeq 35dB, set out in BS 8233:2014 and is further confirmation that sound levels from the new mechanical equipment should not be detrimental to the amenity of any noise-sensitive receptors in the vicinity.

The author considers that the context of the assessment does not alter the initial estimate of the impact, and that sound levels from the new mechanical equipment should not be detrimental to the amenity of any residential occupiers in the vicinity.

6. ACOUSTIC MITIGATION TREATMENTS

As discussed in Section 5, noise control treatments have been included in the calculation model. Acoustic specification for the mitigation scheme is provided below.

It is advised that an acoustic louvre is applied surrounding the condensing units. A single louvre may be installed over all the condensers, with no gaps at the edges. A suitable louvred enclosure would typically be formed from 300mm deep acoustic louvres such as Allaway Acoustic's AL3015 model or equivalent. Minimum insertion loss performance for the louvres is shown on the schedule in Appendix B.

Structural supports/steelwork and access panels or doors may be required and should be determined by the successful supplier accordingly.

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical plant and equipment associated with a new training facility at Whitley Wood Fire Station.

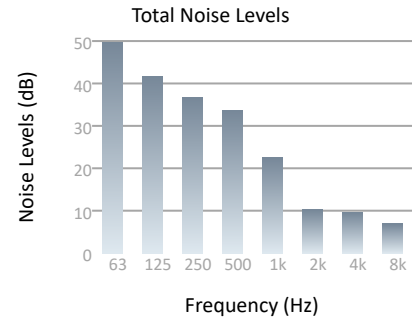
ACA Acoustics have undertaken an assessment of noise from the proposed equipment using manufacturer's published acoustic data. Calculated rating sound levels for the plant is below the background sound level during proposed operating times of the equipment when assessed at 1m from the closest noise-sensitive windows of residential receptors.

The author considers that allowing for the proposed mitigation scheme in this report, the proposed equipment achieve the Local Authority's planning requirements for this development and will not be detrimental to the amenity of nearby noise-sensitive occupants.

Appendix A

Acoustic Calculations

Project Name	Whitley Wood Training Centre, Reading
Project Reference	230712
Reference	Center Opening Hours
Description	
Noise Limit	-
dBA	34.1

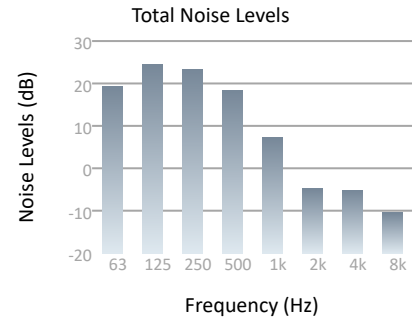


Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
CU 1 AC	1	46.7	38.7	33.7	30.7	19.7	7.6	7.2	5.0
CU 2 AC	1	46.7	38.6	33.6	30.5	19.2	6.7	5.7	2.3
CU3 Hot Water	1	18.7	22.7	18.7	13.7	2.7	-9.4	-9.8	-15.0

230712-ER-1-R001A

Project Name	Whitley Wood Training Centre, Reading
Project Reference	230712
Reference	Overnight
Description	
Noise Limit	-
dBA	18.7



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
CU3 Hot Water	1	19.4	24.4	23.3	18.3	7.3	-4.8	-5.2	-10.5

230712-ER-2-R001A

Calculation Sheet

CU 1 AC to Center Opening Hours

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU 1 AC								
Sound Power Levels	88.0	81.0	78.0	78.0	74.0	69.0	64.0	59.0
Noise Control Treatments								
Treatment - AL01								
	-5.0	-6.0	-8.0	-11.0	-18.0	-25.0	-20.0	-16.0
Dc - Condenser Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.8
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8
External Receiver								
External Receiver - Center Opening Hours								
Sound Pressure, Lp:	46.7	38.7	33.7	30.7	19.7	7.6	7.2	5.0

Calculation Sheet

CU 2 AC to Center Opening Hours

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU 2 AC								
Sound Power Levels	88.0	81.0	78.0	78.0	74.0	69.0	64.0	59.0
Noise Control Treatments								
Treatment - AL01								
	-5.0	-6.0	-8.0	-11.0	-18.0	-25.0	-20.0	-16.0
Dc - Condenser Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.8
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.8	-7.8	-7.9	-8.0	-8.2	-8.6	-9.3	-10.4
External Receiver								
External Receiver - Center Opening Hours								
Sound Pressure, Lp:	46.7	38.6	33.6	30.5	19.2	6.7	5.7	2.3

Calculation Sheet

CU3 Hot Water to Center Opening Hours

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU3 Hot Water								
Sound Power Levels	60.0	65.0	63.0	61.0	57.0	52.0	47.0	39.0
Noise Control Treatments								
Treatment - AL01								
	-5.0	-6.0	-8.0	-11.0	-18.0	-25.0	-20.0	-16.0
Dc - Condenser Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5	-34.5
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.8
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8
External Receiver								
External Receiver - Center Opening Hours								
Sound Pressure, Lp:	18.7	22.7	18.7	13.7	2.7	-9.4	-9.8	-15.0

Calculation Sheet

CU3 Hot Water to Overnight

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU3 Hot Water								
Sound Power Levels	60.0	65.0	63.0	61.0	57.0	52.0	47.0	39.0
Noise Control Treatments								
Treatment - AL01								
	-5.0	-6.0	-8.0	-11.0	-18.0	-25.0	-20.0	-16.0
Dc - Condenser Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-34.7	-34.7	-34.7	-34.7	-34.7	-34.7	-34.7	-34.7
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.8
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-6.9	-5.9	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Overnight								
Sound Pressure, Lp:	19.4	24.4	23.3	18.3	7.3	-4.8	-5.2	-10.5

Appendix B

Acoustic mitigation

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
AL01		AL3015	5	6	8	11	18	25	20	16