

Acoustic Assessment of Proposed New Mechanical Services Equipment

4 Broad Street, Reading RG1 2BH



Client: AFR Air Conditioning

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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	6
6. ACOUSTIC MITIGATION TREATMENTS	8
6.1. Vibration Isolators	8
7. CONCLUSION	8
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 to be installed at 4 Broad Street, 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 for such a development.
- 0.3. A survey has been carried out in the vicinity to establish existing background sound levels. The background sound levels during the most sensitive time of the proposed operating hours are LA90 58dB at the monitoring position.
- 0.4. The most significant residential noise-sensitive receptor (NSR) has been assessed as the second-floor windows of the residential flats above the premises overlooking the plant area.
- 0.5. Calculations using manufacturers' 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 less than the criterion of LAeq 48dB at the receptor.
- 0.6. Noise from the proposed new equipment will not be disturbing or detrimental to the amenity of any nearby residential occupants and complies with the planning requirements of Reading Borough Council.

1. INTRODUCTION

New mechanical equipment is to be installed at 4 Broad Street, Reading.

ACA Acoustics Limited has been commissioned to carry out an assessment of noise emissions from the proposed mechanical plant and, where necessary, make recommendation to reduce sound levels to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the assessment.

2. ACOUSTIC CRITERIA

Based on planning conditions imposed on a recent similar development within the Borough, it is anticipated that Reading Borough Council will require noise from the new equipment to be at least 10dBA below the lowest measured background sound level and the rating level, when assessed in accordance with BS 4142:2014+A1:2019, to not exceed the background sound level.

The criteria are 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 a supply and extract fan and two air conditioning condensers, is being installed on the wall to the rear of the premises. The nearest residential windows are the second floor rear windows of 4 Broad Street which face towards the plant area.

Figure 1 below shows the location of the proposed equipment within the unit.

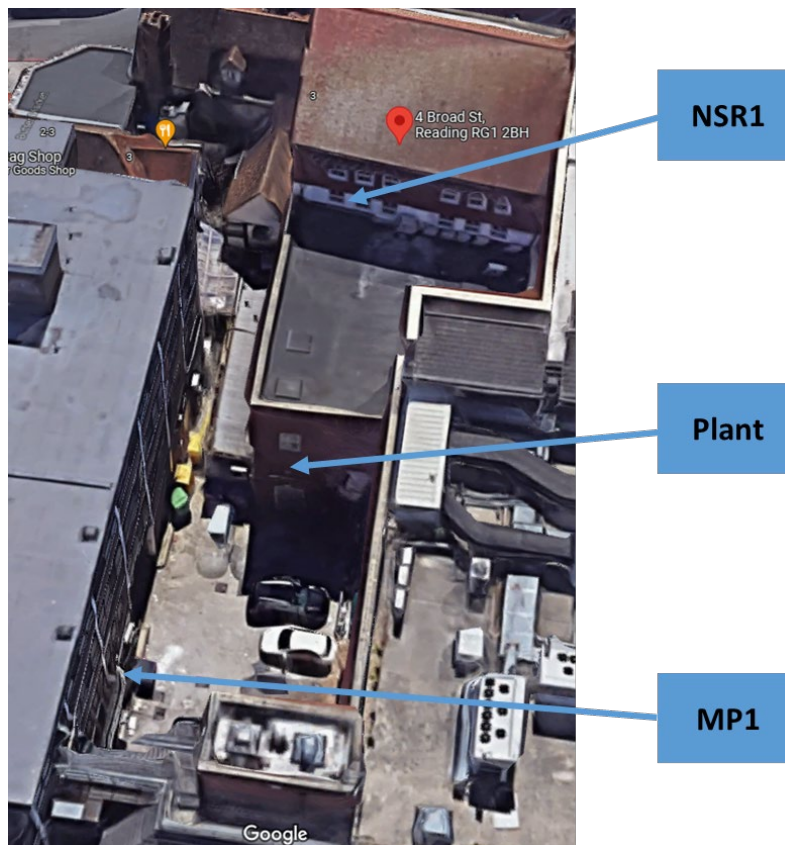


Figure 1: Drawing showing equipment location and most noise-sensitive receptor

Proposed operating times of the equipment are understood to be between the hours of 07:30 and 19:00.

4. SOUND LEVEL SURVEY

To assess sound levels from the new mechanical equipment, it is necessary to establish the 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 above (MP1). This position is assessed as being representative of the NSR1 receptor. The survey was conducted between the 15th - 16th December 2022.

During the survey, the acoustic environment in the vicinity of the receptor was influenced predominantly by third party plant, though some traffic and pedestrian noise could also be heard.

The following equipment was used during the survey; the sound level meter was calibrated before the survey and checked after with no deviation noted.

Equipment	Serial Number
Rion Class 1 sound level meter type NL-52, complete with weatherproof and lockable outdoor environmental kit	00564867
Svantek calibrator type SV33B. Compliant to IEC 60942:2017	122245

Table 1: Equipment used

Weather conditions at the time of setting up the survey were cool and clear with little breeze and dry ground conditions. Weather conditions have been reviewed at www.worldweatheronline.com, using the closest available commercial weather station. The extended nature of the survey ensures that a reasonable sample of results have been recorded with appropriate weather conditions. Meteorological conditions are not considered to have adversely impacted the outcome of the assessment.

Results of the survey are shown in Figure 2 below.

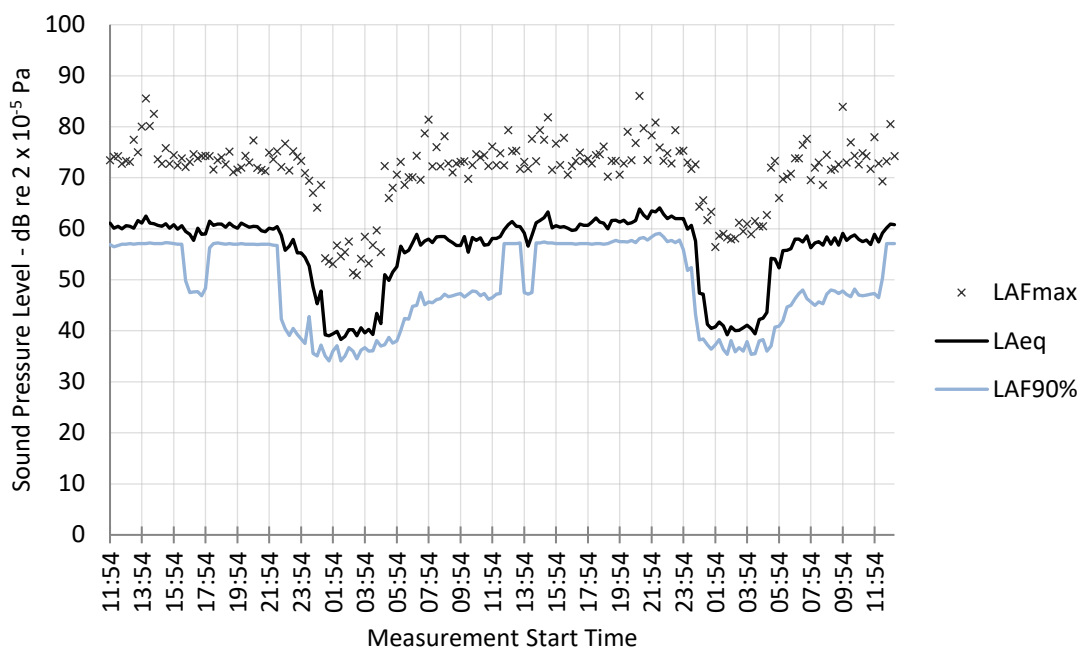


Figure 2: Sound level survey results at Position MP1 15th – 16th December 2022

The pertinent results of the survey are summarised in Table 2 below.

Receptor	Period	Background Sound Level During Operating Period LA90
NSR1	Restaurant opening times to 19:00	58dB

Table 2: Summary sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of a new extract and supply fan as well as two air conditioning condensers. The fans will be installed internally to discharge at the rear. Confirmation of the equipment models used in the assessment is provided in Table 3 below.

Description	Equipment Model	Airflow m ³ /s	Sound Power	Quantity
Supply Fan (SF1)	SystemAir Prio 315 EC	0.4	81dBA	1
Extract Fan (EF1)	SystemAir Prio 315 EC	0.4	79dBA	1
Condenser (CU1)	Mitsubishi PUZ-M140VAR1	N/A	73dBA	1
Condenser (CU2)	Mitsubishi SUZ-M71VAR1	N/A	66dBA	1

Table 3: Proposed new mechanical equipment used in the assessment

Sound emissions from the mechanical equipment can be determined from manufacturers' published data.

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows. The model incorporates losses within the ductwork system based on the calculation method of CIBSE Guide B4 Noise and vibration control for HVAC along with environmental corrections set out in ISO 9613-2:1996.

The assessment has been undertaken using drawings reference 4092/M/01 and 6993/M/01, as provided by the client.

The assessment includes mitigation recommendations as outlined in Section 6.

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)	Criteria Excess/Margin
NSR1	27dBA	-21dB

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	NSR1 Receptor	Relevant Clause	Commentary
Calculated specific sound level to receptor	LAeq 27dB	7.1 7.3.6	New equipment operating. Refer to calculation sheets in Appendix A.
Background sound level	LA90 48dB	8.1.3 8.3	Measured representative background sound level.
Acoustic feature correction	0dB	9.2	The calculated specific sound levels do not indicate any tonal/impulsivity/intermittency component and the equipment will be significantly below the residual sound level.
Rating level	LAr 27dB	9.2	
Excess of rating level over background sound level	-21dB	11	Assessment indicates negligible likelihood of adverse impact

Table 5: BS 4142:2014+A1:2019 Assessment

Table 5 shows the rating level of the proposed new equipment will be more than 10dB below the representative 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 as well as 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 12dBA (27dBA – 15dBA). This is below guideline levels for sleeping in bedrooms of LAeq 30dB, 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.

Additionally, the proposals involve new items of mechanical equipment being introduced to an area with other commercial and retail uses in the vicinity. In this scenario, the change in acoustic character, and subsequent potential for loss of amenity, is lower than if, say, there were no other similar businesses in the area. In addition, the new plant is likely to be much quieter than the existing site plant.

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.

6.1. Vibration Isolators

To control potential for structure-borne noise and vibration from the condensers affecting adjoining occupants, it is recommended it is installed on vibration isolators providing minimum 25mm deflection at the working load, and that flexible connections are fitted between the equipment and adjoining ductwork both sides. Most acoustic hardware suppliers would be able to select suitable isolators based on the fan weight and operating speed, including Allaway Acoustics Limited (www.allawayacoustics.co.uk).

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical plant and equipment for an existing premises at 4 Broad Street, Reading.

ACA Acoustics have undertaken an assessment of noise from the proposed equipment using manufacturer's published acoustic data. Calculated rating level for the new plant is at least 10dB below the background sound level during operating times of the new equipment when assessed at 1m from the closest noise-sensitive windows of both receptors.

The author considers that allowing for the proposed mitigation scheme in this report, the proposed new air conditioning condenser and extraction equipment achieve the Local Authority's planning requirements for this development and will not be detrimental to the amenity of nearby residential occupants.

Appendix A

Acoustic Calculations

4 Broad Street, Reading

Calculation Sheet

CU1 to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU1								
Sound Power Levels	79.0	77.0	74.0	72.0	66.0	64.0	59.0	48.0
Noise Control Treatments								
Treatment - None								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dc - Condenser Directivity								
	2.4	1.5	-0.3	-2.4	-3.0	-3.0	-3.0	-3.0
Adiv - Geometrical Divergence								
	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.4	-1.6
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-12.5	-14.7	-17.2	-20.0	-22.9	-23.0	-23.0	-23.0
External Receiver								
External Receiver - NSR1								
Sound Pressure, Lp:	38.2	33.1	25.8	18.9	9.4	7.2	1.9	-10.3

4 Broad Street, Reading

Calculation Sheet

CU2 to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU2								
Sound Power Levels	66.0	72.0	67.0	61.0	60.0	58.0	50.0	43.0
Noise Control Treatments								
Treatment - None								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dc - Condenser Directivity								
	1.8	0.2	-1.9	-3.0	-3.0	-3.0	-3.0	-3.0
Adiv - Geometrical Divergence								
	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7	-33.7
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.4	-1.6
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-12.5	-14.7	-17.2	-20.0	-22.9	-23.0	-23.0	-23.0
External Receiver								
External Receiver - NSR1								
Sound Pressure, Lp:	24.6	26.9	17.2	7.3	3.4	1.2	-7.1	-15.3

4 Broad Street, Reading

Calculation Sheet

SF1 to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1								
Noise Levels	73.0	86.0	79.0	77.0	76.0	72.0	66.0	59.0
Silencer								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bend Loss								
	0.0	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0
End Reflection & Directional Directivity								
	-7.5	-5.0	-4.9	-6.3	-8.4	-10.6	-10.9	-10.9
Dc - Reflections & Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.6
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-13.5	-15.9	-18.5	-21.3	-23.0	-23.0	-23.0	-23.0
External Receiver								
External Receiver - NSR1								
Sound Pressure, Lp:	24.2	36.3	25.7	18.4	13.7	7.4	0.7	-7.4

4 Broad Street, Reading

Calculation Sheet

EF1 to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1								
Noise Levels	79.0	78.0	79.0	76.0	75.0	71.0	65.0	58.0
Silencer								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bend Loss								
	0.0	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0
End Reflection & Directional Directivity								
	-7.5	-5.0	-4.9	-6.3	-8.4	-10.6	-10.9	-10.9
Dc - Reflections & Directivity								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Adiv - Geometrical Divergence								
	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9	-33.9
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.5	-1.6
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-13.5	-15.9	-18.5	-21.3	-23.0	-23.0	-23.0	-23.0
External Receiver								
External Receiver - NSR1								
Sound Pressure, Lp:	30.2	28.3	25.7	17.4	12.7	6.4	-0.3	-8.4

Appendix B

Noise Control Treatments

4 Broad Street, Reading

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
None		None	0	0	0	0	0	0	0	0