

Acoustic assessment of proposed new mechanical services equipment

The Hanover Building, Corporation Street, Manchester



Client: Blacksheep Design Collective

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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 restaurant to be installed at ground floor level of The Hanover Building, Manchester.
- 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 Manchester City Council's requirements.
- 0.3. A survey has been carried out in the vicinity to establish existing background sound levels during the latest proposed operating times of the new equipment. The background sound levels during the most sensitive time of the proposed operating hours are LA90 50dB at the monitoring position. Based on Manchester City Council's criteria, the rating level from the new plant should not exceed a level 5dB below the measured background sound level when assessed in accordance with the methodology of BS 4142:2014+A1:2019 outside the closest noise-sensitive windows.
- 0.4. The most noise-sensitive residential receptor (NSR) has been assessed as the New Vic apartment complex, at a distance of around 80 meters.
- 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 36dB at the receptor and achieve the requirements of Manchester City Council.
- 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 Manchester City Council.

1. INTRODUCTION

New mechanical services equipment associated with a proposed restaurant is to be installed at the ground floor level of The Hanover Building, Manchester.

ACA Acoustics Limited has been commissioned by Blacksheep Design Collective 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

Based on planning conditions imposed on a recent similar development, it is anticipated that Manchester City Council will require the rating sound level from the new equipment, when assessed in accordance with BS 4142:2014+A1:2019, to not exceed a level 5dB below the background sound level.

The scope of BS 4142:2014+A1:2019 advises that,

“This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature ... to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident”.

BS 4142:2014+A1:2019 is commonly used to assess the potential for loss of amenity due to noise from industrial and commercial processes and is considered appropriate for this application.

The assessment method of BS 4142:2014+A1:2019 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more intrusive to obtain a rating level. This rating level is compared against the prevailing background sound level outside the noise-sensitive property. Section 11 of BS 4142:2014+A1:2019 provides a commentary of the assessment result and advises that:

- a) *The greater the difference between the rating level and the background sound level, the greater the magnitude of the impact;*
- b) *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- c) *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;*
- d) *The lower the rating level is 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.

BS 4142:2014+A1:2019 requires that assessment of noise be conducted considering the context of the development.

3. REVIEW OF SITE LOCATION

New mechanical equipment, comprising of extract and supply fans and condenser units are being installed at ground floor level of The Hanover Building, Manchester. The fans will terminate at louvres within the external façade, with the exception of EF2 which will discharge within the rear plant space. Within this plant space are also three condensing units.

The proposed equipment is located to the northeastern façade of the development site, and therefore the most noise-sensitive residential receptor (NSR) has been assessed as the New Vic apartment complex, nominally 80 meters from the proposed development site, 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 positions.

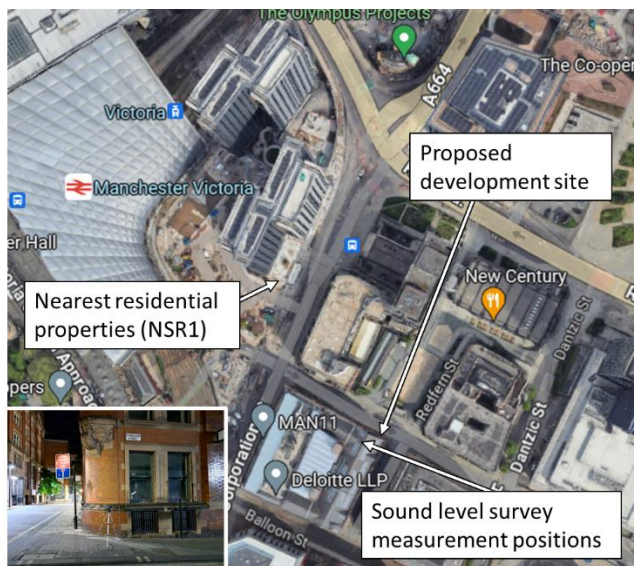


Figure 1: Equipment location, measurement position, and closest receptor (available at [google.com/maps](https://www.google.com/maps))

Proposed operating times of the equipment are up until 00:00 midnight.

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 measurement position was not considered secure and therefore an attended sound level survey was conducted by Tommy Burn of ACA Acoustics during the night of the 19th September. Measurements were taken at two positions, however the position at the development site is considered most representative of the nearest receptor.

The microphone was set up at street level at the northeast façade of the proposed development site. This is representative of sound levels near the New Vic apartment complex, however is screened from the nearby railway lines and so sound levels measured are considered to result in a robust assessment. During the survey, the soundscape in the vicinity was influenced predominantly by road traffic and pedestrian activity in the area, along with low levels of mechanical plant serving retail premises 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-TA	A2A-16877-E0
Svantek calibrator type SV33B. Compliant to IEC 60942:2003	57595

Table 1: Equipment used for the sound level survey

Weather conditions at the time of setting up the survey were warm, dry, and calm, and 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 at the New Vic apartment complex are shown in graphical form in Figure 2 below.

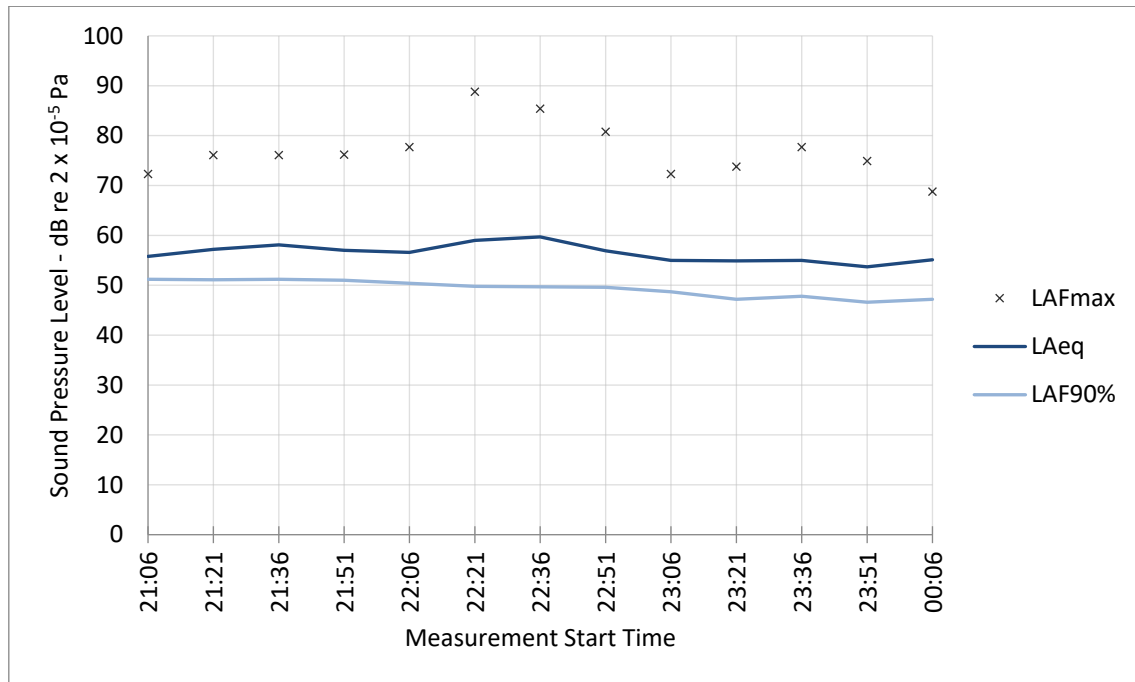


Figure 2: Sound level survey results – 19th September 2023

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 measurement period overnight is shown in Figure 3 below, following guidance set out in the Standard.

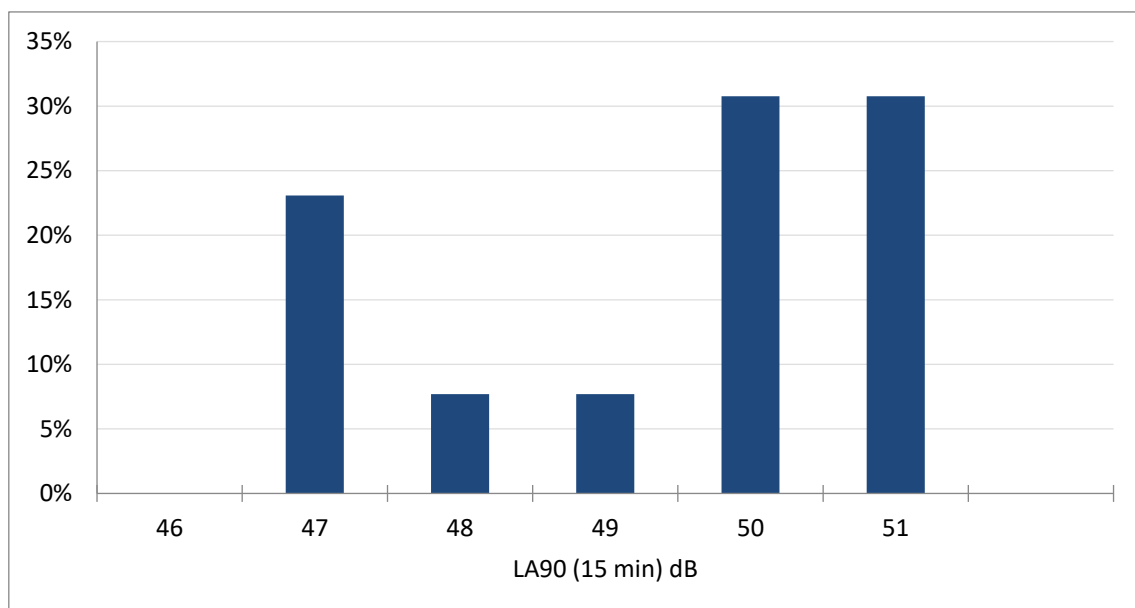


Figure 3: Statistical analysis of measured LA90 sound levels during the assessment period

Based on the statistical analysis of the survey results, the author considers a level of LA90 50dB is representative of the background sound level in the vicinity.

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

Receptor	Period	Lowest Background Sound Level During Operating Period LA90
NSR1	21:00 – 00:00	50dB

Table 2: Summary sound level survey results

5. ACOUSTIC ASSESSMENT

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

Description	Equipment Model	Airflow (m3/s)	Sound Level (LwA)	Quantity
EF1 Kitchen Extract	Halton Pollustop PS3	2.7	93dB	1
EF2 General Extract	TD-1000/200 Silent 3V	0.27	67dB	1
EF3 WC Extract	Systemair K150	0.14	69dB	1
SF1 Supply Fan	Flakt Woods Estoc Powerbox 80-630-3-4	3	85dB	1
CU Condensing Units	Toshiba RAV-GM1401 ATP-E	N/A	69	3

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. Ductwork system losses have been calculated in accordance with CIBSE Guide B4 *Noise and vibration control for HVAC*. Environmental corrections have been calculated in accordance with ISO 9613-2.

The assessment has been undertaken using drawing reference TFP-1053-201, as provided by the client.

Sound levels without mitigation meet the requirements of the local authority due to the large distance and screening to the New Vic apartment complex receptor, however some mitigation has been recommended as outlined in Section 6 of this report to ensure sound levels to the street are controlled, and these mitigation measures 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.

Description	NSR1 Receptor (All Plant)
Calculated specific sound level to receptor	LAeq 36dB

Table 4: Calculated cumulative equipment sound level at NSR1

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

Description	NSR1 Receptor (All Plant)	Relevant Clause	Commentary
Calculated specific sound level to receptor	LAeq 36dB	7.1 7.3.6	New equipment operating. Refer to calculation sheets in Appendix A
Background sound level	LA90 50dB	8.1.3 8.3	Measured representative background sound level.
Residual sound level	LAeq 57dB	7.3.3	Residual sound level measured during proposed operating times of the new plant.
Acoustic feature correction	0dB	9.2	The calculated specific sound levels do not indicate any distinctive component and the equipment will be significantly below the background and residual sound levels.
Rating level	LAr 36dB	9.2	
Excess of rating level over background sound level	-14dB	11	Assessment indicates low likelihood of adverse impact

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

Table 5 shows the rating level of the proposed new equipment will be 14dB 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 residential flats due to the proposed new equipment will be approximately 21dBA (36dBA – 15dBA). This is significantly 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.

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 shown in Section 5, no noise control treatments are required to comply with Manchester's planning consent criteria, however to ensure that noise emissions to the pavement outside the restaurant are not excessive we recommend that duct-mounted attenuators are installed to the atmospheric side of EF1 and SF1 fans. Schedule of minimum dynamic insertion loss performance for the attenuators along with description of typical silencer to comply with the specified performance is provided in Appendix B. Note that the dimensions and free area shown are nominal and the successful supplier should confirm their own selections to meet the minimum specified insertion loss performance.

It is important airflow generated noise from the atmospheric terminal does not increase the cumulative sound level at nearby noise-sensitive properties. Suitable airflow velocity is dependent on the profile of the terminal used and should be verified with the manufacturer accordingly.

It is recommended the fans are installed on high-performance steel spring vibration isolators, providing minimum 25mm deflection at the working load.

Flexible connections should be installed between the fans and adjoining ductwork to both atmospheric and room sides.

All condensers should be installed on rubber or neoprene turret type isolators or pads, providing typically 8mm deflection at the working load. Should it be required, these could be upgraded to 25mm deflection steel spring mounts at a later stage.

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical plant and equipment associated with a new restaurant at The Hanover Building, Manchester.

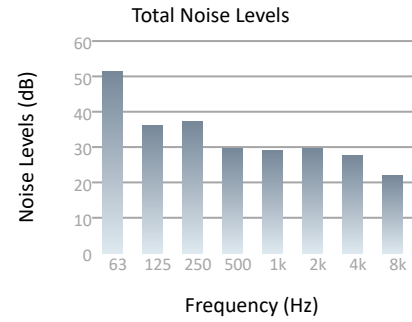
ACA Acoustics have undertaken an assessment of noise from the proposed equipment using manufacturer's published acoustic data. Calculated rating sound levels for the plant is significantly below the background sound level during proposed operating times of the equipment when assessed at 1m from the closest 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	The Hanover Building, Manchester
Project Reference	230908
Reference	New Vic Apartment Complex
Description	
Noise Limit	-
dBA	36.4



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Rear plant space	1	21.6	22.3	19.0	15.8	13.7	8.4	1.7	-13.8
SF1 Inlet	1	51.4	32.9	24.9	17.9	12.6	14.6	13.4	8.7
EF3	1	19.8	32.4	32.3	22.3	16.1	11.1	7.6	2.9
EF1	1	26.5	24.1	34.8	28.0	28.4	29.2	27.4	21.7

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The Hanover Building, Manchester

Reference Rear plant space

Description

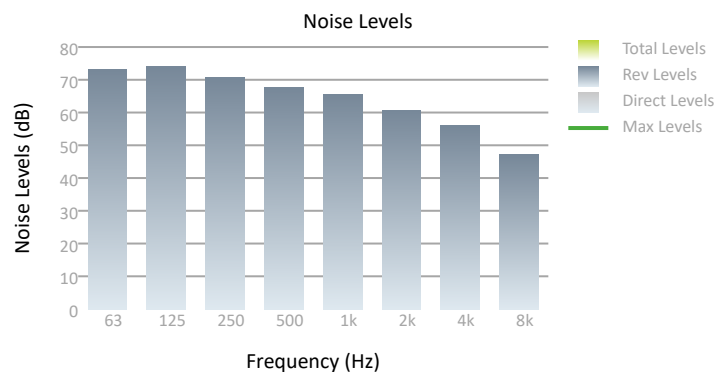
Target Sound Level -

Max Sound Level -

Calculated Sound Level 70.3dB(A)

Calculated Tmf T60 (s) 0.48

Volume (m³) 46.8



Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
CU1	1	68.4	69.1	65.9	62.5	59.5	53.2	47.9	34.9
CU2	1	68.4	69.1	65.9	62.5	59.5	53.2	47.9	34.9
CU3	1	68.4	69.1	65.9	62.5	59.5	53.2	47.9	34.9
EF2	1	29.6	35.6	47.0	55.0	59.6	57.5	53.3	46.3

Calculation Sheet

EF2 to Rear plant space

	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
Noise Source									
Noise Source - EF2									
Noise Levels	41.0	43.0	52.0	59.0	63.0	61.0	57.0	50.0	
Circ Unlined Duct Losses									
	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	
End Reflection - Rect Flush									
Levels at Termination	32.8	38.8	50.3	58.3	62.7	60.8	56.8	49.8	Row A
	-8.0	-4.0	-1.5	-0.5	-0.1	0.0	0.0	0.0	
Grille Lw to Lp Direct									
Lw grille (dB)	32.8	38.8	50.3	58.3	62.7	60.8	56.8	49.8	From Row A
LPdirect (dB)	25.4	31.9	43.8	52.3	57.0	55.2	51.3	44.3	Row B
	-7.4	-7.0	-6.5	-6.1	-5.6	-5.5	-5.5	-5.5	
Grille Lw to LpRev									
Lw (dB)	32.8	38.8	50.3	58.3	62.7	60.8	56.8	49.8	From Row A
LpRev (dB)	27.5	33.2	44.2	51.7	56.0	53.6	48.9	41.9	Row C
	-5.3	-5.7	-6.1	-6.6	-6.6	-7.2	-7.9	-7.9	
Log Sum									
Result	29.6	35.6	47.0	55.0	59.6	57.5	53.3	46.3	
Internal Receiver Noise									
Internal Receiver Noise - Rear plant space									
Reverberant Field, LPrev	29.6	35.6	47.0	55.0	59.6	57.5	53.3	46.3	

Calculation Sheet

SF1 Inlet to New Vic Apartment Complex

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Inlet								
Noise Levels	108.0	88.0	82.0	79.0	75.0	74.0	71.0	67.0
Silencer								
	-6.0	-10.0	-14.9	-21.1	-23.0	-19.6	-16.1	-9.9
Rect Duct Losses								
	-3.0	-2.0	-1.5	-0.4	-0.3	-0.4	-0.5	-0.5
End Reflection & Directional Directivity								
	-7.5	-3.1	-0.5	0.6	1.2	1.5	1.6	1.6
Dc - Reflections & Directivity								
	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Adiv - Geometrical Divergence								
	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1
Aatm - Atmospheric Absorption								
	0.0	0.0	-0.1	-0.2	-0.3	-0.8	-2.6	-9.4
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
External Receiver								
External Receiver - New Vic Apartment Complex								
Sound Pressure, Lp:	51.4	32.9	24.9	17.9	12.6	14.6	13.4	8.7

Calculation Sheet

EF3 to New Vic Apartment Complex

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF3								
Sound Power Levels	72.0	79.0	75.0	63.0	56.0	51.0	49.0	51.0
Rect Duct Losses								
	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
End Reflection & Directional Directivity								
	-11.8	-6.2	-2.2	-0.1	0.8	1.3	1.5	1.6
Dc - Reflections & Directivity								
	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Adiv - Geometrical Divergence								
	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1
Aatm - Atmospheric Absorption								
	0.0	0.0	-0.1	-0.2	-0.3	-0.8	-2.6	-9.4
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
External Receiver								
External Receiver - New Vic Apartment Complex								
Sound Pressure, Lp:	19.8	32.4	32.3	22.3	16.1	11.1	7.6	2.9

Calculation Sheet

EF1 to New Vic Apartment Complex

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1								
Noise Levels	83.0	79.0	91.0	88.0	90.0	84.0	81.0	78.0
Silencer								
	-6.0	-9.7	-14.0	-19.9	-21.9	-14.9	-11.9	-8.0
Rect Duct Losses								
	-3.0	-2.0	-1.5	-0.5	-0.5	-0.5	-0.5	-0.5
End Reflection & Directional Directivity								
	-7.5	-3.1	-0.5	0.6	1.2	1.5	1.6	1.6
Dc - Reflections & Directivity								
	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Adiv - Geometrical Divergence								
	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1
Aatm - Atmospheric Absorption								
	0.0	0.0	-0.1	-0.2	-0.3	-0.8	-2.6	-9.4
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
External Receiver								
External Receiver - New Vic Apartment Complex								
Sound Pressure, Lp:	26.5	24.1	34.8	28.0	28.4	29.2	27.4	21.7

Calculation Sheet

Rear plant space to New Vic Apartment Complex

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Internal Receiver Noise									
Internal Receiver Noise - Rear plant space									
Total Sound Pressure Level (dB)		73.2	73.9	70.6	67.6	65.6	60.8	56.0	47.1
Diffusivity - Cd									
Levels after Correction		70.2	70.9	67.6	64.6	62.6	57.8	53.0	44.1 Row A
Composite R' of structural elements									
Facade Wall - Eternal facade									
Element Area (m2)	4.0								
Facade Area	6.0								
Glazing -									
Element Area (m2)	5.1								
Door - Louvred Door									
Element Area (m2)	2.0								
Roof/Ceiling -									
Area of Roof (m2)	32.0								
Radiating Lw		65.4	66.1	62.9	59.8	57.8	53.0	48.2	39.4
10 log (S)									
		7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Directivity Correction - Dc									
		-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
Adiv - Geometrical Divergence									
		-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1	-49.1
Aatm - Atmospheric Absorption									
		0.0	0.0	-0.1	-0.2	-0.3	-0.8	-2.6	-9.4
Agr - Ground Attenuation									
		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation									
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
External Receiver									
External Receiver - New Vic Apartment Complex									
Sound Pressure, Lp:		21.6	22.3	19.0	15.8	13.7	8.4	1.7	-13.8

Appendix B

Noise Control Treatments

Attenuator Schedule

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
SF1 Inlet		900L 45% Free Area	6	10	15	22	27	21	17	10
EF1 Discharge		900L 45% Free Area c/w Melinex	6	10	14	20	22	15	12	8

Notes:

1. All dimensions in mm
2. Performance shown as static insertion loss. Dynamic insertion loss performance allowing for airflow generated noise is shown on the relevant calculation sheet.
3. Selections are nominal and the successful supplier should ensure their proposal achieves the minimum required static and dynamic insertion loss performance.