Acoustic Assessment of Proposed New Mechanical Services Equipment

10 Charlotte Street, London W1T 2LT

Client: Julynka

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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 proposed restaurant/bakery, to be installed at 10 Charlotte Street, London W1T 2LT.

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 most sensitive time of the proposed operating hours are LA90 52dB at the monitoring position. Based on London Borough of Camden Council's criteria, noise from the new plant should not exceed a cumulative level of 42dBA outside the closest noise-sensitive windows.

0.4. The most noise-sensitive residential receptors (NSRs) have been assessed as the rear first-floor windows of 10 Charlote Street (NSR1), the rear fourth-floor windows of 10 Charlotte Street (NSR2), and the rear first floor windows of 2 Windmill Street, London W1T 2HX (NSR3).

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 most-affected receptor is LAeq 41dB at the receptor.

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 the London Borough of Camden Council.

1. INTRODUCTION

New mechanical services equipment, associated with a new restaurant/bakery, is to be installed at 10 Charlotte Street, London.

ACA Acoustics Limited has been commissioned by Julynka 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

London Borough of Camden Council's policies relating to noise are set out in Appendix 3 of the Local Plan, which provides detailed noise thresholds to determine the potential acoustic impact of new developments.

In Summary, London Borough of Camden requires an assessment to be carried out in accordance with British Standard 4142:2014+A1:2019.

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 mechanical services equipment 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) *Typically, the greater this 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 relative 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.*

Rather than use the assessment of the impacts from the Standard, Camden requires that the calculated rating level is compared against noise-related conditions set out in Table C of the Appendix, as shown in Table 1 below:

Existing Noise Sensitive Receptor	**Assessment Location**	**Design Period**	**LOAEL (Green)**	**LOAEL to SOAEL (Amber)**	**SOAEL (Red)**
Dwellings	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	Rating level 10dB below background	Rating level between 9dB below and 5dB above background	Rating level greater than 5dB above background
Dwellings	Outside bedroom window (façade)	Night	Rating level 10dB below background and no events exceeding 57dB LAmax	Rating level between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	Rating level greater than 5dB above background and/or events exceeding 88dB LAmax

Table 1: London Borough of Camden Noise Limits

The terms “LOAEL” and “SOAEL” are defined as the “Lowest Observed Adverse Effect Level” and “Significant Observed Adverse Effect Level” in the Planning Practice Guidance – Noise (PPG-N) and Noise Policy Statement for England (NPSE). The NPSE and PPG-N both require that significant adverse impacts are avoided and that where the impact lies somewhere between the LOAEL and SOAEL all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life, whilst considering the guiding principles of sustainable development as set out in the National Planning Policy Framework.

Assessment result criteria shown within Appendix A of Camden’s Local Plan are more stringent than those set out in the British Standard and can therefore be taken to ensure a robust assessment. Compliance with the “Green” criteria or lower half of the “Amber” range will generally ensure no loss of amenity to nearby residents.

In this assessment, a criterion of rating level 10dB below the representative background level will be used where practical.

3. REVIEW OF SITE LOCATION

New mechanical equipment, comprising of supply and extract fans along with two air conditioning condensers are being installed to serve a new restaurant/bakery at 10 Charlotte Street, London. The fans will be installed internally, ducted to outside.

The most noise-sensitive residential receptors (NSR) have been assessed as 1st floor windows to the rear of 10 Charlotte Street (NSR1) and 2 Windmill Street (NSR3), closest to the plant on the flat roof, and top floor windows of 10 Charlotte Street London, W1T 2HX (NSR2), adjacent to the riser discharge.

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

Proposed operating times of the equipment are between 08:00 and 23:00 hours.

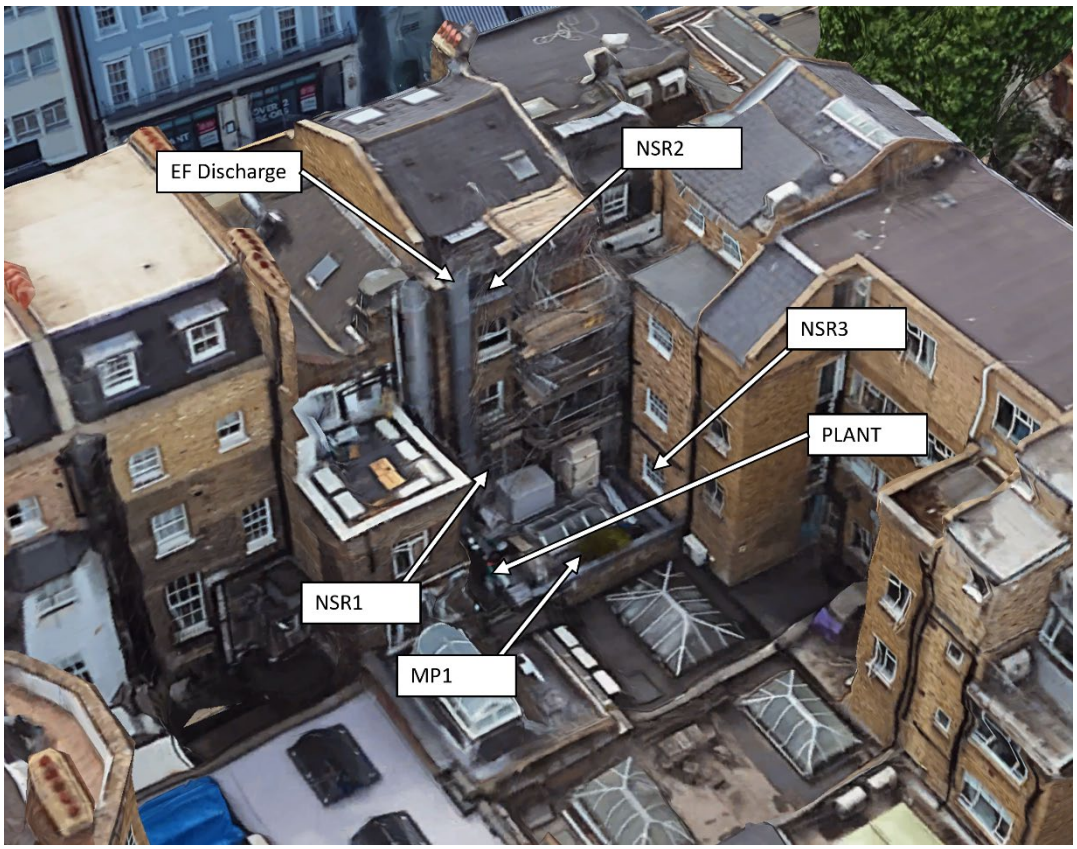


Figure 1: Equipment location, measurement position, and closest receptor (available at google.com/maps)

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 receptors. The survey was set up by Alfie Morgan of ACA Acoustics and conducted between the 8th and 9th January 2024.

The microphone was positioned on the rear flat roof of the site, where the equipment is proposed to be installed and directly beneath the identified receptors.

During the survey, the soundscape in the vicinity was influenced predominantly by existing third-party mechanical services equipment serving other properties 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**
Svantek Class 1 sound level meter type SVAN971 with MOLES weatherproof outdoor environmental kit	84045
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003	83826

Table 2: Equipment used for the sound level survey

Weather conditions at the time of setting up the survey were dry, cold (2°C), and with a 4m/s north-westerly breeze. 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.

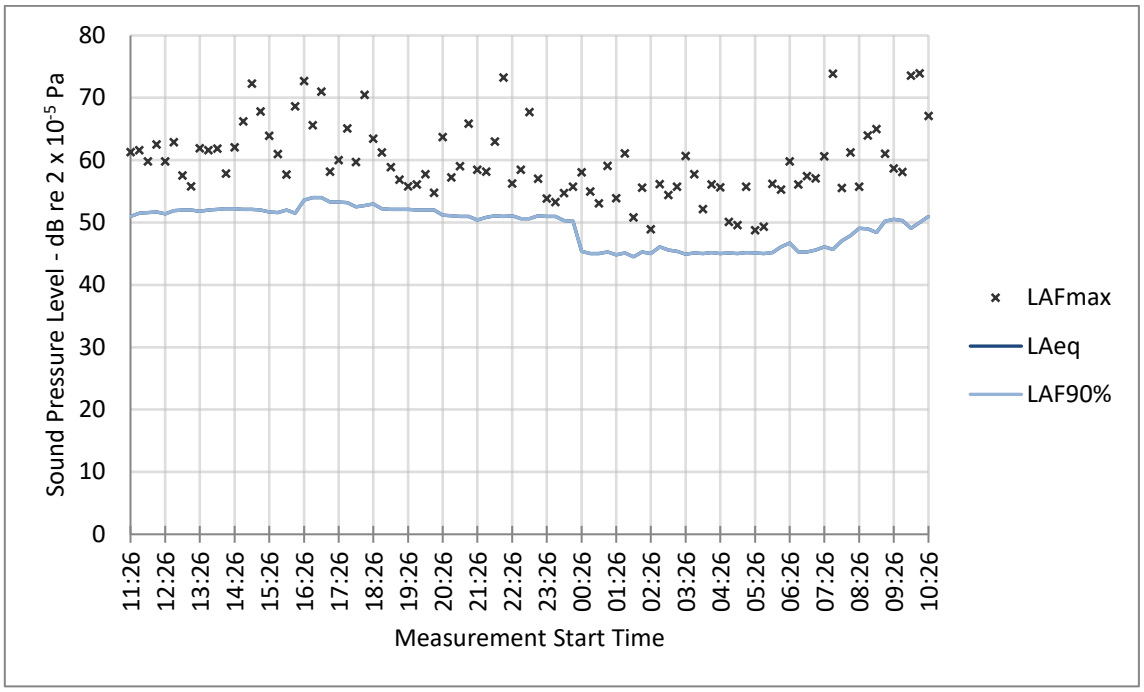


Figure 2: Sound level survey results – 8th to 9th January 2024

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 most sensitive proposed operating times of the equipment is shown in Figure 3 below, following guidance set out in the Standard.

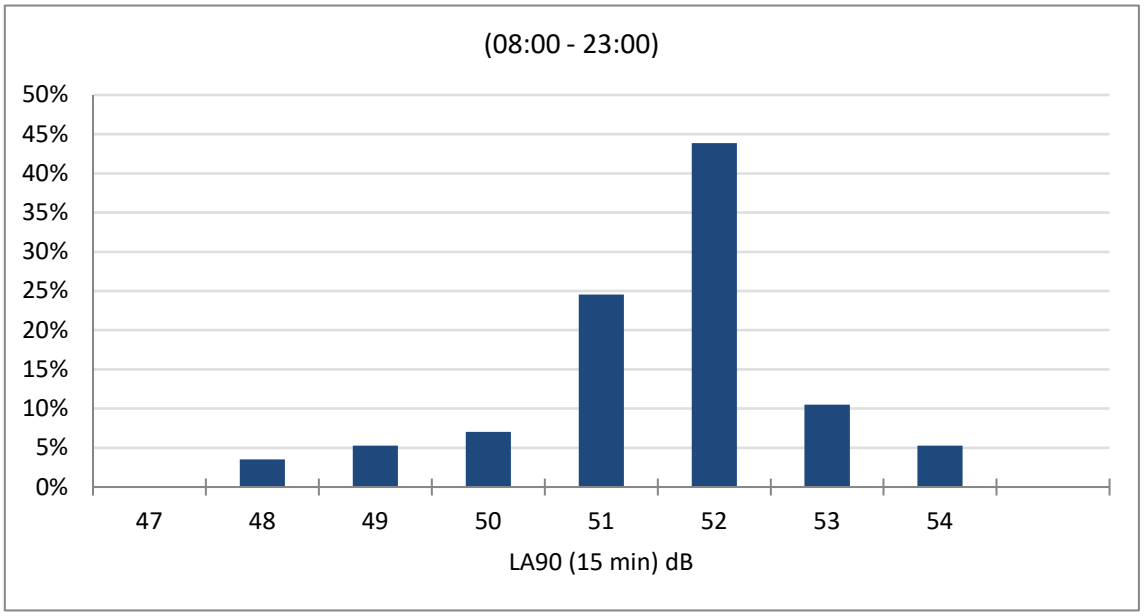


Figure 3: Statistical analysis of measured LA90 sound levels during the assessment period

Based on the statistical analysis of the survey results, the author considers a level of LA90 52dB is representative of the background sound level in the vicinity.

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

Receptor	Period	Background Sound Level During Operating Period - LA90
NSR1-3	08:00 – 23:00	52dB

Table 3: Summary sound level survey results

Based on the above, ACA Acoustics assess that a criterion of 42dBA is required to comply with the requirements of the local authority.

5. ACOUSTIC ASSESSMENT

The development includes the installation of new extract and supply fans along with two air conditioning condensers. 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 Extract	Flakt Woods 31JM/16/2/5/24	0.40	87dB	1
SF1 Supply	Flakt Woods 31JM/16/2/5/24	0.40	86dB	1
CU4	Toshiba RAS-10E22AVG-E	-	62dB	1

Table 4: 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-1059-101-RB-GROUND, as provided by the client.

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)	Camden Council Criteria	Criteria Excess/Margin
NSR1	41dBA	≤42dBA	-1
NSR2	25dBA	≤42dBA	-17
NSR3	39dBA	≤42dBA	-3

Table 5: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Allowing for the mitigation scheme in this report, calculated sound levels are at least 10dBA below the background sound level and achieve the London Borough of Camden Council's planning consent requirements.

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. Duct Mounted Attenuators

The calculation model includes benefit of duct-mounted attenuators to the atmospheric side of the 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 that 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.

The extract fan attenuator is to be installed externally within the riser. It is recommended that the external ductwork up to and including the attenuator is acoustically lagged or constructed with double-skinned casings to control noise breakout.

6.2. High Performance Acoustic Enclosure

It is recommended that the condenser is installed in a high-performance acoustic enclosure such as those supplied by Environ Technologies Limited or equal and approved. Acoustic performance of a suitable enclosure is shown in Appendix B.

6.3. Vibration Isolators

To control the potential for structure-borne noise and vibration from the mechanical equipment affecting adjoining residential and commercial occupants, it is recommended that the plant is installed on vibration isolators.

Vibration isolators for the fans would typically be steel spring type mounts. The isolator supplier would be able to select a suitable model to provide minimum 98% isolation efficiency at the working load and operating speed. Flexible connections should be fitted between the fans and adjoining ductwork both sides.

Suitable vibration isolators for the condensers are typically rubber or neoprene turret type mounts or pads, providing minimum 8mm deflection at the working load. The isolator supplier should ensure their selection is suitable allowing for the condenser operating speed, point load, and installation location.

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical plant and equipment at 10 Charlotte Street, London.

ACA Acoustics have undertaken an assessment of noise from the proposed equipment using manufacturers published acoustic data. Calculated cumulative sound levels for the plant are at least 10dB below the lowest background sound level during proposed operating times of the equipment when assessed at 1m from the closest noise-sensitive windows of residential receptors.

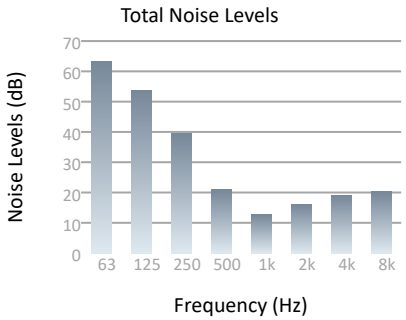
The author considers that allowing for the proposed mitigation scheme in this report, the proposed equipment achieve the Local Authority's planning requirements for this development and will not be detrimental to the amenity of nearby noise-sensitive occupants.

Appendix A

Acoustic Calculations

10 Charlotte Street, London

Project Name	10 Charlotte Street, London
Project Reference	240104
Reference	NSR1
Description	10 Charlotte St - 1st Floor
Noise Limit	42
dBA	41



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Discharge	1	63.1	52.6	37.4	15.7	10.1	14.8	17.6	15.4
SF1 Inlet	1	51.3	47.8	35.2	18.7	8.4	10.2	13.9	18.6
CU4	1	45.4	28.6	18.9	10.9	1.9	-4.2	-7.3	-21.6

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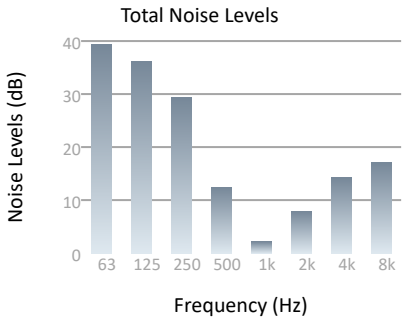
10 Charlotte Street, London

Project Name	10 Charlotte Street, London
Project Reference	240104
Reference	NSR2
Description	10 Charlotte St - Top Floor
Noise Limit	42
dBA	25.2



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Discharge	1	39.3	36.1	29.3	12.4	2.2	7.9	14.2	17.0

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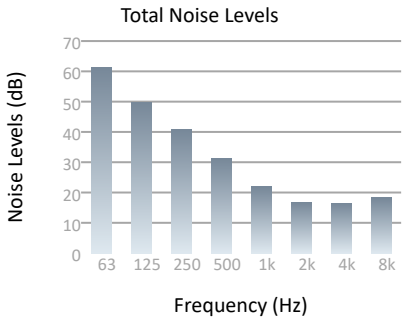
10 Charlotte Street, London

Project Name	10 Charlotte Street, London
Project Reference	240104
Reference	NSR3
Description	2 Windmill St
Noise Limit	42
dBA	39.1



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Discharge	1	52.1	41.6	26.4	4.7	-0.9	3.8	6.5	4.0
SF1 Inlet	1	48.5	46.6	36.5	23.4	10.8	10.3	13.6	18.1
CU4	1	60.5	45.5	38.5	30.5	21.5	15.5	12.5	-1.6

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Calculation Sheet

CU4 to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU4								
Sound Power Levels	**73.0**	**60.0**	**59.0**	**60.0**	**57.0**	**53.0**	**50.0**	**37.0**
Noise Control Treatments								
Treatment - AE1								
	-11.0	*-13.0*	*-19.0*	*-28.0*	*-34.0*	*-36.0*	*-36.0*	*-37.0*
Dc - Condenser Directivity								
	4.5	*2.7*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-24.1	*-24.1*	*-24.1*	*-24.1*	*-24.1*	*-24.1*	*-24.1*	*-24.1*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.5*
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 - NSR1								
Sound Pressure, Lp:	**45.4**	**28.6**	**18.9**	**10.9**	**1.9**	**-4.2**	**-7.3**	**-21.6**

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Calculation Sheet

CU4 to NSR3

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU4								
Sound Power Levels	**73.0**	**60.0**	**59.0**	**60.0**	**57.0**	**53.0**	**50.0**	**37.0**
Noise Control Treatments								
Treatment - AE1								
	-11.0	*-13.0*	*-19.0*	*-28.0*	*-34.0*	*-36.0*	*-36.0*	*-37.0*
Dc - Condenser Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-10.5	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*
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 - NSR3								
Sound Pressure, Lp:	**60.5**	**45.5**	**38.5**	**30.5**	**21.5**	**15.5**	**12.5**	**-1.6**

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Calculation Sheet

EF1 Discharge to NSR2

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Discharge								
Noise Levels	**85.0**	**87.0**	**89.0**	**83.0**	**81.0**	**78.0**	**75.0**	**69.0**
Silencer								
	-13.0	*-23.0*	*-30.0*	*-39.8*	*-47.5*	*-34.9*	*-25.0*	*-16.0*
Rect Duct Losses								
	-0.9	*-0.4*	*-0.6*	*-0.4*	*-0.4*	*-0.4*	*-0.4*	*-0.4*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.8*	*-3.3*	*-4.0*	*-4.0*	*-4.0*
Rect Duct Losses								
	-7.8	*-5.2*	*-3.9*	*-1.3*	*-1.3*	*-1.3*	*-1.3*	*-1.3*
End Reflection & Directional Directivity								
	-9.0	*-6.3*	*-6.2*	*-8.2*	*-11.2*	*-14.5*	*-15.0*	*-15.0*
Dc - Reflections & Directivity								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-18.0	*-18.0*	*-18.0*	*-18.0*	*-18.0*	*-18.0*	*-18.0*	*-18.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.3*
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 - NSR2								
Sound Pressure, Lp:	**39.3**	**36.1**	**29.3**	**12.4**	**2.2**	**7.9**	**14.2**	**17.0**

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Calculation Sheet

EF1 Discharge to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Discharge								
Noise Levels	**85.0**	**87.0**	**89.0**	**83.0**	**81.0**	**78.0**	**75.0**	**69.0**
Silencer								
	-13.0	*-23.0*	*-30.0*	*-39.8*	*-47.5*	*-34.9*	*-25.0*	*-16.0*
Rect Duct Losses								
	-0.9	*-0.4*	*-0.6*	*-0.4*	*-0.4*	*-0.4*	*-0.4*	*-0.4*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.8*	*-3.3*	*-4.0*	*-4.0*	*-4.0*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.3*	*-2.7*	*-3.9*	*-4.0*	*-4.0*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.9*	*-3.9*	*-4.0*	*-4.0*	*-4.0*
Duct Break-Out								
	-6.0	*-6.0*	*-7.0*	*-8.0*	*-11.0*	*-14.0*	*-18.0*	*-23.0*
ISO 9613 Calculation								
	-2.0	*-2.0*	*-2.0*	*-2.0*	*-2.0*	*-2.0*	*-2.0*	*-2.1*
ISO 9613 Barrier Attenuation								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver								
External Receiver - NSR1								
Sound Pressure, Lp:	**63.1**	**52.6**	**37.4**	**15.7**	**10.1**	**14.8**	**17.6**	**15.4**

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Calculation Sheet

SF1 Inlet to NSR1

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Inlet								
Sound Power Levels	**83.0**	**86.0**	**86.0**	**82.0**	**81.0**	**77.0**	**73.0**	**68.0**
Silencer								
	-8.0	*-14.0*	*-22.0*	*-29.9*	*-39.5*	*-33.7*	*-25.9*	*-16.0*
Rect Duct Losses								
	-0.9	*-0.4*	*-0.6*	*-0.4*	*-0.4*	*-0.4*	*-0.4*	*-0.4*
Bend Loss								
	-1.0	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
Bend Loss								
	-1.0	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
End Reflection & Directional Directivity								
	-9.2	*-8.2*	*-10.5*	*-15.3*	*-15.1*	*-15.0*	*-15.0*	*-15.0*
Dc - Reflections & Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-20.7	*-20.7*	*-20.7*	*-20.7*	*-20.7*	*-20.7*	*-20.7*	*-20.7*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*
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 - NSR1								
Sound Pressure, Lp:	**51.3**	**47.8**	**35.2**	**18.7**	**8.4**	**10.2**	**13.9**	**18.6**

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Calculation Sheet

EF1 Discharge to NSR3

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Discharge								
Noise Levels	**85.0**	**87.0**	**89.0**	**83.0**	**81.0**	**78.0**	**75.0**	**69.0**
Silencer								
	-13.0	*-23.0*	*-30.0*	*-39.8*	*-47.5*	*-34.9*	*-25.0*	*-16.0*
Rect Duct Losses								
	-0.9	*-0.4*	*-0.6*	*-0.4*	*-0.4*	*-0.4*	*-0.4*	*-0.4*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.8*	*-3.3*	*-4.0*	*-4.0*	*-4.0*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.3*	*-2.7*	*-3.9*	*-4.0*	*-4.0*
Bend Loss								
	0.0	*-1.0*	*-4.0*	*-5.9*	*-3.9*	*-4.0*	*-4.0*	*-4.0*
Duct Break-Out								
	-3.0	*-3.0*	*-4.0*	*-5.0*	*-8.0*	*-11.0*	*-15.0*	*-20.0*
ISO 9613 Calculation								
	-16.0	*-16.0*	*-16.0*	*-16.0*	*-16.0*	*-16.0*	*-16.1*	*-16.6*
ISO 9613 Barrier Attenuation								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver								
External Receiver - NSR3								
Sound Pressure, Lp:	**52.1**	**41.6**	**26.4**	**4.7**	**-0.9**	**3.8**	**6.5**	**4.0**

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Calculation Sheet

SF1 Inlet to NSR3

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Inlet								
Sound Power Levels	**83.0**	**86.0**	**86.0**	**82.0**	**81.0**	**77.0**	**73.0**	**68.0**
Silencer								
	-8.0	*-14.0*	*-22.0*	*-29.9*	*-39.5*	*-33.7*	*-25.9*	*-16.0*
Rect Duct Losses								
	-0.9	*-0.4*	*-0.6*	*-0.4*	*-0.4*	*-0.4*	*-0.4*	*-0.4*
Bend Loss								
	-1.0	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
Bend Loss								
	-1.0	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
End Reflection & Directional Directivity								
	-7.6	*-5.0*	*-4.8*	*-6.2*	*-8.3*	*-10.5*	*-10.9*	*-10.9*
Dc - Reflections & Directivity								
	6.0	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*	*6.0*
Adiv - Geometrical Divergance								
	-25.0	*-25.0*	*-25.0*	*-25.0*	*-25.0*	*-25.0*	*-25.0*	*-25.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.2*	*-0.6*
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 - NSR3								
Sound Pressure, Lp:	**48.5**	**46.6**	**36.5**	**23.4**	**10.8**	**10.3**	**13.6**	**18.1**

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Appendix B

Noise Control Treatments

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
ATT1-EF1	EF1 Discharge	500H x 500W x 1500L 35% Free Area c/w Melinex	13	23	30	40	49	35	25	16
ATT2-SF1	SF1 Inlet Primary	600W x 350H x 900L 35% Free Area	8	14	22	30	40	34	26	16
AE1	CU4 Condenser	Environ Lite Acoustic Enclosure	11	13	19	28	34	36	36	37

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