Acoustic assessment of proposed new mechanical services equipment

Ottolenghi, 32-34 Rosslyn Hill, Hampstead NW3 1NH

Client: Ottolenghi

Report Reference: 220920-R001D

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CONTENTS

0. SUMMARY

0.1. ACA Acoustics Limited has been commissioned to assess the acoustic impact of proposed new and replacement mechanical services equipment to be installed at 32-34 Rosslyn Hill, Hampstead.

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 previously been carried out by Bickerdike Allen Partners at the site to establish existing background sound levels. The background sound levels at the monitoring position during the most sensitive time of the proposed restaurant operating hours are LA90 44dB.

0.4. The nearest and most sensitive residential receptors have been identified as the upper rear windows of 32 Rosslyn Hill (NSR1) and 2A Pilgrims Lane (NSR2).

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 criteria of LAeq 34dB at the receptors.

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 Camden Borough Council.

1. INTRODUCTION

New mechanical equipment is to be installed for a new Ottolenghi restaurant premises to be located at 32-34 Rosslyn Hill, Hampstead.

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.

Revision D of the report includes amended air conditioning condenser models and an associated acoustic enclosure.

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.

3. REVIEW OF SITE LOCATION

New mechanical equipment, including ventilation fans, AC condensers and a catering condenser, is being installed to the rear flat roof of the premises. The nearest and most sensitive residential receptors have been identified as the upper rear windows of 32 Rosslyn Hill (NSR1) and 2A Pilgrims Lane (NSR2). Each receptor has differing amounts of screening and distance losses for the various items of equipment.

Figure 1 below shows the location of the proposed equipment, receptors, and background survey measurement position.

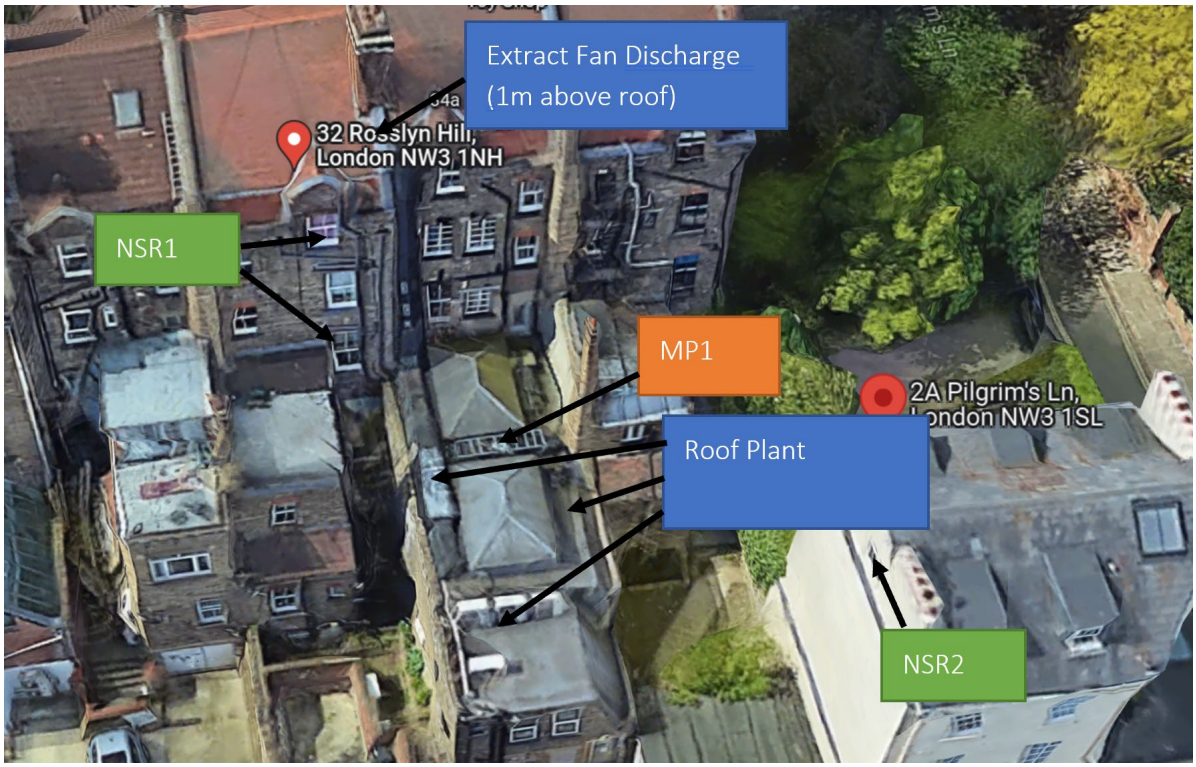


Figure 1: Aerial photograph showing equipment location and most noise-sensitive receptor (available at www.google.com/maps)

Proposed operating times of the equipment are to be between the hours of 06:00 – 00:00. However, the catering condenser will continue to run 24/7 as required by the load on the system.

4. BACKGROUND SOUND LEVEL SURVEY

The background level survey was undertaken by Bickerdike Allen Partners between the 19th – 20th July 2021 at the position indicated in Figure 1 above. The criteria has been derived by using a value of 10dB below the measured LA90. This achieves the green criteria according to the Local Authority guidance and therefore ensures a high level of protection of amenity for neighbouring residents.

The pertinent results of the survey are summarised in Table 2 below, taken from Bickerdike Allen Partners' report reference A11414_01_RP001_2.0 dated 8th September 2021, provided to ACA Acoustics by the client.

Receptor	Period	Background Sound Level During Operating Period LA90	Criteria LAr
NSR1/2	Restaurant Opening Hours (06:00 – 00:00)	44dB	34dB
NSR1/2	Night-time	44dB	34dB

Table 2: Summary sound level survey results

Background sound levels remain very consistent from the early night-time period (23:00 – 00:00) and throughout the night. As such, complying with the criteria for all plant operating during restaurant trading hours will naturally ensure that the catering condenser operating on its own overnight achieve the required limits.

5. ACOUSTIC ASSESSMENT

The development includes the installation of new extract and supply fans, 2 x AC condensers and 1 x catering condenser. Location of the equipment, used in the assessment, is shown in Spiritus Technical Services' drawings reference STS0870-M07A, M08B, and M09B.

Confirmation of the equipment models used in the assessment is provided in Table 3 below.

Description	Equipment Model	Airflow (m^3/s)	Sound Power (Lw)	Quantity
Kitchen Supply Fan (SF1)	SystemAir MUB062 560EC	1.7	83dBA	1
Kitchen Extract Fan (EF1)	SystemAir MUB062 560EC	2.0	86dBA	1
WC Extract Fan (TF1)	Systemair Prio200 EC	0.15	72dBA	1

Description	Equipment Model	Airflow (m^3/s)	Sound Power (Lw)	Quantity
AC Condenser (CU1)	Daikin RZA250D	N/A	79dBA	3
Catering Condenser (CU2)	Danfoss OP-MSBM034	N/A	67dBA	1
AC Condenser (CU3)	Daikin RZASG125MV1	N/A	71dBA	1

Table 3: Proposed new mechanical equipment used in the assessment

Sound emissions from the mechanical equipment can be determined from manufacturer's 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 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.

Note that only the catering condenser is running after 00:00 as such this is the only contributor to the night-time calculated level.

Receptor Location	Period	Calculated Cumulative Equipment Sound Level
NSR1 – Rosslyn Hill	Day	33dBA
	Night	18dBA
NSR2 – Pilgrims Lane	Day	33dBA
	Night	20dBA

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

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

Description	NSR1/2 Day	NSR1/2 Night	Relevant Clause	Commentary
Calculated specific sound level to receptor	LAeq 33dB	LAeq 20dB	7.1 7.3.6	New equipment operating. Refer to calculation sheets in Appendix A.
Background sound level	LA90 44dB	LA90 44dB	8.1.3 8.3	Measured representative background sound level.
Residual sound level	LAeq 54dB	LAeq 49dB	7.3.3	Measured residual sound level.
Acoustic feature correction	0dB	0dB	9.2	The calculated specific sound levels do not indicate any tonal component. The equipment will be at least 10dBA below the background sound level and significantly below the residual sound level. Noise from the equipment should not be clearly distinguishable to nearby receptors and no feature correction is required.
Rating level	LAr 33dB	LAr 20dB	9.2	
Excess of rating level over background sound level	**-11dB**	**-24dB**	**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 at least 11dB 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 18dBA (33dBA – 15dBA). This is significantly below guideline levels for a good standard of amenity inside living rooms and bedrooms of LAeq 35dB during the daytime and LAeq 30dB overnight, set out in BS 8233:2014. This 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.

6.1. Duct Mounted Attenuators

The calculation model includes benefit of duct-mounted attenuators to each of the fans. A 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.

6.2. Acoustic Enclosure for Condenser Units

The two AC condensing units and single catering condenser should be installed in an acoustic enclosure. The enclosure should provide the minimum insertion loss performance as shown in Table 6 below. This would typically be achieved using Noico's 300mm HP acoustic louvres or equivalent, although the enclosure supplier should confirm their design will meet the specified minimum insertion loss performance.

Minimum sound reduction of acoustic enclosure (dB)							
63Hz	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
6	7	12	20	26	28	23	21

Table 6: Minimum insertion loss performance of the condenser acoustic enclosure

6.3. Ventilation Fans Acoustic Panelled Enclosures

It is advised that the main supply and extract fans are housed within acoustic enclosures.

The supply fan should be installed within an acoustic enclosure. A suitable enclosure would typically be formed from 50mm thick acoustic panels incorporating 18swg steel outer casing, 50mm mineral wool insulation and perforated steel inner casing. The enclosure should be enlarged such that the flexible connections and any transformation sections between the fan and attenuator are housed internally within the enclosure. Apertures in the panels where the duct penetrates the enclosure should be sealed airtight with foam strips and a non-hardening flexible mastic.

The existing extract fan which is to be replaced is currently housed within an acoustic enclosure. Where the existing enclosure complies with the above specification it would be acceptable for this to be retained.

6.4. Vibration Isolators

The equipment will be indirectly structurally connected to residential receptors in the adjacent building. To control the potential for vibration or structure-borne noise, it is recommended that it is installed on vibration isolators.

Suitable isolators for the fans would typically comprise steel spring type mounts providing nominally 25mm deflection at the working load. Flexible connections would be installed between the fan and adjoining ductwork both sides.

The condensers should be installed on rubber or neoprene turret-type isolators or vibration isolating pads.

7. CONCLUSION

This report accompanies the planning application submitted on behalf of Ottolenghi for the installation of new and replacement mechanical plant and equipment for a new restaurant premises at 32-34 Rosslyn Hill, Hampstead.

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.

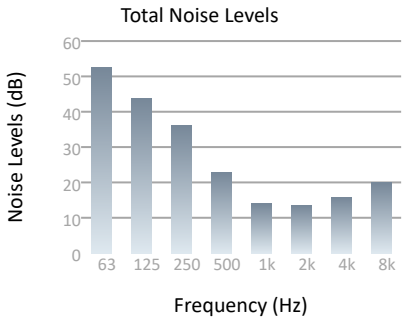
The author considers that allowing for the proposed mitigation scheme in this report, the proposed condensers and ventilation equipment achieve the Local Authority's planning requirements for this development and will not be detrimental to the amenity of nearby residential occupants.

Appendix A

Acoustic Calculations

Ottolenghi Rosslyn Hill

Project Name	Ottolenghi Rosslyn Hill
Project Reference	220920
Reference	R1 - 32 Rosslyn Hill
Description	32 Rosslyn Hill
Noise Limit	34
dBA	33



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Kitchen Extract Fan	1	36	28	21	10	8	12	15	20
EF1 Kitchen Extract Fan Duct	1	41	29	24	11	6	3	0	4
EF1 Breakout	1	37	33	30	3	-5	-9	-17	-23
SF1 Kitchen Supply Fan	1	31	17	5	3	1	0	-1	0
SF1 Breakout	1	35	33	28	1	-7	-11	-18	-24
TF1 WC Extract Fan	1	26	23	10	2	-8	-5	-2	1
CU1	1	52	42	33	21	10	3	2	-3
CU3	1	33	30	23	13	1	-5	-6	-11
CU2	1	34	32	22	8	-2	-10	-10	-17

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Calculation Sheet

EF1 Kitchen Extract Fan to R1 - 32 Rosslyn Hill

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF1 Kitchen Extract Fan									
Sound Power Levels		**82.0**	**81.0**	**86.0**	**83.0**	**82.0**	**77.0**	**74.0**	**71.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT1-EF1									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	45.0								
Face Velocity (m/s)	6.6								
		-12.0	*-20.7*	*-28.8*	*-36.9*	*-38.2*	*-28.8*	*-22.6*	*-15.0*
Bend Loss									
		-1.0	*-2.0*	*-3.0*	*-2.7*	*-2.6*	*-2.9*	*-3.0*	*-3.0*
Rect Duct Losses									
		-6.0	*-4.0*	*-3.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*
End Reflection									
		-6.9	*-3.1*	*-1.1*	*-0.3*	*-0.1*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
		-2.9	*-6.2*	*-11.7*	*-15.0*	*-15.0*	*-15.0*	*-15.0*	*-15.0*
ISO 9613 Environmental Corrections									
		-17.0	*-17.0*	*-17.0*	*-17.0*	*-17.0*	*-17.1*	*-17.1*	*-17.4*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R1 - 32 Rosslyn Hill									
Sound Pressure, Lp:		**36.2**	**27.9**	**21.4**	**10.2**	**8.1**	**12.2**	**15.3**	**19.7**

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Calculation Sheet

EF1 Kitchen Extract Fan Duct to R1 - 32 Rosslyn Hill

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF1 Kitchen Extract Fan Duct									
Sound Power Levels		**82.0**	**81.0**	**86.0**	**83.0**	**82.0**	**77.0**	**74.0**	**71.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT1-EF1									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	45.0								
Face Velocity (m/s)	6.6								
		-12.0	*-20.7*	*-28.8*	*-36.9*	*-38.2*	*-28.8*	*-22.6*	*-15.0*
Rect Duct Losses									
		-3.0	*-2.0*	*-1.5*	*-0.5*	*-0.5*	*-0.5*	*-0.5*	*-0.5*
Duct Break-Out									
		-8.3	*-11.3*	*-14.3*	*-17.3*	*-19.3*	*-27.3*	*-33.3*	*-33.3*
ISO 9613 Calculation									
		-14.5	*-14.5*	*-14.5*	*-14.5*	*-14.6*	*-14.6*	*-14.6*	*-14.9*
ISO 9613 Barrier Attenuation									
		-3.0	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
External Receiver									
External Receiver - R1 - 32 Rosslyn Hill									
Sound Pressure, Lp:		**41.2**	**29.4**	**23.8**	**10.8**	**6.5**	**2.8**	**0.0**	**4.3**

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Calculation Sheet

EF1 Breakout to R1 - 32 Rosslyn Hill

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Breakout								
-	**64.0**	**68.0**	**74.0**	**54.0**	**54.0**	**51.0**	**45.0**	**38.0**
Enclosure								
	-3.0	*-10.3*	*-20.1*	*-27.0*	*-35.0*	*-36.0*	*-37.9*	*-35.8*
Dc - Directivity								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-27.3	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.8*
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 - R1 - 32 Rosslyn Hill								
Sound Pressure, Lp:	**36.7**	**33.4**	**29.7**	**2.7**	**-5.3**	**-9.3**	**-17.4**	**-22.8**

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Calculation Sheet

SF1 Kitchen Supply Fan to R1 - 32 Rosslyn Hill

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - SF1 Kitchen Supply Fan									
Sound Power Levels		**79.0**	**78.0**	**83.0**	**80.0**	**79.0**	**74.0**	**71.0**	**67.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT2-SF1									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	35.0								
Face Velocity (m/s)	7.2								
		-11.9	*-20.3*	*-32.0*	*-34.4*	*-34.7*	*-30.7*	*-28.4*	*-22.6*
Bend Loss									
		-1.0	*-4.0*	*-6.0*	*-3.9*	*-3.9*	*-3.9*	*-4.0*	*-4.0*
End Reflection									
		-5.9	*-2.5*	*-0.8*	*-0.2*	*-0.1*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
		-5.0	*-10.3*	*-15.0*	*-15.0*	*-15.0*	*-15.0*	*-15.0*	*-15.0*
ISO 9613 Environmental Corrections									
		-23.9	*-24.0*	*-24.0*	*-24.0*	*-24.0*	*-24.0*	*-24.2*	*-25.0*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R1 - 32 Rosslyn Hill									
Sound Pressure, Lp:		**31.2**	**16.9**	**5.3**	**2.5**	**1.3**	**0.3**	**-0.6**	**0.5**

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Calculation Sheet

SF1 Breakout to R1 - 32 Rosslyn Hill

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Breakout								
-	**62.0**	**67.0**	**72.0**	**52.0**	**52.0**	**49.0**	**44.0**	**36.0**
Enclosure								
	-3.0	*-10.3*	*-20.1*	*-27.0*	*-35.0*	*-36.0*	*-37.9*	*-35.8*
Dc - Directivity								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-26.6	*-26.6*	*-26.6*	*-26.6*	*-26.6*	*-26.6*	*-26.6*	*-26.6*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.7*
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 - R1 - 32 Rosslyn Hill								
Sound Pressure, Lp:	**35.4**	**33.1**	**28.3**	**1.4**	**-6.7**	**-10.7**	**-17.7**	**-24.1**

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Calculation Sheet

TF1 WC Extract Fan to R1 - 32 Rosslyn Hill

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - TF1 WC Extract Fan									
-		**70.0**	**70.0**	**65.0**	**70.0**	**67.0**	**63.0**	**60.0**	**56.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT3-TF1									
Width (m)	0.4								
Height (m)	0.4								
% Free Area (%)	40.0								
Face Velocity (m/s)	2.3								
		-6.0	*-11.0*	*-18.0*	*-26.0*	*-34.0*	*-27.0*	*-21.0*	*-13.0*
End Reflection									
		-11.8	*-6.9*	*-3.1*	*-1.1*	*-0.3*	*-0.1*	*0.0*	*0.0*
External Grille Directivity									
		-0.5	*-3.8*	*-8.2*	*-15.0*	*-15.0*	*-15.0*	*-15.0*	*-15.0*
ISO 9613 Environmental Corrections									
		-25.7	*-25.7*	*-25.7*	*-25.7*	*-25.7*	*-25.8*	*-26.0*	*-26.9*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R1 - 32 Rosslyn Hill									
Sound Pressure, Lp:		**26.0**	**22.6**	**10.0**	**2.2**	**-8.0**	**-4.9**	**-2.0**	**1.1**

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Calculation Sheet

CU1 to R1 - 32 Rosslyn Hill

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU1								
Sound Power Levels	**88.0**	**81.0**	**79.0**	**78.0**	**74.0**	**69.0**	**63.0**	**57.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-1.4	*-3.1*	*-5.2*	*-7.5*	*-9.0*	*-9.0*	*-9.0*	*-9.0*
Adiv - Geometrical Divergance								
	-32.0	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.3*
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 - R1 - 32 Rosslyn Hill								
Sound Pressure, Lp:	**51.5**	**41.8**	**32.7**	**21.5**	**9.9**	**2.8**	**1.6**	**-3.4**

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Calculation Sheet

CU2 to R1 - 32 Rosslyn Hill

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU2								
Sound Power Levels	**70.0**	**71.0**	**68.0**	**65.0**	**62.0**	**56.0**	**51.0**	**43.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-1.4	*-3.1*	*-5.2*	*-7.5*	*-9.0*	*-9.0*	*-9.0*	*-9.0*
Adiv - Geometrical Divergance								
	-32.0	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.3*
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 - R1 - 32 Rosslyn Hill								
Sound Pressure, Lp:	**33.5**	**31.8**	**21.7**	**8.5**	**-2.1**	**-10.2**	**-10.4**	**-17.4**

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Calculation Sheet

CU3 to R1 - 32 Rosslyn Hill

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU3								
Sound Power Levels	**70.0**	**70.0**	**70.0**	**71.0**	**65.0**	**61.0**	**55.0**	**49.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-1.8	*-3.8*	*-6.4*	*-9.0*	*-9.0*	*-9.0*	*-9.0*	*-9.0*
Adiv - Geometrical Divergance								
	-32.0	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.3*
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 - R1 - 32 Rosslyn Hill								
Sound Pressure, Lp:	**33.1**	**30.1**	**22.6**	**12.9**	**0.9**	**-5.2**	**-6.4**	**-11.4**

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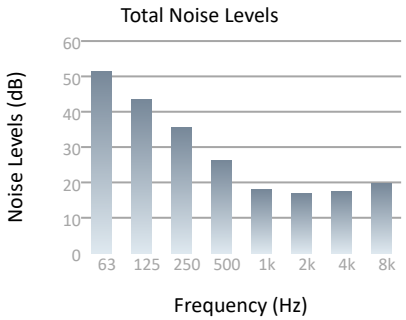
Ottolenghi Rosslyn Hill

Project Name	Ottolenghi Rosslyn Hill
Project Reference	220920
Reference	R2 - 2A Pilgrims Lane
Description	2A Pilgrims Lane
Noise Limit	34
dBA	33



Calculated Lp at Receptor

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Kitchen Extract Fan	1	21	15	12	1	-5	-4	-1	2
EF1 Breakout	1	30	27	23	-4	-12	-16	-24	-30
TF1 WC Extract Fan	1	28	29	20	19	9	12	15	18
SF1 Kitchen Supply Fan	1	36	26	19	16	15	14	14	14
SF1 Breakout	1	29	27	22	-5	-13	-17	-24	-31
CU1	1	51	42	34	23	12	4	3	-2
CU3	1	35	33	27	18	5	-2	-3	-8
CU2	1	34	33	24	12	1	-8	-8	-15

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Calculation Sheet

EF1 Kitchen Extract Fan to R2 - 2A Pilgrims Lane

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF1 Kitchen Extract Fan									
Sound Power Levels		**82.0**	**81.0**	**86.0**	**83.0**	**82.0**	**77.0**	**74.0**	**71.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT1-EF1									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	45.0								
Face Velocity (m/s)	6.6								
		-12.0	*-20.7*	*-28.8*	*-36.9*	*-38.2*	*-28.8*	*-22.6*	*-15.0*
Bend Loss									
		-2.0	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
Rect Duct Losses									
		-6.0	*-4.0*	*-3.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*	*-1.0*
End Reflection									
		-6.9	*-3.1*	*-1.1*	*-0.3*	*-0.1*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
		-1.2	*-2.8*	*-5.5*	*-8.6*	*-12.0*	*-15.0*	*-15.0*	*-15.0*
ISO 9613 Environmental Corrections									
		-32.6	*-32.6*	*-32.6*	*-32.7*	*-32.7*	*-32.8*	*-33.2*	*-34.6*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R2 - 2A Pilgrims Lane									
Sound Pressure, Lp:		**21.3**	**14.7**	**12.0**	**0.6**	**-4.9**	**-3.6**	**-0.8**	**2.4**

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Calculation Sheet

EF1 Breakout to R2 - 2A Pilgrims Lane

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Breakout								
-	**64.0**	**68.0**	**74.0**	**54.0**	**54.0**	**51.0**	**45.0**	**38.0**
Enclosure								
	-3.0	*-10.3*	*-20.1*	*-27.0*	*-35.0*	*-36.0*	*-37.9*	*-35.8*
Dc - Directivity								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-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								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver								
External Receiver - R2 - 2A Pilgrims Lane								
Sound Pressure, Lp:	**30.1**	**26.8**	**23.0**	**-3.9**	**-11.9**	**-16.0**	**-24.2**	**-30.3**

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Calculation Sheet

SF1 Kitchen Supply Fan to R2 - 2A Pilgrims Lane

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - SF1 Kitchen Supply Fan									
Sound Power Levels		**79.0**	**78.0**	**83.0**	**80.0**	**79.0**	**74.0**	**71.0**	**67.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT2-SF1									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	35.0								
Face Velocity (m/s)	7.2								
		-11.9	*-20.3*	*-32.0*	*-34.4*	*-34.7*	*-30.7*	*-28.4*	*-22.6*
Bend Loss									
		-1.0	*-4.0*	*-6.0*	*-3.9*	*-3.9*	*-3.9*	*-4.0*	*-4.0*
End Reflection									
		-5.0	*-2.0*	*-0.6*	*-0.2*	*-0.1*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
		0.9	*0.9*	*1.0*	*1.2*	*1.5*	*1.6*	*1.6*	*1.6*
ISO 9613 Environmental Corrections									
		-26.3	*-26.3*	*-26.3*	*-26.4*	*-26.4*	*-26.4*	*-26.7*	*-27.7*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R2 - 2A Pilgrims Lane									
Sound Pressure, Lp:		**35.6**	**26.3**	**19.1**	**16.4**	**15.4**	**14.5**	**13.5**	**14.3**

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Calculation Sheet

SF1 Breakout to R2 - 2A Pilgrims Lane

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - SF1 Breakout								
-	**62.0**	**67.0**	**72.0**	**52.0**	**52.0**	**49.0**	**44.0**	**36.0**
Enclosure								
	-3.4	*-10.6*	*-20.2*	*-27.0*	*-35.0*	*-36.0*	*-37.9*	*-35.8*
Dc - Directivity								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Adiv - Geometrical Divergance								
	-32.6	*-32.6*	*-32.6*	*-32.6*	*-32.6*	*-32.6*	*-32.6*	*-32.6*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.4*
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 - R2 - 2A Pilgrims Lane								
Sound Pressure, Lp:	**29.0**	**26.8**	**22.2**	**-4.7**	**-12.7**	**-16.8**	**-24.0**	**-30.9**

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Calculation Sheet

TF1 WC Extract Fan to R2 - 2A Pilgrims Lane

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - TF1 WC Extract Fan									
-		**70.0**	**70.0**	**65.0**	**70.0**	**67.0**	**63.0**	**60.0**	**56.0**
Silencer									
Silencer Type - Rectangular									
Silencer Reference - ATT3-TF1									
Width (m)	0.4								
Height (m)	0.4								
% Free Area (%)	40.0								
Face Velocity (m/s)	2.3								
		-6.0	*-11.0*	*-18.0*	*-26.0*	*-34.0*	*-27.0*	*-21.0*	*-13.0*
End Reflection									
		-11.8	*-6.9*	*-3.1*	*-1.1*	*-0.3*	*-0.1*	*0.0*	*0.0*
External Grille Directivity									
		0.0	*0.5*	*0.6*	*0.4*	*0.4*	*0.4*	*0.3*	*0.3*
ISO 9613 Environmental Corrections									
		-24.1	*-24.1*	*-24.1*	*-24.1*	*-24.1*	*-24.2*	*-24.4*	*-25.2*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - R2 - 2A Pilgrims Lane									
Sound Pressure, Lp:		**28.1**	**28.5**	**20.3**	**19.2**	**8.9**	**12.1**	**14.9**	**18.1**

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Calculation Sheet

CU1 to R2 - 2A Pilgrims Lane

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU1								
Sound Power Levels	**88.0**	**81.0**	**79.0**	**78.0**	**74.0**	**69.0**	**63.0**	**57.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-0.7	*-1.8*	*-3.1*	*-4.4*	*-5.8*	*-6.5*	*-6.5*	*-6.5*
Adiv - Geometrical Divergance								
	-33.3	*-33.3*	*-33.3*	*-33.3*	*-33.3*	*-33.3*	*-33.3*	*-33.3*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.5*
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 - R2 - 2A Pilgrims Lane								
Sound Pressure, Lp:	**51.0**	**41.9**	**33.6**	**23.2**	**11.9**	**4.1**	**2.8**	**-2.3**

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Calculation Sheet

CU2 to R2 - 2A Pilgrims Lane

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU2								
Sound Power Levels	**70.0**	**71.0**	**68.0**	**65.0**	**62.0**	**56.0**	**51.0**	**43.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-0.7	*-1.8*	*-3.1*	*-4.4*	*-5.8*	*-6.5*	*-6.5*	*-6.5*
Adiv - Geometrical Divergance								
	-32.0	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*	*-32.0*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.4*	*-1.3*
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 - R2 - 2A Pilgrims Lane								
Sound Pressure, Lp:	**34.3**	**33.2**	**23.9**	**11.6**	**1.2**	**-7.6**	**-7.9**	**-14.8**

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Calculation Sheet

CU3 to R2 - 2A Pilgrims Lane

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU3								
Sound Power Levels	**70.0**	**70.0**	**70.0**	**71.0**	**65.0**	**61.0**	**55.0**	**49.0**
Noise Control Treatments								
	-6.0	*-7.0*	*-12.0*	*-20.0*	*-26.0*	*-28.0*	*-23.0*	*-21.0*
Dc - Condenser Directivity								
	-0.7	*-1.8*	*-3.1*	*-4.4*	*-5.8*	*-6.5*	*-6.5*	*-6.5*
Adiv - Geometrical Divergance								
	-31.3	*-31.3*	*-31.3*	*-31.3*	*-31.3*	*-31.3*	*-31.3*	*-31.3*
Aatm - Atmospheric Absorption								
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.3*	*-1.2*
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 - R2 - 2A Pilgrims Lane								
Sound Pressure, Lp:	**35.1**	**33.0**	**26.6**	**18.3**	**4.9**	**-1.9**	**-3.1**	**-8.0**

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Appendix B

Noise Control Treatments

Ottolenghi Rosslyn Hill

Attenuator Schedule

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
ATT1-EF1	Kitchen Extract Fan Atmos. Side	2400L x 820W x 820H - 45% Free Area c/w Melinex	12	21	29	41	46	30	23	15
ATT2-SF1	Kitchen Supply Fan Atmos. Side	1200L1 x 1500L2 x 820W x 820H - 35% Free Area	12	21	33	45	55	51	39	23
ATT3-TF1	WC Extract Fan Atmos. Side	900L x 400W x 400H - 40% Free Area	6	11	18	26	34	27	21	13

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.

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Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
Acoustic Enclosure	Supply Fan	50mm Thick Panel Enclosure	13	17	24	30	38	39	41	39
Acoustic Louvres 300	All Condensers	Noico 300mm HP Acoustic Louvred Enclosure	6	7	12	20	26	28	23	21

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