Cole Jarman

Retail Unit R02, Centre Point

Plant Noise Assessment

Report 18/0303/R1

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Plant Noise Assessment

Report 18/0303/R1

StreatMarket

c/o Morgan Carr
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0	1st Issue	26 October 2018	Adam Sharpe	Neil Jarman
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Plant Noise Assessment

1 Introduction

1.1 A new theatre food market is to be created in units R01 and R02 at the Centre Point Link, London. In order to satisfy the requirement of Conditions 17 and 19 attached to planning permission ref: 2017/09941P, it is necessary to conduct an assessment of the development's mechanical services installation.

1.2 Planning Condition 17 states the necessity for full details of the proposed mechanical services scheme, including manufacturers specifications, noise levels and attenuation to be submitted and approved by the Local Planning Authority.

1.3 Planning Condition 19 also relates to mechanical services, requiring that noise levels from the proposed scheme meet a limit of at least 5dB(A) below the existing L_{A90} background noise level, with a further 5dB penalty applied to any equipment that exhibits a distinguishable acoustic characteristic, rendering their total noise limit to 10dB(A) below the existing L_{A90} background noise level.

1.4 The report details an evaluation of noise emissions from the proposed plant strategy to the nearest noise sensitive areas. Where necessary, mitigation measures have been set out with performance requirements for the various elements specified.

2 Site Description

2.1 The site, located within the lower basement and parts of the basement, ground and mezzanine levels at the Centre Point Link building, 103 New Oxford Street, London, WC1A 1DB is a 33-storey residential tower building at its western end on the southeastern corner of the A40, New Oxford Street and Charing Cross Road intersection, above a large two-storey podium building that extends across the site's entire footprint to its eastern edge on Earnshaw Street where there is a further nine-storey residential block that extends to the corner of Earnshaw Street and St Giles High Street.

2.2 The area to the north of the site across the A40, New Oxford Street is comprised of rows of mixed use buildings that feature commercial ground floor units with varying storeys of office space above.

2.3 The immediate area to the south of the site's podium building is currently under development as part of the St Giles Square scheme. This development extends to the block of mixed use buildings that are situated along the northern edge of St Giles Street.

2.4 The nearest residences external to the site are located opposite the southern end of the site's nine-storey residential at the Matilda Apartments on the corner of Earnshaw Street and Bucknall Street.

2.5 The site is under the jurisdiction of the London Borough of Camden.

3 Plant Noise Limits

3.1 Planning Conditions (ref: 2017/6980/P)

3.1.1 Under the site's planning application (ref: 2017/6980/P), the Landlord partially discharged Planning Condition 17. The details approved represented a baseline condition which the retail tenants must operate within.

3.1.2 Planning Condition 17 states:

'Prior to the first use of the premises for the A3 or A4 floorspace hereby permitted, full details of a scheme for extract ventilation, including manufacturers specifications, noise levels and attenuation, shall be submitted to and approved by the Local Planning Authority in writing. The use shall not proceed other than in complete accordance with such scheme as has been approved. All such measures shall be retained and maintained in accordance with the manufacturer's recommendations. In the event of no satisfactory ventilation plant and / or machinery being provided, no primary cooking shall take place on the premises.

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies CS5 and CS7 of the London Borough of Camden Local Development Framework Core Strategy and policies DP12 and DP26 of the London Borough of Camden Local Development Framework Development Policies.'

3.1.3 Planning Condition 19 also relates to plant equipment and states the following:

'Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (LA90), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless then plant/equipment herby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed in dB(A).

Reason: To safeguard the amenities of the [adjoining] premises [and the area generally] in accordance with the requirements of policy CS5 of the London Borough of Camden Local Development Framework Core Strategy and policies DP26 and CP28 of the London Borough of Camden Local Development Framework Development Policies.'

3.1.4 This report will address the concerns of Planning Conditions 17 and 19, as shown above. Limits discussed in Condition 19 apply to the whole site, and therefore limits appropriate for units R01 and R02 have been provided within section 3.4, as provided by *Sandy Brown*.

3.2 BREEAM

3.2.1 With regard to mechanical services noise limits, the Landlord's lease agreement requires that the unit conform to the requirements of the BREEAM 2011 New Construction Pol 05 credit.

3.2.2 The requirements for this credit are as follows:

'The Tenant shall ensure that all new plant installed as part of the fit-out works is suitably acoustically insulated so as not to cause an increase in background noise levels within 8OOm radius of the building. The Tenant shall commission a noise survey in accordance with BS 7445 to determine new plant noise limits, and to generate appropriate acoustic performance criteria for any new plant.

The Tenant shall provide a copy of the noise assessment and plant acoustic performance specification to the Landlord and Local Planning Authority for approval. The Tenant shall undertake post completion noise testing to ensure that the installed plant has not increased background noise levels by more than +5dB during the day (7.00-23.00) and more than +3dB at night (23.00-07.00), and where it has increased background noise levels by more than these levels, the Tenant shall undertake the required remedial actions to ensure that noise levels are reduced to background levels.'

3.2.3 The requirements of the BREEAM 2011 New Construction, Non-Domestic Buildings Pol 05 credit are as follows:

1. The credit can be awarded by default where there are or will be no noise-sensitive areas or buildings within 800m radius of the assessed development.

2. Where there are or will be noise-sensitive areas or buildings within 800m radius of the assessed development a noise impact assessment in compliance with BS 7445 has been carried out and the following noise levels measured/determined:

a. Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar.

b. The rating noise level resulting from the new noise-source (see also Compliance nose: Compliance at the design stage).

3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body (see Relevant definitions in the Additional Information section).

4. The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 hr to 23:00 hr) and +3dB at night (23:00 hr to 07:00 hr) compared to the background noise level.

5. Where the noise source(s) from the proposed site/building is greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with criterion 4.

3.2.4 As described above, the nearest residential locations are identified on the attached site plan 18/0303/SP1, both of which are within an 800m radius of the site. As the Landlord's mechanical services noise limits (as approved under reference 2017/6980/P) are more onerous than those set out above, it is anticipated that by meeting the Landlord's mechanical services noise limits at the nearest residences as set out in table T2, these limits will be achieved by default.

3.2.5 We have confirmation from the BRE that where fixed plant is installed in line with recommendations set out in the design report, photographic and documentary evidence is sufficient proof to gain this credit without the need for on-site commissioning post installation. This letter can be forwarded to the BREEAM assessor if required.

3.2.6 As required by BREEAM 2011, consultants at Cole Jarman hold academic qualifications necessary to operate as professional acoustic consultants, holding either Bachelors or Masters degrees in acoustics related fields. All consultants at Cole Jarman are members of the Institute of Acoustics. Cole Jarman is also a member of the Association of Noise Consultants, with the majority of consultants being ANC accredited testers.

3.2.7 Calculations and assessment work, including report writing, have been undertaken by and checked in detail by Suitably Qualified Acousticians as defined within BREEAM 2011.

3.3 Sandy Brown – Planning Noise and Vibration Report

3.3.1 In *Sandy Brown*'s Planning Noise & Vibration Report (ref:11301-R01) section 10, plant noise limits are set for the cumulative noise level from all plant equipment across the development. These limits were derived from survey data and set following appropriate guidance provided by the London Borough of Camden. Limits were set at 5dB below the lowest measured background noise levels and have been displayed in table T1.

Location	Noise Emission Limit, dB	
	Daytime (0700-2300 only)	Night time (2300-0700)
1m from any noise sensitive development	49	48

T1 Plant noise emission limits at the nearest residential properties for all *Centre Point* plant.

3.3.2 If the proposed plant exhibits any acoustic characteristics such as intermittency, tonality, or impulsivity, then a further 5dB correction to the noise limits may be required.

3.3.3 The above limits apply to all elements of plant equipment installed at *Centre Point* running continuously. As the restaurant plant is only one element of the plant equipment on site, the noise limits displayed in table T1 above must be appropriately proportioned to all of the plant

elements in order to ensure that the cumulative noise generated from all plant does not exceed the limits stated.

3.4 Landlord Plant Noise Limits

3.4.1 As the plant equipment subject to this report is only a proportion of all the plant to be installed on site, and the above limits are for the contribution of plant noise equipment emissions from the entire site, the limits must be allocated between the separate units.

3.4.2 *Sandy Brown* were contacted in order to confirm mechanical services noise limits applicable to the installation associated with units R01 & R02, and the following limits were provided:

Location	Noise Emission Limit, dB	
	Daytime (0700-2300 only)	Night time (2300-0700)
1m from Centre Point House windows	37	36
1m from Matilda Apartment windows	36	35

T2 Noise emission limits at the nearest residential properties for units R01 and R02 services.

3.4.3 The above plant noise limits must be met by all plant equipment associated with the restaurant running simultaneously at full capacity.

3.4.4 The above limits are more stringent than those discussed within section 3.2 regarding BREEAM Pol 05, and therefore if results comply with the limits set out within table T2 above, the BREEAM Pol 05 requirements will also be met.

4 Plant Noise Assessment

4.1 Proposed Installation

4.1.1 The proposed internal units ducted to atmosphere are as follows:

Plant Item	Manufacturer & Model	Location
AHU1	Enviropac Flat Range ENV 180FL	Basement ceiling level
AHU2	VES Ecovent EVX616-3	Basement ceiling level
AHU3	Enviropac Narrow Range ENV 90FL	Mezzanine plant area
WC Extract	Helios GBD 500/44	Basement ceiling level
HP5	Carrier 30RQSY045B	Basement plant area

T3 Plant installation details and locations

4.1.2 All plant elements are to terminate through 300mm acoustic louvres fitted within the Mezzanine plant level on the building's eastern façade. The expected minimum insertion losses for these louvres are set out within table T4 below. These losses have been factored in to our calculations.

Mitigation	Insertion Loss (dB) at Octave Band Centred Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
300mm acoustic louvres	4	5	8	9	12	10	8	6

T4 Mezzanine plant room louvre insertion losses

4.1.3 The operating hours for individual plant items as part of the services scheme are currently unknown. As such, we have undertaken calculations of all units to the nearest residences within the night time hours in order to provide a robust assessment.

4.2 Methodology

4.2.1 Our assessment has used manufacturer's noise data for each plant item as shown in the attached schedule 18/0303/PNS1.

4.2.2 Due to a lack of spectral noise data made available by the manufacturer, the noise levels used within our calculations to assess emissions from HP5 have been adapted from previous measurements of a similar *Carrier* heat pump unit undertaken by Cole Jarman. This spectrum has been shifted to fall in line with the manufacturer's quoted sound power level for the proposed unit.

4.2.3 The noise levels generated by all mechanical services elements have been calculated by correcting the plant noise levels for distance, radiation and screening losses where appropriate.

4.2.4 Details of our calculations are set out on attached sheets 18/0303/CS1-CS18.

4.3 Results

4.3.1 The results of our assessment indicate that further mitigation of noise emissions **will not** be required in order to reach the Landlord's noise emission limits.

4.3.2 The rating noise levels calculated within our assessment are shown in table T5.

Assessment Position	Rating Noise Level, dB(A) *(Limit)*	
	Daytime (0700-2300 only)	**Night time (2300-0700)**
AP1 – 1m from nearest Centre Point House windows	25 *(37)*	25 *(36)*
AP2 – 1m from nearest Matilda Apartment windows	27 *(36)*	27 *(35)*

T5 Plant noise emission levels at assessment positions.

5 Conclusions

5.1 A new theatre food market is to be created in units R01 and R02 at the Centre Point building, London.

5.2 An assessment of noise emissions from the units' proposed mechanical services has been completed and it has been shown that the limits would be met at all times without the need for acoustic mitigation. As a result, compliance with Planning Conditions 17 and 19 is achieved.

5.3 As no mitigation measures are required to achieve the requisite compliance with Planning Conditions 17 and 19 of the site's planning permission (ref: 18/6980/P), no further submission is required.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly, L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_{n}.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

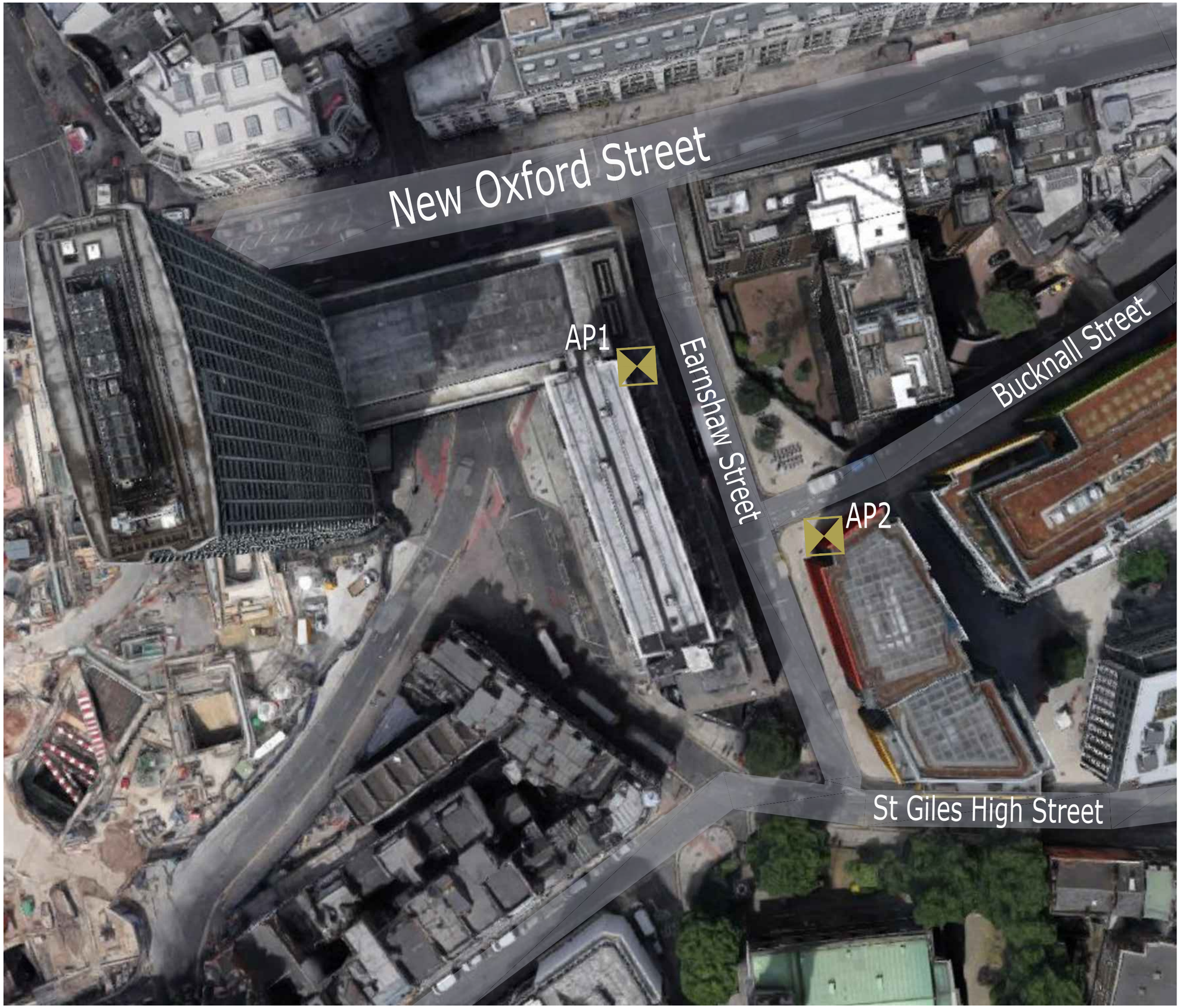

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Figure 18/0303/SP1

Title:

Site plan illustrating location of assessment positions

North

Project:

Theatre Food Market, Centre Point

Date: 19 October 2018

Revision: -

Scale:

Not to scale

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Schedule of Plant and Air Handling Equipment Sound Levels, dB

Reference	Description	Data Source[1]	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
AHU1	Main restaurant AHU at basement level	Man	Sound Power, Lw	85	84	81	79	78	76	72	68
AHU2 Supply	Basement AHU supply fan	Man	Sound Power, Lw	79	84	88	88	85	81	77	73
AHU2 Extract	Basement AHU extract fan	Man	Sound Power, Lw	79	84	88	88	85	81	77	73
AHU3	Mezzanine AHU	Man	Sound Power, Lw	76	75	72	70	69	67	63	59
EF1	Toilet Extract fan	Man	Sound Power, Lw	61	61	73	74	74	73	69	60
HP5	Heat pump at basement level	Meas	Sound Power, Lw	86	85	82	83	80	74	67	57

Notes

1 - Man refers to data supplied by the equipment manufacturer or supplier, Emp refers to data calculated using empirical formulae, and Meas refers to data measured by Cole Jarman

AHU1 to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU1										
Sound Power Levels		**85**	**84**	**81**	**79**	**78**	**76**	**72**	**68**	**83dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	800									
Height (mm)	600									
Length (m)	14									
		-10	*-8*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	600									
No. of Bends (no.)	4									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-4*	*-8*	*-12*	*-12*	*-12*	*-12*	
End Reflection										
Width/Diameter (m)	0.8									
Length (m)	0.6									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-6	*-2*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**18**	**18**	**11**	**6**	**-2**	**-2**	**-4**	**-6**	**9dBA**

AHU2 Supply to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Supply										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**11**	**17**	**23**	**21**	**13**	**9**	**7**	**5**	**21dBA**

AHU2 Extract to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Extract										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**11**	**17**	**23**	**21**	**13**	**9**	**7**	**5**	**21dBA**

AHU3 to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU3										
Sound Power Levels		**76**	**75**	**72**	**70**	**69**	**67**	**63**	**59**	**74dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	4.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	4.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**26**	**20**	**10**	**7**	**3**	**3**	**1**	**-1**	**12dBA**

EF1 to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - EF1										
Sound Power Levels		**61**	**61**	**73**	**74**	**74**	**73**	**69**	**60**	**79dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	16									
		-12	*-10*	*-5*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	5									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-5*	*-10*	*-15*	*-15*	*-15*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**-10**	**-8**	**6**	**4**	**-4**	**-8**	**-10**	**-17**	**4dBA**

HP5 to AP1 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - HP5										
Sound Power Levels		**86**	**85**	**82**	**83**	**80**	**74**	**67**	**57**	**84dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	1350									
Height (mm)	700									
Length (m)	10									
		-6	*-3*	*-2*	*-1*	*0*	*0*	*0*	*0*	
Bend Loss CJ										
Dimension (mm)	700									
No. of Bends (no.)	1									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-1*	*-2*	*-3*	*-3*	*-3*	*-3*	
End Reflection										
Width/Diameter (m)	1.35									
Length (m)	0.7									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-4	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 day										
Sound Pressure, Lp		**26**	**27**	**18**	**17**	**11**	**7**	**2**	**-6**	**18dBA**

AHU1 to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU1										
Sound Power Levels		**85**	**84**	**81**	**79**	**78**	**76**	**72**	**68**	**83dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	800									
Height (mm)	600									
Length (m)	14									
		-10	*-8*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	600									
No. of Bends (no.)	4									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-4*	*-8*	*-12*	*-12*	*-12*	*-12*	
End Reflection										
Width/Diameter (m)	0.8									
Length (m)	0.6									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-6	*-2*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**18**	**18**	**11**	**6**	**-2**	**-2**	**-4**	**-6**	**9dBA**

AHU2 Supply to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Supply										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**11**	**17**	**23**	**21**	**13**	**9**	**7**	**5**	**21dBA**

AHU2 Extract to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Extract										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**11**	**17**	**23**	**21**	**13**	**9**	**7**	**5**	**21dBA**

AHU3 to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU3										
Sound Power Levels		**76**	**75**	**72**	**70**	**69**	**67**	**63**	**59**	**74dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	4.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	4.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**26**	**20**	**10**	**7**	**3**	**3**	**1**	**-1**	**12dBA**

EF1 to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - EF1										
Sound Power Levels		**61**	**61**	**73**	**74**	**74**	**73**	**69**	**60**	**79dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	16									
		-12	*-10*	*-5*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	5									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-5*	*-10*	*-15*	*-15*	*-15*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**-10**	**-8**	**6**	**4**	**-4**	**-8**	**-10**	**-17**	**4dBA**

HP5 to AP1 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - HP5										
Sound Power Levels		**86**	**85**	**82**	**83**	**80**	**74**	**67**	**57**	**84dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	1350									
Height (mm)	700									
Length (m)	10									
		-6	*-3*	*-2*	*-1*	*0*	*0*	*0*	*0*	
Bend Loss CJ										
Dimension (mm)	700									
No. of Bends (no.)	1									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-1*	*-2*	*-3*	*-3*	*-3*	*-3*	
End Reflection										
Width/Diameter (m)	1.35									
Length (m)	0.7									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-4	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	2.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	2.7									
Height (m)	3									
Vertical (°)	55									
Horizontal (°)	90									
		-1	*-6*	*-9*	*-9*	*-9*	*-9*	*-9*	*-9*	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Reflected Distance Loss										
End Distance (m)	69									
		-37	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	*-37*	
External Receiver										
External Receiver - AP1 night										
Sound Pressure, Lp		**26**	**27**	**18**	**17**	**11**	**7**	**2**	**-6**	**18dBA**

AHU1 to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU1										
Sound Power Levels		**85**	**84**	**81**	**79**	**78**	**76**	**72**	**68**	**83dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	800									
Height (mm)	600									
Length (m)	14									
		-10	*-8*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	600									
No. of Bends (no.)	4									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-4*	*-8*	*-12*	*-12*	*-12*	*-12*	
End Reflection										
Width/Diameter (m)	0.8									
Length (m)	0.6									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-6	*-2*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
External Receiver									
External Receiver - AP2 day									
Sound Pressure, Lp	**17**	**21**	**15**	**8**	**-2**	**-5**	**-10**	**-14**	**11dBA**

AHU2 Supply to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Supply										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
External Receiver									
External Receiver - AP2 day									
Sound Pressure, Lp	**10**	**20**	**27**	**24**	**13**	**7**	**2**	**-2**	**23dBA**

AHU2 Extract to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Extract										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
External Receiver									
External Receiver - AP2 day									
Sound Pressure, Lp	**10**	**20**	**27**	**24**	**13**	**7**	**2**	**-2**	**23dBA**

AHU3 to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU3										
Sound Power Levels		**76**	**75**	**72**	**70**	**69**	**67**	**63**	**59**	**74dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	
Silencer										
Silencer - Existing louvres										
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*	
End Reflection										
Width/Diameter (m)	4.7									
Length (m)	3									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
External Grille Directivity										
Width (m)	4.7									
Height (m)	3									
Vertical (°)	10									
Horizontal (°)	70									
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*	

		Octave Band Centre Frequency (Hz)								
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Point Source Radiation Loss										
Radiation - Quarterspherical										
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	
Point Source Distance Loss										
End Distance (m)	56									
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	
Maekawa Screening Loss										
Path Difference (m)	0.1303									
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*	
External Receiver										
External Receiver - AP2 day										
Sound Pressure, Lp		**25**	**22**	**14**	**9**	**3**	**0**	**-4**	**-8**	**12dBA**

EF1 to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - EF1										
Sound Power Levels		**61**	**61**	**73**	**74**	**74**	**73**	**69**	**60**	**79dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	16									
		-12	*-10*	*-5*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	5									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-5*	*-10*	*-15*	*-15*	*-15*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
External Receiver									
External Receiver - AP2 day									
Sound Pressure, Lp	**-11**	**-6**	**10**	**6**	**-4**	**-11**	**-16**	**-25**	**6dBA**

HP5 to AP2 day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - HP5										
Sound Power Levels		**86**	**85**	**82**	**83**	**80**	**74**	**67**	**57**	**84dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	1350									
Height (mm)	700									
Length (m)	10									
		-6	*-3*	*-2*	*-1*	*0*	*0*	*0*	*0*	
Bend Loss CJ										
Dimension (mm)	700									
No. of Bends (no.)	1									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-1*	*-2*	*-3*	*-3*	*-3*	*-3*	
End Reflection										
Width/Diameter (m)	1.35									
Length (m)	0.7									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-4	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
External Receiver									
External Receiver - AP2 day									
Sound Pressure, Lp	**24**	**29**	**22**	**19**	**10**	**4**	**-4**	**-14**	**20dBA**

AHU1 to AP2 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU1										
Sound Power Levels		**85**	**84**	**81**	**79**	**78**	**76**	**72**	**68**	**83dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	800									
Height (mm)	600									
Length (m)	14									
		-10	*-8*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	600									
No. of Bends (no.)	4									
Type - Radiussed Bend - With Vanes										
		0	*0*	*-4*	*-8*	*-12*	*-12*	*-12*	*-12*	
End Reflection										
Width/Diameter (m)	0.8									
Length (m)	0.6									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-6	*-2*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
External Receiver									
External Receiver - AP2 night									
Sound Pressure, Lp	**17**	**21**	**15**	**8**	**-2**	**-5**	**-10**	**-14**	**11dBA**

AHU2 Supply to AP2 night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - AHU2 Supply										
Sound Power Levels		**79**	**84**	**88**	**88**	**85**	**81**	**77**	**73**	**90dBA**
Silencer										
Silencer - None										
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Rect Unlined Duct Losses CJ										
Width (mm)	700									
Height (mm)	350									
Length (m)	12									
		-9	*-7*	*-4*	*-2*	*-2*	*-2*	*-2*	*-2*	
Bend Loss CJ										
Dimension (mm)	350									
No. of Bends (no.)	2									
Type - Radiussed Bend - With Vanes										
		0	*0*	*0*	*-2*	*-4*	*-6*	*-6*	*-6*	
End Reflection										
Width/Diameter (m)	0.7									
Length (m)	0.35									
Rec or Circ - Rectangular										
Free or Flush - Flush										
		-9	*-4*	*0*	*0*	*0*	*0*	*0*	*0*	
Plenum Loss										
Correction (dB)	3									
		-3	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	*-3*	

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Silencer									
Silencer - Existing louvres									
		-4	*-5*	*-8*	*-9*	*-12*	*-10*	*-8*	*-6*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0	*0*	*0*	*0*	*0*	*0*	*0*	*0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3								
Vertical (°)	10								
Horizontal (°)	70								
		2	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*	*-5*
Point Source Distance Loss									
End Distance (m)	56								
		-35	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*	*-35*
Maekawa Screening Loss									
Path Difference (m)	0.1303								
		-6	*-7*	*-8*	*-10*	*-13*	*-15*	*-18*	*-20*

	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
External Receiver									
External Receiver - AP2 night									
Sound Pressure, Lp	**10**	**20**	**27**	**24**	**13**	**7**	**2**	**-2**	**23dBA**

AHU2 Extract to AP2 night

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - AHU2 Extract									
Sound Power Levels		**79.0**	**84.0**	**88.0**	**88.0**	**85.0**	**81.0**	**77.0**	**73.0**
Silencer									
Silencer - None									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Rect Unlined Duct Losses CJ									
Width (mm)	700.0								
Height (mm)	350.0								
Length (m)	12.0								
		-9.0	*-7.2*	*-3.6*	*-1.8*	*-1.8*	*-1.8*	*-1.8*	*-1.8*
Bend Loss CJ									
Dimension (mm)	350.0								
No. of Bends (no.)	2.0								
Type - Radiussed Bend - With Vanes									
		0.0	*0.0*	*0.0*	*-2.0*	*-4.0*	*-6.0*	*-6.0*	*-6.0*
End Reflection									
Width/Diameter (m)	0.7								
Length (m)	0.4								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		-8.6	*-4.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Plenum Loss									
Correction (dB)	3.0								
		-3.0	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Silencer									
Silencer - Existing louvres									
		-4.0	*-5.0*	*-8.0*	*-9.0*	*-12.0*	*-10.0*	*-8.0*	*-6.0*
End Reflection									
Width/Diameter (m)	2.7								
Length (m)	3.0								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
Width (m)	2.7								
Height (m)	3.0								
Vertical (°)	10.0								
Horizontal (°)	70.0								
		1.5	*2.0*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
End Distance (m)	56.0								
		-35.0	*-35.0*	*-35.0*	*-35.0*	*-35.0*	*-35.0*	*-35.0*	*-35.0*
Maekawa Screening Loss									
Path Difference (m)	0.1								
		-6.0	*-6.9*	*-8.3*	*-10.3*	*-12.6*	*-15.2*	*-18.0*	*-20.0*

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
External Receiver								
External Receiver - AP2 night								
Sound Pressure, Lp	**10.0**	**19.8**	**26.6**	**23.5**	**13.2**	**6.5**	**1.7**	**-2.2**

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