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Acoustic Consultancy Report

Environmental Noise Survey Results and Noise Impact Assessment for Fixed Plant

Restaurant, 323 Gray's Inn Road

Client:	Barack Holdings Ltd
Project:	Restaurant 323 Gray's Inn Road London WC1X 8PX
Our Ref:	11093
Revision:	A
Report Prepared By	N. Fowler M.I.O.A.
Date:	10th November 2017

1.0 Introduction

1.1 Acoustic Consultancy Partnership Ltd were appointed by Barack Holdings Ltd to undertake an environmental noise survey and carry out a noise impact assessment for the proposed fixed plant at the proposed restaurant, 323 Gray's Inn Road, London.

1.2 This report provides the results of our environmental noise survey and establishes the resultant plant noise levels for the proposed plant in accordance with the requirements of the London Borough of Camden for noise levels from new plant and machinery.

1.3 The predicted plant noise levels for the proposed plant have been established based on the plant selections and noise data provided to us. A plant noise assessment has been included within this report detailing the resultant noise levels at the nearest affected noise sensitive properties, which for this site are the residential located above the premises in Gray's Inn Road.

1.4 In accordance with the London Borough of Camden requirements, the target noise levels determined within this report have been used to complete a plant noise assessment, taking into account the operational period of the plant items and their location in relation to the nearest noise sensitive facades.

2.0 Environmental Noise Survey Measurement Procedure

2.1 The environmental noise survey adopted the procedure and methodology stated within BS4142:2014. This report has been prepared to provide the Local Planning Authority with existing ambient and background noise levels covering the periods of operation of the proposed plant at the rear of the premises.

3.0 Site Description and Nearest Noise Sensitive Buildings

3.1 The ground floor premises, at the time of our visit, were occupied by the Best Mangal restaurant with three floors of residential above.

3.2 At the rear of the premises is a single storey, flat roof, extension which is the same as the surrounding properties on either side. There are existing condensing units and extract ductwork located on the flat roof area to the side of the rear door access via a stairway from street level. The units were operating at the time of our visit although these units will be replaced with new units under the new scheme proposals.

3.3 The proposed plant would be as follows:

a) The 5no proposed condensers serving the kitchen, restaurant, freezer and chiller rooms will be installed in place of the existing units on the rear flat roof area.

b) The kitchen extract fan would be located external to the building, replacing the existing fan mounted vertically in the existing duct riser passing up the rear of the building to discharge at the roof level.

c) The main supply fan serving the kitchen canopy and the general extract fan serving the toilets and general areas would both be mounted internally with external wall mounted louvred openings in the side wall of the proposed premises.

3.4 Full details of the individual plant items and operating periods are given in section 6.0.

4.0 Receptor Positions

4.1 From our site survey it would appear the nearest existing noise sensitive receptors would be the first, second and third floor flats above the proposed restaurant. The first floor window of the flat facing the flat roof is a kitchen. We have assumed the nearest habitable window will be at second floor level. It should be noted the third floor residential windows are set back from the rear building façade and will only have partial line of sight to the new roof mounted plant but with line of sight to the kitchen extract outlet. These windows will not have line of sight to the wall mounted louvres serving the main kitchen supply fan and the general extract fan serving the toilets and general areas. The distances from the centre of the flat roof to the residential windows would be 3.7m to first floor, 5.5m to second floor and 8.1m to third floor.

4.2 The nearest windows to the buildings opposite the rear flat roof area appear to be an hotel and residential. The nearest windows are 20.4m from the centre of the roof and have line of sight to the proposed roof mounted plant, kitchen extract duct and the wall mounted louvres serving the main kitchen supply fan and the general extract fan.

4.3 Based on the above, we confirm the receptor positions adopted for this report is as follows:

RPA The second floor rear window of the residential above the proposed restaurant nearest to the proposed condensers and wall openings serving the internal fan systems.

RPB The third floor rear window of the residential above the proposed restaurant nearest to the discharge from the kitchen extract system.

RPC Residential within the building opposite the rear flat roof area.

5.0 Plant Information

5.1 The plant models and location are given below.

Unit No	Plant Item	Sound Pressure Level, dB at 1m							
		63	125	250	500	1k	2k	4k	8k
1	CU1- Mitsubishi PUHZ-ZRP140YKA	59	57	55	49	46	42	36	29
2	CU2-Mitsubishi PUHZ-ZRP140YKA	59	57	55	49	46	42	36	29

Table 1 – Plant Sound Pressure Levels at 1m

Unit No	Plant Item	Sound Pressure Level, dB at 1m							
		63	125	250	500	1k	2k	4k	8k
3	Chiller condenser	59	57	55	49	46	42	36	29
4	Chiller condenser	59	57	55	49	46	42	36	29
5	Freezer condenser	59	57	55	49	46	42	36	29

Table 2 – Plant Sound Pressure Levels at 1m

Note: The above noise levels for units 3, 4 and 5 are the low noise option units. The above manufacturers noise data in tables 1 and 2 are measured in free field over a reflecting plane.

Unit No	Plant Item	Sound Power Level, dB							
		63	125	250	500	1k	2k	4k	8k
6	EF1-Kitchen extract-Elta SCPP500/4/3	77	77	83	80	80	78	74	68
7	SF1-Kitchen supply-Elta SCPP450/4/3	71	72	81	78	74	70	64	58
8	EF2-General extract-Elta HIT315	65	66	68	70	66	65	61	57

Table 3 – Plant Sound Power Levels

6.0 Plant Operating Periods

6.1 We have been advised the proposed operating hours of the restaurant will be 11.00 to 02.00 hours on Sunday to Thursday and 11.00 to 03.00 hours on Friday and Sunday.

6.2 We have allowed for the HVAC plant to operate for the proposed trading hours. The refrigeration plant, items 3,4 and 5 serving the freezer and chiller coldrooms will operate 24 hours a day, 7 days a week upon demand.

7.0 Environmental Noise Survey Monitoring Position

7.1 The existing plant on the rear of the building was operating at the time of our survey and could not be turned off. As this plant will be replaced, and there was no option to carry out environmental readings at the rear of the premises, it was decided to undertake the environmental survey off site in Argyle Square.

7.2 The microphone was greater than 3.5m from any vertical reflecting surface and the monitoring position is confirmed on the site plan in Appendix 2.

8.0 Monitoring Equipment

8.1 The noise monitoring equipment comprised of a Svantek 957 type 1 real time analyser, serial number 21434, with a weatherproof microphone protection system. The microphone was mounted on a tripod and a weatherproof windshield and bird spike were used.

8.2 The meter calibration was verified before and after the measurement period by a Svantek SV31 acoustic calibrator, serial number 24687. Any deviation was within an acceptable tolerance.

8.3 The meter and calibrator have current calibration certificates available upon request.

9.0 Noise Monitoring Period and Survey Weather Conditions

9.1 The survey was carried out between midnight and 01.00 and between 02.00 and 03.00 hours on Wednesday 4th October 2017.

9.2 The weather was dry with full cloud cover and a maximum wind speed of 2.9m/sec registered on the hand held Meteos Skywatch anemometer during the survey periods. The temperature was 14°C.

9.3 The weather was acceptable for environmental noise monitoring.

10.0 Noise Measurement Parameters

10.1 The survey established the prevailing L_{AFmax}, $L_{Aeq,T}$, $L_{A10,T}$, and $L_{A90,T}$ noise levels, measured using F time weighting, with a 15 minute reference time period.

11.0 Monitoring Observations and Results

11.1 We consider the survey results to be representative of the typical background and ambient noise levels affecting the rear of the residential properties facing the ground floor roof area of the proposed restaurant.

11.2 The dominant noise sources were traffic movement and occasional pedestrian activity.

11.3 The results of the survey are confirmed in Appendix 1.

12.0 Local Authority Criteria for Fixed Plant

12.1 The London Borough of Camden standard noise requirement is specified in the Camden Local Plan, adopted version dated July 2017. Camden Policy A4: Noise and Vibration makes reference to the Noise and Vibration Thresholds provided in Appendix 3.

12.2 Appendix 3 identifies the following thresholds for noise and vibration in terms of the "effect" levels described in the National Planning Policy Framework and Planning Practice Guidance.

NOEL – No Observed Effect Level
LOAL – Lowest Observed Adverse Effect Level
SOAEL – Significant Observed Adverse Effect Level

12.3 The Industrial and Commercial Noise Sources section detailed in Appendix 3 state:

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 "Methods for rating and assessing industrial and commercial sound (BS4142) will be used. For such cases a Rating Level of 10dB below background (15dB if tonal components are present) should be considered as the design criterion.

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Outside 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
	Outside bedroom window (façade)	Night	Rating level 10dB below background and no events exceeding 57dBL_{Amax}	Rating level between 9dB below and 5dB above background or noise events between 57dB and 88dBL_{Amax}	Rating level greater than 5dB above background and/or events exceeding 88dBL_{Amax}

12.4 This type of modern air conditioning plant would not have a distinguishable discrete continuous note audible at the receptor position.

12.5 Based on the requirements of Table C, and the results of our environmental noise survey given in Appendix 1, the cumulative plant noise criteria to be achieved at the façades of both receptor positions would be:

Cumulative Plant Noise Criteria **34 dB $L_{Aeq,T}$**

13.0 Predicted Plant Noise Levels

13.1 The predicted **un-attenuated** cumulative free field plant noise levels are given below.

Receptor Position	Predicted Total Plant Noise Level $L_{Aeq(15min)}$ dB	Target Plant Noise Level $L_{Aeq(15min)}$ dB
RPA	60	34
RPB	64	34
RPC	56	34

Table 4 – Cumulative Plant Noise Levels at Receptor Positions

14.0 Mitigation

14.1 It can be seen from the table above, the predicted un-attenuated cumulative plant noise levels will exceed the London Borough of Camden target criteria of 10 dBA below the lowest measured L_{A90T} for the operating period of the plant, at 1m external to all three receptor positions.

14.2 To achieve the London Borough of Camden criteria it will be necessary to provide mitigation measures to all plant items.

14.3 The proposed mitigation measures are as detailed below:

a) In duct attenuators on the atmosphere side of the Kitchen supply and both extract fans. The minimum attenuation performances figures are detailed below:

Plant	Minimum Required Insertion Loss, dB							
	63	125	250	500	1k	2k	4k	8k
EF1 Kitchen extract discharge	9	12	24	49	50	37	23	17
SF1 Kitchen supply intake	6	9	19	39	37	27	18	13
EF2 General extract discharge	4	6	14	27	24	16	12	9

Table 5– Fans Minimum Attenuator Insertion Loss Requirements

a) We recommend all five condenser units are positioned in a group at the end of the flat roof furthest from the flats windows.

b) All five condenser units (Units 1,2,3,4 and 5) will need to be screened from receptor positions RPA and RPB with a solid timber screen so that the units are not in view from the rear windows at second and third floor levels. The length and height of the screen will depend on the final layout of the plant but, provisionally will be 1.75m high and the full width of the five units which, I recommend, are grouped together to minimise the length of the screen.

The screen height and length will require verification on site to ensure line of sight protection is provided to the second and third floor windows of the residential flats overlooking the rear flat roof area.

The timber screen would comprise 18mm thick butt jointed boards. There are to be 50x25 capping sections covering all joints between the boards so there are no gaps. The post construction to be timber or metal depending on the finalised design and closure strips to be provided where boards join the posts to prevent gaps. The inner surface of the timber screen is to be lined with 75mm thick 48kg controlled density resin bonded mineral wool infill with a 0.8mm 30% free area perforated inner skin facing the units. The infill is to be bagged and sealed by “Melinex” sheet to prevent water ingress into the mineral wool.

14.4 The predicted **attenuated** cumulative free field plant noise levels allowing for the duct attenuation and the screening are given below.

Receptor Position	Predicted Total Plant Noise Level $L_{Aeq(15min)}$ dB	Target Plant Noise Level $L_{Aeq(15min)}$ dB
RPA	33	34
RPB	33	34
RPC	34	34

Table 6 – Cumulative Plant Noise Levels at Receptor Positions

14.5 The plant noise level calculations are given in Appendix 3.

15.0 Vibration Isolation

15.1 All plant items are to be suitably vibration isolated using proprietary mountings or hangers depending on the fixing method to be adopted. The mounting systems are to provide a static deflection suitable to achieve a minimum 98% isolation efficiency.

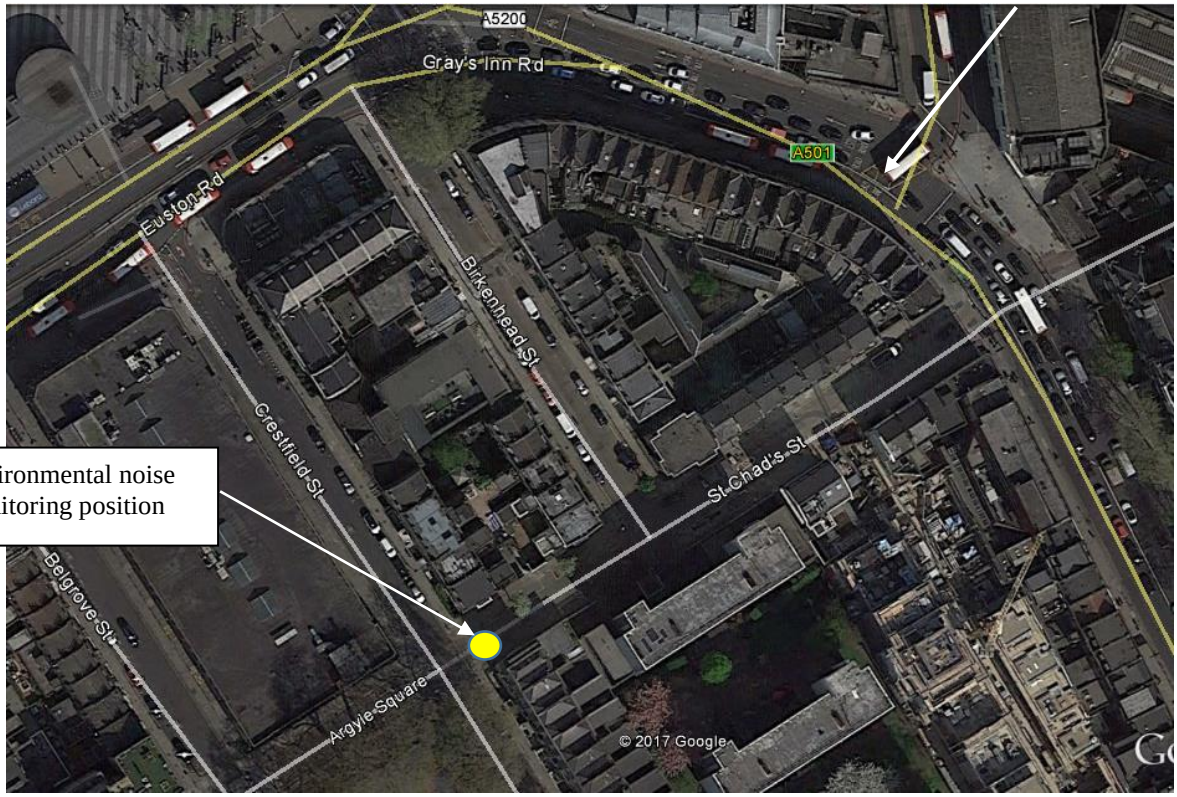
16.0 Conclusions

16.1 Providing the mitigation measures detailed in section 14.3 a) and b) are implemented in full, the London Borough of Camden external criteria will be achieved at all receptor positions.

Appendix 1 – Results

Date	Time			Measured Noise Level, dB			
				L_{AFmax}	$L_{Aeq,T}$	L_{A10}	L_{A90}
Thursday 5th October 2017	00.00	to	00.15	72.8	53.7	56.8	47.5
	00.15	to	00.30	73.4	51.8	54.8	50.6
	00.30	to	00.45	73.6	51.6	54.2	45.4
	00.45	to	01.00	76.5	53.3	56.3	44.7
	01.00	to	01.15	71.0	49.6	50.6	44.2
	02.00	to	02.15	77.3	53.6	56.9	44.9
	02.15	to	02.30	68.7	51.7	55.4	44.2
	02.30	to	22.45	70.9	52.7	56.1	46.4
	02.45	to	03.00	70.1	51.0	54.1	45.4

Appendix 2 – Site Plan



Appendix 3 – Plant Noise Level Calculations

Plant Calcs for Octave Band Sound Pressure Level

Project: Restauarant 323 Grays Inn Road(CONTINUOUS PLANT OPERATION)

Date: 12.10.2017

Section Total, dBA	**Day**	**30.3**	**Nigh**	**30.3**
ALL PLANT TOTAL	**Day**	**33.0**	**Nigh**	**33.0**

barrier values

a					
b	5	5	5	5	5
c	7	7	8	8	9
d	8	9	10	12	15

Section Total, dBA	**Day**	**29.3**	**Nigh**	**29.3**
ALL PLANT TOTAL	**Day**	**33.4**	**Nigh**	**33.4**

RPA

Unit 1 - CU1										Day "y"	Night "y"
Lp at 1m, Q=2		59	57	55	49	46	42	36	29		
A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)	a										
Distance correction m	8	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	y	y
Other Correction (+ve or -ve)		-6.0	-7.0	-9.0	-11.0	-14.0	-16.0	-16.0	-16.0		
Other Correction (+ve or -ve)											
Resultant dBA		9	16	19	17	14	9	3	-6		
Overall dBA		23.3									
214.5673517		7.5	38.4	86.1	47.3	24.8	8.22	1.97	0.24	214.6	214.6

1	Lp at 1m, Q=2		59	57	55	49	46	42	36	29
	A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1
	Directivity Q=	2	0	0	0	0	0	0	0	0
	Barrier (enter as +ve)	a								
	Distance correction m	10	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
	Other Correction (+ve or -ve)		-6.0	-7.0	-8.0	-10.0	-12.0	-15.0	-15.0	-15.0
	Other Correction (+ve or -ve)									
	Resultant dBA		7	14	18	16	14	8	2	-7
	Overall dBA		22.3							
170.4448603		4.8	24.6	69.3	38.1	25.2	6.62	1.59	0.2	170.4	170.4

RPA / RPB

Unit 2 - CU2										Day	Night
Lp at 1m, Q=2		59	57	55	49	46	42	36	29		
A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)	a										
Distance correction m	8	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	y	y
Other Correction (+ve or -ve)		-6.0	-7.0	-9.0	-11.0	-14.0	-16.0	-16.0	-16.0		
Other Correction (+ve or -ve)											
Resultant dBA		9	16	19	17	14	9	3	-6		
Overall dBA		23.3									
214.5673517		7.5	38.4	86.1	47.3	24.8	8.22	1.97	0.24	214.6	214.6

2	Lp at 1m, Q=2		59	57	55	49	46	42	36	29
	A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1
	Directivity Q=	2	0	0	0	0	0	0	0	0
	Barrier (enter as +ve)	a								
	Distance correction m	10	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
	Other Correction (+ve or -ve)		-6.0	-7.0	-8.0	-10.0	-12.0	-15.0	-15.0	-15.0
	Other Correction (+ve or -ve)									
	Resultant dBA		7	14	18	16	14	8	2	-7
	Overall dBA		22.3							
170.4448603		4.8	24.6	69.3	38.1	25.2	6.62	1.59	0.2	170.4	170.4

RPA / RPB

Unit 3 - Chiller Low noise option										Day	Night
Lp at 1m, Q=2		59	57	55	49	46	42	36	29		
A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)	a										
Distance correction m	8	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	y	y
Other Correction (+ve or -ve)		-6.0	-7.0	-9.0	-11.0	-14.0	-16.0	-16.0	-16.0		
Other Correction (+ve or -ve)											
Resultant dBA		9	16	19	17	14	9	3	-6		
Overall dBA		23.3									
214.5673517		7.5	38.4	86.1	47.3	24.8	8.22	1.97	0.24	214.6	214.6

3	Lp at 1m, Q=2		59	57	55	49	46	42	36	29
	A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1
	Directivity Q=	2	0	0	0	0	0	0	0	0
	Barrier (enter as +ve)	a								
	Distance correction m	10	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
	Other Correction (+ve or -ve)		-6.0	-7.0	-8.0	-10.0	-12.0	-15.0	-15.0	-15.0
	Other Correction (+ve or -ve)									
	Resultant dBA		7	14	18	16	14	8	2	-7
	Overall dBA		22.3							
170.4448603		4.8	24.6	69.3	38.1	25.2	6.62	1.59	0.2	170.4	170.4

RPA / RPB

Unit 4 - Chiller low noise option										Day	Night
Lp at 1m, Q=2		59	57	55	49	46	42	36	29		
A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)	a										
Distance correction m	8	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	y	y
Other Correction (+ve or -ve)		-6.0	-7.0	-9.0	-11.0	-14.0	-16.0	-16.0	-16.0		
Other Correction (+ve or -ve)											
Resultant dBA		9	16	19	17	14	9	3	-6		
Overall dBA		23.3									
214.5673517		7.5	38.4	86.1	47.3	24.8	8.22	1.97	0.24	214.6	214.6

4	Lp at 1m, Q=2		59	57	55	49	46	42	36	29
	A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1
	Directivity Q=	2	0	0	0	0	0	0	0	0
	Barrier (enter as +ve)	a								
	Distance correction m	10	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
	Other Correction (+ve or -ve)		-6.0	-7.0	-8.0	-10.0	-12.0	-15.0	-15.0	-15.0
	Other Correction (+ve or -ve)									
	Resultant dBA		7	14	18	16	14	8	2	-7
	Overall dBA		22.3							
170.4448603		4.8	24.6	69.3	38.1	25.2	6.62	1.59	0.2	170.4	170.4

RPA / RPB

Unit 5 - low noise option										Day	Night
Lp at 1m, Q=2		59	57	55	49	46	42	36	29		
A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)	a										
Distance correction m	8	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	-18.1	y	y
Other Correction (+ve or -ve)		-6.0	-7.0	-9.0	-11.0	-14.0	-16.0	-16.0	-16.0		
Other Correction (+ve or -ve)											
Resultant dBA		9	16	19	17	14	9	3	-6		
Overall dBA		23.3									
214.5673517		7.5	38.4	86.1	47.3	24.8	8.22	1.97	0.24	214.6	214.6

5	Lp at 1m, Q=2		59	57	55	49	46	42	36	29
	A weight		-26	-16	-8.6	-3.2		1.2	1	-1.1
	Directivity Q=	2	0	0	0	0	0	0	0	0
	Barrier (enter as +ve)	a								
	Distance correction m	10	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
	Other Correction (+ve or -ve)		-6.0	-7.0	-8.0	-10.0	-12.0	-15.0	-15.0	-15.0
	Other Correction (+ve or -ve)									
	Resultant dBA		7	14	18	16	14	8	2	-7
	Overall dBA		22.3							
170.4448603		4.8	24.6	69.3	38.1	25.2	6.62	1.59	0.2	170.4	170.4

RPA / RPB

Fan Calcs for In duct Sound Power Levels

Project: Restauarant 323 Grays Inn Road(CONTINUOUS PLANT OPERATION)

Date: 12.10.2017

Section Total, dBA	**Day**	**29.7**	**Night**	**29.7**
ALL PLANT TOTAL	**Day**	**33.0**	**Night**	**33.0**

barrier values

a					
b	5	5	5	5	5
c	7	7	8	8	9
d	8	9	10	12	15

Section Total, dBA	**Day**	**31.3**	**Night**	**31.3**
ALL PLANT TOTAL	**Day**	**33.4**	**Night**	**33.4**

RPA

Unit 6 - EF1										Day "y"	Night "y"
Induct Lw		77	77	83	80	80	78	74	68		
End reflection loss (enter +ve)											
Directivity (enter +ve)		4	5	6	7	8	9	9	9		
Distance correction	5	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0		
Barrier attenuation	c	7	7	8	8	9	9	10	10		
Other correction (enter + or -)										y	y
Other correction (enter + or -)											
A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)		10	14	27	55	55	44	28	22		
Resultant dBA		12.8	19.9	20.4	-4.2	-1.0	10.2	21.0	18.9		
Overall dBA		26.5									
444.4971205		7.2	38.4	110	0.38	0.8	10.5	127	74.3	244	244

1	Induct Lw		77	77	83	80	80	78	74	68
	End reflection loss (enter +ve)									
	Directivity (enter +ve)		4	5	6	7	8	9	9	9
	Distance correction	3	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5
	Barrier attenuation	c	7	7	8	8	9	9	10	10
	Other correction (enter + or -)									
	Other correction (enter + or -)									
	A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1
	Attenuation IL (enter +ve)		10	14	27	55	55	44	28	22
	Resultant dBA		17.3	24.4	24.9	0.3	3.5	14.7	25.5	23.4
	Overall dBA		30.9							
1234.734195		13.8	373	307	1.68	2.22	29.3	352	177	1235	1235

RPA / RPB

Unit 7 - SF1										Day	Night
Induct Lw		71	72	81	78	74	70	64	58		
End reflection loss (enter +ve)											
Directivity (enter +ve)		4	5	6	7	8	9	9	9		
Distance correction	5	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0		
Barrier attenuation	c	7	7	8	8	9	9	10	10		
Other correction (enter + or -)										y	y
Other correction (enter + or -)											
A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)		9	12	26	49	50	37	23	17		
Resultant dBA		7.8	16.9	19.4	-0.2	-2.0	9.2	16.0	13.9		
Overall dBA		23.4									
217.7859893		6.07	49.3	87.7	0.96	0.64	8.37	40.1	24.7	216	216

2	Induct Lw		71	72	81	78	74	70	64	58
	End reflection loss (enter +ve)									
	Directivity (enter +ve)		4	5	6	7	8	9	9	9
	Distance correction	10	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0
	Barrier attenuation	c	7	7	8	8	9	9	10	10
	Other correction (enter + or -)									
	Other correction (enter + or -)									
	A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1
	Attenuation IL (enter +ve)		9	12	26	49	50	37	23	17
	Resultant dBA		1.8	10.9	13.4	-6.2	-8.0	3.2	10.0	7.9
	Overall dBA		17.4							
54.44649733		1.52	12.3	21.9	0.24	0.16	2.09	10	6.31	54.4	54.4

RPA / RPB

Unit 8 - EF2										Day	Night
Induct Lw		65	66	68	70	66	65	61	57		
End reflection loss (enter +ve)											
Directivity (enter +ve)		4	5	6	7	8	9	9	9		
Distance correction	5	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0	-25.0		
Barrier attenuation	c	7	7	8	8	9	9	10	10		
Other correction (enter + or -)										y	y
Other correction (enter + or -)											
A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)		5	8	17	33	32	24	17	13		
Resultant dBA		5.8	14.9	15.4	7.8	8.0	17.2	19.0	16.9		
Overall dBA		24.2									
264.3344333		3.83	31.1	34.9	6.07	6.35	52.8	80	49.3	264	264

3	Induct Lw		65	66	68	70	66	65	61	57
	End reflection loss (enter +ve)									
	Directivity (enter +ve)		4	5	6	7	8	9	9	9
	Distance correction	10	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0
	Barrier attenuation	c	7	7	8	8	9	9	10	10
	Other correction (enter + or -)									
	Other correction (enter + or -)									
	A weighting		-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1
	Attenuation IL (enter +ve)		5	8	17	33	32	24	17	13
	Resultant dBA		-0.2	8.9	9.4	1.8	2.0	11.2	13.0	10.9
	Overall dBA		18.2							
66.08360831		0.96	7.78	8.73	1.52	1.59	13.2	20	12	66.1	66.1

RPA / RPB

ACP

Plant Calcs for Octave Band Sound Pressure Level

Section Total, dBA			**Day**	**33.5**			**Nigh**	**33.5**			
ALL PLANT TOTAL			**Day**	**34.2**			**Nigh**	**34.2**			

RPC

Unit 1 - CU1										Day "y"	Night "y"
Lp at 1m, Q=2			59	57	55	49	46	42	36	29		
A weight			-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity	Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)		a										
Distance correction	m	19	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	y	y
Other Correction (+ve or -ve)												
Other Correction (+ve or -ve)												
Resultant dBA			7	15	21	20	20	18	11	2		
Overall dBA			26.5									
450.4043802			5.29	34.2	121	106	111	58	13.9	1.71	450.4	450.4

RPC

Unit 2 - CU2										Day	Night
Lp at 1m, Q=2			59	57	55	49	46	42	36	29		
A weight			-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity	Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)		a										
Distance correction	m	19	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	y	y
Other Correction (+ve or -ve)												
Other Correction (+ve or -ve)												
Resultant dBA			7	15	21	20	20	18	11	2		
Overall dBA			26.5									
450.4043802			5.29	34.2	121	106	111	58	13.9	1.71	450.4	450.4

RPC

Unit 3 - Chiller Low noise option										Day	Night
Lp at 1m, Q=2			59	57	55	49	46	42	36	29		
A weight			-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity	Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)		a										
Distance correction	m	19	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	y	y
Other Correction (+ve or -ve)												
Other Correction (+ve or -ve)												
Resultant dBA			7	15	21	20	20	18	11	2		
Overall dBA			26.5									
450.4043802			5.29	34.2	121	106	111	58	13.9	1.71	450.4	450.4

RPC

Unit 4 - Chiller low noise option										Day	Night
Lp at 1m, Q=2			59	57	55	49	46	42	36	29		
A weight			-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity	Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)		a										
Distance correction	m	19	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	y	y
Other Correction (+ve or -ve)												
Other Correction (+ve or -ve)												
Resultant dBA			7	15	21	20	20	18	11	2		
Overall dBA			26.5									
450.4043802			5.29	34.2	121	106	111	58	13.9	1.71	450.4	450.4

RPC

Unit 5 - low noise option										Day	Night
Lp at 1m, Q=2			59	57	55	49	46	42	36	29		
A weight			-26	-16	-8.6	-3.2		1.2	1	-1.1		
Directivity	Q=	2	0	0	0	0	0	0	0	0		
Barrier (enter as +ve)		a										
Distance correction	m	19	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	-25.6	y	y
Other Correction (+ve or -ve)												
Other Correction (+ve or -ve)												
Resultant dBA			7	15	21	20	20	18	11	2		
Overall dBA			26.5									
450.4043802			5.29	34.2	121	106	111	58	13.9	1.71	450.4	450.4

RPC

Fan Calcs for In duct Sound Power Levels

Section Total, dBA			**Day**	**25.8**			**Night**	**25.8**			
ALL PLANT TOTAL			**Day**	**34.2**			**Night**	**34.2**			

RPC

Unit 6 - EF1										Day "y"	Night "y"
Induct Lw			77	77	83	80	80	78	74	68		
End reflection loss (enter +ve)												
Directivity (enter +ve)			4	5	6	7	8	9	9	9		
Distance correction		24	-38.6	-38.6	-38.6	-38.6	-38.6	-38.6	-38.6	-38.6		
Barrier attenuation		a										
Other correction (enter + or -)											y	y
Other correction (enter + or -)												
A weighting			-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)			10	14	27	55	55	44	28	22		
Resultant dBA			6.2	13.3	14.8	-9.8	-5.6	5.6	17.4	15.3		
Overall dBA			21.7									
148.7213253			3.17	21.4	30.2	0.11	0.28	3.63	55	33	147	147

RPC

Unit 7 - SF1										Day	Night
Induct Lw			71	72	81	78	74	70	64	58		
End reflection loss (enter +ve)												
Directivity (enter +ve)			4	5	6	7	8	9	9	9		
Distance correction		20	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0		
Barrier attenuation		a										
Other correction (enter + or -)											y	y
Other correction (enter + or -)												
A weighting			-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)			9	12	26	49	50	37	23	17		
Resultant dBA			2.8	11.9	15.4	-4.2	-5.0	6.2	14.0	11.9		
Overall dBA			19.9									
97.2547516			1.91	15.4	34.4	0.38	0.32	5.16	25	15.4	102	102

RPC

Unit 8 - EF2										Day	Night
Induct Lw			65	66	68	70	66	65	61	57		
End reflection loss (enter +ve)												
Directivity (enter +ve)			4	5	6	7	8	9	9	9		
Distance correction		20	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0		
Barrier attenuation		a										
Other correction (enter + or -)											y	y
Other correction (enter + or -)												
A weighting			-26.2	-16.1	-8.6	-3.2		1.2	1	-1.1		
Attenuation IL (enter +ve)			5	8	17	33	32	24	17	13		
Resultant dBA			0.8	9.9	11.4	3.8	5.0	14.2	17.0	14.9		
Overall dBA			21.4									
137.2621288			1.2	9.74	13.8	2.39	3.15	26.2	50	30.2	137	137

RPC