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ACOUSTICS PLUS

Proposed Installation of Mechanical Plant

16-17 Redington Gardens London, NW3

Environmental Noise Assessment

February 2012

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1. INTRODUCTION

1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients. APL is a registered member of The Association of Noise Consultants (ANC) and the author is an associate member of The Institute of Acoustics (IOA).

1.2 APL has been instructed by the Applicant's architect, PKS Architects, to consider and advise upon the noise implications of a proposed installation of mechanical plant.

1.3 It is anticipated the proposed installation will consist of a mechanical pool ventilation unit that will be located internally and a climate control unit that will be located in a purpose built enclosure within the rear garden.

1.4 It is understood the Local Planning Authority (LPA) require further information on noise levels from the proposed installation in order to fully assess the noise impact upon the surrounding neighbourhood. This report provides the response to the LPA, on behalf of the Applicant.

2. BASELINE SITUATION

2.1 The Application Site (the "site") is situated at 16-17 Redington Gardens, London, NW3. The site and its surroundings can be seen in Figures 1 to 8.

2.2 The site is currently occupied by two self contained houses. It is the intention to demolish these houses and erect a single new build luxury house located over a number of levels. It is understood this new property is likely to feature a mechanical climate control system throughout and a basement swimming pool with associated ventilation.

2.3 A detailed scheme of mechanical plant has not yet been established. For the purposes of this report, a number of assumptions with regard to the type of plant and its location has been made. This is based on experience of the ventilation and climate control requirements of similar properties of this type.

2.4 It is anticipated that the pool ventilation / dehumidification unit will be located in a basement plantroom and will intake and exhaust air through ducting penetrating the basement level to the court/winter garden area located above the proposed gym. It is recommended that the point of discharge is housed within an acoustic louvred enclosure.

2.5 It is anticipated the condenser unit associated with the climate control system will be located in a purpose built enclosure within the rear garden.

2.6 The nearest noise sensitive façade belongs to the residential windows of adjacent properties located at 15 and 18 Redington Gardens. The location of the nearest noise sensitive facades can be seen in Figure 7.

2.7 The distance from the nearest noise sensitive façade to the location of the proposed mechanical plant was determined from the scaled site plan. The distance from each noise impact to the nearest noise sensitive façade has been determined as 18m from the climate control unit and 10m from the point of discharge from the pool ventilation system.

2.8 Information in regard of the noise levels from the proposed mechanical plant has been provided by Calorex and Mitsubishi (copy of the data sheets is provided in Appendix A). The units are itemised below:

(a) 1No. Calorex Variheat VH3 900

(b) 1No. Mitsubishi PURY P-400 YHM

3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the locality of the installation.

3.2 Measurements of background noise were obtained over a 24 hour period at a location deemed representative of background noise levels experienced at the nearest noise sensitive façade. Measurements were obtained in the courtyard to the side of No.16 Redington Gardens.

3.3 The particulars of the measurement exercise are recorded below:

Date:	24th – 25th January 2012
Start Time:	12:21 hrs.
Location:	Rear courtyard, No.16 Redington Gardens
Weather:	No wind, no precipitation.

3.4 The measurements carried out during the exercise are recorded below:

L_{90} percentile level (dB re 20µPa) at 15 minute intervals

3.5 The measurements obtained during the exercise are presented in Appendix B.

3.6 For the sake of clarity, the lowest measured background noise over the anticipated operational hours of the mechanical plant is highlighted. As the plant will be utilised by residential accommodation, it is anticipated that the operational hours will be on a demand basis during any given 24hr period.

3.7 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the LPA (London Borough of Camden) Local Development Framework 2010-2025 Section DP28 Noise and Vibration:

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq},

3.8 The noise level of the proposed plant was established from the data sheets provided (Appendix A) as follows:

(a) 1No. Calorex Variheat VH3 900 L_w 89dBA

(b) 1No. Mitsubishi PURY P400-YHM@ 61dBA @ 1m

4. EQUIPMENT

4.1 All measurements were obtained using the following equipment:

- Rion NL32 Type 1 Sound Level Meter
  Serial No. 00840861
- Rion Calibrator Type NC-74 Class 1
  Serial No. 00410215

4.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

5. CALCULATIONS

5.1 In order to predict the noise impact of the ventilation and climate control systems, consideration has been given to noise egress from the proposed mechanical plant.

5.2 The following noise impacts have been considered:

(a) Swimming pool air handling and dehumidification unit;

(b) Climate control system.

Impact A

5.3 The calculation exercise utilised detailed noise information provided by Calorex (copy of the data sheet is provided in Appendix A).

5.4 Throughout the calculation exercise, guidance and formula were extracted from the publication *"Noise Control in Building Services" (published by SRL)*.

5.5 The ductwork system attenuation was calculated by considering the attenuation of sound energy produced by each component of the ductwork system. Information regarding the length and diameter of duct runs was assumed based on the proposed building layout.

5.6 Noise leaving the ductwork system at the outlet was propagated to the nearest noise sensitive façade using point source propagation. The calculation exercises (attached as Appendix C) have provided the following noise impact:

	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Calorex VH3 (air off)	22	23	21	0	0	0	0	0	14
Calorex VH3 (air on)	20	26	16	0	0	0	0	0	13
Combined level at nearest façade	24	27	22	0	0	0	0	0	**16**

Table 1

5.7 In order to comply with the requirements of the LPA, any noise from the proposed installation of the Calorex should not exceed a level of 17 dBA (10dB below the lowest measured background noise over the operational hours of the unit).

5.8 The lowest measured background noise was $L_{A90,15min}$ 27dB that occurred during the period 02:06 to 02:21hrs on 25th January 2012.

5.9 The above calculated levels are based on the implementation of a number of design mitigation measures. These are as follows:

(a) Acoustically lined ductwork;

(b) Acoustically lined mitre bends;

(c) Installation of silencers providing minimum performance attenuation for both air on and air off ductwork (see table 2 below);

	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Attenuator requirement	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	

Table 2

(d) Use of double banked Gilberts Series 30 acoustic louvres ventilating the enclosure housing at the point of discharge of the pool ventilation system.

Impact B

5.10 In order to predict the noise impact of the climate control system, consideration has been given to noise egress from the condenser unit mounted within the rear garden at the rear of the site.

5.11 A prediction exercise was undertaken. The calculation exercise utilised information provided by Mitsubishi HVAC (copy of the data sheet is provided in Appendix A).

5.12 The total attenuation was calculated by considering distance attenuation from the location of the unit to the nearest noise sensitive façade. It has been assumed that the condenser unit would be located in a sunken acoustic enclosure (e.g. Environ).

5.13 Noise leaving the condenser unit was propagated to the nearest noise sensitive façade using point source propagation. The distance from the location of the unit to the nearest noise sensitive façade was obtained by measurements made using online mapping software and reported to be 18m.

5.14 In considering the propagation of noise from the climate control condenser, consideration was given to the following equation.

$L_{p2} = L_{p1} - R - 6$

Where L_{p1} is the sound pressure level on the source side of the enclosure
L_{p2} is the sound pressure level close to the enclosure on the outside
R is the sound reduction index of the enclosure

5.15 The sound reduction index of an Environ enclosure was assumed to be as follows (extracted from Environ Modula literature – see Appendix A):

Enclosure type	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Environ Modula	12	13	20	29	36	37	39	39	

Table 3

5.16 The calculation exercise can be shown as follows:

	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Mitsubishi P400-YHM	73	66	63	58	55	51	48	41	61
Environ Modula	12	13	20	29	36	37	39	39	
Distance attenuation over 18m	-25	-25	-25	-25	-25	-25	-25	-25	
Level at noise sensitive façade	30	22	12	0	0	0	0	0	11

Table 4

5.17 In order to comply with the requirements of the LPA, any noise from the proposed installation of one air condensing unit should not exceed a level of 17 dBA (10dB below the lowest measured background noise over the operational hours of the unit).

5.18 The lowest measured background noise was $L_{A90,15min}$ 27dB that occurred during the period 02:06 to 02:21hrs on 25th January 2012.

6. CONCLUSION AND MITIGATION MEASURES

6.1 The foregoing assessment indicates that the proposed installation will meet the requirements imposed by the LPA. Further mitigation measures other than those detailed will not be required.

6.2 It should be stressed that a detailed scheme indicating proposed types and locations of mechanical plant has not yet been developed. It is fully expected that this acoustic study will need to be reworked once the scheme has been created.

Figures

16-17 Redington Gardens, London, NW3


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5


Figure 6

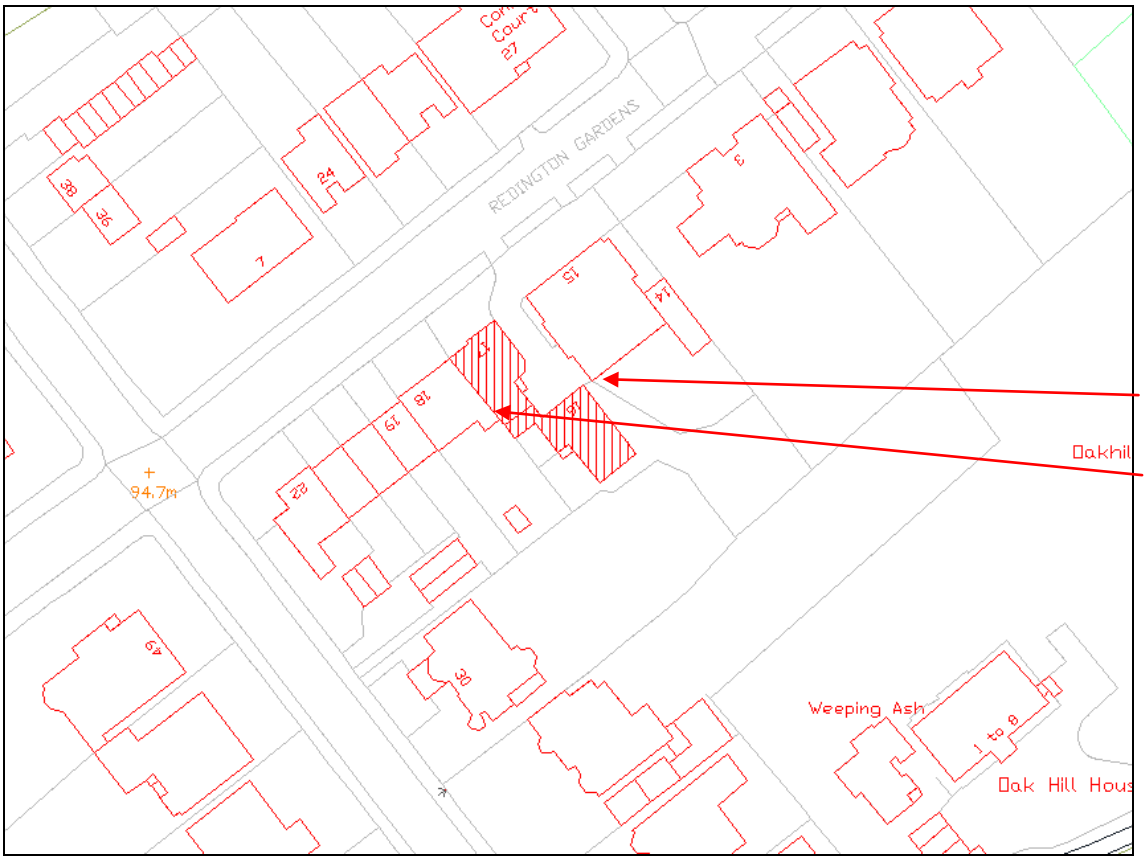


Figure 7

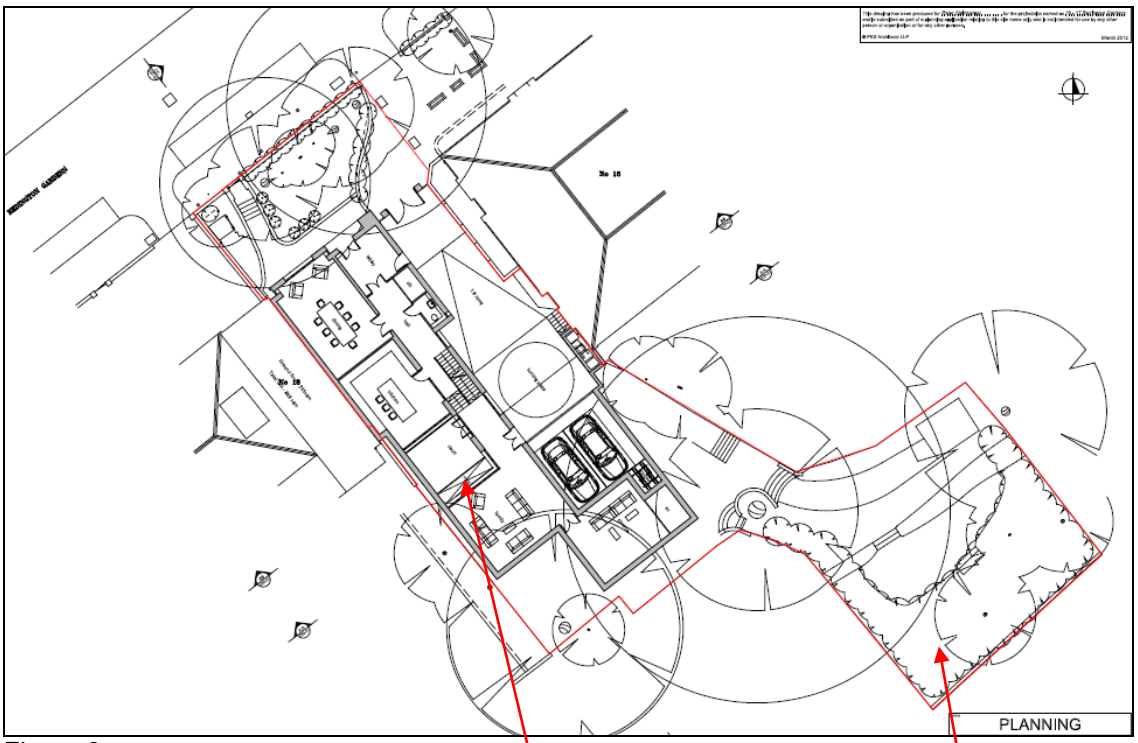
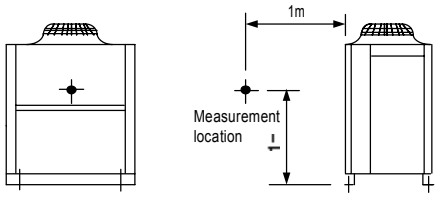


Figure 8

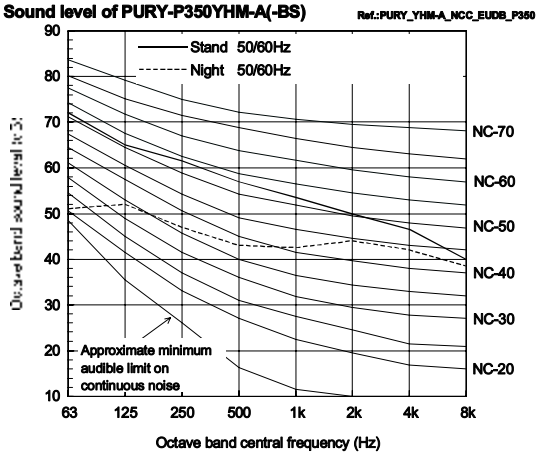
Appendix A

Measurement condition
PURY-P350,400YHM-A(-BS)



Ref.:PURY_YHM-A_NCC_EUDB_P350-P400_R1

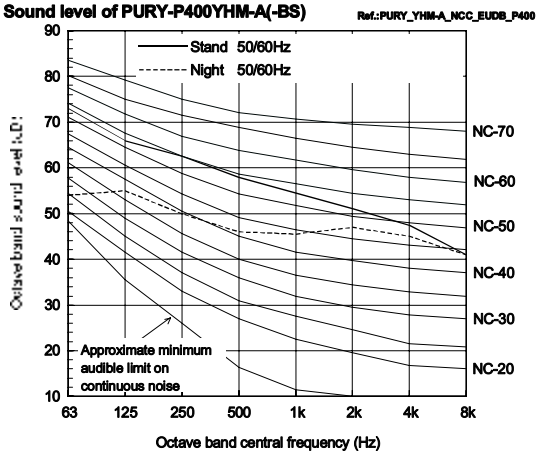
Sound level of PURY-P350YHM-A(-BS) Ref.:PURY_YHM-A_NCC_EUDB_P350



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	72.0	65.0	61.5	57.0	53.5	50.0	46.5	40.0	60.0
Night Mode	50/60Hz	51.0	52.0	47.0	43.0	42.5	44.0	42.0	38.5	50.0

When Night Mode is set,the A/C system's capacity is limited. The system could return to normal operation from Night Mode automatically in the case that the operation condition is severe.

Sound level of PURY-P400YHM-A(-BS) Ref.:PURY_YHM-A_NCC_EUDB_P400



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	73.0	66.0	62.5	58.0	54.5	51.0	47.5	41.0	61.0
Night Mode	50/60Hz	54.0	55.0	50.0	46.0	45.5	47.0	45.0	41.0	53.0

When Night Mode is set,the A/C system's capacity is limited. The system could return to normal operation from Night Mode automatically in the case that the operation condition is severe.

TEST SUBJECT :- VH3 900

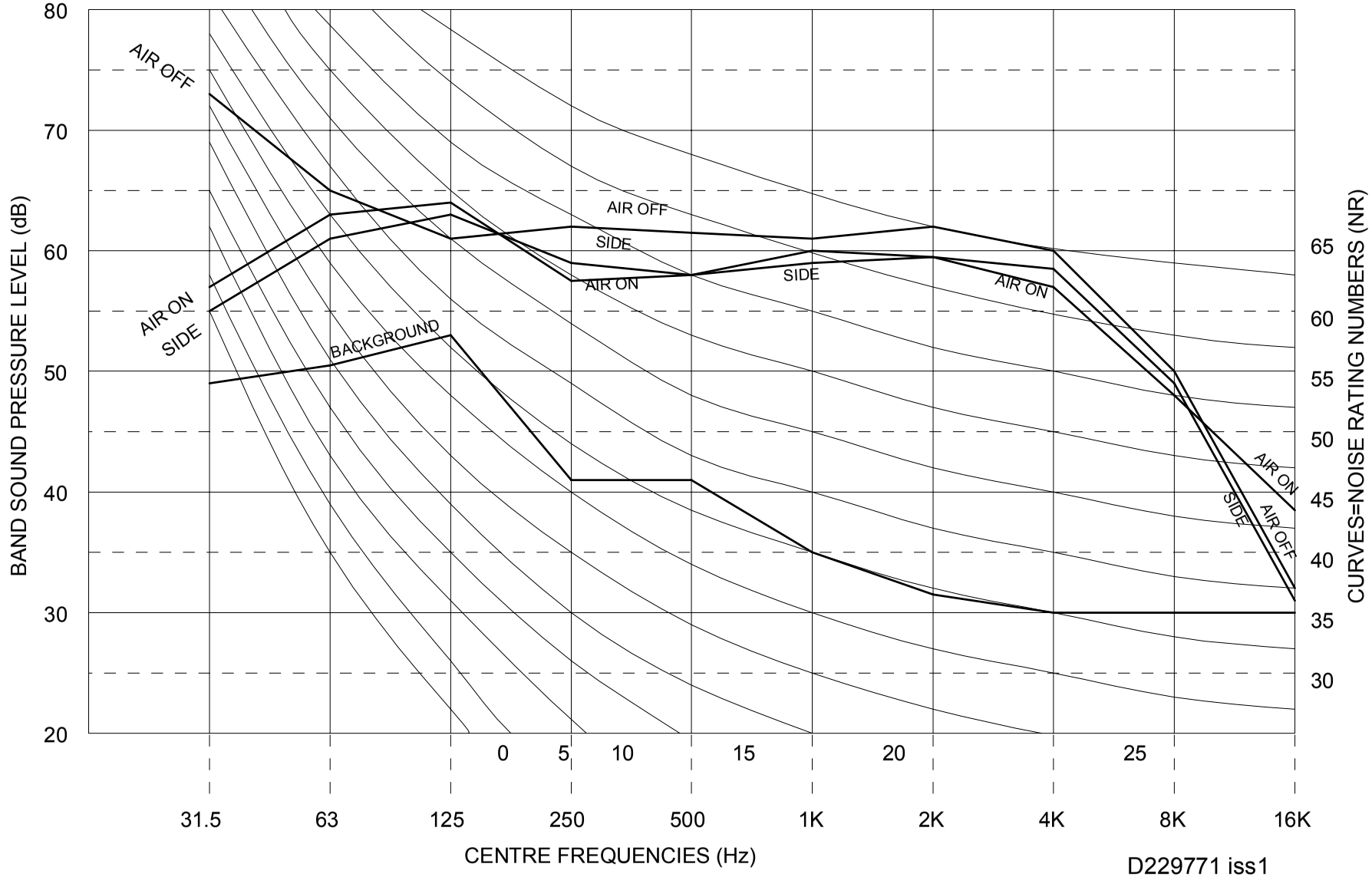
DATE :- 1:10:02

MEASURED dBA :-

AIR 0N= 66.5 AIR OFF= 68 SIDE= 66.5

DISTANCE FROM NOISE SOURCE :- 3M

BACKGROUND= 41.5



D229771 iss1

environ™ Dynamic Acoustic Technology

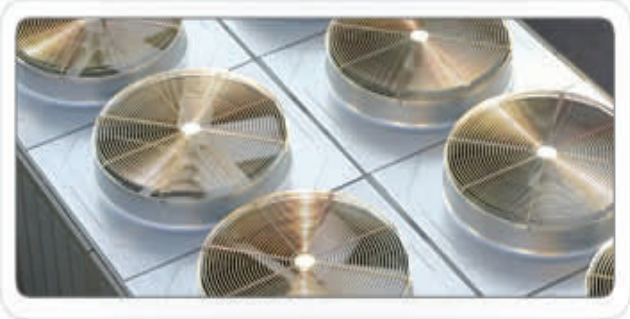
Acoustic Enclosure Systems for Air Conditioning and Refrigeration Plant

environmodula 2.1.25AC VERTICAL DISCHARGE

Noise control for medium to large Air Conditioning systems that have multi-directional air flow characteristics.

These units can be notoriously difficult to treat acoustically, often resulting in an over engineered, unsightly and expensive solution for the user, notwithstanding the difficulties of obtaining planning authority consent.

With environmodula all of these potential pitfalls can be overcome.



An introduction:

By design, environmodula applies its patented noise control features to best advantage, ensuring maximum acoustic performance.

With advanced noise control technology underpinned by quality engineering and manufacturing standards, environmodula solutions help alleviate local authority approval issues, whilst eliminating the noise problem for the user.

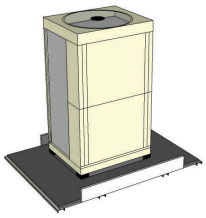
With almost infinite plant application compatibility and deriving its name from its design, environmodula is available in a variety of sizes, allowing it to by tailored to meet specific applications for new build or retro-fit noise abatement. And as an ideal noise control solution for larger air handling and heat pump units with multiple air intake and discharge requirements, environmodula delivers unparalleled noise reduction performance and airflow optimisation.

The enclosures are engineered for simple, quick construction and are designed as a 'flat pack' accessory for AC Contractors to assemble during the system installation - with a minimal number of parts in a kit, environmodula can be assembled quickly and easily by two men.

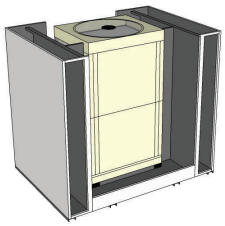
The integrated airways are sized to suit the requirements of the enclosed plant and full service and maintenance access is provided by the provision of removable access panels.

Simple selection documentation is used to establish the correct sizing of the airways to optimise equipment performance and the completed enclosures are available in a variety of colours and finishes to suit the environment in which they operate.

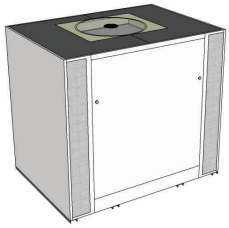
environmodula is secure and gives greater flexibility regarding the positioning of plant and machinery, especially where space is at a premium. Being 'Visually Quiet', no moving parts are visible - so the enclosed plant remains out of sight and out of mind.....



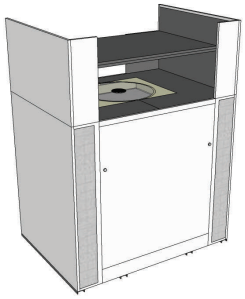
STEPS 1-2 - Base Structure



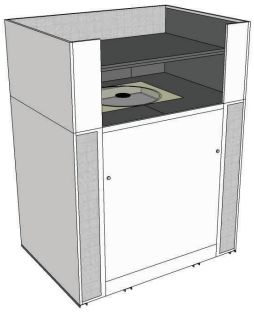
STEPS 3-5 - Air In Plenums



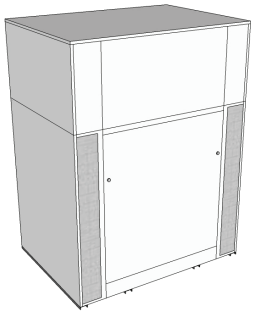
STEP 6-7 - Air Inlet Plenum Seals



STEP 8-9 - Air Discharge Plenum



STEP 10 - Discharge Grilles



STEPS 11-12 - Complete Assembly

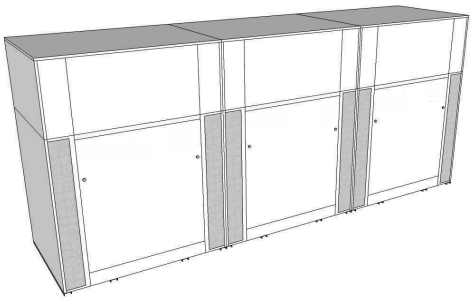
The Environ Integra, Modula and Lite acoustic designs are protected under patent

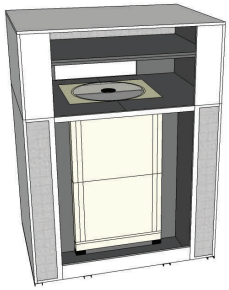
environ™
Dynamic Acoustic Technology

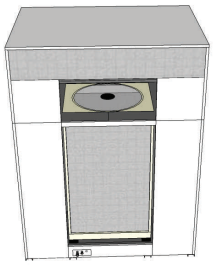
environmodula 2.1.25AC VERTICAL DISCHARGE

Product features at a glance:

- Superior sound engineering characteristics with certified Transmission Loss performance
- Satisfies the most stringent local authority noise requirements as part of the planning or noise enforcement process
- Effective noise control solution for larger plant with multi-directional air flow requirements
- Optimised airways and grilles maximise airflow efficiencies
- Full enclosure design protects plant from the elements, virtually eliminates the effect of solar gain on the operating plant and reduces the need for condenser coil cleaning
- Ultra small footprint, quality build, strong and durable design
- A visually quiet, 'good neighbour' with a choice of external finishes to allow plant to blend into the surroundings







User Benefits:

- Effectively eliminates plant noise on New Build a Retro-fit projects
- Local authority endorsed 'Best Practical Means' solution for large Air Conditioning and Heat Pump units
- No noise nuisance enhances neighbour relations
- Secure, robust and vandal proof - no additional security required
- Reduces installation time and cost compared to other acoustic solutions

Installer Benefits:

- Supplied as a 'Flat Pack' accessory for on-site assembly
- Quick and Easy to assemble - No specialised tools necessary
- Modular sub-assemblies for ease of installation
- Integrated Services and Electrical access points.
- Commissioning, Service and Maintenance access through lockable access panels
- Noise attenuation under installation contractor control

DISTRIBUTED BY:

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Dynamic Acoustic Technology

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environmodula 1.2.25AC Technical Information (May 2006)

DYNAMIC ACOUSTIC TECHNOLOGY

Noise Measurement Information:

Test: Environ Modua Acoustic Enclosure—1470mm W x 1045mm D x 1755mm H

Test Standard:

ISO 717/1 Acoustics - Rating of Sound Insulation in Buildings and of Building Elements - Part 1: Airborne Sound Insulation

Sound Level Measuring Equipment:

CEL 593 C1R Precision Sound Analyser - Type 1
CEL 284/2 Acoustic Calibrator Type 1
JBL Loudspeaker driven by CEL White Noise Source

Transmission Loss Data:

Transmission Loss—Environ Modula 1.2.25AC							
Octave Frequency in Hertz (dB ref 2 x 10^{-5} Pascal's)							
63	125	250	500	1K	2K	4K	8K
12	13	20	29	36	37	39	39
Summary Transmission Loss Equates to an Overall Reduction of 25 dB(A)							

Support Information:

Monitoring was carried out using the BS3740 technique, insofar as measurements were taken in each quadrant and the results averaged. Internal Test Room: 6m W x 12m L x 4m H. Background noise in the semi-reverberant test room was such as not to interfere with the practical measurements

Appendix B

Background Noise Data obtained at rear of Redington Gardens, London

Address	Time	Measurment Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90
1	24/01/2012 12:21	0:15:00	63	92	91	43	64	58	51	47
2	24/01/2012 12:36	0:15:00	53	82	67	43	59	56	49	46
3	24/01/2012 12:51	0:15:00	49	79	63	43	53	52	48	45
4	24/01/2012 13:06	0:15:00	51	81	65	41	57	55	47	44
5	24/01/2012 13:21	0:15:00	51	80	67	41	55	53	47	43
6	24/01/2012 13:36	0:15:00	49	78	71	39	53	50	44	42
7	24/01/2012 13:51	0:15:00	50	80	69	39	56	53	46	42
8	24/01/2012 14:06	0:15:00	49	78	65	39	54	51	44	41
9	24/01/2012 14:21	0:15:00	47	76	63	38	53	50	43	40
10	24/01/2012 14:36	0:15:00	47	77	60	38	52	50	44	41
11	24/01/2012 14:51	0:15:00	47	77	65	39	52	50	45	41
12	24/01/2012 15:06	0:15:00	48	78	63	40	53	51	45	42
13	24/01/2012 15:21	0:15:00	48	78	63	40	54	51	44	42
14	24/01/2012 15:36	0:15:00	48	78	62	41	54	51	45	43
15	24/01/2012 15:51	0:15:00	53	82	67	42	60	57	47	44
16	24/01/2012 16:06	0:15:00	46	76	59	42	49	48	46	44
17	24/01/2012 16:21	0:15:00	47	76	63	41	50	49	45	44
18	24/01/2012 16:36	0:15:00	50	80	77	42	53	51	46	44
19	24/01/2012 16:51	0:15:00	49	79	70	40	56	52	44	42
20	24/01/2012 17:06	0:15:00	46	76	60	41	51	48	43	42
21	24/01/2012 17:21	0:15:00	50	79	65	41	56	53	45	43
22	24/01/2012 17:36	0:15:00	44	74	56	41	47	46	44	43
23	24/01/2012 17:51	0:15:00	46	75	62	38	51	48	43	41
24	24/01/2012 18:06	0:15:00	49	79	66	38	55	52	43	41
25	24/01/2012 18:21	0:15:00	49	79	67	39	56	52	44	41
26	24/01/2012 18:36	0:15:00	46	75	61	38	50	48	43	41
27	24/01/2012 18:51	0:15:00	43	72	54	39	46	45	42	40
28	24/01/2012 19:06	0:15:00	46	76	62	38	52	50	42	40
29	24/01/2012 19:21	0:15:00	47	77	63	39	53	51	44	41
30	24/01/2012 19:36	0:15:00	43	72	55	38	46	44	42	40
31	24/01/2012 19:51	0:15:00	42	72	55	39	45	44	42	40
32	24/01/2012 20:06	0:15:00	45	75	66	39	48	47	42	41
33	24/01/2012 20:21	0:15:00	43	73	56	39	48	45	41	40
34	24/01/2012 20:36	0:15:00	44	73	59	37	48	45	41	39
35	24/01/2012 20:51	0:15:00	48	77	65	37	53	49	42	39
36	24/01/2012 21:06	0:15:00	41	71	58	36	46	44	40	38
37	24/01/2012 21:21	0:15:00	40	70	54	36	44	42	39	38
38	24/01/2012 21:36	0:15:00	45	75	61	36	52	49	40	38
39	24/01/2012 21:51	0:15:00	39	69	53	35	42	41	38	36
40	24/01/2012 22:06	0:15:00	40	70	64	36	43	42	39	37
41	24/01/2012 22:21	0:15:00	40	69	54	35	44	42	39	37
42	24/01/2012 22:36	0:15:00	39	69	53	36	41	41	39	37
43	24/01/2012 22:51	0:15:00	38	68	48	35	40	39	38	37
44	24/01/2012 23:06	0:15:00	39	69	53	35	42	41	38	37
45	24/01/2012 23:21	0:15:00	39	69	51	34	42	41	38	36
46	24/01/2012 23:36	0:15:00	37	67	45	34	40	39	37	36

Background Noise Data obtained at rear of Redington Gardens, London

Address	Time	Measurment Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90
47	24/01/2012 23:51	0:15:00	36	66	53	33	39	38	36	34
48	25/01/2012 00:06	0:15:00	36	66	51	33	38	38	36	35
49	25/01/2012 00:21	0:15:00	36	66	50	33	39	38	36	35
50	25/01/2012 00:36	0:15:00	37	66	50	33	39	38	36	35
51	25/01/2012 00:51	0:15:00	36	65	45	32	38	37	35	34
52	25/01/2012 01:06	0:15:00	32	62	49	27	35	34	32	30
53	25/01/2012 01:21	0:15:00	32	62	47	26	35	34	32	29
54	25/01/2012 01:36	0:15:00	31	61	47	26	35	33	30	28
55	25/01/2012 01:51	0:15:00	31	61	45	25	34	32	30	28
56	25/01/2012 02:06	0:15:00	42	71	60	25	49	41	30	27
57	25/01/2012 02:21	0:15:00	38	67	61	25	43	41	32	28
58	25/01/2012 02:36	0:15:00	36	65	49	25	42	40	32	29
59	25/01/2012 02:51	0:15:00	35	65	49	25	42	40	32	28
60	25/01/2012 03:06	0:15:00	36	66	50	25	43	41	32	29
61	25/01/2012 03:21	0:15:00	36	66	51	28	43	41	33	30
62	25/01/2012 03:36	0:15:00	37	66	50	28	43	41	34	31
63	25/01/2012 03:51	0:15:00	36	66	49	27	42	40	34	30
64	25/01/2012 04:06	0:15:00	37	66	50	29	42	40	34	32
65	25/01/2012 04:21	0:15:00	36	66	50	29	41	39	34	32
66	25/01/2012 04:36	0:15:00	36	66	49	30	41	39	34	32
67	25/01/2012 04:51	0:15:00	36	66	49	30	41	39	34	32
68	25/01/2012 05:06	0:15:00	36	66	48	30	41	39	35	33
69	25/01/2012 05:21	0:15:00	39	69	51	31	44	42	37	35
70	25/01/2012 05:36	0:15:00	41	71	58	35	44	43	40	38
71	25/01/2012 05:51	0:15:00	41	71	56	35	45	43	40	38
72	25/01/2012 06:06	0:15:00	42	72	58	37	46	44	41	39
73	25/01/2012 06:21	0:15:00	42	71	52	37	46	44	41	39
74	25/01/2012 06:36	0:15:00	46	76	64	37	51	47	41	40
75	25/01/2012 06:51	0:15:00	46	75	59	37	52	49	43	40
76	25/01/2012 07:06	0:15:00	48	77	64	40	54	51	44	42
77	25/01/2012 07:21	0:15:00	47	77	63	39	51	49	45	42
78	25/01/2012 07:36	0:15:00	47	77	71	40	49	48	45	43
79	25/01/2012 07:51	0:15:00	48	77	67	41	53	49	46	43
80	25/01/2012 08:06	0:15:00	57	87	75	41	61	60	53	45
81	25/01/2012 08:21	0:15:00	52	81	69	41	56	55	50	45
82	25/01/2012 08:36	0:15:00	51	80	77	41	57	55	46	43
83	25/01/2012 08:51	0:15:00	51	80	64	40	56	55	47	43
84	25/01/2012 09:06	0:15:00	53	83	64	40	61	60	45	42
85	25/01/2012 09:21	0:15:00	57	87	66	38	62	62	47	42
86	25/01/2012 09:36	0:15:00	51	81	68	37	58	54	45	42
87	25/01/2012 09:51	0:15:00	50	79	64	38	57	54	45	41
88	25/01/2012 10:06	0:15:00	50	79	68	38	57	52	44	41
89	25/01/2012 10:21	0:15:00	48	78	61	38	56	50	45	41
90	25/01/2012 10:36	0:15:00	48	77	61	39	54	49	43	41
91	25/01/2012 10:51	0:15:00	48	78	62	38	54	49	44	41
92	25/01/2012 11:06	0:15:00	49	78	61	40	55	52	45	42
93	25/01/2012 11:21	0:06:49	58	84	85	39	57	54	46	43

Appendix C

ACOUSTICS PLUS

CONTRACT TITLE: 16-17 Redington Gardens, London
SOUND SOURCE: Swimming Pool Air Handling Unit (Air on)
MAKE & TYPE: Calorex Variheat VH3 900

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
OVERALL Lw					63	125	250	500	1k	2k	4k	8k	dBA
1													
2				UNIT Lw	84	85	78	78	81	81	77	69	86
3													
4	STRAIGHT DUCT - Circular lined												
5	LENGTH (m)		SIZE (mm)		0.14	0.20	0.20	0.32	0.23	0.23	0.23	0.23	
6	10.00		300		1.40	2.00	2.00	3.20	2.30	2.30	2.30	2.30	
7					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	BENDS & TAKE OFFS												
12	NO.	TYPE	SIZE (mm)				2	11	18	18	17	17	
13	3	90º	300		0.00	0.00	6.00	33.00	54.00	54.00	51.00	51.00	
14					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
17					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
18					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19	OTHER ATTENUATION												
20	Gilberts Series 30				6	6	9	14	21	29	27	27	
21	*Unspecified attenuator*				*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	
22	Building edge diffraction				6	6	6	6	6	6	6	6	
23													
24	END REFLECTION SIZE (mm)												
25	300mm				13	9	4	1	0	0	0	0	
26													
27	**Lw LEAVING SYSTEM**				47	52	41	10	-13	-21	-20	-28	
28													
29	DISTANCE TO LISTENER (m)			10	-31	-31	-31	-31	-31	-31	-31	-31	
30	DIRECTIVITY OUTLET				4	5	6	7	8	9	9	9	
31													
32	**DIRECT Lp**				20	26	16	0	0	0	0	0	13

ACOUSTICS PLUS

CONTRACT TITLE: 16-17 Redington Gardens, London
SOUND SOURCE: Swimming Pool Air Handling Unit (Air off)
MAKE & TYPE: Calorex Variheat VH3 900

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1													
2				UNIT Lw	86	82	83	83	83	84	81	71	89
3													
4	STRAIGHT DUCT - Circular lined												
5	LENGTH (m)		SIZE (mm)		0.14	0.20	0.20	0.32	0.23	0.23	0.23	0.23	
6	10.00		300		1.40	2.00	2.00	3.20	2.30	2.30	2.30	2.30	
7					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	BENDS & TAKE OFFS												
12	NO.	TYPE	SIZE (mm)				2	11	18	18	17	17	
13	3	90º	300		0.00	0.00	6.00	33.00	54.00	54.00	51.00	51.00	
14					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
15					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
17					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
18					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19	OTHER ATTENUATION												
20	Gilberts Series 30				6	6	9	14	21	29	27	27	
21	*Unspecified attenuator*				*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	
22	Building edge diffraction				6	6	6	6	6	6	6	6	
23													
24	END REFLECTION SIZE (mm)												
25	300mm				13	9	4	1	0	0	0	0	
26													
27	**Lw LEAVING SYSTEM**				49	49	46	15	-11	-18	-16	-26	
28													
29	DISTANCE TO LISTENER (m)			10	-31	-31	-31	-31	-31	-31	-31	-31	
30	DIRECTIVITY OUTLET				4	5	6	7	8	9	9	9	
31													
32	**DIRECT Lp**				22	23	21	0	0	0	0	0	14