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ACOUSTICS PLUS

Proposed Installation of Mechanical Plant

5 Ingram Avenue, London NW11.

Environmental Noise Assessment

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Environmental Noise Assessment **Proposed Installation of Mechanical Plant**	
Project Address:	5 Ingram Avenue London NW11
Project Reference:	102227

Issue/Revision Record			
Issue:	**Date:**	**Remarks:**	**Author:**
1	06/07/2012	First Issue	Phil Huffer

	Signature:	**Print:**	**Title:**	**Date:**
Author:		**Phil Huffer**	**Principal Consultant**	**06/07/2012**
Reviewer:		**Andy Dodd**	**Consultant**	**06/07/2012**

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 KUT Partnership, to consider and advise upon the noise implications of a proposed installation of swimming pool mechanical plant and a climate control system.

1.3 The mechanical plant associated with the swimming pool ventilation system will be located in the basement level and intake and exhaust air through internal ducting to the side of the site. The external condensers associated with the climate control system will be located within a small outhouse at the side of the building.

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 5 Ingram Avenue, London, NW11.

2.2 It is proposed to refurbish and modernise the site which will include the installation of a basement swimming pool hall. The swimming pool hall will require the installation of a ventilation system. As part of the refurbishment it is also planned to install a climate control system.

2.3 The swimming pool mechanical plant will be located in the basement and will intake and exhaust air through ducting to the side of the site on its western elevation. The supply and exhaust ducts will include the provision of acoustic attenuators to minimise noise breakout from the duct terminations.

2.4 The external condenser units associated with the climate control of the property will be located within the outhouse located to the side of the property on the western elevation. It is proposed to install 3No. outdoor condenser units. The condenser units will be located in proprietary acoustic enclosures to minimise noise breakout from the outhouse.

2.5 The operational hours of the proposed mechanical plant will be at any time during a 24hr period. The proposed location of the plant is shown in Figure 1 and 7.

2.6 The site and its surroundings can be seen in Figures 1 to 6.

2.7 The nearest noise sensitive façade to the proposed location of plant is located at the rear of the adjacent site and can be seen in Figure 6. The distance from the nearest noise sensitive façade to the location of the proposed mechanical plant discharge points and condenser units was determined from laser measurements and scaled drawings as 8m.

2.8 Published noise data was obtained from The London Swimming Pool Company and Daikin. The units are itemised below (a copy of the data sheets are provided in Appendix A):

(a) 1No. LSPC AHU

(b) 1No Daikin ERHQ008BV3

(c) 1No. Daikin ERHQ016BV3

(d) 1No. Daikin RXYSQ4

3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise in 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.

3.3 The measurements obtained during the exercise were obtained at ground level at the rear of 5 Ingram Avenue. The measurement position can be seen in Figure 3.

3.4 The particulars of the measurement exercise are recorded below:

Date:	18th – 19th June 2012
Start Time:	10:22 hrs
Location:	Ground level at rear of 5 Ingram Avenue.
Weather:	No rain, light wind.

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

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

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

3.7 Information regarding the noise levels not to be exceeded by the installation was provided by the LPA –London Borough of Barnet (taken from Planning Application Number F/00531/12):

"6. The level of noise emitted from the plant in the basement hereby approved shall be at least 5dB(A) below the background level, as measured from any point 1 metre outside the window of any room of a neighbouring residential property.

If the noise emitted has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or distinct impulse (bangs, clicks, clatters, thumps), then it shall be at least 10db(A) below the background level, as measured from any point 1 metre outside the window of any room of a neighbouring residential property.

7. Before development commences, a report should be carried out by a competent acoustic consultant and submitted to the Local Planning Authority for approval, that assesses the likely noise impacts from the development of the ventilation/extraction plant. The report shall also clearly outline mitigation measures for the development to reduce these noise impacts to acceptable levels.

It should also include all calculations and baseline data, and be set out so that the Local Planning Authority can fully audit the report and critically analyse the contents and recommendations. The approved measures shall be implemented in their entirety before the use commences"

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

(a) 1No. LSPC AHU L_w (supply) 69dBA (exhaust) 74dBA

(b) 1No Daikin ERHQ008BV3 L_p @ 50dBA @ 1m

(c) 1No. Daikin ERHQ016BV3 L_p 54dBA @ 1m

(d) 1No. Daikin RXYSQ4 L_p 51dBA @ 1m

4. EQUIPMENT

4.1 All measurements were obtained using the following equipment:

- Svantek Svan 948 Class 1 Serial No. 6988
- 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 swimming pool mechanical plant and outdoor condenser units, consideration has been given to noise egress from each scenario.

5.2 The following noise impacts have been considered:

(a) Swimming pool mechanical plant

(b) Outdoor condenser units.

Impact A

5.3 The calculation exercise utilised detailed noise information provided by LSPC (a 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 was calculated from architectural drawings provided by KUT.

5.6 Noise leaving the ductwork system at the outlet was propagated to the nearest noise sensitive façade using point source propagation with a correction for a single reflecting plane of +3dB in each octave band. The calculation exercises (attached as Appendix C) have provided the following noise impacts:

Swimming pool ventilation noise impact	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Supply side inlet	28	29	15	5	0	8	8	3	16
Exhaust side outlet	30	32	19	10	0	13	12	7	20
TOTAL	32	34	21	11	3	14	13	8	22

Table 1

5.7 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 22 dBA (10dB below the lowest measured background noise over the operational hours of the plant) at 1m from the nearest noise sensitive facade.

5.8 The lowest measured background noise was $L_{A90,15min}$ 32dB that occurred during the period 02:26 to 02:52hrs on 19th June 2012.

Impact B

5.9 In order to predict the noise impact of the climate control system consideration has been given to noise egress from the outdoor condenser units. A prediction exercise was undertaken. The calculation exercise utilised information provided by Daikin (copy of the data sheets are provided in Appendix A).

5.10 The total attenuation was calculated by considering distance attenuation from the location of the units to the nearest noise sensitive façade. Given the location of the units with reference to the nearest noise sensitive façade, a correction factor of +6dB was added to the noise output of the condensers due to their position against two reflecting planes.

5.11 A further correction to account for building edge diffraction of -10dB was assumed. This was extracted from the Department of Energy and Climate Change Planning Standard MCS020. The planning standard MCS020 states the following (Note 5):

"Note 5: Barriers between the heat pump and the assessment position (STEP 5)
A correction should be made for attenuation due to barriers between the air source heat pump and an assessment position. A correction will be necessary if an installer is unable to see an assessment position from the top edge of the air source heat pump. Use the following instructions to determine whether a correction is appropriate:

- *For a solid barrier (e.g. a brick wall or a fence) that completely obscures an installer's vision of an assessment position from the top edge of the air source heat pump attenuation of -10 dB may be assumed.*
- *Where a solid barrier completely obscures an installer's vision of an assessment position from the top or side edges of the air source heat pump, but moving a maximum distance of 25 cm in any direction to the air source heat pump allows an assessment position to be seen, attenuation of -5 dB may be assumed.*
- *If it is possible for an installer to see any part of an assessment position from the top or side edges of the air source heat pump no attenuation may be assumed. "*

5.12 In considering the propagation of noise from the condensers through the acoustic enclosure, 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

5.13 The sound reduction index (R_w) of the Environ enclosure was obtained from manufacturers published data as follows:

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

Table 2

5.14 The calculation exercise can be shown in Table 3 below. The distance attenuation is based on point source propagation.

Climate control	Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
ERHQ008BV3 (cooling)	46	49	49	48	46	39	34	27	50
ERHQ016BV3 (cooling)	48	53	59	53	44	43	39	29	54
RXYSQ4 (cooling)	59	51	51	49	45	43	31	23	51
TOTAL	60	56	60	55	50	47	41	32	57
Reflecting plane	6	6	6	6	6	6	6	6	
Distance @ 8m	-18	-18	-18	-18	-18	-18	-18	-18	
Building edge diffraction	-10	-10	-10	-10	-10	-10	-10	-10	
Insertion loss Environ	12	13	20	29	36	37	39	39	
SPL at Façade	19	15	12	0	0	0	0	0	9

Table 3

5.15 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 22 dBA (10dB below the lowest measured background noise over the operational hours of the plant) at 1m from the nearest noise sensitive facade.

5.16 The lowest measured background noise was $L_{A90,15min}$ 32dB that occurred during the period 02:26 to 02:52hrs on 19th June 2012.

6. CONCLUSION AND MITIGATION MEASURES

6.1 The foregoing assessment indicates that the proposed installation will meet the requirements imposed by the LPA. This is on the basis that the specified acoustic attenuator is installed on the supply and exhaust ducts of the swimming pool ventilation system (or similar approved) and the condenser units are located in an Environ acoustic enclosure (or similar approved).

Figures

5 Ingram Avenue, London, NW11

Swimming pool intake/ discharge point

Figure 1

Figure 2

Background noise monitoring position

Figure 3

Figure 4

Figure 5

Figure 6

Nearest noise sensitive façade (Impact A)

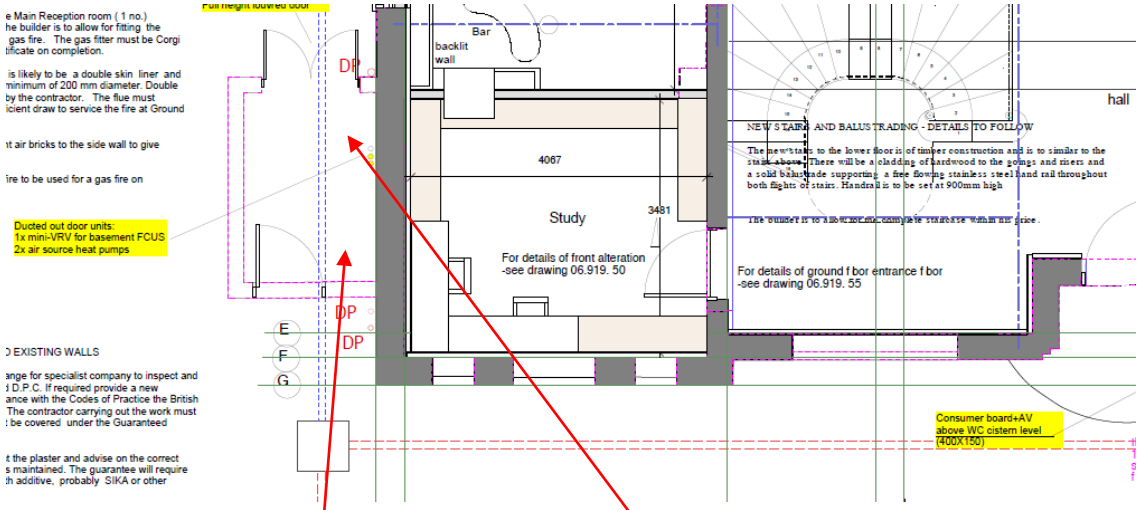


Figure 7

Proposed location of outdoor condenser units

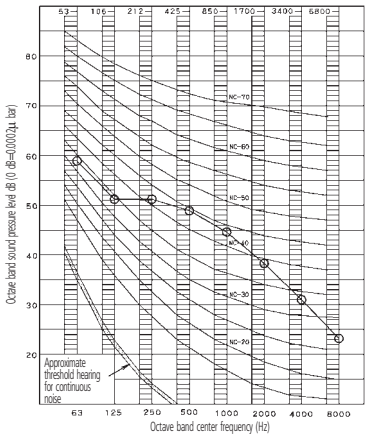
Proposed location of swimming pool ventilation outlet

Appendix A

7 Sound data

7 - 1 Sound pressure spectrum

RXYSQ4PV - Cooling 4D052713A



NOTES

1 Over all (dB):

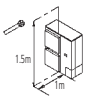
Scale A	50.0
Scale C	62.0

(B.G.N. is already rectified)

2 Measuring place: Anechoic chamber

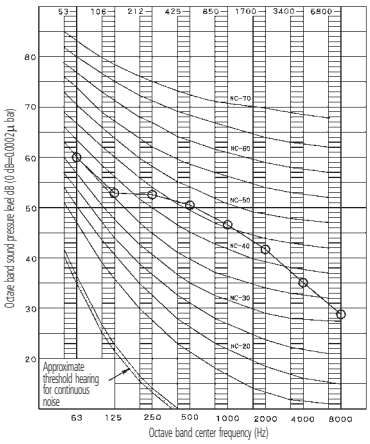
3 Operating conditons:
- Power source: 220-240V 50Hz, 220V 60Hz
- Cooling: Return air temperature: 27°C DB, 19.0°C WB; Outdoor temperature: 35°C DB, 24°C WB

4 Location of microphone



5 The operating sound is measured in anechoic chamber, if it is measured under the actual installation conditions, it is normally over the set value due to enviromental noise and sound reflection.

RXYSQ4PV - Heating 4D052719A



NOTES

1 Over all (dB):

Scale A	52.0
Scale C	63.5

(B.G.N. is already rectified)

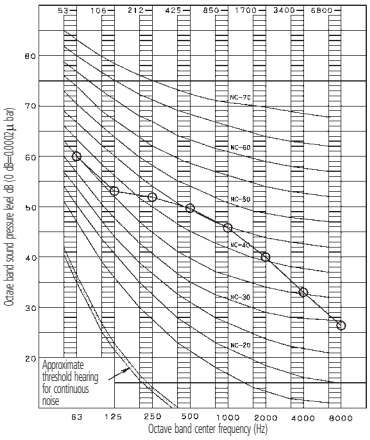
2 Measuring place: Anechoic chamber

3 Operating conditons:
- Power source: 220-240V 50Hz, 220V 60Hz
- Heating: Return air temperature: 20°C DB; Outdoor temperature: 7°C DB, 6°C WB

4 Location of microphone

5 The operating sound is measured in anechoic chamber, if it is measured under the actual installation conditions, it is normally over the set value due to enviromental noise and sound reflection.

RXYSQ5PV - Cooling 4D052714B



NOTES

1 Over all (dB):

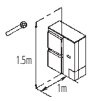
Scale A	51.0
Scale C	63.5

(B.G.N. is already rectified)

2 Measuring place: Anechoic chamber

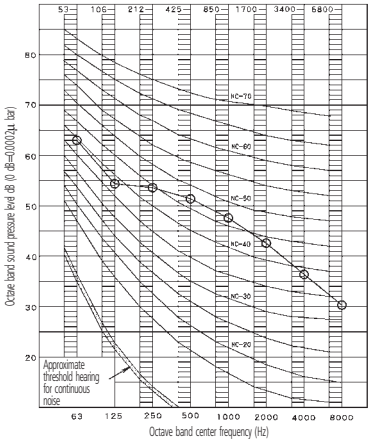
3 Operating conditons:
- Power source: 220-240V 50Hz, 220V 60Hz
- Cooling: Return air temperature: 27°C DB, 19.0°C WB; Outdoor temperature: 35°C DB, 24°C WB

4 Location of microphone



5 The operating sound is measured in anechoic chamber, if it is measured under the actual installation conditions, it is normally over the set value due to enviromental noise and sound reflection.

RXYSQ5PV - Heating 4D052718B



NOTES

1 Over all (dB):

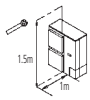
Scale A	53.0
Scale C	65.3

(B.G.N. is already rectified)

2 Measuring place: Anechoic chamber

3 Operating conditons:
- Power source: 220-240V 50Hz, 220V 60Hz
- Heating: Return air temperature: 20°C DB; Outdoor temperature: 7°C DB, 6°C WB

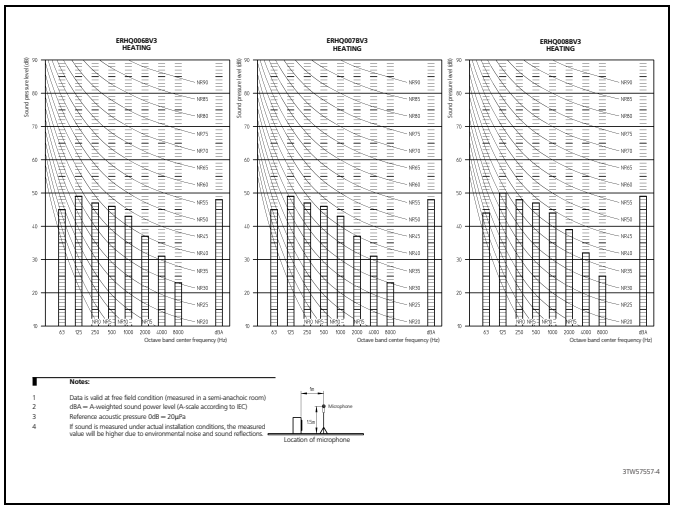
4 Location of microphone

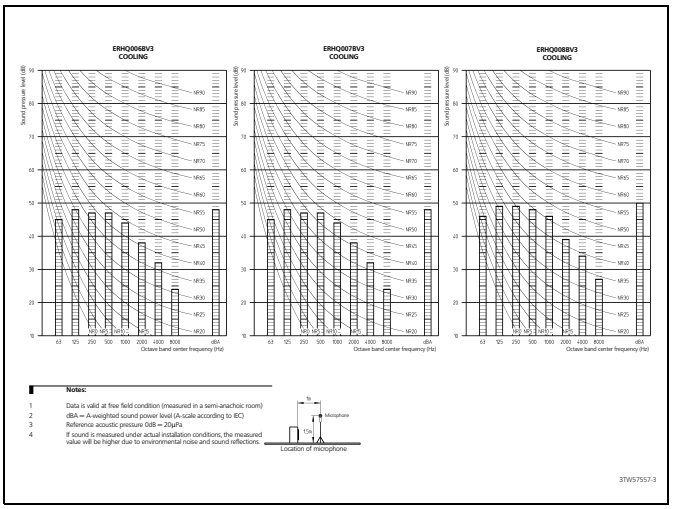


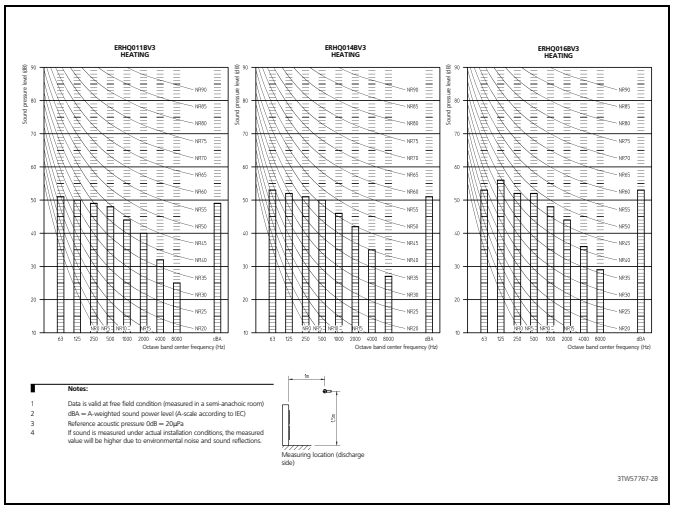
5 The operating sound is measured in anechoic chamber, if it is measured under the actual installation conditions, it is normally over the set value due to enviromental noise and sound reflection.

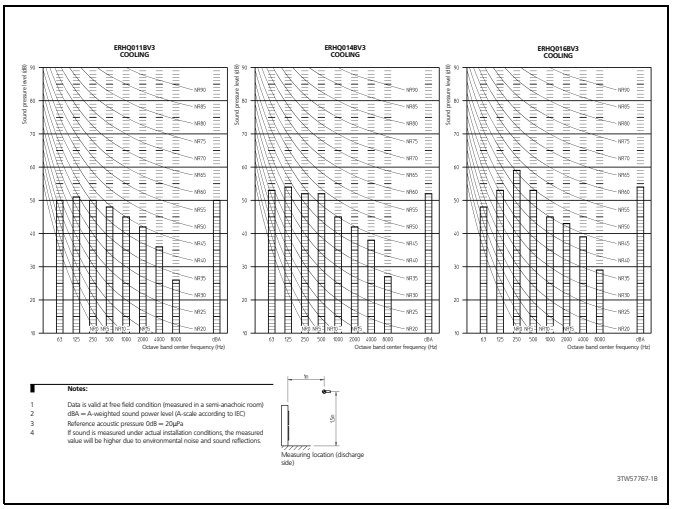
7 Sound data

7 - 1 Sound pressure spectrum









Installation Services

Mains Electricity:	3 ph-Neutral-Earth 400v / 50 Hz Protected supply 1 ph-Neutral-Earth 230v / 50 Hz Protected supply			or
Supply rating :	Three phase:	9	Amps/phase.	or
	Single phase	27	Amps.	
F.L. Running current :	Three phase:	4	Amps/phase.	or
	Single phase	12	Amps.	
Protection required :	RCD (30mA) / Short circuit (MCB) / local isolator switch.			
Other wiring available :	Volt free switch contact to request LTHW demand.			

Air Flow Rating:	Supply/Return Air Flow:	2,000	M^3/Hr.
	Max. External Res.:	150	Pa
	Exhaust/Fresh Air Flow:	1,000	M^3/Hr.
	Max. External Res.:	50	Pa

Linear Sound Power *Lw dB :*	Frequency Hz	Return air	Supply air	Fresh air	Exhaust air
	63	67.9	65.1	65.6	67.7
	125	69.1	66.2	66.2	69.5
	250	66.9	64.1	63.8	67.7
	500	67.9	65.1	64.5	69.1
	1000	65.1	62.3	61.7	66.3
	2000	66.9	64.1	63.4	68.1
	4000	64.3	61.5	60.9	65.3
	8000	55.4	52.6	52.4	56.0

Spigotted Type Circular Attenuator

Internal Diameter	External Diameter	Length	Octave Band Static Insertion Loss(dB)								Weight (kg)
			63	125	250	500	1k	2k	4k	8k	
100	200	625	2	2	4	18	30	27	22	14	5
		925	2	4	5	22	34	29	25	16	7
		1225	2	5	7	27	37	32	28	19	9
125	225	625	2	2	4	18	30	27	22	14	5
		925	2	4	5	22	34	29	25	16	8
		1225	2	5	7	27	37	32	28	19	10
150	250	625	2	2	4	16	28	25	22	14	6
		925	2	4	5	21	32	29	23	15	9
		1225	2	5	7	25	35	29	26	18	12
160	260	625	2	2	4	16	28	25	22	14	6
		925	2	4	5	21	32	27	23	15	9
		1225	2	5	7	25	35	29	26	18	12
200	300	625	2	2	4	15	26	19	19	13	8
		925	2	4	6	19	29	23	21	14	11
		1225	2	5	7	22	32	26	24	17	15
250	350	625	2	2	4	13	22	14	14	11	9
		925	2	4	6	16	26	19	17	13	13
		1225	2	5	7	19	31	22	20	16	17
300	400	625	2	2	5	12	19	13	12	9	11
		925	2	4	6	15	24	17	15	12	15
		1225	2	5	7	18	30	20	18	15	20
315	415	625	2	2	5	12	17	12	11	9	11
		925	3	4	7	14	23	16	14	12	16
		1225	3	5	8	17	29	19	17	15	21
355	455	625	2	3	5	12	16	12	11	9	12
		925	3	5	7	15	23	15	14	12	18
		1225	3	5	8	18	29	18	17	15	23
400	500	625	2	3	6	13	15	12	11	8	14
		925	3	5	7	17	22	15	13	11	20
		1225	3	6	9	20	28	18	16	14	26

NOTES

Static insertion losses shown represent typical performance data when the attenuator is directly connected to the discharge of an axial flow fan operating at the middle of its performance range. Attenuation can vary with certain intake conditions, and also in high volume and high temperature applications.

Insertion Loss Correction Factors For Melinex

Octave Band Static Insertion Loss(dB)							
63	125	250	500	1k	2k	4k	8k
1.0	1.0	0.95	0.85	0.8	0.65	0.55	0.5

Regenerated noise data is available on request

environ™
Dynamic Acoustic Technology

Acoustic Enclosure Systems for Air Conditioning and Refrigeration Plant

environlite 1.2.25AC SPLIT

Versatile yet cost effective noise control solutions for small and medium sized Split Air Conditioning and Heat Pump systems that have horizontal air flow characteristics.

This attractive range of units combines superior noise reduction characteristics and application versatility with a user friendly design for ease of assembly.

An introduction:

environlite is not only physically compact and discrete; its flexibility allows for a wide range of AC applications and is particularly suited to 'difficult to access' locations. Available as a new build or retro-fit solution, environlite is supplied to the user palletised as a simple on-site self build kit.

All Environ products are a proven solution for the elimination of noise where commercial establishments coexist with domestic neighbours and environlite is especially suited to the ever growing domestic AC market.

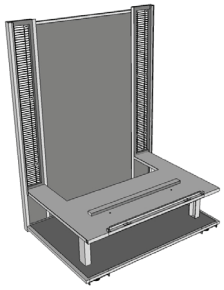
By design, environlite applies its patented noise control features to best advantage, ensuring maximum acoustic performance.

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

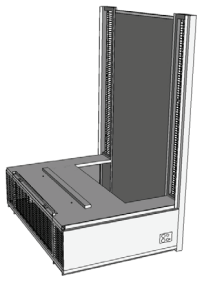
With almost infinite plant application compatibility and deriving its name from its design, environlite is matched to provide unparalleled acoustic performance to light commercial and domestic AC applications. The range is available in a variety of sizes, allowing it to by tailored to meet specific applications for new build or retro-fit noise abatement.

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 and hinged access panels.

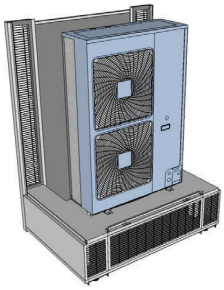
environlite is secure and gives greater flexibility regarding the positioning of plant and machinery, especially where space is at a premium. Being 'Visually Quiet', no moving parts are visible - so the enclosed plant remains out of sight and out of mind.....



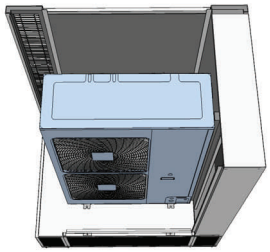
STEPS 1-4 - Structure



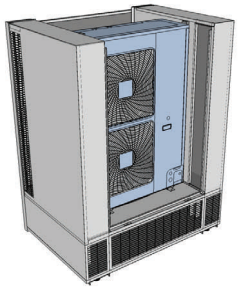
STEPS 5-6 - Air In Grilles



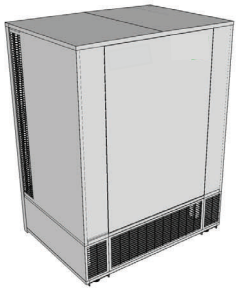
STEP 7 - Locate AC unit



STEP 8 - Fit RH Airway



STEP 9 - Fit LH Airway



STEPS 11-12 - Complete Assembly

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

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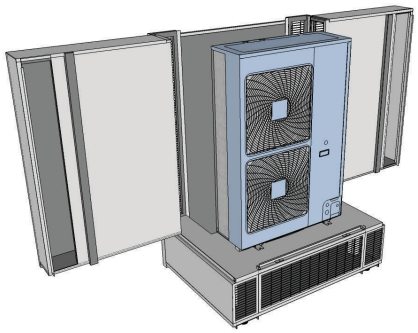
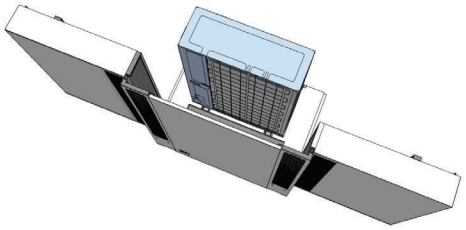
environlite 1.2.25AC SPLIT

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 Air Conditioning plant with horizontal 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
- Floor or Wall Mount
- Integrated Services and Electrical access points.
- Commissioning, Service and Maintenance access through lockable access panels
- Noise attenuation under installation contractor control

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

DISTRIBUTED BY:

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environlite Technical Information (May 2006)

DYNAMIC ACOUSTIC TECHNOLOGY

Noise Measurement Information:

Test: Environ Lite 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 Lite							
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 Date - 5 Ingram Avenue, London, NW11 6TG

No	Date & time	Filename	Elapsed time	PEAK [dB]	MAX [dB]	MIN [dB]	LEQ [dB]	L10	L90
1	18/06/2012 10:22:26	@APL0001	00:15:00	99	78	39	51	53	41
2	18/06/2012 10:37:26	@APL0002	00:15:00	84	67	38	50	54	41
3	18/06/2012 10:52:26	@APL0003	00:15:00	76	62	38	45	47	40
4	18/06/2012 11:07:26	@APL0004	00:15:00	74	59	38	44	47	39
5	18/06/2012 11:22:26	@APL0005	00:15:00	75	64	39	48	50	41
6	18/06/2012 11:37:26	@APL0006	00:15:00	73	63	39	50	53	41
7	18/06/2012 11:52:26	@APL0007	00:15:00	79	67	39	48	49	41
8	18/06/2012 12:07:26	@APL0008	00:15:00	76	68	41	48	49	43
9	18/06/2012 12:22:26	@APL0009	00:15:00	77	62	40	50	54	43
10	18/06/2012 12:37:26	@APL0010	00:15:00	73	62	41	48	51	44
11	18/06/2012 12:52:26	@APL0011	00:15:00	71	59	39	46	49	43
12	18/06/2012 13:07:26	@APL0012	00:15:00	69	56	38	45	48	40
13	18/06/2012 13:22:26	@APL0013	00:15:00	72	59	36	43	45	38
14	18/06/2012 13:37:26	@APL0014	00:15:00	69	51	37	42	44	39
15	18/06/2012 13:52:26	@APL0015	00:15:00	72	63	37	44	47	39
16	18/06/2012 14:07:26	@APL0016	00:15:00	80	64	38	46	49	40
17	18/06/2012 14:22:26	@APL0017	00:15:00	77	65	36	49	51	39
18	18/06/2012 14:37:26	@APL0018	00:15:00	73	60	36	43	46	38
19	18/06/2012 14:52:26	@APL0019	00:15:00	77	60	36	44	47	37
20	18/06/2012 15:07:26	@APL0020	00:15:00	73	61	35	43	45	37
21	18/06/2012 15:22:26	@APL0021	00:15:00	77	62	34	45	49	37
22	18/06/2012 15:37:26	@APL0022	00:15:00	79	71	36	49	50	39
23	18/06/2012 15:52:26	@APL0023	00:15:00	76	65	36	48	52	39
24	18/06/2012 16:07:26	@APL0024	00:15:00	77	69	36	48	50	39
25	18/06/2012 16:22:26	@APL0025	00:15:00	81	70	36	49	51	38
26	18/06/2012 16:37:26	@APL0026	00:15:00	80	61	36	45	48	38
27	18/06/2012 16:52:26	@APL0027	00:15:00	83	63	35	47	50	38
28	18/06/2012 17:07:26	@APL0028	00:15:00	80	71	36	49	51	39
29	18/06/2012 17:22:26	@APL0029	00:15:00	72	58	35	42	45	38
30	18/06/2012 17:37:26	@APL0030	00:15:00	77	67	37	47	49	39
31	18/06/2012 17:52:26	@APL0031	00:15:00	70	57	36	43	46	38
32	18/06/2012 18:07:26	@APL0032	00:15:00	89	75	34	54	50	36
33	18/06/2012 18:22:26	@APL0033	00:15:00	69	54	33	40	43	35
34	18/06/2012 18:37:26	@APL0034	00:15:00	76	64	34	48	53	37
35	18/06/2012 18:52:26	@APL0035	00:15:00	68	55	35	42	45	37
36	18/06/2012 19:07:26	@APL0036	00:15:00	76	67	34	49	52	38
37	18/06/2012 19:22:26	@APL0037	00:15:00	74	64	34	46	50	38
38	18/06/2012 19:37:26	@APL0038	00:15:00	96	72	35	50	52	38
39	18/06/2012 19:52:26	@APL0039	00:15:00	81	70	36	50	53	38
40	18/06/2012 20:07:26	@APL0040	00:15:00	75	67	38	48	50	40
41	18/06/2012 20:22:26	@APL0041	00:15:00	78	70	37	50	53	40
42	18/06/2012 20:37:26	@APL0042	00:15:00	74	65	36	46	47	38
43	18/06/2012 20:52:26	@APL0043	00:15:00	74	63	36	46	49	38
44	18/06/2012 21:07:26	@APL0044	00:15:00	74	66	36	47	49	38
45	18/06/2012 21:22:26	@APL0045	00:15:00	75	67	36	49	52	38
46	18/06/2012 21:37:26	@APL0046	00:15:00	74	65	36	50	53	39
47	18/06/2012 21:52:26	@APL0047	00:15:00	65	54	35	45	49	39
48	18/06/2012 22:07:26	@APL0048	00:15:00	69	60	35	43	46	37

No	Date & time	Filename	Elapsed time	PEAK [dB]	MAX [dB]	MIN [dB]	LEQ [dB]	L10	L90
49	18/06/2012 22:22:26	@APL0049	00:15:00	75	64	36	46	48	39
50	18/06/2012 22:37:26	@APL0050	00:15:00	77	68	36	49	51	38
51	18/06/2012 22:52:26	@APL0051	00:15:00	65	54	36	42	45	37
52	18/06/2012 23:07:26	@APL0052	00:15:00	62	50	35	42	45	38
53	18/06/2012 23:22:26	@APL0053	00:15:00	61	49	35	41	44	38
54	18/06/2012 23:37:26	@APL0054	00:15:00	70	55	36	42	46	38
55	18/06/2012 23:52:26	@APL0055	00:15:00	69	58	35	43	46	37
56	19/06/2012 00:07:26	@APL0056	00:15:00	64	53	35	38	40	36
57	19/06/2012 00:22:26	@APL0057	00:15:00	64	53	35	39	41	36
58	19/06/2012 00:37:26	@APL0058	00:15:00	62	52	33	38	40	35
59	19/06/2012 00:52:26	@APL0059	00:15:00	67	55	32	39	40	34
60	19/06/2012 01:07:26	@APL0060	00:15:00	70	59	32	41	41	34
61	19/06/2012 01:22:26	@APL0061	00:15:00	66	51	32	36	36	34
62	19/06/2012 01:37:26	@APL0062	00:15:00	62	46	32	35	37	34
63	19/06/2012 01:52:26	@APL0063	00:15:00	64	40	32	34	36	33
64	19/06/2012 02:07:26	@APL0064	00:15:00	56	38	32	34	36	33
65	19/06/2012 02:22:26	@APL0065	00:15:00	73	47	30	35	37	32
66	19/06/2012 02:37:26	@APL0066	00:15:00	67	44	31	34	35	32
67	19/06/2012 02:52:26	@APL0067	00:15:00	54	41	32	34	36	33
68	19/06/2012 03:07:26	@APL0068	00:15:00	59	46	32	36	37	34
69	19/06/2012 03:22:26	@APL0069	00:15:00	54	41	32	36	37	34
70	19/06/2012 03:37:26	@APL0070	00:15:00	63	42	33	35	37	34
71	19/06/2012 03:52:26	@APL0071	00:15:00	63	51	32	36	37	34
72	19/06/2012 04:07:26	@APL0072	00:15:00	63	50	33	37	39	35
73	19/06/2012 04:22:26	@APL0073	00:15:00	72	60	35	50	56	37
74	19/06/2012 04:37:26	@APL0074	00:15:00	78	69	34	50	55	36
75	19/06/2012 04:52:26	@APL0075	00:15:00	75	63	34	49	55	37
76	19/06/2012 05:07:26	@APL0076	00:15:00	79	68	35	46	47	37
77	19/06/2012 05:22:26	@APL0077	00:15:00	78	68	36	50	55	39
78	19/06/2012 05:37:26	@APL0078	00:15:00	73	62	36	42	42	38
79	19/06/2012 05:52:26	@APL0079	00:15:00	63	50	36	40	42	38
80	19/06/2012 06:07:26	@APL0080	00:15:00	79	67	36	47	43	37
81	19/06/2012 06:22:26	@APL0081	00:15:00	79	68	37	43	42	38
82	19/06/2012 06:37:26	@APL0082	00:15:00	82	73	38	51	48	39
83	19/06/2012 06:52:26	@APL0083	00:15:00	73	61	36	45	47	38
84	19/06/2012 07:07:26	@APL0084	00:15:00	71	60	36	43	46	37
85	19/06/2012 07:22:26	@APL0085	00:15:00	71	60	36	43	46	38
86	19/06/2012 07:37:26	@APL0086	00:15:00	66	55	37	44	47	39
87	19/06/2012 07:52:26	@APL0087	00:15:00	76	65	38	48	50	40
88	19/06/2012 08:07:26	@APL0088	00:15:00	75	65	38	49	52	40
89	19/06/2012 08:22:26	@APL0089	00:15:00	71	62	38	47	49	41
90	19/06/2012 08:37:26	@APL0090	00:15:00	72	63	39	49	53	42
91	19/06/2012 08:52:26	@APL0091	00:15:00	75	67	37	48	51	43
92	19/06/2012 09:07:26	@APL0092	00:15:00	78	66	38	49	53	41
93	19/06/2012 09:22:26	@APL0093	00:15:00	83	70	36	51	52	39
94	19/06/2012 09:37:26	@APL0094	00:15:00	77	68	37	47	50	39
95	19/06/2012 09:52:26	@APL0095	00:15:00	81	72	38	51	54	42
96	19/06/2012 10:07:26	@APL0096	00:15:00	97	75	38	61	63	55

Appendix C

ACOUSTICS PLUS

CONTRACT TITLE: 5 Ingram Avenue, London
SOUND SOURCE: Pool Ventilation Exhaust
MAKE & TYPE: LSPC AHU

				OCTAVE BAND CENTRE FREQUENCY (Hz)								
OVERALL Lw				63	125	250	500	1k	2k	4k	8k	dBA
1												
2			UNIT Lw	68	70	68	70	66	68	65	56	73.6
3												
4	STRAIGHT DUCT - Circular											
5	LENGTH (m)		SIZE (mm)	0.07	0.07	0.07	0.10	0.16	0.16	0.16	0.16	
6	7.00		690 x 420	0.49	0.49	0.49	0.70	1.12	1.12	1.12	1.12	
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)		1	7	7	4	3	3	3	
13	2	90°	690 x 420	0.00	2.00	14.00	14.00	8.00	6.00	6.00	6.00	
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	Circular Spigotted Attenuator 1225mm			2	5	7	19	31	22	20	16	
21	(manufactured by Caice)											
22												
23												
24	END REFLECTION SIZE (mm)											
25	690			9	4	1	0	0	0	0	0	
26												
27	**Lw LEAVING SYSTEM**			56	58	45	36	26	39	38	33	
28												
29	DISTANCE TO LISTENER (m)		8	-29	-29	-29	-29	-29	-29	-29	-29	
31												
32	Reflecting plane			3	3	3	3	3	3	3	3	
33	**DIRECT Lp**			30	32	19	10	0	13	12	7	20

ACOUSTICS PLUS

CONTRACT TITLE: 5 Ingram Avenue, London
SOUND SOURCE: Pool Ventilation Supply
MAKE & TYPE: LSPC AHU

				OCTAVE BAND CENTRE FREQUENCY (Hz)								
	OVERALL Lw			63	125	250	500	1k	2k	4k	8k	dBA
1												
2			UNIT Lw	66	66	64	65	62	63	61	52	68.9
3												
4	STRAIGHT DUCT - Circular											
5	LENGTH (m)		SIZE (mm)	0.07	0.07	0.07	0.10	0.16	0.16	0.16	0.16	
6	7.00		690 x 420	0.49	0.49	0.49	0.70	1.12	1.12	1.12	1.12	
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)		1	7	7	4	3	3	3	
13	2	90°	690 x 420	0.00	2.00	14.00	14.00	8.00	6.00	6.00	6.00	
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	Circular Spigotted Attenuator 1225mm			2	5	7	19	31	22	20	16	
21	(manufactured by Caice)											
22												
23												
24	END REFLECTION SIZE (mm)											
25	690			9	4	1	0	0	0	0	0	
26												
27	**Lw LEAVING SYSTEM**			54	55	41	31	22	34	34	29	
28												
29	DISTANCE TO LISTENER (m)		8	-29	-29	-29	-29	-29	-29	-29	-29	
31												
32	Reflecting plane			3	3	3	3	3	3	3	3	
33	**DIRECT Lp**			28	29	15	5	0	8	8	3	16