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DOUBLE 24-HOUR NOISE LEVEL SURVEY CARRIED OUT AT THE FRONT AND REAR OF 11 FITZROY SQUARE, LONDON W1 AND A REPORT ON THE NOISE CONTROL MEASURES REQUIRED TO MINIMISE THE NOISE IMPACT OF THE PROPOSED NEW EXTERNAL PLANT

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Client	:	Carmody Groarke
Project	:	11 Fitzroy Square, London W1
Emtec Ref.	:	QF7351/PF4765/RP1
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1.0. INTRODUCTION

This report details the results of a double 24-hour noise survey carried out at the front and the rear of 11 Fitzroy Square, London SW1.

The objectives of this survey were as follows:

- To establish the existing background noise level in the vicinity of the proposed plant.
- To assess the proposal that is to install a new air conditioning equipment into lower ground floor store rooms, and to have a number of new extract fans discharging at various points on the building envelope, and to recommend design noise limits and any necessary measures to ensure that the operation of the new plant does not disturb the occupants of the neighbouring residential properties.

This report has been divided into the following sections for ease of analysis:

2.0. SITE DESCRIPTION

11 Fitzroy Square is a four storey residential building located at the north east corner of Fitzroy Square, London W1.

It has adjoining dwellings to the western side, 12 Fitzroy Square, and to the northern side, 11a Fitzroy Square.

3.0. TEST INSTRUMENTATION

All measurement equipment used during the survey complied with the requirements of BS4142:1997 "Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas". Details of the equipment are as follows:

Integrating Sound Level Meters	: Bruel & Kjaer type 2231 fitted with a Bruel & Kjaer type 4155 ½ inch condenser microphone.
Statistical Analysis Modules	: Bruel & Kjaer type BZ 7115 capable of computing the percentile levels L1, L10, L50, L90 and L99 and also the Leq level.
Acoustic Calibrator	: Bruel & Kjaer type 4231 electronic calibrator.

Calibration was performed before and after the surveys and found to be, in all cases, +/- 0.1 dB from the reference source.

3.1. Existing Noise Climate

Road traffic noise on nearby was heard during the manned period at the start and end of the survey. We feel this would ordinarily be the dominant source of noise affecting the ambient noise level.

There being no overground railway nearby, rail noise was not heard during the manned periods at the start and end of the survey.

Aircraft were observed during the manned periods at the start and the end of survey. It is likely that the noise levels measured will include contributions from medium altitude aircraft.

4.0. TEST PROCEDURE

The survey was conducted during a continuous period from 14.06pm on Tuesday the 4th of December 2012 to 13.26pm on Thursday the 6th December 2012.

Data was continuously acquired throughout the measurement period with the individual averaging time for statistical noise data set to 20 minutes. The following 'A' weighted statistical measurements were recorded concurrently:

LA1	The Sound Pressure Level exceeded for 1% of the measurement period.
LA10	The Sound Pressure Level exceeded for 10% of the measurement period.
LA50	The Sound Pressure Level exceeded for 50% of the measurement period.
LA90	The Sound Pressure Level exceeded for 90% of the measurement period. LA90 is considered to represent the "background noise level" during the measurement period and is used for the assessment of noise to determine the likelihood of complaints (See BS 4142).
LA99	The Sound Pressure Level exceeded for 99% of the measurement period.
LAeq	The continuous steady state Sound Pressure Level that has the same acoustic energy as the real fluctuating level.

Measurement Positions

Front:

Noise levels were measured at ground level at the front of the property, at a position considered equivalent to the closest receptor locations in order to enable noise predictions from the proposed air conditioning plant to be compared and assessed against.

The microphone was pointing due west and was approximately 1.2 metres above ground level. The rest of the measurement equipment was located in a weatherproof enclosure with a low impedance cable running from the microphone to the instrumentation.

Rear:

Noise levels were measured on the flat roof above the basement living area at the rear of the building, at a position considered equivalent to the closest receptor locations in order to enable noise predictions from the proposed extract fans to be compared and assessed against.

The microphone was pointing due south and was approximately 1.2 metres above roof level. The rest of the measurement equipment was located in a weatherproof enclosure with a low impedance cable running from the microphone to the instrumentation.

Weather Conditions

The weather conditions prevailing during the measurement periods were generally in line with those recommended in BS 4142:1997. The sky was generally clear throughout the daytime and night time periods with calm conditions during the daytime and during the night time periods. The microphone was protected throughout the tests by an acoustically transparent wind balloon.

5.0. RESULTS AND EVALUATION OF NOISE CRITERIA

The raw data, gathered during the noise survey, is given in Appendix 'A 'of this report.

The 'A' Weighted Leq levels measured over each 20 minute interval throughout the 24-hour periods (denoted by LAeq, (20 mins) are displayed as bar graphs on the attached Sketch Nos. QF/7351/T1F and QF/7351/T1R at the back of this report.

The 'A' Weighted percentile levels measured over each 20 minute interval denoted by LA10 (20 mins), LA50 (20 mins) and LA90 (20 mins) are displayed as a line graph on the attached Sketch Nos. QF/7351/T2F and QF7351/T2R at the back of this report.

5.1. Summary of Results

The tables QF/7351/D1F and QF/7351/D1R below summarises the noise levels taken over the 24-hour period in terms of the maximum and minimum Sound Pressure Levels recorded.

Table QF/7351/D1F – Summary of Maximum and Minimum Noise Levels at Front

	LA1	LA10	LA50	LA90	LA99	LAeq
Min.	58.1dBA	56.1dBA	53.6dBA	51.6dBA	49.1dBA	53.9dBA
Max.	72.1dBA	62.1dBA	58.1dBA	54.6dBA	53.6dBA	60.9dBA

Table QF/7351/D1R – Summary of Maximum and Minimum Noise Levels at Rear

	LA1	LA10	LA50	LA90	LA99	LAeq
Min.	53.6dBA	52.1dBA	47.1dBA	43.6dBA	41.6dBA	48.8dBA
Max.	69.1dBA	60.6dBA	58.1dBA	51.6dBA	49.6dBA	57.6dBA

5.2. Noise sensitive property design criteria

Table E of Camden's current Unitary Development Plan states that noise from external plant and machinery must be at least 5dB less than the lowest measured LA90 when measured at 1 metre external to the nearest sensitive façade.

Where the noise has a distinguishable discrete continuous note (whine, hiss, screech, hum) the Development Plan states that noise from external plant and machinery must be at least 10dB less than the lowest measured LA90 when measured at 1 metre external to the nearest sensitive façade.

Where the noise has distinct impulses (bangs, clicks, clatters, thumps) the Development Plan states that noise from external plant and machinery must be at least 10dB less than the lowest measured LA90 when measured at 1 metre external to the nearest sensitive façade.

Where the lowest background noise level exceeds 60dBA, then noise from external plant and machinery must be at least 55dBA when measured at 1 metre external to the nearest sensitive façade.

The new plant will not contain discrete notes or impulses, may operate on an intermittent basis. We therefore recommend that the new plant be designed to be 10 dBA below the minimum existing LA_{90} background noise level during the relevant operational period.

Front: The lowest recorded LA_{90} level measured during the 24-hour period was 51.6dBA, which occurred during six consecutive time periods between 02.06am and 04.26am.

New plant at the front of the building should therefore be designed to achieve 41.6dBA at 1 metre from the nearest noise sensitive properties' windows if the equipment is to be operated on a 24-hour basis.

Rear: The lowest recorded LA_{90} level measured during the 24-hour period was 43.6dBA, which occurred during once during the time period ending at 03.06am.

New plant at the rear of the building should therefore be designed to achieve 33.6dBA at 1 metre from the nearest noise sensitive properties' windows if the equipment is to be operated on a 24-hour basis.

5.3. Commercial property design criteria

Ordinarily we would refer to BS8233:1999 for guidance on commercial property design criteria.

The nearest affected properties are both residential. Compliance with the residential design criteria will therefore ensure compliance with commercial property design criteria so further analysis of commercial design criteria will not be necessary.

5.4. Summary of external noise criteria

Based upon the above results and design criteria we summarise the actual design rating levels to be adopted for this project in table QF/7351/D2 below: -

Table QF/7351/D2 – recommended design rating levels $L_{Ar,T}$

Type of premises	**$L_{Ar,T}$ (24-hour)**
Noise sensitive - front	41.6 dBA
Noise sensitive - rear	33.6 dBA

6.0. DISCUSSION OF RESULTS

The buildings surrounding the proposed locations of the plant were inspected.

To front aspects of the building, the nearest affected windows were identified belonging to the neighbouring properties 11a Fitzroy Square, which has first floor windows approximately 8 metres away from the proposed plant located in the store room R1.11, and 12 Fitzroy Square which has first floor windows approximately 6 metres away from the proposed plant located in the store room R1.18.

To the rear of the building, the nearest affected windows were identified belonging to the neighbouring property 12 Fitzroy Square, which has rear elevation windows approximately 5 metres away from the location of the proposed plant.

The following sections describe the equipment in each of the various locations and suitable measures to control the noise in order to meet the recommended noise limits.

6.1. Description of Equipment and Predicted Noise Levels – Front – Room R1.11

The proposal is to install the following equipment to the front aspects of the property:

1 off VES type Ecovent Size 1 heat recovery unit located in store room ref. R1.11
Published casing breakout noise: - 40dBA @ 1m (sound pressure level)
Published in-duct sound power level: - 67dBA
(see Appendix 'C' for details of noise data)

1 off Nuaire Opus Plus 100 extract fan located in store room ref. R1.1167
Published casing breakout noise: - 45dBA @ 3m (sound pressure level)
Published in-duct sound power level: - 63dBA
(see Appendix 'C' for details of noise data)

Combined sound power level (HRU fresh-air, HRU exhaust and extract fan) 71dBA.

The store room has a massive structure that will adequately contain the breakout noise of the heat recovery unit and the extract fan.

Each unit will ventilate to atmosphere, where in-duct fan noise can leave the system. Using the formula: SPL = SWL – 20 log r – 11 + D,

where SPL = Sound Pressure Level, SWL = Sound Power Level, r = distance = 8m and D = Directivity factor = 6,

we predict that plant noise levels at 1 metre external to the nearest affected residential window will be in the order of 48dBA.

6.2. Measures to mitigate noise – Front – Room R1.11

We understand the plant will operate on a 24-hour basis.

The recommended design rating level at the front of the property for plant operating on a 24-hour basis is 41.6dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 48dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 6.4dB above the recommended design rating level.

It will therefore be necessary to reduce the noise emissions of the plant located in the store room ref. R1.11.

This shall be achieved by fitting in-line duct silencers to the atmospheric connections of the heat recovery unit and the extract fan, such as Emtec type RAAC/38/600S silencers, having the following minimum dynamic insertion loss figures: -

	Sound Reduction Index at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
HRU and utility extract fan silencers	3	6	13	21	28	29	25	15

The silencers should be built in the store room walls and properly sealed to the peripheral structure to ensure internal noise cannot break out to atmosphere.

The store room door shall be of a solid construction with peripheral seals and have a minimum weighted sound reduction index Rw:30dB.

6.3. Description of Equipment and Predicted Noise Levels – Front – Room R1.18

The proposal is to install the following equipment to the front aspects of the property:

1 off Daikin type RXS 35J condenser unit located in store room ref. R1.18
Published sound power level: - 61dBA @ 1m
(see Appendix 'C' for details of noise data)

The store room has a massive structure that will adequately contain the breakout noise of the condenser unit.

For efficient operation of the condenser it will be necessary to bring in fresh air in to the store room and discharge exhaust air via openings in the front of the store room. Condenser noise will be able to escape the store room via these openings.

Using the formula: $SPL = SWL - 20 \log r - 11 + D$,

where SPL = Sound Pressure Level, SWL = Sound Power Level, r = distance = 6m and D = Directivity factor = 6,

we predict that plant noise levels at 1 metre external to the nearest affected residential window will be in the order of 40dBA.

6.4. Measures to mitigate noise – Front – Room R1.18

We understand the plant will operate on a 24-hour basis.

The recommended design rating level at the front of the property for plant operating on a 24-hour basis is 41.6dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 40dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 1.6dB below the recommended design rating level.

It will therefore be unnecessary to apply additional acoustic treatment to the proposed condenser in order to meet the suggested design noise limits at the front of the property.

For the condenser to operate efficiently within the store room, we recommend fresh air is introduced into the store room via an aperture to one side of the store room wall and the condenser exhaust is ducted to a separate opening on the opposite side of the store room wall.

If this arrangement is adopted, then we would recommend silencing the air paths.

This shall be achieved by incorporating silencers within the store room wall apertures, such as Emtec type RAAC/38/600S silencers, having the following minimum dynamic insertion loss figures: -

	Sound Reduction Index at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Condenser silencers	3	6	13	21	28	29	25	15

The silencers should be built in the store room walls and properly sealed to the peripheral structure to ensure internal noise cannot break out to atmosphere.

If air for the condensers is ducted through the store room walls, the store room door can then be of a solid construction, with peripheral seals and a minimum weighted sound reduction index Rw:30dB.

6.5. Description of Equipment and Predicted Noise Levels – Rear

The proposal is to install the following ventilation equipment inside the property that will exhaust to atmosphere towards the rear of the building:

1 off Nuaire Opus 40 toilet extract fan handling approximately 25 l/s
Published in-duct sound power level: - 48dBA

1 off kitchen extract fan handling approximately 60l/s
Typical in-duct sound power level: - 60dBA

Combined sound power level (toilet extract and kitchen extract fans) 60dBA.

The building has a massive structure that will adequately contain the breakout noise of the extract fans.

Each unit will ventilate to atmosphere, where in-duct fan noise can leave the system.

Using the formula: SPL = SWL – 20 log r – 11 + D,

where SPL = Sound Pressure Level, SWL = Sound Power Level, r = distance = 5m and D = Directivity factor = 3,

we predict that plant noise levels at 1 metre external to the nearest affected residential window at the rear of the building will be in the order of 38dBA.

6.6. Measures to mitigate noise – Rear

We understand the plant will operate on a 24-hour basis.

The recommended design rating level at the front of the property for plant operating on a 24-hour basis is 33.6dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 39dBA.

The predicted plant noise level at 1 metre outside the nearest affected noise sensitive window is 5.4dB above the recommended design rating level.

It will therefore be necessary to reduce the duct borne fan noise of the kitchen extract fan.

This shall be achieved by fitting in-line duct silencers to the atmospheric side duct work of this fan, such as an Emtec type RAAC/38/900M silencer, having the following minimum dynamic insertion loss figures: -

	Sound Reduction Index at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Kitchen extract silencer	4	8	12	11	14	13	13	14

Note ! The kitchen extract fan silencer shall incorporate Melinex protection the acoustic infil.

6.7. High Level Toilet Extract Fans

It is proposed to discharge two toilet extract fans at high level through roof vent slate tiles. Assuming a typical in duct sound power level of 48dBA for these units, and a distance of approximately 10 metres to the nearest affected residential window, we predict a combined sound pressure level below 30dBA outside the nearest affected windows which will be inaudible at any time of day or night based on the measured background noise levels.

6.8. Further Recommendations

The proposed heat recovery unit and condenser shall be effectively isolated from the structure using double deflection neoprene-in-shear anti-vibration mounts to prevent the transmission of structure borne noise.

6.9. Equipment Layout

The drawing numbers 3128/M/01_P2, 3128/M/05_P1 and 3128/M/06_P1 in Appendix 'B' of this report, shows the general layout and location of the proposed plant.

6.10. Summary

A double 24-hour noise survey has been undertaken at 11 Fitzroy Square, London W1.

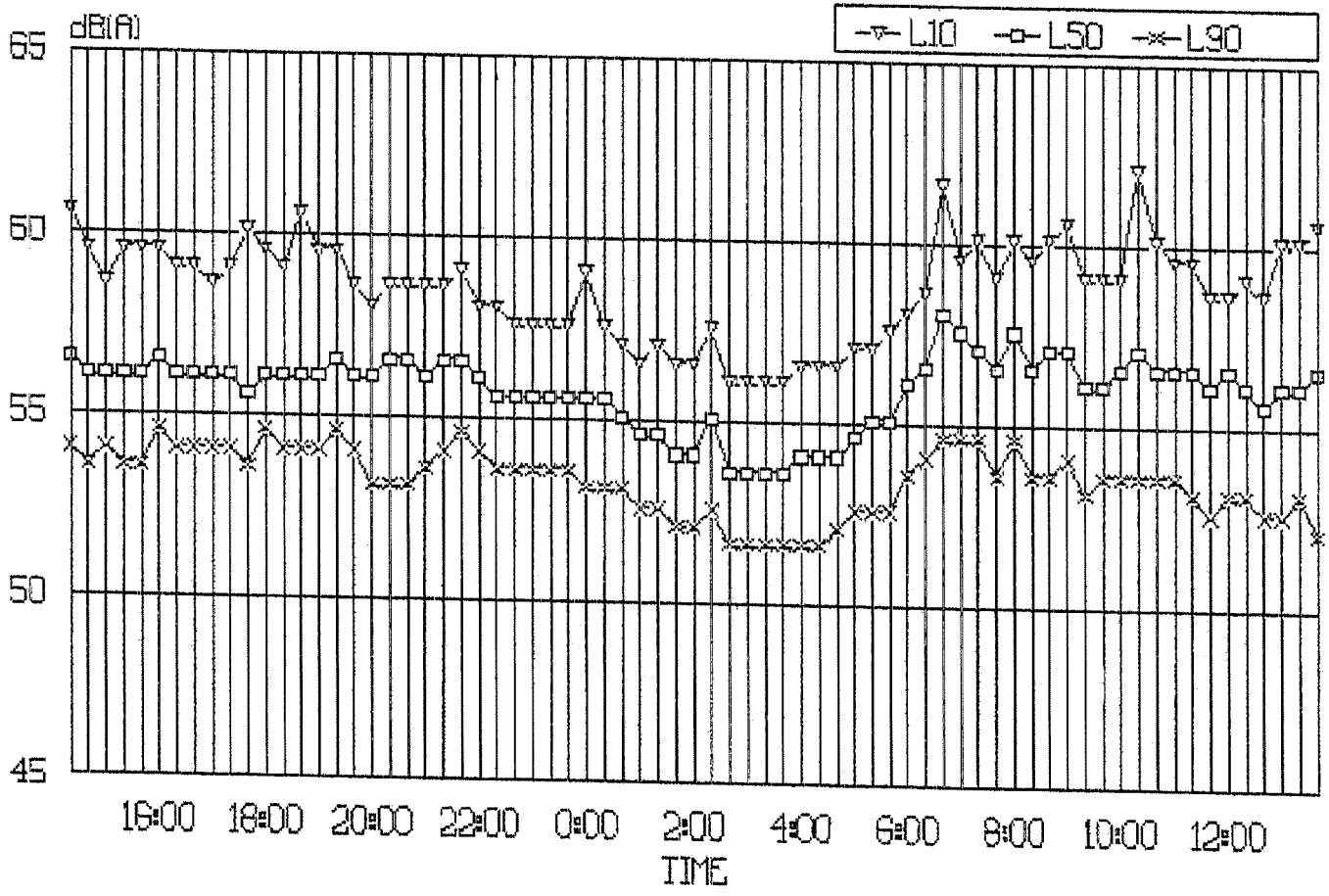
Design noise limits have been recommended based on the results of the survey and Camden Council's planning guidelines.

Appropriate noise control measures have been advised for the proposed new external plant.

If the recommended noise control measures are implemented and the design rating levels are achieved, it is predicted that operation of the new plant should attract no justifiable complaints under the guidelines set out in Camden's planning policies and as such reservations are not expected from the planning authority on the grounds of noise.

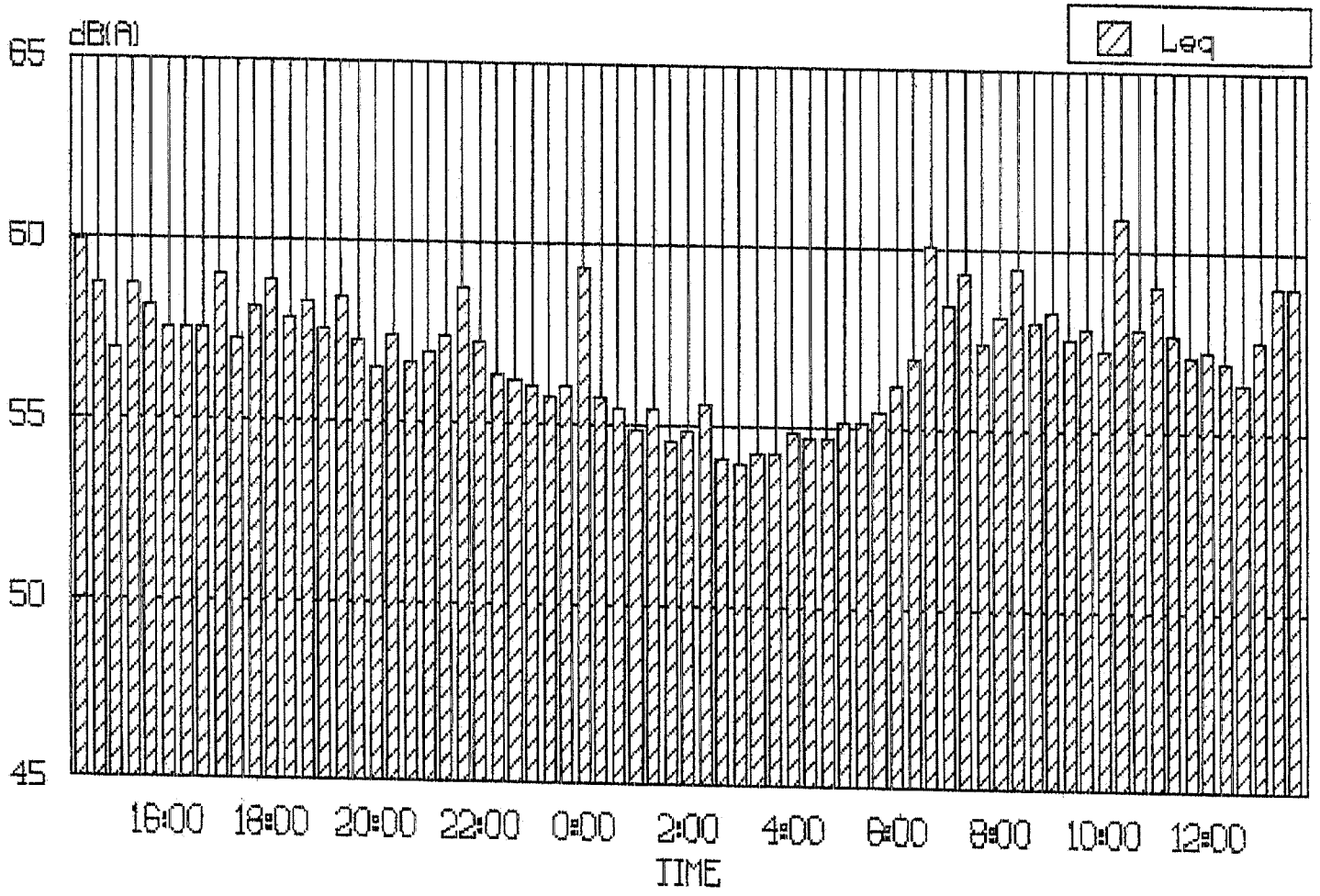
EMTEC PRODUCTS LTD
8th January 2013

Front of 11, Fitzroy Square, London W1
4th to 5th December 2012



TITLE: LA10;LA50 and LA90 Levels	*ISSUE DATE:* 8th January 2013				*DRAWN BY:* JT	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	EMTEC	
CLIENT: Carmody Groarke	*PF No:4765*				*APPROVED BY:* JT	*REVISION*								Enterprise House, 133 Blyth Road Hayes, Middlesex UB3 1DD Tel: 020 8848 3031 Fax: 020 8573 3605	
PROJECT: 11 Fitzroy Square	*Q*	*A*	*M*	*I*	*DESIGN AUTH:* JT	*SKETCH No. QF/7351/T1F*									

Front of 11, Fitzroy Square, London W1
4th to 5th December 2012



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CLIENT: Carmody Groarke	*PF No:4765*				*APPROVED BY:* JT	*REVISION*							
PROJECT: 11 Fitzroy Square	*Q*	*A*	*M*	*I*	*DESIGN AUTH:* JT	*SKETCH No. QF/7351/T2F*							

EMTEC
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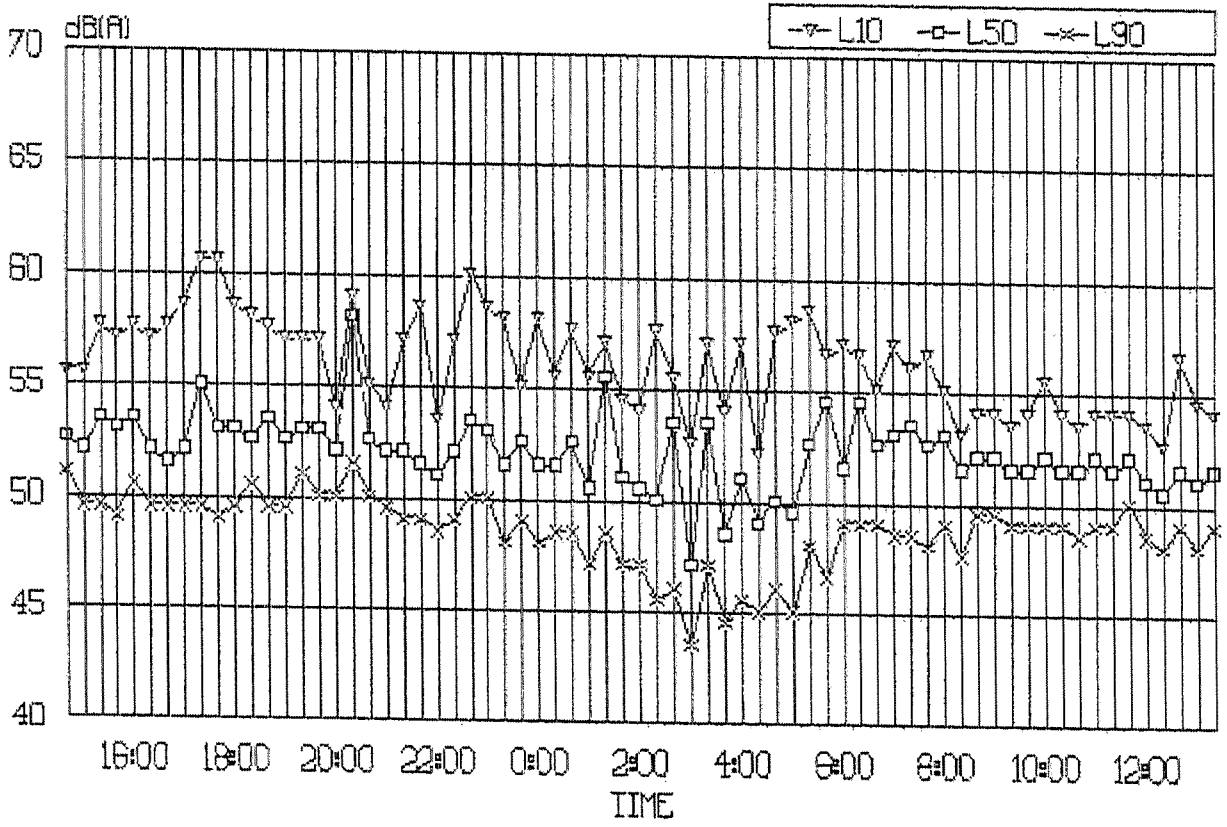
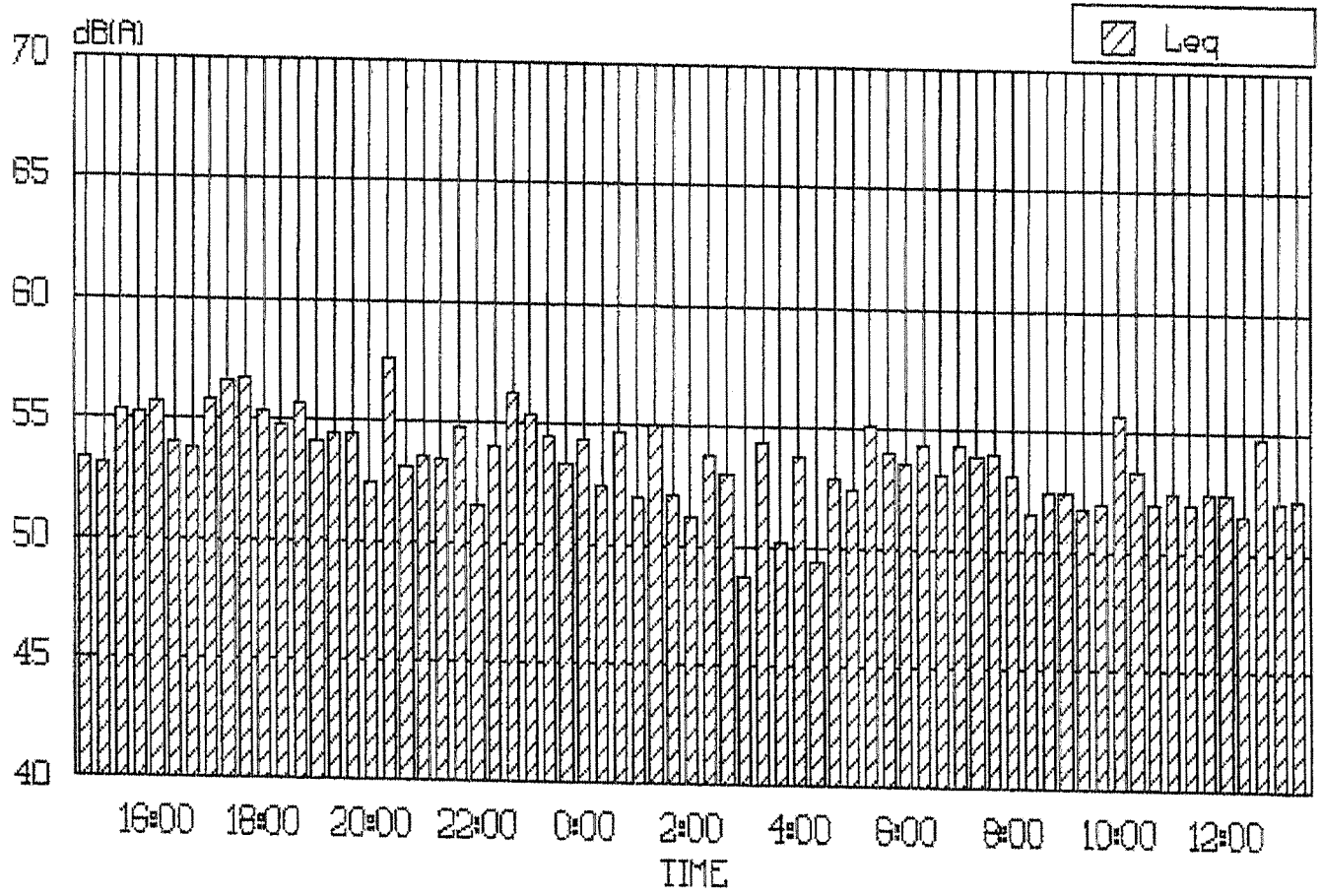
Hayes, Middlesex UB3 1DD
Tel: 020 8848 3031 Fax: 020 8573 3605

Rear of 11, Fitzroy Square, London W1
5th to 6th December 2012



TITLE: *LA10; LA50 and LA90 Levels*	*ISSUE DATE:* 8th January 2013				*DRAWN BY:* JT	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	EMTEC	
CLIENT: Carmody Groarke	*PF No:4765*				*APPROVED BY:* JT	*REVISION*								Enterprise House, 133 Blyth Road Hayes, Middlesex UB3 1DD Tel: 020 8848 3031 Fax: 020 8573 3605	
PROJECT: 11 Fitzroy Square	*Q*	*A*	*M*	*I*	*DESIGN AUTH:* JT	*SKETCH No. QF/7351/T1R*									

Rear of 11, Fitzroy Square, London W1
5th to 6th December 2012



TITLE: Leq Levels	*ISSUE DATE:* 8th January 2013				*DRAWN BY:* JT	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	EMTEC	
CLIENT: Carmody Groarke	*PF No:4765*				*APPROVED BY:* JT	*REVISION*								Enterprise House, 133 Blyth Road Hayes, Middlesex UB3 1DD Tel: 020 8848 3031 Fax: 020 8573 3605	
PROJECT: 11 Fitzroy Square	Q	A	M	I	*DESIGN AUTH:* JT	*SKETCH No. QF/7351/T2R*									

APPENDIX 'A'

Raw Data – Noise Survey

4th to the 6th of December 2013

NOISE SURVEY DATA FROM BACKGROUND NOISE LEVEL SURVEY CARRIED OUT AT THE FRONT OF No. 11 FITZROY SQUARE, LONDON W1

Project : 11 Fitzroy Square, London W1
Client : Environmental Engineering Partnership Ltd.
Ref : QF7531
Survey Date : 4th to 5th December 2012

Measure No.	Finish Time	MaxP (dBA)	L1 (dBA)	L10 (dBA)	L50 (dBA)	L90 (dBA)	L99 (dBA)	Leq (dBA)
1	14:26	97.4	69.1	60.6	56.6	54.1	53.1	59.9
2	14:46	89.5	69.6	59.6	56.1	53.6	52.6	58.7
3	15:06	84.7	63.6	58.6	56.1	54.1	52.6	56.9
4	15:26	95.4	69.1	59.6	56.1	53.6	52.6	58.8
5	15:46	89.6	68.1	59.6	56.1	53.6	53.1	58.2
6	16:06	84.5	64.6	59.6	56.6	54.6	53.1	57.6
7	16:26	85.2	65.6	59.1	56.1	54.1	53.1	57.5
8	16:46	91.9	65.6	59.1	56.1	54.1	53.1	57.6
9	17:06	87.5	71.1	58.6	56.1	54.1	53.1	59
10	17:26	84.4	64.6	59.1	56.1	54.1	53.1	57.3
11	17:46	85.3	67.6	60.1	55.6	53.6	53.1	58.1
12	18:06	91.8	69.1	59.6	56.1	54.6	53.1	58.9
13	18:26	87.8	66.1	59.1	56.1	54.1	52.6	57.8
14	18:46	88.8	66.6	60.6	56.1	54.1	52.6	58.3
15	19:06	93.2	65.6	59.6	56.1	54.1	53.1	57.6
16	19:26	88.2	67.6	59.6	56.6	54.6	53.1	58.5
17	19:46	84.2	66.1	58.6	56.1	54.1	52.6	57.3
18	20:06	82.5	61.6	58.1	56.1	53.1	51.6	56.5
19	20:26	92.6	66.1	58.6	56.6	53.1	52.1	57.4
20	20:46	83.5	61.6	58.6	56.6	53.1	52.1	56.7
21	21:06	84.5	63.6	58.6	56.1	53.6	53.1	57
22	21:26	88.3	64.6	58.6	56.6	54.1	52.1	57.4
23	21:46	88.9	68.1	59.1	56.6	54.6	52.1	58.7
24	22:06	86.4	66.1	58.1	56.1	54.1	52.6	57.3
25	22:26	84.2	61.6	58.1	55.6	53.6	52.6	56.3
26	22:46	84.1	61.1	57.6	55.6	53.6	52.1	56.2
27	23:06	84	61.6	57.6	55.6	53.6	51.6	56.1
28	23:26	81.6	59.6	57.6	55.6	53.6	51.6	55.8
29	23:46	80.6	60.6	57.6	55.6	53.6	52.1	56
30	00:06	88	71.6	59.1	55.6	53.1	52.1	59.4
31	00:26	78.7	61.1	57.6	55.6	53.1	51.6	55.8
32	00:46	78.2	59.6	57.1	55.1	53.1	51.6	55.5
33	01:06	74.4	58.6	56.6	54.6	52.6	51.6	54.8
34	01:26	85.4	60.1	57.1	54.6	52.6	51.1	55.5
35	01:46	74.8	58.6	56.6	54.1	52.1	51.1	54.6
36	02:06	83.6	59.6	56.6	54.1	52.1	51.1	54.9
37	02:26	85	61.6	57.6	55.1	52.6	51.6	55.6
38	02:46	72.6	58.6	56.1	53.6	51.6	50.6	54.1
39	03:06	76.4	58.6	56.1	53.6	51.6	50.6	53.9
40	03:26	78.1	60.1	56.1	53.6	51.6	51.1	54.2
41	03:46	74.2	58.1	56.1	53.6	51.6	50.6	54.2
42	04:06	91.7	60.1	56.6	54.1	51.6	50.6	54.8
43	04:26	83.9	59.6	56.6	54.1	51.6	51.1	54.7
44	04:46	73.5	58.6	56.6	54.1	52.1	51.1	54.7
45	05:06	74.6	59.1	57.1	54.6	52.6	51.1	55.2
46	05:26	73.1	58.6	57.1	55.1	52.6	51.6	55.2
47	05:46	73.6	59.1	57.6	55.1	52.6	51.1	55.4
48	06:06	77.1	60.6	58.1	56.1	53.6	51.6	56.2
49	06:26	83.5	62.6	58.6	56.6	54.1	52.6	56.9
50	06:46	92.4	69.1	61.6	58.1	54.6	53.6	60.1
51	07:06	89.9	63.6	59.6	57.6	54.6	53.1	58.5
52	07:26	97.4	66.1	60.1	57.1	54.6	53.6	59.3
53	07:46	94.7	64.6	59.1	56.6	53.6	52.1	57.4
54	08:06	88.9	64.6	60.1	57.6	54.6	52.6	58.2
55	08:26	93.8	71.1	59.6	56.6	53.6	52.1	59.5
56	08:46	85.4	65.6	60.1	57.1	53.6	52.6	59
57	09:06	91.1	65.6	60.6	57.1	54.1	52.1	58.3
58	09:26	88.7	66.1	59.1	56.1	53.1	51.6	57.5
59	09:46	86.1	66.6	59.1	56.1	53.6	51.1	57.8
60	10.06	87.4	64.1	59.1	56.6	53.6	51.1	57.3
61	10:26	91	72.1	62.1	57.1	53.6	51.1	60.9
62	10:46	87.4	65.6	60.1	56.6	53.6	51.1	57.9
63	11:06	88.9	70.1	59.6	56.6	53.6	51.6	59
64	11:26	85	66.1	59.6	56.6	53.1	51.1	57.7
65	11:46	91	65.1	58.6	56.1	52.6	50.6	57.1
66	12:06	87.1	65.1	58.6	56.6	53.1	50.6	57.2
67	12:26	85.9	64.1	59.1	56.1	53.1	51.1	56.9
68	12:46	85.2	62.6	58.6	55.6	52.6	50.6	56.4
69	13:06	87.9	64.6	60.1	56.1	52.6	50.6	57.5
70	13:26	89.5	70.1	60.1	56.1	53.1	50.6	59.1
71	13:46	97.3	67.1	60.6	56.6	52.1	49.1	59.1

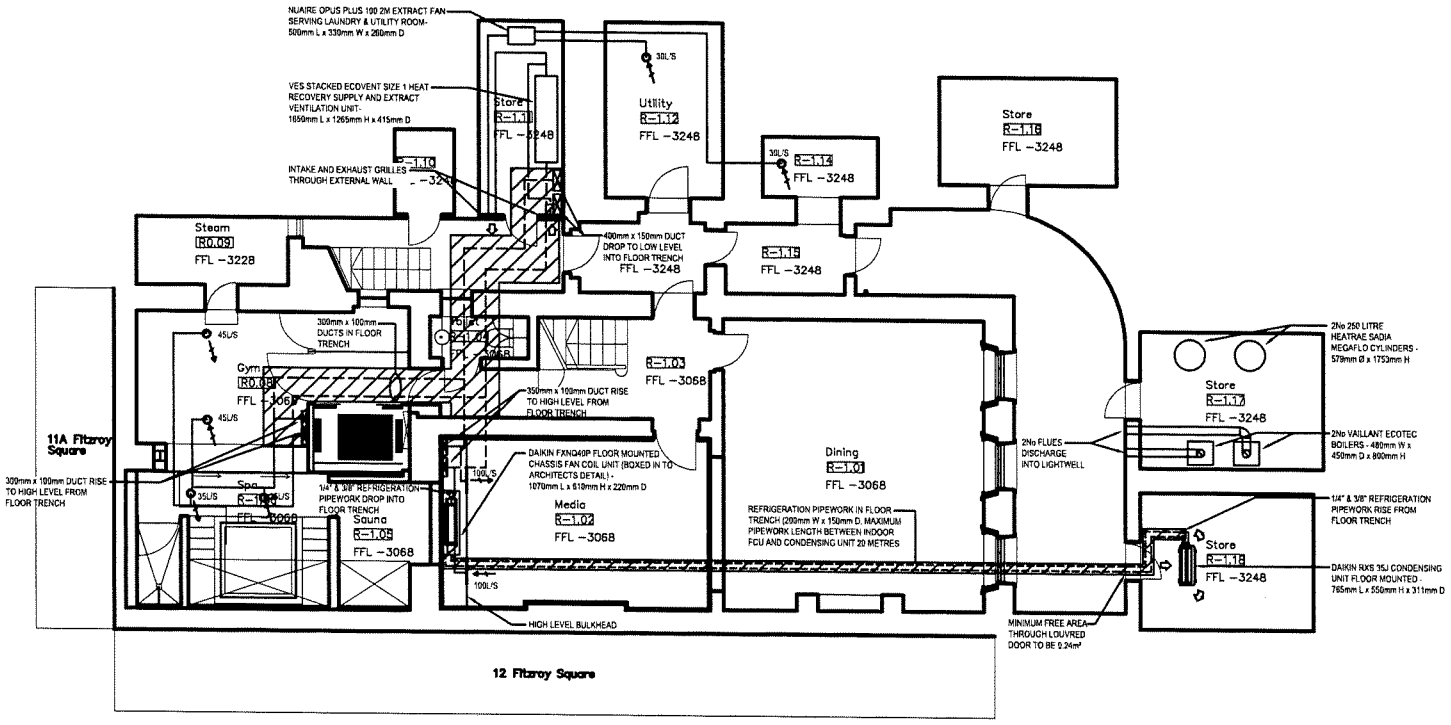
NOISE SURVEY DATA FROM BACKGROUND NOISE LEVEL SURVEY CARRIED OUT AT THE REAR OF No. 11 FITZROY SQUARE, LONDON W1

Project :	11 Fitzroy Square, London W1
Client :	Environmental Engineering Partnership Ltd.
Ref :	QF7531
Survey Date :	5th to 6th December 2012

Measure No.	Finish Time	MaxP (dBA)	L1 (dBA)	L10 (dBA)	L50 (dBA)	L90 (dBA)	L99 (dBA)	Leq (dBA)
1	14:46	73.5	57.1	55.6	52.6	51.1	49.6	53.3
2	15:06	76.9	58.1	55.6	52.1	49.6	47.6	53.1
3	15:26	80.2	62.1	57.6	53.6	49.6	47.6	55.4
4	15:46	82.7	64.6	57.1	53.1	49.1	47.1	55.3
5	16:06	81.7	64.6	57.6	53.6	50.6	49.1	55.7
6	16:26	81.7	63.1	57.1	52.1	49.6	48.6	54
7	16:46	76.3	60.1	57.6	51.6	49.6	48.6	53.8
8	17:06	83.8	66.6	58.6	52.1	49.6	48.6	55.8
9	17:26	80.4	63.6	60.6	55.1	49.6	47.6	56.6
10	17:46	78.5	63.6	60.6	53.1	49.1	47.1	56.7
11	18:06	73.8	59.6	58.6	53.1	49.6	47.1	55.4
12	18:26	74.1	59.1	58.1	52.6	50.6	48.1	54.8
13	18:46	83.6	64.6	57.6	53.6	49.6	48.1	55.7
14	19:06	79	59.6	57.1	52.6	49.6	48.1	54.1
15	19:26	80.5	62.1	57.1	53.1	51.1	48.6	54.5
16	19:46	89.4	59.6	57.1	53.1	50.1	48.6	54.5
17	20:06	75.2	56.6	54.1	52.1	50.1	48.6	52.5
18	20:26	79.9	60.1	59.1	58.1	51.6	48.6	57.6
19	20:46	73.6	58.1	55.1	52.6	50.1	47.6	53.1
20	21:06	82.5	61.6	54.1	52.1	49.6	46.6	53.6
21	21:26	78.2	58.1	57.1	52.1	49.1	47.1	53.5
22	21:46	79.9	60.6	58.6	51.6	49.1	47.6	54.7
23	22:06	71	57.1	53.6	51.1	48.6	46.6	51.6
24	22:26	79.5	59.1	57.1	52.1	49.1	47.1	54
25	22:46	76.2	61.1	60.1	53.6	50.1	47.6	56.3
26	23:06	75.5	59.6	58.6	53.1	50.1	47.6	55.4
27	23:26	74.2	59.1	58.1	51.6	48.1	46.1	54.5
28	23:46	88.3	59.6	55.1	52.6	49.1	47.1	53.3
29	00:06	78.3	58.6	58.1	51.6	48.1	45.6	54.4
30	00:26	76.8	58.1	55.6	51.6	48.6	46.6	52.5
31	00:46	74.5	58.6	57.6	52.6	48.6	46.1	54.6
32	01:06	89.2	56.6	55.6	50.6	47.1	44.6	51.9
33	01:26	74.6	58.6	57.1	55.6	48.6	45.6	55
34	01:46	72.4	56.1	54.6	51.1	47.1	45.1	52.1
35	02:06	71.9	55.1	54.1	50.6	47.1	44.6	51.2
36	02:26	73.6	58.1	57.6	50.1	45.6	43.1	53.7
37	02:46	77.7	56.6	55.6	53.6	46.1	43.1	53
38	03:06	68.9	54.6	52.6	47.1	43.6	41.6	48.8
39	03:26	79.9	58.1	57.1	53.6	47.1	44.1	54.4
40	03:46	70.9	55.6	54.1	48.6	44.6	41.6	50.2
41	04:06	76.3	60.1	57.1	51.1	45.6	42.6	53.8
42	04:26	71.2	53.6	52.1	49.1	45.1	43.1	49.4
43	04:46	74.2	59.1	57.6	50.1	46.1	43.1	52.8
44	05:06	78.8	60.1	58.1	49.6	45.1	43.1	52.5
45	05:26	74.9	59.1	58.6	52.6	48.1	44.6	55.1
46	05:46	76.8	57.6	56.6	54.6	46.6	42.1	54
47	06:06	74.9	60.1	57.1	51.6	49.1	46.6	53.6
48	06:26	72.5	57.6	56.6	54.6	49.1	47.1	54.4
49	06:46	84.5	59.6	55.1	52.6	49.1	45.6	53.1
50	07:06	73.1	58.1	57.1	53.1	48.6	45.1	54.4
51	07:26	76	58.6	56.1	53.6	48.6	46.6	53.9
52	07:46	72.6	57.6	56.6	52.6	48.1	45.6	54
53	08:06	71.1	56.6	55.1	53.1	49.1	45.6	53.1
54	08:26	76	55.6	53.1	51.6	47.6	46.1	51.5
55	08:46	70.4	55.6	54.1	52.1	49.6	47.6	52.4
56	09:06	76.1	56.1	54.1	52.1	49.6	47.1	52.4
57	09:26	71	56.1	53.6	51.6	49.1	47.6	51.8
58	09:46	75.2	55.6	54.1	51.6	49.1	47.6	52
59	10.06	84.9	69.1	55.6	52.1	49.1	47.1	55.7
60	10:26	83.1	62.1	54.1	51.6	49.1	47.6	53.3
61	10:46	76.4	55.6	53.6	51.6	48.6	46.6	51.9
62	11:06	76.4	58.1	54.1	52.1	49.1	47.1	52.4
63	11:26	75.8	57.1	54.1	51.6	49.1	47.6	52
64	11:46	90.2	57.6	54.1	52.1	50.1	49.1	52.5
65	12:06	88.4	57.1	53.6	51.1	48.6	47.1	52.5
66	12:26	88.3	60.6	52.6	50.6	48.1	47.1	51.6
67	12:46	85.9	64.6	56.6	51.6	49.1	47.6	54.7
68	13:06	84.9	57.1	54.6	51.1	48.1	46.6	52.1
69	13:26	87.9	58.6	54.1	51.6	49.1	47.6	52.2

APPENDIX 'B'

- Drawing numbers 3128/M/01_P2, 3128/M/05_P1 and 3128/M/06_P1 showing the general arrangement of the proposed air conditioning plant and extract fans.



Castle Data 3128/M/01 (1:50@A1) Date: 18/12/2012

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR MECHANICAL SERVICES INSTALLATION AND ALL ASSOCIATED ELECTRICAL DRAWINGS LISTED THEREIN.
2. ALL MECHANICAL SERVICES DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ASSOCIATED ARCHITECTURAL,STRUCTURAL, DRAINAGE AND ELECTRICAL MECHANICAL SERVICES DRAWINGS.
3. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING CONSTRUCTION.

REV.	DATE	DESCRIPTION
P2	DEC 12	REVISED AS PER ARCHITECTS COMMENTS
P1	DEC 12	PRELIMINARY ISSUE

ENVIRONMENTAL ENGINEERING PARTNERSHIP
CONSULTING ENGINEERS

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CLIENT
-

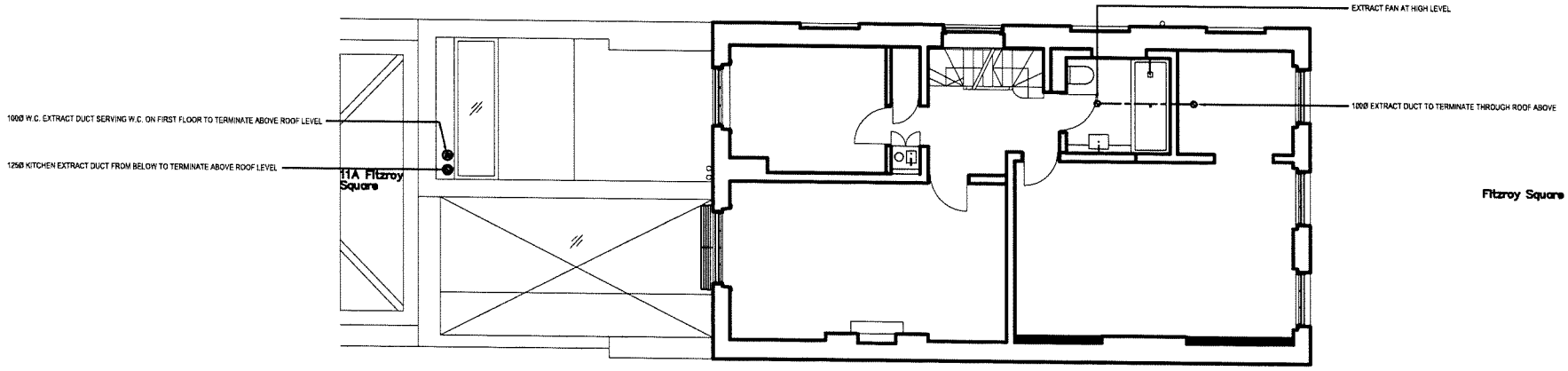
PROJECT
11 FITZROY SQUARE

TITLE
LOWER GROUND FLOOR MECHANICAL SERVICES

DRAWN	SCALE
N.R.	1:50
CHECKED	DATE
I.B	DEC. 2012

DRAWING No	REVISION
3128/M/01	P2

Fitzroy Street



12 Fitzroy Square

Codlle Data 3128/M/05 (1:50@A1) Date: 14/12/2012

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR MECHANICAL SERVICES INSTALLATION AND ALL ASSOCIATED ELECTRICAL DRAWINGS LISTED THEREIN.
2. ALL MECHANICAL SERVICES DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ASSOCIATED ARCHITECTURAL,STRUCTURAL, DRAINAGE AND ELECTRICAL MECHANICAL SERVICES DRAWINGS.
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REV.	DATE	DESCRIPTION
P1	DEC 12	PRELIMINARY ISSUE

ENVIRONMENTAL
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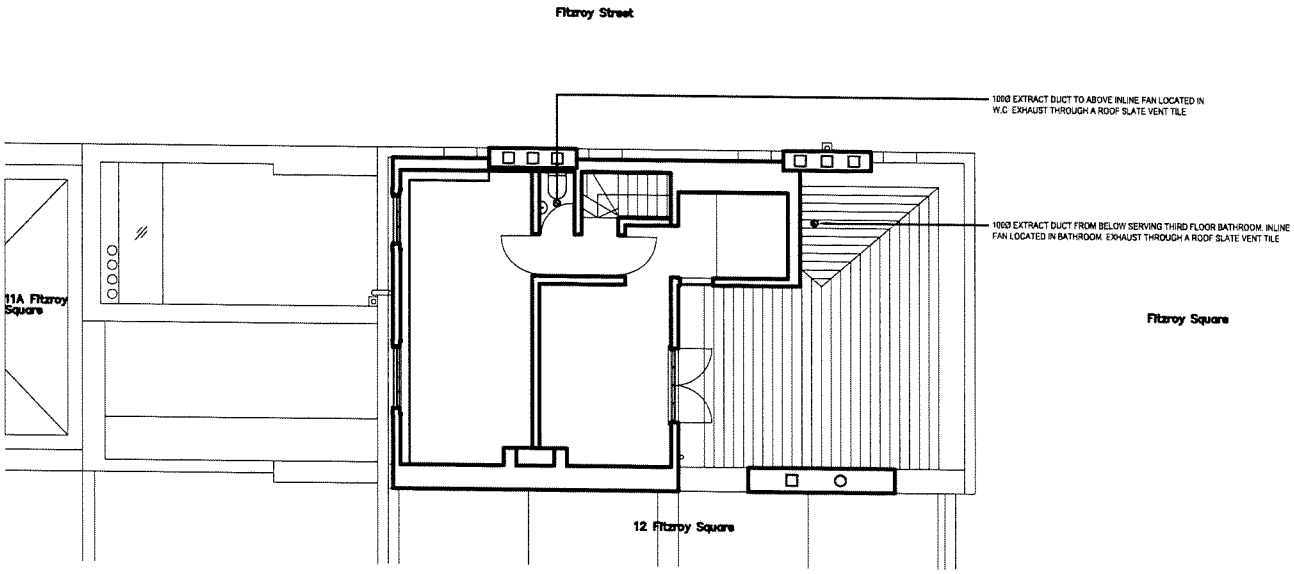
PROJECT
11 FITZROY SQUARE

TITLE
THIRD FLOOR
MECHANICAL SERVICES

DRAWN	SCALE
N.R.	1:50
CHECKED	DATE
I.B	DEC. 2012

DRAWING No.	REVISION
3128/M/05	P1



Castle Data: 3128/M/06 (1:50@A1) Date: 14/12/2012

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR MECHANICAL SERVICES INSTALLATION AND ALL ASSOCIATED ELECTRICAL DRAWINGS LISTED THEREIN.
2. ALL MECHANICAL SERVICES DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ASSOCIATED ARCHITECTURAL,STRUCTURAL, DRAINAGE AND ELECTRICAL MECHANICAL SERVICES DRAWINGS.
3. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING CONSTRUCTION.

REV.	DATE	DESCRIPTION
P1	DEC 12	PRELIMINARY ISSUE

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PROJECT
11 FITZROY SQUARE

TITLE
FOURTH FLOOR
MECHANICAL SERVICES

DRAWN	SCALE
N.R.	1:50
CHECKED	DATE
I.B	DEC. 2012

DRAWING No	REVISION
3128/M/06	P1

APPENDIX 'C'

- Equipment Noise Data

2 Specifications

2-10 Technical Specifications					RXS25J	RXS35J	RXS42J	RXS50J
Heat exchanger	Length			mm	805		810	845
	Rows	Quantity			2			
	Fin pitch			mm	1.4		1.5	1.8
	Stages	Quantity			24			32
	Tube type				ø7 Hi-XA		ø8 Hi-XA	
	Fin	Type			Waffle louvered fin			
		Treatment			Anti-corrosion treatment (PE)			
Fan	Type				Propeller fan			
	Air flow rate	Cooling	High	m³/min	33.5	36.0	37.3	50.9
				cfm	1,183	1,271	1,317	1,797
			Super low	m³/min	30.1		30.6	48.9
				cfm	1,063		1,080	1,727
		Heating	High	m³/min	28.3		31.3	45.0
				cfm	999		1,105	1,589
			Super low	m³/min	25.6		27.2	43.1
				cfm	904		960	1,522
Fan motor	Model				D23H-28		D50R-28	KFD-380-50-8C
	Output			W	23		50	53
	Speed	Cooling	High	rpm	860	920	890	780
			Super low	rpm	780		790	670
		Heating	High	rpm	860		890	720
			Super low	rpm	740		780	670
Sound power level	Cooling	High		dBA	61	63		
Sound pressure level	Cooling	High		dBA	46	48		
		Silent operation		dBA	43	44		
	Heating	High		dBA	47	48		
		Silent operation		dBA	44	45		
Compressor	Model				1YC23AEXD		2YC36BXD	
	Type				Hermetically sealed swing compressor			
	Output			W	600		1,100	
Operation range	Cooling	Ambient	Min.	°CDB	-10			
			Max.	°CDB	46			
	Heating	Ambient	Min.	°CWB	-15			
			Max.	°CWB	18			
Refrigerant	Type				R-410A			
	Charge			kg	1.0	1.2	1.3	1.7
Refrigerant oil	Type				FVC50K			
	Charged volume			l	0.375		0.65	
Piping connections	Liquid	OD		mm	6.35			
	Gas	OD		mm	9.52			12.7
	Drain	Type			Hole			
		ID		mm	15.9			
	Piping length	OU - IU	Max.	m	20			30
	Level difference	IU - OU	Max.	m	15			20
	Heat insulation				Both liquid and gas pipes			

2-11 Electrical Specifications				RXS25J2V1B	RXS35J2V1B	RXS42J2V1B	RXS50J2V1B
Power supply	Phase			1~			
	Frequency		Hz	50			
	Voltage		V	220-240			
Current	Nominal running current (RLA)	Cooling	A	3.0 (1) / 2.8 (2) / 2.7 (3)	4.3 (1) / 4.1 (2) / 3.9 (3)	6.0 (1) / 5.7 (2) / 5.5 (3)	6.7 (1) / 6.4 (2) / 6.1 (3)
		Heating	A	3.9 (1) / 3.8 (2) / 3.6 (3)	4.7 (1) / 4.5 (2) / 4.3 (3)	7.1 (1) / 6.8 (2) / 6.5 (3)	7.0 (1) / 6.7 (2) / 6.4 (3)
	Starting current	Cooling	A	4.0	4.8	7.2	7.1
		Heating	A	4.0	4.8	7.2	7.1

PERFORMANCE - OPUS PLUS FANS

ELECTRICAL & SOUND

100B/2B Surface Mounted

Curve	Fan Code	Speed Control Setting	Input Power (watts)	FLC amps	Sound Power Levels (dB re 1pW) Octave band mid frequency (Hz) 125	250	500	1K	2K	4K	8K	dBA @ 3m
1	OPUS100	25%	24	0.10	28	27	32	27	19	10	4	13
2	OPUS100	50%	36	0.15	43	42	48	42	34	25	20	28
3	OPUS100	75%	44	0.19	51	50	56	51	44	39	33	37
4	OPUS100	100%	100	0.39	59	59	62	58	54	48	45	45

150B Surface Mounted

1	OPUS150	25%	55	0.23	30	31	35	30	23	14	7	16
2	OPUS150	50%	65	0.27	45	47	51	46	38	30	25	31
3	OPUS150	75%	130	0.55	53	56	61	56	51	44	40	41
4	OPUS150	100%	200	0.78	57	61	65	61	57	51	47	48

100M/2M Surface Mounted

1	OPUS100	25%	24	0.10	30	24	20	18	12	1	-	4
2	OPUS100	50%	36	0.15	45	39	36	33	27	16	7	20
3	OPUS100	75%	46	0.19	53	47	44	42	37	30	20	30
4	OPUS100	100%	100	0.39	61	56	50	49	47	39	32	37

150M Duct Mounted

1	OPUS150	25%	55	0.23	31	27	22	18	13	2	-	4
2	OPUS150	50%	65	0.27	46	43	38	34	28	18	10	20
3	OPUS150	75%	130	0.55	54	52	48	44	41	32	25	30
4	OPUS150	100%	200	0.78	58	58	52	49	46	39	32	37

The electrical and sound information in the table is nominal. Breakout dBA@3m is spherical, free field.

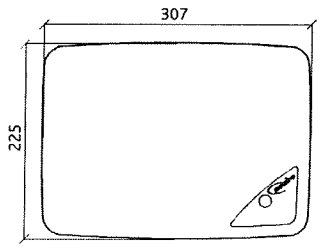
ELECTRICAL & SOUND

Fan Unit	Frequency Hz 63	125	250	500	1K	2K	4K	8K	Open inlet dBA @ 3m	FLC amps	Power watts
Opus 40	45	47	53	49	47	48	43	33	36	0.1	14
Opus 60	48	57	57	55	54	55	51	44	43	0.32	43
Opus 95 Dual fan	50	57	62	58	57	57	52	46	46	0.6	72

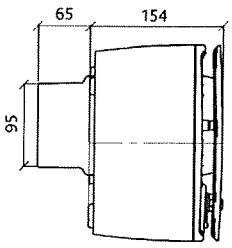
DIMENSIONS (MM)

Surface mounted unit

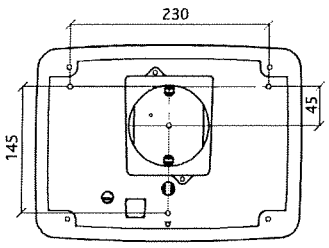
Front view



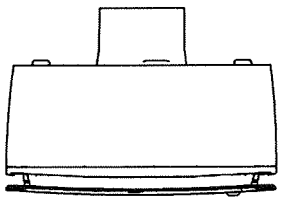
Side view



Back view

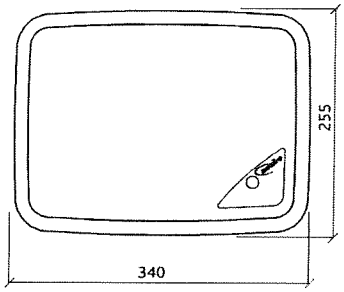


Top view

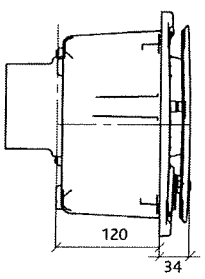


Recessed mounted unit rear discharge

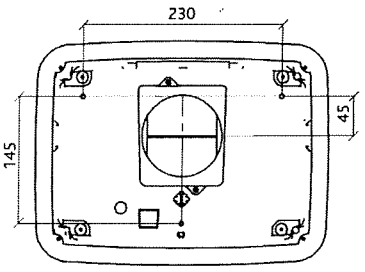
Front view



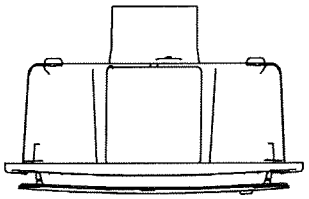
Side view



Back view

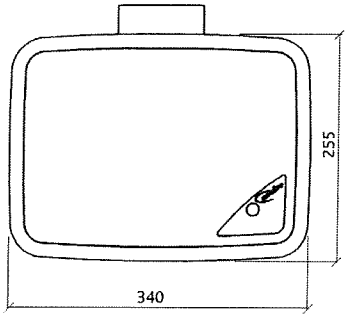


Top view

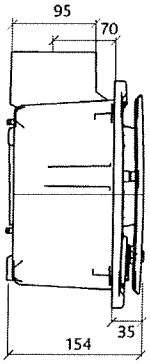


Recessed mounted unit side discharge

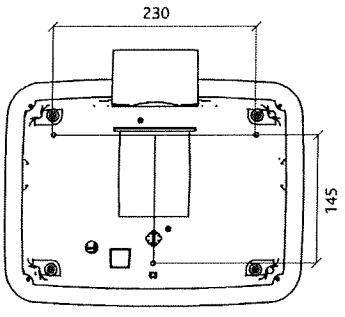
Front view



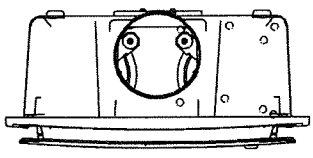
Side view



Back view



Top view



Selection Data

Unit Size 1 EVX143-1

2a Performance

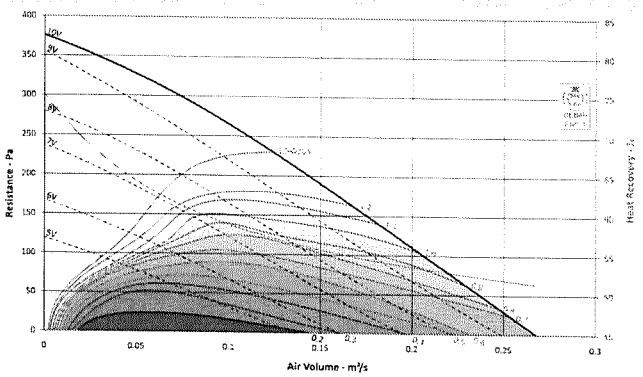
$$SFP = \frac{\text{Electrical input power (Watts)}}{\text{Air volume flow rate (litres/second)}}$$

Notes: SFP figures quoted at voltages tested in accordance with BS 848: Part 1 1997 for each of the two fans

Heat exchanger efficiency is calculated based upon EAT -5°C and RAT +20°C

The fan performance is calculated using standard G4 filters. Alternative F7 will add a maximum of 150Pa

Tolerances:
On flow rates: +/- 5%
On acoustic power and pressure: Levels: +/- 3dB
By octave band +/- 5db



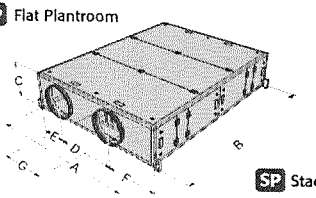
Size	Phase	Motor Size	Voltage	Fan Speed	Full Load Current	Speed Control
EVX143-1	1 Phase	0.23 kW	230 VAC	3290 rpm	1.65 A	EC

2b Configuration

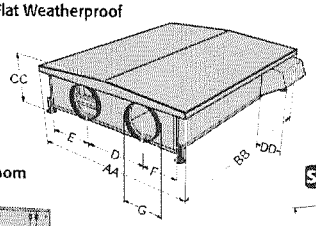
Configuration and Handling

EVX143-1 / FP SP ...../ LT RB RT ...../
FW SW LB L R

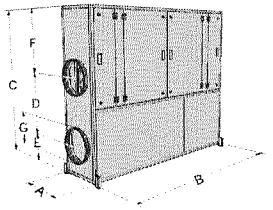
FP Flat Plantroom



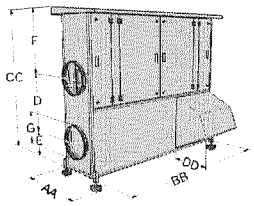
FW Flat Weatherproof



SP Stacked Plantroom



SW Stacked Weatherproof



Unit Type	Dimensions mm								Weight kg	Configuration Options					
	A	B	C	D		E	F	GØ		LT	LB	RT	RB	L	R
EVX1 Flat Plantroom	1100	1650	365	550		275	275	315	136	✔	✔	✔	✔		
EVX1 Stacked Plantroom	415	1650	1265	550		275	440	315	150					✔	✔
	AA	BB	CC	D	DD	E	F	GØ							
EVX1 Flat Weatherproof	1300	1750	440	550	250	275	275	315	165	✔		✔			
EVX1 Stacked Weatherproof	615	1750	1340	550	300	275	515	315	168					✔	✔

2c Heating and Controls

EVX143-1 / FP- W / DS / RT / G4 / ISC
E CPSC
null

Heating Controls

	Technical Data						Heating and Control Options	
	Air Volume m³/s	Maximum Leaving Air Temp °C	Maximum kW Output	Water Flow Rate l/sec	Water Pressure Kpa	Coil Connection Size BSP	Control Panel	Valve & Actuator Kit
LPHW Heating	0.100	31.1	4.4	0.10	6.3	1/2"	CPB0-1/W/P/CC/C	EVXCWKT100
	0.125	29.7	5.3	0.12	8.9			
	0.150	28.5	6.1	0.14	11.7			
	0.170	25.0	6.2	0.14	12.0			

LPHW coil, designed for LPHW 82/71°C, EAT -5°C, LAT 25°C, coil construction copper tubes, aluminium fins, coil connections 1/2" BSP.

Note: If no control panel is purchased the unit will be supplied with a main isolator.

	Technical Data			Heating and Control Options			
				1ph - Electric Heater		3ph - Electric Heater	
	Air Volume m³/s	Maximum Leaving Air Temp °C	Maximum kW Output	Electric Heater	Control Panel	Electric Heater	Control Panel
Electric Thyristor Heating	0.100	31.1	1 kw	EHEX1/1KW/1X1	CPB0-1/6KW-1/P/CC/C	EHEX1/1KW/1X3	CPB0-1/6KW-3/P/CC/C
	0.125	29.7	2 kw	EHEX1/2KW/1X1		EHEX1/2KW/1X3	
	0.150	28.5	3 kw	EHEX1/3KW/1X1		EHEX1/3KW/1X3	
	0.170	25.0	4 kw	EHEX1/4KW/1X1		EHEX1/4KW/1X3	
	0.170	29.2	6 kw	EHEX1/6KW/1X1		EHEX1/6KW/1X3	

Air off temperature based upon entering air of -5°C. Power = Air Volume x Constant x Temperature Rise

$kW = m^3/s \times 1.21 \times \Delta T°C$

Note: If no control panel is purchased the unit will be supplied with a main isolator.

2d Noise Data

Fan Voltage	Fan Speed rpm	Sound Spectrum dB re 10-12w PWL Centre Frequency Hz								Casing Noise Breakout	
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m
10 v dc	2518	68	68	66	67	63	57	54	51	40	30
9 v dc	2266	66	67	64	63	60	54	52	50	35	25
8 v dc	2014	67	64	61	60	59	51	51	46	35	25
7 v dc	1763	65	61	58	58	56	49	51	42	30	20
6 v dc	1511	61	59	55	54	50	46	50	37	25	15
5 v dc	1375	59	57	53	50	48	45	50	34	25	15

Case Insertion Loss

Centre Frequency	63	125	250	500	1k	2k	4k	8k
Sound Reduction	8	10	12	26	29	27	27	26

Silencer Option	Sound Spectrum dB re 10-12w PWL Centre Frequency Hz							
EVXVA100/1200/STD	63	125	250	500	1k	2k	4k	8k
	4	5	6	14	24	27	21	18

Note: The silencer will add a maximum of 26Pa to the external resistance.