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CASTLEWOOD HOUSE, 77-91 NEW OXFORD STREET, LONDON

NOISE IMPACT ASSESSMENT REPORT

Report 9527.NIA.01 Rev. A

For:

Morgan Lovell

16 Noel Street

London

W1F 8DA

Site Address	Report Date	Revision History
Castlewood House, New Oxford Street, London	5/11/2012	Rev. A – 07/06/13

Registered in England Company No. 7947892
KP Acoustics is the Trading Name of KP Acoustics Limited

CONTENTS

List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by Morgan Lovell, 16 Noel Street, London, to undertake an environmental noise survey at Castlewood House, 77-91 New Oxford Street, London.

The background noise levels measured will be used to determine daytime and night-time noise emission criteria for a proposed installation several plant units, in agreement with the planning requirements of Westminster City Council.

This report presents the overall methodology and results from the environmental survey followed by calculations to demonstrate the feasibility of the plant installation to satisfy the emissions criterion at the closest noise-sensitive receiver and outline mitigation measures as appropriate.

2.0 ENVIRONMENTAL NOISE SURVEY AND EQUIPMENT

2.1 Procedure

Automated noise monitoring was undertaken at the position shown in Site Plan 9527.SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver relative to the proposed plant installation. The duration of the survey was between 13:15 on 30/10/2012 and 13:10 on 31/10/2012.

Initial inspection of the site revealed that the background noise profile at the monitoring location was wholly dominated by road traffic noise from the surrounding roads, as well as well as from a number of existing plant units.

The weather during the course of the survey was generally dry with wind speeds within acceptable tolerances and therefore suitable for the measurement of environmental noise. The measurement procedure generally complied with BS7445:1991 "*Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*".

2.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- Svantek Type 957 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

3.0 RESULTS

The results from the continuous noise monitoring are shown as a time history of L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} averaged over 5 minute sample periods in Figure 9527.TH1.

Minimum background noise levels are shown in Table 3.1.

	Minimum background noise level $L_{A90: 5min}$ dB(A)
Daytime (07:00-23:00)	51
Night-time (23:00-07:00)	49

Table 3.1: Minimum measured background noise levels

4.0 NOISE CRITERIA

The criterion of Westminster City Council for noise emissions of new plant in this instance is as follows:

"The proposed plant and machinery shall be operated so as to ensure that any noise generated is "not audible" outside the nearest residential premises. To demonstrate inaudibility, you will need to provide calculations that show that the plant noise level is 10dBA below the lowest background level (LA90 (15minutes)) 1m from the nearest residential window, over the proposed operating hours. Tonality must also be taken into consideration."

We therefore propose to set the noise criteria as shown in Table 3.2 in order to comply with the above requirement.

	Daytime (07:00 to 23:00)	**Night-time (07:00 to 23:00)**
Noise criterion at nearest residential receiver (10dB below minimum L_{A90})	41 dB(A)	39 dB(A)

Table 3.2: Proposed Noise Emissions Criteria

As the proposed units will be used 24 hours a day, the criterion of 39 dB(A) will be used in this assessment.

5.0 DISCUSSION

The plant unit installation spans over two distinct locations, which are the West and South Wings of the flat roof of Castlewood House. The installation locations of the proposed plant units are shown in Appendix C.

West Wing

- 1 No. Daikin RXYSQ4P8V1 Condenser Unit (SYS1)
- 2 No. Daikin RXYSQ5P8V1 Condenser Units (SYS3 & SYS4)
- 1 No. AVT Supply AHU SRE4 (AHU2)
- 1 No. Daikin ERQ100AV1 Condensing Unit (AHU2/OUT1)

South Wing

- 1 No. Daikin REYQ8P9 Condenser Unit (SYS2)
- 1 No. Daikin RYYQ8T Condenser Unit (SYS5)
- 1 No. Daikin 3MXS52E Condenser Unit (SYS6)
- 2 No. Daikin RYYQ10T Condenser Units (SYS7 & SYS8)
- 2 No. Daikin RYYQ14T Condenser Units (SYS9 & SYS10)
- 1 No. Swegon GOLD RX08 Heat Recovery AHU (AHU1)
- 1 No. Daikin ERQ100AV1 Condensing Unit (AHU1/OUT1)

The closest noise sensitive receiver to the proposed installation locations will be a residential window of the flats adjacent to Centre Point, located on Earnshaw Street.

The sound pressure levels as provided by the manufacturers for the aforementioned units are shown in Table 5.1. Where manufacturers have specified sound power levels, these have been converted to sound pressure levels, with calculations shown in Appendix B.

	Sound Pressure Level (dB) in each Frequency Band at 1m							
Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
West Wing								
Daikin RXYSQ4P8V1 Condenser Unit	59	53	53	50	47	42	35	28
Daikin RXYSQ5P8V1 Condenser Unit	63	54	54	52	48	43	36	30

AVT Supply AHU SRE4	63	65	58	63	63	61	58	54
Daikin ERQ100AV1 Condensing Unit	60	53	53	50	56	42	35	29
South Wing								
Daikin REYQ8P9 Condenser Unit	61	63	62	56	52	46	43	35
Daikin RYYQ8T Condenser Unit	60	58	58	57	52	46	48	37
Daikin 3MXS52E Condenser Unit	52	57	50	47	42	40	38	33
Daikin RYYQ10T Condenser Units	62	65	57	58	51	48	41	35
Daikin RYYQ14T Condenser Units	65	67	64	59	54	50	47	39
Swegon GOLD RX08 Heat Recovery AHU	70	66	62	61	62	60	56	53
Daikin ERQ100AV1 Condensing Unit	60	53	53	51	47	42	35	29

Table 5.1 Manufacturer's Sound Pressure Levels at 1m

5.1 Objective overview

Taking all acoustic corrections into consideration, including distance corrections, the noise levels expected at the closest window would be as shown in Table 5.2. Detailed calculations are shown in Appendix B.

Receiver - Nearest Office Window	**Criterion**	**Noise Level at Receiver**
Operating hours	39 dB(A)	38 dB(A)

Table 5.2: Predicted noise levels and criterion at nearest noise sensitive location

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the plant installation fully satisfies the emissions criteria set by Westminster City Council.

It is the professional opinion of KP Acoustics that this level is not going to pose any negative impact on the amenity of nearby receivers. Furthermore, the value of 38dB(A) is to be considered outside of the building. Windows may be closed or partially closed leading to further attenuation, as follows.

Further calculations have been undertaken to assess whether the noise emissions from the proposed plant unit installations would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:1999 '*Sound insulation and noise reduction for buildings – Code of Practice*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:1999 recommends 30dB(A) as being 'Good' internal resting/sleeping conditions.

According to BS8233:1999, even a partially open window offers 10-15dB attenuation, thus leading to an acceptable interior noise level that meets the criterion.

Receiver	'Good' Condition Design Range – *For resting/sleeping conditions in a bedroom, in BS8233:1999*	Noise Level at Receiver (due to plant installation)
Inside Nearest Receiving Space	30 dB(A)	28 dB(A)

Table 5.3: Noise levels and criteria inside nearest receiving space

Predicted levels are shown in Table 5.3, with detailed calculations shown in Appendix B. It can therefore be stated that, as well as complying with the requirements of Westminster City Council, the plant unit installation would be expected to comfortably meet the most stringent recommendations of the relevant British Standard, even with neighbouring windows partially open.

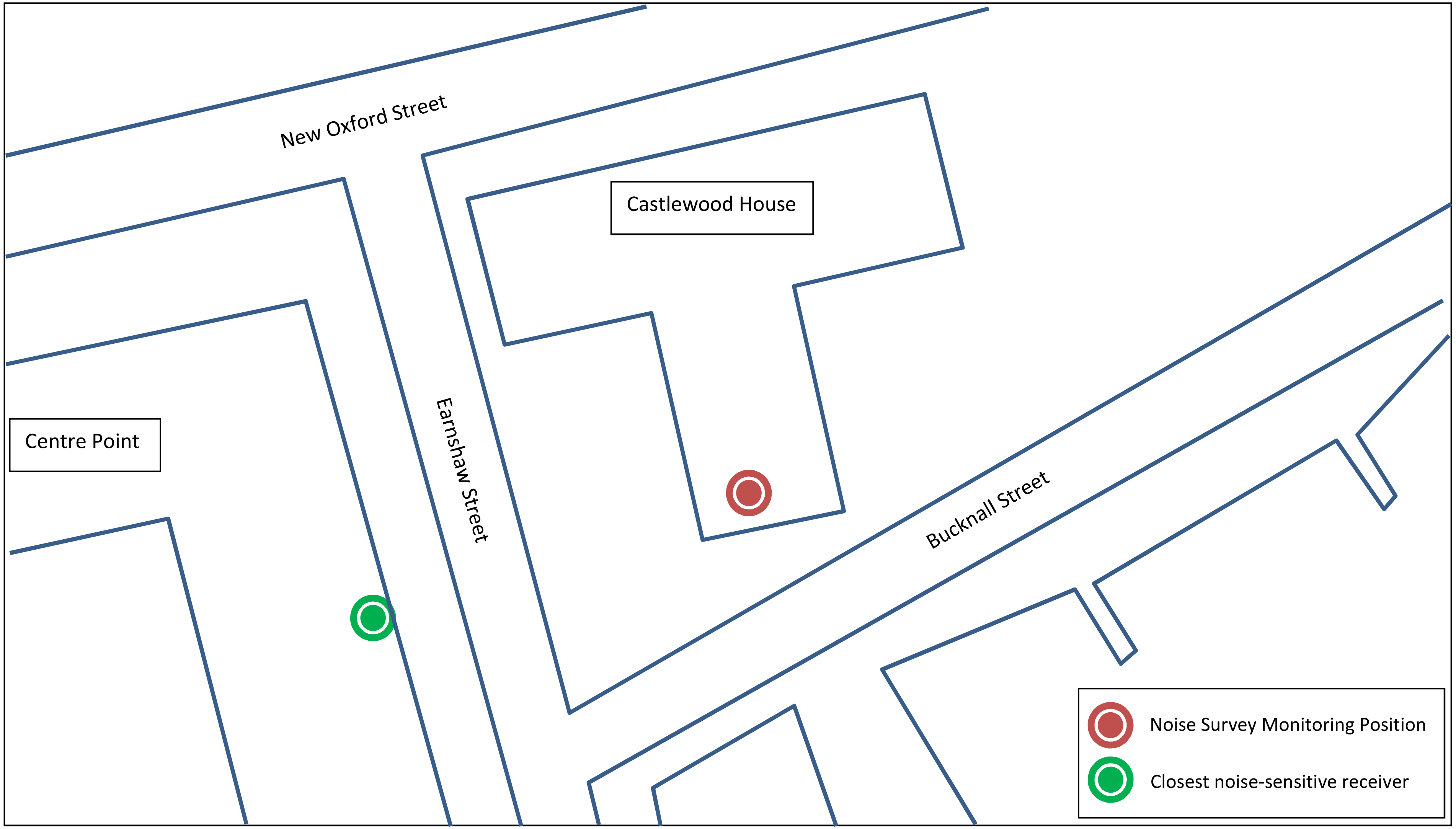
6.0 CONCLUSION

An environmental noise impact survey has been undertaken at Castlewood House, 77-91 New Oxford Street, London, by KP Acoustics Ltd between 30/10/2012 and 31/10/2012. The results of the survey have enabled criteria to be set for noise emissions. Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receivers for compliance with current requirements.

Calculations show that noise emissions from the proposed plant unit installation would meet the requirements of Westminster City Council.

Further calculations have been undertaken with regards to the relevant British Standard and it has been ensured that the amenity of nearby residential receivers will be protected.

Report by	Checked by
Dan Green Tech IOA	**Kyriakos Papanagiotou MIOA**



Title:

Indicative site plan showing noise monitoring position

Date: 6 November 2012

FIGURE 9527.SP1

KP acoustics

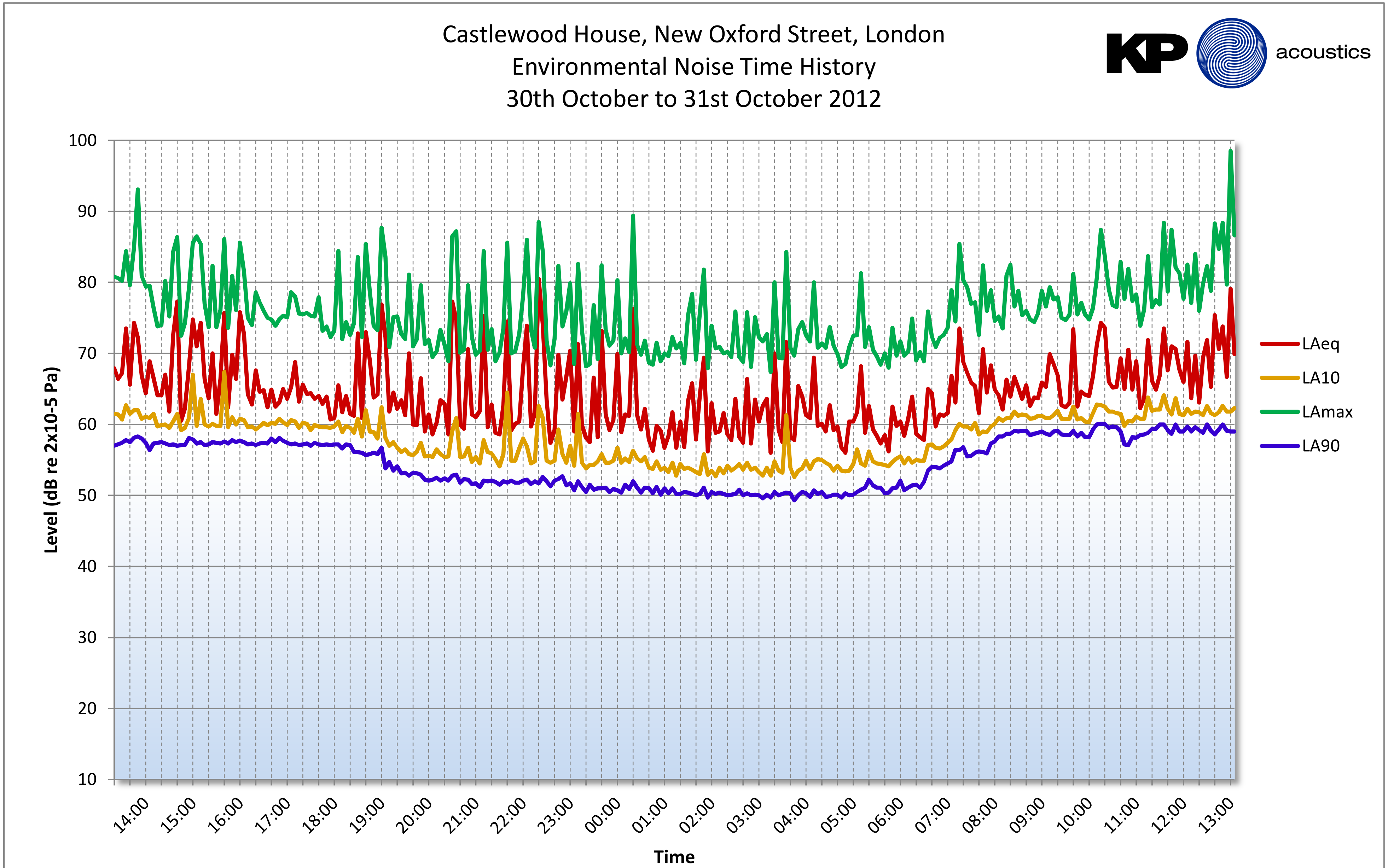


Figure 9527.TH1

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

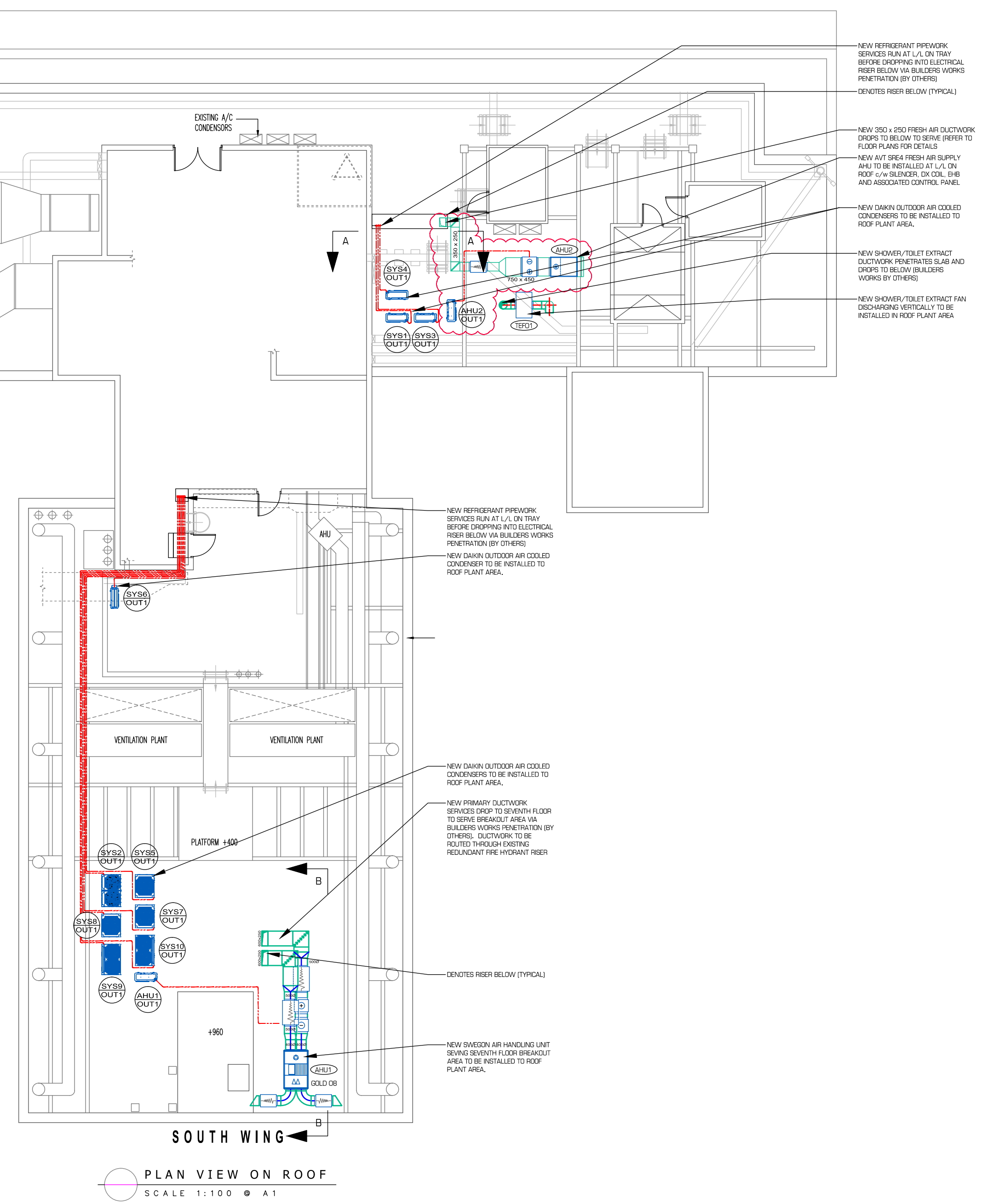
PLANT UNIT EMISSIONS CALCULATIONS

Source: Plant Unit Installation	Frequency, Hz								
Receiver: Nearest Residential Window	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Manufacturers Sound Pressure/Power Levels									
WEST WING UNITS									
Daikin RXYSQ4P8V1 Condenser Unit Sound Pressure Level	59	53	53	50	47	42	35	28	
Daikin RXYSQ5P8V1 Condenser Unit Sound Pressure Level	63	54	54	52	48	43	36	30	
Correction for number of units (2)	3	3	3	3	3	3	3	3	
Total sound pressure level from Daikin RXYSQ5P8V1 Condenser Units	66	57	57	55	51	46	39	33	
Daikin ERQ100AV1 Condensing Unit Sound Pressure Level	60	53	53	50	56	42	35	29	
AVT Supply AHU SRE4	71	73	66	71	71	69	66	62	
Conversion to sound pressure level at 1m	-8	-8	-8	-8	-8	-8	-8	-8	
Total sound pressure level from AVT Supply AHU SRE4	63	65	58	63	63	61	58	54	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Attenuation provided by distance, min 50m	-34	-34	-34	-34	-34	-34	-34	-34	
Minimum attenuation provided by building envelope, dB	-5	-5	-5	-5	-5	-5	-5	-5	
Total Sound Pressure Level From West Wing Units, dB	**33**	**30**	**26**	**28**	**28**	**25**	**22**	**18**	**32**
SOUTH WING UNITS									
Daikin REYQ8P9 Condenser Unit Sound Pressure Level	61	63	62	56	52	46	43	35	
Daikin RYYQ8T Condenser Unit Sound Pressure Level	60	58	58	57	52	46	48	37	
Daikin 3MXS52E Condenser Unit Sound Pressure Level	52	57	50	47	42	40	38	33	
Daikin RYYQ10T Condenser Units Sound Pressure Level	62	65	57	58	51	48	41	35	
Correction for number of units (2)	3	3	3	3	3	3	3	3	
Total sound pressure level from Daikin RYYQ10T Condenser Units	65	68	60	61	54	51	44	38	
Daikin RYYQ14T Condenser Units Sound Pressure Level	65	67	64	59	54	50	47	39	
Correction for number of units (2)	3	3	3	3	3	3	3	3	
Total sound pressure level from Daikin RYYQ14T Condenser Units	68	70	67	62	57	53	50	42	
Daikin ERQ100AV1 Condensing Unit Sound Pressure Level	60	53	53	51	47	42	35	29	
Swegon GOLD RX08 Heat Recovery AHU Sound Power Level	78	74	70	69	70	68	64	61	
Conversion to sound pressure level at 1m	-8	-8	-8	-8	-8	-8	-8	-8	
Total sound pressure level from Swegon GOLD RX08 Heat Recovery AHU	70	66	62	61	62	60	56	53	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Attenuation provided by distance, min 35m	-31	-31	-31	-31	-31	-31	-31	-31	
Minimum attenuation provided by building envelope, dB	-5	-5	-5	-5	-5	-5	-5	-5	
Total Sound Pressure Level From South Wing Units, dB	**41**	**41**	**37**	**34**	**31**	**29**	**25**	**21**	**37**
Sound pressure level 1m from nearest residential receiver	**41**	**41**	**37**	**35**	**33**	**30**	**27**	**23**	**38**

Design Criterion	**39**

Receiver: Inside Nearest Residential Window	Frequency, Hz								
Source: Plant Unit Installation	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	41	41	37	35	33	30	27	23	38
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	
Sound pressure level inside nearest residential window	**31**	**31**	**27**	**25**	**23**	**20**	**17**	**13**	**28**

APPENDIX C



PLAN VIEW ON ROOF

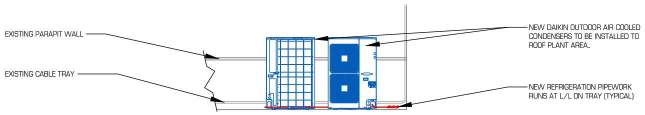
SCALE 1:100 @ A1

EQUIPMENT SCHEDULE

REF	MODEL	DESCRIPTION	DIMENSIONS h x w x d	WEIGHT kg	POWER	FUSE	PIPE SIZE
SYS1/OUT1	RXYSQ4P8V1	DAIKIN EXTERNAL CONDENSING UNIT	1345 x 900 x 320	125	230V/1ph/50Hz	32A	SCHEMATIC
SYS2/OUT1	REYQ8P9	DAIKIN EXTERNAL CONDENSING UNIT	1680 x 1300 x 765	331	400V/3ph/50Hz	20A	SCHEMATIC
SYS3/OUT1	RXYSQ5P8V1	DAIKIN EXTERNAL CONDENSING UNIT	1345 x 900 x 320	125	230V/1ph/50Hz	32A	SCHEMATIC
SYS4/OUT1	RXYSQ5P8V1	DAIKIN EXTERNAL CONDENSING UNIT	1345 x 900 x 320	125	230V/1ph/50Hz	32A	SCHEMATIC
SYS5/OUT1	RYYQ8T	DAIKIN EXTERNAL CONDENSING UNIT	1685 x 930 x 765	261	400V/3ph/50Hz	20A	SCHEMATIC
SYS6/OUT1	3MXS52E	DAIKIN EXTERNAL CONDENSING UNIT	735 x 936 x 300	49	230V/1ph/50Hz	20A	SCHEMATIC
SYS7/OUT1	RYYQ10T	DAIKIN EXTERNAL CONDENSING UNIT	1685 x 930 x 765	268	400V/3ph/50Hz	25A	SCHEMATIC
SYS8/OUT1	RYYQ10T	DAIKIN EXTERNAL CONDENSING UNIT	1685 x 930 x 765	268	400V/3ph/50Hz	25A	SCHEMATIC
SYS9/OUT1	RYYQ14T	DAIKIN EXTERNAL CONDENSING UNIT	1685 x 1240 x 765	364	400V/3ph/50Hz	32A	SCHEMATIC
SYS10/OUT1	RXYQ14T	DAIKIN EXTERNAL CONDENSING UNIT	1680 x 1240 x 765	364	400V/3ph/50Hz	32A	SCHEMATIC
TEF01	QST315	AVT TWIN IN-LINE ACOUSTIC FAN	425 x 1050 x 650	52	230V/1ph/50Hz	13A	N/A
AHU1	GOLD RX 08	SWEGON HEAT RECOVERY AIR HANDLING UNIT	1185 x 2381 x 995	431	415V/3ph/50Hz	10A	N/A
AHU1/OUT1	ERQ100AV1	DAIKIN EXTERNAL CONDENSING UNIT	1345 x 900 x 320	120	230V/1ph/50Hz	32A	3/8" + 5/8"
AHU2	SRE4	AVT SUPPLY AIR HANDLING UNIT	580 x 1350 x 800	66	230V/1ph/50Hz	10A	N/A
AHU2/OUT1	ERQ100AV1	DAIKIN EXTERNAL CONDENSING UNIT	1345 x 900 x 320	120	230V/1ph/50Hz	32A	3/8" + 5/8"

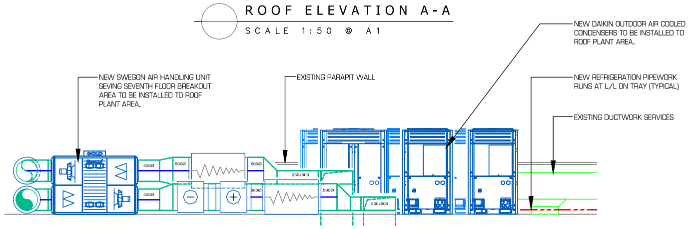
Notes:-

1) ALL OFFICE AREA AIR CONDITIONING EQUIPMENT TO BE MANUFACTURED BY DAIKIN EUROPE LIMITED



ROOF ELEVATION A-A

SCALE 1:50 @ A1



ROOF ELEVATION B-B

SCALE 1:50 @ A1

CONSTRUCTION ISSUE

All dimensions must be checked on site and NOT scaled from this drawing.

Building parameters taken from drawings provided.

NOTES

1. DRAWING FOR INDICATIVE PURPOSES ONLY. FULL BUILDING SURVEY TO BE UNDERTAKEN.
2. ALL SERVICES ROUTES AND POSITIONS TO BE CORRECTLY IDENTIFIED FOLLOWING FULL SITE SURVEY

STATUS

Preliminary / Info | Approval / Comments | Contract | As – Built | Construction | Building Control

Rev	Revision	By	Date	Chk'd
E	AHU2 ADDED	DDB	23.05.13	AS
D	AHU1 DUCTWORK SERVICES REVISED	TJF	08.05.13	AS
C	DUCTWORK ROUTES REVISED	TJF	25.04.13	AS
B	EQUIPMENT NUMBERING UPDATED	DDB	09.04.13	AS
A	FIRST ISSUE OF CONSTRUCTION DRAWING	DDB	03.04.13	AS

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LINKEDIN

Project
CASTLEWOOD HOUSE
77-91 NEW OXFORD STREET
LONDON
WC1A 1DG

Title
ROOF PLANT AREA
MECHANICAL SERVICES
ADDITIONS AND ALTERATIONS

Scale	Date	Dsgnr/CAD	Checkd/Date
1:100 @ A1	05.03.13	DDB	AS

Drawing Number

Project No.	Drawing	Floor	Detail	Revision
ACO907	M07	R	M	E