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Western Transit Shed, King's Cross

Noise assessment
Planning condition 60

1 Introduction

Sandy Brown Associates LLP (SBA) has been commissioned to provide acoustic advice in relation to the Western Transit Shed at King's Cross.

This report presents an assessment of noise emission from proposed building services plant associated with the Western Transit Shed in relation to discharging planning condition 60.

The development is part of the wider King's Cross Central project, and the purpose of the assessment is to demonstrate compliance with the relevant planning condition for plant noise emission from the UAL development.

The English Cogger LLP carried out a background noise survey and set noise emission limits for plant. This survey was detailed in The English Cogger LLP report 00489\R03a issued in April 2008. The limits for noise emission from plant are detailed in English Cogger LLP letter 00489\L025-CEE. These limits form the criteria for this assessment.

This report presents a description of the site identifying noise sensitive locations, description of new items of plant, a discussion of the criteria, and an assessment of the noise emission from the new items of plant. It also compares the predicted noise levels to the relevant plant noise limits.

2 Criteria

2.1 Local Authority noise criteria

Planning condition

Planning condition 60 states:

> *Applications for approval of Reserved Matters shall include full particulars of the noise impact of any plant or equipment included in that application which shall*

meet the following standards unless otherwise agreed in writing by the local planning authority:

a) *noise levels at a point 1 metre external to sensitive facades to be at least 5 dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment are in operation;*

b) *where it is anticipated that any plant/equipment will have a noise that has a distinguishable, discrete continuous note (whine, hiss, shreech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps) special attention to be given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10 dB(A) below the L_{A90}, expressed in dB(A).*

Noise sensitive premises

Camden Council provides the definition of 'noise sensitive premises' in their Unitary Development Plan (UDP). This definition (from paragraph 1.45 of the Camden UDP) is set out below:

> *Noise/vibration sensitive development includes housing, schools and hospitals as well as offices, workshops and open spaces...*

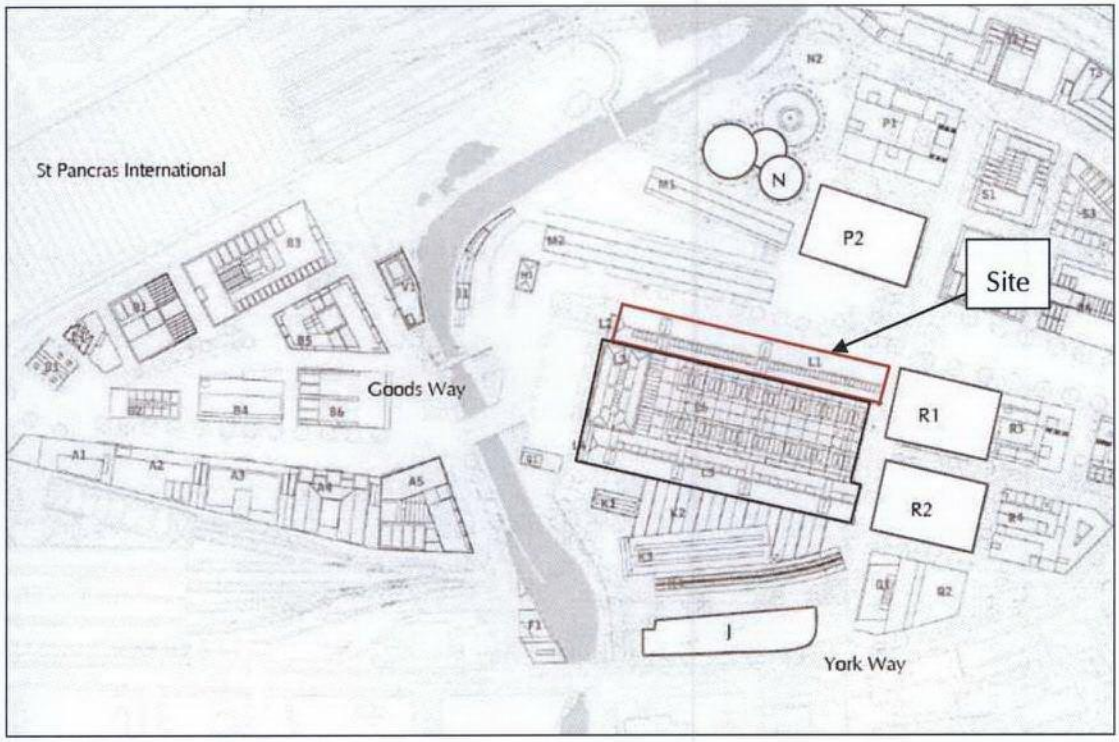
Therefore, any nearby residential, educational, medical, and commercial premises need to be considered in this assessment. Noise limits at residential premises and hospitals are applicable over the full operational hours of the plant, as they are generally occupied at all times of the day and night.

Noise limits at other noise sensitive premises are typically applicable over the hours of occupation of the sensitive premises.

2.2 Location of noise sensitive premises

The locations of the noise sensitive premises (including future uses) are shown on Figure 1 below.

Figure 1 Site plan indicating nearest noise sensitive premises



N	Residential
P2	Hotel
R1 & R2	Office
J	Residential

2.3 Background noise levels and noise limits

A background noise survey to determine the existing background levels in the area was carried out in April 2008 by The English Cogger LLP and detailed in report 00489\R03a. A summary of the English Cogger LLP background noise survey results is given in letter 00489\L025-CEE issued April 2009.

The relevant results are summarised below.

Table 1 Measured background noise levels (English Cogger LLP report)

Location	Measured background noise level L_{A90} dB		
	Day	Evening	Night
Zones adjacent to York Way: Facades adjacent or perpendicular to the road.	55	55	50
Facades facing away from York Way and all other development zones	50	50	45

The planning condition requires that the cumulative noise level from all plant items associated with this development be limited to 5 dB(A) below the existing measured background noise level. However, this does not take into account contribution from noise sources on other new developments within the masterplan, and it has been recommended by the English Cogger LLP that noise limits are reduced further to ensure that the cumulative effect from the masterplan development is limited.

Therefore, it has been recommended that a limit of 8 dB below the existing measured background noise levels is applied to this development. The relevant noise limits have been determined on this basis for each of the noise sensitive premises, and are set out below.

Table 2 Plant noise limits for relevant noise sensitive premises

Premises (ref Fig 1)	Premises usage	Plant noise limit L_{Aeq} dB	Comments
J	Residential	37	Facades away from York Way
N	Residential	37	Zone located away from York Way
P2	Hotel	37	Zone away from York Way
R1	Office	47	Premises operational between hours 0900-1800. Facades facing York Way

It should be noted that these limits would need to be reduced by a further 5 dB for any specific plant items that are considered to have tonal or attention catching features.

3 Plant noise assessment

3.1 Proposed plant installation

The proposed plant locations and manufacturers' noise data are shown in Appendix A. The attenuator schedule indicating the insertion losses for the proposed attenuators has been provided in Appendix B.

3.2 Plant noise assessment

The following tables provide a summary of the calculations of plant noise emission for each of the noise sensitive premises, and a comparison to the relevant noise limit.

The following notes apply to Tables 3, 4, 5 and 6.

NOTES:

1 The total sound power level of the plant item has been calculated from the manufacturers' data for case radiated noise and noise from any atmospheric connections taking into account the inclusion of the attenuators as per the relevant schedule.

2 These figures have been calculated using the octave band data – the corrections listed in this table are approximate and for presentation purposes. Therefore, the figure in this column may vary by 1 dB from that calculated from the single figure values listed in this table due to differences in rounding.

3 Limits for the future tenant plant areas have been set as sound pressure level at 1 m; therefore no sound power to sound pressure conversion has been applied.

Receiver N (residential)

The following table sets out the assessment of the rooftop plant items to receiver location N, which is a residential development.

Table 3 Plant assessment to receiver location N

Plant item	Sound power level of plant item[1] (Lw, dB)	Sound power to pressure level conversion	Approx distance to receiver	Distance correction	Screening	Predicted sound pressure level at receiver (Lp, dB)[2]
AHU1	70	3	110	41	5	21
AHU2	70	3	100	40	5	22
AHU3	69	3	105	40	5	21
AHU4	69	3	110	41	5	20
Chiller 1	80	20	100	40	5	15
Chiller 2	80	20	100	40	5	15
HRU1	68	16	105	40	5	7
HRU2	68	16	105	40	5	7
Toilet Extract 1	65	13	110	41	5	6
Toilet Extract 2	56	13	100	40	5	-2
Toilet Extract 4	57	13	110	41	5	-2
Tenant plant 1	65[3]	0	110	41	5	19
Tenant plant 2	65[3]	0	100	40	5	20
Tenant plant 3	65[3]	0	100	40	5	19
Tenant plant 4	65[3]	0	100	40	5	20
Tenant plant 5	65[3]	0	105	40	5	20
Tenant plant 6	65[3]	0	110	41	5	19
TOTAL SOUND PRESSURE LEVEL AT RECEIVER N						31
Criterion at receiver N						37

Receiver J (residential)

The following table sets out the assessment of the rooftop plant items to receiver location J, which is a residential development.

Table 4 Plant assessment to receiver location J

Plant item	Sound power level of plant item[1] (Lw, dB)	Sound power to pressure level conversion	Approx distance to receiver	Distance correction	Screening	Predicted sound pressure level at receiver (Lp, dB)[2]
AHU1	70	3	185	45	5	17
AHU2	70	3	160	44	5	18
AHU3	69	3	145	43	5	18
AHU4	69	3	135	43	5	18
Chiller 1	80	20	140	43	5	12
Chiller 2	80	20	140	43	5	12
HRU1	68	16	145	43	5	4
HRU2	68	16	145	43	5	4
Toilet Extract 1	65	13	185	45	5	2
Toilet Extract 2	56	13	160	44	5	-6
Toilet Extract 4	57	13	135	43	5	-4
Tenant plant 1	65[3]	0	185	45	5	15
Tenant plant 2	65[3]	0	160	44	5	16
Tenant plant 3	65[3]	0	160	44	5	16
Tenant plant 4	65[3]	0	140	43	5	17
Tenant plant 5	65[3]	0	145	43	5	17
Tenant plant 6	65[3]	0	135	43	5	17
TOTAL SOUND PRESSURE LEVEL AT RECEIVER J						27
Criterion at receiver J						37

Receiver P2 (hotel)

The following table sets out the assessment of the rooftop plant items to receiver location P2, which is a hotel development.

Table 5 Plant assessment to receiver location P2

Plant item	Sound power level of plant item[1] (Lw, dB)	Sound power to pressure level conversion	Approx distance to receiver	Distance correction	Screening	Predicted sound pressure level at receiver (Lp, dB)[2]
AHU1	70	3	120	42	5	20
AHU2	70	3	85	39	5	23
AHU3	69	3	75	38	5	23
AHU4	69	3	75	38	5	23
Chiller 1	80	20	75	38	5	17
Chiller 2	80	20	75	38	5	17
HRU1	68	16	75	38	5	9
HRU2	68	16	75	38	5	9
Toilet Extract 1	65	13	120	42	5	5
Toilet Extract 2	56	13	85	39	5	-1
Toilet Extract 4	57	13	75	38	5	1
Tenant plant 1	65[3]	0	120	42	5	18
Tenant plant 2	65[3]	0	85	39	5	21
Tenant plant 3	65[3]	0	85	39	5	21
Tenant plant 4	65[3]	0	75	38	5	22
Tenant plant 5	65[3]	0	75	38	5	22
Tenant plant 6	65[3]	0	75	38	5	22
TOTAL SOUND PRESSURE LEVEL AT RECEIVER P2						32
Criterion at receiver P2						37

Receiver R1&R2 (office)

The following table sets out the assessment of the rooftop plant items to receiver locations R1&R2, which are commercial developments.

Table 6 Plant assessment to receiver location R1 and R2

Plant item	Sound power level of plant item[1] (Lw, dB)	Sound power to pressure level conversion	Approx distance to receiver	Distance correction	Predicted sound pressure level at receiver (Lp, dB)[2]
AHU1	70	3	165	44	23
AHU2	70	3	105	40	27
AHU3	69	3	80	38	28
AHU4	69	3	40	32	34
Chiller 1	80	20	90	39	21
Chiller 2	80	20	90	39	21
HRU1	68	16	80	38	14
HRU2	68	16	80	38	14
Toilet Extract 1	65	13	165	44	8
Toilet Extract 2	56	13	105	40	3
Toilet Extract 4	57	13	40	32	12
Tenant plant 1	65[3]	0	165	44	21
Tenant plant 2	65[3]	0	105	40	25
Tenant plant 3	65[3]	0	105	40	25
Tenant plant 4	65[3]	0	90	39	26
Tenant plant 5	65[3]	0	80	38	27
Tenant plant 6	65[3]	0	40	32	33
TOTAL SOUND PRESSURE LEVEL AT RECEIVERS R1&R2					39
Criterion at receivers R1&R2					47

3.3 Discussion

The predicted noise levels provided above comply with the criterion for each receiver. Conservative values for attenuation due to screening effects have been included in the calculations so the actual plant noise egress levels are likely to be lower than those presented. Therefore, it is anticipated that the criteria will be comfortably complied with.

4 Summary

SBA has been appointed to provide acoustic advice on the Western Transit Shed development at King's Cross. This report provides an assessment of noise egress from the proposed plant installation at the development with regard to planning condition 60.

Noise limits have been established based on the existing and future uses of the land surrounding the development, the background noise survey conducted by the English Cogger LLP, and the relevant criteria.

The proposed plant installation has been assessed, based on the plant locations and manufacturers' noise data, and the predicted noise levels compared with the relevant noise limit for each noise sensitive premises.

The predictions indicate that relevant external noise criteria will be complied with.

Appendix A

Plant locations and noise data

Figure 2 Rooftop plant locations 1

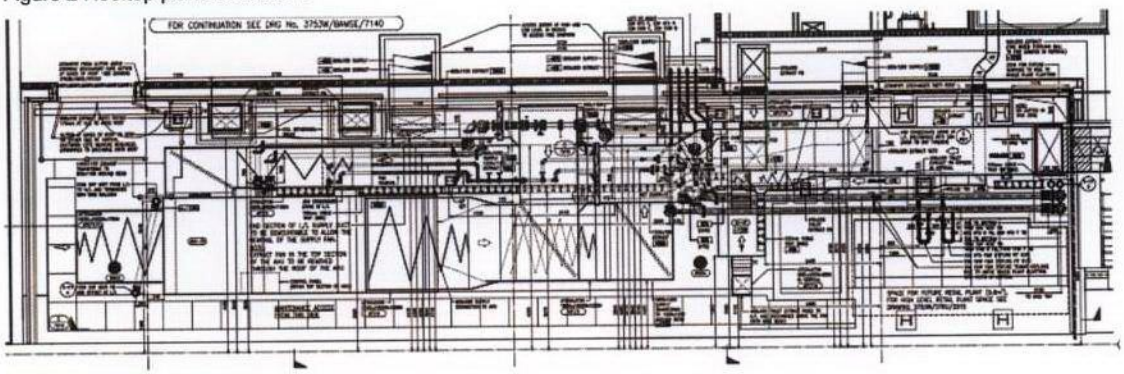


Figure 3 Rooftop plant locations 2

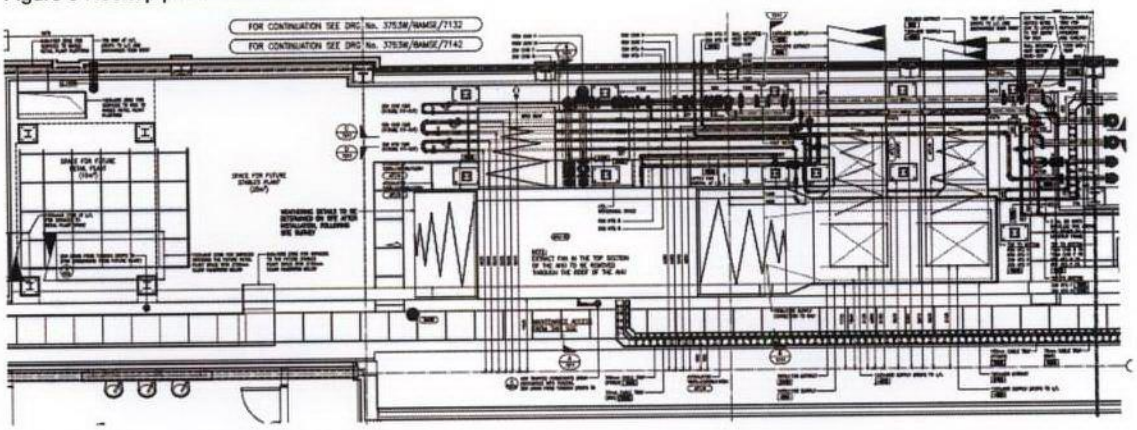


Figure 4 Rooftop plant locations 3

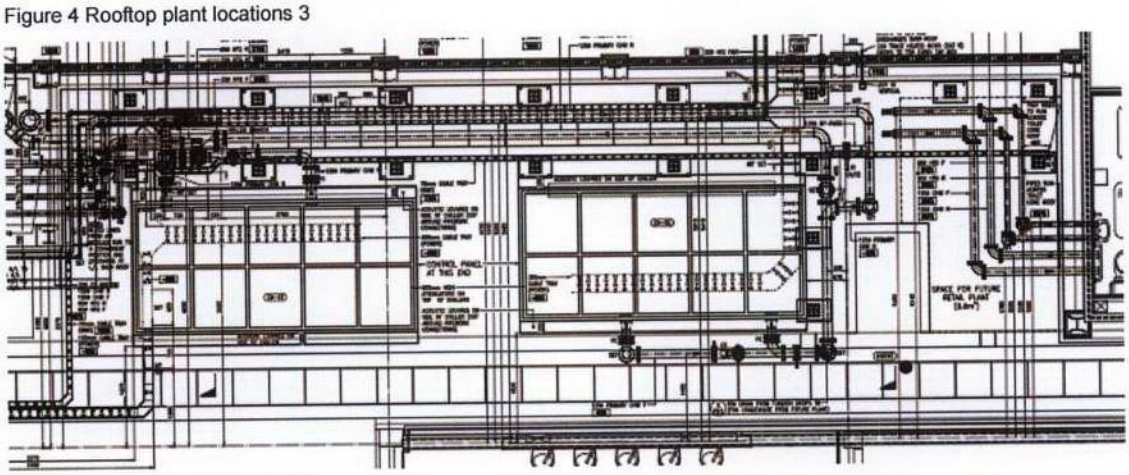


Figure 5 Rooftop plant locations 4

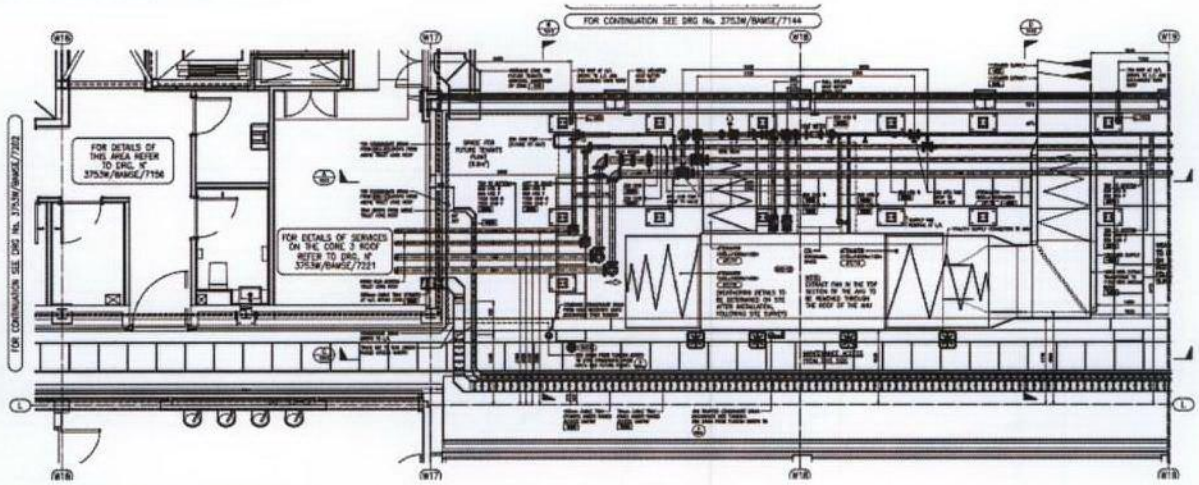
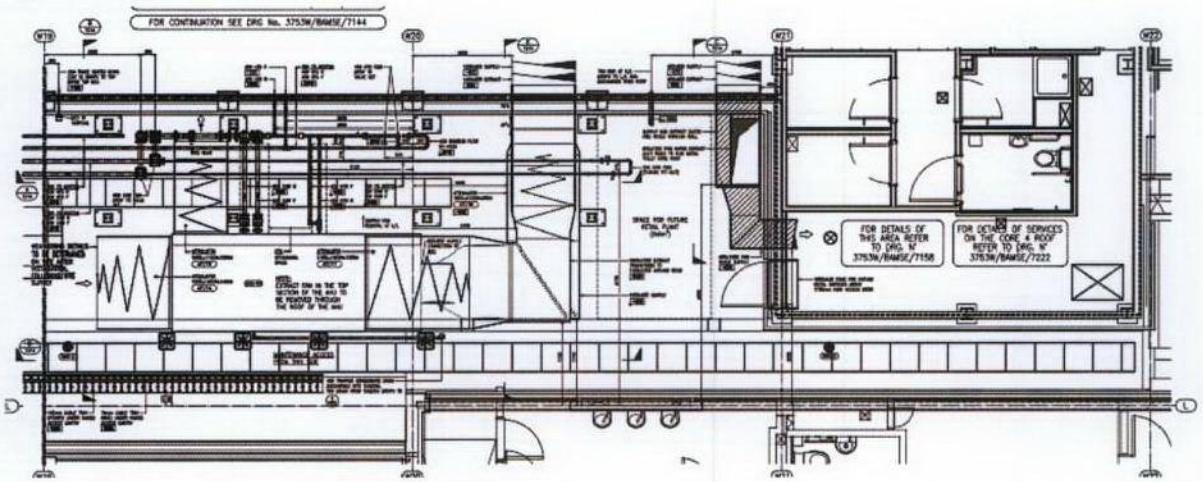


Figure 6 Rooftop plant locations 5



Dalair Limited (Head Office)
Quotation Reference: CS10373
Project Reference: Kings Cross Central, Eastern Goods Yard
Date: Wednesday 29th June 2011

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 1 (Supply Air Volume: 8.5m³/s / Extract Air Volume: 7.65m³/s)

CASING RADIATED	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum (Fan)	SWL	87	84	88	88	89	82	77	72
2 No Fans Running & Mounting In AHU	dB	6	6	6	6	6	6	6	6
50mm Panel Insertion Loss (100kg/m³ Rockwool)	dB	-17	-20	-25	-25	-31	-33	-37	-26
SPL Panel	**dB**	**76**	**70**	**69**	**69**	**64**	**55**	**46**	**52**
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3
RESULTANT Sound Pressure Level	**dB**	**73**	**67**	**66**	**66**	**61**	**52**	**43**	**49**

ATMOSPHERIC - Supply INLET	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Inlet (Supply Fan)	SWL	80	83	88	88	84	81	73	66
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Component Losses	dB	-3	-5	-10	-12	-16	-15	-11	-9
Sound Power Level To AHU Fresh Air Inlet	**SWL**	**81**	**82**	**82**	**80**	**72**	**70**	**66**	**61**

ROOMSIDE - Supply DISCHARGE	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Outlet (Supply Fan)	SWL	87	84	88	88	89	82	77	72
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Supply Air Outlet	**SWL**	**91**	**88**	**92**	**92**	**93**	**86**	**81**	**76**

ATMOSPHERIC - Extract DISCHARGE	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Outlet (Extract Fan)	SWL	83	80	84	84	85	78	73	68
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Outlet	**SWL**	**87**	**84**	**88**	**88**	**89**	**82**	**77**	**72**

ROOMSIDE - Extract INLET	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Inlet (Extract Fan)	SWL	76	79	84	84	80	77	69	62
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Inlet	**SWL**	**80**	**83**	**88**	**88**	**84**	**81**	**73**	**66**

1. The above In duct power spectrum makes no allowance for room acoustics or ductwork losses

Table 7 AHU 1 Noise data

Dalair Limited (Head Office)
Quotation Reference: CS10373
Project Reference: Kings Cross Central, Eastern Goods Yard
Date: Wednesday 29th June 2011

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 2 (Supply Air Volume: 9.5m³/s / Extract Air Volume: 8.55m³/s)

CASING		Octave Band Centre Frequency							
RADIATED	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum (Fan)	SWL	85	84	89	89	88	80	73	67
2 No Fans Running & Mounting In AHU	dB	6	6	6	6	6	6	6	6
50mm Panel Insertion Loss (100kg/m³ Rockwool)	dB	-17	-20	-25	-25	-31	-33	-37	-26
SPL Panel	**dB**	**74**	**70**	**70**	**70**	**63**	**53**	**42**	**47**
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3
RESULTANT Sound Pressure Level	**dB**	**71**	**67**	**67**	**67**	**60**	**50**	**39**	**44**

ATMOSPHERIC - Supply		Octave Band Centre Frequency							
INLET	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Inlet (Supply Fan)	SWL	83	83	93	84	81	76	68	64
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Component Losses	dB	-3	-5	-10	-12	-16	-15	-11	-9
Sound Power Level To AHU Fresh Air Inlet	**SWL**	**84**	**82**	**87**	**76**	**69**	**65**	**61**	**59**

ROOMSIDE - Supply		Octave Band Centre Frequency							
DISCHARGE	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Outlet (Supply Fan)	SWL	85	84	89	89	88	80	73	67
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Supply Air Outlet	**SWL**	**89**	**88**	**93**	**93**	**92**	**84**	**77**	**71**

ATMOSPHERIC - Extract		Octave Band Centre Frequency							
DISCHARGE	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Outlet (Extract Fan)	SWL	86	83	87	87	88	81	76	71
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Outlet	**SWL**	**90**	**87**	**91**	**91**	**92**	**85**	**80**	**75**

ROOMSIDE - Extract		Octave Band Centre Frequency							
INLET	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Inlet (Extract Fan)	SWL	79	82	87	87	83	80	72	65
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Inlet	**SWL**	**83**	**86**	**91**	**91**	**87**	**84**	**76**	**69**

1. The above In duct power spectrum makes no allowance for room acoustics or ductwork losses

Table 8 AHU 2 Noise data

Dalair Limited (Head Office)
Quotation Reference: CS10373
Project Reference: Kings Cross Central, Eastern Goods Yard
Date: Wednesday 29th June 2011

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 3 (Supply Air Volume: 5.5m³/s / Extract Air Volume: 4.95m³/s)

CASING RADIATED	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum (Fan)	SWL	86	87	90	85	88	82	78	74
2 No Fans Running & Mounting In AHU	dB	6	6	6	6	6	6	6	6
50mm Panel Insertion Loss (100kg/m³ Rockwool)	dB	-17	-20	-25	-25	-31	-33	-37	-26
SPL Panel	**dB**	**75**	**73**	**71**	**66**	**63**	**55**	**47**	**54**
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3
RESULTANT Sound Pressure Level	**dB**	**72**	**70**	**68**	**63**	**60**	**52**	**44**	**51**

ATMOSPHERIC - Supply INLET	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Inlet (Supply Fan)	SWL	80	86	89	86	85	81	77	71
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Component Losses	dB	-3	-5	-10	-12	-16	-15	-11	-9
Sound Power Level To AHU Fresh Air Inlet	**SWL**	**81**	**85**	**83**	**78**	**73**	**70**	**70**	**66**

ROOMSIDE - Supply DISCHARGE	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Outlet (Supply Fan)	SWL	86	87	90	85	88	82	78	74
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Supply Air Outlet	**SWL**	**90**	**91**	**94**	**89**	**92**	**86**	**82**	**78**

ATMOSPHERIC - Extract DISCHARGE	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Outlet (Extract Fan)	SWL	82	83	86	81	84	78	74	70
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Outlet	**SWL**	**86**	**87**	**90**	**85**	**88**	**82**	**78**	**74**

ROOMSIDE - Extract INLET	Hz	Octave Band Centre Frequency 63	125	250	500	1000	2000	4000	8000
Power Spectrum Inlet (Extract Fan)	SWL	76	82	85	82	81	77	73	67
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Inlet	**SWL**	**80**	**86**	**89**	**86**	**85**	**81**	**77**	**71**

1. The above In duct power spectrum makes no allowance for room acoustics or ductwork losses

Table 9 AHU3 Noise data

Dalair Limited (Head Office)
Quotation Reference: CS10373
Project Reference: Kings Cross Central, Eastern Goods Yard
Date: Wednesday 29th June 2011

Air Handling Unit Acoustic Analysis

AHU Reference : AHU 4 (Supply Air Volume: 6.5m³/s / Extract Air Volume: 5.85m³/s)

CASING		Octave Band Centre Frequency							
RADIATED	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum (Fan)	SWL	84	84	92	85	87	82	78	75
2 No Fans Running & Mounting In AHU	dB	6	6	6	6	6	6	6	6
50mm Panel Insertion Loss (100kg/m³ Rockwool)	dB	-17	-20	-25	-25	-31	-33	-37	-26
SPL Panel	**dB**	**73**	**70**	**73**	**66**	**62**	**55**	**47**	**55**
Distance @ 1 metre (Corrected to Actual Test Values)	dB	-3	-3	-3	-3	-3	-3	-3	-3
RESULTANT Sound Pressure Level	**dB**	**70**	**67**	**70**	**63**	**59**	**52**	**44**	**52**

ATMOSPHERIC - Supply		Octave Band Centre Frequency							
INLET	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Inlet (Supply Fan)	SWL	81	84	90	86	84	82	74	69
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Component Losses	dB	-3	-5	-10	-12	-16	-15	-11	-9
Sound Power Level To AHU Fresh Air Inlet	**SWL**	**82**	**83**	**84**	**78**	**72**	**71**	**67**	**64**

ROOMSIDE - Supply		Octave Band Centre Frequency							
DISCHARGE	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Outlet (Supply Fan)	SWL	84	84	92	85	87	82	78	75
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Supply Air Outlet	**SWL**	**88**	**88**	**96**	**89**	**91**	**86**	**82**	**79**

ATMOSPHERIC - Extract		Octave Band Centre Frequency							
DISCHARGE	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Outlet (Extract Fan)	SWL	80	80	88	81	83	78	74	71
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Outlet	**SWL**	**84**	**84**	**92**	**85**	**87**	**82**	**78**	**75**

ROOMSIDE - Extract		Octave Band Centre Frequency							
INLET	**Hz**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power Spectrum Inlet (Extract Fan)	SWL	77	80	86	82	80	78	70	65
Mounting In AHU	dB	4	4	4	4	4	4	4	4
Sound Power Level To AHU Extract Air Inlet	**SWL**	**81**	**84**	**90**	**86**	**84**	**82**	**74**	**69**

1. The above In duct power spectrum makes no allowance for room acoustics or ductwork losses

Table 10 AHU 4 Noise data

Calculation of Chiller Noise with Acoustic Package (5-sided box radiation)

Chiller Type: Clivet Model WDATB 2.240

Length	**4.75**	m
Width	**2.23**	m
Height	**2.22**	m
Distance	**1.0**	m *Enter zero for Lw calc*
5SB area	99.3	m2
5SB corr	-20	dB

	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	A or Lin?
Chiller Lw	**79**	**92**	**88**	**86**	**81**	**73**	**70**	**68**	dB

	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Lp @ 1m untreated	59	72	68	66	61	53	50	48	67
Lp @ 1m with AA202	59	71	66	63	58	49	47	46	64
Lp @ 1m with AA203L	59	71	66	61	55	47	44	43	63
Lp @ 1m with AA203	59	70	64	58	51	44	42	41	60
Lp @ 1m with AA204	59	68	62	54	48	40	38	37	58
Lp @ 1m with AA205	56	63	56	48	41	34	32	34	52
Lp @ 1m with AA301	56	66	58	50	44	38	36	36	54
Lp @ 1m with AA303	55	63	55	44	37	30	30	32	51
Lp @ 1m with AA401	51	60	52	46	36	25	22	21	48

Lw is Sound Power Level, dB re 10-12W (1pW); **Lp** is Sound Pressure Level, dB re 2 x 10-5Pa
Propagation in accordance with 5-sided box (conformal surface) model, with chiller on reflecting plane in otherwise free field.
Measurement position 1.5m above surface upon which chiller stands.
Data are derived from tests carried out in accordance with ISO 3744 or ISO9614, and are therefore a logarithmic average around the machine. Individual points may be noisier or quieter.
Octave band levels are provided for information only.
Acoustic base panels are required when chiller is raised off the ground, or is not on a solid surface.

Figure 7 Chiller noise data

Supply Plug Fan - SFP = 1.2 w/l/s

Model	:ER 50	Working RPM	:1767 RPM
Efficiency	:79 %		
Sound Power	:92	Absorbed Power	:2.61
Motor	:4.0 kW	Fan Blade Type	:Backward
Motor Type	:Three Phase IE2		
FLC	:16.5 A		

Sound Power Level

PWL:	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
dB:	79	83	87	87	83	79	75	70

Extract Plug Fan - SFP = 1.2 w/l/s

Model	:ER 50	Working RPM	:1776 RPM
Efficiency	:79 %		
Sound Power	:92	Absorbed Power	:2.66
Motor	:4.0 kW	Fan Blade Type	:Backward
Motor Type	:Three Phase IE2		
FLC	:16.5 A		

Sound Power Level

PWL:	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
dB:	79	83	87	87	83	79	75	70

Noise ratings at the following distances.

1) At 3m from the fresh air inlet = NR 55
2) At 3m from the supply discharge = NR 65
3) At 3m from the extract inlet = NR 70
4) At 3m from the Exhaust discharge = NR 55
5) Casing breakout level at 3m = NR 40

Figure 8 HRU1 noise data

The supply side comprises the following components:

a: Inlet cowl to end of unit.
b: Pleated filter to grade G4 withdrawal through side access panel.
c: Plate heat exchanger with an efficiency of approximately 50% depending on conditions.
d: Supply centrifugal fan, backward curved impellor, single inlet, running at 1330RPM and direct driven by a 0.450kW, 400volt, 3 phase, single speed external rotor motor. Full load current 0.86amps.

Sound Power Level Spectrum

Hz	63	125	250	500	1k	2k	4k	8k
PWL, dBW	64	74	69	64	59	54	50	44

The exhaust side comprises the following components:

a: Inlet spigot size, 550mm high x 450mm wide with 20mm Mez flange.
b: Pleated filter to grade G4 withdrawal side top access panel.
c: Extract centrifugal fan, backward curved impellor, single inlet, running at 1330RPM, and direct driven by a 0.450kW, 400volt, 3 phase, single speed external rotor motor. Full load current 0.86amps.

Sound Power Level Spectrum

Hz	63	125	250	500	1k	2k	4k	8k
PWL, dBW	64	74	69	64	59	54	50	44

Noise ratings at the following distances.

1) At 3m from the fresh air inlet = NR 45
2) At 3m from the supply discharge = NR 55
3) At 3m from the extract inlet = NR 60
4) At 3m from the Exhaust discharge = NR 45
5) Casing breakout level at 3m = NR 30

Figure 9 HRU2 noise data

Sound Data

Acoustic perfomance to BS848 Part 2.2 and AMCA 300.
Breakout Noise (dBA): 44 dBA @ 3m (90% of Max Pa)
Breakout level is hemi-spherical. For spherical deduct 3 dBA.

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	79	74	68	63	64	56	51	47
Induct Outlet	81	76	75	72	74	64	60	54
Breakout	77	69	68	63	60	48	41	33

Above noise calculated speed controlled to required duty (95.8%)

For 100% Speed:	+0	+0	+0	+1	+1	+1	+1	+1

Breakout Noise (dBA): +4 (90% of Max Pa)

Figure 10 Toilet extract fan 1

Sound Data

Acoustic perfomance to BS848 Part 2.2 and AMCA 300.
Breakout Noise (dBA): 34 dBA @ 3m (90% of Max Pa)
Breakout level is hemi-spherical. For spherical deduct 3 dBA.

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	72	67	56	47	45	46	44	39
Induct Outlet	80	75	66	62	64	64	61	56
Breakout	59	62	58	53	47	45	42	34

Above noise calculated speed controlled to required duty (84.5%)

For 100% Speed:	+1	+1	+2	+2	+4	+4	+4	+4

Breakout Noise (dBA): +6 (90% of Max Pa)

Figure 11 Toilet extract fan 2

Sound Data

Acoustic perfomance to BS848 Part 2.2 and AMCA 300.
Breakout Noise (dBA): 35 dBA @ 3m (90% of Max Pa)
Breakout level is hemi-spherical. For spherical deduct 3 dBA.

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	72	67	57	47	47	48	46	41
Induct Outlet	80	75	67	62	66	66	63	58
Breakout	59	62	59	53	49	47	44	36

Above noise calculated speed controlled to required duty (89.3%)

For 100% Speed:	+1	+1	+1	+2	+2	+2	+2	+2

Breakout Noise (dBA): +5 (90% of Max Pa)

Figure 12 Toilet extract fan 4

Appendix B
Atmosphere side attenuators

Table 11 Atmosphere side attenuator insertion losses

	Octave band centre frequency (Hz)							
Insertion loss (L_w, dB)	63	125	250	500	1k	2k	4k	8k
1. AHU01 FRESH AIR INTAKE	10	18	30	47	55	51	44	26
2. AHU01 EXHAUST	7	15	27	42	53	39	27	18
3. AHU02 FRESH AIR INTAKE	12	20	30	39	52	44	33	25
4. AHU02 EXHAUST	9	16	25	37	49	40	33	22
5. AHU03 FRESH AIR INTAKE	11	19	31	45	55	53	41	30
6. AHU03 EXHAUST	10	17	29	43	55	48	39	26
7. AHU04 FRESH AIR INTAKE	11	19	31	45	55	53	41	30
8. AHU04 EXHAUST	10	17	29	43	55	48	39	26
9. TOILET FAN 1 EXHAUST	9	15	22	31	43	36	27	20
10. TOILET FAN 2 EXHAUST	9	15	22	31	43	36	27	20
11. TOILET FAN 4 EXHAUST	9	15	22	31	43	36	27	20
12. HRU01 INTAKE	8	16	26	39	55	50	43	26
13. HRU01 EXHAUST	8	16	26	39	55	50	43	26
14. HRU02 INTAKE	8	16	26	39	55	50	43	26
15. HRU02 EXHAUST	8	16	26	39	55	50	43	26