Indoor Environment Quality
IEQ-1 Ventilation Rates

Points Available	Points Claimed	CIR Submitted
3	1	N

Credit Criteria
Up to three points are awarded where it is demonstrated that outside air is provided at rates that exceed the requirements of AS 1668.2-1991 OR if natural ventilation is provided.
Mechanically Ventilated Tenancy:
- 1 point for a 50% increase on AS 1668.2-1991;
- 2 points for a 100% increase on AS 1668.2-1991;
- 3 points for a 150% increase on AS 1668.2-1991.

Documents Provided

✓	A summary document which demonstrates that each space served by an AHU that exceeds 50% increase on AS 1668.2-1991 'The Use of Mechanical Ventilation and Air-conditioning in Buildings - Mechanical Ventilation for Acceptable indoor air quality' (approx. 11.25 L/s/person) The summary document must include a table that clearly references: - the commissioning report, - the minimum fresh air rates delivered through each AHU and must correlate each of these rates with the NLA served by each AHU; and demonstrate that all meeting rooms comply with the above requirements. IEQ-1: 1
✓	As-built drawings indicating the NLA served by each Air Handling Unit (AHU) IEQ-1: 2
✓	A copy of the commissioning report indicating the minimum fresh air rates served by each AHU IEQ-1: 3

Discussion
- The GBCA tenancy achieves a 50% increase on AS 1668.2-1991 outside air ventilation rates. The method in which we achieve this is covered in the Summary report which references both the Lincolne Scott calculation and the commissioning air balance sheets that were provided as part of the HVAC system commissioning.

green building council australia
green star
environmental rating system for buildings
BUILDING A SUSTAINABLE FUTURE
ABN 43 100 789 937
Phone (612) 8252 8222
Fax (612) 8252 8223
Email info@gbcaus.org
Address Level 15/179 Elizabeth St
Sydney NSW 2000
Postal PO Box Q78 QVB NSW 1230
Website www.gbcaus.org

18 February 2009

Increase on AS 1668.2-1991 in GBCA Tenancy

Summary report written by Joe Karten

The GBCA Tenancy on L15, 179 Elizabeth St, Sydney, was designed to provide an increase on outside air rates above the AS-1668.2-1991 standard by 50% to improve IEQ in the space. While this 50% increase is normally approximately 15 L/s per person, because of an increase in filter efficiency, the GBCA can use 7.5 L/s as per the calculation provided by Lincolne Scott in IEQ-1: 3.

The outside air rate for the office, as stipulated by the Air System Data Report in IEQ-1: 3, is 924 L/s. Lincolne Scott designed the outside air to account for the 56 employee workstations + ½ employee per chair in the meeting rooms. Because the meeting rooms and board room have a total capacity of 36, 18 employees are added to the total of 56 employees at workstations. This equals 74 employees. Because we are targeting 11.25 L/s/person, this equates to a design supply of 832 L/s. Lincolne Scott designed the system to deliver 860l/s. Commissioning test data in the Air System Data Report shows the actual delivery to be 924 L/s, which provides 12.5l/s/person.

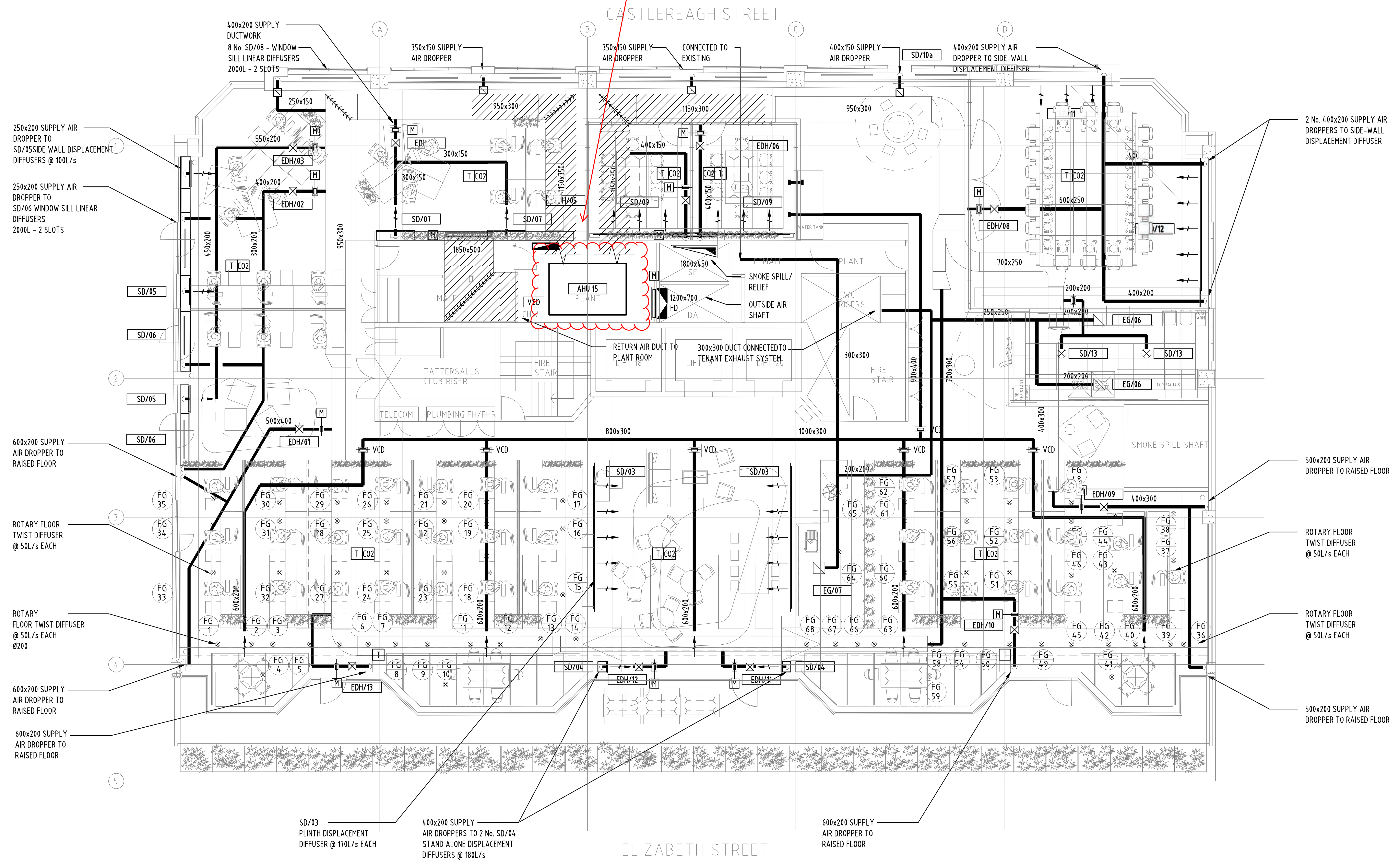
The data given in the table below is taken from the air balance test report data sheets provided in IEQ-1: 2. The actual air rates are called out on the sheets and list the corresponding meeting room.

Room	Actual delivery	OA ratio (rc)	OA rate	L/s/person
Meeting Rm 1	156 L/s	.60	93.6 L/s	11.7
Meeting Rm 2	165 L/s	.60	99 L/s	12.4
Board Room	648 L/s	.357	231 L/s	11.6

All spaces have an outside air component delivery of greater than 11.25 L/s/person. Therefore, the system delivers an increase of greater than 50% of outside air rates on the AS 1668.2-1991 requirements.

IEQ-1: 2

The entire 804m2 NLA is served by this AHU



LEGEND

AxB	RECTANGULAR DUCTWORK
	SUPPLY AIR DUCTWORK
	RETURN AIR DUCTWORK
	EXHAUST AIR DUCTWORK
	DROPPER
SD/xx	STAND ALONE DISPLACEMENT DIFFUSER
SD/xx	SIDE WALL DISPLACEMENT DIFFUSER
SD/xx	SWIRL DIFFUSER
	ROTARY FLOOR DIFFUSER
EG/xx	RETURN/EXHAUST AIR GRILLE
FD	FIRE DAMPER
VCD	VOLUME CONTROL DAMPER
M	MOTORISED DAMPER
EDH/xx	ELECTRICAL DUCT HEATER
T	TEMPERATURE SENSOR
CO2	CO2 SENSOR
	DISTRIBUTION BOARD
FG 48	FLOOR DIFFUSER NO.

Rev	Description	By	Date
A	AS BUILT	ENRAVEL	11.03.2009

CONSULTANT

Lincolne Scott

Consulting Engineers
Adelaide Auckland Bangkok
Brisbane Cairns Honolulu
Melbourne Perth Shanghai
Singapore Sydney

JLW
ESTABLISHED 1875
JAMES L. WILLIAMS PTY. LTD.
ACN 004 122 650
AIR CONDITIONING & MECHANICAL CONTRACTORS

SYDNEY
UNIT 10 CENTURY ESTATE
476 GARDENERS ROAD
ALEXANDRIA NSW 2015
P.O.BOX 636
ROSEBERY NSW 1445
TELEPHONE (02) 9313 5911
FACSIMILIE (02) 9313 5613

BRISBANE
MOUNT ISA
MELBOURNE
HEAD OFFICE

CLIENT

GBCA

Project

LEVEL 15
179 ELIZABETH STREET
SYDNEY NSW 2000

Drawing Title

DUCTWORK LAYOUT
L15

CAD File		Drawn	-
Coordinated		Scale	1:100 @A1
Project Architect		Date	11-03-09
Project Director			
PTW Project No. -	Drawing Number ST 236-M01 A	Rev A	
JLW Project No. ST 236			

AS BUILT

Consulting Engineers
Adelaide Auckland Bangkok
Brisbane Cairns Canberra
Honolulu Melbourne Perth
Singapore Sydney

Lincolne Scott Australia Pty Ltd
ABN 47 005 113 468
Level 1 41 McLaren Street
PO Box 6245 North Sydney
New South Wales 2060 Australia
Telephone 61 2 8907 0900
Facsimile 61 2 9957 4127
sydney@lincolnescott.com
lincolnescott.com

Lincolne Scott

To	**Green Building Council of Australia**	Date	**17 February 2009**
Attention	**Joe Karten**	Email	**Joe.Karten@gbca.org.au**
From	**Astrid Siohan**	Project No	**SYD0703900**
Project	**GBCA Fitout - 179 Elizabeth Street**	No. of pages	**3**
Subject	**IEQ 1 - Ventilation Rates**	Copies	**Richard Palmer - Advanced Environmental**

Joe,

Please see attached the outside air multi-enclosure calculation spreadsheet based on a 50% improvement on AS1668.2-1991 requirements.

The calculation is based on a minimum outdoor air flow rate to be supplied to the space of 7.5L/s per person as per paragraph 2.3.4 (b).

The on-floor Air Handling Unit serving the whole floor (incl. the meeting rooms and board room) is provided with a F5 filter (50% efficiency).

Regards

Astrid Siohan
Engineer

Lincolne Scott

Outside Air Multiple Enclosure Calculation

Project Name:	GBCA Offices Fit-Out	Prep. By:	AS	Date:	8/10/2007
Project No:	SYD0703900	Chkd by:		Date:	

Unit No: 1

Note: SAQ is the minimum required and may be in Heating or VAV minimum mode. In some cases rc needs to be adjusted to suit special applications and may have to be modelled or adjusted so a minor room does not drive the whole plant. Apply designer discretion.

Room	Area (m2)	Density (per/m2)	Number People	OA/ Person (l/s)	Min OA (l/s)	Room Supply Air (l/s)	rc
Open Plan	696	0.1	70	11.250	783	3864	0.203
Meeting Room			8	11.250	90	150	0.600
Meeting Room			8	11.250	90	150	0.600
Board Room			20	11.250	225	630	0.357
			106	45	1188	4794	0.600

For a series of multiple enclosures being fed from a common plant calculate R,rc,M, for totals of OA &SA to

Minimum outside air= MxQf

2.3.4 Minimum outdoor airflow rates, (q_f), to be supplied to an enclosure, based on number of occupants in the enclosure For an enclosure for which the minimum outdoor airflow rate in accordance with Appendix A is based on the number of occupants (litres per second per person), the outdoor airflow rate shall be determined in accordance with Paragraphs (a), (b), and (c) below, as appropriate.

(a) Where an air cleaning unit, in accordance with Appendix D, is not provided, the greater of—

$q_f \geq a_f N$ ..... 2.3.4(1); or

$q_f \geq a_o N$ ..... 2.3.4(2).

(b) Where an air cleaning unit to remove particulate contaminants only, in accordance with Appendix D, is provided, q_f may be taken as—

$q_f \geq a_o N$ ..... 2.3.4(3); or

(c) Where an air cleaning unit to remove particulates and odours, in accordance with Appendix D, is provided, q_f may be taken as the greater of—

$q_f \geq 2.5N$ ..... 2.3.4(4); or

$q_f \geq 0.35A$ ..... 2.3.4(5)

where

A = the area of the enclosure, in square metres

N = the occupancy, in accordance with Clause 2.3.2

a_f = the minimum outdoor airflow rate given in Appendix A, in litres per second per person (L/s person)

a_o = the minimum outdoor airflow rate for dilution of gaseous contaminants (e.g. body odours), in litres per second per person, as follows—

(i) a_o = 15 L/s per person if the temperature in the enclosure exceeds 27°C in normal use, or

(ii) a_o = 7.5 L/s per person if the temperature of the enclosure is below 27°C in normal use, except for:

autopsy rooms a_o	= 50 L/s person
operating theatres a_o	= 20 L/s person
delivery rooms a_o	= 20 L/s person
embalming rooms a_o	= 15 L/s person
air traffic control rooms a_o	= 20 L/s person

NOTES:

1 The occupancy (N) should not exceed the number stated or estimated unless the outdoor-airflow rate is already sufficient, or is appropriately increased to satisfy such occupancy.

2 The installation of air cleaning units to remove particulates or odours does not permit any reduction in the outside air supply quantity for non-recirculatory systems.

2.3.5 Minimum flow rate of outdoor air into a single-enclosure system (q_F) Minimum flow rate of outdoor air into a single-enclosure system shall be the greater of—

(a) $q_F \geq$ the requirements in Clauses 2.3.3 and 2.3.4; or

(b) $q_F \geq$ the make-up air requirements, where the enclosure is also used for make-up air to another enclosure ventilated by an exhaust system (see Clause 3.5.2).

2.3.6 Minimum flow rate of outdoor air into a system serving a group of enclosures (Q_F) For the purpose of this Clause groups of enclosures used for a similar purpose and subject to the same density of occupancy such as general office space may, subject to approval, be regarded as a single enclosure. Minimum total outdoor airflow rate for a system serving any other group of enclosures shall be the greater of—

(a) $Q_F \geq MQ_f$ ..... 2.3.6(1); or

(b) $Q_F \geq$ the rate at which make-up air must be admitted to the system (see Clause 3.5.2).

where the multiple enclosure factor $(M) = 1/(1 + R - r_c)$;

and where

Q_f = $\Sigma q_{fn} = (q_{f1} + q_{f2} + ... + q_{fn})$, that is, the sum of outdoor airflow rates for all enclosures served determined in accordance with Clauses 2.3.3 and 2.3.4

Q_s = $\Sigma q_{sn} = (q_{s1} + q_{s2} + ...+ q_{sn})$, i.e. the sum of the supply airflow rates for all the enclosures served by the system

q_{fn} = the flow rate of outdoor air to be supplied to the n^{th} enclosure, in litres per second, determined in accordance with Clauses 2.3.3 and 2.3.4

q_{sn} = the flow rate of supply air to be supplied to the n^{th} enclosure, in litres per second

R = the ratio of the sum of outdoor airflow rates for all enclosures served to the total supply air for all enclosures served = Q_f/Q_s

Consulting Engineers
Adelaide Auckland Bangkok
Brisbane Cairns Honolulu
Melbourne Perth San Diego
Singapore Sydney

Lincolne Scott Australia Pty Ltd
ABN 47 005 113 468
Level 1 41 McLaren Street
PO Box 6245 North Sydney
New South Wales 2060 Australia
Telephone 61 2 8907 0900
Facsimile 61 2 9957 4127
sydney@lincolnescott.com
lincolnescott.com

Lincolne Scott

Project **GBCA Offices Fit-out**
179 Elizabeth Street

Project No **SYD0703900**
Dated **22/10/2007**

Schedule of Equipments

Supply Air Diffusers by Krantz

Ref.	Location	No.	Type	Manufacturer Ref.	Face velocity	Size				Flow rate	ΔP	NR
						Dia	Height	Length	Depth			
					m/s	mm	mm	mm	mm	L/s	Pa	dbA
SD/01	Open-plan / Raised floor area (1)	37	Rotary floor twist outlet	DB-D-DN200	n/a	200				50	TBC	
SD/02	Open-plan / Raised floor area (2)	32	Rotary floor outlet	DB-D-DN200	n/a	200				50		
SD/03	Members Lounge/Café	2	Plinth diffuser	Q-R	0.15		190	6000	TBC	170		
SD/04	Members Lounge/Café	2	Stand-alone rectangular displacement diffuser	Q-R	0.25		1500	500	350	180		
SD/05	Open-plan / South	3	Stand-alone rectangular displacement diffuser	Q-R	0.15		1000	700	350	100		
SD/06	Window sill / South	3	Sill mounted linear diffuser	IN-V2.2	n/a			2000	2 rows	90		
SD/07	Open-plan / West	2	Stand-alone rectangular displacement diffuser	Q-R	0.15		1000	700	350	100		
SD/08	Window sill / West	7	Sill mounted linear diffuser	IN-V2.2	n/a			2000	2 rows	90		
SD/09	Meeting rooms	2	Side-wall displacement diffuser	Q-R	0.15		250	4000	200	150		
SD/10	Open plan / Meeting	1	Stand-alone rectangular displacement diffuser	Q-R	0.15		1200	800	300	150		
SD/11	Boardroom	1	Side-wall displacement diffuser	Q-R	0.2		400	3000	350	220		
SD/12	Boardroom	1	Side-wall displacement diffuser	Q-R	0.2		400	5500	350	410		
SD/13	Utilities/Store room	2	Swirl diffusers	RA-N3-DN350 Collar 5	n/a	350				50		

Exhaust/Return Air Grilles by Air Grilles

Ref.	Location	No.	Type	Manufacturer Ref.	Face velocity	Size				Flow rate	ΔP	NR
						Dia	Height	Length	Depth			
					m/s	mm	mm	mm	mm	L/s	Pa	dbA
EG/01	South of core	2	Duct mounted return air grille	EG5	1	n/a	n/a	600	400	250	TBC	
EG/02	East of core	4	Duct mounted return air grille	EG5	1	n/a	n/a	600	400	240		
EG/03	Eastern perimeter	5	Duct mounted return air grille	EG5	1	n/a	n/a	600	400	240		
EG/04	North of core	2	Duct mounted return air grille	EG5	1	n/a	n/a	750	400	310		
EG/05	Meeting/Board room area	1	Duct mounted return air grille	EG5	1	n/a	n/a	750	400	310		
EG/06	Utilities/Store room	1	Ceiling mounted exhaust air grille	EG5	1	n/a	n/a	350	350	250		
EG/07	Kitchenette	1	Duct mounted exhaust air grille	EG5	1	n/a	n/a	200	200	100		

Consulting Engineers
Adelaide Auckland Bangkok
Brisbane Cairns Honolulu
Melbourne Perth San Diego
Singapore Sydney

Lincolne Scott Australia Pty Ltd
ABN 47 005 113 468
Level 1 41 McLaren Street
PO Box 6245 North Sydney
New South Wales 2060 Australia
Telephone 61 2 8907 0900
Facsimile 61 2 9957 4127
sydney@lincolnescott.com
lincolnescott.com

Lincolne Scott

Project **GBCA Offices Fit-out**
179 Elizabeth Street

Project No **SYD0703900**
Dated **22/10/2007**

Schedule of Equipments

Electrical Duct Heaters

Ref.	Location	No.	Type	Manufacturer Ref.	Capacity	Size				Flow rate	ΔP
						Dia	Height	Length	Depth		
					kW	mm	mm	mm	mm	L/s	Pa
EDH/01	Open plan - East	1	In-line		7.5	TBC				1220	TBC
EDH/02	Open plan - South	1	In-line		0.9					150	
EDH/03	Open plan - South	1	In-line		1.8					300	
EDH/04	Open plan - West	1	In-line		1.2					200	
EDH/05	Meeting room	1	In-line		0.9					150	
EDH/06	Meeting room	1	In-line		0.9					150	
EDH/07	Meeting area	1	In-line		1.1					180	
EDH/08	Board room	1	In-line		3.9					630	
EDH/09	Open plan - East	1	In-line		4.9					800	
EDH/10	Eastern perimeter	1	In-line		4.9					800	
EDH/11	Eastern perimeter	1	In-line		1.1					180	
EDH/12	Eastern perimeter	1	In-line		1.1					180	
EDH/13	Eastern perimeter	1	In-line		4.9					800	

ESTABLISHED 1875

James L Williams Pty Ltd

Air Conditioning & Mechanical Services
ACN 004 122 650 ABN 17 004 122 650

To:	Adam Terrill		
Company:	Schiavello	**Date:**	06/02/08
Project:	GBCA – L5, 179 Elizabeth St Sydney	**Pages:**	1
Subject:	Commissioning Report	**Ref:**	

Report for the commissioning of the GBCA project.

1. Commissioning dates

- 29th of Jan 08 to 8th of Feb 08

2. People involved with commissioning

- Paul Glekas and Adam Hook (JLW)
- Mark Olender (Honeywell)

3. Testing procedure

- Air balancing
- Chilled water measurement
- Controls – MVCD's and Heaters
- Heater Safeties
- AHU fan speed adjustment
- C02 testing

4. Changes made to the System

- Air balancing
  - Adjustment of manual push pull dampers in the ductwork and opposed blade dampers behind some diffusers.
- Chilled water measurement
  - No adjustment
- Controls – MVCD's and Heaters
  - No change to affect the rest of the building.
  - Proof of temperaure sensors, MVCD's and heaters operating on the correct zones.

James L. Williams Pty Ltd.
Unit 10/476 Gardeners Road, Alexandria NSW 2015Ph: (02) 8338 5888 Fax: (02) 9313 5612
Mob: 0412 781 738 Email: paul.glekas@jlwilliams.com.au

- Proof of MVCD's modulating with respect to temperature.
- Proof of heaters, heating with respect to temperature.
- Proof that economy cycle dampers operate.
- Proof that existing base building warm up heaters operate.

- Heater Safeties
  - Testing of heater safety high limit and air flow sensors operate correctly.
- AHU fan speed adjustment
  - Adjustments to VSD and pulleys to increase airflow and pressure.
- C02 testing
  - Not possible at this stage.

5. Results

- Please refer to the attachments for the results of the above testing.
- Attachements will be filled in as testing is completed.

Regards

Paul Glekas
Project Manager B.E. SYDU (HONS)

Adcom ***corp aust p/l***

testing and commissioning

AIR SYSTEM DATA REPORT

Client :	JL Williams	Date:	1/08/2008
Project :	179 Elizabeth St L15	Technician:	ADAM HOOK
System :	AHU 15-1	Page:	1 of 1

	Design	*Actual*
Volume		4794
Manufacturer		Airite
Size		AS5314
Serial No		ND4506
Suction Pressure		-325
Discharge Pressure		277
Total Static		602
Fan shaft dia		38
Taperlock		2012
Fan pulley dia		180
Belts		2 x SPB 1260
Pulley centres		360
Motor Adjustment		100 200
Motor Manufacturer		Brooks Crompton
Motor kW/HP	11	11
Amps	20	17 @ 59 Hz
Frame size		160 M
Shaft dia		38
Taperlock		2012
Pulley dia		170
R.P.M		1460
Phase / Volts		3 / 415

Comments

System operating Static 125 Pa

OUTSIDE AIR BALANCE

Outside Air 1200 x 700 = 0.84

Design =860 l/s

Av verlocity =1.1m/s

Total = 924 l/s

Adcom corp aust p/l
testing and commissioning

IEQ-1: 3

AIR BALANCE TEST REPORT

Client :	JL Williams	Date :	1/08/2008
Project :	179 Elizabeth St L15	Test By :	AH
System :	VAV Box Supply Air	Page :	
Instrument :		Ref :	

SYSTEM OR LOCATION	OUTLET REF.	SIZE mm x mm	AREA m2	DESIGN		ACTUAL	
				Volume L/S	Velocity M/S	Volume L/S	Velocity M/S
Pitot 1							
Main duct		1100 x 300	0.33	2970	9	2649	8.03
Pitot 2							
Main duct		1100 x 300	0.33	2710	8.2	2145	6.5
Pitot 3							
Slot diffuser		350 x 150	0.052	-	-	161	3.1
Pitot							
Hood factor							
0.036							
Pitot 4							
VAV 1		600 x 200	0.12	616	5.1	624	5.2
Raised floor							
Pitot 4A							
VAV 1		600 x 200	0.12	616	5.1	616	5.1
Raised floor							
Pitot 5							
VAV 13		600 x 200	0.12	800	6.6	480	4
Raised floor							

Adcom corp aust p/l
testing and commissioning

AIR BALANCE TEST REPORT

Client :	JL Williams	Date :	1/08/2008
Project :	179 Elizabeth St L15	Test By :	AH
System :	VAV Box Supply Air	Page :	
Instrument :		Ref :	

SYSTEM OR LOCATION	OUTLET REF.	SIZE mm x mm	AREA m2	DESIGN		ACTUAL	
				Volume L/S	Velocity M/S	Volume L/S	Velocity M/S
Pitot 6							
VAV 12		350 x 200	0.07	180	2.6	186	2.65
Pitot 7							
VAV 11		350 x 200	0.07	180	2.6	189	2.7
Pitot 8							
VAV 10		600 x 200	0.12	533	4.4	540	4.5
Raised floor							
Pitot 9							
VAV 9		600 x 200	0.12	400	3.3	384	3.2
Raised floor							
Pitot 10							
VAV 9		600 x 200	0.12	400	3.3	420	3.5
Raised floor							
Pitot 11							
VAV 8		400 x 200	0.08	220	2.75	220	2.75
Pitot 12							
VAV 8		400 x 200	0.08	220	2.75	216	2.7
Pitot 13							
VAV 8		400 x 200	0.08	220	2.75	212	2.65

These VAV 8 measurements correspond to supply in Board Room

Adcom corp aust p/l
testing and commissioning

IEQ-1: 3

AIR BALANCE TEST REPORT

Client :	JL Williams	Date :	1/08/2008
Project :	179 Elizabeth St L15	Test By :	AH
System :	VAV Box Supply Air	Page :	
Instrument :		Ref :	

SYSTEM OR LOCATION	OUTLET REF.	SIZE mm x mm	AREA m2	DESIGN		ACTUAL	
				Volume L/S	Velocity M/S	Volume L/S	Velocity M/S
Pitot 14							
VAV 3		200 x 250	0.05	100	2	115	2.3
Pitot 15							
VAV 3		200 x 250	0.05	100	2	120	2.4
Pitot 16							
VAV 3		200 x 250	0.05	100	2	113	2.25
Pitot 17							
VAV 4		300 x 150	0.045	100	2.2	104	2.3
Pitot 18							
VAV 4		300 x 150	0.045	100	2.2	101	2.25
Pitot 19							
VAV 6		400 x 150	0.06	150	2.5	156	2.6
Pitot 20							
VAV 5		400 x 150	0.06	150	2.5	165	2.75

Shown on drawing as EDH/06 - meeting room

Shown on drawing as EDH/05 - meeting room

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testing and commissioning

IEQ-1: 3

AIR BALANCE TEST REPORT

Client :	JL Williams	Date :	1/08/2008
Project :	179 Elizabeth St L15	Test By :	AH
System :	Constant Velocity Supply Air	Page :	
Instrument :		Ref :	

SYSTEM OR LOCATION	OUTLET REF.	SIZE mm x mm	AREA m2	DESIGN		ACTUAL	
				Volume L/S	Velocity M/S	Volume L/S	Velocity M/S
Slot fiffusers							
VAV 2	1	Hood	0.036	90	2.5	101	2.8
	2	Hood	0.036	90	2.5	101	2.8
	3	Hood	0.036	90	2.5	101	2.8
	4	Hood	0.036	100	2.7	86	2.4
	5	Hood	0.036	100	2.7	90	2.5
	6	Hood	0.036	100	2.7	90	2.5
	7	Hood	0.036	100	2.7	94	2.6
	8	Hood	0.036	100	2.7	90	2.5
	9	Hood	0.036	100	2.7	94	2.6
	10	Hood	0.036	100	2.7	90	2.5
SD 13	1	Flow Hood	1	50	-	55	-
SD 13	2	Flow Hood	1	50	-	60	-