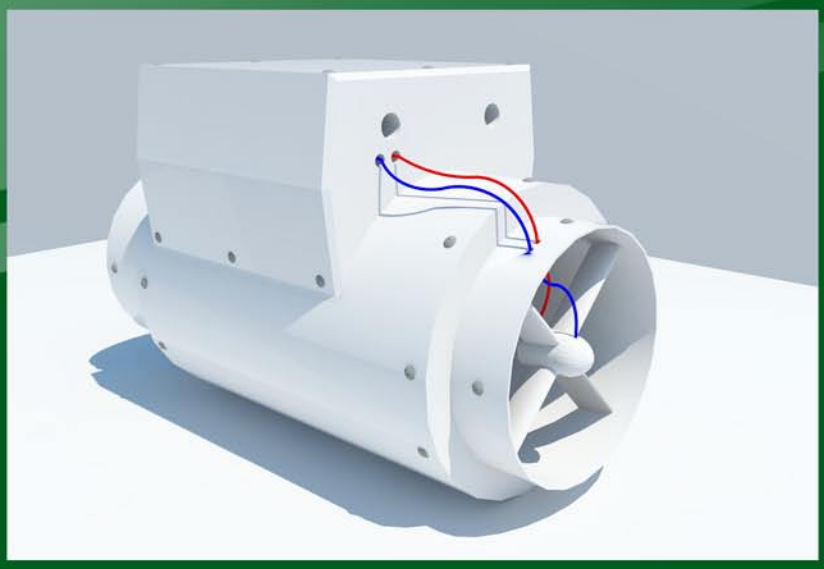

CONNOLS-AIR
AIR TERMINAL UNITS
Engineered for Versatile Application and Energy Conservation
OUE



Marina Bay Business District is considered the trendiest and most technologically-advance area for business in Singapore. Strategically located at the southern part of Singapore, and lies to the east of the Downtown Core, the district houses the most modern and sophisticated office buildings in the country. With ease in access to almost all types of transportation - not to mention seven rail stations stopping on different areas of the district.

Connols-Air is proud to be part of the improvement and development of the Marina Bay Business District. Connols-Air supplied thousands of VAV air terminal units on most of newly erected buildings.

- Marina Bay Finance Centre Tower 1 : 2,100 VAV boxes
- Marina Bay Finance Centre Tower 2 : 3,000 VAV boxes
- Marina Bay Finance Centre Tower 3 : 3,050 VAV boxes
- Asia Square Tower 1 : 3,123 VAV boxes
- Asia Square Tower 2 : 1,900 VAV boxes
- Ocean Financial Centre : 1,498 VAV boxes

Total : 14,671 VAV boxes

Single duct VAV and CAV units

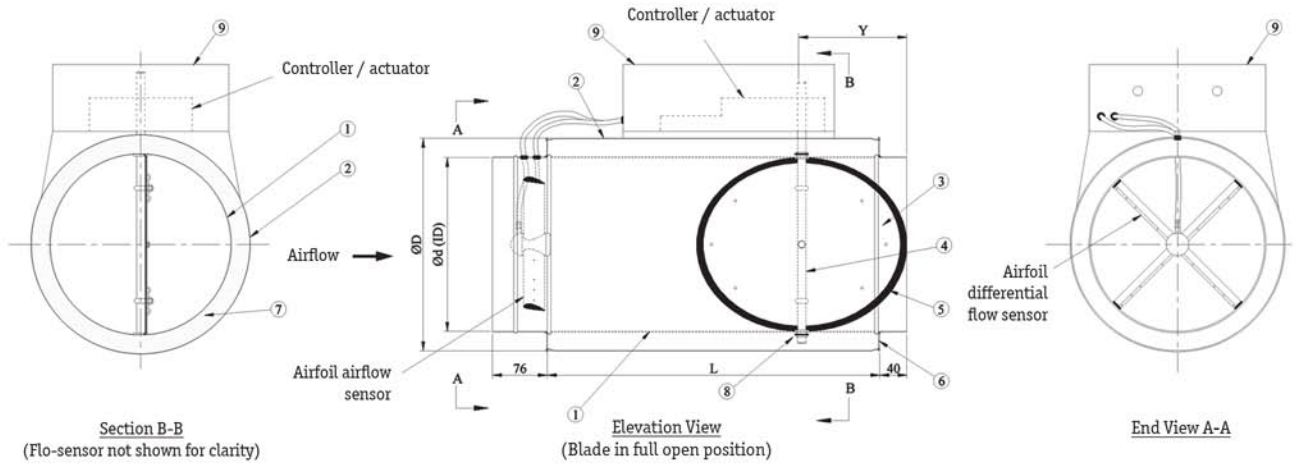
Model V750 - I	Model V750 - D	Model V750 - C
Pressure Independent VAV	Pressure Dependent VAV	Constant Air Volume

Description of devices

Connols-Air DDC microprocessor based V750 air terminal units are the latest, state-of-the-art, high quality terminal units, which provide good control accuracy and capabilities required in every modern intelligent building of today. The air terminal units are capable of stand-alone operation. However, optimum functional benefits are derived when network communication capabilities are used. Connols-Air stand-alone air terminal units with DDC controller may be integrated in a communication system at a later stage. This can be done with the addition of networking devices such as a controller module, router, and repeater module and terminal module. The air terminal unit consists of an air valve with integrated pressure differential flow sensor, a digital thermostat and BACnet™ or LonWorks® compliant DDC controller. The air terminal units are available in standard sizes of 5, 6, 8, 10, 12, 14, 16, 18 and covering air flow range up to 6900 cmh (1920 l/s).

Features of Connols-Air air terminal unit

- Double-skin casing construction ensures low radiated noise and absence of fiberglass erosion.
- Double-skin blade with felt seal all round ensures blade rigidity and low air leakage across it when closed.
- Blade is designed to close at 60 degrees so as to provide more linear flow characteristics; hence, more precise modulation of airflow.
- Accurate control of air volumes is possible with accurate multi-point pressure differential flow sensor *(X-Sensor)*.
- Low-pressure loss for energy conservation.
- Low generated noise from the aerodynamic *X-Sensor*.



Note:
Connecting duct internal diameter should be 5mm bigger than Ød.

Size	Ød	ØD	Y	L
5″	125	175	125	370
6″	150	200	125	370
8″	200	250	125	370
10″	250	300	175	470
12″	300	350	175	470
14″	350	400	225	540
16″	400	450	225	540
18″	450	500	250	600

Item	Description	Material
1	Inner Casing	1.0mm thk. Galv. steel for size 14″ - 18″
2	Outer Casing	0.7mm thk. Galv. steel for size 5″ - 12″
3	Damper Blade (Double skin)	1.0mm thk. Galv. steel for size 8″ - 18″ 0.7mm thk. Galv. steel for size 5″ - 6″
4	Blade Shaft	Ø 12mm Aluminum for size 5″ - 12″ & steel for size 14″ - 18″
5	Blade Seal	3.0mm thk. Felt
6	End Ring	1.0 thk. Galv. steel
7	Insulation	25mm thk. 32kg/m³ fibreglass
8	Bush	Nylon
9	Controller Shroud	Galv. steel

Air valve construction

Connols-Air terminal unit air valve is constructed of hot-dip pre-galvanized steel circular double-skin casing of 0.7 mm thick for valve size 5 to 10 and 1.0 mm thick for size 12 to 18. In contrast to rectangular air terminal unit, the circular casing of our air valve provides rigidity and prevents drumming during high flow and/or elevated pressure especially for larger units. Furthermore, double-skin casing construction reduces radiated noise, which could penetrate through false ceiling into the occupied space below. The space within the casing is filled with 25mm thick 32kg/m^3 density glass wool insulation. The air valve damper blade is constructed of double-skin galvanized steel plates with felt all around to provide a good seal when the damper blade is closed. A steel shroud is provided with each air valve to house the DDC controller to protect it against dust and damage (except for certain DDC controller models, which are factory-encased in PVC housing).

Airfoil multiple point pressure differential air flow sensor, *X-Sensor*

Each terminal valve is installed with a *X-Sensor* which is a true averaging pressure differential airflow sensor upstream of the damper for accurate determination of air volume. The *X-Sensor* is constructed of 4 extruded aluminum airfoil-shape wings assembled to form a cross, the centre of which is an aerodynamic-shape reservoir that receives the pressure signal from each wing and provide the true averaging output signal to the DDC controller. The airfoil-shape wing utilizes the pressure difference generated by the cambered airfoil where the top surface is curved more than its bottom surface, which causes the top surface pressure to be lower (see Fig. 1) resulting in an amplified signal. For air terminal unit of size

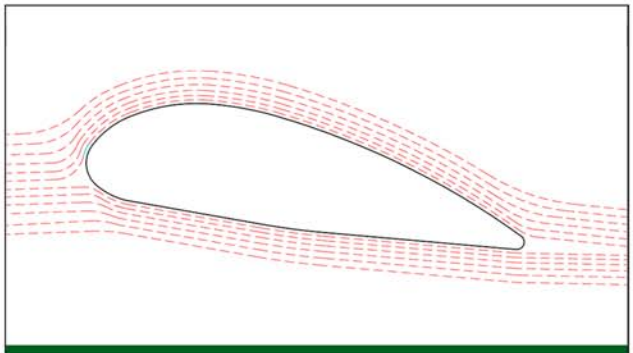


Fig. 1: Airfoil Flow Sensor

5, 6, 8 and 10, each airfoil-shape wing has 6 sensing taps, 3 in front for Hi signal and 3 on the side for Lo signal, giving a total of 12 Hi and 12 Lo sensing points for each *X-Sensor*. For air terminal unit of size 12, 14, 16 and 18, each airfoil-shape wing has 8 sensing taps, 4 in front for Hi signal and 4 on the side for Lo signal, giving a total of 16 Hi and 16 Lo sensing points for each *X-Sensor*. The location of each sensing point is determined according to Tchebycheff Rule for circular duct. The centre reservoir is constructed of fire retardant ABS and has two internal compartments one Hi and one Lo. The aerodynamic design of the wings and reservoir reduce pressure low across the *X-Sensor*, reduce generated noise and at the same time, is able to achieve amplified signal of 2 times for better accuracy. The accuracy of the *X-Sensor* is 5% within the recommended range of airflow for each size. Laboratory data are available from accredited laboratory for verification.

Controller and thermostat

The latest technology in electronic control uses microprocessor that provides rapid and precise control of desire room temperature. This device is direct digital controller (DDC) and may be used on the air terminal unit for stand-alone pressure independent, pressure dependent and constant air volume operation. However, optimum functional benefits are derived when network communication capabilities are used. In a minimum

system configuration, the VAV terminal unit is used together with a basic version of temperature controller for space temperature measurement. Other models of temperature controller are available with additional features including analog set point, input, and override digital input push button. A temperature controller can be shared among two or more VAV terminal units. Generally, the VAV system provide only cool air to the zone, however, the air terminal unit controller may provide additional outputs for the control of heating system, such as reheat coil for heat mode or morning warm-up mode operation. The heating equipment can be staged resistive heating, staged 2 position (solenoid) valve, or modulated steam hot water.

DDC networking system

Connols-Air air terminal units with DDC controllers can be networked via a twisted pair to a zone controller module. The zone controller module can be connected to the PCP peer bus network to form a true integration in the BMS network using industry open communication protocol such as BACnet™ or LonWorks®. These data communication protocols enable standardize communications between building automation devices from different manufacturers, allowing data to be shared and equipment to work together easily - and do so competitively.

Both BACnet™ or LonWorks® compliant DDC controller can be supplied with our Connols-Air air terminal unit. However, BACnet™ technology is recommended for the following reasons:

- Practical interoperability between building automation and controls systems from multi vendors.
- Real choices for scalability between cost, performance and size.
- Systems based on ANSI and international standards.
- Capability for integration with and use of existing LANS and LAN infrastructure.
- Highest performance or lowest cost.
- Robust internetworking including multiple LAN types and dial-up.
- Easy and robust scalability from very small to enormous system sizes.
- Unrestricted growth and the ability to add new innovations and new features anytime.

BACnet™ is designed to allow communication of building automation and control systems for applications such as heating, ventilating, and air-conditioning control, lighting control, access control, and fire detection systems and their associated equipment. The BACnet™ protocol provides mechanisms for computerized building automation devices to exchange information, regardless of the particular building service they perform.

Detail information our DDC controller and networking system are available in our Engineering Data Sheet.

Accessories

The V750 air terminal units can be coupled with accessories such as hot water coils and electric heaters for reheat and water heating purposes. High performance silencers, multiple outlet silencers and multiple outlet plenums are also available to meet low noise requirement. Performance data, dimensions and construction details of each accessory are available in our Engineering Data Sheet.

Recommended Design Air Flow

VAV Size	Dia ID (mm)	cmh		l/s		cfm	
5	125	150	497	41	138	88	292
6	150	498	800	138	222	292	470
8	200	801	1356	222	376	470	797
10	250	1357	2121	376	589	797	1247
12	300	2122	3054	589	848	1247	1795
14	350	3055	4156	848	1154	1796	2443
16	400	4157	5430	1154	1508	2444	3192
18	450	5431	6869	1508	1908	3193	4038

If required design air flow exceeds 6869 cmh or is less than 150 cmh, consult our application engineer.

Performance generated noise of V750 terminal unit only

UNIT SIZE	AIR FLOW		MIN. PRESS. LOSS	SOUND POWER LEVEL Lw, dB re 10^{-12} WATTS													
				@125 Pa (0.5"W.G.) OCTAVE BAND CENTRE FREQUENCIES, Hz							@250 Pa (1.0"W.G.) OCTAVE BAND CENTRE FREQUENCIES, Hz						
	I/S	CFM		125	250	500	1k	2k	4k	NC	125	250	500	1k	2k	4k	NC
	43	90	18	42	41	41	38	35	29	26	43	43	44	44	41	34	34
	59	125	28	45	42	41	40	37	30	29	45	44	45	45	42	35	34
	83	175	47	46	43	43	42	39	31	31	48	47	48	47	43	37	36
5	94	200	61	49	45	43	44	41	34	33	51	49	48	48	46	38	37
	106	225	76	50	45	45	45	42	35	34	52	50	49	48	47	40	38
	118	250	90	52	47	45	46	43	36	35	52	51	51	49	48	41	39
	142	300	125	53	52	50	47	44	37	36	54	54	52	51	49	42	40
	94	200	4	43	40	42	43	40	33	32	46	44	45	46	45	38	35
	118	250	6	48	43	45	43	40	35	32	52	47	48	47	46	40	37
	142	300	10	50	45	46	45	42	36	34	53	49	50	49	48	41	39
6	165	350	14	51	47	47	45	43	38	35	54	52	51	50	49	43	40
	189	400	19	52	47	47	46	44	40	36	56	53	52	52	50	45	41
	213	450	24	52	49	47	46	44	42	36	57	54	53	53	51	47	42
	236	500	31	53	50	49	47	45	45	37	60	56	55	54	52	50	43
	260	550	38	53	52	49	48	45	47	37	60	55	56	54	52	52	44
	142	300	7	49	45	44	41	38	30	30	53	48	48	45	46	41	37
	189	400	14	52	47	47	43	40	33	32	56	52	52	49	47	43	38
	236	500	31	53	50	49	45	42	37	34	60	55	55	52	48	45	41
7	283	600	34	55	54	54	46	43	39	39	64	59	58	53	49	47	44
	331	700	49	57	55	56	48	44	40	41	66	61	62	55	50	48	48
	378	800	66	58	58	58	50	45	42	44	67	63	64	58	52	49	50
	425	900	88	59	60	60	53	47	43	46	68	64	66	59	53	50	52
	142	300	5	46	44	42	36	33	24	26	51	47	46	41	41	32	32
	189	400	9	50	47	46	39	35	25	32	54	51	51	45	42	34	36
	236	500	15	53	50	49	42	38	29	34	58	55	55	48	44	37	40
8	283	600	22	55	52	52	44	40	30	37	63	57	58	51	46	38	43
	331	700	32	56	53	54	46	41	32	39	64	59	61	53	47	40	47
	378	800	42	57	56	56	48	43	36	41	65	61	63	56	50	42	49
	472	1000	70	58	60	60	53	47	40	46	66	65	66	59	52	45	52
	189	400	4	49	44	43	38	34	24	27	53	47	48	43	41	32	33
	283	600	9	54	49	48	40	39	29	33	58	53	53	47	44	36	38
	378	800	16	55	53	52	45	40	35	37	60	57	57	51	46	41	42
10	472	1000	25	57	57	55	49	43	37	40	62	61	61	55	50	42	47
	567	1200	36	59	60	60	53	48	40	45	64	62	63	58	52	44	49
	661	1400	49	61	63	63	58	51	43	49	66	66	67	62	56	49	53
	779	1600	66	64	66	67	61	54	46	53	69	69	70	64	58	52	57
	378	800	7	53	54	42	47	39	31	37	57	57	56	51	46	39	41
	567	1200	17	55	55	55	49	41	33	40	60	58	59	55	49	41	44
12	756	1600	30	60	61	62	55	47	40	48	64	64	64	60	53	46	49
	944	2000	48	62	64	66	58	52	43	52	66	67	68	62	56	50	51
	1133	2400	70	64	66	68	60	55	46	55	69	69	71	64	56	53	57
	567	1200	7	53	53	53	46	38	30	38	55	54	55	55	49	42	44
	756	1600	13	55	55	57	48	40	33	40	59	59	60	56	51	44	46
	944	2000	22	58	59	61	51	44	38	47	62	61	62	67	52	45	48
14	1133	2400	34	59	61	64	54	48	41	50	65	64	66	60	53	48	53
	1322	2800	49	60	62	64	55	49	43	53	66	66	68	63	55	49	54
	1511	3200	67	61	64	66	59	52	46	53	67	68	70	65	58	52	57
	1700	3600	90	62	65	69	62	55	48	56	68	69	72	66	60	54	58
	756	1600	8	52	53	53	48	39	33	38	56	56	56	53	49	43	42
	944	2000	13	55	57	56	50	44	36	41	59	59	58	55	51	45	44
	1133	2400	20	56	59	59	52	46	40	45	61	61	61	58	52	47	47
	1322	2800	29	58	61	60	53	47	41	46	63	63	64	60	53	48	50
16	1511	3200	37	59	63	62	56	50	44	48	65	66	66	62	56	50	52
	1700	3600	48	61	64	64	59	52	46	50	66	67	67	63	58	52	54
	1889	4000	60	63	66	66	62	54	47	53	68	69	68	65	59	54	56
	2078	4400	76	66	68	67	65	56	49	54	70	71	70	67	61	56	57
	2267	4800	84	69	70	69	68	58	50	57	71	74	72	68	64	57	58
	944	2000	5	52	55	51	48	43	37	37	55	57	54	53	50	44	42
	1133	2400	7	53	56	53	50	44	38	39	56	58	56	55	51	45	44
	1322	2800	9	56	59	55	50	45	39	40	60	61	59	56	51	46	45
	1511	3200	13	57	61	57	52	47	42	43	62	63	61	58	54	48	47
18	1700	3600	17	59	62	59	55	48	43	45	63	64	62	60	55	49	49
	1889	4000	21	59	63	60	56	49	44	46	64	66	64	61	56	51	50
	2078	4400	25	60	63	60	56	50	45	46	65	66	64	62	56	51	51
	2267	4800	31	60	65	61	57	51	47	47	65	68	65	63	57	52	52
	2456	5200	37	61	67	62	60	52	48	49	66	70	66	64	58	53	53

Note:
- Test data obtained generally in accordance to ISO 5220, ISO 5135, ISO 3741 and related standards.
- NC values are based on dB room absorption in all octave bands.
- All pressure indicated are differential pressure measured across the VAV terminal box.
- "---" represents noise level below 20dB

Performance radiated noise of V750 terminal unit only

UNIT SIZE	AIR FLOW		MIN. PRESS.	SOUND POWER LEVEL Lw, dB re 10^{-12} WATTS													
				@125 PA (0.5"W.G.) OCTAVE BAND CENTRE FREQUENCIES, Hz							@250 PA (1.0"W.G.) OCTAVE BAND CENTRE FREQUENCIES, Hz						
	I/S	CFM	LOSS	125	250	500	1K	2K	4K	NC	125	250	500	1K	2K	4K	NC
5	43	90	18	28	25	22	21	20	–	–	29	27	25	27	26	23	–
	59	125	28	31	26	22	23	22	–	–	31	28	26	28	27	24	–
	83	175	47	32	27	24	25	24	20	–	34	31	29	30	28	26	–
	94	200	61	35	29	24	27	26	23	–	37	33	29	31	31	27	21
	106	225	76	36	29	26	28	27	24	–	38	34	30	31	32	29	22
	118	250	90	38	31	26	29	28	25	–	38	35	31	32	33	30	23
	142	300	125	39	36	31	30	29	26	–	40	38	33	34	34	31	25
6	94	200	4	29	24	23	26	25	22	–	32	28	26	29	30	27	20
	118	250	6	34	27	26	26	25	24	–	38	31	29	30	31	29	21
	142	300	10	36	29	27	28	27	25	–	39	33	31	32	33	30	23
	165	350	14	37	31	28	28	28	27	20	40	36	32	33	34	32	25
	189	400	19	38	31	28	29	29	29	22	42	37	33	35	35	34	27
	213	450	24	38	33	28	29	29	31	24	43	40	34	36	36	36	28
	236	500	31	39	34	30	30	30	34	27	46	41	36	37	37	39	31
	260	550	38	39	36	30	31	30	36	28	46	39	37	37	37	41	33
7	142	300	7	38	34	31	26	27	–	–	42	37	35	30	35	27	26
	189	400	14	41	36	34	28	29	–	–	47	41	39	34	36	29	26
	236	500	31	42	39	36	30	31	23	20	49	45	42	37	37	31	27
	283	600	34	44	43	41	31	32	25	25	53	48	45	38	38	33	30
	331	700	49	46	44	43	33	33	26	27	55	50	49	40	39	34	34
	378	800	66	47	47	45	35	34	28	30	56	52	51	43	41	35	36
	425	900	88	48	49	47	38	36	29	33	57	53	53	44	42	36	37
8	142	300	5	35	33	29	21	22	–	–	40	36	33	26	30	–	20
	189	400	9	39	36	33	24	24	–	–	46	40	38	30	31	20	23
	236	500	15	42	39	36	27	27	–	20	49	44	42	33	33	23	26
	283	600	22	44	41	39	29	29	–	23	52	46	45	36	35	24	30
	331	700	32	45	42	41	31	30	–	25	53	48	48	38	36	26	33
	378	800	42	46	45	43	33	32	22	27	54	50	50	41	39	28	35
	472	1000	70	47	49	47	38	36	26	32	55	54	53	44	41	31	37
10	189	400	4	38	32	31	25	21	–	–	42	35	36	30	28	–	20
	283	600	9	43	37	36	27	26	–	20	47	41	41	34	31	21	25
	378	800	16	44	41	40	32	27	20	24	49	45	45	38	33	26	30
	472	1000	25	46	45	43	36	30	22	27	51	49	49	42	37	27	34
	567	1200	36	48	48	48	40	35	25	33	53	50	51	45	39	29	36
	661	1400	49	50	51	51	45	38	28	36	55	54	55	49	43	34	40
	779	1600	66	53	54	55	48	41	31	40	58	57	58	51	45	37	43
12	378	800	7	42	42	40	34	26	–	24	46	45	44	38	33	24	29
	567	1200	17	44	43	43	36	28	–	28	48	46	47	42	36	26	31
	756	1600	30	49	49	50	42	34	25	35	53	52	52	47	40	31	36
	944	2000	48	51	52	54	44	39	28	39	55	55	56	49	43	35	41
	1133	2400	70	53	54	56	47	42	31	41	58	57	59	51	45	38	44
14	567	1200	7	42	41	41	33	25	–	25	44	42	43	42	36	27	31
	756	1600	13	44	43	45	35	27	–	30	48	47	48	43	38	29	33
	944	2000	22	46	46	48	38	31	22	33	52	49	52	45	39	31	36
	1133	2400	34	48	49	52	41	35	26	36	54	52	54	47	40	33	39
	1322	2800	49	49	50	52	42	36	28	36	55	53	56	50	42	34	41
	1511	3200	67	50	52	54	46	39	31	38	56	56	58	52	45	37	43
	1700	3600	90	51	53	57	49	42	33	42	57	57	60	53	47	39	46
16	756	1600	8	43	41	43	37	27	21	27	47	44	46	42	37	31	31
	944	2000	13	46	45	46	39	32	26	31	50	47	48	44	39	33	33
	1133	2400	20	47	47	49	41	34	28	34	52	49	51	47	40	35	36
	1322	2800	29	49	49	50	42	35	29	35	54	51	54	49	41	35	38
	1511	3200	37	50	51	52	45	38	32	37	56	54	56	51	44	38	40
	1700	3600	48	52	52	54	48	40	34	39	57	55	57	52	46	40	41
	1889	4000	60	54	54	56	51	42	35	41	59	57	58	54	47	42	43
	2078	4400	76	57	56	57	54	44	37	43	61	59	60	56	49	44	45
	2267	4800	84	60	58	59	57	46	38	46	62	62	62	57	52	45	46
18	944	2000	5	43	43	41	37	31	25	25	46	45	44	42	38	32	31
	1133	2400	7	44	44	43	39	32	26	27	47	46	46	44	39	33	33
	1322	2800	9	47	47	45	39	33	27	30	51	49	49	45	39	34	34
	1511	3200	13	48	49	47	41	35	30	32	53	51	51	47	42	36	36
	1700	3600	17	50	50	49	44	36	31	34	54	52	52	49	43	37	38
	1889	4000	21	50	51	50	45	37	32	35	55	54	54	50	44	39	39
	2078	4400	25	51	51	50	45	38	33	35	56	54	54	51	44	39	39
	2267	4800	31	51	53	51	46	39	35	36	56	56	55	52	45	40	41
	2456	5200	37	52	55	52	49	40	36	38	57	58	56	53	46	41	42

Note:
- Test data obtained generally in accordance to ISO 5220, ISO 5135, ISO 3741 and related standards.
- NC values are based on 10 dB room absorption in all octave bands.
- All pressure indicated are differential pressure measured across the VAV terminal box.
- "---" represents noise level below 20 dB.



Connols-Air (S) Pte Ltd

3-B Joo Koon Circle, Singapore 629034
Tel : (+65) 6861 5253
Fax : (+65) 6861 9850
Email : enquiry@connols-air.com
www.connols-air.com