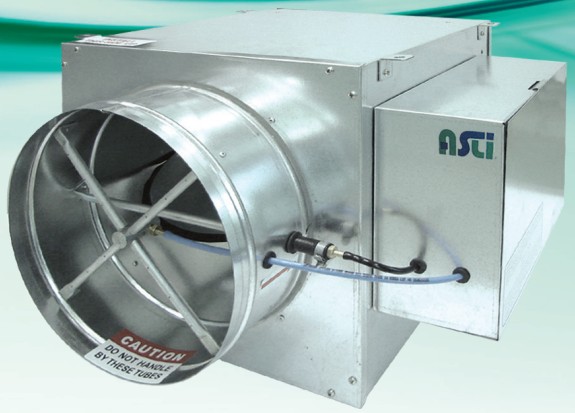
VAV Terminal Units



Asli Variable Air Volume (Vav) Terminal Units are volume flow rate controller for supply air on variable air volume system. These units are designed to control the airflow rate of conditioned air into an occupied space in response to a control signal from thermostat or Building Automation System (BAS). They could be used in stand alone system or interfaced with LONWORKS or BACnet.

ASLI VAV terminal units consist of a casing with circular inlet spigot, rectangular outlet connection with integral of fiberglass with black matt tissue for noise reduction, damper blade for air volume control and cross flow differential pressure sensor for measuring air volume.

ASLI VAV terminal units also incorporate control components, (VAV controller actuator, and transformer) which are factory fitted. ASLI in-house testing facility ensured that all boxes that come out from the factory are calibrated and tested to match the controller of individual size. This allow the terminals to monitor the desired flow rate, as dictated by the thermostat or BAS, and compensate instantly for any changes in supply air pressure that might tend to alter the supply air volume. Hence, the net result is a pressure independent variable air volume system.

Materials

Casing : 0.7 mm thickness galvanized steel.
Damper blade : Double layer 0.7 mm thickness galvanized steel with a sandwiched peripheral gasket.
Internal insulation : 25mm (1") 32 kg/m³ (2 lb) density fiber glass with matt black tissue facing.
Bearing : Engineering plastic.
Hexagon shaft : Hexagon bar mild steel
Differential pressure sensor : Aluminum.

Air Volume Control Type

Variable Air Volume (VAV) Pressure Dependent Control

- Without differential pressure sensor.
- Pressure dependent.
- No monitoring of air volume.

Variable Air Volume (VAV) Pressure Independent Control

- With differential pressure sensor.
- Pressure independent.
- Air volume varies depending on design flow and signal by controller.
- Air volume could be monitored.

Constant Air Volume (CAV) Pressure Independent Control

- With differential pressure sensor.
- Pressure independent.
- Air volume is constant (design flow) provided that the minimum static pressure is achieved.
- Air volume could be monitored.

Features

- Oval shape damper for better flow management.
- Neoprene peripheral gasket to prevent leakage.
- Multi-point averaging inlet differential pressure sensor.
- 1", 2 lbs fiberglass with black matt tissue internal insulation for noise reduction.
- Round inlet with beading for good inlet connection.
- Hexagon shaft for better grip mounting of actuator.
- Shaft indicator indicating damper position.
- Tube conceal (optional).
- Double layer heavy gauge damper blade.
- Protective metal shroud for control components mounting.
- Low pressure drop construction with round inlet and rectangular outlet- static regain.
- Can be used for Constant Air Volume (CAV) application.
- Rectangular discharge opening with slip and drive cleat duct connection.
- Optional internal perforated sheet or aluminum foil facing.
- Reheat coil available upon request.

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VAV Terminal Units

Construction Illustrations

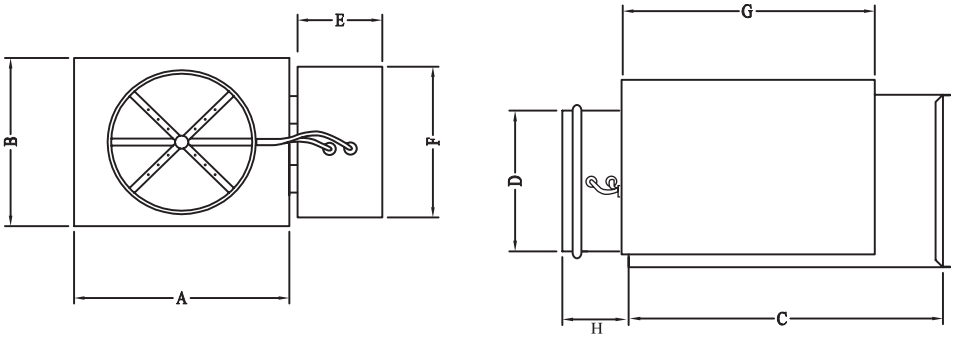

Figure 1: Basic VAV Terminal Unit

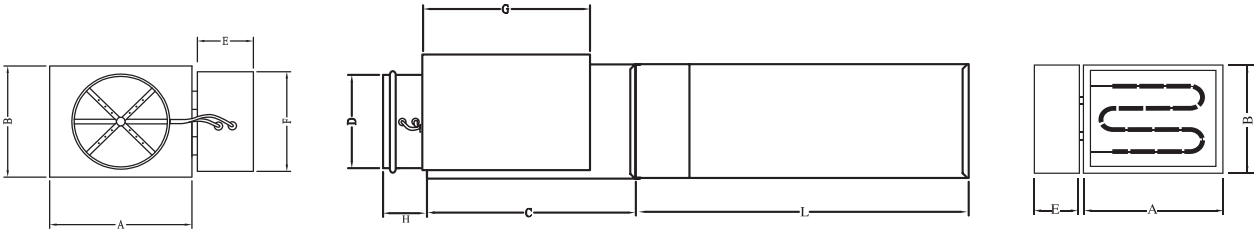

Figure 2: VAV Terminal Unit with Electric Reheat Coil

Physical Dimension *Unit : mm*

D	A	B	C	E	F	G	L	H
100	305	203	394	120	250	360	700	100
150	305	203	394	120			700	100
200	305	254	394	120			700	100
250	356	318	394	120			700	100
300	406	381	394	120			700	100
350	508	445	396	120			700	100
400	610	457	396	120			700	100
609 x 406	965	460	395	120			700	100

General notes:

- Internal insulation 25mm (1") 32 kg/m³ (2 lb) density coated to prevent air erosion.
- Galvanized steel housing.
- Mechanically seal-leak resistant construction.
- Rectangular discharge opening have drive and slip cleat duct connections as standard.
- Right hand control location standard, as shown above.
- Turbulent flow approaching the terminal will create additional noise, pressure drop and greater air flow variation. It is therefore recommended for optimum performance there should be a minimum of 4 duct diameters of straight inlet duct, same size as inlet, between the inlet and any transition, take off or fitting.

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VAV Terminal Units

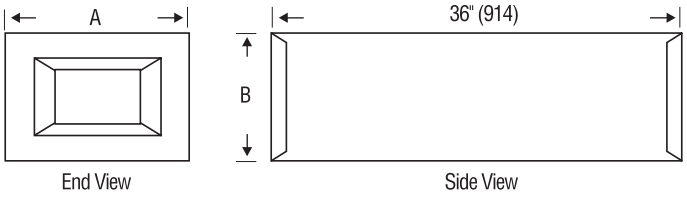
ST-5000 Single Duct Variable Air Volume Terminal Selection Guide

ST	A= DDC Control by ASLI	-	5	0 = Cooling Only	0 = Time proportional	4 = 4" dia.	NC = Without Tube Conceal
	B = Bare Unit				1 = Single Stage	6 = 6" dia.	
	C = Constant Volume Unit			1 = Water Reheat		8 = 8" dia.	
	D = DDC Control by Others				2 = Two Stage	10 = 10" dia.	
	E = Electronic Control					12 = 12" dia.	C = With Tube Conceal
	F = Pneumatic Control			2 = Electric Reheat		14 = 14" dia.	
					3 = Three Stage	16 = 16" dia.	
						24X16 = 24"X16" inlet	

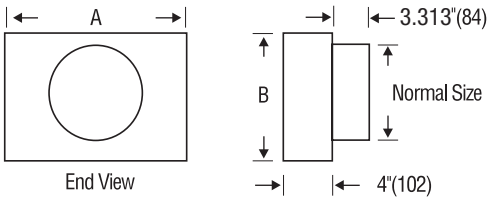
Air Volume Ranges

Unit Size, mm (inch)	Air Volume Range (Min - Max)	
	liter/s	CFM
100 (4)	12 - 106	26 - 225
150 (6)	29 - 212	62 - 450
200 (8)	52 - 378	110 - 800
250 (10)	85 - 637	180 - 1350
300 (12)	127 - 991	270 - 2100
350 (14)	189 - 1510	400 - 3200
400 (16)	269 - 1888	570 - 4000
609 X 406 (24X16)	1800 - 3775	2500 - 8000

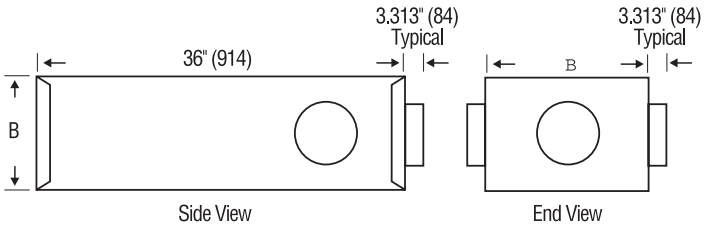
ATT Attenuator Section



RDC Round Discharge Collar



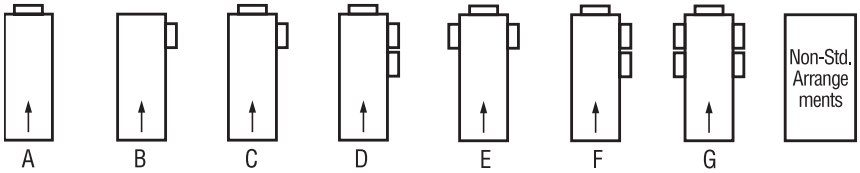
MOA Multi-Outlet Attenuator Section



NOTES :

- Only one outlet size to be specified per M.O.A.- No mixing of outlet sizes on the same unit.
- All round outlet c/w manual dampers.
- Denotes air flow direction.
- For special outlet sizes & arrangements, consult your ASLI representative office.

Standard MOA Configuration



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VAV Terminal Units

Electric Reheat Application

ASLI offers factory supplied and mounted electric coils for VAV terminal units. The electric reheat extension comes in separate unit which can be installed on the existing basic VAV terminal units. The electric heater coils are removable from the side of the terminal units consoled within a shroud.

Features Of ASLI VAV Terminal Units With Electric Reheat Coils

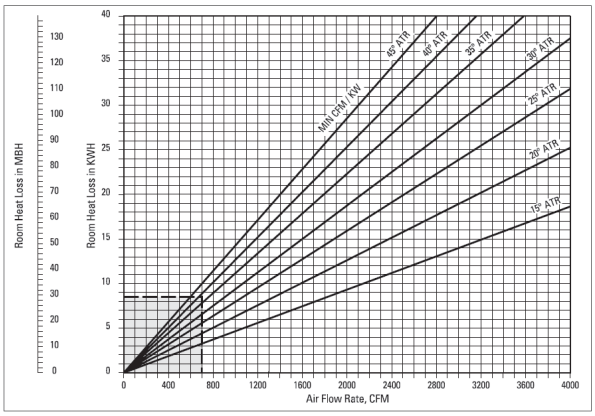
- Heaters are factory wired and tested ensuring a high level of quality.
- Electric coil configuration and air flow is matched to eliminate hot spots, provide efficient heat transfer and to maintain element life.
- Reheat units come with a manual reset thermal cut-out to protect unit from overheating.
- 25mm (1") 32 kg/m³ (2 lb) density fiberglass internal insulation to prevent air erosion.
- Magnetic contactors are provided as standard on stages heaters for de-energizing or disconnecting power to heating coils.
- An air flow switch is provided as standard to ensure air is passing over the electric coil before it will energize. This is to ensure that the electric coil will not energize when the system fan is shut-down or fails.

Electric Reheat Coil Selection Table

Unit Size (inch)	CFM Range	Stages	Allowable Maximum kW					
			1 Phase			3 Phase		
			120V	240V	277V	208V	415V	600V
4	100 - 225	1,2	3.0	3.0	3.0	3.0	3.0	3.0
6	100 - 450	1,2	5.0	6.0	6.0	6.0	6.0	6.0
8	167 - 800	1,2,3	5.5	9.5	11.0	11.0	11.0	11.0
10	243 - 1350	1,2,3	5.5	11.5	13.0	17.0	17.0	17.0
12	333 - 2100	1,2,3	5.5	11.5	13.0	17.0	30.0	30.0
14	486 - 3000	1,2,3	5.5	11.5	13.0	17.0	34.5	49.5
16	600 - 4000	1,2,3	5.5	11.5	13.0	17.0	34.5	49.5
24 X 16	950 - 8000	1,2,3	5.5	11.5	13.0	17.0	34.5	49.5

- Minimum kW – Single phase = 0.5 kW/stage, three phase = 1.5 kW/stage.
- Minimum air velocity should be 1m/s.
- Minimum air volume must be greater than minimum air volume listed or 70 CFM per kilowatt.
- Static pressure loss of coil is negligible, therefore the minimum static pressure drop is equal to basic unit value.

Electric Reheat Coil Selection Guide



1. Locate the room heat loss on the MBH scale on the far left side of the chart. Convert to kWh by moving horizontally to the right to the kWh scale (1kWh = 3.413 MBH)
2. Calculate the kWh required to heat the primary air to room temperature using the following equation,

$$kWh = \frac{CFM \times \Delta T}{3160}$$

3. Add the kWh value obtained in the step 2 to the kWh scale at the let side. More horizontally to the right to the point where the kWh value and the air flow volume intersect.
4. With the point of intersection from step 3, the air temperature rise (ATR), can be obtained by interpolating between the air temperature rise lines on the graph.
5. To verify the selection, sum the air temperature rise and the temperature of the primary air. The sum total should be less then 120°F.

Selection Example
Select electric coil for a size 10" VAV Terminal with a minimum air flow of 600 CFM. Space heat loss is estimated at 18 MBH and space design temperature is 70°F. The temperature of the primary air flow is 60°F.

1. Space heat loss (18 MBH) = 5.2 kWh
2. heat required to raise the temperature of primary air:

$$kWh = \frac{600 \times 10}{3160} = 1.90kWh$$

3. Total heat required = 5.2 + 1.90 = 7.1 kWh
4. Referring to chart, air temperature rise ATR = 35°F
5. Leaving air temperature = 60°F + 35°F = 95°F. since the leaving air temperature is less than the recommended maximum limit of 120°F, the selection is satisfactory
6. Select a suitable power supply from the reheat coil selection table
7. Verify minimum airflow requirement are met. (minimum 70 CFM/kW)

$$\frac{600\ CFM}{7.1\ kW} = 85\ CFM/kW$$

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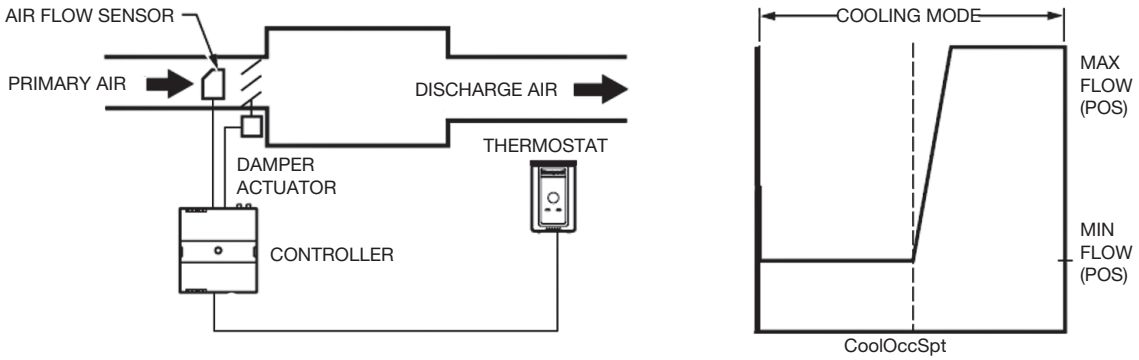
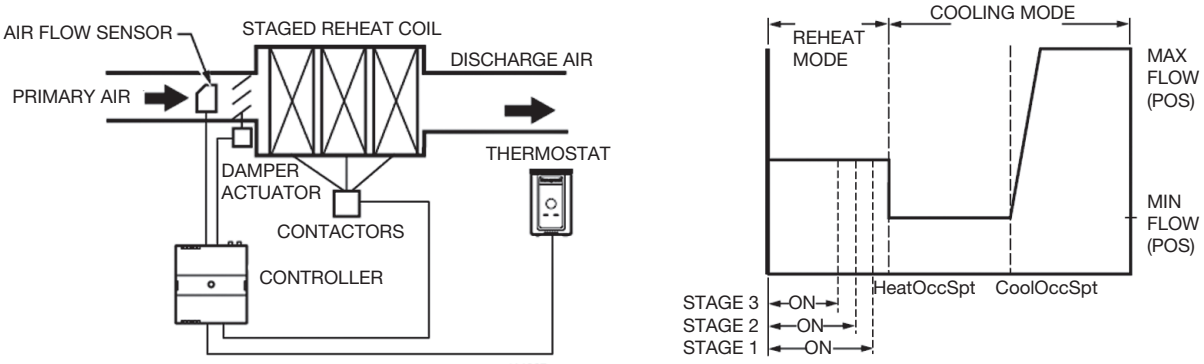
VAV Terminal Units

VAV Controller Control Mode (Cooling Only)



This mode is used where only cooling application is required. The controller will modulate the VAV box damper according to the set point and room temperature between the cooling mode minimum and maximum flow setting.

VAV Controller Control Mode (Cooling With Electric Stages Reheat)



During this mode, 2 or 3 stages reheat control the heater output by using 2 or 3 stages of heater control at different intervals. The heaters cut-in at different stages depending on the heating set-point of reheat.

When the room temperature is above the cooling set point, the flow shall be maximum and when the room temperature fall below cooling set point (by more than 1 degree Celsius), the flow will be minimum.

When the room temperature fall beyond heating set point, the control should automatically increase to auxiliary flow (which is resettable) when the 1st stage of heater cut in. When the room temperature continues to fall, the 2nd heater and 3rd heater will cut in accordingly. The interval for each stage of reheat to cut in is determined by the room temperature and heating set point.

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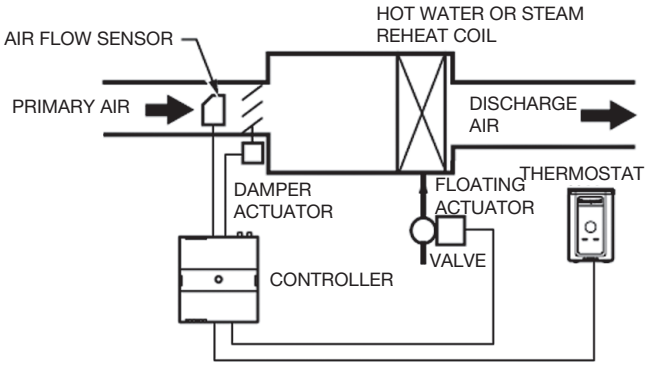
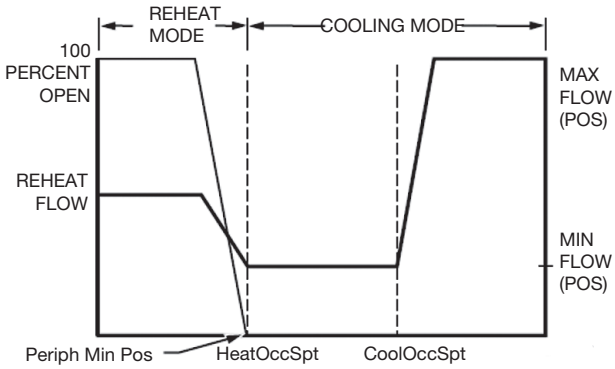
VAV Terminal Units

VAV Controller Control Mode (Cooling With Modulating Reheat)

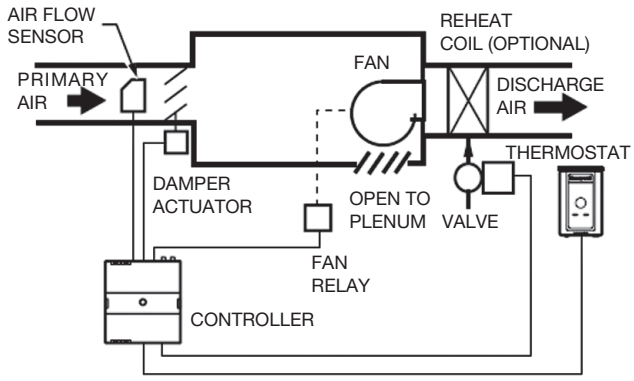




During this mode, reheat coils or hot water coil are controlled with modulating output from controller. When the room temperature is above the cooling set point, the flow shall be maximum and when the room temperature fall below cooling set point (by more than 1 degree Celsius), the flow will be minimum.

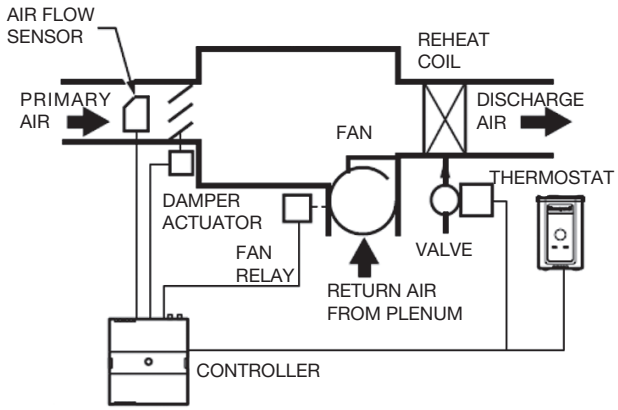
When the room temperature fall beyond heating set point, the air flow should automatically be increased to reheat flow (which is resettable). At the same time, the peripheral output will gradually increase the valve position to increase the hot water volume. Hence the supply air temperature rises.

VAV Controller Control Mode (Cooling With Series Fan And Reheat)



At this mode, the fan is intended to run continuously when the main air handler is on and is in-line with the primary air flow through the box. The controller will activate the fan when the primary flow is above minimum flow setting or a pre-determined flow volume, say 50 CFM whichever is higher). The heater will cut in when the room temperature drops below the heating set point.

VAV Controller Control Mode (Cooling With Parallel Fan And Reheat)



A parallel fan is not located in the primary air stream, but is designed to add return air from the plenum into the air stream delivered to the space. The controller turns on the parallel fan when the space temperature falls below set point as a first stage of reheat, or if the air flow falls below a minimum air flow set point to maintain a minimum air flow to the space (parallel flow). The heater will cut in when the room temperature drops below the heating set point.

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VAV Terminal Units

Performance Data (Radiated Sound Power Levels, Basic Assembly Unit)

Unit Size	Air Flow		Sound Power Level, Lw dB, re 10^{-12} watts																							
			ΔPs 125 Pa (0.5" W.G.)						ΔPs 250 Pa (1.0" W.G.)						ΔPs 500 Pa (2.0" W.G.)						ΔPs 750 Pa (3.0" W.G.)					
			Octave Band						Octave Band						Octave Band						Octave Band					
	CFM	L/s	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	79	37	44	42	33	29	21	12	45	44	37	33	26	17	47	45	40	36	30	23	48	47	44	40	35	28
	128	60	47	45	36	32	24	15	48	47	40	36	29	20	50	48	43	39	33	26	51	50	47	43	38	31
	176	83	51	46	42	39	31	25	53	49	45	41	34	28	54	52	48	43	38	31	56	55	51	45	41	34
	225	106	54	50	46	44	37	30	56	53	48	45	39	32	57	55	50	46	41	34	59	58	52	47	43	36
6	158	74	45	43	34	30	22	13	47	45	38	34	27	19	49	48	43	39	33	25	51	50	47	43	38	31
	255	120	48	46	37	33	25	16	50	48	41	37	30	22	52	51	46	42	36	28	54	53	50	46	41	34
	353	166	52	47	43	40	32	26	54	51	47	43	36	30	57	54	50	45	40	33	59	58	54	48	44	37
	450	213	55	51	47	45	38	31	57	54	50	47	41	34	60	58	52	48	43	36	62	61	55	50	46	39
8	280	132	48	46	37	33	25	16	50	48	41	37	30	22	52	51	46	42	36	28	54	53	50	46	41	34
	453	214	51	49	40	36	28	19	53	51	44	40	33	25	55	54	49	45	39	31	57	56	53	49	44	37
	627	296	55	50	46	43	35	29	57	54	50	46	39	33	60	57	53	48	43	36	62	61	57	51	47	40
	800	378	58	54	50	48	41	34	60	57	53	50	44	37	63	61	55	51	46	39	65	64	58	53	49	42
10	473	223	54	52	43	39	31	22	56	54	47	43	36	28	58	57	52	48	42	34	60	59	56	52	47	40
	765	361	58	53	49	46	38	32	60	57	53	49	42	36	63	60	56	51	46	39	65	64	60	54	50	43
	1058	499	61	57	53	51	44	37	63	60	56	53	47	40	66	64	58	54	49	42	68	67	61	56	52	45
	1350	638	62	58	57	54	48	43	65	61	59	55	50	44	67	65	60	57	52	46	70	68	62	58	54	47
12	735	347	52	51	42	38	29	20	54	53	46	42	34	26	56	56	51	47	40	32	58	58	55	51	45	38
	1076	508	55	54	45	41	32	23	57	56	49	45	37	29	59	59	54	50	43	35	61	61	58	54	48	41
	1418	669	59	55	51	48	39	33	61	59	55	51	43	37	64	62	58	53	47	40	66	66	62	56	51	44
	1759	831	62	59	55	53	45	38	64	62	58	55	48	41	67	66	60	56	50	43	69	69	63	58	53	46
	2100	992	63	60	59	56	49	44	66	63	61	57	51	45	68	67	62	59	53	47	71	70	64	60	55	48
14	1120	529	53	52	43	39	30	21	55	54	47	43	35	27	57	57	52	48	41	33	59	59	56	52	46	39
	1640	774	57	56	47	43	34	25	59	58	51	47	39	31	61	61	56	52	45	37	63	63	60	56	50	43
	2160	1020	61	59	52	49	41	33	63	61	56	52	45	37	65	64	59	55	49	41	67	67	63	58	53	46
	2680	1266	64	61	57	55	47	40	66	64	60	57	50	43	69	68	62	58	52	45	71	71	65	60	55	48
	3200	1511	65	62	61	58	51	46	68	65	63	59	53	47	70	69	64	61	55	49	73	72	66	62	57	50
16	1400	661	51	50	41	39	30	21	53	52	45	43	35	27	55	55	50	48	41	33	57	57	54	52	46	39
	1920	907	54	53	44	42	33	24	56	55	48	46	38	30	58	58	53	51	44	36	60	60	57	55	49	42
	2440	1152	58	57	48	46	37	28	60	59	52	50	42	34	62	62	57	55	48	40	64	64	61	59	53	46
	2960	1398	62	60	53	52	44	36	64	62	57	55	48	40	66	65	60	58	52	44	68	68	64	61	56	49
	3480	1643	65	62	58	58	50	43	67	65	61	60	53	46	70	69	63	61	55	48	72	72	66	63	58	51
	4000	1889	66	63	62	61	54	49	69	66	64	62	56	50	71	70	65	64	58	52	74	73	67	65	60	53
24 x16	2800	1322	70	67	63	61	53	46	72	70	66	63	56	49	75	74	68	64	58	51	77	77	71	66	61	54
	3840	1813	71	68	67	64	57	52	74	71	69	65	59	53	76	75	70	67	61	55	79	78	72	68	63	56
	4880	2304	57	56	47	45	36	27	59	58	51	49	41	33	61	61	56	54	47	39	63	63	60	58	52	45
	5920	2796	60	59	50	48	39	30	62	61	54	52	44	36	64	64	59	57	50	42	66	66	63	61	55	48
	6960	3287	64	63	54	52	43	34	66	65	58	56	48	40	68	68	63	61	54	46	70	70	67	65	59	52
	8000	3778	68	66	59	58	50	42	70	68	63	61	54	46	72	71	66	64	58	50	74	74	70	67	62	55

• ΔPs is the difference in static pressure from inlet to discharge of the unit.

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VAV Terminal Units

Performance Data (Discharge Sound Power Levels, Basic Assembly Unit)

Unit Size	Air Flow		Sound Power Level, Lw dB, re 10^{-12} watts																							
			ΔPs 125 Pa (0.5" W.G.)						ΔPs 250 Pa (1.0" W.G.)						ΔPs 500 Pa (2.0" W.G.)						ΔPs 750 Pa (3.0" W.G.)					
			Octave Band						Octave Band						Octave Band						Octave Band					
	CFM	L/s	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	79	37	43	42	40	36	34	30	46	47	45	43	41	37	50	51	49	49	47	43	53	56	54	56	54	50
	128	60	47	46	44	40	38	34	50	51	49	47	45	41	54	55	53	53	51	47	57	60	58	60	58	54
	176	83	51	51	52	50	45	41	55	56	57	55	51	47	59	60	61	61	58	54	63	65	66	66	64	60
	225	106	55	56	58	55	49	48	59	59	62	60	55	52	63	62	65	64	61	57	67	65	69	69	67	61
6	158	74	47	46	41	37	36	31	50	51	46	44	42	38	54	55	50	50	49	46	57	60	55	57	55	53
	255	120	51	50	45	41	40	35	54	55	50	48	46	42	58	59	54	54	53	50	61	64	59	61	59	57
	353	166	55	55	53	51	47	42	59	60	58	56	53	49	63	64	62	62	59	56	67	69	67	67	65	63
	450	213	59	60	59	56	51	49	63	63	63	61	57	54	67	66	66	65	62	59	71	69	70	70	68	64
8	280	132	52	51	46	42	41	36	55	56	51	49	47	43	59	60	55	55	54	51	62	65	60	62	60	58
	453	214	55	54	49	45	44	39	58	59	54	52	50	46	62	63	58	58	57	54	65	68	63	65	63	61
	627	296	58	58	54	52	48	43	62	63	59	57	54	51	66	67	63	63	60	58	70	72	68	68	66	66
	800	378	62	63	60	57	52	50	66	66	64	62	58	56	70	69	67	66	63	61	74	72	71	71	69	67
10	473	223	58	57	52	48	47	42	61	62	57	55	53	49	65	66	61	61	60	57	68	71	66	68	66	64
	765	361	59	59	54	52	49	45	63	64	59	58	55	52	66	68	63	63	61	59	70	73	68	69	67	66
	1058	499	61	61	55	53	50	46	65	66	60	58	56	53	69	70	64	64	61	60	73	75	69	69	67	67
	1350	638	65	66	61	58	54	53	69	69	65	63	59	58	73	72	68	67	65	63	77	75	72	72	70	68
12	735	347	58	56	52	48	47	41	62	61	57	55	54	49	64	64	60	60	58	54	69	70	67	69	67	64
	1076	508	60	58	54	50	49	43	64	63	59	57	56	51	66	66	62	62	60	56	71	72	69	71	69	66
	1418	669	61	60	56	54	51	46	65	65	61	60	57	53	68	68	64	64	62	58	73	74	71	72	70	68
	1759	831	63	62	57	55	52	47	67	67	62	61	58	54	70	70	65	64	62	59	76	76	72	72	70	69
	2100	992	67	67	63	60	56	54	71	70	67	65	62	59	74	72	70	68	65	63	80	76	75	75	73	70
14	1120	529	60	57	54	50	49	43	64	62	59	57	56	50	67	66	64	64	62	58	71	71	69	71	69	65
	1640	774	62	59	56	52	51	44	66	64	61	59	58	52	69	68	66	66	64	59	73	73	71	73	71	67
	2160	1020	63	61	58	56	53	47	67	66	63	62	59	54	71	70	68	68	66	62	75	75	73	74	72	69
	2680	1266	65	63	59	57	54	48	69	68	64	63	60	55	74	72	69	68	66	63	78	77	74	74	72	70
	3200	1511	69	68	65	62	58	55	73	71	69	67	64	60	78	74	73	72	69	66	82	77	77	77	75	71
16	1400	661	62	59	56	52	51	44	65	63	60	58	57	52	67	66	64	64	63	60	70	70	68	70	69	68
	1920	907	64	60	58	54	53	45	67	64	62	60	59	54	70	69	67	67	66	62	73	73	71	73	72	71
	2440	1152	65	62	60	58	55	48	68	66	64	64	62	56	72	71	69	69	68	64	75	75	73	75	75	72
	2960	1398	66	63	61	59	56	49	70	68	65	64	61	55	73	72	70	70	66	61	77	77	75	76	71	67
	3480	1643	67	64	61	59	56	49	71	69	66	65	62	56	76	74	71	70	67	62	80	79	76	76	73	69
	4000	1889	71	69	67	64	60	56	75	72	71	69	65	61	80	76	75	74	69	66	84	79	79	79	74	71
24 x16	2800	1322	68	65	62	58	57	50	69	67	66	64	63	58	70	70	70	70	69	66	71	72	74	76	75	74
	3840	1813	70	66	64	60	59	51	71	69	68	66	65	60	73	72	73	73	72	68	74	75	77	79	78	77
	4880	2304	71	68	66	64	61	54	73	71	70	70	68	62	74	74	75	75	74	70	76	77	79	81	81	78
	5920	2796	72	69	67	65	62	55	74	72	71	70	67	61	76	76	76	76	72	67	78	79	81	82	77	73
	6960	3287	73	70	67	65	62	55	76	74	72	71	68	62	78	77	77	76	73	68	81	81	82	82	79	75
	8000	3778	77	75	73	70	66	62	80	77	77	75	71	67	82	79	81	80	75	72	85	81	85	85	80	77

• ΔPs is the difference in static pressure from inlet to discharge of the unit.

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VAV Terminal Units

Performance Data (Typical Selection Guide)

Unit Size	Air Flow		Minimum ΔPs Across Unit Basic unit		Minimum Ps Across Unit With Attenuator		Min ΔPt Basic Unit		Discharge NC					Discharge NC					Radiated NC				
									Basic Unit					c/w 36" Attenuator					Basic Unit				
									ΔPs Across unit					ΔPs Across unit					ΔPs Across unit				
									Min	0.5" W.G.	1.0" W.G.	2.0" W.G.	3.0" W.G.	Min	0.5" W.G.	1.0" W.G.	2.0" W.G.	3.0" W.G.	Min	0.5" W.G.	1.0" W.G.	2.0" W.G.	3.0" W.G.
	CFM	L/s	W.G	Pa	W.G	Pa	W.G	Pa		125 Pa	250 Pa	500 Pa	750 Pa		125 Pa	250 Pa	500 Pa	750 Pa		125 Pa	250 Pa	500 Pa	750 Pa
4	79	37	0.01	2	0.01	2	0.06	14	-	-	-	-	22	-	-	-	-	20	-	-	-	-	-
	128	60	0.01	2	0.01	2	0.14	35	-	-	-	-	26	-	-	-	-	24	-	-	-	-	20
	176	83	0.02	5	0.02	5	0.27	67	-	-	-	26	31	-	-	-	24	29	-	-	-	21	24
	225	106	0.04	10	0.04	10	0.45	112	-	20	24	29	32	-	-	22	27	30	-	-	22	24	28
6	158	74	0.01	2	0.01	2	0.04	11	-	-	-	-	25	-	-	-	-	20	-	-	-	-	20
	255	120	0.03	7	0.03	7	0.12	31	-	-	-	22	29	-	-	-	-	24	-	-	-	-	23
	353	166	0.10	25	0.10	25	0.28	71	-	-	21	28	34	-	-	-	23	29	-	-	20	23	28
	450	213	0.21	53	0.21	53	0.51	128	-	21	26	30	35	-	-	21	25	30	-	20	23	28	32
8	280	132	0.01	2	0.01	2	0.04	10	-	-	-	23	30	-	-	-	-	22	-	-	-	-	23
	453	214	0.01	2	0.01	2	0.09	24	-	-	-	26	32	-	-	-	-	24	-	-	-	23	27
	627	296	0.02	6	0.02	6	0.19	47	-	-	23	30	37	-	-	-	22	29	-	-	23	27	32
	800	378	0.06	16	0.06	16	0.33	83	-	23	28	32	38	-	-	20	24	30	-	23	27	32	35
10	473	223	0.01	2	0.01	2	0.05	11	-	-	20	27	33	-	-	-	22	28	-	20	23	27	30
	765	361	0.01	2	0.01	2	0.11	26	-	-	23	29	35	-	-	-	24	30	-	22	27	30	35
	1058	499	0.02	6	0.02	6	0.21	53	-	-	25	30	36	-	-	20	25	31	22	27	30	35	38
	1350	638	0.06	16	0.06	16	0.37	92	-	25	29	33	37	-	20	24	28	32	26	31	33	36	39
12	735	347	0.01	2	0.01	2	0.05	13	-	-	-	24	33	-	-	-	-	27	-	-	22	25	29
	1076	508	0.01	2	0.01	2	0.10	25	-	-	22	26	35	-	-	-	20	29	-	23	25	29	32
	1418	669	0.01	2	0.01	2	0.17	41	-	-	24	28	37	-	-	-	22	31	-	24	29	33	37
	1759	831	0.02	4	0.02	4	0.26	65	-	20	27	30	38	-	-	23	26	34	24	29	33	37	40
	2100	992	0.04	10	0.04	10	0.39	96	21	27	30	33	39	-	23	26	29	35	28	33	35	38	42
14	1120	529	0.01	2	0.01	2	0.06	16	-	-	-	26	32	-	-	-	22	28	-	20	23	27	30
	1640	774	0.01	2	0.01	2	0.13	32	-	-	22	27	34	-	-	-	23	30	-	25	28	32	34
	2160	1020	0.01	2	0.01	2	0.21	53	-	-	24	30	36	-	-	20	26	32	24	29	32	35	38
	2680	1266	0.02	6	0.02	6	0.34	85	-	20	27	32	37	-	-	23	28	33	27	32	35	39	43
	3200	1511	0.06	16	0.06	16	0.52	128	21	27	30	34	38	-	23	26	30	34	30	35	37	40	44
16	1400	661	0.01	2	0.01	2	0.06	14	-	-	20	25	31	-	-	-	19	25	-	-	20	24	28
	1920	907	0.01	2	0.01	2	0.10	25	-	-	22	28	34	-	-	-	22	28	-	22	24	28	31
	2440	1152	0.01	2	0.01	2	0.16	39	-	-	24	30	36	-	-	-	24	30	22	27	29	33	35
	2960	1398	0.01	2	0.01	2	0.23	57	-	20	27	32	38	-	-	23	28	34	25	30	33	36	39
	3480	1643	0.02	5	0.02	5	0.32	81	-	22	28	34	39	-	-	24	30	35	28	33	36	40	44
	4000	1889	0.05	12	0.05	12	0.45	112	23	28	32	36	40	-	24	28	32	36	31	36	38	42	45
24 x16	2800	1322	0.01	2	0.01	2	0.06	14	-	23	25	30	37	-	21	23	28	35	20	25	28	32	34
	3840	1813	0.02	5	0.02	5	0.11	27	-	24	28	33	40	-	22	26	31	38	24	29	32	35	37
	4880	2304	0.04	9	0.04	9	0.18	45	22	27	30	35	42	20	25	28	33	40	29	34	36	39	42
	5920	2796	0.06	15	0.06	15	0.27	68	23	28	32	37	44	21	26	30	35	42	32	37	39	43	48
	6960	3287	0.10	24	0.10	24	0.39	97	24	29	34	37	45	22	27	32	35	43	34	39	43	48	52
	8000	3778	0.16	40	0.16	40	0.55	136	30	35	37	40	46	28	33	35	38	44	38	43	45	49	53

- NC are derived from sound power level, which are obtained in accordance with ARI standard 885-98.
- ΔPs is the difference in static pressure from inlet to discharge of the unit.
- ΔPt is the difference in total pressure from inlet to discharge of the unit.
- ΔPs for terminal units with electric coils is equal to basic unit. Resistance of the coil elements is negligible.
- Dash(-) in space indicates NC less than 20.

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VAV Terminal Units

Suggested Specification

General

- Variable Air Volume (VAV) units shall be fully/truly pressure independent with multi-point velocity sensor, detachable flow transmitter, 3 point floating electric actuator, room thermostat, and open protocol LonMark DDC (direct digital control) controller.
- The unit including all the control components shall be supplied, installed and the complete unit tested at the factory by a qualified VAV manufacturer. A qualified VAV manufacturer shall have both good manufacturing facility and a pressure independent test laboratory for variable air volume testing.
- The warranty of the complete unit including the controls shall be the sole responsibility of the supplier.
- The calibration of the VAV units shall be conducted in accordance with Industry Standard for Air Terminals Standard ARI 880 published jointly by Air Diffusion Council (ADC) and Air conditioning and Refrigeration Institute (ARI).
- The manufacturer shall maintain an air distribution laboratory capable of performing full testing of pressure independent boxes and airflow accuracy test.

Basic Assembly

- The basic assembly shall be constructed of galvanized steel, not less than 0.7mm (24ga.) thickness.
- Internal insulation shall be at least 25mm, 32kg/cu.m density fiberglass black tissue to prevent erosion.
- The damper shall be of heavy gauge metal, with peripheral tear resistant Neoprence lip seal to ensure a tight air seal at full shut off position. Damper shaft shall have damper position indicator and of square shape to ensure a fool proof grip between damper and electric actuator. Round shaft shall not be accepted.
- All control components shall be mounted inside a protective metal shroud.

Pressure Requirement

- The static pressure drop across the terminal unit shall not be more than 53Pa (0.22 in. W.G.) at the selected design air flow.
- The pressure independence shall be achieved using a differential pressure type velocity sensor on a feed forward control loop.
- The velocity sensor shall be a differential pressure multi-point sensing type using the reliable pitot tube concept for air flow measurement.
- The high and low tubing connection shall be air tight to prevent leakage affecting the accuracy of the air flow measurement. Airflow measurement accuracy must be within +/- 5%.

Noise

- Sound power level in each octave band 2 through 6 shall not exceed the following when operating at the rated air flow rate with 125Pa (0.5 in W.G.) static pressure across the terminal unit:

Frequency	Hz	125	250	500	1000	2000
Radiated Noise	dB	66	63	62	54	49
Discharged Noise	dB	65	62	60	55	48

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Controls

- The VAV controller shall be Lon based microprocessor based direct digital control (DDC) with open system concept to ensure ease of interfacing on site with others.
- Each VAV unit shall have its own dedicated, stand-alone microprocessor-based, truly independent LonMark open system controller.
- Each VAV controller shall accept standard thermistor input for temperature sensing.
- All the VAV units shall be capable of stand-alone or networking operation. In networking mode, the DDC controller shall be truly open to be freely integrated to existing LonWork BAS without any additional hardware or software.
- As a minimum, the user shall have the capability of monitoring the following dynamics up-dated information through each of the operator interface devices :-

  - zone temperature
  - actual live airflow
  - desired set-point airflow
  - cooling set-point etc
  - operating mode

- The room thermostat shall have a LCD display for room temperature and set point adjustment capability.
- The controller shall have an overriding function to occupied/unoccupied mode.
- As a minimum the user shall have the ability to monitor and control the following set-points through each of the operator interface devices :-

  - cooling set-point
  - minimum and maximum air flows
  - neutral zone
  - occupied/unoccupied time schedule
  - room temperature
  - live actual air flow

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