Advanced Air

General Product Overview

Single Duct Terminal Units
3000 Series

Designed for cooling only, cooling with reheat, heating only or heat/cool changeover applications.

- Available in 12 sizes 100 – 3776 l/s.
- Unit sizes from 4-100 to 16-400 – up to 1700 l/s, and size 24 x 16 - 600x400 up to 3776 l/s. The low profile design is advantageous where ceiling space is restricted.
- High performance inclined opposed blade damper.
- 'Diamond Flow' multi-point averaging sensor on pressure independent models.
- Pressure independent airflow control.
- Electric, analogue electronic or digital control.
- Options include secondary attenuators, hot water coils or electric coils for reheat and various linings for indoor air quality applications.

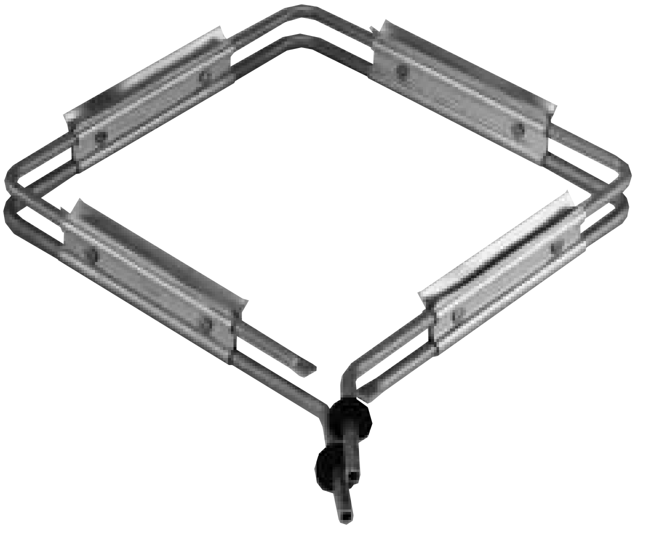
Series Flow (Constant Volume) Fan Powered Terminal Units
35S Series

- Quiet constant fan operation.
- Available in 2 fan sizes, each with various primary air inlet size options for optimum design flexibility. 140 – 990 l/s flow range.
- High performance inclined opposed blade primary air damper.
- 'Diamond Flow' multi-point averaging sensor.
- High efficiency motor/fan design.
- Solid state fan speed controller.
- Pressure independent airflow control.
- Electric, analogue electronic or digital control.
- Induced air attenuator option.
- Options include hot water coils or electric coils for supplementary heat and various linings for indoor air quality applications

Super Quiet 'STEALTH' Series Flow (Constant Volume) Fan Powered Terminal Units
35SST 'STEALTH' Series

- Super quiet premium design. Constant fan operation.
- 'STEALTH' design technology.
- Available in 2 fan sizes, each with various primary air inlet size options for optimum design flexibility. 140 – 990 l/s flow range.
- High performance inclined opposed blade primary air damper.
- 'Diamond Flow' multi-point averaging sensor.
- Custom high efficiency motor/fan design.
- Solid state fan speed controller.
- Pressure independent airflow control.
- Electric, analogue electronic or digital control.
- Options include hot water coils or electric coils for supplementary heat and various linings for indoor air quality applications.

'Diamond Flow' Sensor



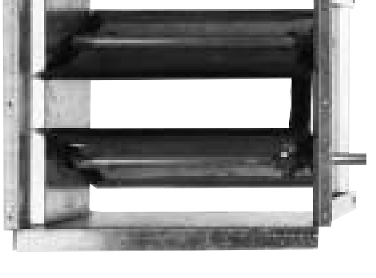
The Nailor 'Diamond Flow' is a multi-point airflow sensor that is designed to provide an averaged and very accurate flow signal for use with pressure independent controls.

The 'Diamond Flow' is constructed of aluminum (stainless steel is optional) to ensure longevity and strength and is therefore not affected by adverse ambient temperature fluctuations before or after installation. It has a minimum of four pick-up points on each side which sample airflow in each quadrant of the inlet and then averages those readings. The 'Diamond Flow' has a maximum error envelope of only ± 5%. Therefore, flow measurement is always accurate within the tolerances of normal measuring methods.

The second advantage of the 'Diamond Flow' is that it amplifies the velocity pressure signal (Δp) sent to the controller by an average factor of about 2.5. Inside pneumatic reset controllers, the static pressure signal is subtracted from the total pressure signal by piping these pressures to opposite sides of a diaphragm. The combined diaphragm and spring assembly have a mass equivalent to about 7.5 Pa. This mass defines the dead band and the minimum Δp setting. By amplifying the velocity signal, the controller is 'tricked' into a lower minimum capability and a narrower dead band. The same advantage is realised with digital and analogue electronic controls utilising a flow sensor and transducer. Low flow sensitivity is increased and lower settings can be held.

Thirdly, the aerodynamic aluminum sensor design causes minimal disturbance to the airstream. Therefore, compared with other bulkier sensor designs, it produces only a minimal pressure drop increase across the terminal unit damper, reducing inlet static pressure requirement and increasing energy efficiency, while at the same time producing negligible sensor generated noise.

Opposed Blade Damper



All Nailor single duct and fan powered terminals are equipped with inclined opposed blade dampers that provide premium performance and control accuracy. Blades shut-off at 45° in the direction of airflow. This ensures quiet operation with near linear performance for primary air control. Airflow disturbance and hence the turbulence created over a throttling opposed blade damper is less than that produced when compared with a similarly throttling round 'butterfly' type damper design, therefore generating less noise.

Controlled throttling of the airflow is achieved throughout the complete damper rotation from fully open to fully closed, desirable characteristics not found in round 'butterfly' dampers, thereby providing accurate control under all conditions. Opposed blade dampers ensure a smooth response as airflow is adjusted in response to changing thermostat demand or the damper adjusts to compensate for varying static pressure conditions.

All Nailor dampers feature a solid plated steel 13mm dia. driveshaft with an indicator mark on the end of the shaft to show damper position.

Electric Re-Heat/Supplementary Heater Batteries

All terminal units are available with factory installed electric re-heat/supplementary heater batteries.

Casing: Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

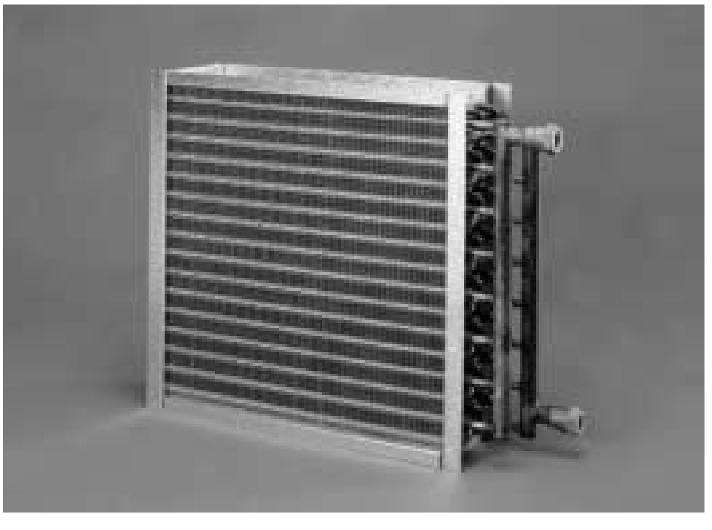
Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Electric Elements: Manufactured from stainless steel tubing with copper resistance wire and magnesium oxide insulation.

High Temperature Cut-Out: All electric re-heat or supplementary heater batteries incorporate automatic and manual high temperature cut-out safety devices, which disconnect the electrical power in the event that the air temperature exceeds a pre set maximum.

Pressure Switch: All electric re-heat or supplementary heater batteries incorporate a positive pressure switch which does not allow the heating elements to be energised unless there is positive air pressure (indicating airflow) available.

Low Pressure Hot Water Re-Heat/Supplementary Heater Batteries



All terminal Units are available with factory installed low pressure hot water re-heat/supplementary heater batteries.

Casing: Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Inlets and outlets incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Water Tubes: Manufactured from 10mm diam. copper tube to BS 1278 table Y.

Pipe Connections: Plain male ends suitable for solder jointing or threaded.

Heat Exchange Fins: Manufactured from 0.13mm thick rectangular aluminium plates, being mechanically bonded to the copper tubes. Fins are spaced at 2.5mm intervals.

All low pressure hot water re-heat/supplementary heater batteries incorporate an air vent and drain point.

Pressure Testing: All low pressure hot water re-heat/supplementary heater batteries are air pressure tested under water to a pressure of 3,000 kPa.

Analogue Electronic Controls

A comprehensive range of control options are available for all terminal types and pressure independent application sequences. Featuring 'Diamond Flow' multi-point sensor for accurate feedback control.

Direct Digital Controls (DDC).

Nailor has a wealth of experience supplying terminal units for use with state-of-the-art digital controls. We have worked with all major controls companies in recent years and have developed standard factory mounting programs to ensure operational efficiency is maximised for all terminal types and applications.

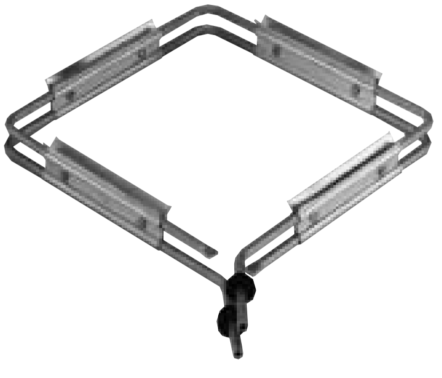
Nailor has designed its VAV terminal units to be generic in nature and compatible with all DDC controllers.

Analogue Electronic Components

Control Features:

- Proportional plus integral control function provides precise flow and temperature control.
- Stand alone operation.
- Simple installation and balancing.
- Reliable operation and excellent repeatability
  (settings do not drift with time)
- Less costly than digital controls with no programming requirement.
- Suitable for all types and sizes of building applications.
- Flexibility built-in to handle all control applications

Nailor is pleased to make available a new and improved range of pressure independent analogue electronic controls for terminal units. These controls now incorporate the 'Diamond Flow' multi-point averaging sensor for accurate flow measurement as standard, a re-designed higher torque controller/ actuator and new room thermostat design



Controller/Actuator

This device is mounted externally on the side of the terminal casing by means of a clamping mechanism directly onto the primary air damper operating shaft and a purpose made anti rotation bracket.

These units incorporate a dynamic differential pressure sensor and a microprocessor based electronic measuring device, coupled to type NM 8 Nm. damper motor all contained within a common housing.

The relationship between differential pressure and the output voltage signal is internally linearised within the microprocessor to provide a linear relationship to air volume

'Diamond Flow' Sensor

All components are matched and calibrated to provide regulated airflow in response to the electronic room thermostat, which is furnished as an integral part of the control package. Minimum and maximum airflow settings are adjusted at the thermostat, using a small screwdriver and digital voltmeter. Voltage settings correspond to airflow volumes on the Nailor calibration chart supplied with each project. It is not necessary to enter the ceiling space and locate the terminal itself for field calibration thereby reducing time and disruption.

Analogue Electronic (continued

Temperature Sensor/Controller

This electronic temperature controller is purpose made to provide an analogue interface for the Belimo NMV-D2-ANI Compact Variable Air Volume Controller. It is a modulating temperature controller with 0-10 Vdc fully modulating outputs for heating and cooling

Direct Digital Controls (DDC)

Microprocessor based technology is now commonplace in HVAC building management systems, particularly in larger building applications. Most controls companies have therefore developed DDC controllers and software programs for terminal units, to enhance energy efficient VAV systems and the well proven associated control strategies. VAV digital controllers are only one part of a much larger fully integrated building management system and the common availability and specification of terminal unit DDC controllers from control companies ensures compatibility and common protocol for trouble-free systems communication, maintenance support and trouble shooting. Digital VAV controls offer all the advantages of accurate, pressure independent operation plus the additional benefits of a networking capability and two-way communication. Parameters can be loaded and downloaded via communication with a remote PC.

Nailor has extensive experience factory mounting digital controls supplied by the controls contractor. Nailor has developed individual factory mounting programs for most manufacturers currently offering digital controls, providing the assurance of a high quality, professional installation and minimising start-up problems.

Nailor has designed its VAV terminal units to be generic in nature and compatible with all DDC controllers.

- Nailor supplies as standard an IP21 full controls enclosure for protection of the controls during shipment, installation and for the life of the building HVAC system. Dust tight construction is an option.
- The vast majority of digital controls require a flow sensor. Nailor's 'Diamond Flow' multi-point averaging sensor is compatible with all such controls. Nailor will mount its own sensor as standard, whether the digital controls are to be factory or field mounted, ensuring accurate measurement regardless of inlet conditions. K Factors have been developed for loading into the flow control algorithm.
- Separate isolation control transformers are available on fan terminal units to protect digital components from potentially harmful voltage spikes.

Advanced Air

Single Duct Terminals

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Single Duct Variable or Constant Air Volume 3000 Series

Models:

3001 Cooling or Heating only

30RW Cooling with Hot Water Re-heat

30RE Cooling with Electric Re-heat

Variable Air Volume Systems supply constant temperature air to an area while the volume of air varies as opposed to a conventional HVAC system which has constant volume and varies the air temperature.

Operating costs are greatly reduced compared to the larger conventional HVAC systems by using less fan energy and less refrigeration energy.

Variable Air Volume Systems also cut initial costs since the system capacity is determined from the peak demands of specific zones in lieu of peak demands for the entire building.

The smaller components of a VAV system require less floor space and give the owner the flexibility to adapt to tenant changes as desired at any time during or after construction of the building.

With today's energy conservation needs, **3000 Series** air terminals are designed for and adaptable to any modern VAV requirements.

The latest in control components and options provides maximum flexibility with a wide scope for cost effective innovation.

FEATURES:

- Inclined opposed blade primary air damper is inherently more linear in its flow characteristics than the standard butterfly type damper. More accurate flow control is ensured, which reduces hysteresis for more stable control of the temperature in the zone.
- Available in 12 unit sizes to handle from 100 – 3776 l/s.
- Compact low profile design to accommodate tight ceiling spaces.
- Gauge taps provided for field calibration and balancing.
- The unique blade and jamb seals provide tight closure capabilities while minimising sound generation.

Unit Size	Height mm
4-100 to 6-150	200
6.5-160 to 10-250	300
2-315 to 16-400	450
4 x 16 - 600 x 400	450

- 18 swg (1.2mm thick) zinc coated steel casing, mechanically sealed, low leakage construction.
- 18 swg (1.2mm thick) corrosion-resistant steel inclined opposed blade damper with seals. 45° rotation. 13mm dia. plated steel drive shaft. An indicator mark on the end of the shaft shows damper position. Tight close-off. Damper leakage is less than 2% of nominal flow rate at 750 Pa.
- Rectangular discharge with flanged duct connection.
- Acoustic/thermal lining: the terminal is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based, open cellular construction, having a non woven black tissue facing and complying with class O fire rating. The material is adhered to all internal surfaces and inside box/channel sections.
- Special Indoor Air Quality linings are available.
- Right-hand controls location is standard (shown) when looking in direction of airflow. Damper is clockwise to close. Optional left hand controls mounting is available, when damper is counter clockwise to close.

Low-Leakage Casing

Terminal Size	Max. Leakage, l/s	
	250 Pa	500 Pa
4-100	<4.0	5.5
5-125	<4.0	5.5
5.5-140	<4.0	5.5
6-150	<4.0	5.5
6.5-160	<4.0	5.5
7-180	<4.0	7.0
8-200	<4.0	7.0
10-250	<4.0	7.0
12-315	4.0	7.6
14-355	4.5	8.0
16-400	4.5	8.1
24 x 16 600 x 400	4.5	8.1

Recommended Airflow Ranges for Single Duct VAV Terminal Units

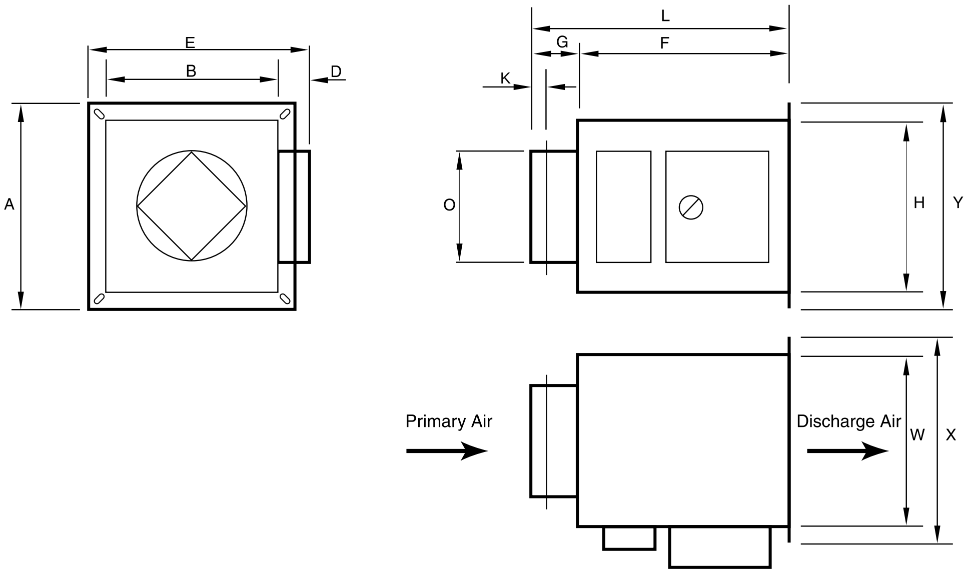
The recommended airflow ranges below are for terminal units with pressure independent controls and are based upon controller sensitivity limits as shown for each control type. For a given unit size, the minimum, auxiliary minimum (where applicable) and the maximum flow settings must be within the range limits to ensure pressure independent operation, accuracy and repeatability. For these reasons, factory settings will not be made outside these ranges. A minimum setting of zero (shut-off) is also available. Where an auxiliary setting is specified, the value must be greater than the minimum setting.

When digital or other controls are mounted by Nailor, but supplied by others, these values are guidelines only, based upon experience with the majority of controls currently available. Controls supplied by others for factory mounting are configured and calibrated in the field.

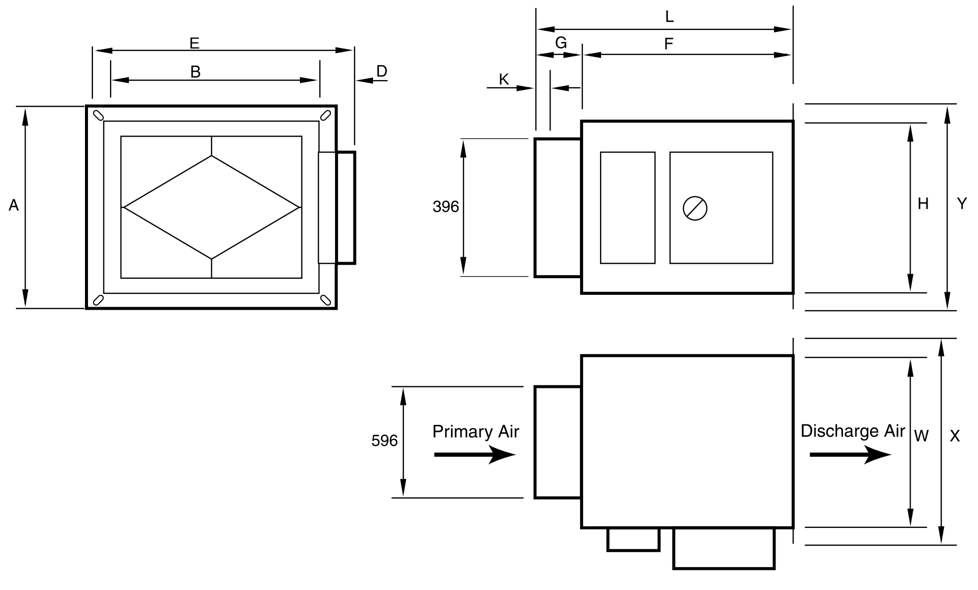
Air Volume Range

Unit Size	Inlet Spigot dia mm	Min l/s	Max l/s
4	100	30	100
5	125	40	150
5.5	140	50	200
6	150	55	235
6.5	160	60	275
7	180	75	365
8	200	90	470
10	250	150	670
12	315	240	1035
14	355	300	1275
16	400	350	1700
24x16	600 x 400	400	3775

Basic Unit with Controls - Dimensions
Model 3001 Sizes 4-100 to 16-400



Basic Unit with Controller - Dimensions - Model 3001 Size 24 x 16 - 620 x 400



Model 3001 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	D mm	E mm	F mm	G mm	K mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
4-100	96	360	300	100	430	450	150	40	600	300	200	360	260	9.5
5-125	121	360	300	100	430	450	150	40	600	300	200	360	260	9.5
5.5-140	136	360	300	100	430	450	150	40	600	300	200	360	260	9.5
6-150	146	360	300	100	430	450	150	40	600	300	200	360	260	9.5
6.5-160	156	360	300	100	430	450	150	40	600	300	300	360	360	9.5
7-180	176	360	300	100	430	450	150	40	600	300	300	360	360	9.5
8-200	196	360	300	100	430	450	150	40	600	300	300	360	360	12.5
10-250	246	410	350	100	480	450	150	40	600	350	300	410	360	16.5
12-315	311	510	450	100	580	450	150	40	600	450	450	510	510	20.0
14-355	351	510	450	100	580	450	150	40	600	450	450	510	510	20.0
16-400	396	510	450	100	580	450	150	40	600	450	450	510	510	20.0
24x16-600x400	596x396	770	710	100	840	450	150	40	600	710	450	770	510	30.0

Acoustic Data • Discharge Sound Power Levels

Model 3001, Basic Unit

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown																																			
			Min. ΔPs OBCF -Hz.						125 Pa. ΔPs OBCF -Hz.						250Pa ΔPs OBCF -Hz.						375Pa ΔPs OBCF -Hz.						500Pa ΔPs OBCF -Hz.						750Pa ΔPs OBCF -Hz.					
			125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
	94	27	*	46	52	57	48	43	52	56	58	57	49	44	58	50	62	59	53	49	59	62	63	61	56	53	60	63	65	63	58	55	59	64	68	67	62	58
	71	15	*	41	46	49	39	35	51	52	54	50	44	38	55	56	57	55	50	47	57	59	60	58	54	51	56	59	63	62	56	53	55	59	66	70	63	58
4-100	47	7	*	*	37	37	27	*	47	47	47	46	41	35	49	51	55	53	47	43	49	52	60	60	53	48	48	52	62	65	58	53	46	50	61	68	66	60
	35	2	*	*	31	28	*	*	*	45	45	43	37	31	*	46	56	56	49	42	*	46	58	62	56	49	*	45	58	64	62	55	*	45	58	65	66	62
	24	2	*	*	*	*	*	*	*	43	49	48	40	31	*	42	56	60	55	46	*	41	57	63	60	53	*	40	55	58	60	55	*	40	55	59	58	56
	142	10	48	55	53	57	49	47	55	59	60	59	51	48	47	63	63	61	53	50	60	64	65	64	56	53	62	67	67	65	59	56	62	69	69	67	62	59
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	47	2	*	*	29	25	*	*	*	45	42	40	33	30	*	51	54	52	46	40	*	51	58	60	53	47	*	51	59	65	59	53	*	47	58	67	66	60
	212	22	49	51	52	59	48	45	57	60	61	63	53	48	62	63	65	65	64	51	64	65	67	67	58	54	67	70	72	73	64	60	68	71	73	73	71	61
	189	17	47	48	48	54	44	40	58	59	60	61	51	46	61	62	63	62	62	50	63	65	66	66	57	54	65	67	68	68	59	56	67	70	70	70	62	60
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10-250	º389	2	*	41	45	44	38	33	55	57	55	54	49	43	61	61	61	60	55	52	64	65	64	64	59	56	65	68	66	66	62	59	66	69	70	69	67	63
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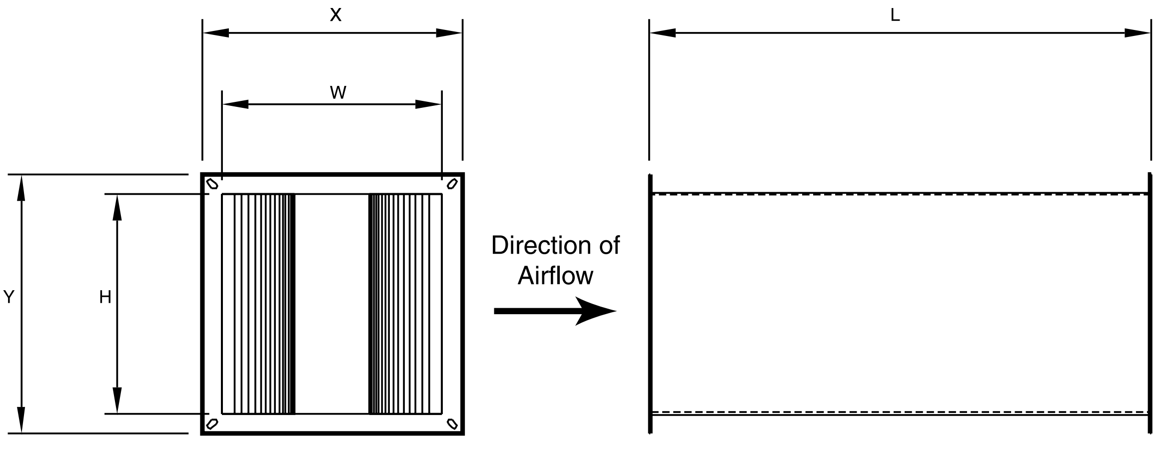
	991	2	54	55	58	55	51	44	63	61	62	62	56	50	67	65	66	65	60	59	70	68	68	68	63	63	71	70	70	70	65	64	74	73	74	73	70	68
14-355	543	2	48	43	48	46	41	33	58	55	55	54	49	43	63	61	61	60	55	55	66	64	64	63	60	59	68	67	67	66	63	61	69	69	71	69	66	64
	496	2	*	35	36	32	27	*	53	51	50	48	44	40	59	57	56	56	53	51	60	60	60	59	56	54	62	62	63	62	59	57	63	64	66	66	63	61
	248	2	*	*	*	*	*	*	49	45	44	43	40	37	52	50	51	50	48	45	51	50	54	54	53	51	54	53	56	57	56	55	54	54	58	60	60	60
	1652	2	60	59	66	64	60	54	65	65	70	70	64	58	71	69	72	72	66	59	73	72	73	74	68	64	74	73	75	75	70	66	77	76	77	78	73	70
	1322	2	56	54	56	58	54	48	64	62	64	65	58	53	67	66	67	66	61	56	70	69	70	69	64	61	72	71	72	71	67	63	76	75	75	75	71	68
16-400	991	2	50	46	51	49	44	38	59	57	58	57	51	46	64	63	62	62	57	54	68	67	66	66	61	59	70	68	68	68	60	58	72	71	72	72	69	66
	661	2	*	37	39	35	30	*	54	57	51	50	45	42	60	59	57	57	53	51	63	62	61	61	58	56	64	65	65	64	61	59	66	67	69	68	65	63
	330	2	*	*	25	23	*	*	50	46	45	45	42	42	53	52	53	52	50	48	54	54	56	56	55	54	56	56	59	59	58	58	58	57	62	63	62	62
	3776	154	75	72	72	67	66	62	81	78	76	71	70	66	84	81	80	76	75	71	86	82	82	78	77	73	88	85	84	81	80	76	90	87	87	84	83	78
24x16	3304	117	72	69	71	65	64	60	80	77	75	71	69	65	83	80	79	76	74	70	84	82	81	78	76	72	86	84	84	81	79	74	88	86	86	84	82	77
600x400	2832	87	69	68	67	62	61	56	78	75	74	70	68	64	81	79	78	75	73	69	82	81	79	77	75	71	84	83	82	80	78	73	86	85	85	83	81	76
	2360	60	67	64	62	57	56	51	76	74	73	69	66	63	79	77	77	74	71	67	80	79	78	76	73	69	82	81	81	79	76	72	84	83	84	82	79	75
	1888	37	65	59	58	51	50	45	73	72	71	67	65	61	77	76	76	72	70	65	78	78	78	74	72	67	80	79	80	77	75	70	82	81	82	80	78	73

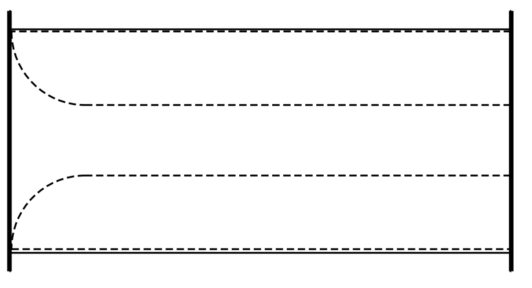
Acoustic Data • Radiated Sound Power Levels

Model 3001, Basic Unit

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa							Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown																													
			Min. ΔPs OBCF -Hz.						125 Pa. ΔPs OBCF -Hz.						250Pa ΔPs OBCF -Hz.						375Pa ΔPs OBCF -Hz.						500Pa ΔPs OBCF -Hz.						750Pa ΔPs OBCF -Hz.					
			125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
	94	27	*	36	33	32	*	*	*	39	37	38	29	29	49	46	43	37	30	29	53	52	47	40	32	31	53	53	50	42	33	33	54	55	53	47	37	37
	71	15	*	35	29	31	*	*	*	40	36	30	25	23	47	46	40	34	28	26	49	50	47	39	31	30	47	48	48	43	34	32	48	48	48	50	40	37
4-100	47	7	*	*	*	*	*	*	*	37	32	27	*	*	*	43	42	34	27	23	*	44	45	41	32	29	*	43	46	46	36	32	*	42	44	51	43	38
	35	2	*	*	*	*	*	*	*	37	31	26	*	*	*	41	43	37	29	24	*	42	45	42	32	29	49	38	42	45	40	33	*	36	41	48	44	40
	24	2	*	*	*	*	*	*	*	37	38	30	*	*	*	36	41	40	32	27	*	35	40	43	38	31	*	34	38	40	38	33	*	32	36	37	35	37
	142	10	47	38	32	32	30	27	50	43	37	37	35	31	54	46	44	37	35	31	57	49	47	39	38	33	59	52	49	40	39	35	59	55	53	43	43	39
	118	7	*	35	31	25	23	*	50	39	36	29	28	25	54	45	42	33	32	28	55	48	45	35	35	30	56	51	48	37	37	32	57	53	51	42	41	35
5-125	94	5	*	*	*	*	*	*	50	38	34	27	26	*	52	43	39	30	30	25	52	45	43	32	32	28	53	48	46	36	36	30	53	48	48	44	41	34
	59	2	*	*	*	*	*	*	*	43	29	21	*	*	48	40	38	28	27	*	48	42	42	34	33	27	49	42	44	39	38	29	49	42	44	47	46	37
	47	2	*	*	*	*	*	*	*	33	29	*	*	*	*	39	38	28	26	*	*	40	42	36	34	26	46	40	43	43	41	31	47	41	43	47	46	37
	212	22	48	44	37	35	30	28	48	47	40	38	32	29	56	50	45	40	34	31	59	53	48	44	36	33	61	55	50	43	39	37	64	58	54	46	42	41
	189	17	*	42	33	33	28	26	49	46	39	35	30	28	56	49	44	38	32	29	59	52	47	40	36	33	62	54	49	42	39	36	65	58	54	45	42	41
6-150	142	10	*	34	27	26	*	*	47	42	35	29	25	*	55	46	40	33	30	28	58	49	44	36	33	32	59	51	47	38	36	34	60	55	51	43	39	39
	94	5	*	*	*	*	*	*	47	36	30	24	*	*	53	43	38	30	29	28	53	45	43	32	31	30	53	47	44	36	32	32	55	49	46	43	37	37
	47	2	*	*	*	*	*	*	*	34	27	*	*	*	*	35	38	33	29	24	45	39	40	37	31	28	47	39	40	42	37	32	46	40	40	46	44	38
	307	2	48	45	46	38	31	30	49	48	45	37	31	29	54	50	47	40	34	32	60	54	50	44	37	35	64	58	54	48	40	38	67	63	58	51	44	43
	260	2	49	43	41	33	27	25	48	44	40	32	28	26	55	49	45	38	32	30	61	54	49	43	36	33	64	58	52	45	38	36	65	61	57	50	42	40
7-180	158	2	*	*	28	33	*	*	*	40	35	29	24	*	58	48	42	36	30	28	57	51	46	40	32	30	57	52	48	42	34	32	57	53	50	47	39	38
	106	2	*	*	*	*	*	*	*	39	33	28	*	*	50	45	40	34	28	25	52	47	43	38	31	29	51	47	43	41	33	31	52	48	45	42	35	36
	52	2	*	*	*	*	*	*	*	*	28	25	*	*	*	37	33	32	27	24	*	36	32	31	27	26	*	38	35	34	29	29	*	38	35	35	32	36
	378	7	51	46	40	33	31	28	55	48	44	35	33	29	57	51	48	38	36	32	61	54	50	41	40	35	64	56	53	43	43	38	66	58	55	46	47	41
	330	5	50	43	37	31	29	25	51	47	42	33	31	28	57	51	47	37	36	32	61	53	50	40	39	35	63	55	51	42	41	37	64	59	56	45	44	40
8-200	283	5	*	39	33	29	26	*	50	45	40	31	30	26	57	49	45	35	34	31	60	53	49	38	38	33	61	55	51	40	40	36	63	59	56	46	43	40
	189	2	*	35	26	*	*	*	49	41	36	28	27	24	54	47	41	32	31	30	57	52	46	35	34	32	57	52	47	37	36	34	59	54	51	41	40	39
	83	2	*	*	*	*	*	*	*	36	31	23	23	*	48	41	35	29	29	27	48	42	37	31	31	30	49	42	39	33	33	33	49	42	40	35	37	38
	637	2	53	42	41	36	30	23	55	47	46	39	34	29	58	53	50	44	38	34	60	56	53	48	42	37	63	57	54	50	46	41	65	61	57	54	48	45
	519	2	51	37	35	30	25	*	53	46	42	35	31	27	55	50	47	41	35	31	60	54	50	45	39	36	61	66	51	47	42	39	64	61	55	51	45	43
10-250	389	2	*	33	29	25	*	*	50	43	38	32	29	25	55	48	43	38	33	30	58	52	47	42	37	34	59	54	49	44	38	36	61	57	53	49	43	40
	260	2	*	*	*	*	*	*	*	38	33	29	25	*	51	44	38	34	30	28	53	47	42	38	32	34	56	50	45	41	36	33	57	52	48	45	39	37
	130	2	*	*	*	*	*	*	*	35	29	26	*	*	*	39	33	31	28	*	*	40	36	34	31	29	*	40	36	36	33	32	48	43	40	40	36	36
	944	2	54	50	49	44	37	33	58	55	51	46	39	35	61	59	53	49	43	37	64	61	56	52	45	41	65	62	58	55	48	44	68	66	61	58	51	49
	755	2	52	45	41	36	30	27	56	52	45	40	34	30	59	56	49	46	38	35	61	58	53	49	42	39	62	60	55	51	44	42	65	64	58	55	48	46
12-315	566	2	47	39	33	29	24	*	52	48	40	36	30	27	55	52	45	41	34	32	58	55	49	45	38	36	60	58	51	48	41	39	61	61	55	52	45	44
	378	2	*	*	*	*	*	*	50	41	34	30	26	*	52	48	41	37	31	30	53	52	45	42	35	33	54	53	47	44	37	36	56	55	50	48	42	42
	189	2	*	*	*	*	*	*	*	37	31	28	*	*	*	42	36	33	29	28	47	45	40	37	32	31	48	47	42	40	35	34	47	44	40	43	40	42
	1274	2	57	54	50	46	42	36	59	57	52	48	44	38	61	60	54	49	46	38	64	63	56	51	49	45	65	66	59	53	50	48	69	69	63	57	53	51
	991	2	54	48	44	39	35	30	56	53	45	40	37	31	61	57	50	44	41	38	63	61	55	48	44	43	64	63	57	50	46	44	66	66	60	55	50	48
14-355	543	2	46	40	35	30	28	*	51	48	40	33	31	27	57	55	48	40	36	35	60	58	52	45	40	39	60	60	53	47	43	41	62	63	57	52	47	45
	496	2	*	32	24	*	*	*	49	46	38	31	28	24	52	51	43	37	33	31	54	55	47	41	37	35	55	58	50	45	40	38	56	58	52	48	43	42
	248	2	*	*	*	*	*	*	*	39	31	27	24	*	*	45	38	32	30	28	*	45	39	35	31	32	48	48	42	39	37	36	49	49	44	42	40	42
	1652	2	57	57	53	49	43	36	59	60	55	50	45	38	63	62	57	52	46	37	66	65	59	54	48	43	68	68	61	56	50	48	71	71	64	59	53	48
	1322	2	54	51	49	43	37	32	59	55	50	44	38	32	62	59	53	47	41	35	65	63	57	50	44	39	66	65	59	52	46	41	68	69	62	56	50	46
16-400	991	2	49	44	41	34	28	*	54	50	44	37	32	28	59	57	50	42	37	32	61	60	53	45	40	35	63	63	56	49	43	39	64	65	58	53	47	44
	661	2	*	34	31	*	*	*	50	47	39	32	29	26	54	53	46	38	35	31	56	57	49	42	38	35	57	59	51	45	40	38	58	61	54	49	44	42
	330	2	*	*	*	*	*	*	*	40	33	28	25	*	47	47	39	33	32	29	49	49	42	37	35	33	60	51	44	39	37	36	51	53	46	43	41	41
	3776	154	71	67	66	61	58	53	73	70	68	62	60	55	77	74	72	67	63	58	79	76	75	70	65	60	81	77	77	72	67	61	83	80	80	75	69	63
24x16	3304	117	67	64	65	59	57	53	71	68	66	60	58	53	75	72	71	65	62	56	77	74	73	68	64	58	79	76	75	70	65	59	81	78	78	73	68	61
600x400	2832	87	64	60	61	55	53	51	69	66	64	58	56	51	72	70	69	63	60	54	74	72	71	66	62	56	76	73	73	69	63	57	78	76	76	72	66	59
	2360	60	62	56	56	51	51	46	66	63	62	56	53	48	69	67	67	61	57	52	71	69	69	64	59	54	73	71	71	67	61	55	75	73	74	70	63	57
	1888	37	61	52	50	46	43	40	62	60	60	54	50	45	66	64	64	59	54	49	68	66	67	62	56	51	69	68	69	64	58	52	72	70	71	67	60	54

Secondary Attenuators Dimensions
Models 30FB and 30FG Series





Terminal Size	W mm	H mm	X mm	Y mm	L mm	Wgt kg
4-100	300	200	330	230	600	12.00
4-100	300	200	330	230	900	16.00
4-100	300	200	330	230	1200	12.00
5-125	300	200	330	230	600	12.00
5-125	300	200	330	230	900	16.00
5-125	300	200	330	230	1200	20.00
5.5-140	300	200	330	230	600	12.00
5.5-140	300	200	330	230	900	16.00
5.5-140	300	200	330	230	1200	20.00
6-150	300	200	330	230	600	12.00
6-150	300	200	330	230	900	16.00
6-150	300	200	330	230	1200	20.00
6.5-160	300	200	330	330	600	15.00
6.5-160	300	300	330	330	900	19.00
6.5-160	300	300	330	330	1200	24.00
7-180	300	300	330	330	600	15.00
7-180	300	300	330	330	900	19.00
7=180	300	300	330	330	1200	24.00
8-200	300	300	330	330	600	15.00
8-200	300	300	330	330	900	19.00
8-200	300	300	330	330	1200	24.00
10-250	350	300	380	330	600	16.00
10-250	350	300	380	330	900	21.00
10-250	350	300	380	330	1200	26.00
12-315	450	450	480	480	600	24.00
12-315	450	450	480	480	900	31.00
12-315	450	450	480	480	1200	38.00
14-355	450	450	480	480	600	24.00
14-355	450	450	480	480	900	31.00
14-355	450	450	480	480	1200	38.00
16-400	450	450	480	480	600	24.00
16-400	450	450	480	480	900	31.00
16-400	450	450	480	480	1200	38.00

Secondary Attenuators

All terminal units are available with attached secondary attenuators

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all longitudinal casing joints are mechanically sealed.

Flanges:

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the attenuator.

Splitters:

Arranged within the casing are vertical attenuating splitter sections manufactured from 21 swg. (0.8mm thick) Galvanised Mild Steel, fixed to the casing by rivets. Splitters are fitted at inlet and discharge with aerodynamically shaped bullnose fairings. Splitters are fitted with 22 swg. (0.7mm thick) expanded or perforated metal facings. Horizontal splitters are also available if required.

Acoustic infill:

Splitters and side linings are filled with an inert, non combustible, non hygroscopic, vermin and rot proof mineral fibre slab which will not support bacterial growth. Usually faced with a glass fibre tissue (FB), however hermetically sealed Melinex membrane bags (FG) are available wherever indoor air quality conditions demand.

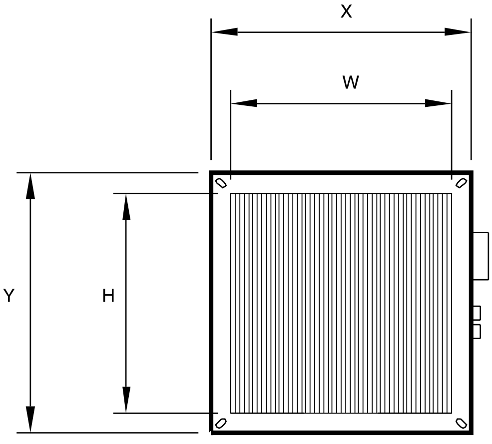
Acoustic Performance Data - Secondary Attenuator Static Insertion Loss dB Models 30FB and 30FG

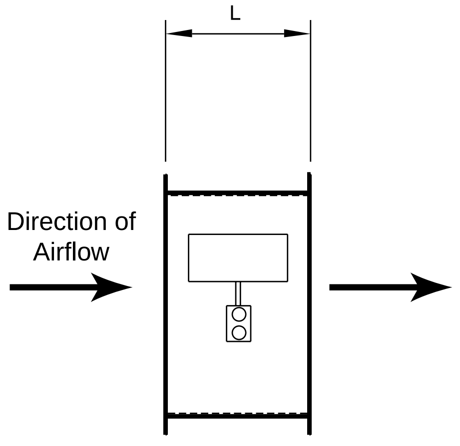
Terminal size	Air vol. l/s.	Air vol. m3/h	Press. drop Pa.	width mm.	height mm.	length mm.	O.B.C.F.-Hz 125	250	500	1k	2k	4k
4-100	24	86	neg.	300	200	600	6	10	17	22	18	16
4-100	94	338	60	300	200	600	6	10	17	22	18	16
4-100	24	86	neg.	300	200	900	8	14	26	33	27	22
4-100	94	338	65	300	200	900	8	14	26	33	27	22
4-100	24	86	neg.	300	200	1200	9	18	34	43	36	27
4-100	94	338	70	300	200	1200	9	18	34	43	36	27
5-125	47	169	neg.	300	200	600	6	10	17	22	18	16
5-125	142	511	60	300	200	600	6	10	17	22	18	16
5-125	47	169	neg.	300	200	900	8	14	26	33	27	22
5-125	142	511	65	300	200	900	8	14	26	33	27	22
5-125	47	169	neg.	300	200	1200	9	18	34	43	36	27
5-125	142	511	70	300	200	1200	9	18	34	43	36	27
6-150	45	162	neg.	300	200	600	6	10	17	22	18	16
6-150	210	756	60	300	200	600	6	10	17	22	18	16
6-150	45	162	neg.	300	200	900	8	14	26	33	27	22
6-150	210	756	65	300	200	900	8	14	26	33	27	22
6-150	45	162	neg.	300	200	1200	9	18	34	43	36	27
6-150	210	756	70	300	200	1200	9	18	34	43	36	27
8-200	80	288	neg.	300	300	600	6	10	17	22	18	16
8-200	375	1350	75	300	300	600	6	10	17	22	18	16
8-200	80	288	neg.	300	300	900	8	14	26	33	27	22
8-200	375	1350	80	300	300	900	8	14	26	33	27	22
8-200	80	288	neg.	300	300	1200	9	18	34	43	36	27
8-200	375	1350	85	300	300	1200	9	18	34	43	36	27
10-250	130	468	neg.	350	300	600	6	7	13	17	13	8
10-250	635	2286	60	350	300	600	6	7	13	17	13	8
10-250	130	468	neg.	350	300	900	9	12	20	25	19	12
10-250	635	2286	70	350	300	900	9	12	20	25	19	12
10-250	130	468	neg.	350	300	1200	12	14	26	34	26	15
10-250	635	2286	80	350	300	1200	12	14	26	34	26	15
12-315	190	684	neg.	450	450	600	2	5	8	10	7	4
12-315	945	3402	60	450	450	600	2	5	8	10	7	4
12-315	190	684	neg.	450	450	900	4	7	12	15	11	5
12-315	945	3402	65	450	450	900	4	7	12	15	11	5
12-315	190	684	neg.	450	450	1200	5	10	16	19	14	7
12-315	945	3402	70	450	450	1200	5	10	16	19	14	7
14-355	235	846	neg.	450	450	600	2	5	8	10	7	4
14-355	1275	4590	60	450	450	600	2	5	8	10	7	4
14-355	235	846	neg.	450	450	900	4	7	12	15	11	5
14-355	1275	4590	65	450	450	900	4	7	12	15	11	5
14-355	235	846	neg.	450	450	1200	5	10	16	19	14	7
14-355	1275	4590	70	450	450	1200	5	10	16	19	14	7
16-400	330	1188	neg.	450	450	600	2	5	8	10	7	4
16-400	1652	2549	60	450	450	600	2	5	8	10	7	4
16-400	330	1188	neg.	450	450	900	4	7	12	15	11	5
16-400	1652	2549	65	450	450	900	4	7	12	15	11	5
16-400	330	1188	neg.	450	450	1200	5	10	16	19	14	7
16-400	1652	2549	70	450	450	1200	5	10	16	19	14	7

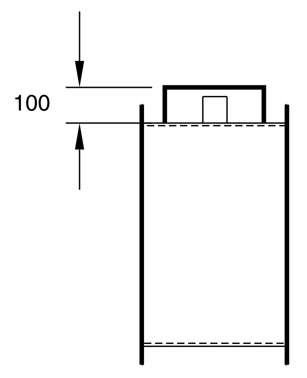
Acoustic Performance Data - Secondary Attenuator Static Insertion Loss dB Models 30FB and 30FG

Terminal size	Air vol. l/s.	Air vol. m3/h	Press. drop Pa.	width mm.	height mm.	length mm.	O.B.C.F.-Hz 125	250	500	1k	2k	4k
24 x 16	595	2142	6	750	450	600	8	12	17	28	26	20
600x400	595	2142	7	750	450	900	11	16	23	37	34	24
	595	2142	9	750	450	1200	13	20	28	46	42	28
24 x 16	1200	4320	25	750	450	600	8	12	17	28	26	20
600x400	1200	4320	26	750	450	900	11	16	23	37	34	24
	1200	4320	28	750	450	1200	13	20	28	46	42	28
24 x 16	595	2142	7	900	450	600	9	14	19	32	31	23
600x400	595	2142	7	900	450	900	12	18	25	42	41	29
	595	2142	8	900	450	1200	14	22	31	50	50	35
24 x 16	1600	5760	47	900	450	600	9	14	19	32	31	23
600x400	1600	5760	50	900	450	900	12	18	25	42	41	29
	1600	5760	55	900	450	1200	14	22	31	50	50	35
24 x 16	595	2142	4	900	600	600	9	14	19	32	31	23
600x400	595	2142	4	900	600	900	12	18	25	42	41	29
	595	2142	5	900	600	1200	14	22	31	50	50	35
24 x 16	2200	7920	50	900	600	600	9	14	19	32	31	23
600x400	2200	7920	54	900	600	900	12	18	25	42	41	29
	2200	7920	58	900	600	1200	14	22	31	50	50	35
24 x 16	595	2142	2	900	750	600	9	14	19	32	31	23
600x400	595	2142	2	900	750	900	12	18	25	42	41	29
	595	2142	3	900	750	1200	14	22	31	50	50	35
24 x 16	2600	9468	45	900	750	600	9	14	19	32	31	23
600x400	2600	9468	48	900	750	900	12	18	25	42	41	29
	2600	9468	52	900	750	1200	14	22	31	50	50	35
24 x 16	595	2142	1	1200	750	600	9	14	19	32	31	23
600x400	595	2142	1	1200	750	900	12	18	25	42	41	29
	595	2142	2	1200	750	1200	14	22	31	50	50	35
24 x 16	3600	12960	48	1200	750	600	9	14	19	32	31	23
600x400	3600	12960	50	1200	750	900	12	18	25	42	41	29
	3600	12960	55	1200	750	1200	14	22	31	50	50	35
24 x 16	595	2142	1	1500	750	600	9	14	19	32	31	23
600x400	595	2142	1	1500	750	900	12	18	25	42	41	29
	595	2142	1	1500	750	1200	14	22	31	50	50	35
24 x 16	3800	13590	34	1500	750	600	9	14	19	32	31	23
600x400	3800	13590	37	1500	750	900	12	18	25	42	41	29
	3800	13590	40	1500	750	1200	14	22	31	50	50	35

Low Pressure Hot Water Re-heat Batteries - Dimensions
Model 30RW







Terminal Size	W mm	H mm	L mm	X mm	Y mm	Wgt kg
4-100	300	200	200	370	270	10
5-125	300	200	200	370	270	10
5.5-140	300	200	200	370	270	10
6-150	300	200	200	370	270	10
6.5-160	300	200	200	370	370	10
7-180	300	300	200	370	370	13
8-200	300	300	200	370	370	13
10-250	350	200	200	420	370	14
12-315	450	450	200	520	520	15
14-355	450	450	200	520	520	15
16-400	450	450	200	520	520	15
2x16-600x400	750	450	200	820	520	20

All terminal units are available with factory installed low pressure hot water re-heat batteries.

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Inlets and outlets incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Water Tubes:

Manufactured from 10mm diam. copper tube to BS 1278 table Y.

Pipe Connections:

Plain male ends suitable for solder jointing.

Heat Exchange Fins:

Manufactured from 0.13mm thick rectangular aluminium plates, mechanically bonded to the copper tubes. Fins are spaced at 2.5mm intervals.

All low pressure hot water supplementary heater batteries incorporate an air vent and drain point.

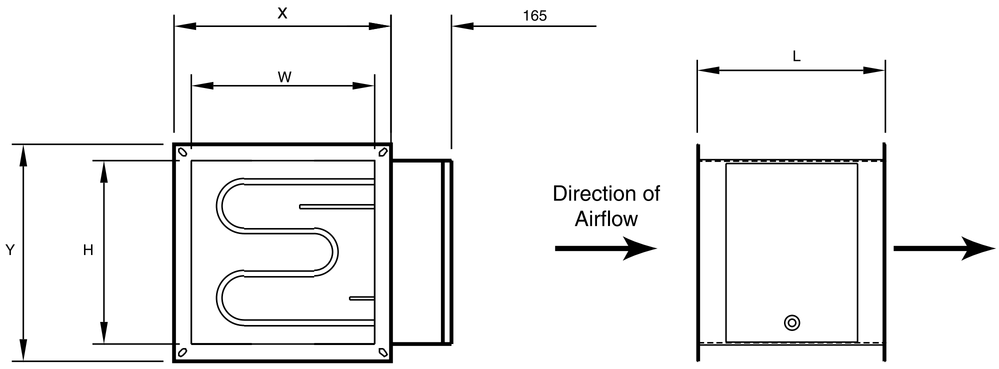
Pressure Testing:

All low pressure hot water supplementary heater batteries are air pressure tested under water to a pressure of 3,000 kPa.

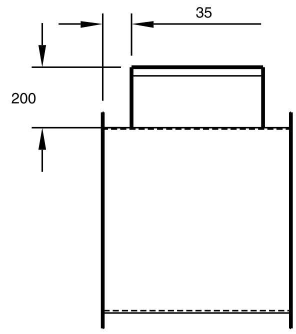
LPHW Re-Heat Battery Performance 82°C Flow, 71°C Return, 10 fpi
Model 30RW

Terminal Size	Air Vol. l/s	Air Vol. m^3/h	Dimensions Width mm	Height mm	Face Vel m/s	Air On C	1 Row Duty kW	Air Off C	Water Pd KPa	Water kg/s	Air Pd Pa	2 Row Duty kW	Air Off C	Water Pd kPa	Water kg/s	Air Pd Pa
4-100	24	87	300	200	0.40	16	0.8	43.6	0.7	17.3	1	1.3	60	3.0	28.1	2
4-100	47	170	300	200	0.78	16	1.6	43.4	2.4	34.6	4	2.4	59	1.7	52.6	7
4-100	71	256	300	200	1.18	16	2.2	42.0	4.6	47.6	8	3.5	57	3.4	75.8	13
4-100	94	338	300	200	1.57	16	2.7	46.1	6.7	58.4	12	4.4	55	5.0	95.2	21
5-125	47	170	300	200	0.78	16	2.2	42.0	4.6	47.6	8	3.5	57	3.4	75.8	13
5-125	94	338	300	200	1.57	16	2.7	46.1	6.7	58.4	12	4.4	55	5.0	95.2	21
5-125	118	425	300	200	1.97	16	3.2	38.9	9.0	69.3	18	5.2	53	6.9	112.6	32
5-125	142	511	300	200	2.32	16	3.4	35.6	1.8	73.6	25	6.0	51	8.9	129.9	43
5.5-140	46	166	300	200	0.77	16	1.5	43.5	2.8	32.9	4	2.7	59	2.0	58.4	64
5.5-140	92	331	300	200	1.53	16	2.7	40.2	7.9	57.6	12	4.3	55	2.9	92.9	21
5.5-140	139	500	300	200	2.32	16	3.3	35.8	2.1	71.6	24	5.7	50	4.0	123.2	42
5.5-140	185	666	300	200	3.08	16	4.0	34.0	3.0	86.6	39	7.0	47	5.9	151.5	68
6-150	45	162	300	200	0.75	16	1.5	43.4	2.2	32.5	4	2.4	60	10.0	51.9	6
6-150	115	414	300	200	1.92	16	3.1	38.6	6.7	67.1	17	5.1	53	6.7	110.4	30
6-150	185	666	300	200	3.08	16	4.0	33.9	2.5	86.6	39	6.7	46	4.5	145.0	68
6-150	210	756	300	200	3.50	16	4.5	33.6	3.1	97.4	48	7.4	45	5.5	160.2	84
6.5-160	60	216	300	300	0.67	16	2.0	44	5.7	43.3	3	3.1	60	4.0	68.2	5
6.5-160	120	432	300	300	1.33	16	3.5	40.5	2.7	75.8	9.3	5.8	56	4.7	124.9	16
6.5-160	181	652	300	300	2.01	16	4.7	37.7	4.7	102.6	19	8.0	53	8.4	172.1	33
6.5-160	241	868	300	300	2.68	16	5.8	36	6.8	124.7	31	9.8	42	9.8	213.2	53
7-180	76	274	300	300	0.84	16	2.6	44	8.7	55.4	4.3	4.0	60	6.0	86.1	7.5
7-180	153	551	300	300	1.70	16	4.2	38.9	3.8	91.3	14	7.0	54	6.6	151.5	25
7-180	229	824	300	300	2.54	16	5.6	36.2	6.4	120.6	28	9.3	48	6.7	200.4	49
7-180	305	1098	300	300	3.39	16	6.9	39.7	9.4	149.1	46	11.6	48	10.2	251.1	80
8-200	80	288	300	300	0.89	16	2.7	43.9	9.6	58.4	5	4.2	60	6.6	90.9	8
8-200	190	684	300	300	2.11	16	4.9	31.4	5.0	106.1	20	8.2	52	9.0	177.5	36
8-200	280	1008	300	300	3.11	16	6.5	35.2	8.4	140.7	39	6.9	48	9.0	149.4	69
8-200	375	1350	300	300	4.17	16	7.5	32.6	5.0	162.3	65	11.3	41	7.2	244.6	113
10-250	130	468	350	300	1.24	16	3.7	39.9	3.0	80.1	11	6.1	55	5.2	132.0	19
10-250	350	1260	350	300	3.33	16	7.2	33.0	4.5	155.8	57	10.7	41	6.5	231.6	101
10-250	520	1872	350	300	4.95	16	8.8	30.0	6.7	190.5	113	15.4	41	10.9	333.3	197
10-250	635	2236	350	300	6.05	16	9.0	27.9	7.0	194.8	156	16.1	37	11.9	348.5	273
12-315	190	684	450	450	0.94	16	5.7	40.8	7.8	123.4	10	9.1	56	7.3	197.0	18
12-315	565	2034	450	450	2.79	16	11.5	33.0	8.1	249.6	65	19.6	45	15.1	425.3	114
12-315	750	2700	450	450	3.70	16	13.4	30.8	10.8	289.2	105	21.7	40	16.1	469.9	185
12-315	945	3402	450	450	4.67	16	12.8	27.2	7.0	276.8	156	22.9	36	17.8	496.1	273
14-355	235	846	450	450	1.16	16	7.1	41.1	5.7	154.5	9	10.2	52	7.0	220.6	16
14-355	800	2680	450	450	3.95	16	15.0	32.7	9.7	321.2	64	25.6	45	22.2	553.9	112
14-355	1035	3726	450	450	5.11	16	17.6	30.1	13.1	380.5	112	30.8	41	31.7	666.0	196
14-355	1275	4590	450	450	6.30	16	18.0	27.7	13.8	390.5	160	32.3	37	34.7	699.6	279
16-400	320	1152	450	450	1.58	16	8.3	37.4	5.6	178.8	12	13.6	51	9.0	293.9	22
16-400	780	2808	450	450	3.85	16	12.3	29.0	7.1	265.6	57	26.0	44	25.0	562.8	99
16-400	1240	4464	450	450	6.12	16	19.0	28.6	14.7	409.1	129	33.4	38	40.4	722.3	218
16-400	1700	6120	450	450	8.40	16	19.5	25.5	15.7	423.2	213	35.6	33	45.8	771.2	372
600 x 400	1890	6804	710	450	5.92	16	13.3	21.8	7.6	288.5	118	25.0	27	25.2	541.1	207
600 x 400	2360	8496	710	450	7.39	16	13.5	20.7	7.8	291.6	173	25.8	25	24.0	558.7	303
600 x 400	3300	11880	710	450	10.33	16	13.6	19.4	8.0	295.2	305	26.4	23	25.1	572.3	535
600 x 400	3775	13590	710	450	11.82	16	13.7	19.0	8.0	296.3	384	26.6	22	25.5	576.8	623

Electric Re-Heat Batteries - Dimensions
Model 30RE



Terminal Size	W mm	H mm	L mm	X mm	Y mm	Weight kg
4-100	300	200	370	370	270	5.00
5-125	300	200	370	370	270	5.00
5.5-140	300	200	370	370	270	5.00
6-150	300	200	370	370	270	5.00
6.5-160	300	200	370	370	370	6.50
7-180	300	300	370	370	370	6.50
8-200	300	300	370	370	370	6.50
10-250	350	200	370	420	370	7.50
12-315	450	450	370	520	520	13.50
14-355	450	450	370	520	520	13.50
16-400	450	450	520	520	520	13.50
2x16-600x400	750	450	370	820	520	25.00



All terminal units are available with factory installed electric re-heat batteries.

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Electric Elements:

Manufactured from stainless steel tubing with copper resistance wire and magnesium oxide insulation.

High Temperature Cut-Out:

All electric supplementary heater batteries incorporate automatic and manual high temperature cut-out safety devices, which disconnect the electrical power in the event that the air temperature exceeds a pre set maximum.

Pressure Switch:

All electric supplementary heater batteries incorporate a positive pressure switch which does not permit the heating elements to be energised unless there is positive air pressure (indicating airflow) available.

Selection

Table 1 opposite provides guidance as to the input voltage, output rating and number of stages available for electric re-heat batteries.

Terminal units incorporating analogue controls should be limited to a maximum of two stages.

Thyristor controls are recommended for output ratings in excess of those indicated in table 1.

In order to prevent stratification of the discharge air, a maximum recommended discharge temperature of 39°C should not be exceeded

Input Voltage Vac.	Phase	Freq. Hz.	Output kW.	Stages
230	1	50	0.1-4.5	1
415	3	50	0.1 - 13.0	1, 2, 3

Table 1

$$\text{Air Temp Rise } ^{\circ}\text{C} = \frac{\text{kW}}{1.2 \times 1.02 \times \text{m3/s.}}$$

Options

- 24Vac control transformer.
- Isolator
- Door interlocked isolator
- Power circuit fusing.
- Dust tight construction.

Electric Re-Heat Battery Performance
Model 30RE

Terminal Size	Air Vol. l/s	Air Vol. m^3/h	Air Pd. Pa.	Dimensions Width mm	Dimensions Height mm	kW 0.5	kW 1.0	kW 1.5	kW 2.0	kW 2.5	kW 3.0	kW 3.5	kW 4.0	kW 4.5	kW 5.0	kW 5.5	kW 6.0	kW 6.5	kW 7.0	kW 7.5	kW 8.0	kW 8.5	kW 9.0
4 - 100	90	324	14	300	200	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4 - 100	100	360	15	300	200	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5 - 125	90	324	14	300	200	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5 - 125	150	540	19	300	200	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5.5 - 140	90	324	14	300	200	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5.5 - 140	200	720	25	300	200	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a
6 - 150	90	324	14	300	200	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6 - 150	235	846	36	300	200	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
6.5 - 160	90	324	14	300	200	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6.5 - 160	275	990	40	300	200	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
7 - 180	90	324	14	300	200	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7 - 180	365	1314	72	300	200	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
8 - 200	135	486	14	300	300	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
8 - 200	470	1692	52	300	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
10 - 250	158	569	14	350	300	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10 - 250	670	2412	78	350	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
12 - 315	236	850	11	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a
12 - 315	1035	3726	50	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
14 - 355	360	1296	15	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a
14-355	1275	4590	76	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
16 - 400	405	1458	17	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
16 - 400	1700	6120	132	450	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
600 x 400	360	1296	14	750	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
600 x 400	3775	13590	200+	750	450	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Terminal Size	Output kW 10.0	kW 11.0	kW 12.0	kW 13.0	kW 14.0	kW 15.0	kW 16.0	kW 17.0	kW 18.0	kW 19.0	kW 20.0	kW 22.0	kW 24.0	kW 26.0	kW 28.0	kW 30.0	kW 32.0	kW 34.0	kW 36.0	kW 38.0	kW 40.0	kW 42.0	kW 44.0	kW 46.0	kW 48.0	kW 50.0	kw 52.0	kw 54.0
4 - 100	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4 - 100	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5 - 125	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5 - 125	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5.5 - 140	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5.5 - 140	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6 - 150	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6 - 150	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6.5 - 160	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6.5 - 160	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7 - 180	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7 - 180	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
8 - 200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
8 - 200	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10 - 250	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10 - 250	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12 - 315	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12 - 315	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
14 - 355	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
14-355	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a
16 - 400	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
16 - 400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
600 x 400	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
600 x 400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

High temperature cut-out settings:

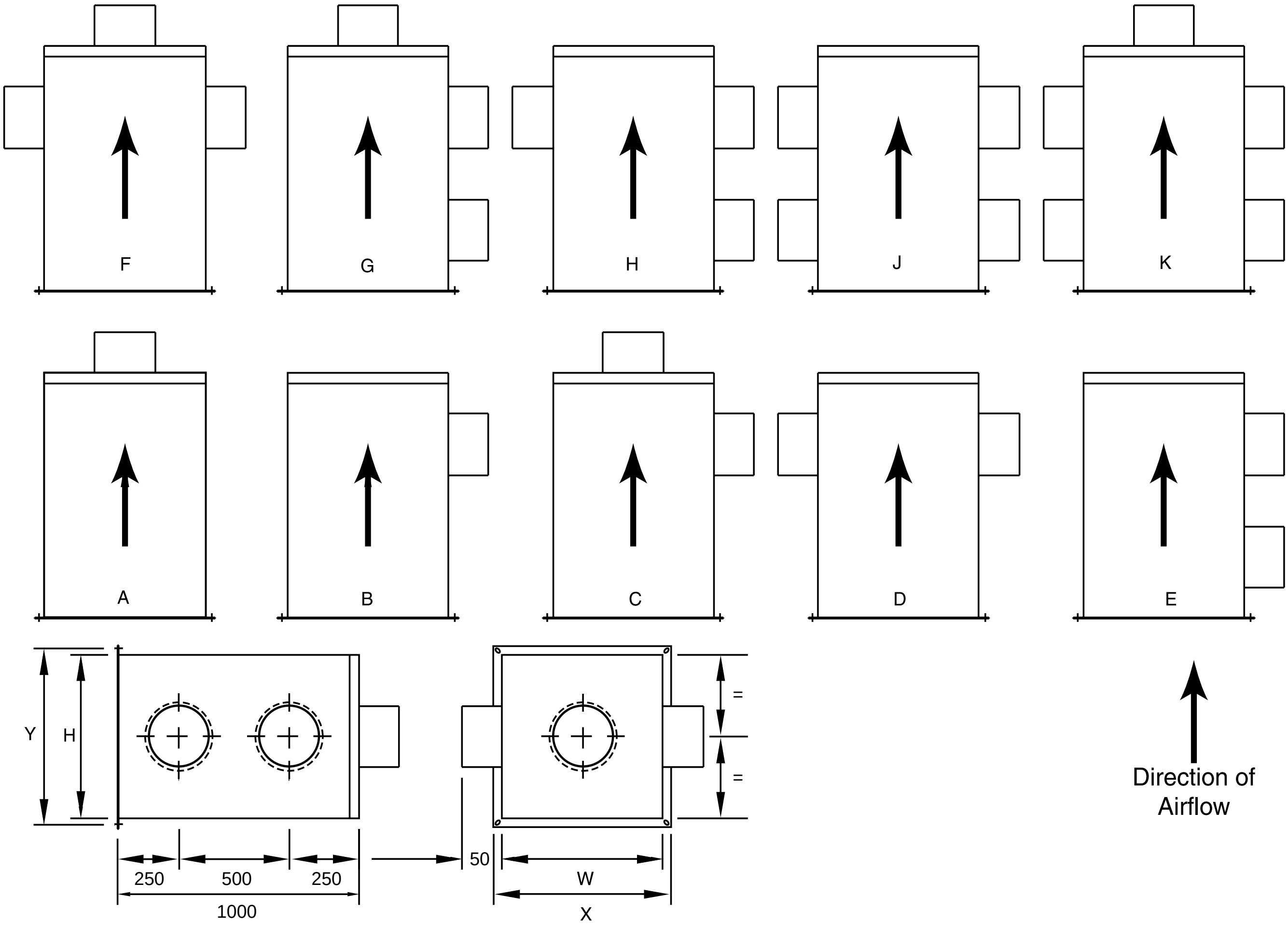
Automatic - 70°C

Manual - 120°C

Maximum recommended

Leaving Air Temperature - 39°C

Multiple Outlet Plenums - Dimensions
Models 30GB and 30GG



Model 30GB - Insulation faced with non woven tissue as standard.

Model 30GG - Insulation covered with hermetically sealed Melinex membrane bags for indoor air quality applications.

Terminal Size	W mm	H mm	X mm	Y mm	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Wgt kg
4-100	300	200	370	270	150	A-K	200	n/a.	250	n/a.	315	n/a.	355	n/a.	400	n/a.	10.0
5-125	300	200	370	270	150	A-K	200	n/a.	250	n/a.	315	n/a.	355	n/a.	400	n/a.	10.0
5.5-140	300	200	370	270	150	A-K	200	n/a.	250	n/a.	315	n/a.	355	n/a.	400	n/a.	10.0
6-150	300	200	370	270	150	A-K	200	n/a.	250	n/a.	315	n/a.	355	n/a.	400	n/a.	10.0
6.5-160	300	300	370	370	150	A-K	200	A-K	250	A-K.	315	n/a.	355	n/a.	400	n/a.	12.0
7-180	300	300	370	370	150	A-K	200	A-K	250	A-K.	315	n/a.	355	n/a.	400	n/a.	12.0
8-200	300	300	370	370	150	A-K	200	A-K	250	A-K.	315	n/a.	355	n/a.	400	n/a.	12.0
10-250	350	300	420	370	150	A-K	200	A-K	250	A-K	315	n/a.	355	n/a.	400	n/a.	12.0
12-315	450	450	520	520	150	A-K	200	A-K	250	A-K	315	A-K	355	A-K	400	A-K	15.0
14-355	450	450	520	520	150	A-K	200	A-K	250	A-K	315	A-K	355	A-K	400	A-K	15.0
16-400	450	450	520	520	150	A-K	200	A-K	250	A-K	315	A-K	355	A-K	400	A-K	15.0
24x16-600x400	750	450	820	520	150	A-K	200	A-K	250	A-K	315	A-K	355	A-K	400	A-K	25.5

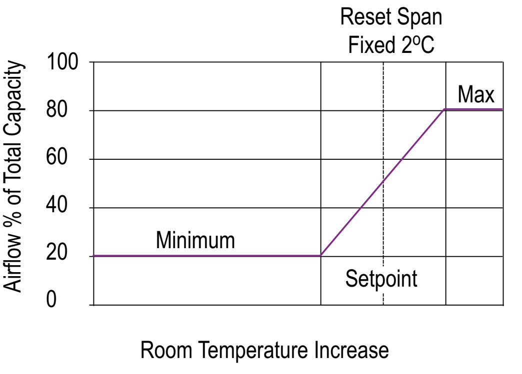
Standard Control Sequences

Single Duct • Analogue Electronic • Pressure Independent

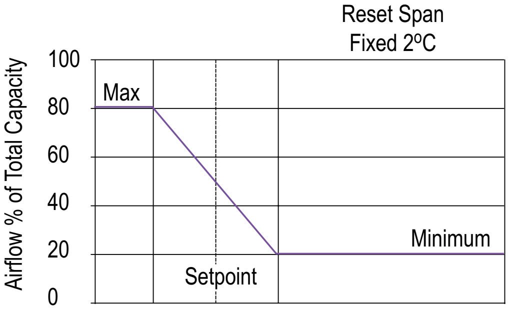
Control Package 1 EL • Cooling Only

The operating sequence for a cooling application is as follows:

1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
2. At a space temperature of 1 °C above thermostat setpoint, the maximum airflow is maintained at a preselected setting.
3. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce airflow.
4. At a space temperature of 1 °C below thermostat setpoint, the minimum airflow is maintained at a preselected setting.
5. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.



Control Package 2 EL • Heating Only

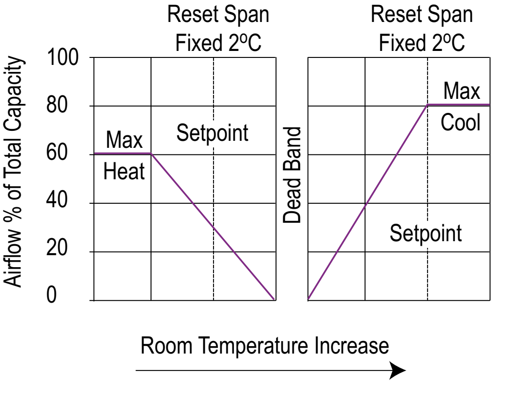


The operating sequence for a heating application is as follows:

1. On a decrease in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
2. At a space temperature of 1 °C below thermostat setpoint, the maximum airflow is maintained at a preselected setting.
3. On a rise in space temperature, the thermostat regulates the controller/actuator to reduce airflow.
4. At a space temperature of 1 °C above thermostat setpoint, the minimum airflow is maintained at a preselected setting.
5. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.

Control Package 3 EL • Cooling/Heating with Auto - Changeover

The heating/cooling thermostat features separate temperature setpoints and separate min./max. velocity limits for heating and cooling operation. The automatic changeover relay energises either the heating or cooling mode of the thermostat in response to the duct temperature. The operating sequence for a heating/cooling application is as follows:



1. At a duct temperature above 24°C, the heating side of the thermostat is energised.
2. On a decrease in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
3. At a space temperature of 1 °C below thermostat heating setpoint, the maximum airflow is maintained at a preselected setting.
4. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
5. At a space temperature of 1 °C above thermostat heating setpoint, the minimum airflow is maintained at a preselected setting.
6. At a duct temperature below 18 °C the cooling side of the thermostat is energised.
7. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
8. At a space temperature of 1 °C above thermostat cooling setpoint, the maximum airflow is maintained at a preselected setting.
9. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce the airflow.
10. At a space temperature of 1 °C below thermostat cooling setpoint, the minimum airflow is maintained at a preselected setting.
11. During both the heating and cooling cycle, airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.

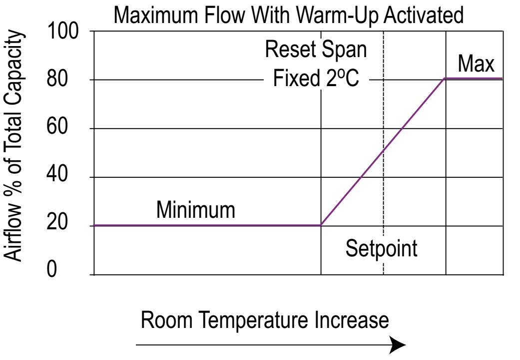
Standard Control Sequences

Single Duct • Analogue Electronic • Pressure Independent

Control Package 4 EL • Cooling With Morning Warm-Up

The operating sequence for a cooling application is as follows:

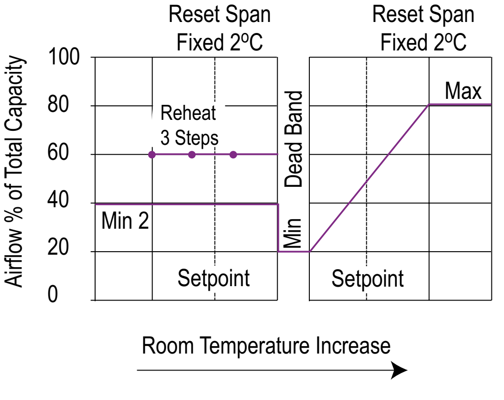
1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
2. At a space temperature of 1°C above thermostat setpoint, the maximum airflow is maintained at a preselected setting.
3. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce airflow.
4. At a space temperature of 1°C below thermostat setpoint, the minimum airflow is maintained at a preselected setting.
5. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.
6. When duct airflow temperature is above 24°C (warm-up cycle), the inlet sensor switches a relay module and the actuator will open the box damper for maximum airflow.



Control Package 5 EL • Cooling with Electric Reheat Plus Auxiliary Minimum Air Volume

The reheat thermostat features a separate temperature setpoint and a separate auxiliary velocity limit for reheat control. The reheat relay energises up to three stages of electric reheat in response to the thermostat. The operating sequence for a reheat application is as follows:

1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow.
2. At a space temperature of 1°C above thermostat setpoint, the maximum airflow is maintained at a preselected setting.
3. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce the airflow.
4. At a space temperature of 1°C below thermostat setpoint, the minimum airflow is maintained at a preselected setting.



5. On a further decrease in space temperature the heating side of the thermostat is activated, automatically initiating the auxiliary velocity limit. Airflow is maintained at the preselected auxiliary setting.
6. The three stages of reheat are energised in sequence in response to the thermostat.
   The first stage is energised 0.5°C above the heating setpoint.
   The second stage is energised 0.5°C below the heating setpoint.
   The third stage is energised 1°C below the heating setpoint.
7. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.

The Following Additional Control Sequences are Also Available:

6 EL • Cooling with Electric Re-heat Plus Morning Warm-up.
7 EL • Cooling with On/Off Hot Water Re-heat.
8 EL • Cooling with Proportional Hot Water Re-heat (controls 0 – 10 Vdc proportional hot water valve supplied by others).
9 EL • Cooling with Time Proportional Hot Water Re-heat (requires the use of a time proportional water valve (optional or by others).
10 EL • Constant Volume Operation.

Suggested Specifications

Single Duct Variable or Constant Volume Terminals - 3000 Series

1.01 Supply and install single duct variable or constant volume terminal units of the sizes and capacities as indicated on the drawings. Units shall be pressure independent with analogue electronic, (or digital electronic) controls. Units shall be as manufactured by Advanced Air (UK) Ltd.

1.02 The entire terminal shall be designed and built as a single unit. The units shall be provided with a primary variable air volume damper that controls the air quantity in response to electronic temperature sensor. The space limitations shall be reviewed carefully to ensure that all units will fit into the space allowed.

1.03 Unit casings shall be manufactured from 18swg. (1.2 mm. thick) galvanised mild steel sheet. Acoustic/thermal lining: the terminal is internally lined with a 25 mm. thick acoustic/thermally insulating foam which is Melamine based, open cellular construction, having a non-woven black tissue facing and complying with class O fire rating. This material is adhered to all internal surfaces.

1.04 Units shall be rated to operate in left hand or right hand mode by turning the unit over. Casing leakage shall not exceed 2% of terminal rated airflow at 125 Pa interior casing pressure. All high pressure side casing joints shall be sealed with an approved sealant and high pressure side casing leakage shall not exceed 2% of terminal rated airflow at 750 Pa.

1.05 Units shall have round inlets for the primary air connections and shall have a 150 mm. deep inlet spigot for field connection. The outlets shall be rectangular and suitable for flanged duct connections. Casing shall have mounting brackets for hanging from concrete slab.

1.06 The damper shall be of rectangular, multiple inclined opposed blade construction and designed to operate on a 45° arc. Blades shall be minimum 18swg. (1.2 mm. thick) galvanised mild steel, single thickness construction with heavy duty gasket glued to the blades. The blades shall be screwed through the damper shaft to ensure that no slippage occurs. Blade shafts shall pivot on corrosion free bearings. Damper leakage shall not exceed 2% of the rated terminal air volume at 750 Pa. inlet static pressure.

1.07 Entire terminal unit shall be factory assembled with (electronic) controls. All components, including all controls except the room mounted temperature sensor and (field wiring) shall be factory installed and mounted with the unit.

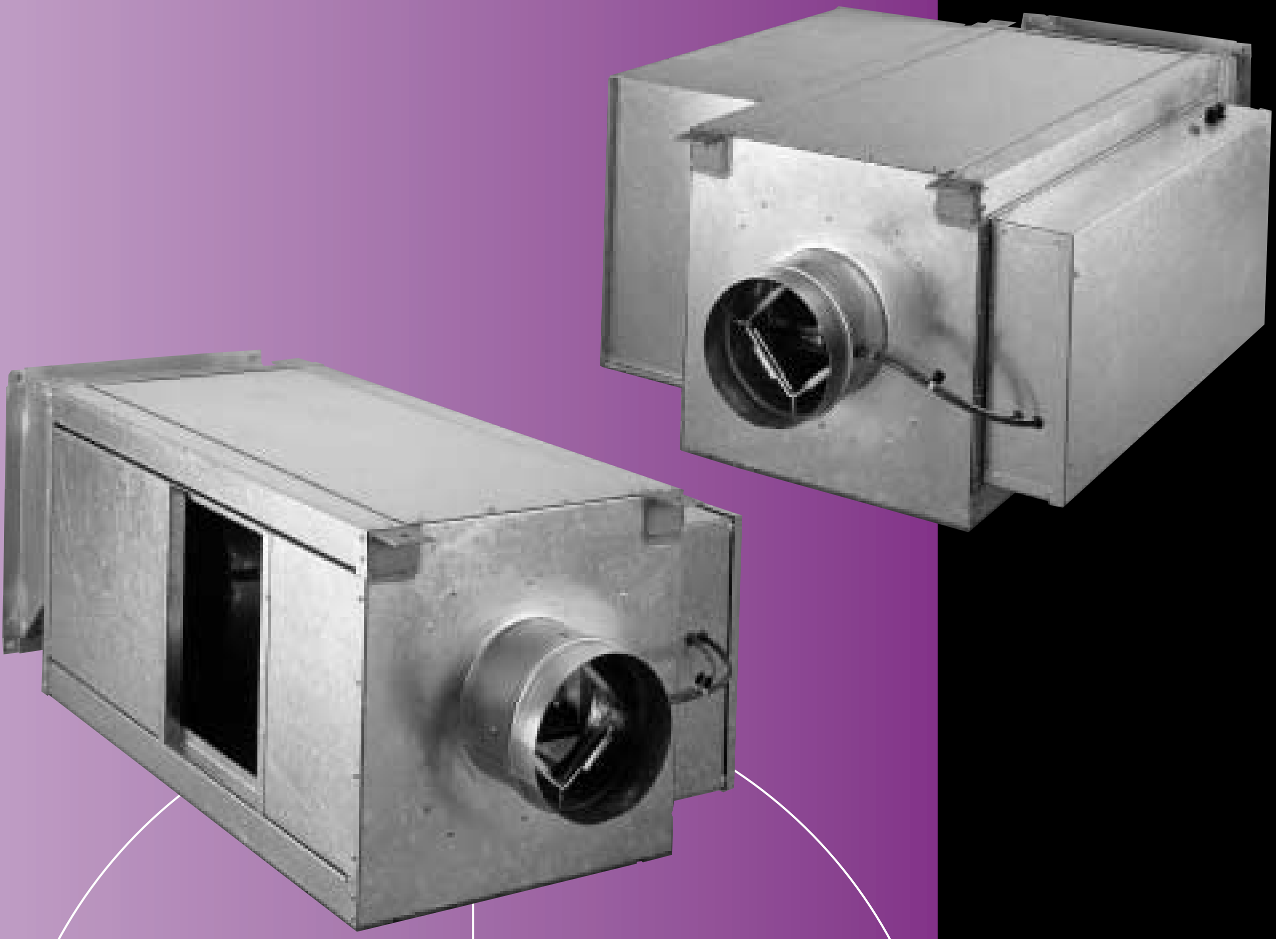
1.08 Provide a (analogue electronic, digital electronic) flow control device that will limit the maximum and minimum airflow to that scheduled on the drawings. Airflow limits shall be factory set. Temperature sensor signal shall reset the flow control device to adjust primary airflow to match load requirements. Control of the terminal unit shall be pressure independent.

1.09 The terminal unit shall be capable of operation as described herein with inlet static pressure of 12 Pa. at full cooling.

1.10 Units shall incorporate a single point electrical connection for the entire unit. All electrical components shall be CE marked. All electrical components shall be mounted in a control box.

1.11 All sound data shall be compiled in an independent laboratory.

Advanced Air



FAN POWERED TERMINALS

Contents

PRODUCT DESIGN AND APPLICATION

Copyright© 2001 by Advanced Air (UK) Ltd. All rights reserved. The information contained in this publication is correct at the time of printing. Continuous product development means that from time to time product specifications and other information will change. The company reserve the right to modify or withdraw any of the products described without prior notice.

Product Overview

Nailor is proud to introduce the next generation of fan powered terminal units – designed to lead the industry.

Providing products that incorporate the desires and requirements of the Building Services industry that we serve, has been a primary focus at Nailor.

Following an extensive and intense period of research, (involving consultation with design engineers and contractors) design and development, we have produced a range of fan powered terminal units that we believe meet the exacting criteria of the Building Services industry.

On the next page, you can see at a glance some of the unique universal features that have been incorporated into the new generation of Nailor fan powered terminals, providing the benefits of high performance operation and many site friendly features to aid installation.

All Nailor terminals include the following additional features as standard:

- Compatibility with analogue electronic and digital controls.
- Factory supplied controls are tested and calibrated before shipment.
- Fan motors and heaters are energised and dielectric tests are performed on every terminal to ensure correct operation prior to shipment.
- Custom fabricated motor/fan combinations are mounted on special 1.6mm thick angles and isolated from casing with rubber insulators.
- All motors incorporate an anti-backward rotation device to prevent backward rotation upon start-up.
- Units can be rotated in the field for right or left hand configuration.

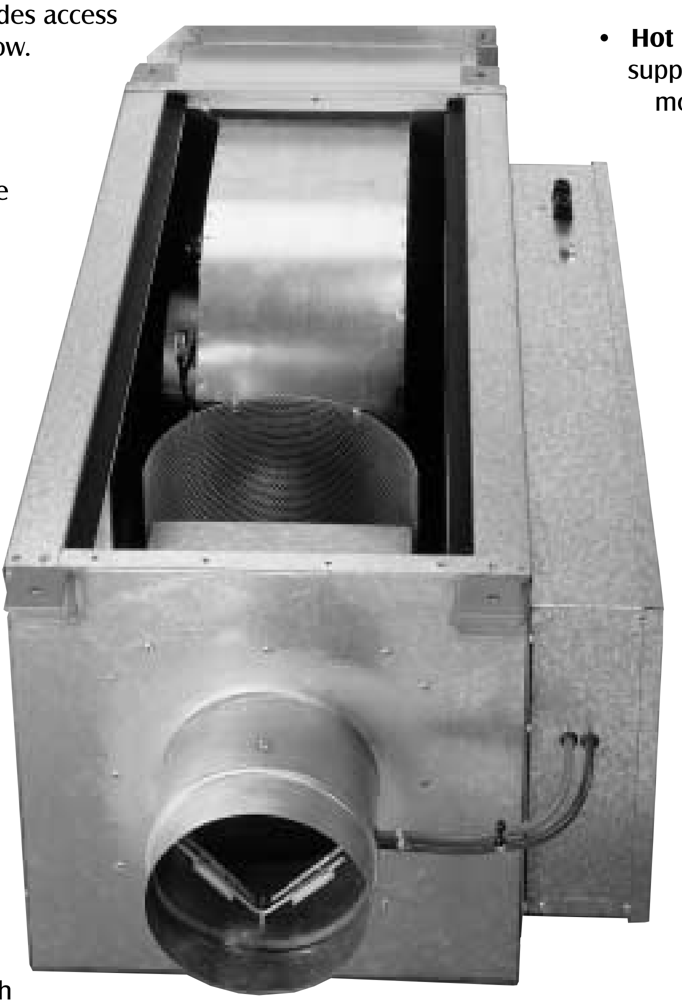
Features

Features common to Series Terminals:

- **18 swg. (1.2mm thick) channel space frame construction.** Provides an extremely rigid terminal.
- **18 swg. (1.2mm thick) Removable Panels** on four sides provides access from above, beside or below.
- **Inclined Opposed Blade Primary Air Damper** minimises noisy turbulence and ensures smooth accurate control.
- **Acoustic/Thermal Lining.** The terminal is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based, open cellular construction, having a non-woven black tissue facing, and complying with Class O fire rating. The material is adhered to all internal surfaces and inside box/channel sections.
- **Solid State Fan Speed Controller** is custom designed by Nailor for each fan size and provides the widest turn-down available for maximum flexibility and accurate primary/induced air balancing.
- **'Diamond Flow' Multi-point Averaging Sensor** provides accurate primary air control.

Features unique to Nailor Series Flow Terminals:

- **Perforated Diffusion Baffle** optimises mixing of primary and induced airflows and improves sound performance.
- **Hot Water Coils** for supplementary heat are mounted at discharge
- **Maintenance Access Panels** on top, bottom and sides are standard.



Design Characteristics and Application

Introduction

Fan Powered Terminal Units are an economical means of both cooling and periodically heating the perimeter zones of a building utilising a single duct control system. In addition to inherent VAV economies, fan powered terminals utilise the free heat derived from lighting, people and other equipment and induce this warmer plenum air from the building core ceiling plenum space and re-circulate it to rooms calling for heating. If additional heating is required, optional supplementary heating coils may be activated. The need for a central source of warm air is eliminated.

During weekend or night-time operation, the central fans may be turned off. Heat, if required, may be provided by the terminal unit fan itself.

Fan Powered Terminal Units are a popular design for office buildings because they provide performance benefits by way of lower first cost, (such as reduced central system fan power and smaller ductwork), lower operating cost, the recovery of waste heat and the capacity for improved air circulation and diffuser performance.

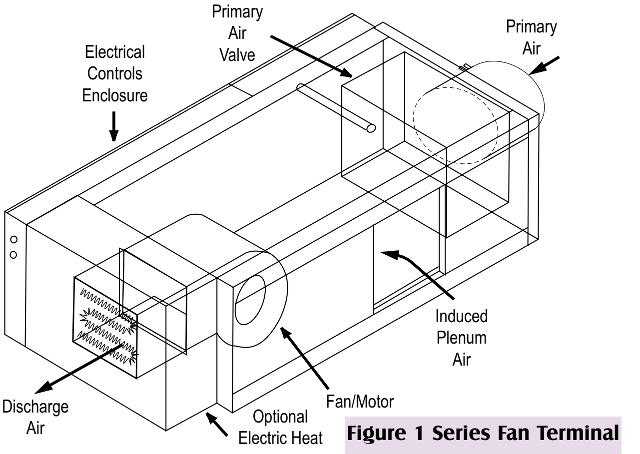


Figure 1 Series Fan Terminal

Fan terminals are configured for series flow, containing a fan motor assembly and a variable air volume damper to modulate primary air.

In a series unit (Fig. 1), the fan sits in the primary airstream and runs constantly when the zone is occupied.

Series fan terminals boost both induced air and primary air, so the inlet static pressure need only overcome the loss across the damper (less than 12.5 Pa with Nailor terminals).

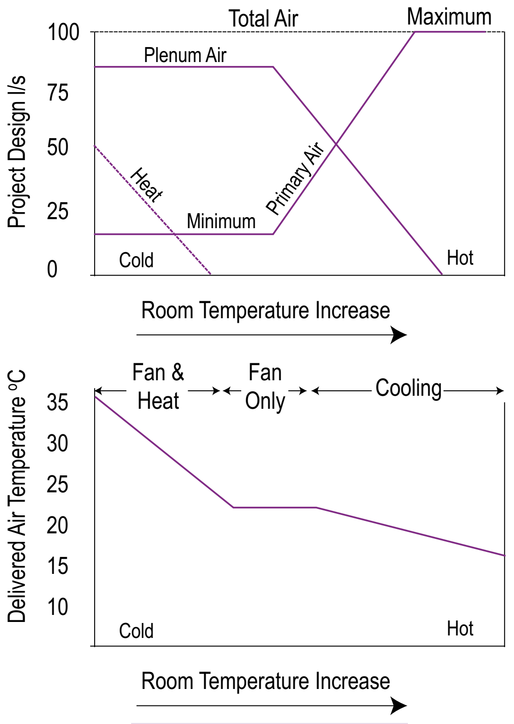


Figure 2 Series Operation

Series Flow Terminals – (Constant Volume)

A series fan powered terminal unit mixes primary air with induced plenum air by using a continuously operating fan during the occupied mode. It provides a constant volume of air to the space regardless of load.

As the cooling load decreases, the zone thermostat throttles the primary air damper. The terminal fan makes up the difference by inducing more return air from the plenum. At low cooling loads, the primary air may close or go to a minimum ventilation setting. If the zone temperature drops still further, the thermostat can energise optional supplemental heat. The sequence reverses when the load is increased.

The series terminal is therefore a constant volume, variable temperature unit. (See Fig. 2).

Series units should only be used with pressure independent controls. Series fans must be adjusted to match the maximum cooling air volume, to ensure that the primary air does not exceed the fan air volume as this would result in the short-circuiting of primary air directly into the ceiling plenum and waste energy. A pressure independent controller and inlet flow sensor controls the primary air damper to compensate for changes in inlet static pressure and ensures design air volume is maintained.

Application

Fan powered terminals are installed in the ceiling return air plenum and take return air from the plenum or have the induction port(s) ducted to the space. For maximum heat pick-up and minimum sound radiation, the assembly should ideally be located in the ceiling cavity, preferably over a corridor, toward the building core.

Careful consideration should be given to both overall sound level and change in sound level in the space. With series terminals the sound remains virtually constant as the fan runs continuously.

When properly applied, the relatively long distance between the fan terminal discharge outlet and the conditioned space it serves minimises any concern about discharge sounds in the space due to the terminal, and only the radiated sound, below the space where it is located, need be considered. Both the primary air damper and fan act as sound sources in both units and each generates discharged and radiated sound. Series units will have the fan sized for the full airflow and downstream resistance.

Fan Powered Induction Systems combine the energy saving diversity of single duct VAV shut-off systems with the additional benefits of heat reclamation. In most climates, fan powered systems are a lower operating cost alternative. Plenum air heating eliminates the inefficiencies inherent in reheating cold primary air. Utilising warmer plenum air allows for recovery of heat from lighting and other heat sources in the building. Fan Powered Terminals move more air through a room at low cooling loads and during heating compared to single duct VAV reheat systems, thereby providing improved air circulation.

EPIC Fan Technology

ECM Motor Control Technology From Nailor

The Diamond sensor is standard on all Nailor VAV terminal units that are equipped with pressure independent controls.
In addition to the "Diamond Flow" multi-point averaging sensor and opposed blade damper configuration of the primary air damper that are described in detail on page G 3 of this catalogue, all Nailor fan powered terminals incorporate the following features and benefits:

Nailor Epic Fan Technology

Nailor's 35SST, 37SST, 35S and 37S series units are all equipped with Nailor's EPIC fan technology. EPIC cuts the energy consumption to the fan by 50 to 67% at typical fan set points (even more at lower set points) while making the motor and fan assembly a completely predictable and programmable pressure independent assembly. Nailor's EPIC option allows the fan discharge air volume to be set at the factory before shipment to the project site or dynamically reset the room demand by the DDC controller. There is as much difference between this motor and an AC induction motor as there is between a DDC controller and a pneumatic controller. EPIC fan technology starts with a smart motor, (a DC electronically commutated motor - ECM) and a fan reset controller. Each motor is equipped with its own AC to DC converter and variable frequency drive. With the reset controller, the motor knows its speed, the amount of torque it is producing and what airflow is required. It can calculate airflow from the known data and automatically adjust its torque and speed to meet the required output regardless of external conditions, even if they are not constant and even if they are constantly changing.

Nailor was the first to introduce this technology to the industry in 1997. It is still revolutionary as it allows fans to be preset at the factory or from the computer terminal, never requiring the commissioning contractor to go into the ceiling void for fan adjustment. Additional features are sealed ball bearings that never require lubrication, slewed speed ramps and soft starts that never apply torque to the mounting hardware, Nailor's EPIC fan technology is industry leading state-of-the-art. It incorporates the highest efficiency and most predictable and controllable motor options in any fractional horsepower application.

In terms of air handling capability, the wider operating range of the ECM motor allows each terminal model equipped with ECM to replace two or more terminal models equipped with induction motors.
This feature alone provides several benefits: a simpler product line to choose from, little or no equipment changes necessary when tenants change, more similar sized terminal units on the project, decreased spare parts inventory and increased contractor flexibility. The lower operating temperature of the ECM motor requires less energy to offset the heat gain from the motor. In addition to all of these standard features, there are two primary benefits - energy savings and the ability to pre-set the fan air volume at the factory.

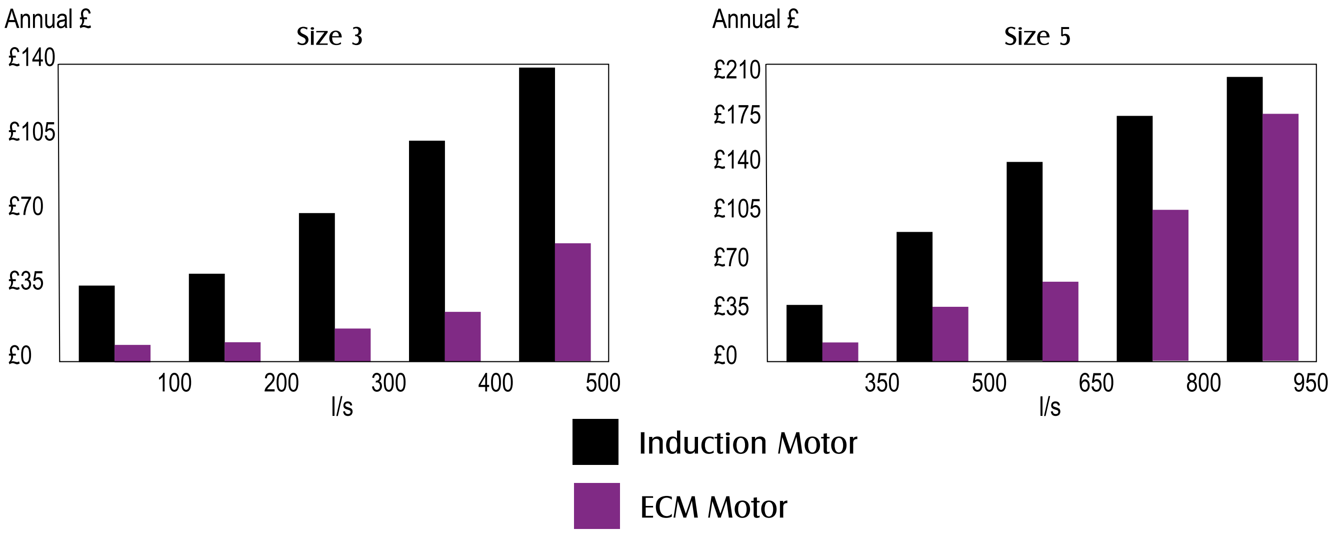
How Do You Pre-Set Fan Air Volume?

Pre-setting the fan air volume has always been a problem for fan powered terminal manufacturers for two main reasons. Firstly, AC motors are not synchronous machines. Secondly, the motor speed (rpm) and consequently the unit air volume changes when static pressure changes. The difficulty in pre-setting the fan air volume lies in estimating the motor workload required at the project under actual operating conditions. The fan will not produce the same volume of air as it did at the factory without the added resistance of the discharge ductwork. Generally as there has been no way to accurately predict the downstream static pressure, as it would exist at the project site, it has been impossible to pre-set the fan air volume. The ECM motors, being DC, are synchronous machines. The motors are programmed to calculate the work that they are doing. By comparing the work accomplished to the actual air volume requirement, the motor adjusts itself to produce a constant air volume. This value can be pre-set on the assembly line at the factory. It is field adjustable by manipulation of a potentiometer with a screwdriver, or more conveniently, a 0-10 volt DC signal from a DDC controller. The importance of this feature is that a commissioning engineer never has to go into the ceiling void to adjust the fan air volume. This relieves the commissioning engineer of a large proportion of his work per zone on fan powered terminal units and associated problems. This feature also removes the uncertainty of diffuser airflow measurements with hood type measuring devices. The fan air volume is guaranteed to be within ± 5% of the factory set value. There is available a factory supplied table indicating air volume related to a 0-10 volt DC signal from a DDC controller to facilitate fan air volume adjustment from a computer terminal when DDC controls are used. This is a great benefit to the building owner, the controls contractor, the mechanical services contractor and the ceiling contractor.

Energy Savings

The following graphs show the energy savings of fan powered terminal units equipped with ECM motors compared to terminal units equipped with Induction (Permanent Split Capacitor) motors.

Operating Costs



The above graphs have been calculated on an operating period of 66 hours per week, with electricity at 70p per kWh.

What is the Payback period on ECM motors compared to induction motors?

The payback period varies, it depends on which terminal unit is used, at what point the air volume is set, the duration of operation of the equipment and how much is being paid for electricity. If the equipment is operated for greater period of time or if electricity cost is higher, then the payback period will change proportionally. Considering the pre-set capability of the motor, there will also be a reduced cost for commissioning. Typically with the operating costs as shown above, the payback period should be between 6 and 18 months.

Low Noise Levels

In addition to those items listed above, Nailor holds down noise levels in the occupied space with heavy gauge metal casings, high quality insulation and multiple isolation points between motors and casings. Notice that the minimum static requirement on series fan powered terminal units is 12 Pa.

Controls - General Information

For a description of individual control components; see the controls overview section of this catalogue.

Analogue Electronic

The analogue electronic controls provide pressure independent control. The components are matched and calibrated and provide regulated airflow in response to the electronic room temperature sensor/controller, which is furnished as a part of the control package. Minimum and maximum airflow settings are adjusted at the temperature sensor/controller, using a digital voltmeter. It is not necessary to adjust flow setting at the terminal in the ceiling space.

The new range of Nailor analogue electronic controls utilise the 'Diamond Flow' multi-point averaging sensor as standard for accurate flow measurement.

The electronic temperature sensor/controller has a fixed 1˚C proportional band regardless of minimum or maximum velocity setpoints and provides a linear reset function. The electronic controller/actuator features an on-board flow transducer.

Electric actuators are not spring return devices (there is no normally open or normally closed action). If there is a loss of power to the terminal, the damper will remain in the position it was in at the time of power failure. All electric components use low voltage (24 volt) controls. A step down transformer is provided as standard.

Direct Digital Controls

Nailor Fan Powered Terminals are generic in nature and compatible with all DDC controls currently available.

The 'Diamond Flow' multi-point averaging flow sensor can be supplied and mounted if required.

Controls may be factory mounted and wired or field installed by the controls contractor.

A 24 volt control transformer and fan relay are provided as standard on all fan powered terminals intended for use with digital controls.

Control Operation • Series Flow (Constant Volume) • Models 35S and 35SST

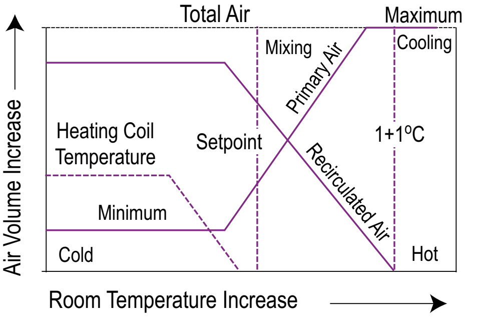
Pressure Independent

Occupied Cycle

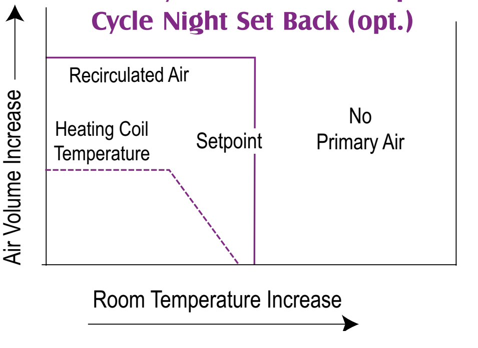
1. The series terminal fan is directly or indirectly interlocked and energised before or when the central system starts up.

   Nailor recommends that the terminal fan is indirectly interlocked by means of an airflow switch (optional) which senses primary air pressure at the inlet. Upon central system start up, the fan in the terminal is automatically energised.
2. On a rise in room temperature, the temperature sensor/controller sends a signal to increase the flow of cold primary air.
3. As more cold air is supplied to the fan section, less warm air is induced from the ceiling space or plenum.
4. When the room temperature exceeds the setpoint by 1°C or more, cold airflow is maintained at the maximum setting. The maximum setting is the same as the total fan volume setting.
5. On a decrease in room temperature, the temperature sensor/controller sends a signal to decrease the flow of cold primary air.
6. As less cold air is supplied to the fan section, more warm air is induced from the ceiling space.
7. When the room temperature and temperature sensor/controller output signal reach the setpoint, the cold airflow is at its minimum limit (usually zero) and the fan is supplying the maximum volume of induced air.
8. If room temperature continues to drop, an optional heating coil may be energised.
9. When the optional airflow switch is supplied, and the central system is turned off (night-time or weekend), the series terminal fan is shut down upon loss of primary air.

Central System On - Occupied Cycle



Central System Off - Unoccupied Cycle Night Set Back (opt.)



Analogue Electronic Sequence	Code	Analogue Electronic Sequence	Code
Cooling (continuous operation)	A1	Cooling with night shutdown	B1
Cooling with morning warm up (continuous operation)	A2	Cooling with morning warm up and night shutdown	B2
Cooling with electric or on-off hot water heat (continuous operation)	A3	Cooling with electric or on-off hot water heat and night shutdown	B3
Cooling with proportional hot water heat (continuous operation)	A4	Cooling with proportional hot water heat and night shutdown	B4
Cooling with night cycle	A5	Cooling with night temp. set-back cycle	B5
Cooling with morning warm up and night cycle	A6	Cooling with morning warm up and night temp. set-back cycle	B6
Cooling with electric or on-off hot water heat and night cycle	A7	Cooling with electric or on-off hot water heat and night temp. set-back cycle	B7
Cooling with proportional hot water heat and night cycle	A8	Cooling with proportional hot water heat and night temperature set-back cycle	B8

Electric Heater Batteries - Application Guidelines

Discharge Air Temperature

When considering the capacity and airflow for the heater, discharge air temperature can be an important factor. Rooms use different types of diffusers, and they are intended to perform different functions. Slots that mix the air at the glass and set up air curtains within the room, must be able to discharge the air to low level in the room. Hot air will be too buoyant to be effective in this case. Discharge air temperatures for this application should be in the 29 – 32˚C range.

Diffusers in the centre of the room mix their discharge air as it crosses the ceiling. Discharge air temperatures in this application can be as high as 41˚C and still be effective. However, if the return air grilles are in the discharge air pattern, the warm air will be returned to the plenum before it heats the room. Again, the air temperature needs to be mixed to an acceptable temperature that can be forced down into the occupied space by the time the air gets to the walls. Discharging warm air into the room at temperatures above 41˚C usually will set up stratification layers and will not keep the occupants warm if there is a ceiling return because only the top 300 – 600 mm of the room will be heated.

The maximum approved discharge air temperature for any Nailor Fan Powered VAV Terminal Unit with supplemental heat is 39˚C. No heater should be allowed to exceed this temperature.

Electric Heater Selection

To properly select an electric heater, three things must be determined: the heat requirement for the room, the entering air temperature and the desired discharge air temperature. The heat requirement for the room is the sum of the heat loss calculation and the amount of heat required to raise the entering air temperature to the desired room temperature. Usually, the second item is small compared to the first for fan powered terminal units in a return air plenum. The heat required to raise the return air temperature can be calculated from the following equation:

$$kW = m^3/s \times 1.02 \times 1.2 \times \Delta t$$

Next, the desired discharge air temperature should be ascertained. This will depend on the type of diffusers that are in the room.

The desired heating airflow for the room can then be calculated using the following equation:

$$m^3/s = \frac{kW}{1.2 \times 1.02 \times \Delta t}$$

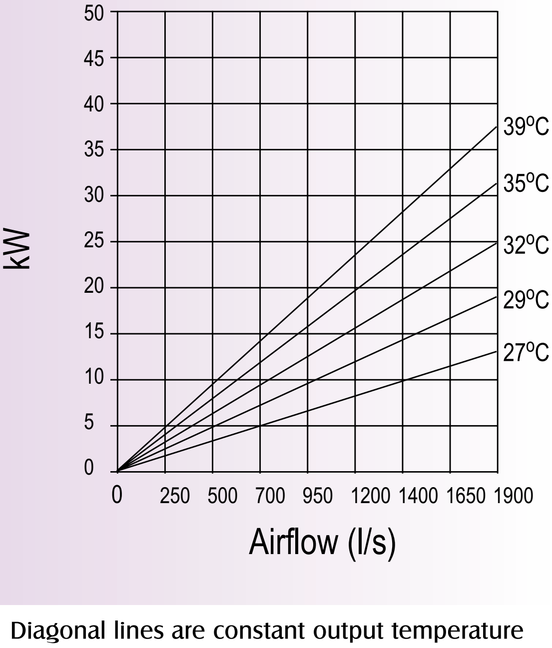
Assuming 21˚C supply air temperature to the heater, the room airflow can be selected directly from the chart. Start at the left at the design kW. Move horizontally to the desired discharge air temperature. Then, move vertically down to the air volume at the bottom of the chart.

The kW can be selected directly from the chart. Start at the bottom with the design air volume into the room. Move vertically up to the line that represents the desired discharge air temperature. Then, move left to the kW.

The discharge air temperature can also be selected directly from the chart. Start at the bottom with the design air volume into the room. Move to the left side of the chart and find the design kW. Move horizontally and vertically into the chart until the lines intersect. The intersection will be the desired discharge air temperature. Interpolation between the curves is linear.

Heater Selection Chart

Assuming 21°C inlet air temperature at heater



Diagonal lines are constant output temperature

Recommended Selection:

The table below is a quick reference guide, to illustrate the relationship between electrical power supply, heater capacity in kilowatts and terminal unit size that are available for Nailor Fan Powered Terminals.

- Digital control terminals are available with up to 3 stages of heat. Analogue electronic control terminals are available with 1 or 2 stages of heat only. A minimum of 4 kW is required for 3 stages.
- Voltage and kilowatt ratings are sized so as not to exceed 48 amps.
- A minimum airflow of 33 l/s per kW is required for any given terminal in order to avoid possible nuisance tripping of the thermal cutouts.
- Discharge air temperature should not exceed 39˚C.

Optional Accessories:

- Door interlocking disconnect switch.
- Power circuit fusing.
- Dust tight control enclosure.

Unit Size	Maximum Kilowatts 230v 1 Phase	415v 3 Phase
3	8.0	11.5
5	8.0	20.5
7	8.0	32.5

Suggested Specifications

Series Flow (Constant Volume) Fan Powered Terminals – Models 35S/SST & 37S/SST

1.01 Supply and install constant volume series fan powered terminal units of the sizes and capacities as indicated on the drawings. Units shall be pressure independent with analogue electronic, (or digital electronic) controls. Units shall be manufactured by **Advanced Air UK Limited** Models **35S, 37S, 35SST, 37SST**.

1.02 The entire terminal unit shall be designed and built as a single unit. The units shall be provided with a primary variable air volume damper that controls the air quantity in response to a (pneumatic, electronic) temperature sensor. The space limitations shall be reviewed carefully to ensure that all units will fit into the space allowed.

1.03 Unit casings shall be space frame construction utilising 18swg. (1.2mm thick) galvanised steel corner structural members and galvanised steel panels. Acoustic/thermal lining: the terminal is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based, open cellular construction, having non-woven black tissue facing and complying with class O fire rating. This material is adhered to all internal surfaces and inside box/channel sections.

1.04 Unit casing shall have four access panels, one on each side of the unit and one on the bottom and top for easy access to motor and fan assembly and for maintenance and replacement of parts without disturbing duct connections. The unit shall be rated to operate in left hand or right hand mode by turning the unit over. Access panels shall be attached to casing with (screws, quick acting latches, hinges). Casing leakage shall not exceed 2% of terminal rated airflow at 125 Pa interior casing pressure. All high pressure side casing joints shall be sealed with approved sealant and high pressure side casing leakage shall not exceed 2% of terminal rated airflow at 750 Pa.

1.05 Units shall have round inlets for the primary air connections and shall have a 150mm deep inlet duct spigot for field connection. The outlets shall be rectangular and suitable for flanged duct connections. Casing shall have mounting brackets for hanging from a concrete slab.

1.06 The damper shall be of rectangular, multiple inclined opposed blade construction and designed to operate on a 45° arc. Blades shall be minimum 18 swg. (1.20mm thick) galvanised steel, single thickness construction with heavy duty gasket glued to the blades. The blades shall be screwed through the damper shaft to ensure that no slippage occurs. Blade shafts shall pivot on corrosion free bearings. Damper leakage shall not exceed 2% of the terminal rated air volume at 750 Pa inlet static pressure.

1.07 Entire terminal unit shall be factory assembled with (electronic) controls. All components including all controls except the room mounted temperature sensor and (field wiring) shall be factory installed and mounted with the unit.

1.08 Provide a (analogue electronic, digital electronic) flow control device that will limit the maximum and minimum airflow to that scheduled on the drawings. Airflow limits shall be factory set. Temperature sensor signal shall reset the flow control device to adjust primary airflow to match load requirements. Control of the terminal unit shall be pressure independent.

1.09 The terminal unit shall be capable of operation as described herein with inlet static pressure of 12 Pa at full cooling with no mixing of induced and primary air. (The sequence of operation should be described here, if not part of the temperature controls specifications). Mixing of the primary and secondary airstreams shall be such that no more than 0.5° C variation shall exist in the discharge airstream for each 11° C of difference between the primary and secondary airstreams.

1.10 Fan casings shall be constructed of heavy gauge coated steel. Fan wheel shall be forward curved centrifugal type, dynamically balanced and driven by direct drive motors. Motors shall be suitable for 240 volts single phase power. Motors shall have bearings capable of low rpm oiling, permanently oiled bearings and a built-in anti-backward rotation device. Fan assembly shall be mounted so as to isolate the casing from the motor and fan vibration at no less than four points. Isolation shall be supplied at the motor and at the fan mounting points.

1.11 An electronic motor speed controller sized and designed for the specific fan motor combination shall be provided to allow infinitely adjustable fan speed from the minimum voltage stop to the line voltage signal to the motor. A minimum voltage stop shall be employed to ensure that the fan cannot run in stall mode.

1.12 Units shall incorporate a single point electrical connection for the entire unit. All electrical components shall be CE marked. All electrical components shall be mounted in a control box.

1.13 All sound data shall be compiled in an independent laboratory

35SST Series Only

1.14 Unit shall be complete with an integral induction port attenuator - (Stealth), manufactured from 18swg. (1.2mm thick) galvanised mild steel sheet, folded into a rectangular casing and being integrated into the terminal unit side panel. The complete assembly of side panel and induction port attenuator shall be removable as one-piece. The induction port attenuator is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based, open cellular construction, having a non-woven black tissue facing, complying with class O fire rating. This material is adhered to all internal surfaces.

Suggested Specifications

Series Flow (Constant Volume) Fan Powered Terminals – Models 35S/SST & 37S/SST

Air Flow Controls

Analogue Electronic Controls (Pressure Independent)

2.01 The terminal unit manufacturer shall provide pressure independent analogue electronic controls which can be reset to modulate airflow between zero and the maximum catalogued capacity. Each terminal shall be equipped with labels showing unit size, location and minimum and maximum airflow settings. Controls shall be factory calibrated and set for the scheduled minimum and maximum flow rates.

2.02 Each unit shall be supplied with a Nailor Diamond flow sensor with four pick-up points on each side to ensure that controller accuracy shall be within ± 5% of set volume under various same size duct inlet conditions and inlet static variation of 12 – 1500 Pa. Flow measuring taps shall be furnished with each terminal.

2.03 The velocity controller shall have a constant 1.0°C reset span regardless of minimum and maximum airflow limits. It shall include an onboard flow-through transducer utilising twin platinum resistance temperature detectors and shall be capable of controlling a velocity setpoint from 0 - 16.5 m/s with an accuracy of 3%. The controller shall allow all airflow adjustments to be made from the matching mounted temperature sensor.

2.04 The terminal shall have a 24 VAC combination controller/actuator single assembly. The actuator shall be of a direct drive design and provide a minimum torque of 8 Nm. the actuator shall be of the floating reversible type and include a magnetic clutch, adjustable stops and a gear disengagement button.

2.05 The terminal manufacturer shall provide a Class 2, 24 Vac control transformer with internal current limiting protection. All controls shall be installed in an approved IP21 enclosure.

Digital (DDC) Controls (Pressure Independent) Factory Mounting Procedure

2.11 The terminals shall be equipped with pressure independent direct digital controls supplied by the controls contractor and mounted by the terminal unit manufacturer. The controls contractor shall, in addition to sending the controls to the terminal unit manufacturer, provide technical data sheets for all components to be mounted, including dimensional data, mounting hardware and method, as well as application specific wiring and piping diagrams for each terminal type as depicted on the schedules and mechanical drawings.

2.12 Controls shall be compatible with the pneumatic 'Diamond Flow' multi-point averaging flow sensor supplied by the terminal manufacturer. The sensor shall have four pick-up points on each side to ensure that controller accuracy shall be ± 5% of set volume with any typical air turbulence in the duct and any typical flex inlet condition and with an inlet static variation of 12 – 1500 Pa. The sensor shall amplify the sensed velocity pressure and provide a minimum differential pressure of 7.5 Pa at 2.50 m/s inlet velocity. Flow measuring taps and flow curves shall be furnished with each terminal.

2.13 Controls shall be configured and field calibrated in the field by the controls contractor after terminal installation has been completed. Each terminal shall be supplied with a label showing unit type, model number, size and location.

2.14 The terminal manufacturer shall provide a 24 Vac control transformer with internal current limiting protection and disconnect switch. All controls shall be installed in an approved IP21 enclosure supplied and installed by the terminal manufacturer.

Advanced Air

35S Series Fan Powered Terminals

Contents

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Series Flow Constant Volume Model 35S - Quiet Operation

Models:

35S **Cooling Only**

35SE **Electric Heat**

35SW **Hot Water Heat**

The **Model 35S** provides many standard design features and superior sound performance when compared with other basic model designs. The **35S** offers a compact and economical design well suited to the majority of applications.

Features:

- Unique 18 swg (1.2mm thick) galvanised steel channel space frame construction provides extreme rigidity and 18 swg casing components.
- 1.2mm thick galvanised steel inclined opposed blade primary air damper operating on a 45° arc.
- Unique perforated baffle on primary air discharge optimises mixing with induced air for rapid and effective temperature equalisation. The baffle also converts low frequency primary air damper generated sound into more readily attenuated higher frequencies.
- Pressure independent primary airflow control.
- Multi-point averaging flow sensor.
- Terminal may be field installed either way up, providing the additional flexibility of right or left field connections.
- Access panels on three sides of terminal for ease of maintenance and service to motor and fan from below or from the side of unit.
- Energy saving Nailor EPIC fan technology
- Motor fan assembly mounted on special 1.6 mm thick angles and isolated from casing with rubber isolators.
- Removable door on controls enclosure
- Acoustic/thermal lining - the terminal is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based open cellular construction, having a non-woven black tissue facing and complying with class O fire rating. This material is adhered to all internal surfaces and inside box/channel sections.
- Available with electric or hot water supplementary heat.
- All controls are mounted on exterior of terminal providing ready access for field adjustment.
- Each terminal factory tested prior to shipment.
- Single point electrical connections.
- Discharge opening designed for flanged duct connection.

QUALITY SYSTEM CERT.NO. FM1714
ASSESSED TO BS EN ISO 9002

Controls

- Analogue electronic controls. Factory supplied, mounted and calibrated.
- Digital controls. Factory mounting and wiring of DDC controls supplied by BMS Controls Manufacturers.

Options & Accessories

- Induced air filter
- Fan disconnect switch (except units with electric heat, when disconnect is an electric heat option and includes fan).
- Melinex liner
- Solid metal inner liner.
- Perforated metal liner.
- Fan airflow switch for night shutdown (analogue electronic controls).
- Night setback fan/heat cycle (analogue).
- Fan mounted total air sensor.
- Induced air attenuator.
- Top entry induced air inlet

Recommended Primary Airflow Ranges for Fan Powered Terminal Units

The recommended airflow ranges below are for terminal units with pressure independent controls. For a given unit size, the minimum and the maximum flow settings must be within the range limits to ensure pressure independent operation, accuracy and repeatability. For these reasons, factory settings will not be made outside these ranges. A minimum setting of zero (shut-off) is also available.

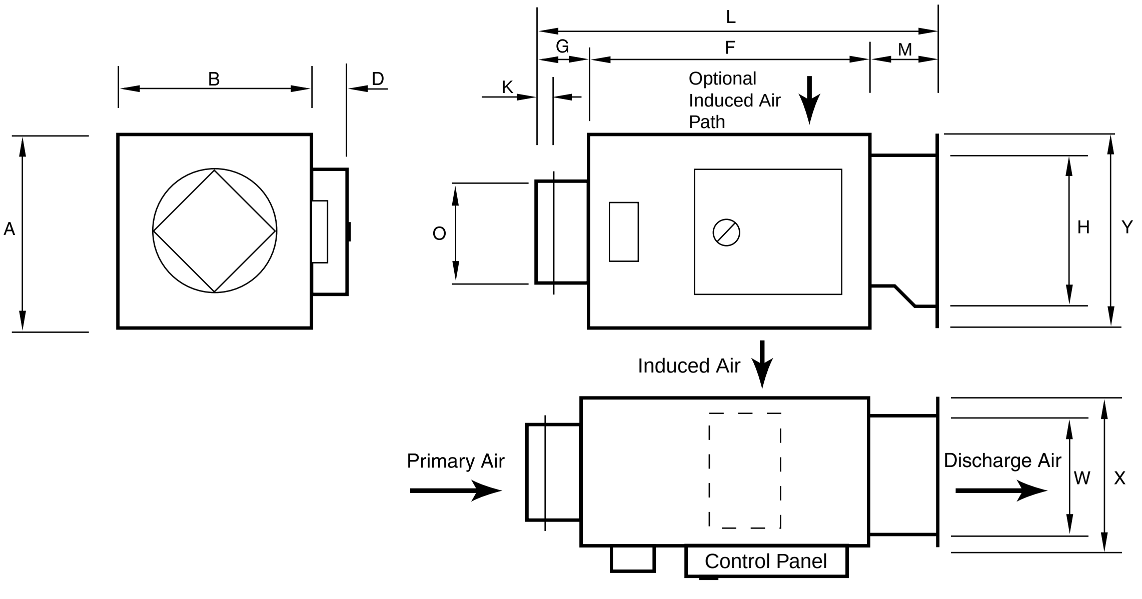
When digital or other controls are factory mounted, but supplied by others, these values are guidelines only, based upon experience with the majority of controls currently available. Controls supplied by others for factory mounting are configured and calibrated in the field.

For a detailed analysis of fan powered terminal selection procedures with working examples, consult the engineering section of this catalogue

Air Volume Range

Unit Size	Inlet Spigot dia mm	Min l/s	Max l/s
3	150	0	236
3	200	0	330
3	250	0	520
5	250	0	520
5	315	0	750
5	355	0	900
7	400	0	1400
7	450	0	1700

Model 35 S - Series Flow - Size 3



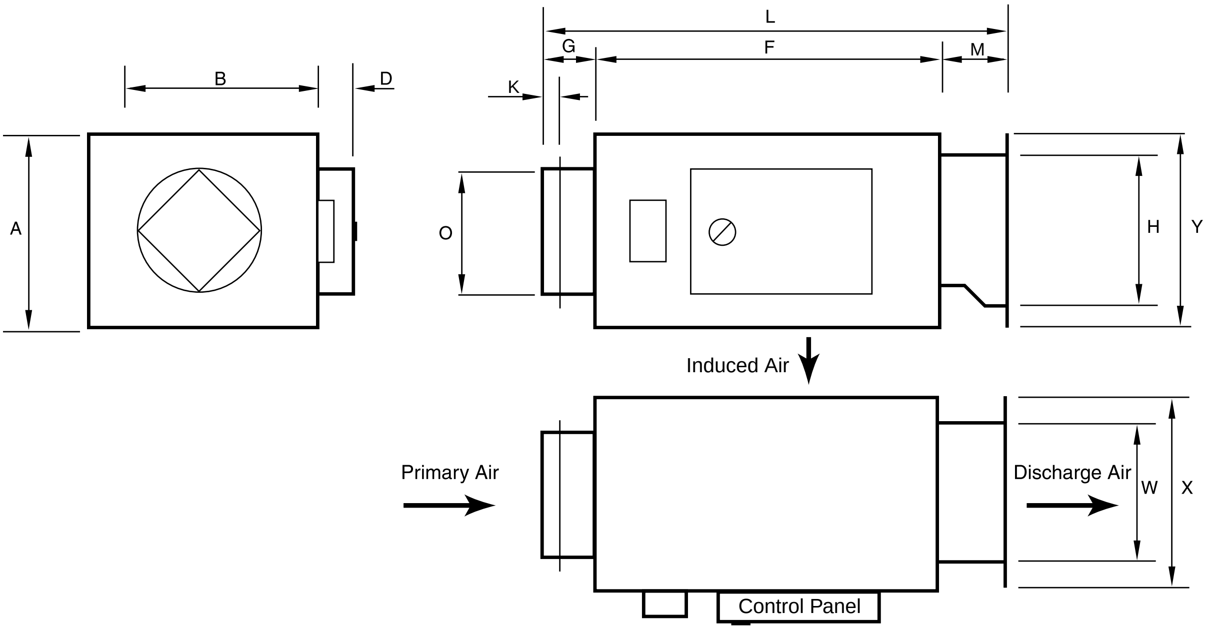
Model 35 S Size 3 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	D mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
3-150	146	470	470	100	914	150	40	175	1238	400	400	460	460	70.0
3-200	196	470	470	100	914	150	40	175	1238	400	400	460	460	70.0
3-250	246	470	470	100	914	150	40	175	1238	400	400	460	460	70.0

'Q' Option - Induced Air Inlet Attenuator

This acoustically lined accessory is designed to deflect radiated sound upward and away from the ceiling, eliminating any direct sound path from the terminal to the occupied space. Radiated sound is diffused within the ceiling cavity and the decay that occurs as a result due to the ceiling plenum effect allows up to an additional 5 dB to be taken from radiated sound power levels. A minimum clearance of 150mm must be provided above the unit, so that induced airflow is not impeded.

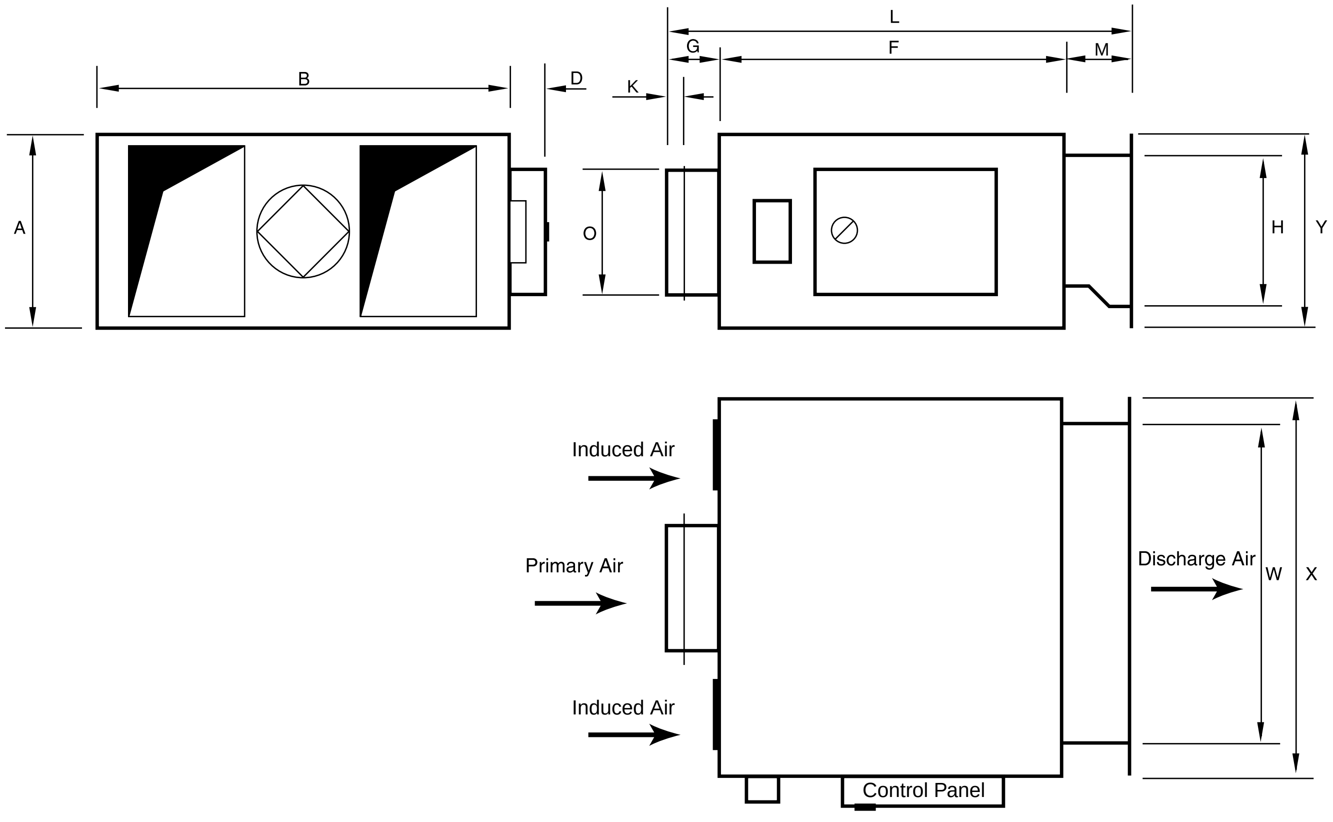
Model 35 S - Series Flow - Size 5



Model 35 S Size 5 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	D mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
5-250	246	470	670	100	1050	150	40	175	1375	600	400	660	460	82.5
5-315	311	470	670	100	1050	150	40	175	1375	600	400	660	460	82.5
5-355	351	470	670	100	1050	150	40	175	1375	600	400	660	460	82.5

Model 35 S - Series Flow - Size 7



Model 35 S Size 7 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	D mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
7-400	396	470	1321	100	1050	150	40	175	1375	1200	400	1260	460	165.0
7-450	513x352	470	1321	100	1050	150	40	175	1375	1200	400	1260	460	165.0

Model 35S • Series Flow • Acoustic Data

Radiated NC Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	NC Levels @ Inlet Pressure (DPs) shown					
			Fan Only	Minimum ΔPs	125 Pa.	250Pa.	375 Pa.	500Pa.
3-200	330	12	21	21	24	31	35	38
3-200	283	12	21	21	23	29	33	36
3-200	212	12	-	-	21	27	32	33
3-250	519	12	27	27	29	33	36	40
3-250	425	12	25	24	26	32	35	38
3-250	330	12	-	-	22	28	34	37
3-250	212	12	-	-	-	24	32	34
5-315	755	12	36	34	35	36	40	43
5-315	661	12	34	30	33	35	40	42
5-315	566	12	31	28	28	34	34	41
5-315	495	12	28	24	26	33	36	40
5-400	909	12	38	36	38	39	42	45
5-400	802	12	34	31	35	37	41	43
5-400	661	12	31	30	31	35	40	42
5-400	496	12	28	21	26	34	36	41
7-400	1440	45	45	42	44	44	49	52
7-400	1274	35	42	39	41	42	45	47
7-400	1080	25	40	36	35	39	42	45
7-400	944	17	36	32	34	37	40	44
7-450	1723	12	46	45	46	47	49	51
7-450	1534	12	43	41	44	45	46	48
7-450	1227	12	40	38	40	41	42	45
7-450	944	12	36	30	34	36	38	40

Performance Notes

1. Application data is based on procedures and factors found in the ARI Standard 885-98; 'Procedure for estimating occupied space sound levels in the application of air terminal units and outlets'.
2. Min. inlet ΔPs is the minimum operating pressure of the primary air damper.
3. Dash (–) in space denotes an NC level of less than 20.
4. Discharge (external) static pressure is 63 Pa in all cases.

Performance Data Series Flow (Constant Volume) Radiated Sound Power Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa							Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown																													
			Fan Only						Min. ΔPs OBCF -Hz.						125 Pa. ΔPs OBCF -Hz.						250Pa ΔPs OBCF -Hz.						375Pa ΔPs OBCF -Hz.						500Pa ΔPs OBCF -Hz.					
			125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
3-200	330	12	62	52	52	46	43	39	63	53	52	46	44	39	65	56	54	52	52	50	66	59	57	55	58	59	68	61	60	58	61	64	69	65	62	60	64	67
	283	12	61	51	51	44	42	37	61	52	51	45	41	37	63	55	53	50	52	50	65	58	56	54	58	58	66	61	59	57	61	63	67	63	60	59	63	65
	212	12	55	43	49	40	37	31	57	48	48	40	36	30	59	51	50	48	49	48	60	54	53	51	55	54	63	57	56	56	60	60	63	59	58	58	61	61
3-250	519	12	68	59	57	52	51	47	67	60	57	52	51	47	69	62	59	56	57	55	71	65	61	58	61	61	72	65	64	61	64	65	68	68	65	63	66	68
	425	12	66	55	54	49	46	42	64	56	54	48	46	42	66	58	56	53	54	52	68	60	59	56	60	60	70	64	62	60	63	64	68	66	63	61	65	67
	330	12	60	52	51	44	41	36	58	51	50	43	40	36	61	55	53	50	51	48	64	59	56	54	57	57	65	60	59	57	61	62	66	62	60	59	64	66
	212	12	54	48	48	39	35	28	55	47	48	39	34	27	56	50	49	46	48	45	58	55	53	51	56	55	59	56	55	54	59	60	62	58	57	59	61	62
5-315	755	12	75	66	58	53	51	48	73	65	58	52	50	48	74	69	64	59	62	64	74	69	64	59	62	64	75	70	67	63	64	68	76	73	69	65	66	71
	661	12	73	62	55	50	47	44	70	61	55	48	46	44	72	65	60	54	56	55	73	67	63	58	61	63	73	70	66	61	64	68	74	72	68	64	65	70
	566	12	71	60	53	47	45	41	68	58	52	46	43	40	67	62	57	52	55	54	70	65	61	58	60	62	71	67	64	60	63	66	72	70	66	62	64	69
	495	12	68	56	50	44	41	37	65	55	50	43	39	36	66	60	55	50	54	53	67	63	59	56	60	61	70	66	62	58	62	65	71	69	65	61	64	68
5-355	909	12	76	71	61	57	56	53	75	69	62	58	55	53	76	71	64	59	61	61	77	72	66	61	64	66	77	73	67	63	66	70	78	75	69	65	67	73
	802	12	73	67	59	54	52	50	72	65	59	53	51	49	74	68	61	56	59	59	75	70	64	59	63	66	75	71	65	61	64	69	76	72	67	63	66	71
	661	12	71	64	56	50	48	46	69	61	55	49	46	44	71	65	58	54	57	57	72	67	61	57	62	64	73	67	63	59	64	68	73	70	64	61	65	70
	496	12	68	57	50	44	41	37	63	55	50	43	40	37	66	59	53	50	55	53	68	62	57	54	60	62	69	64	59	56	62	65	69	66	62	59	64	69
7-400	1440	12	78	69	61	56	54	51	76	68	61	55	53	51	77	70	66	59	61	60	77	72	67	62	65	67	81	76	73	69	70	74	82	79	75	71	72	77
	1274	12	76	65	58	53	50	47	73	64	58	51	49	47	75	68	63	57	59	58	76	70	66	61	64	66	78	73	69	64	67	71	77	75	71	67	68	73
	1080	12	74	63	56	50	48	44	71	61	55	49	46	43	70	65	60	55	58	57	73	68	64	61	63	65	74	70	67	63	66	69	75	73	69	65	67	72
	948	12	71	59	53	47	44	40	68	58	53	46	42	39	69	63	58	53	57	56	70	66	62	59	63	64	73	69	65	61	65	68	74	72	68	64	67	71
7-450	1723	12	79	74	64	60	59	56	78	72	65	61	58	56	79	74	67	62	64	64	80	75	69	64	67	69	80	76	70	66	69	73	81	78	72	68	70	76
	1534	12	76	70	62	57	55	53	75	68	52	56	54	52	77	71	64	59	62	62	78	73	67	62	66	69	78	74	68	64	67	72	79	75	70	65	69	74
	1227	12	74	67	59	53	51	49	72	64	58	52	49	47	74	68	61	57	60	60	75	70	64	60	65	67	76	70	66	62	68	71	76	73	67	64	68	73
	944	12	71	60	53	47	44	40	66	58	53	46	43	40	69	62	56	53	58	56	71	65	60	57	63	64	72	67	62	59	65	68	72	69	65	62	67	72

1. Discharge (external) static pressure is 63 Pa in all cases. It is the difference (ΔPs) in static pressure from terminal discharge to the room.
2. Radiated sound power is the breakout noise transmitted through the unit casing walls and induction port.
3. Sound power levels are in decibels, dB re 10^{-12} watts.
4. All sound data listed by octave bands is raw data without any corrections for room absorption or duct attenuation.
5. Min. inlet ΔPs is the minimum operating pressure of the primary air damper section.
6. Data derived from independent tests conducted in accordance with ANSI/ASHRAE Std. 130-1996 and ARI Standard 880-98.

Model 35S • Series Flow • Acoustic Data

Discharge NC Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	Fan Only	NC Levels @ Inlet Pressure (DPs) shown Minimum DPs	125 Pa.	250Pa.	375 Pa.	500Pa.
3-200	330	12	-	-	-	-	-	-
3-200	283	12	-	-	-	-	-	-
3-200	212	12	-	-	-	-	-	-
3-250	519	12	-	-	-	-	-	-
3-250	425	12	-	-	-	-	-	-
3-250	330	12	-	-	-	-	-	-
3-250	212	12	-	-	-	-	-	-
5-315	755	12	-	-	-	-	-	-
5-315	661	12	-	-	-	-	-	-
5-315	566	12	-	-	-	-	-	-
5-315	495	12	-	-	-	-	-	-
5-355	909	12	22	22	23	24	24	24
5-355	802	12	20	-	20	20	20	20
5-355	661	12	-	-	-	-	-	-
5-355	496	12	-	-	-	-	-	-
7-400	1440	45	31	29	31	33	31	32
7-400	1274	35	28	27	28	28	29	29
7-400	1080	25	25	25	25	25	25	26
7-400	944	17	20	20	20	20	20	22
7-450	1723	12	36	36	36	37	37	33
7-450	1534	12	34	32	34	34	34	34
7-450	1227	12	29	27	28	28	28	29
7-450	944	12	20	20	21	20	20	22

Performance Notes

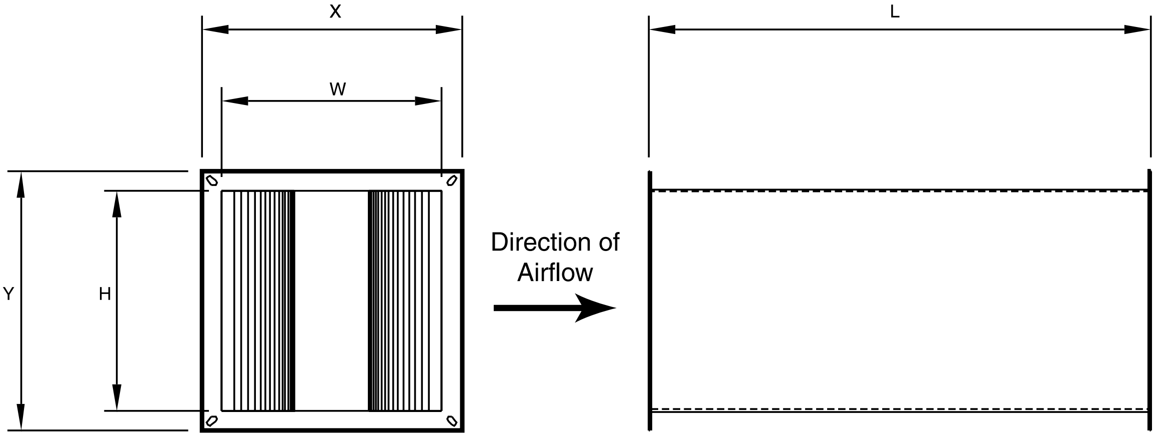
1. Application data is based on procedures and factors found in the ARI Standard 885-98; 'Procedure for estimating occupied space sound levels in the application of air terminal units and outlets'.
2. Min. inlet ΔPs is the minimum operating pressure of the primary air damper.
3. Dash (–) in space denotes an NC level of less than 20.
4. Discharge (external) static pressure is 63 Pa in all cases.

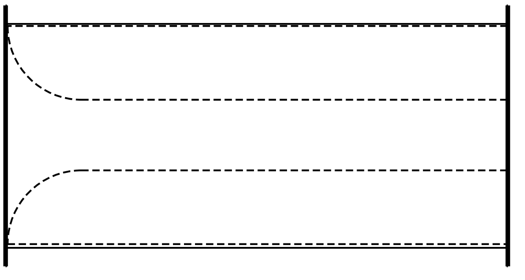
Performance Data Series Flow (Constant Volume) Discharge Sound Power Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown																																			
			Fan Only						Min. ΔPs OBCF -Hz.						125 Pa. ΔPs OBCF -Hz.						250Pa ΔPs OBCF -Hz.						375Pa ΔPs OBCF -Hz.						500Pa ΔPs OBCF -Hz.					
			125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
3-200	330	12	56	56	59	56	52	48	57	56	59	55	51	48	58	58	60	56	52	48	59	59	60	56	52	48	61	61	60	56	52	48	61	61	61	58	52	48
	283	12	56	55	58	55	51	46	56	55	58	54	50	45	57	57	59	55	51	46	58	58	59	55	51	46	59	58	59	55	51	46	59	60	59	55	49	46
	212	12	55	52	54	50	46	38	55	52	54	50	45	37	56	53	55	50	45	38	57	54	55	50	45	38	57	55	55	49	44	38	57	55	55	49	44	38
3-250	519	12	62	64	68	65	62	61	61	64	68	64	61	60	65	67	68	64	63	61	66	67	69	66	64	62	67	67	69	67	64	62	68	68	69	67	64	62
	425	12	60	61	64	61	58	56	59	61	63	60	57	55	61	63	65	62	59	56	63	64	65	63	60	57	64	64	65	63	60	58	64	65	65	63	60	58
	330	12	57	58	59	55	5	48	57	58	58	55	51	48	59	59	60	57	53	49	60	60	60	57	54	50	60	59	60	57	53	50	61	61	60	57	53	50
	212	12	57	56	54	50	46	38	56	56	54	50	45	38	57	56	55	51	46	39	58	57	55	50	46	39	58	57	55	50	46	39	59	57	55	50	45	40
5-315	755	12	67	68	69	69	66	65	67	67	68	67	64	63	69	69	69	68	65	65	70	70	69	68	65	65	70	70	69	68	65	65	71	70	69	68	64	64
	661	12	66	66	67	66	63	62	64	64	65	64	61	61	67	66	66	64	62	62	68	67	66	65	62	62	68	67	66	65	62	62	69	67	67	65	62	61
	566	12	62	62	63	62	59	58	60	61	62	60	57	57	63	63	62	61	58	58	64	63	63	61	58	57	65	62	63	61	57	57	66	65	63	61	57	57
	495	12	60	59	59	58	55	53	58	58	59	57	53	53	60	59	59	58	54	53	62	60	59	57	54	53	63	61	60	57	54	53	64	62	60	57	54	53
5-355	909	12	73	74	73	74	71	70	73	74	73	73	70	70	73	74	74	73	70	70	74	75	74	73	71	70	74	75	74	73	71	70	75	75	74	73	70	70
	802	12	71	71	70	70	67	67	69	69	70	69	66	66	71	71	71	70	67	66	72	71	71	70	67	66	72	71	70	69	66	66	72	71	70	69	66	66
	661	12	67	67	67	67	63	63	64	64	66	62	61	61	67	67	66	65	62	62	68	66	66	65	62	62	68	65	66	65	61	61	68	67	66	65	61	62
	496	12	60	60	61	60	56	54	59	59	59	58	54	53	60	60	60	58	55	54	61	60	60	58	54	54	63	61	60	58	54	54	64	62	60	58	55	54
7-400	1440	12	70	71	72	72	69	68	70	70	71	70	67	68	72	72	72	71	68	68	73	73	72	71	68	68	74	72	72	71	68	68	74	73	72	71	67	67
	1274	12	69	69	70	69	66	65	67	67	68	67	64	64	70	69	69	67	65	65	71	70	69	68	65	65	71	70	69	67	64	64	72	70	70	68	65	64
	1080	12	65	65	66	65	62	61	63	64	65	63	60	60	66	66	65	64	61	61	67	66	66	64	61	60	67	66	66	64	61	60	69	68	66	64	60	60
	948	12	63	62	62	61	58	56	61	61	62	60	56	56	63	62	62	61	57	56	65	63	62	60	57	56	65	63	62	60	57	56	65	63	62	60	57	56
7-450	1723	12	76	77	76	77	74	73	76	77	76	76	73	73	76	77	77	76	73	73	77	78	77	76	74	73	77	78	77	76	74	73	78	78	77	76	73	73
	1534	12	74	74	73	73	70	70	72	72	73	72	69	69	74	74	74	73	70	69	75	74	74	73	70	69	75	74	74	7	70	69	75	74	73	72	69	69
	1227	12	70	70	70	70	66	66	67	67	69	65	64	64	70	70	69	68	65	65	71	69	69	68	65	65	71	69	69	68	65	65	71	70	69	68	64	65
	944	12	63	63	64	63	59	57	62	62	62	61	57	56	63	63	63	61	58	57	64	63	63	61	57	57	64	63	63	61	57	57	67	65	63	61	58	57

1. Discharge (external) static pressure is 63 Pa in all cases. It is the difference (ΔPs) in static pressure from terminal discharge to the room.
2. Radiated sound power is the breakout noise transmitted through the unit casing walls and induction port.
3. Sound power levels are in decibels, dB re 10^{-12} watts.
4. All sound data listed by octave bands is raw data without any corrections for room absorption or duct attenuation.
5. Min. inlet ΔPs is the minimum operating pressure of the primary air damper section.
6. Data derived from independent tests conducted in accordance with ANSI/ASHRAE Std. 130-1996 and ARI Standard 880-98.

Secondary Attenuators-Dimensions
Model 35SFB





Terminal Size	W mm	H mm	X mm	Y mm	L mm	Wgt kg
3-150	400	400	460	460	600	21.00
3-150	400	400	460	460	900	28.00
3-150	400	400	460	460	1200	35.00
3-200	400	400	460	460	600	21.00
3-200	400	400	460	460	900	28.00
3-200	400	400	460	460	1200	35.00
3-250	400	400	460	460	600	21.00
3-250	400	400	460	460	900	28.00
3-250	400	400	460	460	1200	35.00
5-250	600	400	660	460	600	28.00
5-250	600	400	660	460	900	36.00
5-250	600	400	660	460	1200	44.00
5-315	600	400	660	460	600	28.00
5-315	600	400	660	460	900	36.00
5-315	600	400	660	460	1200	44.00
5-355	600	400	660	460	600	28.00
5-355	600	400	660	460	900	36.00
5-355	600	400	660	460	1200	44.00
7-400	1200	400	1260	460	600	45.00
7-400	1200	400	1260	460	900	59.00
7-400	1200	400	1260	460	1200	73.00
7-450	1200	400	1260	460	600	45.00
7-450	1200	400	1260	460	900	59.00
7-450	1200	400	1260	460	1200	73.00

Secondary Attenuators

All Nailor terminal units are available with attached secondary attenuators

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all longitudinal casing joints are mechanically sealed.

Flanges:

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the attenuator.

Splitters:

Arranged within the casing are vertical attenuating splitter sections manufactured from 21 swg. (0.8mm thick) galvanised mild steel, fixed to the casing by rivets. Splitters are fitted at inlet and discharge with aerodynamically shaped bullnose fairings. Splitters are fitted with 22 swg. (0.7mm thick) expanded or perforated metal facings. Horizontal splitters are also available if required.

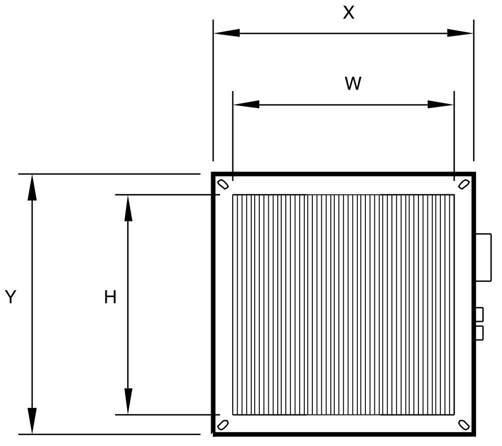
Acoustic infill:

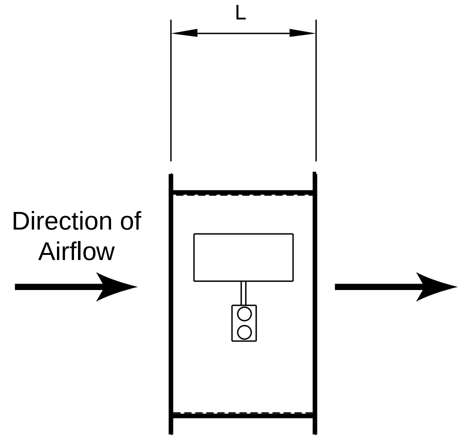
Splitters and side linings are filled with an inert, non combustible, non hygroscopic, vermin and rot proof mineral fibre slab which will not support bacterial growth. Usually faced with a glass fibre tissue (FB), however hermetically sealed Melinex membrane bags (FG) are available wherever indoor air quality conditions demand.

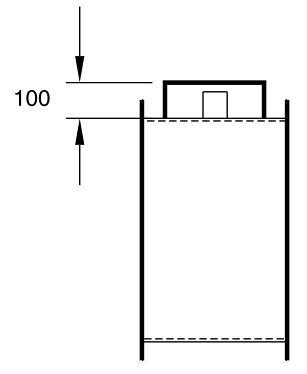
Acoustic Performance Data - Secondary Attenuator Static Insertion Loss dB Model 35S FB

Terminal size	Air vol. l/s.	Air vol. m^3/h	Press. drop Pa.	width mm.	height mm.	length mm.	O.B.C.F.-Hz 125	250	500	1k	2k	4k
3-150	24	324	neg.	400	400	600	6	8	15	18	13	9
3-150	236	1872	15	400	400	600	6	8	15	18	13	9
3-150	24	324	neg.	400	400	900	9	12	20	25	19	12
3-150	236	1872	15	400	400	900	9	12	20	25	19	12
3-150	24	324	neg.	400	400	1200	11	16	30	36	25	15
3-150	236	1872	20	400	400	1200	11	16	30	36	25	15
3-200	30	324	neg.	400	400	600	6	8	15	18	13	9
3-200	330	1872	15	400	400	600	6	8	15	18	13	9
3-200	30	324	neg.	400	400	900	9	12	20	25	19	12
3-200	330	1872	15	400	400	900	9	12	20	25	19	12
3-200	30	324	neg.	400	400	1200	11	16	30	36	25	15
3-200	330	1872	20	400	400	1200	11	16	30	36	25	15
3-250	50	324	neg.	400	400	600	6	8	15	18	13	9
3-250	520	1872	15	400	400	600	6	8	15	18	13	9
3-250	50	324	neg.	400	400	900	9	12	20	25	19	12
3-250	520	1872	15	400	400	900	9	12	20	25	19	12
3-250	50	324	neg.	400	400	1200	11	16	30	36	25	15
3-250	520	1872	20	400	400	1200	11	16	30	36	25	15
5-250	60	216	neg.	600	400	600	1	3	5	6	5	2
5-250	640	2304	60	600	400	600	1	3	5	6	5	2
5-250	60	216	neg.	600	400	900	2	5	8	10	7	3
5-250	640	2304	60	600	400	900	2	5	8	10	7	3
5-250	60	216	neg.	600	400	1200	3	6	10	13	9	4
5-250	640	2304	65	600	400	1200	3	6	10	13	9	4
5-315	75	270	neg.	600	400	600	1	3	5	6	5	2
5-315	750	2700	60	600	400	600	1	3	5	6	5	2
5-315	75	270	neg.	600	400	900	2	5	8	10	7	3
5-315	750	2700	60	600	400	900	2	5	8	10	7	3
5-315	75	270	neg.	600	400	1200	3	6	10	13	9	4
5-315	750	2700	65	600	400	1200	3	6	10	13	9	4
5-355	105	378	neg.	600	400	600	1	3	5	6	5	2
5-355	900	3240	60	600	400	600	1	3	5	6	5	2
5-355	105	378	neg.	600	400	900	2	5	8	10	7	3
5-355	900	3240	60	600	400	900	2	5	8	10	7	3
5-355	105	378	neg.	600	400	1200	3	6	10	13	9	4
5-355	900	3240	65	600	400	1200	3	6	10	13	9	4
7-400	130	468	1	1200	400	600	9	14	19	32	31	23
7-400	1400	5040	37	1200	400	600	9	14	19	32	31	23
7-400	130	468	1	1200	400	900	12	18	25	42	41	29
7-400	1400	5040	43	1200	400	900	12	18	25	42	41	29
7-400	130	468	1	1200	400	1200	14	22	31	50	50	35
7-400	1400	5040	45	1200	400	1200	14	22	31	50	50	35
7-450	150	540	3	1200	400	600	9	14	19	32	31	23
7-450	1700	6120	40	1200	400	600	9	14	19	32	31	23
7-450	150	540	3	1200	400	900	12	18	25	42	41	29
7-450	1700	6120	43	1200	400	900	12	18	25	42	41	29
7-450	150	540	3	1200	400	1200	14	22	31	50	50	35
7-450	1700	6120	47	1200	400	1200	14	22	31	50	50	35

Low Pressure Hot Water Supplementary Heater Batteries - Dimensions - Model 35SW







Terminal Size	W mm	H mm	L mm	X mm	Y mm	Wgt kg
3-150	400	400	200	460	460	15.00
3-200	400	400	200	460	460	15.00
3-250	400	400	200	460	460	15.00
5-250	600	400	200	660	460	18.00
5-315	600	400	200	660	460	18.00
5-355	600	400	200	660	460	18.00
7-400	1200	400	200	1260	460	25.00
7-450	1200	400	200	1260	460	25.00

All terminal units are available with factory installed low pressure hot water re-heat/supplementary heater batteries.

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Inlets and outlets incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Water Tubes:

Manufactured from 10mm diam. copper tube to BS 1278 table Y.

Pipe Connections:

Plain male ends suitable for solder jointing.

Heat Exchange Fins:

Manufactured from 0.13mm thick rectangular aluminium plates, mechanically bonded to the copper tubes. Fins are spaced at 2.5mm intervals.

All low pressure hot water supplementary heater batteries incorporate an air vent and drain point.

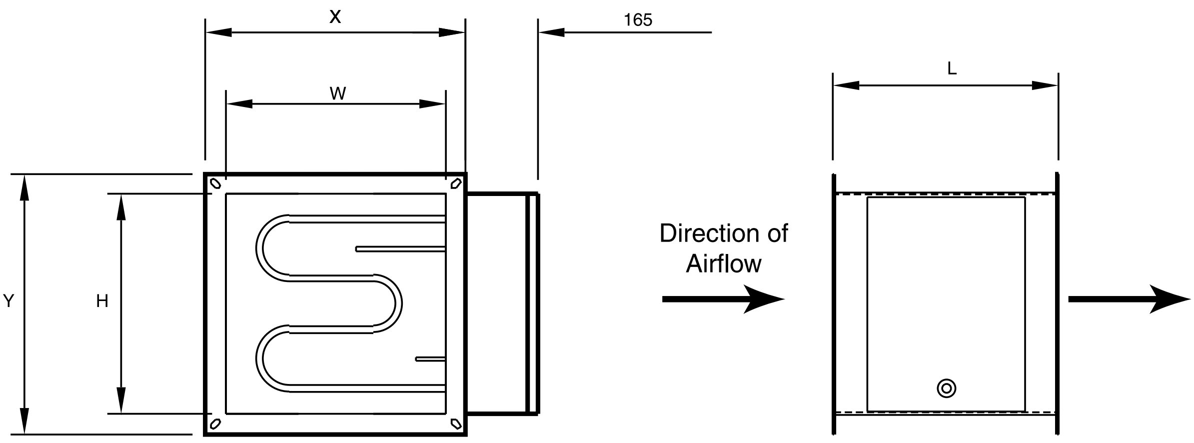
Pressure Testing:

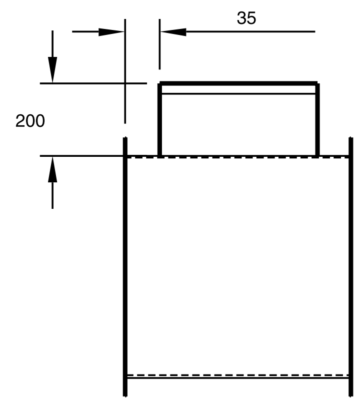
All low pressure hot water supplementary heater batteries are air pressure tested under water to a pressure of 3,000 kPa.

LPHW Supplementary Heater Battery Performance 82°C Flow, 71°C Return, 10 fpi Model 35SW

Terminal Size	Air Vol. l/s	Air Vol. m³/h	Dimensions Width mm	Dimensions Height mm	Face Vel m/s	Air On C	1 Row Duty kW	Air Off C	Water Pd KPa	Water kg/s	Air Pd Pa	2 Row Duty kW	Air Off C	Water Pd kPa	Water kg/s	Air Pd Pa
3-150	95	342	400	400	0.6	13	3.2	41	0.9	69.5	2.4	4.92	56	1.2	106.5	4
3-150	110	396	400	400	0.7	13	3.7	41	1.1	80.5	3.1	5.74	56	1.6	124.2	5
3-150	150	540	400	400	0.9	13	5.0	41	2.0	108.9	5.2	7.86	57	3.0	170.1	9
3-150	185	666	400	400	1.2	13	6.0	40	2.7	129.0	7.4	9.4	55	4.2	203.5	13
3-200	210	756	400	400	1.3	13	6.5	39	3.2	140.5	9.2	10.35	54	5.0	224.0	16
3-200	283	1019	400	400	1.8	13	8.0	37	4.8	174.0	15	13.06	51	7.8	282.7	27
3-200	330	1188	400	400	2.1	13	8.9	35	5.8	193.3	20	14.66	50	9.7	203.5	35
3-250	210	756	400	400	1.3	13	6.5	39	3.2	140.5	9.2	10.35	54	5.0	224.0	16
3-250	330	1188	400	400	2.1	13	8.9	35	5.8	193.3	20	14.66	50	9.7	317.3	35
3-250	425	1530	400	400	2.7	13	10.6	34	8.0	229.7	30	17.70	48	14.0	383.1	53
3-250	520	1872	400	400	3.2	13	12.4	33	10.7	267.7	43	20.80	46	19.0	450.2	75
5-250	210	756	600	400	0.9	13	7.3	42	4.5	157.6	4.6	11.34	58	6.3	245.5	8
5-250	330	1188	600	400	1.4	13	10.4	39	8.7	224.9	9.9	16.57	55	12.9	358.7	17
5-250	425	1530	600	400	1.8	13	11.7	36	5.9	252.4	16	19.01	50	13.4	411.5	27
5-250	520	1872	600	400	2.2	13	13.4	34	7.7	289.4	22	22.08	48	17.8	477.9	37
5-315	495	1782	600	400	2.1	13	13.0	35	7.2	280.1	20	21.30	49	16.6	461.0	32
5-315	565	2034	600	400	2.3	13	14.1	39	8.5	306.3	25	23.45	42	20.0	507.6	43
5-315	660	2376	600	400	2.7	13	15.7	33	6.4	339.8	32	26.30	46	24.9	569.3	57
5-315	750	2700	600	400	3.1	13	17.4	32	12.6	376.4	40	29.25	45	30.5	633.1	70
5-355	495	1782	600	400	2.1	13	13.0	35	7.2	280.1	20	21.30	49	16.6	461.0	32
5-355	660	2376	600	400	2.7	13	15.7	33	6.4	339.8	32	26.30	46	24.9	569.3	57
5-355	800	2880	600	400	3.3	13	18.2	32	13.7	393.9	45	30.72	45	33.5	664.9	78
5-355	910	3276	600	400	3.8	13	19.9	3.1	16.2	429.9	56	33.75	44	40.1	730.5	98
7-400	948	3413	1200	400	2.0	13	26.9	37	10.8	583.3	18	36.93	45	14.8	799.4	32
7-400	1080	3888	1200	400	2.2	13	29.5	36	12.8	638.5	23	40.00	44	17.7	865.8	40
7-400	1274	4586	1200	400	2.6	13	33.0	35	15.9	714.3	30	45.00	42	22.0	974.0	53
7-400	1440	5184	1200	400	3.0	13	36.0	34	18.5	779.2	37	49.00	41	26.0	1060.6	65
7-450	944	3398	1200	400	2.0	13	27.0	37	10.8	584.4	18	36.00	45	19.7	779.2	32
7-450	1227	4417	1200	400	2.6	13	32.0	35	15.0	692.6	28	44.00	43	21.0	952.4	50
7-450	1534	5522	1200	400	3.2	13	38.0	34	21.0	822.5	42	52.00	41	29.0	1125.5	73
7-450	1723	6023	1200	400	3.6	13	41.5	33	24.0	898.3	50	57.00	40	34.0	1233.8	89

Electric Supplementary Heater Batteries- Dimensions
Model 35SE





Terminal Size	W mm	H mm	L mm	X mm	Y mm	Wgt kg
3-150	400	400	370	40	460	11.00
3-200	400	400	370	40	460	11.00
3-250	400	400	370	40	460	11.00
5-250	600	400	370	660	460	15.00
5-315	600	400	370	660	460	15.00
5-355	600	400	370	660	460	15.00
7-400	1200	400	370	1260	460	25.00
7-450	1200	400	370	1260	460	25.00

All Nailor terminal units are available with factory installed electric supplementary heater batteries.

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Electric Elements:

Manufactured from stainless steel tubing with copper resistance wire and magnesium oxide insulation.

High Temperature Cut-Out:

All electric supplementary heater batteries incorporate automatic and manual high temperature cut-out safety devices, which disconnect the electrical power in the event that the air temperature exceeds a pre set maximum.

Pressure Switch:

All electric supplementary heater batteries incorporate a positive pressure switch which does not permit the heating elements to be energised unless there is positive air pressure (indicating airflow) available.

Electric Supplementary Heater Battery Performance
Model 35SE

Terminal Size	Air Vol. l/s	Air Vol. m³/h	Air Pd. Pa.	Dimensions Width mm	Height mm	Output kW 0.5	kW 1.0	kW 1.5	kW 2.0	kW 2.5	kW 3.0	kW 3.5	kW 4.0	kW 4.5	kW 5.0	kW 5.5	kW 6.0	kW 6.5	kW 7.0	kW 7.5	kW 8.0	kW 9.0	kW 10.0	kW 11.0	kW 12.0	kW 13.0	kW 14.0	kW 15.0	kW 16.0	kW 17.0	kW 18.0	kW 20.0	kW 22.0	kW 24.0	kW 26.0	kW 28.0	kW 30.0	kW 32.0	kW 34.0	kW 36.0	kW 38.0	kW 40.0	kW 42.0	kW 44.0	kW 46.0	kW 48.0	kW 50.0	kW 52.0	kW 54.0
3-150	95	342	5	400	400	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	110	396	7	400	400	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	150	540	9	400	400	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	185	666	11	400	400	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	210	756	13	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	283	1019	15	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	330	1188	17	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	210	756	13	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	330	1188	17	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	425	1530	19	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	520	1872	22	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	210	756	8	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	330	1188	13	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	425	1530	15	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	520	1872	18	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	495	1782	17	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	565	2034	18	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	660	2376	19	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	750	2700	23	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	495	1782	17	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	660	2376	19	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	800	2880	25	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	910	3276	32	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	948	3413	17	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1080	3888	18	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1274	4586	19	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1440	5184	22	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a
7-450	944	3398	17	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-450	1227	4417	19	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-450	1534	5522	23	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a
7-450	1723	6023	30	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

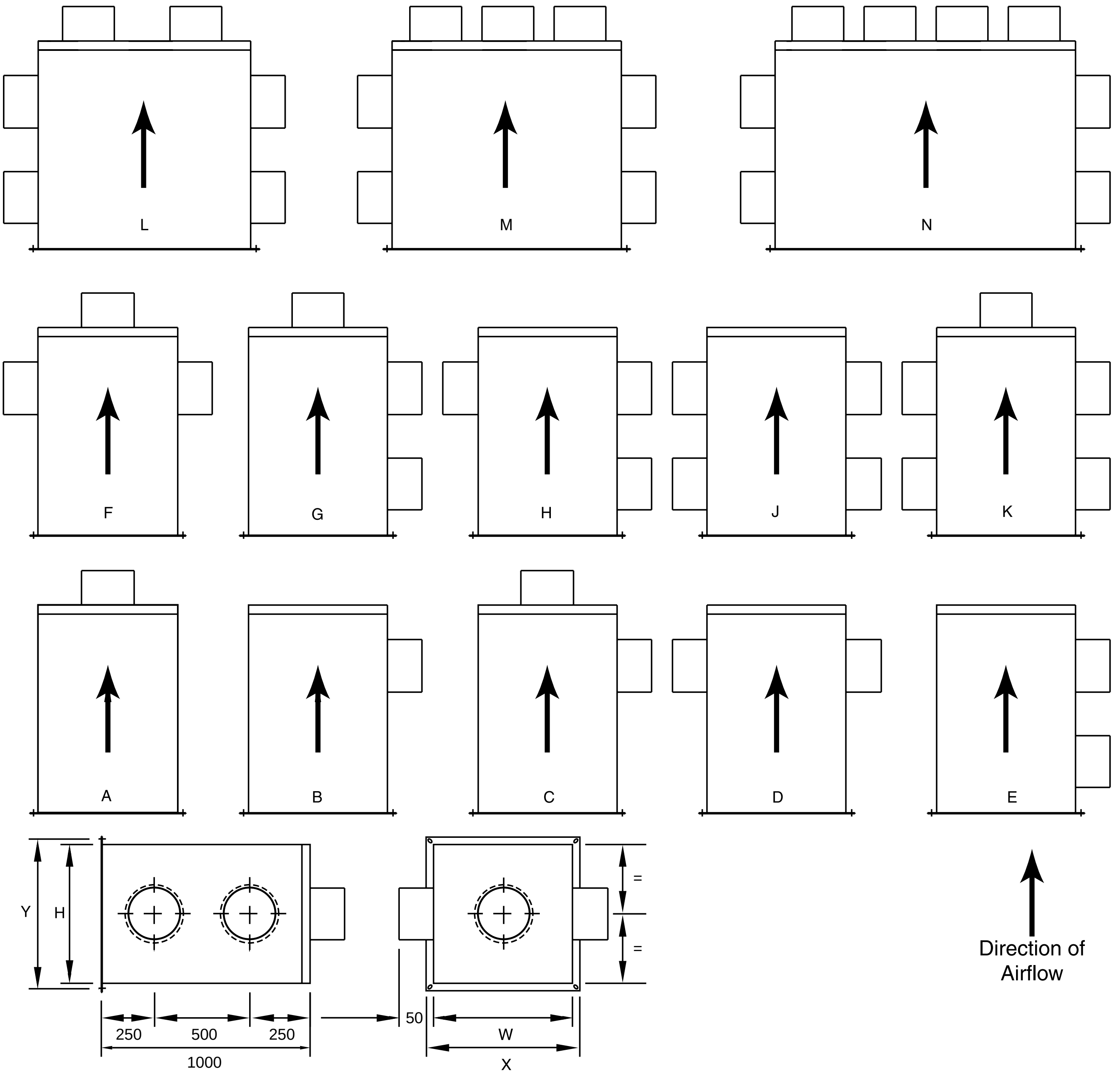
High temperature cut-out settings:

Automatic - 70°C

Manual - 120°C

Maximum recommended
Leaving Air Temperature - 39°C

Multiple Outlet Plenums - Dimensions
Models 35GB and 35GG



Model 35GB - Insulation faced with non woven tissue as standard.

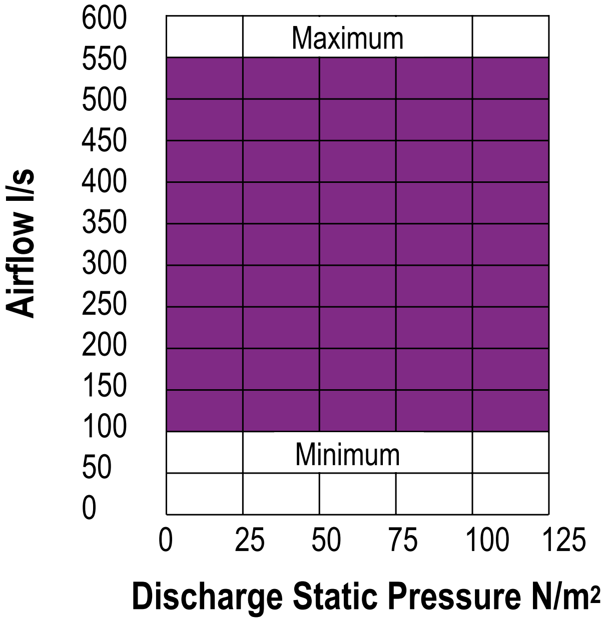
Model 35GG - Insulation covered with hermetically sealed Melinex membrane bags for indoor air quality applications.

Terminal Size	W mm	H mm	X mm	Y mm	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Wgt kg
3-150	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
3-200	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
3-250	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
5-250	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
5-315	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
5-355	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
7-400	1200	400	1260	460	150	A-N	200	A-N	250	A-M	315	A-L	45.0
7-450	1200	400	1260	460	150	A-N	200	A-N	250	A-M	315	A-L	45.0

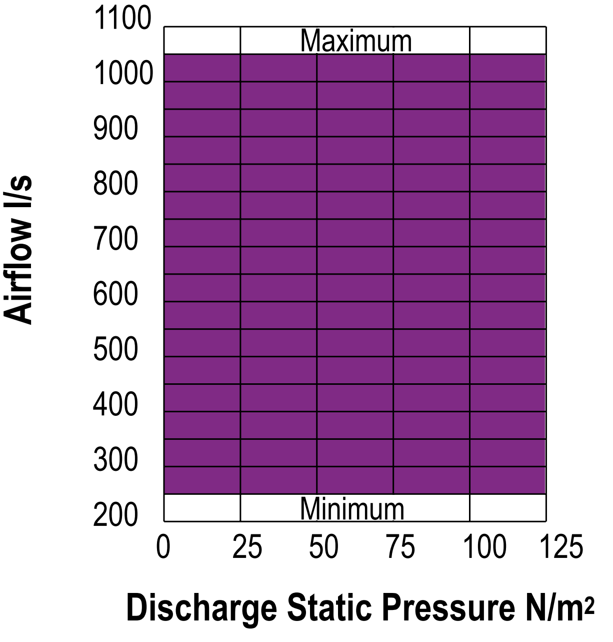
Series Flow ECM Brushless DC Motor Performance Data
Model 35S

Fan Curves - Airflow vs. Downstream Static Pressure

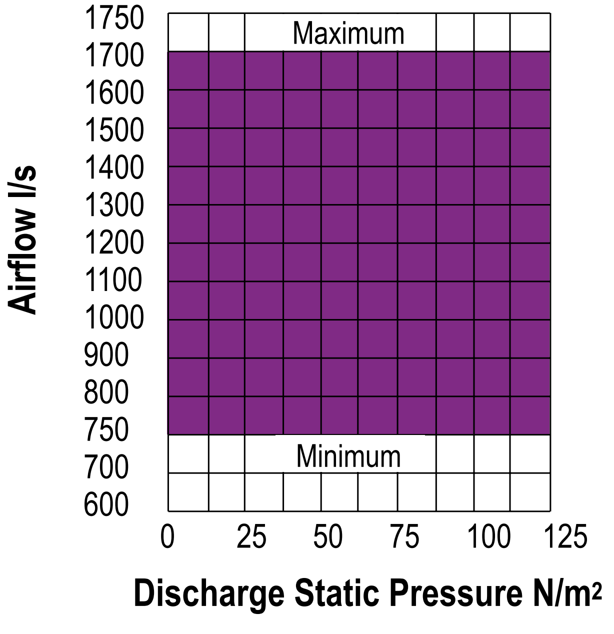
Unit Size 3 (1/2 H.P.)



Unit Size 5 (3/4 H.P.)



Unit Size 7 (2 @ 3/4 H.P.)



Notes

- The fan curves for the ECM motor are unlike those for traditional induction motors. The ECM motor is constant volume and airflow does not vary with changing static pressure conditions. The motor compensates for any changes in external static pressure or varying internal conditions such as filter loading.
- Airflow can be set to operate on a horizontal performance line at any point within the shaded area using the solid state volume controller provided.
- Fan powered terminal units featuring the ECM motor have considerably wider turn-down ratios than conventional induction motors. Hence, only three unit sizes are required in order to provide the same fan airflow range that would require six terminal unit/fan sizes when equipped with induction motors. A reduction in the number of different terminal sizes required on a typical project simplifies design lay-out and installation and reduces inventory of field service parts.
- Fan curves shown are applicable to 230 volt, single phase ECM motors. ECM motors, although DC in operation, include a built-in inverter.

Advanced Air

35SST Series "Stealth" Fan Powered Terminals

Contents

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Series Flow Constant Volume
Model 35SST STEALTH - Super Quiet Operation

Models:

35SST Cooling Only

35SEST Electric Heat

35SWST Hot Water Heat

The **Model 35SST 'STEALTH'** has been especially designed for the most demanding applications where premium quality design and performance characteristics are desired.

Features:

- Unique 18swg (1.2mm thick) galvanised steel channel space frame construction provides extreme rigidity and 18 swg casing components.
- 18swg (1.2mm thick) galvanised steel inclined opposed blade primary air damper operating on a 45° arc.
- STEALTH design technology provides significant reductions in radiated sound levels
- Unique perforated baffle on primary air discharge optimises mixing with induced air for rapid and effective temperature equalisation. The baffle also converts low frequency primary air damper generated sound into more readily attenuated higher frequencies.
- Pressure independent primary airflow control.
- Multi-point averaging flow sensor.
- Terminal may be field installed either way up, providing the additional flexibility of right or left field connections.
- Access panels on three sides of terminal for ease of maintenance and service to motor and fan from below or from the side of unit.
- Energy saving Nailor EPIC fan technology
- Motor fan assembly mounted on special 16swg. (1.6mm thick) angles and isolated from casing with rubber isolators.
- Removable door on controls enclosure.
- Acoustic/thermal lining - the terminal is internally lined with a 25mm thick acoustic/thermally insulating foam which is Melamine based open cellular construction, having a non-woven black tissue facing and complying with class O fire rating. This material is adhered to all internal surfaces and inside box/channel sections.
- Available with electric or hot water supplementary heat.
- All controls are mounted on exterior of terminal providing ready access for field adjustment.
- Each terminal factory tested prior to shipment.
- Single point electrical connections.
- Discharge opening designed for flanged duct connection.

Controls

- Analogue electronic controls. Factory supplied, mounted and calibrated.
- Digital controls. Factory mounting and wiring of DDC controls supplied by BMS Controls Manufacturers.

Options & Accessories

- Induced air filter
- Fan disconnect switch (except units with electric heat, when disconnect is an electric heat option and includes fan).
- Melinex liner
- Solid metal inner liner.
- Perforated metal liner.
- Fan airflow switch for night shutdown (analogue electronic controls).
- Night setback fan/heat cycle (analogue).
- Fan mounted total air sensor.
- Top entry induced air inlet.

Recommended Primary Airflow Ranges for Fan Powered Terminal Units

The recommended airflow ranges below are for terminal units with pressure independent controls. For a given unit size, the minimum and the maximum flow settings must be within the range limits to ensure pressure independent operation, accuracy and repeatability. For these reasons, factory settings will not be made outside these ranges. A minimum setting of zero (shut-off) is also available.

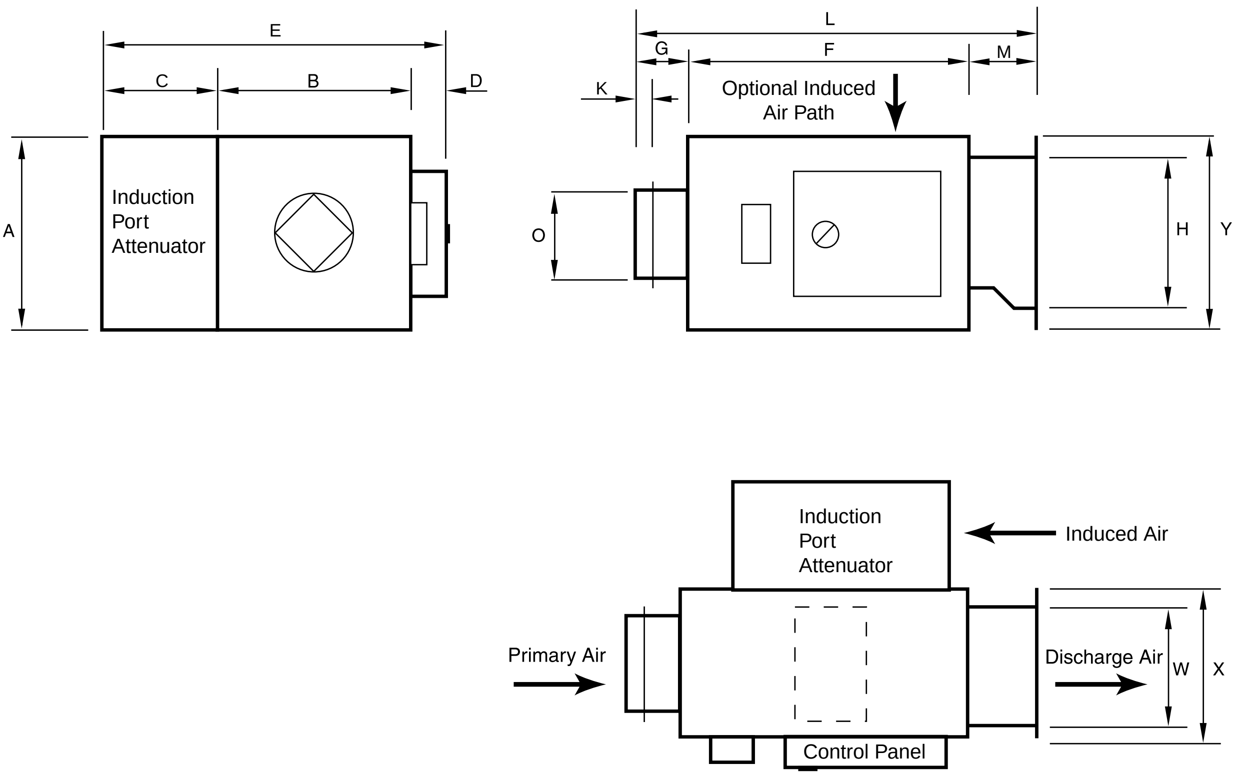
When digital or other controls are factory mounted, but supplied by others, these values are guidelines only, based upon experience with the majority of controls currently available. Controls supplied by others for factory mounting are configured and calibrated in the field.

For a detailed analysis of fan powered terminal selection procedures with working examples, consult the engineering section of this catalogue

Air Volume Range

Unit Size	Inlet Spigot dia mm	Min l/s	Max l/s
3	150	0	236
3	200	0	330
3	250	0	520
5	250	0	520
5	315	0	750
5	355	0	900
7	400	0	1400
7	450	0	1700

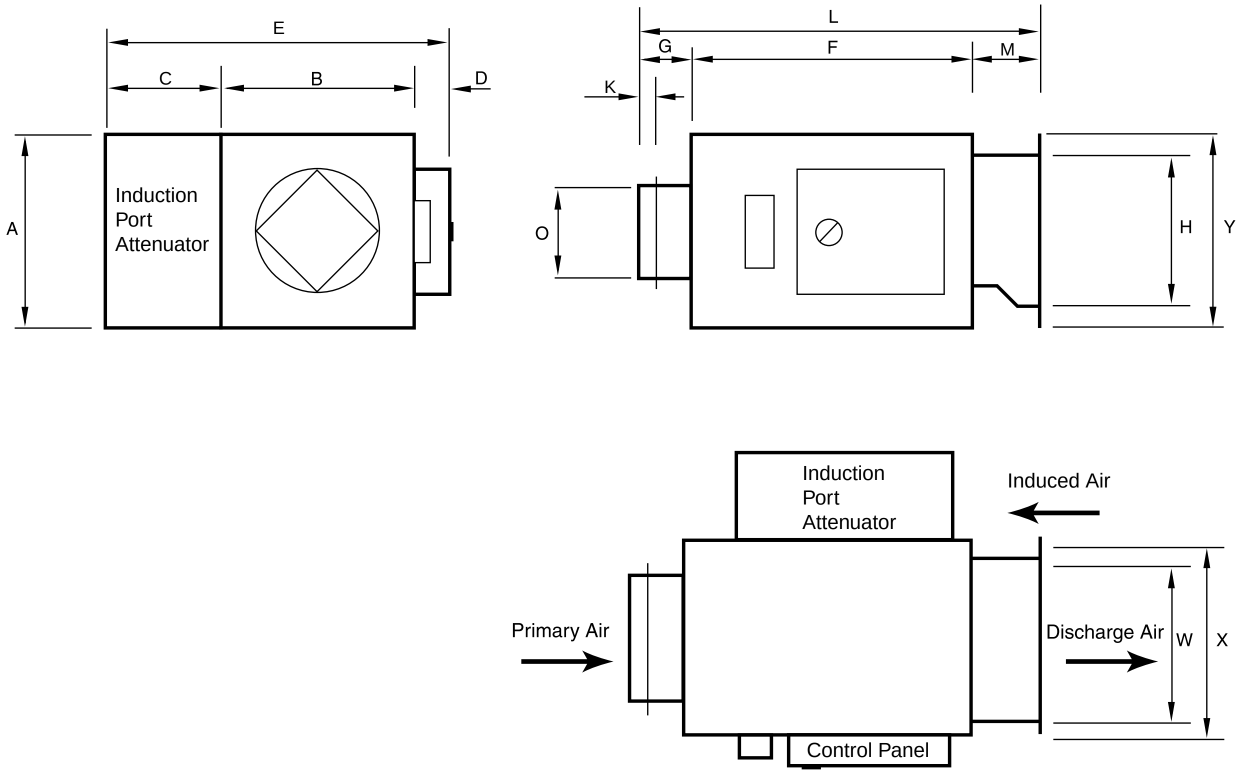
Model 35SST STEALTH - Series Flow - Size 3



Model 35SST STEALTH Size 3 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	C mm	D mm	E mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
3-150	146	470	470	287	100	857	914	150	40	175	1238	400	400	460	460	70.0
3-200	196	470	470	287	100	857	914	150	40	175	1238	400	400	460	460	70.0
3-250	246	470	470	287	100	857	914	150	40	175	1238	400	400	460	460	70.0

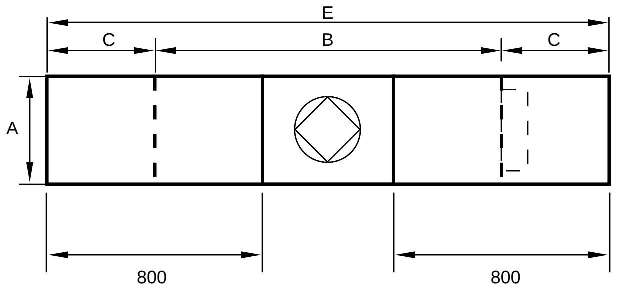
Model 35SST STEALTH - Series Flow - Size 5

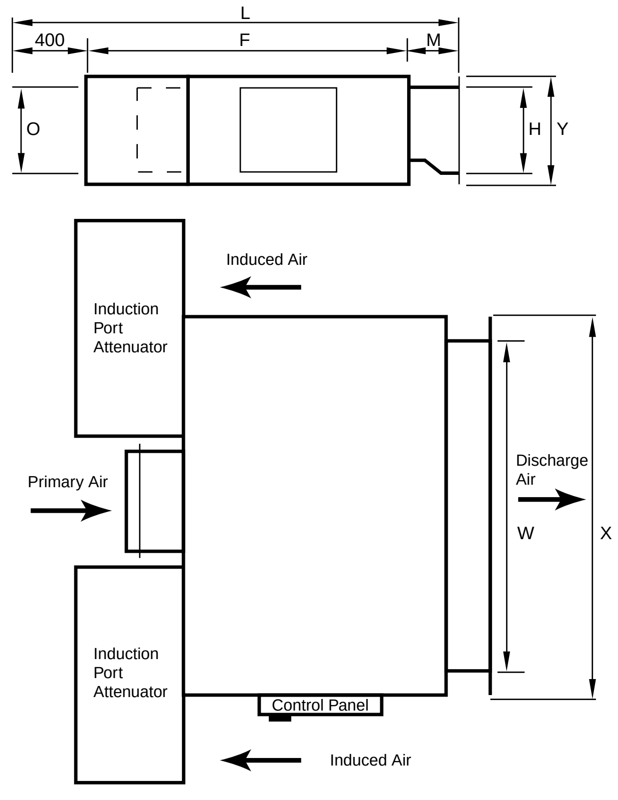


Model 35SST STEALTH Size 5 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	C mm	D mm	E mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
5-250	246	470	670	374	100	1144	1050	150	40	175	1375	600	400	660	460	82.5
5-315	311	470	670	374	100	1144	1050	150	40	175	1375	600	400	660	460	82.5
5-355	351	470	670	374	100	1144	1050	150	40	175	1375	600	400	660	460	82.5

Model 35SST STEALTH - Series Flow - Size 7





Model 35SST STEALTH Size 7 Terminal Dimensions

Terminal Size	O mm	A mm	B mm	C mm	D mm	E mm	F mm	G mm	K mm	M mm	L mm	W mm	H mm	X mm	Y mm	Wgt kg
7-400	396	470	1321	400	100	2134	1050	150	40	175	1375	1200	400	1260	460	165.0
7-450	513x352	470	1321	400	100	2134	1050	150	40	175	1375	1200	400	1260	460	165.0

Model 35SST STEALTH • Series Flow • Acoustic Data

Radiated NC Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	NC Levels @ Inlet Pressure (DPs) shown Fan Only	Minimum ΔPs	125 Pa.	250Pa.	375 Pa.	500Pa.
3-200	330	12	-	-	20	24	25	31
3-200	283	12	-	-	-	21	25	29
3-200	212	12	-	-	-	-	21	24
3-250	519	12	24	23	27	30	30	35
3-250	425	12	-	-	24	26	29	31
3-250	330	12	-	-	-	24	24	29
3-250	212	12	-	-	-	-	21	25
5-315	755	12	31	29	29	31	33	37
5-315	661	12	28	25	30	29	33	35
5-315	566	12	24	23	21	26	29	33
5-315	495	12	-	20	20	25	29	33
5-355	909	12	31	30	33	35	34	37
5-355	802	12	29	28	30	33	34	36
5-355	661	12	30	24	26	29	30	33
5-355	496	12	-	-	-	24	26	29
7-400	1652	60	42	40	41	44	46	49
7-400	1416	42	39	36	39	41	44	46
7-400	1180	30	34	33	35	39	41	44
7-400	944	17	29	25	30	36	39	41
7-400	708	12	23	20	25	32	36	38

Performance Notes

1. Application data is based on procedures and factors found in the ARI Standard 885-98; 'Procedure for estimating occupied space sound levels in the application of air terminal units and outlets'.
2. Min. inlet ΔPs is the minimum operating pressure of the primary air damper.
3. Dash (–) in space denotes an NC level of less than 20.
4. Discharge (external) static pressure is 63 Pa in all cases.

Performance Data Series Flow (Constant Volume) Radiated Sound Power Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	Fan Only 125	250	500	1k	2k	4k	Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown: Min. ΔPs OBCF -Hz. 125	250	500	1k	2k	4k
	330	12	55	51	46	38	33	30	57	51	45	38	33	28
3-200	283	12	55	50	45	37	33	29	55	50	44	37	31	27
	212	12	51	42	42	33	30	24	50	46	40	32	28	22
	519	12	60	58	50	44	38	33	59	58	50	43	37	33
3-250	425	12	58	55	48	41	35	30	56	54	47	39	33	30
	330	12	53	51	45	36	31	27	52	49	43	35	29	25
	212	12	50	47	41	32	28	21	48	45	40	31	26	19
	755	12	71	61	52	47	45	40	69	62	52	47	44	41
5-315	661	12	68	57	49	45	41	37	66	57	49	42	40	37
	566	12	66	55	47	42	39	35	64	54	46	40	37	34
	495	12	61	52	45	39	35	32	61	52	43	37	33	30
	909	12	71	63	54	50	47	44	69	64	56	51	47	45
5-355	802	12	69	62	53	48	46	42	68	62	53	48	45	42
	661	12	66	59	50	45	42	39	65	57	49	43	40	37
	496	12	61	53	45	39	35	32	59	52	43	37	34	31
	1642	60	76	71	63	56	53	50	74	68	62	54	48	46
7-400	1416	42	73	67	62	52	47	44	71	65	58	51	44	42
	1180	30	69	63	57	49	45	41	68	61	56	45	39	37
	944	17	65	57	52	44	37	33	62	55	50	39	33	30
	708	10	61	53	48	37	32	28	59	51	46	35	29	25

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	125 Pa. ΔPs OBCF -Hz. 125	250	500	1k	2k	4k	250Pa ΔPs OBCF -Hz. 125	250	500	1k	2k	4k
	330	12	61	56	47	42	36	35	62	58	51	45	41	42
3-200	283	12	59	55	46	40	35	35	65	57	49	44	41	41
	212	12	57	51	44	39	34	34	58	54	46	40	37	36
	519	12	64	62	52	46	41	37	66	64	55	49	44	43
3-250	425	12	61	59	50	43	38	35	63	61	52	46	42	42
	330	12	57	55	46	40	35	33	60	58	50	44	40	40
	212	12	54	50	43	37	33	31	56	55	43	40	38	37
	755	12	69	63	57	49	45	42	69	65	57	51	47	45
5-315	661	12	68	60	54	45	42	39	68	63	56	49	45	45
	566	12	62	57	51	43	40	38	65	61	54	48	44	44
	495	12	61	56	49	41	38	37	62	60	52	46	43	43
	909	12	71	66	58	52	49	47	72	68	59	53	50	50
5-355	802	12	69	64	55	49	46	44	70	66	57	51	48	48
	661	12	67	60	52	45	43	41	67	63	54	48	46	46
	496	12	61	55	47	41	39	37	63	59	50	44	43	44
	1642	60	75	68	62	54	48	47	77	69	63	55	50	50
7-400	1416	42	73	65	59	51	45	43	75	66	61	52	48	47
	1180	30	70	61	56	47	42	40	73	64	59	50	47	47
	944	17	66	57	53	43	40	37	71	61	56	48	45	45
	708	10	63	54	50	40	37	34	68	58	54	45	43	43

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	375Pa ΔPs OBCF -Hz. 125	250	500	1k	2k	4k	500Pa ΔPs OBCF -Hz. 125	250	500	1k	2k	4k
	330	12	65	60	53	47	43	46	66	65	57	50	45	48
3-200	283	12	64	60	52	46	43	45	64	63	55	48	44	47
	212	12	63	57	50	45	42	42	60	59	52	45	43	44
	519	12	67	64	57	51	46	47	68	68	59	53	47	50
3-250	425	12	65	63	55	49	44	46	66	65	57	51	46	49
	330	12	62	59	52	46	43	44	63	63	55	49	45	47
	212	12	59	57	49	43	41	42	59	60	51	46	43	45
	755	12	71	66	61	54	50	51	71	70	63	56	51	54
5-315	661	12	68	66	59	52	48	50	70	68	63	55	50	53
	566	12	66	63	57	50	47	49	67	66	60	52	48	51
	495	12	64	63	56	48	46	48	66	66	58	50	48	50
	909	12	73	67	61	54	51	53	73	70	62	55	52	55
5-355	802	12	71	67	59	52	50	52	71	69	61	54	51	54
	661	12	68	63	56	50	48	50	69	66	59	52	50	53
	496	12	63	61	53	46	46	48	64	63	55	48	48	51
	1642	60	79	69	65	57	52	53	81	72	67	58	54	56
7-400	1416	42	77	68	63	55	50	52	79	70	65	57	53	54
	1180	30	75	64	61	52	49	50	77	68	63	55	51	53
	944	17	73	63	59	50	47	49	75	66	62	53	50	52
	708	10	71	61	57	48	46	47	72	63	60	51	48	50

1. Discharge (external) static pressure is 63 Pa in all cases. It is the difference (ΔPs) in static pressure from terminal discharge to the room.
2. Radiated sound power is the breakout noise transmitted through the unit casing walls and induction port.
3. Sound power levels are in decibels, dB re 10^{-12} watts.
4. All sound data listed by octave bands is raw data without any corrections for room absorption or duct attenuation.
5. Min. inlet ΔPs is the minimum operating pressure of the primary air damper section.
6. Data derived from independent tests conducted in accordance with ANSI/ASHRAE Std. 130-1996 and ARI Standard 880-98.

Model 35SST STEALTH • Series Flow • Acoustic Data

Discharge NC Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa	NC Levels @ Inlet Pressure (DPs) shown					
			Fan Only	Minimum ΔPs	125 Pa.	250Pa.	375 Pa.	500Pa.
3-200	330	12	-	-	-	-	-	-
3-200	283	12	-	-	-	-	-	-
3-200	212	12	-	-	-	-	-	-
3-250	519	12	-	-	-	-	-	-
3-250	425	12	-	-	-	-	-	-
3-250	330	12	-	-	-	-	-	-
3-250	212	12	-	-	-	-	-	-
5-315	755	12	-	-	-	-	-	-
5-315	661	12	-	-	-	-	-	-
5-315	566	12	-	-	-	-	-	-
5-315	495	12	-	-	-	-	-	-
5-355	909	12	22	22	23	24	24	24
5-355	802	12	20	-	20	20	20	20
5-355	661	12	-	-	-	-	-	-
5-355	496	12	-	-	-	-	-	-
7-400	1652	60	39	32	34	35	35	35
7-400	1416	42	33	29	29	30	32	33
7-400	1180	30	26	23	24	25	27	30
7-400	944	17	20	-	-	22	25	26
7-400	708	12	-	-	-	-	22	25

Performance Notes

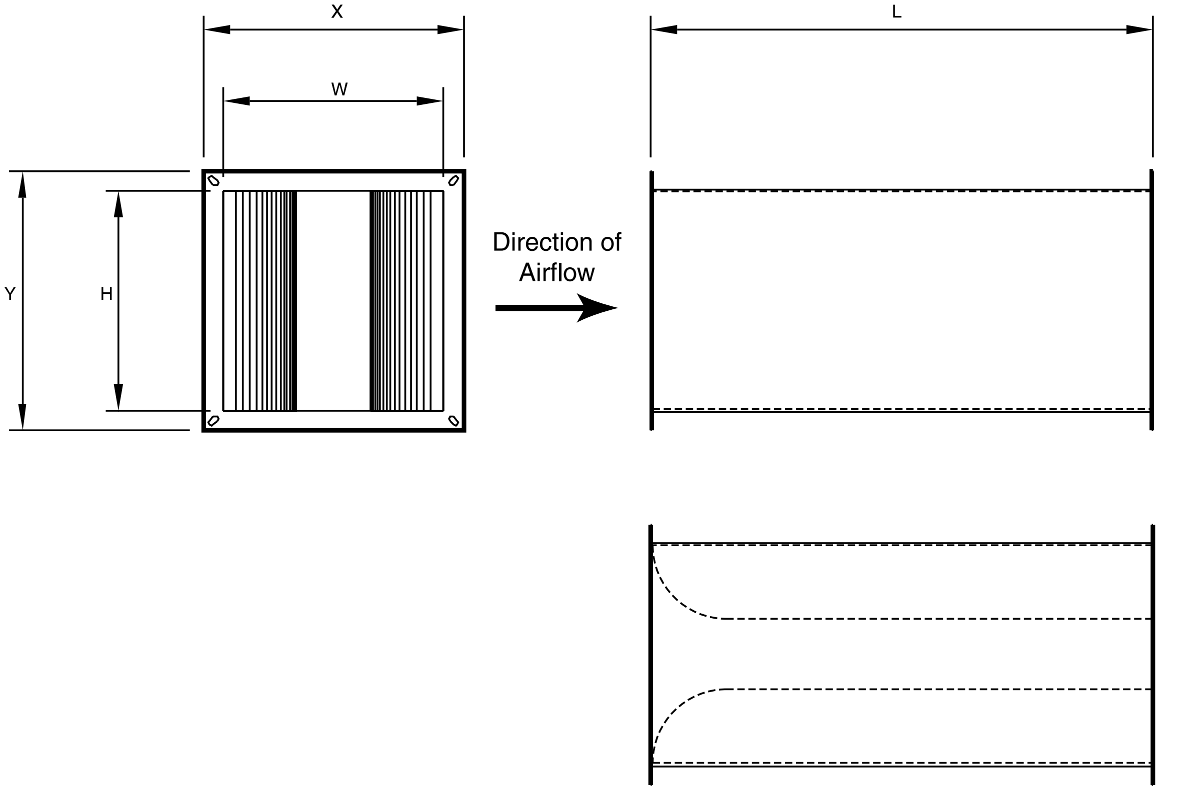
1. Application data is based on procedures and factors found in the ARI Standard 885-90; 'Procedure for estimating occupied space sound levels in the application of air terminal units and outlets'.
2. Min. inlet ΔPs is the minimum operating pressure of the primary air damper.
3. Dash (–) in space denotes an NC level of less than 20.
4. Discharge (external) static pressure is 63 Pa in all cases.

Performance Data Series Flow (Constant Volume) Discharge Sound Power Levels

Terminal Size	Air Flow l/s	Min. inlet ΔPs Pa							Fan and100% Primary Air- Sound Power Octave Bands @ Inlet Pressure Shown																													
			Fan Only						Min. ΔPs OBCF -Hz.						125 Pa. ΔPs OBCF -Hz.						250Pa ΔPs OBCF -Hz.						375Pa ΔPs OBCF -Hz.						500Pa ΔPs OBCF -Hz.					
			125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
	330	12	56	56	59	56	52	48	57	56	59	55	51	48	58	58	60	56	52	48	59	59	60	56	52	48	61	61	60	56	52	48	61	61	61	58	52	48
3-200	283	12	56	55	58	55	51	46	56	55	58	54	50	45	57	57	50	55	51	46	58	58	59	55	51	46	59	58	59	55	51	46	59	60	59	55	49	46
	212	12	55	52	54	50	46	38	55	52	54	50	45	37	56	53	55	50	45	38	57	54	55	50	45	38	57	55	55	49	44	38	57	55	55	49	44	38
	519	12	62	64	68	65	62	61	61	64	68	64	63	61	65	67	68	64	63	61	66	67	69	66	64	62	67	67	69	67	64	62	68	68	69	67	61	62
3-250	425	12	60	61	64	61	58	56	59	61	63	60	57	55	61	63	65	62	59	56	63	64	65	63	60	57	64	64	65	63	60	58	64	65	65	63	60	58
	330	12	57	58	59	55	52	48	57	58	58	55	51	48	59	59	60	57	53	49	60	60	60	57	54	50	60	59	60	57	53	50	61	61	60	57	53	50
	212	12	57	56	54	50	46	38	56	56	54	50	45	38	57	56	55	51	46	39	58	57	55	50	46	39	58	57	55	50	46	39	59	57	55	50	45	40
	755	12	67	68	69	69	66	65	67	67	68	67	64	63	69	69	69	68	65	65	70	70	69	68	65	65	70	70	69	68	65	65	71	70	69	68	64	64
5-315	661	12	66	66	67	66	63	62	64	64	65	64	61	61	67	66	66	64	62	62	68	67	66	65	62	62	68	67	66	65	62	62	69	67	67	65	62	61
	566	12	62	62	63	62	59	58	60	61	62	60	57	57	63	63	62	61	58	58	64	63	63	61	58	57	64	63	63	61	58	57	66	65	63	61	57	57
	495	12	60	59	59	58	55	53	58	58	59	57	53	53	60	59	59	58	54	53	62	60	59	57	54	53	62	60	59	57	54	53	64	62	60	57	54	53
	909	12	73	74	73	74	71	70	73	74	73	73	70	70	73	74	74	73	70	70	74	75	74	73	71	70	74	75	74	73	71	70	75	75	74	73	70	70
5-355	802	12	71	71	70	70	67	67	69	69	70	69	66	66	71	71	71	70	67	66	72	71	71	70	67	66	72	71	70	69	66	66	72	71	70	69	66	66
	661	12	67	67	67	67	63	63	64	64	66	62	61	61	67	67	65	65	62	62	68	66	66	65	62	62	68	65	66	65	61	61	68	67	66	65	61	62
	496	12	60	60	61	60	56	54	59	59	59	58	54	53	60	60	60	58	55	54	61	60	60	58	54	54	63	61	60	58	54	54	64	62	60	58	55	54
	1642	60	73	76	76	77	75	75	69	71	74	73	71	69	70	71	74	73	71	71	72	73	74	74	71	72	74	73	75	74	72	72	76	76	76	75	73	73
7-400	1416	42	70	71	73	73	70	70	66	67	69	69	66	66	67	68	70	69	67	66	70	70	71	70	68	68	71	71	72	71	69	69	73	73	72	71	69	70
	1180	30	65	66	68	67	64	63	61	62	64	63	60	59	63	63	65	64	61	60	66	66	66	65	63	62	69	68	67	65	64	64	71	71	68	67	65	66
	944	17	59	60	63	61	57	56	55	56	58	57	53	51	59	59	60	58	56	53	63	62	61	60	59	58	65	65	63	61	61	61	67	68	64	63	63	63
	708	10	53	55	56	54	50	47	50	51	53	51	46	43	55	54	54	53	51	47	59	59	57	56	57	54	62	62	60	59	60	58	64	65	62	60	61	60

1. Discharge (external) static pressure is 63 Pa in all cases. It is the difference (ΔPs) in static pressure from terminal discharge to the room.
2. Radiated sound power is the breakout noise transmitted through the unit casing walls and induction port.
3. Sound power levels are in decibels, dB re 10^{-12} watts.
4. All sound data listed by octave bands is raw data without any corrections for room absorption or duct attenuation.
5. Min. inlet ΔPs is the minimum operating pressure of the primary air damper section.
6. Data derived from independent tests conducted in accordance with ANSI/ASHRAE Std. 130-1996 and ARI Standard 880-98.

Secondary Attenuators-Dimensions
Model 35SFBST and 35SFGST



Terminal Size	W mm	H mm	X mm	Y mm	L mm	Wgt kg
3-150	400	400	460	460	600	21.00
3-150	400	400	460	460	900	28.00
3-150	400	400	460	460	1200	35.00
3-200	400	400	460	460	600	21.00
3-200	400	400	460	460	900	28.00
3-200	400	400	460	460	1200	35.00
3-250	400	400	460	460	600	21.00
3-250	400	400	460	460	900	28.00
3-250	400	400	460	460	1200	35.00
5-250	600	400	660	460	600	28.00
5-250	600	400	660	460	900	36.00
5-250	600	400	660	460	1200	44.00
5-315	600	400	660	460	600	28.00
5-315	600	400	660	460	900	36.00
5-315	600	400	660	460	1200	44.00
5-355	600	400	660	460	600	28.00
5-355	600	400	660	460	900	36.00
5-355	600	400	660	460	1200	44.00
7-400	1200	400	1260	460	600	45.00
7-400	1200	400	1260	460	900	59.00
7-400	1200	400	1260	460	1200	73.00
7-450	1200	400	1260	460	600	45.00
7-450	1200	400	1260	460	900	59.00
7-450	1200	400	1260	460	1200	73.00

Secondary Attenuators

All Nailor terminal units are available with attached secondary attenuators

Casing:

Manufactured from 18 swg. (1.2mm thick) folded Galvanised Mild Steel sheet, formed into a rectangular casing, all longitudinal casing joints are mechanically sealed.

Flanges:

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the attenuator.

Splitters:

Arranged within the casing are vertical attenuating splitter sections manufactured from 21swg. (0.8mm thick) galvanised mild steel, fixed to the casing by rivets. Splitters are fitted at inlet and discharge with aerodynamically shaped bullnose fairings. Splitters are fitted with 22 swg. (0.7mm thick) expanded or perforated metal facings. Horizontal splitters are also available if required.

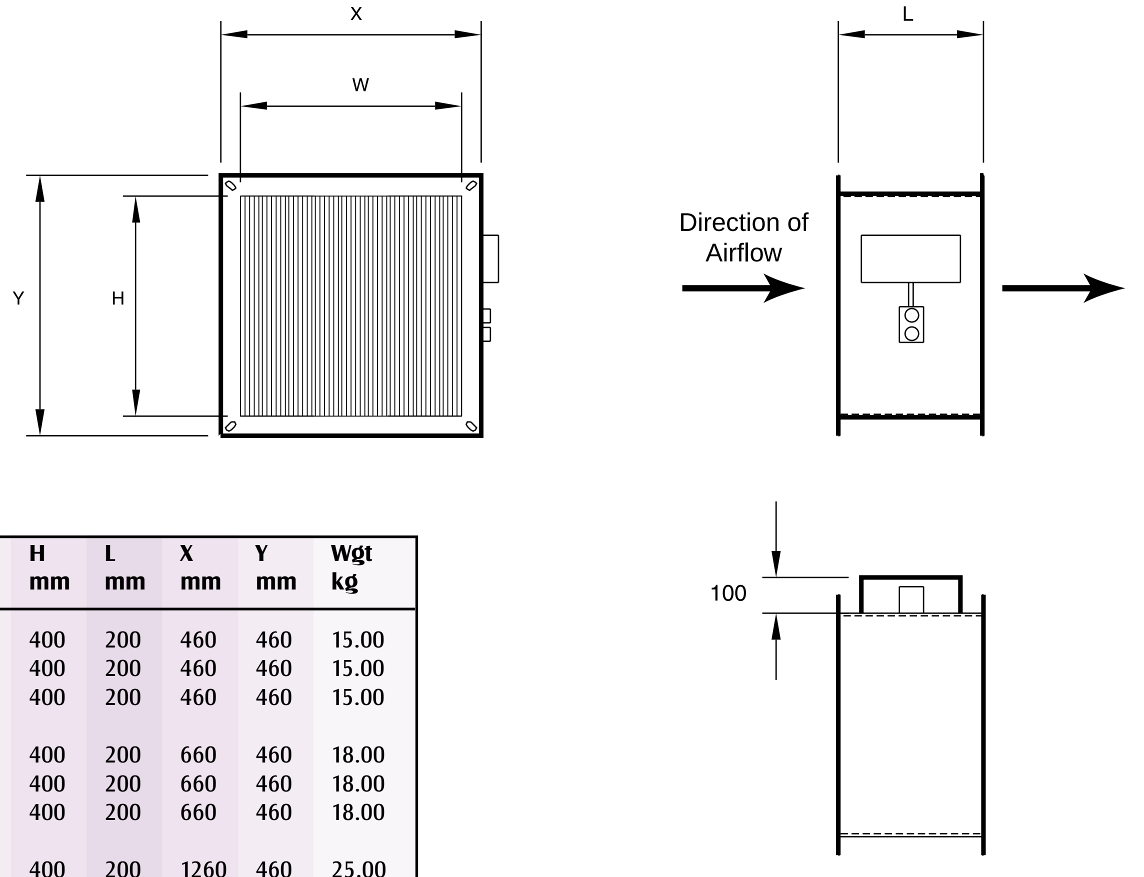
Acoustic infill:

Splitters and side linings are filled with an inert, non combustible, non hygroscopic, vermin and rot proof mineral fibre slab which will not support bacterial growth. Usually faced with a glass fibre tissue (FB), however hermetically sealed Melinex membrane bags (FG) are available wherever indoor air quality conditions demand.

Acoustic Performance Data - Secondary Attenuator Static Insertion Loss dB Model 35SFBST and 35SFGST

Terminal size	Air vol. l/s.	Air vol. m^3/h	Press. drop Pa.	width mm.	height mm.	length mm.	O.B.C.F.-Hz 125	250	500	1k	2k	4k
3-150	24	324	neg.	400	400	600	6	8	15	18	13	9
3-150	236	1872	15	400	400	600	6	8	15	18	13	9
3-150	24	324	neg.	400	400	900	9	12	20	25	19	12
3-150	236	1872	15	400	400	900	9	12	20	25	19	12
3-150	24	324	neg.	400	400	1200	11	16	30	36	25	15
3-150	236	1872	20	400	400	1200	11	16	30	36	25	15
3-200	30	324	neg.	400	400	600	6	8	15	18	13	9
3-200	330	1872	15	400	400	600	6	8	15	18	13	9
3-200	30	324	neg.	400	400	900	9	12	20	25	19	12
3-200	330	1872	15	400	400	900	9	12	20	25	19	12
3-200	30	324	neg.	400	400	1200	11	16	30	36	25	15
3-200	330	1872	20	400	400	1200	11	16	30	36	25	15
3-250	50	324	neg.	400	400	600	6	8	15	18	13	9
3-250	520	1872	15	400	400	600	6	8	15	18	13	9
3-250	50	324	neg.	400	400	900	9	12	20	25	19	12
3-250	520	1872	15	400	400	900	9	12	20	25	19	12
3-250	50	324	neg.	400	400	1200	11	16	30	36	25	15
3-250	520	1872	20	400	400	1200	11	16	30	36	25	15
5-250	60	216	neg.	600	400	600	1	3	5	6	5	2
5-250	640	2304	60	600	400	600	1	3	5	6	5	2
5-250	60	216	neg.	600	400	900	2	5	8	10	7	3
5-250	640	2304	60	600	400	900	2	5	8	10	7	3
5-250	60	216	neg.	600	400	1200	3	6	10	13	9	4
5-250	640	2304	65	600	400	1200	3	6	10	13	9	4
5-315	75	270	neg.	600	400	600	1	3	5	6	5	2
5-315	750	2700	60	600	400	600	1	3	5	6	5	2
5-315	75	270	neg.	600	400	900	2	5	8	10	7	3
5-315	750	2700	60	600	400	900	2	5	8	10	7	3
5-315	75	270	neg.	600	400	1200	3	6	10	13	9	4
5-315	750	2700	65	600	400	1200	3	6	10	13	9	4
5-355	105	378	neg.	600	400	600	1	3	5	6	5	2
5-355	900	3240	60	600	400	600	1	3	5	6	5	2
5-355	105	378	neg.	600	400	900	2	5	8	10	7	3
5-355	900	3240	60	600	400	900	2	5	8	10	7	3
5-355	105	378	neg.	600	400	1200	3	6	10	13	9	4
5-355	900	3240	65	600	400	1200	3	6	10	13	9	4
7-400	130	468	1	1200	400	600	9	14	19	32	31	23
7-400	1400	5040	37	1200	400	600	9	14	19	32	31	23
7-400	130	468	1	1200	400	900	12	18	25	42	41	29
7-400	1400	5040	43	1200	400	900	12	18	25	42	41	29
7-400	130	468	1	1200	400	1200	14	22	31	50	50	35
7-400	1400	5040	45	1200	400	1200	14	22	31	50	50	35
7-450	150	540	3	1200	400	600	9	14	19	32	31	23
7-450	1700	6120	40	1200	400	600	9	14	19	32	31	23
7-450	150	540	3	1200	400	900	12	18	25	42	41	29
7-450	1700	6120	43	1200	400	900	12	18	25	42	41	29
7-450	150	540	3	1200	400	1200	14	22	31	50	50	35
7-450	1700	6120	47	1200	400	1200	14	22	31	50	50	35

Low Pressure Hot Water Supplementary Heater Batteries - Dimensions - Model 35SWST



Terminal Size	W mm	H mm	L mm	X mm	Y mm	Wgt kg
3-150	400	400	200	460	460	15.00
3-200	400	400	200	460	460	15.00
3-250	400	400	200	460	460	15.00
5-250	600	400	200	660	460	18.00
5-315	600	400	200	660	460	18.00
5-355	600	400	200	660	460	18.00
7-400	1200	400	200	1260	460	25.00
7-450	1200	400	200	1260	460	25.00

All terminal units are available with factory installed low pressure hot water supplementary heater batteries.

Casing:

Manufactured from 18swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Inlets and outlets incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Water Tubes:

Manufactured from 10mm diam. copper tube to BS 1278 table Y.

Pipe Connections:

Plain male ends suitable for solder jointing.

Heat Exchange Fins:

Manufactured from 0.13mm thick rectangular aluminium plates, mechanically bonded to the copper tubes. Fins are spaced at 2.5mm intervals.

All low pressure hot water supplementary heater batteries incorporate an air vent and drain point.

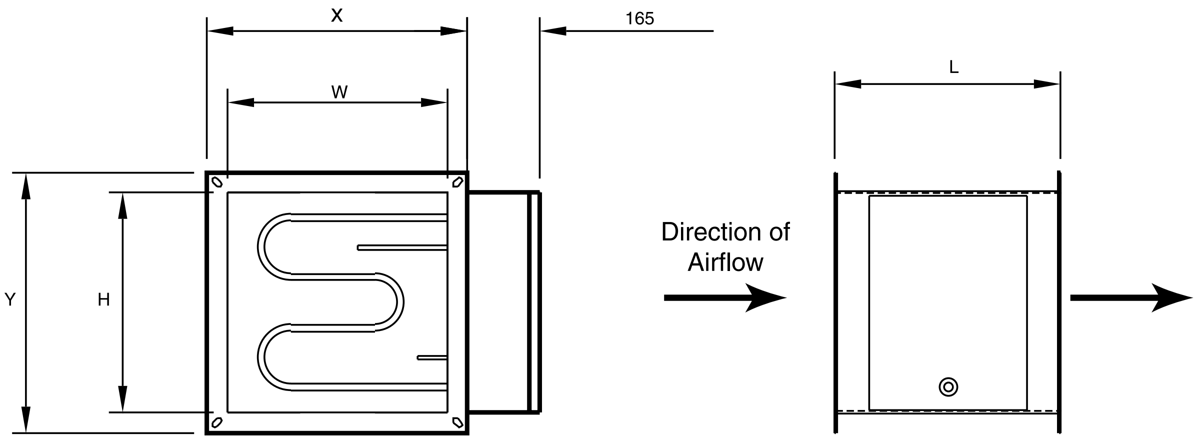
Pressure Testing:

All low pressure hot water supplementary heater batteries are air pressure tested under water to a pressure of 3,000 kPa.

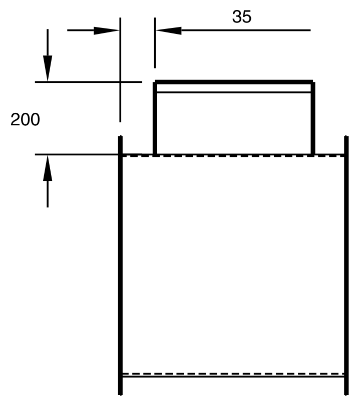
LPHW Supplementary Heater Battery Performance 82°C Flow, 71°C Return, 10 fpi Model 35SWST

Terminal Size	Air Vol. l/s	Air Vol. m³/h	Dimensions Width mm	Height mm	Face Vel m/s	Air On °C	1 Row Duty kW	Air Off °C	Water Pd KPa	Water kg/s	Air Pd Pa	2 Row Duty kW	Air Off °C	Water Pd kPa	Water kg/s	Air Pd Pa
3-150	95	342	400	400	0.6	13	3.2	41	0.9	69.5	2.4	4.9	56	1.2	106.5	4
3-150	110	396	400	400	0.7	13	3.7	41	1.1	80.5	3.1	5.7	56	1.6	124.2	5
3-150	150	540	400	400	0.9	13	5.0	41	2.0	108.9	5.2	7.9	57	3.0	170.1	9
3-150	185	666	400	400	1.2	13	6.0	40	2.7	129.0	7.4	9.4	55	4.20	203.5	13
3-200	210	756	400	400	1.3	13	6.5	39	3.2	140.5	9.2	10.3	54	5.	224.0	16
3-200	283	1019	400	400	1.8	13	8.0	37	4.8	174.0	15	13.1	51	7.8	282.7	27
3-200	330	1188	400	400	2.1	13	8.9	35	5.8	193.3	20	14.7	50	9.7	203.5	35
3-250	210	756	400	400	1.3	13	6.5	39	3.2	140.5	9.2	10.3	54	5.0	224.0	16
3-250	330	1188	400	400	2.1	13	8.9	35	5.8	193.3	20	14.7	50	9.7	317.3	35
3-250	425	1530	400	400	2.7	13	10.6	34	8.0	229.7	30	17.7	48	14.0	383.1	53
3-250	520	1872	400	400	3.2	13	12.4	33	10.7	267.7	43	20.8	46	19.0	450.2	75
5-250	210	756	600	400	0.9	13	7.3	42	4.5	157.6	4.6	11.3	58	6.3	245.5	8
5-250	330	1188	600	400	1.4	13	10.4	39	8.7	224.9	9.9	16.6	55	12.9	358.7	17
5-250	425	1530	600	400	1.8	13	11.7	36	5.9	252.4	16	19.0	50	13.4	411.5	27
5-250	520	1872	600	400	2.2	13	13.4	34	7.7	289.4	22	22.1	48	17.8	477.9	37
5-315	495	1782	600	400	2.1	13	12.9	35	7.2	280.1	20	21.3	49	16.6	461.0	32
5-315	565	2034	600	400	2.3	13	14.1	39	8.5	306.3	25	23.4	42	20.0	507.6	43
5-315	660	2376	600	400	2.7	13	15.7	33	6.4	339.8	32	26.3	46	24.9	569.3	57
5-315	750	2700	600	400	3.1	13	17.4	32	12.6	376.4	40	29.2	45	30.5	633.1	70
5-355	495	1782	600	400	2.1	13	12.9	35	7.2	280.1	20	21.3	49	16.6	461.0	32
5-355	660	2376	600	400	2.7	13	15.7	33	6.4	339.8	32	26.3	46	24.9	569.3	57
5-355	800	2880	600	400	3.3	13	18.2	32	13.7	393.9	45	30.7	45	33.5	664.9	78
5-355	910	3276	600	400	3.8	13	19.9	3.1	16.2	429.9	56	33.7	44	40.1	730.5	98
7-400	948	3413	1200	400	2.0	13	26.9	37	10.8	583.3	18	36.9	45	14.8	799.4	32
7-400	1080	3888	1200	400	2.2	13	29.5	36	12.8	638.5	23	40.0	44	17.7	865.8	40
7-400	1274	4586	1200	400	2.6	13	33.0	35	15.9	714.3	30	45.0	42	22.0	974.0	53
7-400	1440	5184	1200	400	3.0	13	36.0	34	18.5	779.2	37	49.0	41	26.0	1060.6	65
7-450	944	3398	1200	400	2.0	13	27.0	37	10.8	584.4	18	36.0	45	19.7	779.2	32
7-450	1227	4417	1200	400	2.6	13	32.0	35	15.0	692.6	28	44.0	43	21.0	952.4	50
7-450	1534	5522	1200	400	3.2	13	38.0	34	21.0	822.5	42	52.0	41	29.0	1125.5	73
7-450	1723	6023	1200	400	3.6	13	41.5	33	24.0	898.3	50	57.0	40	34.0	1233.8	89

Electric Supplementary Heater Batteries - Dimensions
Model 35SEST



Terminal Size	W mm	H mm	L mm	X mm	Y mm	Wgt kg
3-150	400	400	370	40	460	11.00
3-200	400	400	370	40	460	11.00
3-250	400	400	370	40	460	11.00
5-250	600	400	370	660	460	15.00
5-315	600	400	370	660	460	15.00
5-355	600	400	370	660	460	15.00
7-400	1200	400	370	1260	460	25.00
7-450	1200	400	370	1260	460	25.00



All terminal units are available with factory installed electric supplementary heater batteries.

Casing:

Manufactured from 18 swg. (1.2mm thick) folded galvanised mild steel sheet, formed into a rectangular casing, all casing joints are mechanically sealed.

Intake and discharges incorporate rectangular flanges, which are mechanically fixed to the main body of the casing.

Electric Elements:

Manufactured from stainless steel tubing with copper resistance wire and magnesium oxide insulation.

High Temperature Cut-Out:

All electric supplementary heater batteries incorporate automatic and manual high temperature cut-out safety devices, which disconnect the electrical power in the event that the air temperature exceeds a pre set maximum.

Pressure Switch:

All electric supplementary heater batteries incorporate a positive pressure switch which does not permit the heating elements to be energised unless there is positive air pressure (indicating airflow) available.

Electric Supplementary Heater Battery Performance
Model 35SEST

Terminal Size	Air Vol. l/s	Air Vol. m³/h	Air Pd. Pa.	Dimensions Width mm	Height mm	Output kW 0.5	kW 1.0	kW 1.5	kW 2.0	kW 2.5	kW 3.0	kW 3.5	kW 4.0	kW 4.5	kW 5.0	kW 5.5	kW 6.0	kW 6.5	kW 7.0	kW 7.5	kW 8.0	kW 9.0	kW 10.0	kW 11.0	kW 12.0	kW 13.0	kW 14.0	kW 15.0	kW 16.0	kW 17.0	kW 18.0	kW 20.0	kW 22.0	kW 24.0	kW 26.0	kW 28.0	kW 30.0	kW 32.0	kW 34.0	kW 36.0	kW 38.0	kW 40.0	kW 42.0	kW 44.0	kW 46.0	kW 48.0	kW 50.0	kW 52.0	kW 54.0
3-150	95	342	5	400	400	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	110	396	7	400	400	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	150	540	9	400	400	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-150	185	666	11	400	400	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	210	756	13	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	283	1019	15	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-200	330	1188	17	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	210	756	13	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	330	1188	17	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	425	1530	19	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3-250	520	1872	22	400	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	210	756	8	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	330	1188	13	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	425	1530	15	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-250	520	1872	18	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	495	1782	17	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	565	2034	18	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	660	2376	19	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-315	750	2700	23	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	495	1782	17	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	660	2376	19	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	800	2880	25	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-355	910	3276	32	600	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	948	3413	17	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1080	3888	18	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1274	4586	19	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-400	1440	5184	22	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a
7-450	944	3398	17	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-450	1227	4417	19	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
7-450	1534	5522	23	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	n/a	n/a
7-450	1723	6023	30	1200	400	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

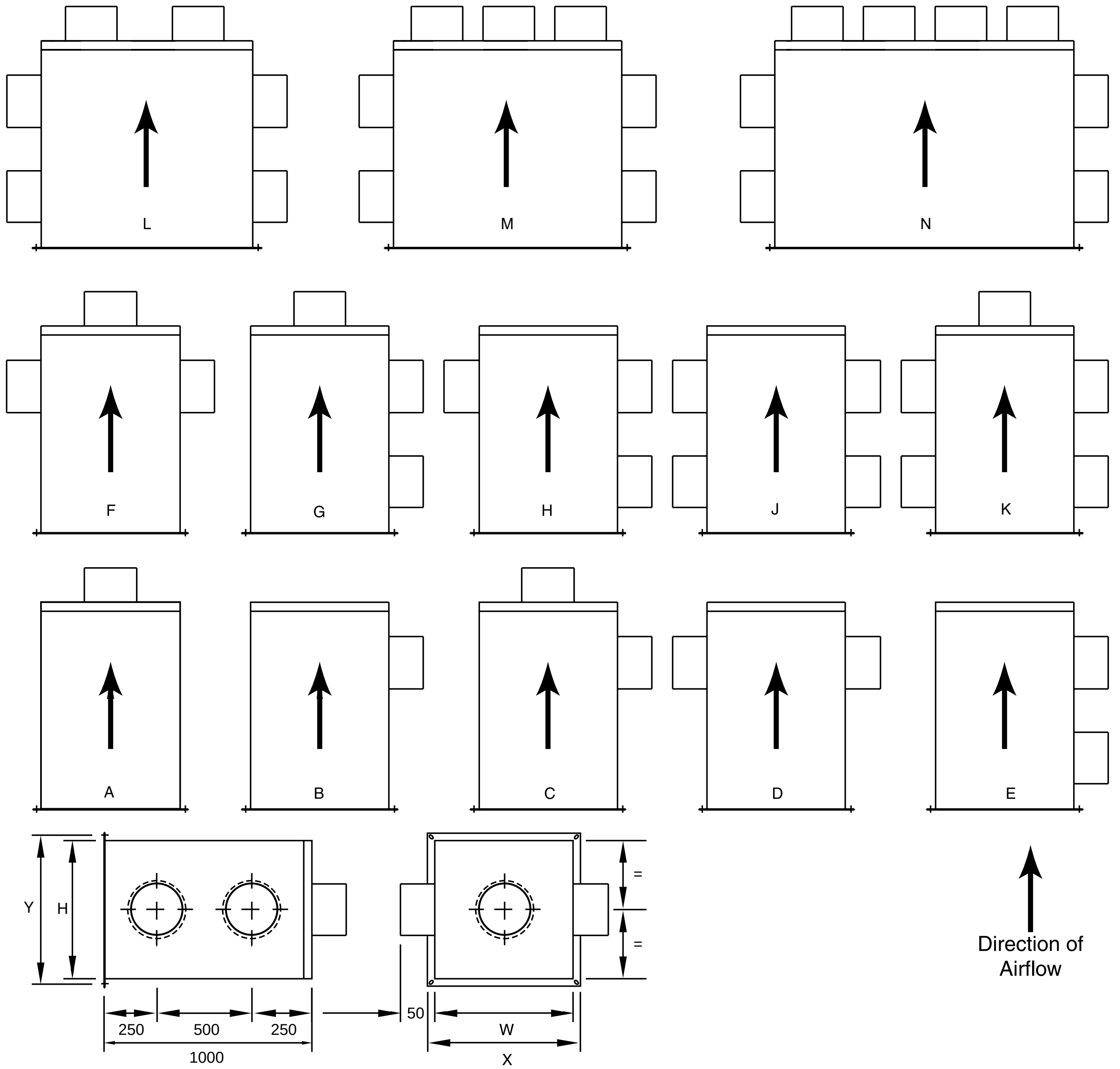
High temperature cut-out settings:

Automatic - 70°C

Manual - 120°C

Maximum recommended
Leaving Air Temperature - 39°C

Multiple Outlet Plenums - Dimensions
Models 35GB and 35GG



Model 35GB - Insulation faced with non woven tissue as standard.

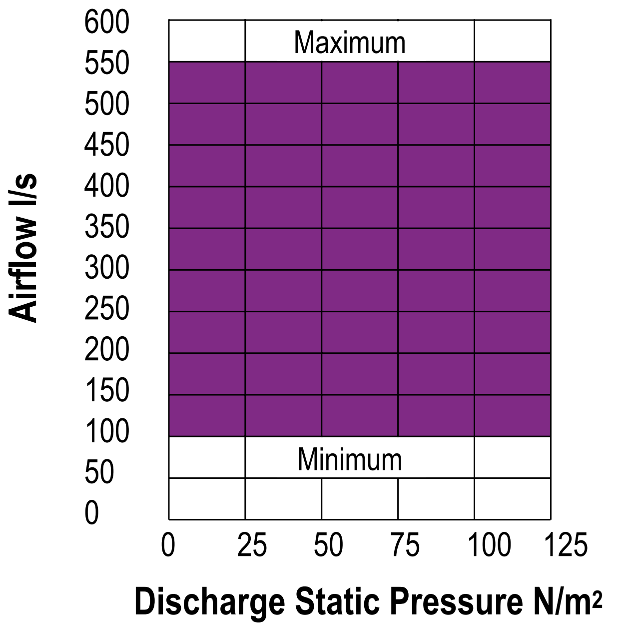
Model 35GG - Insulation covered with hermetically sealed Melinex membrane bags for indoor air quality applications.

Terminal Size	W mm	H mm	X mm	Y mm	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Spigot diam mm	Spigot qty	Wgt kg
3-150	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
3-200	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
3-250	400	400	460	460	150	A-K	200	A-K	250	A-K	315	A-K	15.0
5-250	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
5-315	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
5-355	600	400	660	460	150	A-L	200	A-L	250	A-K	315	A-K	25.5
7-400	1200	400	1260	460	150	A-N	200	A-N	250	A-M	315	A-L	45.0
7-450	1200	400	1260	460	150	A-N	200	A-N	250	A-M	315	A-L	45.0

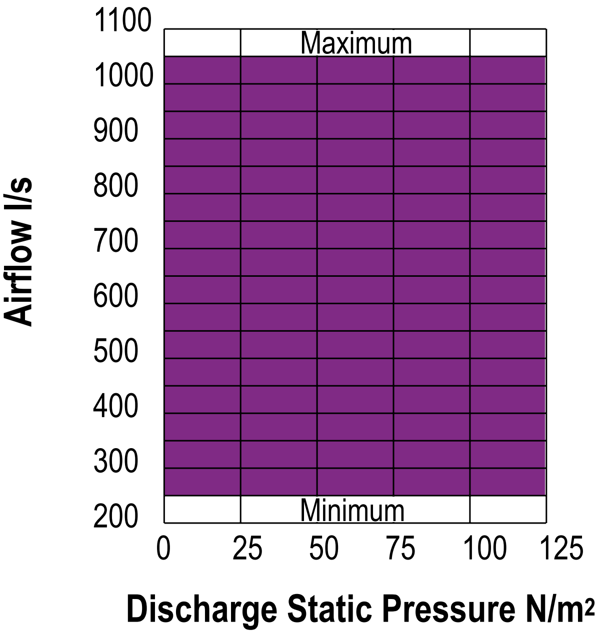
Series Flow ECM Brushless DC Motor Performance Data
Model 35SST

Fan Curves - Airflow vs. Downstream Static Pressure

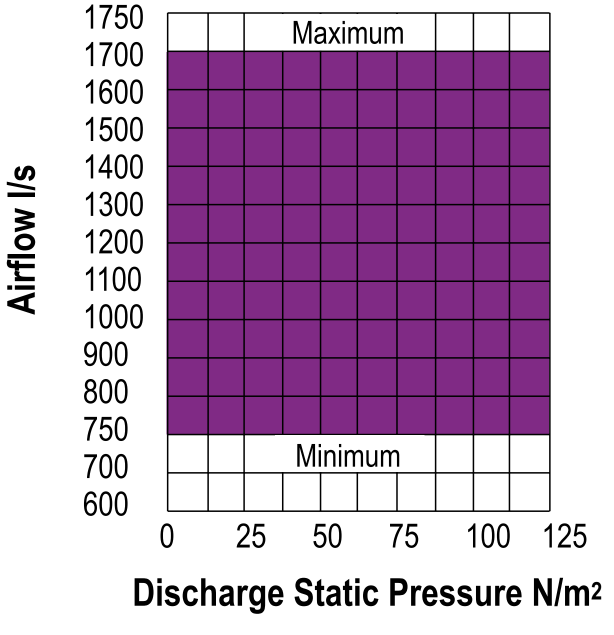
Unit Size 3 (1/2 H.P.)



Unit Size 5 (3/4 H.P.)



Unit Size 7 (2 @ 3/4 H.P.)



Notes

- The fan curves for the ECM motor are unlike those for traditional induction motors. The ECM motor is constant volume and airflow does not vary with changing static pressure conditions. The motor compensates for any changes in external static pressure or varying internal conditions such as filter loading.
- Airflow can be set to operate on a horizontal performance line at any point within the shaded area using the solid state volume controller provided.
- Fan powered terminal units featuring the ECM motor have considerably wider turn-down ratios than conventional induction motors. Hence, only three unit sizes are required in order to provide the same fan airflow range that would require six terminal unit/fan sizes when equipped with induction motors. A reduction in the number of different terminal sizes required on a typical project simplifies design lay-out and installation and reduces inventory of field service parts.
- Fan curves shown are applicable to 230 volt, single phase ECM motors. ECM motors, although DC in operation, include a built-in inverter.

Advanced Air

ENGINEERING GUIDE

Contents

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System Selection

Designers have various systems to choose from when designing a building. Choosing which one to use is not always easy. The owners' needs must be met for installation, application and cost of operation. The designer must consider performance, capacity, reliability and spatial requirements and restrictions. The following guidelines describe different types of equipment and their general uses, restrictions and limitations.

Building Use

The designer must consider the intended building use as he begins to consider the type of equipment he will use. Office buildings with daily operational schedules may use fan powered terminal units. Usually fan powered terminals with auxiliary heaters (supplementary heat) would be used in the perimeter zones. These terminal units allow the greatest flexibility for individual zones while also allowing the central system to be turned off during unoccupied periods. During the unoccupied periods, the fan powered terminal units maintain the minimum or set back temperature levels without the help of the central air conditioning equipment.

Building Size

In large buildings, the central air handling units deliver large volumes of air to many zones with different needs. This is a perfect application for fan powered terminal units. Interior zones may not require heat at all; therefore they can be served either by single duct units or fan powered units with no supplemental heat. Unless the building is located in a tropical climate, the perimeter zones will require some type of heat, either electric or hot water. These are usually included with the terminal units, but sometimes perimeter heat is used. Buildings where the owner desires low operating costs usually employ series type fan powered terminal units, and the static pressure in the ducts is lowered to 125 Pa or less at the highest points. Interior zones in these buildings would require fan powered terminal units.

In shopping malls and other low rise buildings where each tenant area is small and in very small buildings, it is common to use small package air conditioners. If terminal units are employed on these systems, usually bypass units are selected. A variation of this system uses single duct units with a main bypass damper in the supply duct. The bypass damper is regulated by the static pressure in the supply duct. A nearly constant pressure can be maintained allowing the package units to operate at constant volume and the individual zones to be pressure dependent VAV.

Acoustical Constraints

Broadcast studios, theatres, and libraries require very low noise levels. Equipment selection and location is important here. If fan powered terminal units are to be used, careful examination of the equipment sound performance is imperative. RFI and EMI should also be considered when designing television studios.

Environmental Factors

Environmental factors include the climate and air conditions inside as well as outside the building. They also include legislative requirements such as outdoor air ventilation rates and local building codes. If high ventilation rates are required in interior zones, reheat will be required. In laboratories where high ventilation rates exist when multiple fume cupboards are open, reheat is required. In zones where the load changes significantly during the day such as exterior zones in high rise office buildings that are affected by the season, solar loads and occupancy, fan powered terminal units are ideal. Single duct terminal units are usually employed where the load is usually stable.

Contamination Considerations

Hospitals, clean rooms and laboratories pose special problems. Operating rooms, AIDS, TB and bone marrow transplant patient areas and clean rooms require pressurised environments. In addition to the pressure requirements, reheat coils and exposed fibreglass are usually avoided to eliminate the possibility of microbial growth in hospitals. Hospital rooms and clean rooms frequently also require constant and high ventilation rates which tend to favour dual duct terminal units. Patient housing for highly contagious diseases, such as tuberculosis, require negative pressure within the rooms to avoid allowing the germs to escape. Laboratories handling hazardous materials also require negative pressure areas. Single duct and dual duct units are usually selected for this type of building, too. Nailor room pressurisation units employing Nailor EPIC technology, installed with a HEPA filter are ideal for this application.

Maintenance and Accessibility

Certain types of buildings such as clean rooms require high levels of reliability from terminal units due to the difficulty and cost associated with servicing or maintaining the equipment. In a clean room, for example, if the ceiling must be opened, the space may require disinfection before it can be used again. Associated costs would include lost production time as well as the cost for disinfecting the room. In cases like these, the equipment should be located outside of the clean room space or highly reliable, low maintenance equipment should be used.

Cost Factors

Costs must be considered before the final system selection is made. Installation, operation and maintenance all contribute to total cost. Sometimes one of these costs is more important than others. For example, if the owner/builder sells the building before construction begins, then his main concern will be construction costs, and operating costs will be unimportant. If the tenants pay their own utilities, operating costs are not a concern to the developer/builder. Electric heaters usually have a lower installed cost than hot water coils, but they usually have a higher operating cost as well. Local rates will have to be researched to arrive at the correct decision before making the final selection.

System Selection

The following table presents a summary of the different types of terminal units currently available and their suitability for particular commercial building applications.

	Facility Type												
	Office Space, Educational & Institutional Buildings				Hospitals, Clean Rooms & Laboratories*			Noise Sensitive Applications #			Other Facilities		
	Large Building		Small Building										
Terminal Type	Interior Zone	Exterior Zone	Interior Zone	Exterior Zone	Patient Areas	Operating Areas	Laboratory Space	Broadcast Studios	Theatres	Libraries	Public Use	Shopping Centres	Hotels, Multi-Residential
Single Duct													
VAV Without Reheat	S	N	S	S	S	P	S	S	S	S	N	S	S
VAV With Reheat	S	N	S	S	S	N	P	S	S	S	P	S	S
Fan Powered													
Series Without Heat	P	N	S	S	N	N	N	P	P	P	P	P	P
Series With Heat	S	P	S	P	N	N	N	P	P	P	P	P	P
Low Temperature	S	P	N	N	N	N	N	S	S	S	P	N	N

P = Preferred for this application.
S = Sometimes used for this application.
N = Not recommended for this application.

* = Sealed lining is recommended for ease of cleaning.
# = Special consideration should be given to selecting very quiet operating equipment and use of secondary attenuators.

Terminal Unit Selection

All of the terminal units described below share several common components; corrosion resistant galvanised mild steel casing, sound absorbing internal insulation with an erosion resistant facing and a throttling damper to control conditioned air. Associated controls may be pneumatic, analogue electronic or digital.

Single Duct

Description
Basic unit consists of a damper, actuator, flow sensor and selected controls. Secondary discharge attenuators and multiple outlet plenums are also frequently used.

Operation
The terminal resets the volume of conditioned cold air delivery to the space in response to the room temperature sensor. The terminal can handle hot or cold air. Occasionally, the terminal is used to control both hot and cold air, where a dual function thermostat and inlet temperature sensing with change-over controls are utilised.

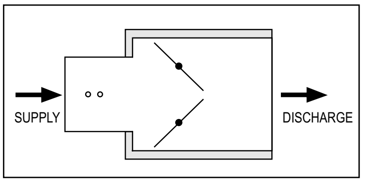


Figure 1. Single Duct (cross section)

Common Applications
Interior zones of a building which have a permanent cooling load and therefore no heating requirement, as well as hospitals, labs and clean rooms.

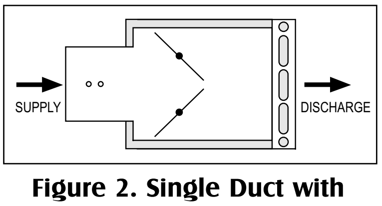


Figure 2. Single Duct with Re-heat (cross section)

Single Duct with Re-heat

Description
Basic unit consists of a damper, actuator, flow sensor and selected controls as above with the addition of a heating coil (hot water or electric). Secondary discharge attenuators and multiple outlet plenums are also frequently used.

Operation
The terminal resets the volume of conditioned cold air delivery to the space in response to the room temperature sensor. Upon a call for heat in the space the heating coil is energised and reheats the conditioned air. Electric coils are activated in stages upon temperature sensor demand and water coils are controlled using a proportional or two position on/off hot water valve.

Common Applications
1. Exterior zones (adjacent to outside walls or the upper floor in the case of multi-story buildings) where convective and radiated heat losses create an intermittent need for moderate heating as the terminal usually reheats at the minimum setting. An auxiliary higher minimum setting is available as an option with additional controls.
2. Interior zones where ventilation requirements preclude full shut-off of the terminal or minimum airflow requires some added heat.

Terminal Unit Selection

Fan Powered Series Flow (Constant Volume)

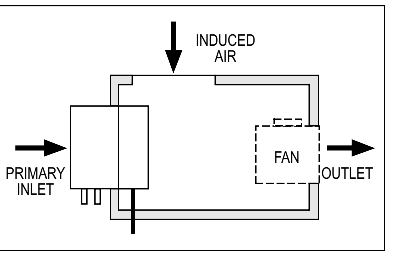


Figure 3. Fan Powered, Series (Constant Volume) (Plan View)

Description
Basic unit consists of a primary air damper, actuator, flow sensor, fan/motor (with flow adjustment), and selected controls. Accessory heating coils either hot water or electric are also generally required.

Operation
The primary air damper throttles conditioned cold air in response to the room temperature sensor and delivers this air stream to the mixing chamber upstream of the fan/motor located in series with the primary airflow. The fan/motor then delivers a constant volume of air to the space. Upon demand for maximum cooling, the airflow is derived entirely from the conditioned air supply. As the cooling demand diminishes, the primary damper reduces the conditioned air supply and the fan/motor compensates for this reduction by inducing make-up quantities of plenum air from the ceiling plenum thereby reclaiming otherwise wasted heat and mixing it with the conditioned air to maintain a constant volume variable temperature delivery of air to the space. Upon further reductions in space temperature, the supplemental heating coil is energised. The result is a constant volume of air diffusion to the space while the central system encounters a variable volume distribution system.

Common Applications
1. Exterior zones where heating and cooling loads may vary considerably and occupancy variances allow the central system to be shut-down or set-back during unoccupied hours.
2. Situations where central system economy is desired as central fans can be reduced in size because they only need to provide sufficient static to deliver air to the terminal.
3. Where occupant comfort is very important since the constant volume variable air temperature delivery produces optimal air distribution and optimum ventilation.

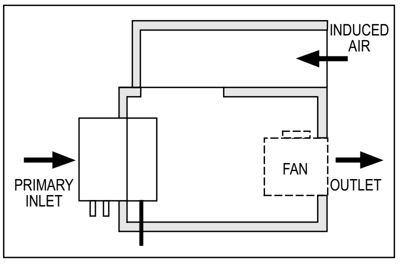


Figure 4 Fan Powered, STEALTH Series (Constant Volume)
(Plan View)

Fan Powered Series Flow (Constant Volume) Super Quiet Operation

Super Quiet Series Flow (Constant Volume)

Description
A terminal similar to above, but incorporating special design and construction features that provide unusually quiet operation.

Operation
As described above.

Common Applications
As described above, but premium performance and high quality construction are ideally suited to high profile design projects and applications requiring minimum noise, especially suitable for large zones and buildings allowing a lower first cost.

Fan Powered Series Flow, Low Temperature Air Distribution

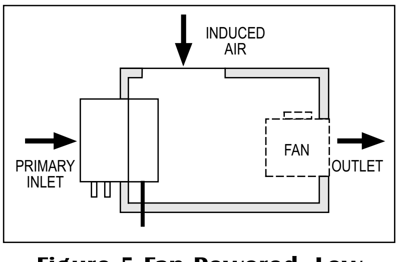


Figure 5 Fan Powered, Low Temperature (Plan View)

Description
Same as Fan Powered Series (Constant Volume) with special lining and insulated inlet spigot.

Operation
Same as Fan Powered Series (Constant Volume) description above.
The maximum cold air limit is established lower than the fan delivery in order to maintain the minimal mixing required to raise and temper the unit discharge temperature to a level acceptable for introduction to the occupied space, usually 13°C, with standard air outlets and maintaining ceiling coanda.

Common Applications
This unit is used with ice storage systems that are designed to provide low temperature (4 – 7°C) central system air distribution to the zone terminals

Introduction to VAV Terminal Controls

The control of air temperature in a space requires that the variable heating and/or cooling loads in the space are offset by some means. Space loads vary within a building and are influenced by many factors. These may include climate, season, time of day and zone position within the building, i.e. interior or exterior zone and geographic orientation. Other variable loads include people, mechanical equipment, lighting, computers, etc. In an air conditioning system compensating for the loads is achieved by introducing air into the space at a given temperature and quantity. Since space loads are always fluctuating the compensation to offset the loads must also change in a corresponding manner. Varying the air temperature or varying the air volume or a combination of both in a controlled manner in response to changing load conditions will offset the space load as required.

The variable air volume terminal unit or VAV box allows us to vary the air volume into a room and depending on type selected, also lets us vary the air temperature into a room.

The VAV terminal unit may be pressure dependent or pressure independent. This is a function of the control package.

VAV terminals are the most energy efficient means of providing control as the central system supply may be sized based on the simultaneous peak demand of the total zones. The diversity factor allows a reduction in capacity as the central unit does not have to be sized for the sum of the peak demands of the entire building.

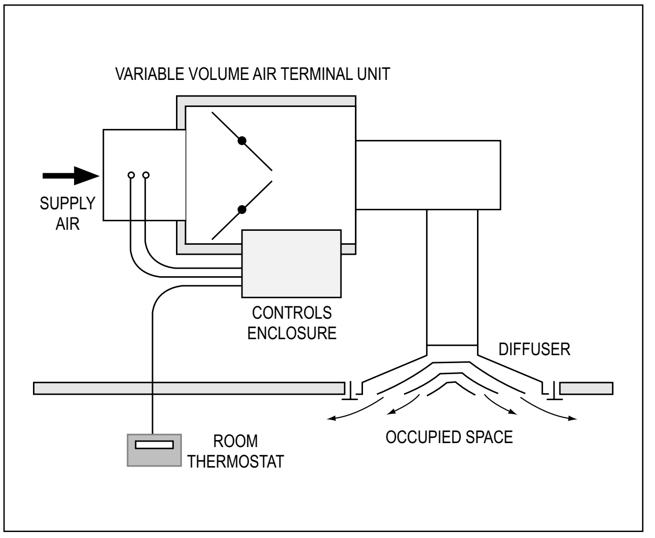


Figure 6. Typical Pressure Independent terminal unit controls and installation.

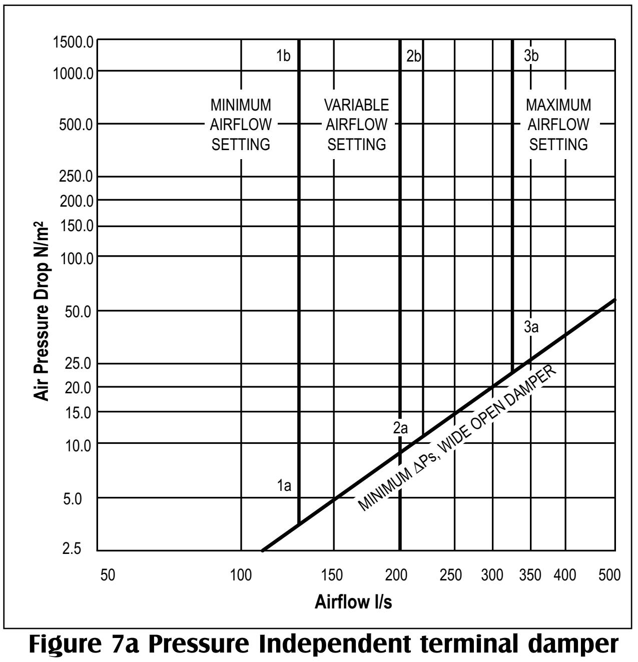


Figure 7a Pressure Independent terminal damper characteristics.

Pressure independence assures the proper distribution of air to the conditioned space as required and allows the engineer to know that the design limits specified will be maintained. Maximum and minimum airflow limits are important for maintaining proper air distribution.

- Maximum airflow limits prevent over-cooling and excess noise in the occupied space.
- Minimum airflow limits assure that proper ventilation is maintained.

Pressure Independent

A device is said to be pressure independent when the flow rate passing through it is maintained constant regardless of variations in system inlet pressure.

The pressure independent control is achieved with the addition of a flow sensor and flow controller to the VAV box. The controller maintains a preset volume by measuring the flow through the inlet and modulating the damper in response to the flow signal. The preset volume can be varied between calibrated minimum or the maximum limits by the thermostat output.

The logarithmic graph shown in figure 11a illustrates pressure independent terminals' typical airflow settings and characteristics. The vertical lines 1a – 1b and 3a – 3b represent the calibrated minimum and maximum airflow settings respectively, that are adjusted at the flow controller. Line 2a – 2b represents any intermediate airflow setting maintained by the flow controller in response to thermostat demand. The damper will modulate (open and close) as required to hold the airflow setting constant up and down this vertical line regardless of upstream static pressure variations. Airflow will only change when the thermostat signal (demand) changes. The vertical lines are cut off by the diagonal line 1a – 3a, which represents the minimum operating static pressure requirement of the terminal unit for the given airflow – the pressure drop across the terminal with the damper in the fully open position.

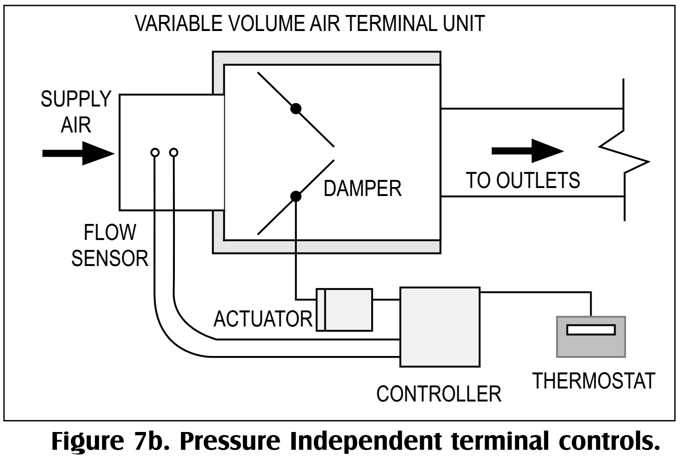


Figure 7b. Pressure Independent terminal controls.

Control Types

The various VAV controls available may include some or all of the following common components:

a) Flow Sensor

This device monitors the primary air inlet, measures air velocity and provides a feedback signal to the controller which directs the operation of the damper actuator. This control loop is the essence of the pressure independent operation.

b) Room Thermostat or Temperature Sensor

A room thermostat senses the room temperature, allows setpoint adjustment and also signals the controller to direct the damper actuator accordingly. Digital controls utilize a temperature sensor. Setpoint changes are managed by the digital controller.

c) Flow Controller

This device is 'the brain' and receives the signals from the Flow Sensor and the Room Thermostat or Temperature Sensor and processes the data to regulate the damper actuator.

d) Damper Actuator

This device receives the commands from the controller and opens or closes the damper to change or maintain the required airflow setting.

Analogue Electronic Systems (Pressure Independent)

Analogue electronic controls operate at 24 Vac powered by a transformer usually mounted within the control box of the terminal.

The electronic controls feature a velocity sensor (either the hot wire thermistor or pneumatic multi-point type with an electronic transducer) and an electronic velocity controller. They provide a proportional and integral (PI) control function.

The electronic thermostat is selected from one of four types; cooling, heating, cooling with reheat or cooling-heating. A three-stage reheat (two stages for fan powered terminals) or automatic heat/cool changeover relay can be furnished in the control box.

Analogue electronic controls are pressure independent and compensate for changes in duct pressure.

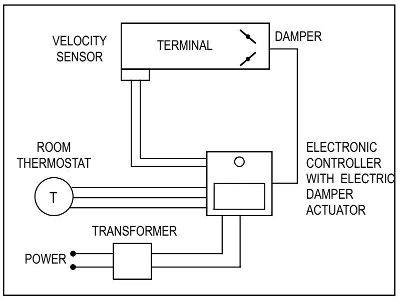


Figure 8. Analogue Electronic Control Schematic.

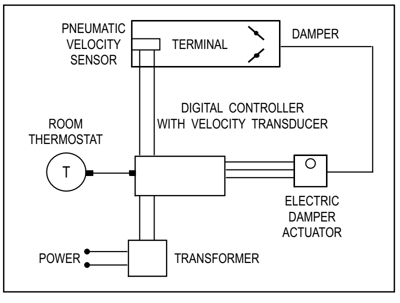


Figure 9. Digital Control Schematic.

Direct Digital Control (DDC) Systems (Pressure Independent)

These micro-processor based electronic controls also operate at 24 Vac powered by a transformer usually mounted within the control box of the terminal.

The flow signal from a pneumatic or electronic velocity sensor and signals from the room temperature sensor are converted to digital impulses in the specialized micro-computer controller. The program usually includes a proportional, integral and derivative (PID) control algorithm for highly accurate operation.

The controller not only performs the reset and volume control functions, but also can be programmed and adjusted either locally or remotely. It can link to other controllers and interface with fans, lighting and other equipment. Control can be centralized in one computer.

DDC Controls are pressure independent and compensate for changes in duct pressure.

Digital Control Overview

A direct digital controller uses a digital computer to implement control algorithms on one or multiple control loops. Interface hardware allows the digital computer to process signals from various input devices. The control software calculates the required state of the output devices, such as damper actuators and fan starters. The output devices are then positioned to the calculated state via interface hardware.

The basic principles of temperature control for heating, ventilation and air conditioning systems are well established. These control strategies have been implemented using pneumatic, electric, and analog electronic control devices. In this computer age, the microprocessor technology is now available in applications specifically designed for HVAC control. Microprocessor based controllers bring cost effective, state of the art computing power to the control of VAV terminal units, air handling units, packaged heating and cooling units, and entire building HVAC systems.

Microprocessor based controllers use direct digital control to replace conventional pneumatic or analogue electronic controls. A direct digital controller takes input signals from sensors to generate numbers, processes this information digitally as directed by the programmed sequence of operation, and generates control action through binary on/off outputs or analogue output voltages.

Features of Series Flow Fan Powered Terminal Units

General

Fan powered variable air volume terminal units are one of the most economical ways to heat and cool many types of buildings today. Typically used for exterior zones, they have advantages for interior zones as well.

Applications

Series units, sometimes called Constant Volume Units because the fan runs constantly, are typically installed in the ceiling plenum. Induction air is either from the ceiling plenum or occasionally ducted from the conditioned space.

Configuration

The fan and VAV damper are aligned so that all the conditioned air that enters the mixing section as well as all the induced air that enters the mixing section must go through the fan to exit the unit and enter the occupied space. The mixing section is between the VAV damper and the fan. See figure 10.

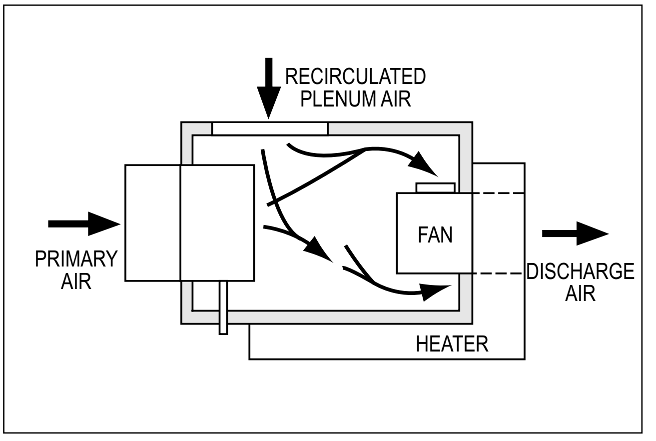


Figure 10. Series Flow Terminal Configuration

Fan Design

Typically the fan runs continuously supplying a constant volume to the space. (Some DDC manufacturers offer special controller features incorporating fan speed control which is accomplished by the building management system. This allows dynamic fan speed control which can be modulating or multiple speed operation from a single speed motor.) Usually you would use Nailor EPIC fan volume control in this case The fan must be sized to match the maximum airflow to be supplied to the zone. Fan energy consumption is constant during occupied periods

VAV Cooling and Inlet Static Pressure Requirements

All the savings of VAV operation at the air handler and at the chiller are retained by using the series unit. Additional savings compared to single or dual duct VAV are realized due to the low inlet static pressure requirement of the Nailor 35S. Since the air handler is only required to push the conditioned air through the ducts to the unit and across the VAV damper into the mixing section, the pressure at the air handler can be greatly reduced. Nailor 35S units require only 12 Pa static pressure at the inlet to operate properly. Using the 35S allows the duct designer to reduce the minimum static pressure in the upstream ductwork to (typically) 25 – 50 Pa or whatever is required to allow 12 Pa at the terminal while allowing a further reduction in horsepower and static pressure requirement from the air handler.

Control Sequence

The fan runs constantly during occupied periods.

During full cooling, the controls open the VAV damper to its maximum setpoint, delivering primary air to the mixing chamber. If the fan is set at the same airflow as the primary air VAV damper, then no air is induced from the plenum. If the fan is set at a higher airflow than the VAV damper, as it would be in a low temperature application, then air is induced from the plenum to meet the setpoint of the fan. The primary air and the induced air are blended before they enter the fan. Constant volume, constant temperature air is then discharged into the downstream duct and into the conditioned space.

As cooling demand decreases, the VAV damper modulates to lower setpoints until it reaches its minimum setpoint. Reducing the primary air into the plenum increases the volume of warmer induced air into the mixing chamber. The unit delivers mixed, constant volume, variable temperature air to the zone. The increased plenum air causes the discharge temperature to rise to nearly meet the plenum temperature taking advantage of the recaptured heat from lights, people and machinery.

Upon a further decrease in zone temperature, the controls will automatically energize the supplemental heat (optional equipment), either electric or hot water coils. The discharge temperature will increase as heat is applied.

As the temperature increases in the zone, the sequence will reverse.

Fan Interlocks

Sometimes series units are designed to run continuously. Usually, they are energized only during occupied periods or when needed for emergency heating during unoccupied periods. It is important to interlock the unit fan with the air handlers in the building to insure that they start during occupied periods. Series unit fans should be started ahead of the air handler to prevent back flow into the plenum and backwards rotation of the fan. Nailor 35S series units have a built-in, anti-backward rotation device; however, if the fan is allowed to rotate backwards at unusually high rpms before the motor is energized, the device can be overwhelmed by the backward momentum causing the motor to run backwards. Interlocking the unit fan with the air handler eliminates this problem. Interlocks can be airflow switches or relays to match the building management system. ECM motors can not run backwards.

Acoustics

Series fans are sized to match the maximum airflow required in the zone. The fan runs constantly during occupied periods. There are two sound sources in the unit, the fan and the VAV damper. While both contribute to the overall discharge and radiated sound emitted from the unit, the fan is primarily responsible for discharge noise while both the damper and the fan are responsible for radiated noise. Usually the radiated noise into the room is the larger and therefore more critical of the two components.

Comparing the sound level between a series and a parallel unit in similar zones, the series unit might generate slightly more noise. The fan and damper would be at their peak when the unit operates at full cooling capacity, the worst position in the sequence of operation for noise generation. As the primary air decreases, the noise generated would eventually be only from the fan.

Damper noise must be considered, however, as the noise decreases with decreasing inlet static pressure. It would be possible to select a very quiet series unit if very low inlet static pressure were utilized along with a very quiet fan since both components would decrease the radiated noise significantly.

Fan noise is constantly emitted into the zone. If the building is designed well and the terminal units are selected correctly, the fan will be the major noise component.

Energy Consumption

Fan powered VAV terminal units were originally designed and introduced to the HEVAC industry for their ability to save energy. That is what makes them so necessary and popular. They take advantage of typical VAV savings at the air handler and the chiller during the cooling periods, but the real savings are realised when heating is required. Fan powered terminals induce warm plenum air from the ceiling and blend it with the primary air at minimum ventilation requirements during the heating sequence. This recaptures all the heat created in the zone and plenum by lights, occupants, solar loading, and machinery or equipment such as computers, coffee machines, copiers, etc. Then the unit returns this heat as free heating rather than wasting it back at the air handler. If additional heating is required, then supplemental heat is added to the sequence, but the unit still saves energy by warming blended air at 24°C rather than reheating primary cooled air at 13°C, saving the cost of 11°C. at the heating airflow. Costs of operating the units pale in comparison to the cost of running other systems.

Fan Flow Control on Fan Powered Terminal Units

Introduction

When designing air systems and using fan powered VAV terminal units, it is as important to match the fan air to the space requirements as it is to match the primary air. To facilitate this process, Nailor Industries designed their units to work over a wide range of adjustability. The two commonly used methods are electronic fan speed control and mechanical trimming. The ultimate in fan control is Nailor EPIC fan control.

Nailor EPIC Fan Technology

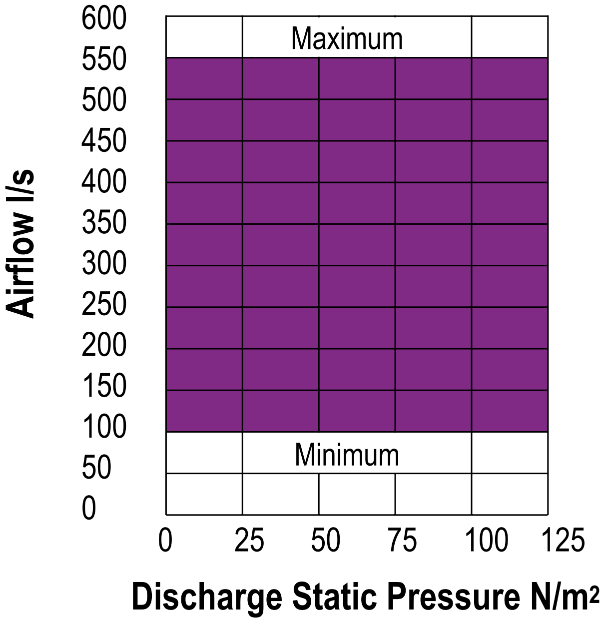
Nailors 35SST, 37SST, 35S and 37S series units are all available with Nailor's EPIC fan technology. This option reduces the energy consumption at the fan by more than 50% at typical fan set points (even more at lower set points) while making the fan and motor assembly a completely predictable and programmable pressure independent assembly. Nailor's EPIC option allows the fan to be set at the factory before shipment to the job site or dynamically reset to room demand by the DDC controller and a pneumatic controller. EPIC fan technology starts with a smart motor (a DC electronically commutated motor) and a fan reset controller. Each motor is equipped with its own AC to DC converter and variable frequency drive. With the reset controller, the motor knows its rpm, the amount of torque it is producing and what airflow is required. It can calculate airflow from the known data and automatically adjust its torque and rpm to meet the required output regardless of external conditions, even if they are not constant and even if they are constantly changing.

Nailor was the first to introduce this technology to the industry in April 1997. It is still revolutionary as it allows fans to be preset at the factory or at the computer terminal, never requiring the commisioning contractor to go into the ceiling for fan adjustment. Additional features are sealed ball bearings that never require lubrication, slewed speed ramps and soft starts that never apply torque to the mounting hardware. Nailor's EPIC fan technology is industry leading state-of-the-art. It incorporates the highest effciency and most predictable and controllable motor options in any fractional horsepower application.

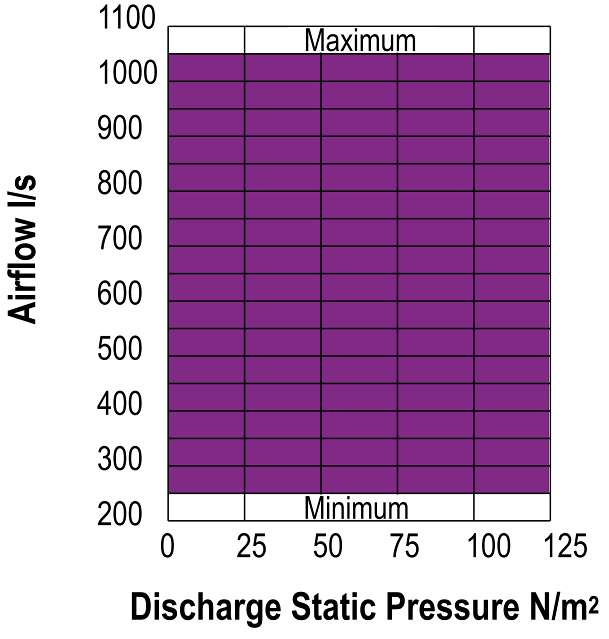
Fan Shift in Series Fan Powered Terminal Units

Before adjusting the fan, the possibility of fan shift must be considered. Some VAV terminal units suffer from a condition known as fan shift. This occurs when the fan is subjected to variations in pressure on the inlet side of the fan. As the primary damper changes from full cooling to minimum cooling, the pressure drop caused by the induction mixing chamber and associated inlet attenuators may cause the fan to shift its performance as it rides the fan curve. Consequences from the phenomenon vary from building to building and zone to zone, but if diffusers add background masking noise at design flow, then the noise levels will change as the volume changes. Design ventilation rates can also vary. Nailor series fan powered terminal units are designed to eliminate fan shift by using EPIC fan technology.

Unit Size 3 (1/2 H.P.)



Unit Size 5 (3/4 H.P.)



Unit Size 7 (2 @ 3/4 H.P.)

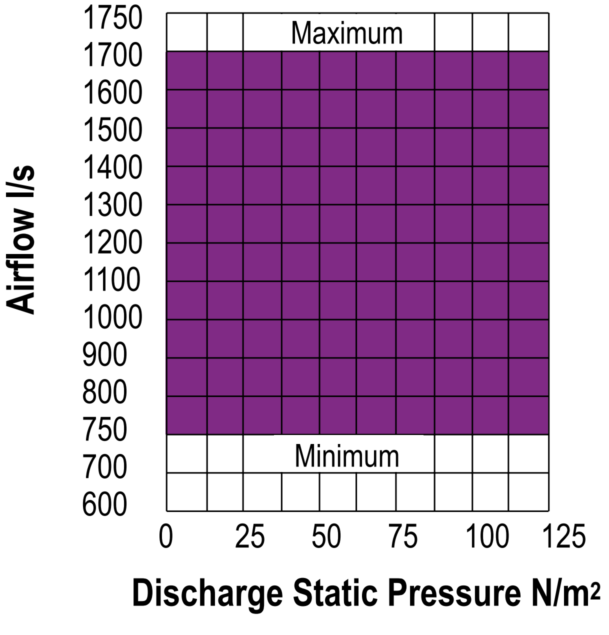


Figure 11 Nailor ECM Fan Curves

Notes

- The fan curves for the ECM motor are unlike those for traditional induction motors. The ECM motor is constant volume and airflow does not vary with changing static pressure conditions. The motor compensates for any changes in external static pressure or varying internal conditions such as filter loading.
- Airflow can be set to operate on a horizontal performance line at any point within the shaded area using the solid state volume controller provided.
- Fan powered terminal units featuring the ECM motor have considerably wider turn-down ratios than conventional induction motors. Hence, only three unit sizes are required in order to provide the same fan airflow range that would require six terminal unit/fan sizes when equipped with induction motors. A reduction in the number of different terminal sizes required on a typical project simplifies design lay-out and installation and reduces inventory of field service parts.
- Fan curves shown are applicable to 230 volt, single phase ECM motors. ECM motors, although DC in operation, include a built-in inverter.

Caution on Meters

Many digital multi-meters are not designed for true RMS readings. Using these meters when measuring amps or voltage on the motor in the fan powered terminal unit can result in erroneous readings. To measure the correct current and voltage, a true RMS DMM designed for this type of sine wave is required. These meters are not usually the least expensive meters

Nailor Benefits

- Motors have a larger turn down ratio.
- Nailor uses an electronic fan speed controller.
- Nailor units do not suffer from fan shift.

Sizing Fan Powered Terminals

The selection of fan powered terminal units involves four elements. How these elements are selected and their interactive effect determine the final overall performance of the units.

1. Primary Air Damper Selection

Identify the type of controller that is desired and select an inlet size that meets the minimum and maximum airflow desired from the recommended primary air volume range table provided in the Performance Data section of the catalogue. Selecting terminals near the top of their range may reduce cost, but will increase velocity and noise. For typical low pressure applications – selecting towards the bottom of the airflow range will reduce sound levels as larger inlets reduce face velocity and are quieter. Selecting the maximum airflow setting at between 70 – 85% of full capacity is a good trade-off to avoid possible low velocity control problems and sound problems at higher velocities.

2. Fan Size Selection

Fan selection is dictated by model, type and maximum primary airflow.

Series (constant) fan terminals usually require the fan to be sized to handle the maximum design air volume. The secondary fan air volume must be at least equal to the primary air to ensure the terminal does not become pressurized resulting in primary air spilling out into the ceiling plenum through the induction ports. The external static pressure requirements are the sum of the ductwork and diffusers downstream at design airflow plus an applicable hot water coil or electric heater, if required.

When fan airflow and downstream static pressure have been determined, select the fan size from the fan curves in the Performance Data section of the catalogue. Selecting towards the upper end of the range will keep down first cost and optimize fan operating efficiency. Upsizing the fan and operating it at a reduced speed can result in quieter operation. When electric or hot water coils are required, the Nailor EPIC fan volume control will continue to deliver the airflow designated by the fan curves without degradation.

3. Heater battery Selection

First determine the heating supply air temperature to the space by calculation using the heat transfer equation:

Where:

$Q = \text{vol.} \times 1.2 \times 1.02 \times \Delta t$ Q = Design Heat Loss (kW.)

Δt = Supply air temperature (SAT) - Room design temperature (RT).

The supply air temperature (SAT) to the space equals the leaving air temperature (LAT) for the terminal unit.

Once the terminal LAT is determined, the heating requirements for the coil can be calculated. The leaving air temperature for the coil varies based on the type of model.

It is generally a good idea to maintain air temperatures of 29-35°C for air entering a room. This is LAT off the heating coil. Air this temperature can be effectively used to warm the room as it is not so buoyant that it cannot be driven to the floor, and it is warm enough to not produce chills from drafts.

Once both coil EAT (entering air temperature) and LAT are calculated, the heat transfer (Q) for the coil must be calculated, using the heat transfer equation. For electric heat, the capacity must be converted to kWh for selection. The required kW and number of steps desired should be checked with availability from the charts in the Performance Data section of the catalogue. For hot water coils, reference the capacity charts in the Performance Data to select the appropriate coil.

In fig 12, heating coils are located on the unit discharge so LAT for the coil equals the LAT for the terminal unit. Heating coil EAT equals the temperature of blended primary air and plenum air.

$$\therefore \text{EAT (of coil)} = \frac{T_1Q_1 + T_2Q_2}{Q_T}$$

Where:

T_1 = Plenum air temperature T_2 = Primary air temperature

Q_1 = Plenum air quantity (l/s) Q_2 = Primary air quantity (l/s)

Q_T = Total air moved by terminal fan (l/s)

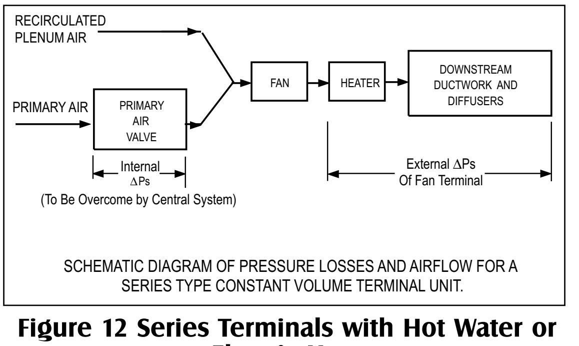


Figure 12 Series Terminals with Hot Water or Electric Heat

4. Acoustics

Resulting sound levels are due to air valve generated noise and fan generated noise. The maximum noise generated by a given primary air damper size is determined by the difference between design inlet static pressure (the damper's most pressurized condition) and external static pressure at design cooling airflow. This represents the most extreme operating condition.

To determine fan noise levels, fan airflow (adjusted within its range by the Nailor EPIC fan volume controller) and external static pressure conditions are required.

With a series unit, primary air damper and fan are evaluated together for cooling, as they operate simultaneously and fan only for heating, in the occupied mode (in the unoccupied mode, a night setback fan cycling option is available).

From the performance data, determine the sound power levels for both discharge and radiated path under the appropriate operating conditions. If the terminal is properly located some distance from the supply air space, discharge air noise is generally a secondary concern. Radiated noise from the unit casing typically dictates the noise level in the installed location space.

Terminal Installation and Application Precautions
Avoiding Common Problems

Sizing Terminals

Select terminals based upon recommended air volume ranges. The pressure independent terminal's main feature is its ability to accept factory calibrated minimum and maximum airflow limits that correspond to the designer's space load and ventilation requirements for a given zone.

A common misconception is that oversizing a terminal will make the unit operation quieter. In reality, the terminal damper will have to operate in a pinched-down condition most of the time which may actually increase noise levels to the space. Control accuracy may suffer as the terminal is only using a fraction of its total damper travel or stroke. In addition, the low inlet velocities may be insufficient to produce a readable signal for the sensor and reset controller. This means minimum settings may not hold with a resultant loss of control accuracy and undesirable hunting.

The recommended selection for maximizing performance is to size the terminal's maximum airflow limit for 70 – 85% of its rated capacity in accordance with the catalogue recom-mendations. For accurate control the minimum setting guideline is not lower than 20% of the unit's rated total capacity.

Another problem associated with oversizing terminals with electric heat is again insufficient velocity causing occasional tripping of the airflow safety switch.

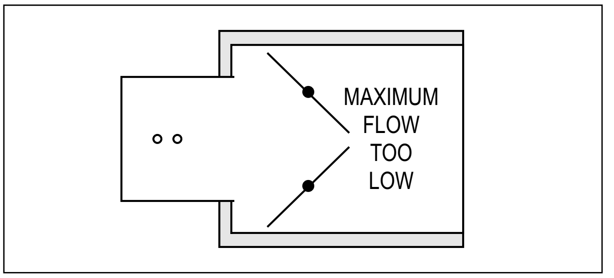


Figure 13 Severe Throttling: Oversized terminals will operate in a near closed position even at maximum airflow. Control accuracy may also suffer.

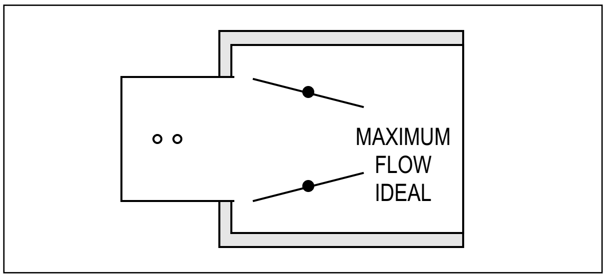


Figure 14 Ideal Throttling: Correctly sized terminal will utilize the majority of its damper travel and improve performance.

Observe Space Restrictions

During the design phase try and ensure terminals are located for ease of installation, optimum performance and maintenance accessibility. Figure 15 shows all of the worst conditions: a convoluted inlet, controls and heating coil connections are restricted as the terminal is against a wall and the outlet restricted condition reduces performance.

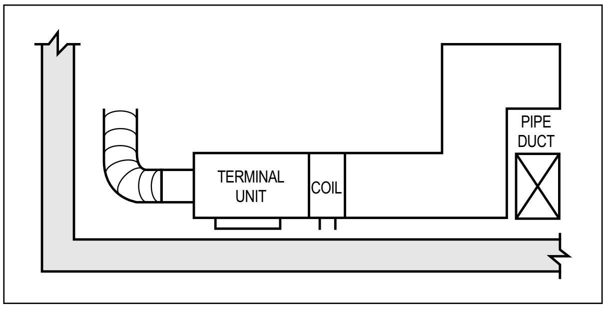


Figure 15 Restricted Installation, Poor Location.

Optimize Inlet Conditions

The type of duct and its approach may have a large and adverse impact on both pressure drop and control accuracy. Figure 16 shows several typical poor conditions that generate unwanted turbulence. Although multi-point sensors can compensate to a large degree, good design practice should always prevail. Nailor recommends wherever possible, a straight duct inlet connection with a minimum length of two duct diameters, the same size as the inlet.

Terminal inlet spigots are undersized to suit nominal ductwork dimensions. The inlet duct slips over the terminal inlet spigot and is fastened and sealed in accordance with project specifications. Never insert a duct inside the inlet spigot, control calibration will be adversely affected.

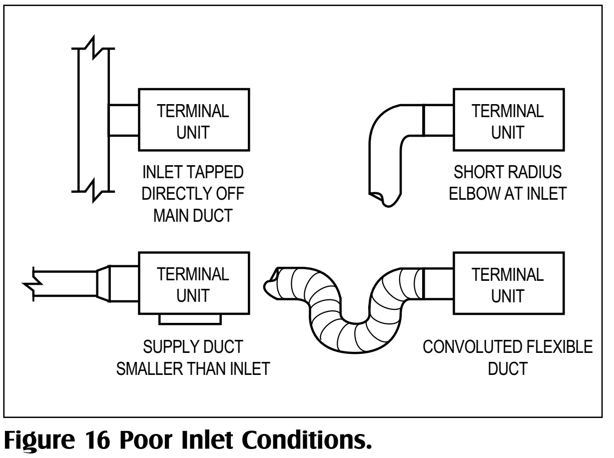


Figure 16 Poor Inlet Conditions.

Terminal Installation and Application Precautions
Avoiding Common Problems

Sometimes it is not possible due to space restrictions to provide an ideal inlet condition. In this case field adjustment of the airflow settings on the velocity controller may be required to compensate. The use of flow straightening devices (equalizing grids) are recommended after short radius elbows that are immediately ahead of the terminal and where terminals are unavoidably tapped directly off the main duct.

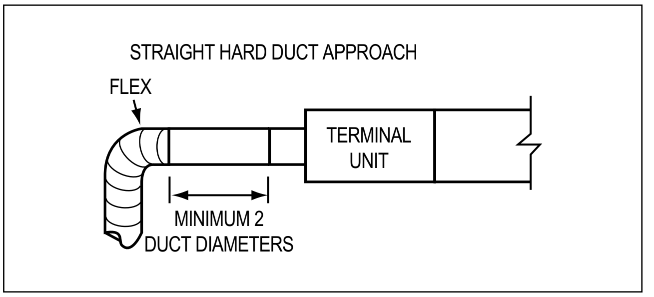


Figure 17 Ideal Inlet Conditions.

Observe Zoning Requirements

Correctly sizing terminals with regard to the physical conditions of the occupied space is vital to ensure acceptable performance. One large terminal serving a space with divided work areas may result in the single thermostat only providing acceptable temperature control where it is located. The other space(s) served may be too cold or too hot if it has differing space load requirements.

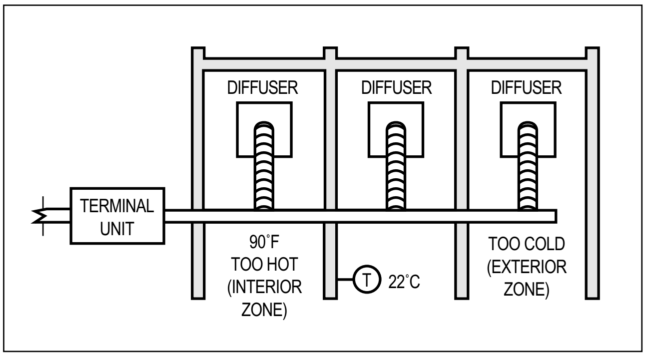


Figure 18 Poor Zone Application.

Optimize Discharge Conditions

Poor discharge duct connections may have an adverse affect on pressure drop. Try and avoid installing tees, transitions and elbows close to the inlet discharge. Avoid long runs of flex and keep short flex runs as straight as possible. Make curves as shallow as possible and ensure entrance condition to diffuser outlet is straight.

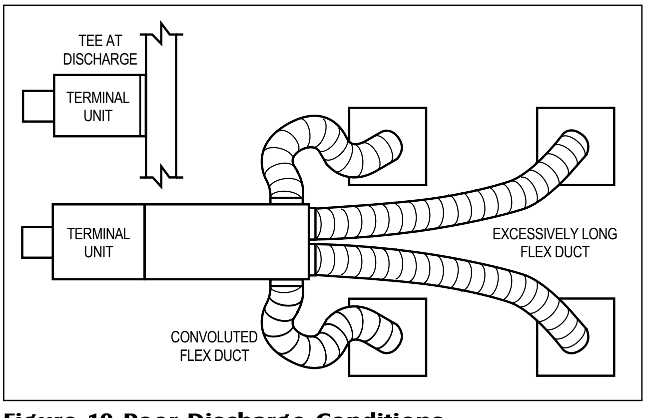


Figure 19 Poor Discharge Conditions.

Terminal Installation and Application Precautions Avoiding Common Problems

Avoid Excessive Air Temperature Rise

Terminals with electric or hot water reheat coils should be designed to satisfy load conditions but attention should be paid to the temperature differential (Δt) between the entering room air and ambient temperature. We recommend a maximum Δt of 8˚C to avoid possible stratification due to the excessive buoyancy of the warm air and ensure good room mixing and temperature equalization. Absolute maximum air entry temperature is 49˚C for comfort heating.

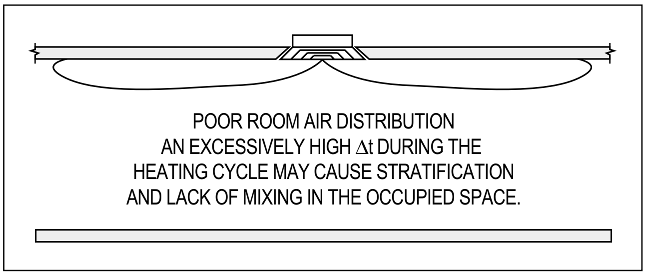


Figure 20 Avoid excessive temperature differentials

Correctly Supported Terminal

Although the basic single duct terminal is light enough that it can be supported by the ductwork in which it is installed, we recommend that the units be independently supported. When accessory modules such as heating coils, attenuators or multiple-outlet plenums are included, the assembly should also be supported directly.

Larger terminals such as fan powered terminal units should always be independently supported and secured to building structure.

Be careful not to block access panels with drop rods or hanger wires.

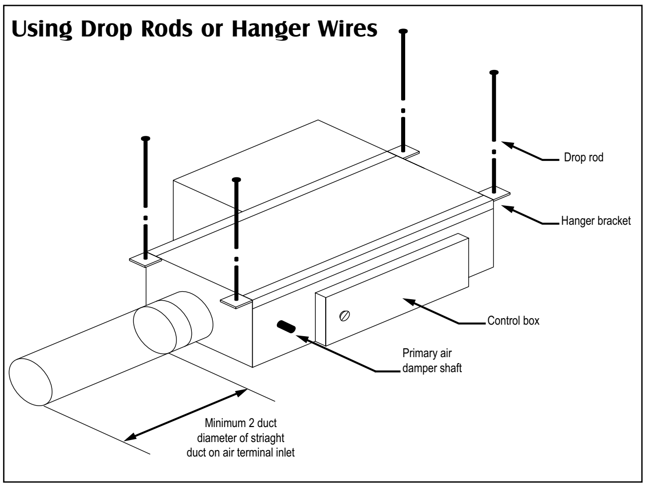


Figure 21 Recommended Terminal Suspension.

Minimise Duct Leakage

To prevent excess air leakage and minimize energy waste, all joints should be sealed with an approved duct sealer. Most leakage can be avoided by practicing good fabrication and installation techniques, particularly upstream of the terminal which may be required to hold significantly higher pressures than downstream of the terminal.

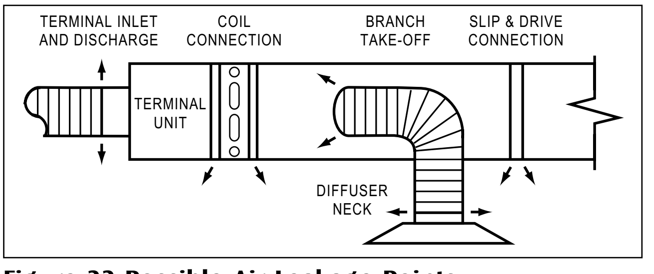


Figure 22 Possible Air Leakage Points.

Useful Formulae and Definitions

Airflow

Q = V x A

Q = Airflow Rate - m^3/s
V = Velocity - m/s
A = Area - m^2

Pressure

$$Pv = \left(\frac{V}{1.3}\right)^2$$

Pv	=	Velocity Pressure	N/m^2
V	=	Velocity	m/s
PT	=	Pv + Ps	
PT	=	Total Pressure	N/m^2
Pv	=	Velocity Pressure	N/m^2
Ps	=	Static Pressure	N/m^2

Heat Transfer

$Q = m\,c\,\Delta t$

Q	=	Quantity of Heat	kW
M	=	Mass	kg
C	=	Specific Heat Capacity	kJ/kg°C
Δt	=	Temperature Difference	°C

Water Coils

$$\Delta t = \frac{Q}{m \times c \times v}$$

Δt	=	Air Temperature Rise	°C
Q	=	Quantity of Heat	kW
M	=	Mass	
C	=	Specific Heat Capacity	kJ/kg °C = 4.2 water
V	=	Air Volume	m^3/s

Electric Heater Batteries

$$\Delta t = \frac{Q}{m \times c \times v}$$

Δt	=	Air Temperature Rise	°C
Q	=	Quantity of Heat	kW
M	=	Mass	kg
C	=	Specific Heat Capacity	kJ/kg°C = 1.02 Air
V	=	Air Volume	m^3/s

Power DC Circuits

$$HP = \frac{V \times A \times Eff}{746} \qquad Eff = \frac{746 \times HP}{kW}$$

kW = V x A
V = Volts
A = Amperes
Eff = Efficiency

Power AC Circuits Single Phase

$$PF = \frac{kW}{V \times A}$$

$$A = \frac{746 \times HP}{V \times Eff \times PF}$$

$$Eff = \frac{746 \times HP}{V \times A \times PF}$$

$$kW = \frac{V \times A \times PF \times Eff}{1000}$$

$$HP = \frac{V \times A \times PF \times Eff}{746}$$

Power AC Circuits Three Phase

$$PF = \frac{kW}{V \times A \times 1.732}$$

$$A = \frac{746 \times HP}{V \times Eff \times PF \times 1.732}$$

$$Eff = \frac{746 \times HP}{V \times A \times PF \times 1.732}$$

$$kW = V \times A \times PF \times Eff \times 1.732$$

$$HP = \frac{V \times A \times PF \times Eff \times 1.732}{746}$$

PF = Power Factor
kW = Kilowatts
V = Volts
A = Amperes
HP = Horse Power
Eff = Efficiency