Fan Assisted VAV Control Assemblies

Holyoake fan assisted VAV terminals, both **Parallel** and **Series** types, have been designed to provide optimum performance with robust construction, minimum noise and maximum reliability.

Construction is rugged galvanised steel with non-woven acoustic polyester insulation, minimising casing radiated and airborne noise.

Access for service has been given high priority. The complete bottom panel has been designed for removal without affecting the mounting of any internal components.

Fan and Motor. A forward curved fan assembly is used and is directly driven by a 3 speed single phase motor. Housed in a semi rigid high density casing. A 3 speed switch is provided as standard.

Infinite Speed Control is achieved by an optional variable speed controller with minimum voltage adjustment to guard against stalling at low speeds. The speed controller is used in conjunction with the most suitable motor speed winding, connections for which, together with the controller, are located on a small panel.

Accurate Velocity Control of primary air is achieved, where the selected controls allow, by the use of Holyoake PDI averaging (multi-point) velocity sensors, which tolerate up to 90º hard bend inlet conditions with little change in accuracy. These sensors have been shown by independent tests in straight duct to be consistent, one to another, within 1%. Their flow measurement accuracy is within ±2.5% in straight duct and ±5% after a hard 90º bend. Actual flow may be measured independently of controls by micromanometer, or magnahelic, using the capped Tees provided.

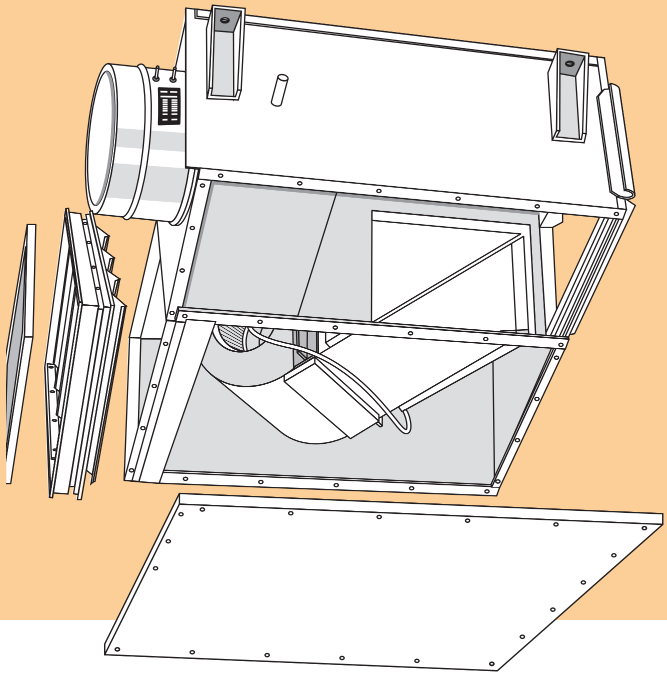
* Note that velocities below 1.8 m/s generate ΔP's below 3 Pa and instrument sensitivity may preclude measurement at these levels.

Secondary Air Filters are furnished with 'EU2' washable type media as standard.

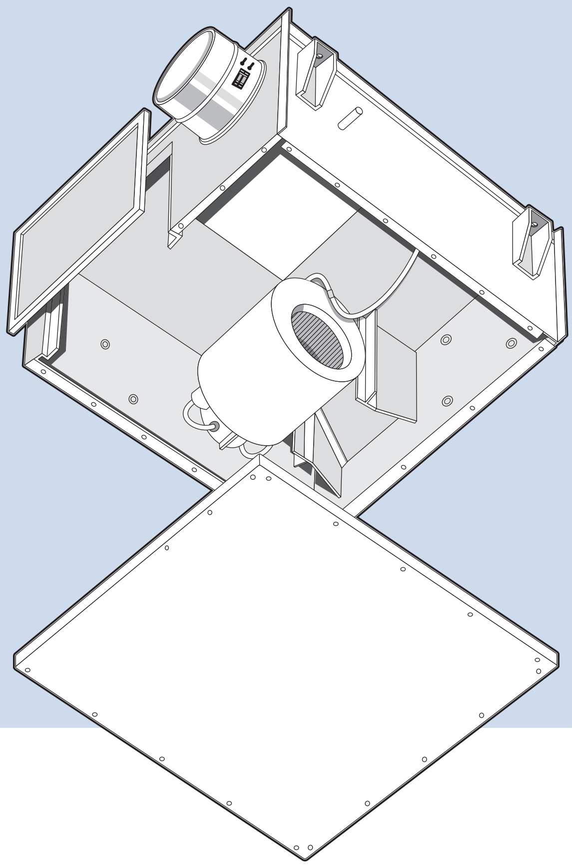
Controls may be of any specified make and type to match any B.M.S. This normally implies compatible D.D.C. However, where a B.M.S. is not involved, or where communication with it can be kept to a limited level, Electronic Analogue controls offer a lower cost alternative, with all or most of the features offered by D.D.C. Pneumatic control is also available.

Guide Product Weights		
Case Size	Description	Approximate Weight in Kg.
350	HFCP Fan Assisted - Parallel (Inc Square Flange)	20
350	HFCS Fan Assisted - Series (Inc Square Flange)	20

Model **HFCP**



Model **HFCS**



HFC – Fan Assisted VAV Terminals

Fan assisted VAV terminals offer features which may be desirable where load conditions can not be entirely met by primary only VAV, without compromising either air movement standards, or running costs. With conventional primary air temperature systems, they are more likely to be found in the perimeter zones, where load fluctuations and reversals occur, or in stable low load interior zones where air circulation requirements need boosting above those required to match cooling loads. Lower primary air temperatures, such as those encountered with ice storage plants, would be likely to find fan assisted units essential, in order to provide adequate diffuser performance, offsetting the effects of a down sized air system. The selection of any fan assisted unit should always be done with the knowledge that it is a piece of mechanical equipment above the occupied area. It needs full voltage electrical power and it will require regular access for filter replacement. Like any piece of mechanical equipment, it does have the potential for noise, or failure, however carefully it is made and installed.

Applications which need fan assisted units will be those which must benefit from the following features:

a. Increased air movement during low cooling, or re-heat periods.

b. Full or partial heating by waste heat accumulated in the ceiling space, significantly reducing heating operating cost.

c. Primary air turn-down to zero, or very low minimum ventilation requirements, with room air velocities maintained at full primary air levels or greater, as required.

d. Independent operation as a fan/heater, either with, or without, electric, or hot water heating coils.

e. Retrofit to replace constant, or variable volume dual duct units.

All of the above must be achievable without compromising minimum ventilation rates and indoor air quality.

Two Basic Types

The two basic types are **Parallel** (variable flow), or **Series** (constant flow).

Both contain a primary air variable volume valve and re-circulation fan, and both take secondary air from the ceiling space.

The illustrations, figures 1 and 2, show the different configuration of the two types.

Figure 1.

In the **Parallel** unit, primary air enters the valve and flows directly into the distribution duct. At reduced volumes, the fan is called into operation causing secondary air to flow **Parallel** to the primary air, mixing with it before entering the distribution duct. The fan therefore, runs intermittently.

Figure 2.

In the **Series** units, the primary air enters the valve, mixes with the secondary (ceiling) air, and continues in **Series**, through the fan into the distribution duct. The fan runs continuously while air conditioning is required.

Comparisons between the two are outlined on the following pages.

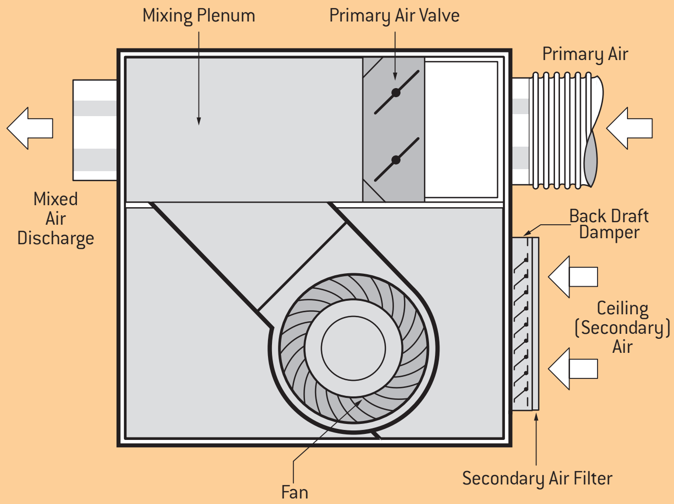


Figure 1. Parallel Fan Terminal HFCP.

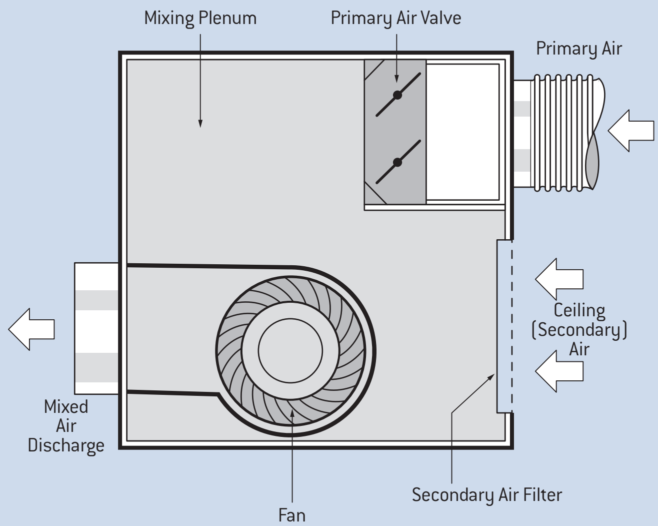


Figure 2. Series Fan Terminal HFCS.

GENERAL COMPARISON OF TYPES

Para. Ref.	Item	Parallel	Series
1	Primary air inlet pressure requirement	higher	lower
2	Fan air flow and discharge pressure	lower	higher
2	Terminal running cost	lower	higher
2	Noise type	intermittent	constant
2	Noise level	lower	higher
3	Diffuser maximum airflow	larger	smaller
4	Precaution against backward rotation	none	some
5	Suitable pressure independent	yes	no
6	Main plant running cost at zone part load	lower	higher
7	Loss of service if secondary fan fails	heating	all
•	Filter cleaning	less	more

This table relates to Paragraphs 1-7 of System Considerations on page 285G.

System Considerations

1. Although power savings at the primary fan can be achieved by both types, they do not have the same inlet static pressure requirements.

   Like primary only VAV terminals, **Parallel** units require sufficient static pressure to overcome the open valve resistance, typically about 40 Pa, as well as the discharge duct and diffusers of around 60 Pa. i.e. a total of 100 Pa.

   Series units can be supplied with primary air at a static pressure only marginally above ambient, typically around 40 Pa, since the fan power, which is always available, covers the down stream requirements.

2. Air Volumes handled by the fan for **Parallel** units are usually between 50% and 65% of full primary air, generally using the same fan operating at a lower speed and therefore, lower operating noise level and running cost. The secondary fan is also selected for the lower discharge static pressure required by reduced air flow.

   Consideration by the designer should be given to whether it is more desirable to have a quieter, but variable noise level.

   Air volumes handled by the fan for the same load are greater for the **Series** unit at 100% full primary air.

   Noise levels are higher, but constant on these units.

3. When sizing the discharge duct and diffusers, it should be noted that larger total air quantities and the consequent increase in friction if duct sizes are not increased, are likely to occur with **Parallel** units when the fan begins to operate while primary air is turned down to anything more than 30%. It is likely that the discharge duct and diffusers will need to be sized for a maximum air flow of the combined primary (say 60%) and secondary (say 65%) i.e. 125% of full primary. The effect of increased resistance on the fan will probably reduce secondary flow, but it is still likely that discharge air flows will be 120% of full primary air. The effect of this should be taken into account when selecting diffusers and when determining discharge pressure requirements for the fan assisted terminal.

4. As a precaution against the possibility of backward fan rotation at start up of the fan terminal, **Series** terminal fans should be interlocked so that they are energised before the main fan which could otherwise cause back flow of primary air into the ceiling plenum. It would be necessary however, for the secondary fan motor to reach almost synchronous speed in reverse at start up to cause damage, so this precaution should be evaluated in the context of the main air system.

5. **Series** type terminal fans should have speeds adjusted to match (or be slightly greater than) full primary air flow. Over-pressurising the unit with primary air causes lost energy as it spills into the ceiling void. For this reason **Series type units should not be used in pressure dependant systems.**

6. For all practical considerations, non assisted, or **Parallel** units, would have lower running costs compared with the equivalent **Series** type units, which continuously draw heat from the ceiling space. This adds to the occupied zone sensible cooling load, particularly at partial load conditions, increasing the primary air requirement.

7. In a **Parallel** system, failure of the assembly fan, or its power supply, leaves the primary (and ventilation) air supply unaffected, so that occupants notice no discomfort during full, or partial cooling demand. Only heating demands cannot be met.

   Such a failure in a **Series** system, completely and immediately deprives the zone of air conditioning while primary air, flowing at maximum levels due to the unsatisfied room stat, is ineffectively spilled into the ceiling void.

Economics

An energy audit of a fan assisted system must include the effects on central plant heating and refrigeration capacity. The main effects of the choice between **Parallel** and **Series** units however, can be shown by considering just the main fan and the terminals. Energy used by terminal fans depends upon operating hours and fan loading.

Parallel fans run only at partial cooling load and for heating for periods ranging between 500 and 2,000 hours per annum.

Series units run continuously for rather more than occupied hours, ranging between 3,000 and 4,000 hours per annum.

Parallel fans typically handle 50% to 65% of primary air and operate against a lower external static pressure for the same downstream duct.

Series fans must handle the full flow, plus a small margin.

For example, a **Parallel** fan may be selected for 0.300 m^3/s at 19 Pa external.

A **Series** fan selected for 0.500 m^3/s in the same duct system operates against 50 Pa.

Comparative operating costs can be illustrated by the following example, using power at 25¢ per kWh.

	Parallel	Series
Air flow m^3/s	0.300	0.500
Watts	145	390
Operating hours	2,000	4,000
kWh P.A.	290	1,560
Annual cost	**$72.50**	**$390.00**

Estimated savings on the central fan could be as shown in the following example, which assumes a total air flow of 5.600 m^3/s.

	Parallel	Series
Discharge Static Pressure, Pa	1,000	940
kW	9.325	8.206
Annual Power cost over 4,000 hours at 25¢ per kWh	$9,325	$8,206
Annual Main fan saving for **Series** units		**$1,119**

The above combined would represent a system of say 15 fan boxes and their main supply fan.

The annual running cost of the **Parallel** system would be, for this example only, **$10,412.25.**

For a **Series** system, on the same basis, annual running cost would be **$14,055.55.**

Capital cost of a **Parallel** unit is slightly higher than the equivalent **Series** assembly, due mainly to the need for a back draft damper. For the sizes in the foregoing example, this difference is about $165 per assembly.

The first year of operation would favour the **Parallel** unit by an energy cost of $3,643.05, almost exactly cancelling the first cost penalty. From then on the difference of $3,643.05, each year is the cost which can probably be identified with noise type preference.

None of the above considers the effect with **Series** fans of unwanted reheat at part load, the effect of any over supply of secondary air at full cooling, or the possibility of ceiling pressurisation with treated primary air in the event of a fault.

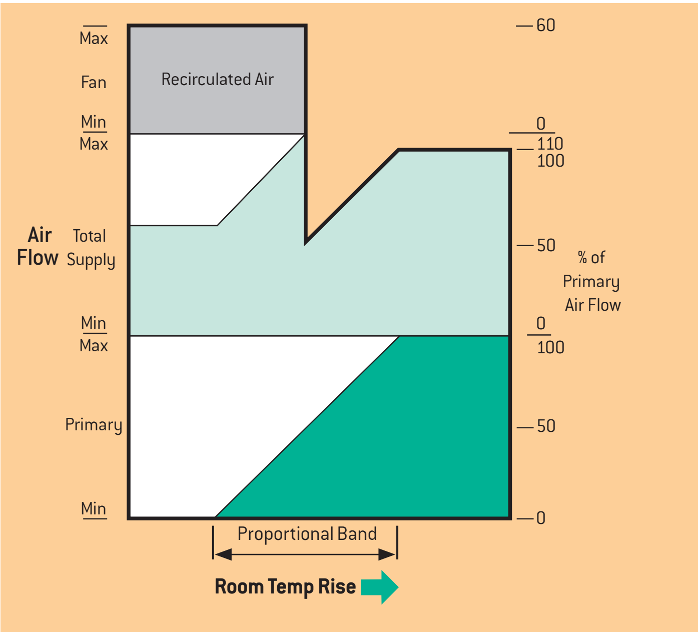
HFC – Control

Control of Fan Assisted VAV Terminals

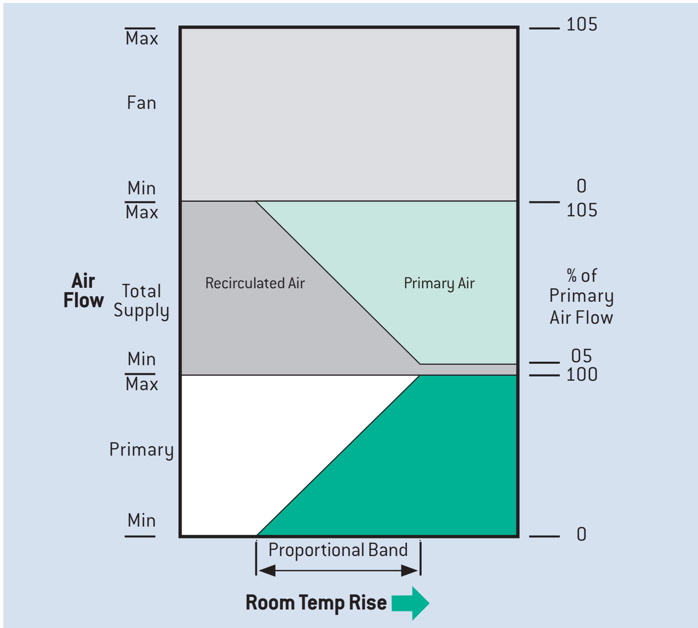
With the exception of fan operation, control sequences for fan assisted units are the same as those for non-assisted assemblies.

- These diagrams are for pressure independent applications. Pressure dependent options are available for areas with stable loads, with low velocity and pressure.
  Their design should minimise inlet pressure fluctuations. These would benefit from primary air temperature re-set.
- **Parallel** units energise the fan at the correct point in the zone sequence, via a P.E. switch (pneumatic), or a control signal (electronic), or through a relay, from a local 240V AC power supply.
- The illustration below shows the secondary fan is set to provide 60% of the primary air flow and function only when it falls to 50%. Air quantities are variable. Cooling only is shown, with reheat from ceiling recirculation.
- **Series** units require either a remotely switched relay, or direct 240V AC power to control the fan in the correct sequence with the main fan.
- The illustration below shows a 5% mismatch of fan and primary air. This could raise general room air movement, or guard against primary air loss to the ceiling.
  This mismatch can be reduced, or eliminated, but voltage fluctuations could alter delivered fan air flow.
  The fan is set to provide slightly more air than maximum primary in this example to prevent loss of primary air to the ceiling void. Fan and primary air quantities are essentially the same.
  Cooling only is shown, with reheat from ceiling air re-circulation. The primary valve functions as a single duct terminal, with pressure independent, constant maximum, primary air flow when room temperature rises to and above, the top end of the room stat setting.

Parallel HFCP



Series HFCS



- Operating as a single duct VAV terminal until primary air flow reduces to 50%. Then the secondary fan starts, boosting the total supply air to about 110% of primary. As the temperature falls, primary air reduces to preset minimum and the secondary fan provides the total air flow, at approximately 60%.

Option

- As an option Holyoake fan assisted units can be furnished with one metre of electrical flex from the fan speed selector / speed controller panel, terminating in a three pin plug. Local power wiring should terminate in a matching socket.

PRIMARY VALVE INLET DIAMETER mm	MAX. FLOW m^3/s	SMALLEST CASING SIZE
150	0.225	A1
200	0.500	A2
250	0.650	B
300	1.000	C
300	1.000	D*
350	1.600	E
400	1.900	F

* Casing size D* is a low profile size 300 inlet diameter which uses a double fan deck. Casing size E and F also have double fan decks.

- A fall in temperature gradually reduces primary air flow to its preset minimum, or zero and maintains this irrespective of upstream pressure. The secondary fan provides warm ceiling air to provide a constant flow and supplement the reduced primary air.

- The two diagrams shown are typical, without additional heating.

Both types can be furnished with auxiliary electric, or hot water reheat.

Selection Procedure

1. Select primary air valve inlet size, from table opposite.
2. Determine whether **Parallel** or **Series** operation. Refer to 'Type' description and 'System Considerations' on previous pages, 283G - 285G.
3. Identify smallest casing size to suit the chosen air valve, from table opposite.
4. Establish secondary air flow (generally 50-65% **Parallel**, or 100% **Series** - of full primary air).
5. Check that fan capacity for selected casing is adequate against design static pressure of discharge duct and outlets. If not check next larger casing size.
6. Select heater (if required in addition to heat from ceiling void). See pages 273G - 274G (**HW coils**) or 275G (**electric**).

Fan Assisted VAV Control Assemblies

The Holyoake model HFCP is a parallel type fan-assisted VAV assembly, offering a robust unitary construction, which:-

- Eliminates the need for a discharge plenum.
- Reduces airborne and radiated noise levels to a minimum.
- Simplifies ductwork connections.
- Offers compatibility with all accessories available for the HCV series.

All HFCP terminals are furnished with:

- Back draft damper.
- Secondary air inlet filter.
- Two, or three speed fan motor.
- Variable speed controller.
- Access for motor/rotor service, or replacement, without removal of the assembly.
- Fully removable bottom panel.

Construction

The primary air element is identical to the HCV series air valve and mechanism, with extruded aluminium blades mounted in a steel liner, forming a high pressure chamber for ducted inlet air. A forward curved fan, directly driven by a multi speed, resilient mounted single phase P.S.C. motor, is rigidly supported within the casing. A low loss extruded aluminium back draft damper with acetal cranks and bearings is mounted in an extruded aluminium frame, and all components are housed in an acoustically lined steel enclosure.

Inner & Outer Casing: 0.75 mm galvanised steel with 0.55 mm inlet neck.

Insulation: 25 mm black non-woven polyester acoustic insulation.

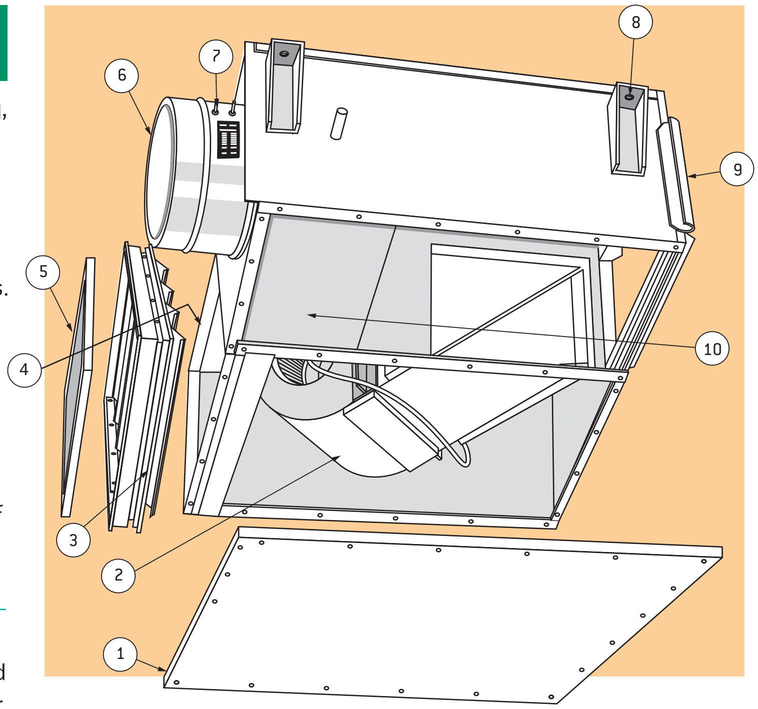
Control Damper: 6063-T5 extruded aluminium frame and blades on hexagonal axles. Sizes 100 to 200 double blade, larger sizes multi-blade opposed action.

Back Draft Damper: 6063-T5 extruded aluminium frame and blades on moulded acetal axles. Sizes 100 to 200 double blade, larger sizes multi-blade opposed action.

Bearings: Acetal.

Filter: 'EU2' washable type filter media, fitted to the front of Backdraft damper, Inlet Attenuator, or Hot Water Coil, as applicable.

Fan: Forward curved. For fan performance curves contact your local Holyoake branch.



View Of Model HFCP From Below, With Bottom Panel Removed.

1. Removable bottom panel.
2. Secondary air fan and direct drive motor.
3. Back draft damper mounted at the secondary air inlet.
4. Hot water heating coil where required (not shown).
5. Secondary air filter (lift and drop fixing).
6. Primary air inlet.
7. Averaging velocity sensor with capped Tees for independent flow measurement.
8. Suspension brackets.
9. Slip and drive discharge duct connections.
10. Primary air control valve assembly.

Accessories

- One, or two row H.W. heating coil.*
- Electric heater. *
- Inlet attenuator.**
- Outlet attenuator. *
- Multiple dampered outlet adapter.*
- Round outlet adapter.*

(* Refer to details in HCV section).

(** Refer to details on Page 291G).

Model: Number Key

HFCP	x	x	x	x	x	INLET: xxx	x
	CONTROLLER MAKE	CONTROL TYPE AND ACTION.	HEATING COIL	ATTENUATOR	OUTLET ADAPTER	HCV SIZE (PRIMARY AIR)	CASING SIZE
Parallel Fan Assisted VAV Assembly	1 Siemens 2 Honeywell 3 Alerton 4 Belimo 5 KMC 6 Delta 7 Schneider Electric 8 CSI 9 Other Manufacturers (Please Specify).	0 None 1 Pneumatic 2 Electronic.	0 None 1 1 Row HW 2 2 Row HW 3 Electric** 9 Special.	0 None 1 Outlet Attenuator. 2 Inlet Attenuator. 3 Both.	0 None 1 Round (undampered) 2 Multiple (dampered) 9 Special	Inlet Diameter in mm. 150 200 250 300 300* 350 400	 A1 A2 B C D* E F

Casing size D is a low profile size 300 inlet diameter which uses a double fan deck. Casing size E and F also have double fan decks."

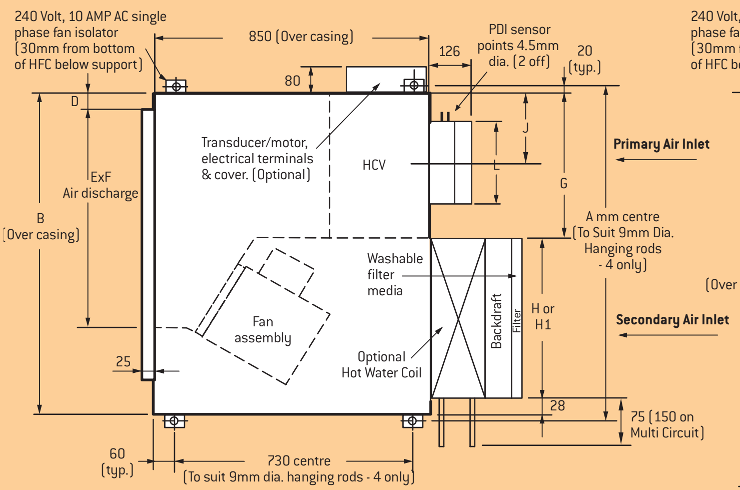
** Seperately schedule voltage, phases, kW & stages.

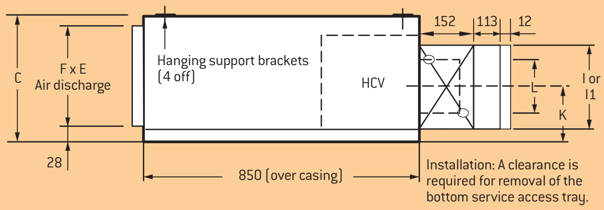
HFC – Fan Assisted VAV (Parallel)

Model: **HFCP**

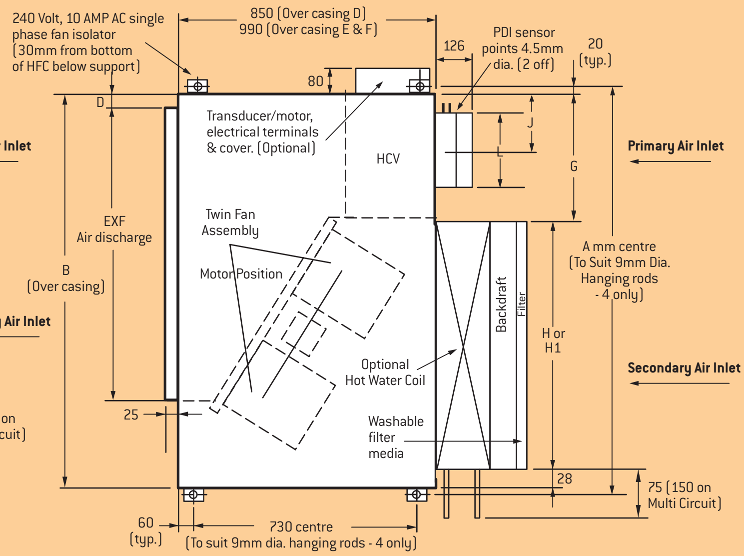
Dimensions

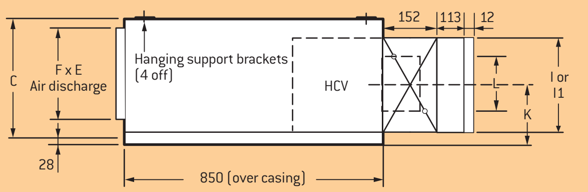
HFCP 100-300 Dimensions





HFCP 300/350/400 Dimensions





Casing Size		A	B	C	D	E	F	G	H	H1 ++	I	I1 ++	J	K	L
100-125-150	A1	865	825	376	30	540	300	315	482	286	316	223	145	138	95-120-145
175-200-225	A2	865	825	376	30	540	300	315	482	286	316	296	145	174	170-195-220
250	B	1015	975	376	30	680	300	431	516	428	316	296	216	174	245
300	C	990	950	450	30	680	370	431	491	428	390	369	216	210	295
300	D*	1365	1325	376	30	1000	300	431	866	428	316	369	216	186	295
350	E	1545	1505	450	30	1100	370	515	962	512	390	398	258	225	345
400	F	1770	1730	450	30	1200	370	640	1062	636	390	442	320	222	395

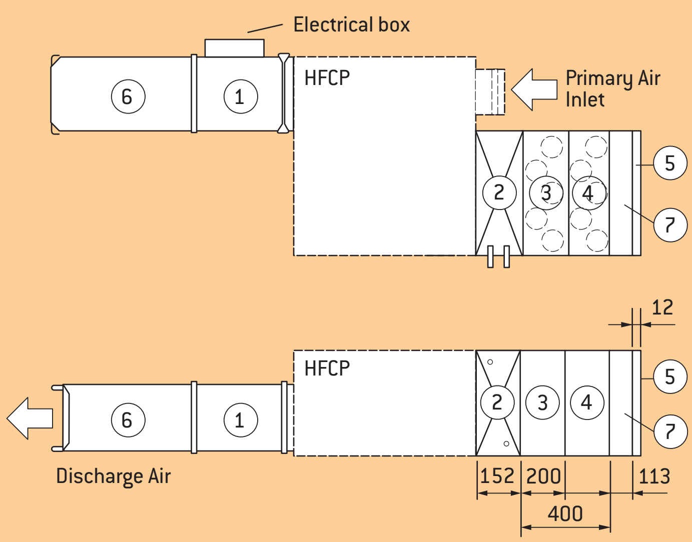
NOTE: Casing size D, E and F have double fan decks.

* Casing size D is a low profile size 300 inlet diameter which uses a double fan deck.

++ H1 and I1 only applicable when fitted with H.W. Coil, backdraft damper, or inlet attenuator.

Accesssories

1. Electric heater - see HCV section pages 275G.
2. Hot water coil. For selection and dimensional information on H.W. coils and attenuators, refer to page 291G.
3. Inlet attenuator type ST2, with 2 row core. Item 3 shows location of ST2 when a hot water coil is fitted.
4. Inlet attenuator type ST4 is a double banked assembly, consisting of a 4 row core, 400mm deep.
5. Discharge attenuator. See page 265G.

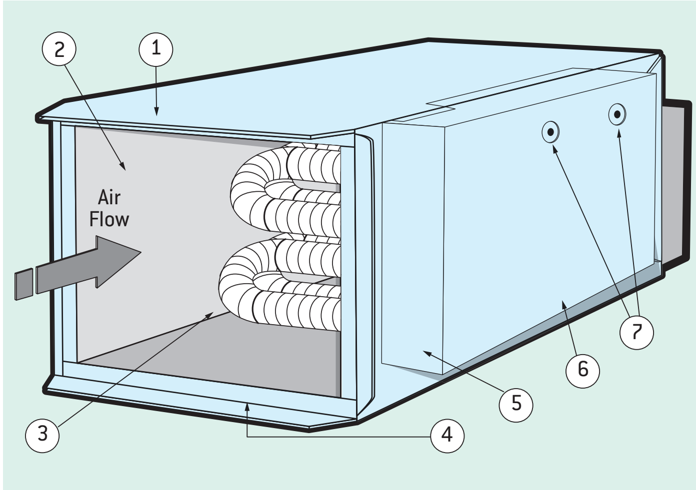


Due to a policy of continuous development and improvement the right is reserved to supply products which may differ slightly from those illustrated and described in this publication.

Electrical Heater Boxes & VAV Electric Heater Box Assemblies

Holyoake electric heater packs are designed as accessories for either single duct VAV terminals, or fan assisted VAV assemblies. They comply with AS 1668.1 - 1998, section 2.6 and with AS/NZS 3102:2002.

Installers must take special consideration of AS/NZS 3102, clause 7.2 , Interlocking of supply to heater unit and blower motor and clause 7.3, Devices to prevent overheating.



General

Maximum heater capacities have been established in consideration of both likely maximum need and physical size of the element bundle. The latter is in turn dictated by the allowable watt density of the elements, which governs the maximum sheath temperature. The standard sizes listed here as finned tubular elements, achieve "black heat" (sheath temperature 400°C) in air moving across the element surface at a velocity of 1 m/s, i.e. "still air" with the velocity created only by the temperature of the element itself. These capacities meet the requirements of AS 1668.

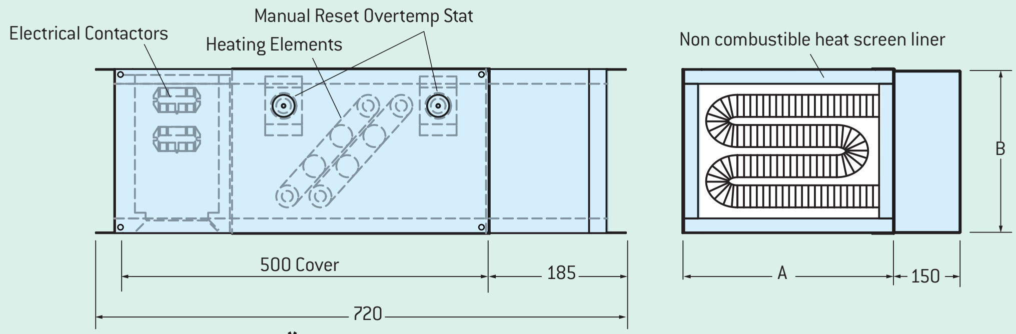
Standard Features

1. Duct casing 0.75mm galv. steel.
2. Non combustible heat screen liner.
3. Finned elements comprising of 304 stainless steel fins on 309S stainless steel tubes.
4. Slip and drive duct connections (drive connections on all four sides are available on request).
5. Electrical box containing heater terminals, contactors (or power relays), over-temp stat and wiring to terminal block. If required an isolating switch may be added.
6. Cover held by screws accessible from the sides.
7. Manual reset over-temp stats.

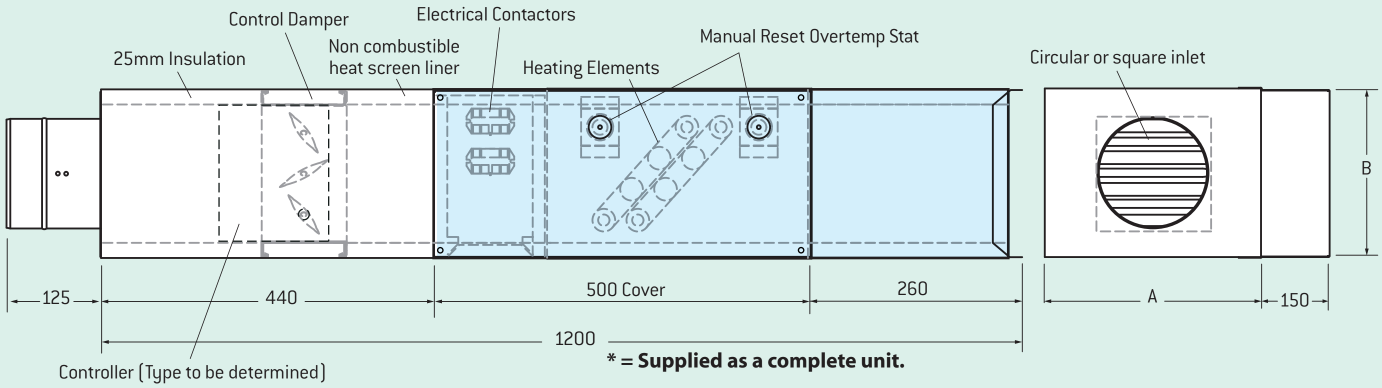
Option

Solid state control for pulsed heater control.

Heater Section Only



VAV with Electric Heater*



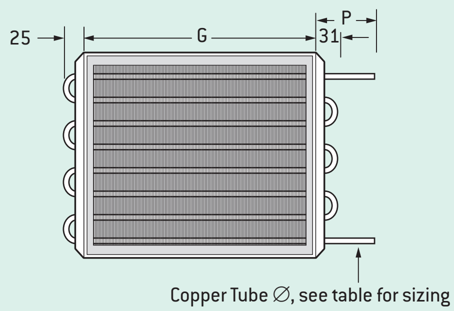
*** = Supplied as a complete unit.**

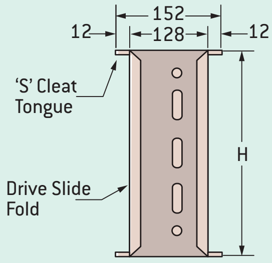
Inlet Dia	Max (kW)	A (mm)	B (mm)
100,125,150	2.5	286	223
175,200,225	3.75	286	296
250	6.0	428	296
300	9.0	428	369
350	12.0	512	398
400	15.0	636	442
600 x 400	15.0	965	442

Note

Maximum kilowatt ratings are guidlines only. Larger ratings can be accommodated.

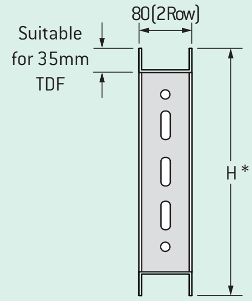
Hot Water Heating Coil





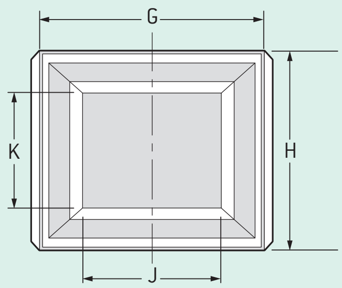
Single Row Single Circuit Illustrated.
Connections Similar But Offset For Others

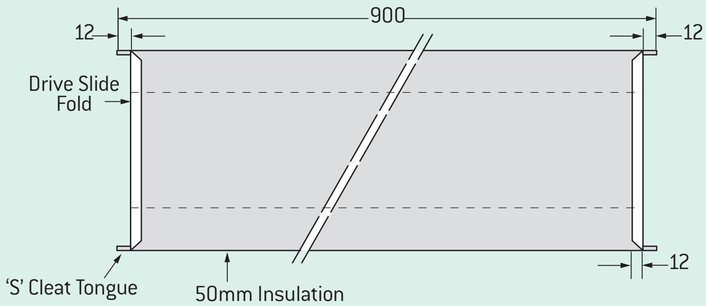
Australian Manufactured VAV Boxes Only



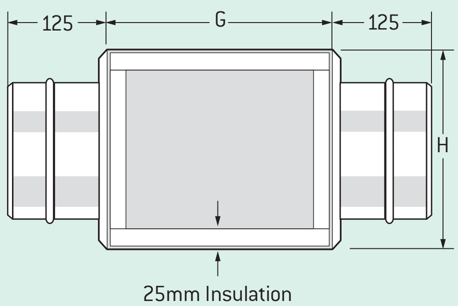
Single Row Single Circuit Illustrated.

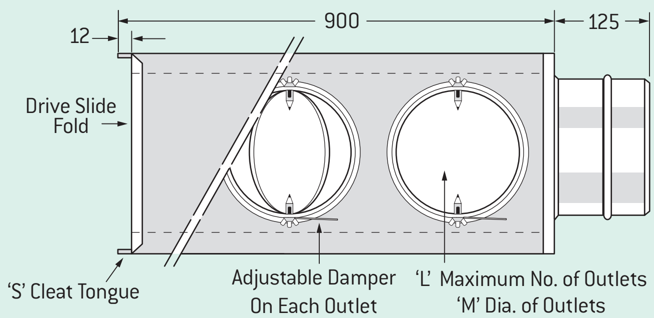
Attenuator



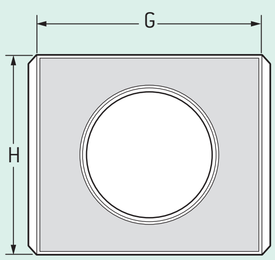


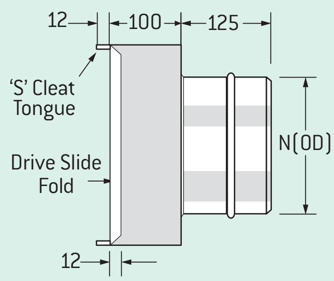
Multi Outlet Adaptor



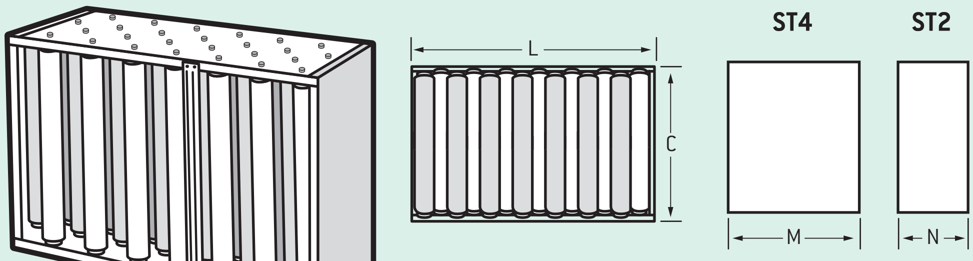


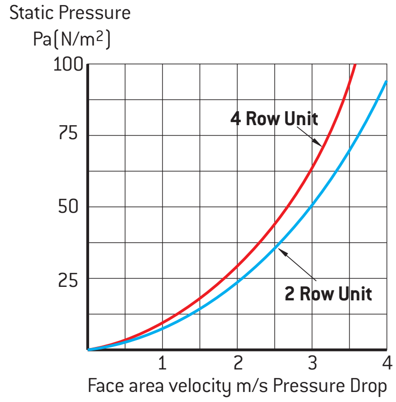
Round Outlet Adaptor





Inlet Attenuator





Insertion Loss (dB)								
Frequency Hz	63	125	250	500	1K	2K	4K	8K
2 Row Unit - ST2	0	1	3	5	6	13	8	11
4 Row Unit - ST4	0	1	6	9	12	19	18	15

CASING SIZE	DIMENSION			
	C	L	M	N
A	376	560	400	200
B	376	560	400	200
C	450	560	400	200
D	376	860	400	200
E	450	960	400	200
F	450	1060	400	200

Note See also page 252F, for further data.

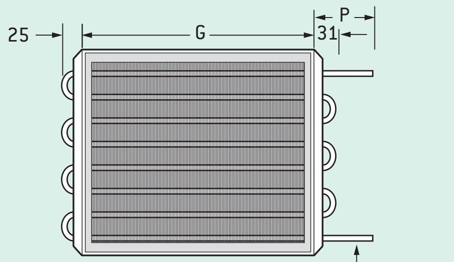
Hot Water Coils

CASING SIZES A, B, C & D

ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m³/s								
	litres/s	kPa	0.400	0.450	0.500	0.550	0.600	0.750	0.800	0.900	1.000
One Row Single Circuit	0.063	0.40	5.67	5.88	6.08	6.27	6.45	6.81	6.92	7.13	7.36
	0.126	1.39	6.96	7.30	7.61	7.91	8.24	8.81	9.02	9.38	9.77
	0.252	4.77	7.85	8.28	8.71	9.10	9.49	10.34	10.61	11.13	11.66
	0.315	7.08	8.06	8.52	8.96	9.39	9.82	10.72	11.03	11.58	12.15
	0.504	16.31	8.42	8.93	9.40	9.88	10.33	11.37	11.72	12.35	13.00
	0.630	24.23	8.55	9.07	9.58	10.06	10.51	11.62	11.99	12.63	13.31
Two Rows Two Circuits	0.063	0.76	8.91	9.23	9.52	9.79	10.06	10.52	10.68	10.91	11.23
	0.126	2.60	11.42	12.01	12.55	13.06	13.55	14.53	14.86	15.41	16.01
	0.252	8.90	13.18	13.98	14.75	15.46	16.18	17.71	18.22	19.10	20.05
	0.315	13.22	13.59	14.45	15.29	16.05	16.86	18.51	19.08	20.06	21.10
	0.504	30.44	14.26	15.22	16.15	17.04	17.89	19.87	20.53	21.70	22.91
	0.630	45.23	14.50	15.50	16.48	17.39	18.30	20.38	21.06	22.31	23.59

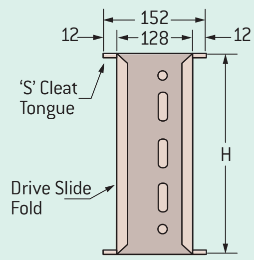
CASING SIZES E & F

ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m³/s								
	litres/s	kPa	0.750	0.800	0.850	0.900	1.000	1.250	1.500	1.750	1.900
One Row Multi-Circuit	0.063	0.20	8.01	8.09	8.25	8.41	8.61	8.94	9.22	9.46	9.64
	0.126	0.69	11.09	11.26	11.59	11.92	12.31	13.05	13.70	14.28	14.66
	0.189	1.43	12.44	12.67	13.08	13.48	14.00	15.01	15.92	16.70	17.22
	0.315	3.55	13.78	14.10	14.61	15.08	15.75	17.11	18.31	19.37	20.06
	0.630	12.14	15.07	15.46	16.06	16.67	17.44	19.18	20.70	22.11	23.00
Two Rows Multi-Circuit	0.063	0.37	11.80	11.89	12.11	12.31	12.51	12.84	13.12	13.35	13.56
	0.126	1.28	17.45	17.70	18.21	18.72	19.26	20.28	21.14	21.85	22.36
	0.189	2.64	20.16	20.54	21.25	21.94	22.73	24.32	25.64	26.80	27.57
	0.315	6.54	22.91	23.45	24.37	25.27	26.43	28.71	30.72	32.49	33.63
	0.630	22.39	25.47	26.19	27.32	28.42	29.95	33.09	35.93	38.46	40.06



Copper Tube ∅, see table for sizing

See page 264G for dimensional data



Single Row Single Circuit Illustrated.
Connections Similar But Offset For Others.

Notes

1. Tabulated values are in kW and for hot water only.
2. Data is for the coil type specified (one row-single circuit, two rows-two circuits etc). Data for alternative circuit types are available on request.
3. Tables are based on a temperature difference of 64°K between entering air and entering water. For other temperatures multiply tabulated values by the factors below.
4. Air temperature rise (°K) =kW / (1.2 x m/s).
5. Water temperature drop (°K) = kW / (4.187 x l/s).
6. Connections: Single Circuit 12.7 O.D male solder, Multi-Circuit 22.2 O.D. male solder.

ΔT (°K)	20	30	40	50	60	64	70	80	90
Factors	0.47	0.59	0.71	0.83	0.95	1.00	1.07	1.20	1.31

HFC – Model: HFCP (Parallel Flow)

Sound Power Data

Heating Cycle (Fan Only)

CASING SIZE A

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
0.475	75	60	57	58	50	48							
0.350	75	60	50	48	45	40	0.170	100	61	54	48	49	41
0.250	75	59	53	48	41	40	0.360	50	59	43	47	46	46
0.450	125	62	59	60	52	50	0.447	20	57	57	58	61	57
0.300	125	62	52	50	47	42							
0.225	125	61	55	50	43	42							

CASING SIZE B

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
0.500	75	68	62	54	51	47							
0.400	75	66	56	53	49	42	0.195	300	65	54	53	57	55
0.300	75	60	54	50	45	41	0.530	200	69	52	56	57	56
0.500	125	70	64	59	50	45	0.720	20	77	58	60	63	61
0.400	125	68	61	54	50	43							
0.300	125	65	61	52	48	43							

CASING SIZE C

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
0.850	75	67	63	52	52	47							
0.700	75	62	59	51	51	49	0.600	330	65	65	64	66	63
0.550	75	59	54	49	48	44	0.800	250	70	65	64	66	63
0.850	125	66	62	55	51	53	1.000	20	71	64	67	68	64
0.700	125	61	59	54	52	59							
0.550	125	58	57	47	48	45							

CASING SIZE D

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
0.850	75	59	68	56	54	49							
0.700	75	57	59	54	51	41	0.800	200	60	58	58	60	58
0.550	75	56	54	53	46	39	0.850	130	58	56	56	59	55
0.850	125	62	60	63	59	56	0.900	20	61	54	56	58	53
0.700	125	60	61	57	60	56							
0.550	125	59	61	58	59	55							

CASING SIZE E

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
1.600	75	73	67	64	59	56							
1.450	75	64	68	63	58	51	1.200	350	66	66	64	65	63
1.200	75	61	66	61	53	49	1.450	250	68	67	65	66	65
1.600	125	76	66	67	64	63	1.600	20	76	64	66	65	65
1.450	125	70	67	66	67	66							
1.200	125	69	68	66	68	65							

CASING SIZE F

RADIATED							DISCHARGE						
Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K	Flow m^3/s	Disch. Ps, Pa	Octave Band, Lw 125	250	500	1K	2K
2.180	75	75	68	62	57	51							
1.920	75	68	67	63	59	51	1.450	350	68	67	65	66	65
1.480	75	63	67	62	54	51	1.920	250	72	66	65	67	65
2.180	125	78	67	65	62	58	2.180	20	78	61	64	63	60
1.920	125	74	69	66	68	66							
1.480	125	71	69	67	69	67							

Notes

1. ΔPs: Difference in static pressure, inlet to discharge.
2. ΔPt: Difference in total pressure, inlet to discharge.
3. Minimum Ps: Lowest inlet to discharge static pressure at which control can be pressure independent.
4. Lw: Sound power level, re 10^{-12} watts. These are power readings and do include allowances for room, ceiling or duct attenuation.
5. Discharge NC: Room noise criteria from sound transmitted through assembly casing, allowing 10 dB room plus 13 dB ceiling absorption.

Sound Power Data

Cooling Cycle (100% Primary Air-Fan Off)

DISCHARGE SOUND POWER, Lw

Inlet Diameter (mm).	m³/s	MIN ΔPs								Disch. NC		125 ΔPs							Disch. NC		250 ΔPs							Disch. NC		500 ΔPs							Disch. NC	
		BASIC UNIT										BASIC UNIT									BASIC UNIT									BASIC UNIT								
		ΔPs	ΔPt	OCTAVE BANDS						Basic Unit	With Atten.	ΔPt	OCTAVE BANDS						Basic Unit	With Atten.	ΔPt	OCTAVE BANDS						Basic Unit	With Atten.	ΔPt	OCTAVE BANDS						Basic Unit	With Atten.
		Pa	Pa	125	250	500	1K	2K	4K			Pa	125	250	500	1K	2K	4K			Pa	125	250	500	1K	2K	4K			Pa	125	250	500	1K	2K	4K		
150	0.080	8	17	48	47	35	26	18	18	-	-	134	55	58	56	48	45	43	28	-	259	59	59	58	56	52	51	32	-	509	61	62	62	60	59	60	39	15
	0.110	14	31	52	52	39	31	23	19	17	-	142	58	60	56	48	46	44	29	-	267	60	60	57	56	52	52	32	15	517	62	63	62	61	60	60	39	16
	0.140	21	49	57	57	46	38	31	23	23	-	153	61	61	57	50	48	46	30	17	278	62	63	58	56	53	54	33	18	528	64	65	64	64	60	62	40	20
	0.170	28	70	58	57	51	43	37	32	23	-	167	62	62	59	52	49	48	32	17	292	64	64	59	57	55	55	34	20	542	66	67	65	64	60	62	41	22
	0.200	37	95	59	59	56	48	42	38	28	-	183	63	62	61	54	51	50	34	17	308	65	64	59	58	56	56	35	21	558	67	68	67	65	61	63	42	23
200	0.150	4	13	43	37	35	25	18	16	-	-	134	57	56	52	47	47	46	25	15	259	59	60	56	53	53	54	33	15	509	61	62	61	60	58	60	39	14
	0.200	8	23	46	41	38	29	21	19	-	-	140	59	58	54	50	50	49	28	18	265	61	62	58	55	55	56	35	17	515	63	64	63	62	60	62	41	17
	0.250	12	36	53	47	44	37	30	23	16	-	149	61	59	56	52	51	50	29	20	274	63	64	60	57	56	57	36	19	524	66	67	64	63	62	64	43	21
	0.300	17	52	57	51	49	42	36	31	21	-	160	63	60	58	54	53	52	31	19	285	64	65	61	58	58	59	38	21	535	68	68	65	64	63	65	44	23
	0.350	22	69	59	55	53	46	41	37	25	-	172	65	61	59	56	55	54	33	19	297	66	65	62	60	59	60	39	25	547	68	69	67	66	64	66	45	25
250	0.250	7	17	49	45	38	28	20	18	-	-	135	59	56	54	52	50	50	29	-	260	63	62	59	58	55	58	36	20	510	65	65	65	65	64	64	43	23
	0.350	13	32	51	47	44	37	31	22	15	-	144	60	59	59	54	52	52	31	16	269	65	63	62	60	59	59	38	25	519	67	66	66	65	65	66	45	25
	0.450	19	50	60	53	50	44	40	34	22	-	156	62	61	60	57	56	55	34	19	281	66	65	64	62	61	62	40	25	531	68	67	67	66	66	68	47	27
	0.550	27	74	62	57	55	50	46	41	28	16	172	64	62	61	59	58	58	37	21	297	68	67	66	64	63	63	42	27	547	70	69	68	68	67	69	48	29
	0.625	35	96	64	60	58	54	50	46	31	16	186	66	63	61	60	58	59	38	21	311	70	69	67	65	64	65	43	28	561	72	70	69	69	69	69	48	31
300	0.400	4	15	54	42	35	26	19	17	12	-	136	61	58	55	52	52	50	30	17	261	63	62	61	58	57	56	35	22	511	67	67	68	66	63	64	43	26
	0.550	8	28	59	49	45	39	32	29	17	-	145	63	60	58	55	55	53	33	21	270	66	64	63	60	59	59	38	25	520	69	69	68	67	65	66	45	29
	0.700	14	47	63	55	52	48	43	39	24	15	158	65	61	61	58	57	56	35	24	283	68	66	65	62	61	62	41	28	533	70	70	69	69	66	68	47	31
	0.850	19	68	66	59	56	54	49	46	30	19	174	67	64	63	61	60	59	38	26	299	70	68	67	65	63	64	43	30	549	72	71	71	70	68	69	48	33
	1.000	26	93	69	62	60	59	54	51	35	25	192	70	65	64	64	62	61	40	30	317	71	70	69	67	65	66	45	33	567	73	72	72	72	69	70	49	34
350	0.600	4	15	58	49	43	39	38	34	16	-	136	65	60	58	55	56	53	33	21	261	69	66	65	60	60	60	39	28	511	71	70	72	68	65	66	46	31
	0.825	6	26	63	54	50	48	45	44	24	16	145	67	63	61	59	59	57	37	25	270	72	68	68	64	63	63	42	30	520	74	73	73	70	68	69	48	35
	1.050	9	41	66	59	55	53	50	51	30	19	157	70	64	62	63	61	60	40	26	282	74	70	69	66	65	66	45	34	532	76	74	76	71	70	71	50	37
	1.275	13	61	69	62	60	58	55	56	35	24	173	73	67	64	64	62	61	40	30	298	75	73	71	68	67	67	46	35	548	77	75	77	73	71	70	51	37
	1.500	20	86	72	65	64	63	60	58	39	29	191	74	68	66	66	64	62	42	30	316	76	74	72	70	69	69	48	36	566	78	76	78	74	73	72	52	38
400	0.750	3	15	62	51	49	46	43	41	22	-	137	69	63	61	59	56	55	35	23	262	71	69	67	64	63	62	40	30	512	72	70	70	68	67	66	45	32
	1.000	5	27	66	57	52	50	49	47	27	18	147	72	65	63	62	59	58	38	27	272	74	72	69	67	66	64	43	34	522	74	73	71	69	68	67	46	34
	1.250	8	42	69	60	57	54	52	50	30	22	159	74	66	65	63	61	59	39	30	284	76	74	71	69	67	66	45	36	534	77	75	73	71	69	68	47	36
	1.500	13	62	71	64	60	59	56	55	35	26	174	75	68	67	64	63	61	41	31	299	77	74	72	71	68	67	47	36	549	78	76	74	72	71	69	49	37
	1.900	25	104	75	68	65	63	60	58	39	31	204	77	70	68	67	65	64	43	33	329	79	76	74	73	70	69	49	38	579	80	78	76	74	73	71	51	41

RADIATED SOUND POWER, Lw

Inlet Diameter (mm).	m³/s	125 ΔPs						250 ΔPs						500 ΔPs					
		OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS					
		125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K
150	0.080	57	45	33	27	22	20	59	51	42	35	30	26	59	56	48	41	39	39
	0.110	60	47	35	28	23	20	61	51	42	36	31	28	62	56	49	42	39	39
	0.140	63	49	39	29	27	22	64	53	43	36	32	31	65	58	49	42	39	39
	0.170	64	51	41	32	30	27	66	55	44	36	35	33	67	59	49	43	40	40
	0.200	65	53	43	35	33	33	68	57	46	37	37	36	70	61	51	44	41	41
200	0.150	55	41	34	28	27	22	58	48	41	34	32	29	59	53	47	40	34	33
	0.200	57	44	37	30	29	25	60	51	43	36	34	31	62	56	49	42	37	35
	0.250	59	46	40	32	31	27	63	53	45	38	36	32	65	58	51	43	40	37
	0.300	63	50	43	35	34	30	65	55	46	40	37	35	68	60	53	45	42	41
	0.350	64	52	46	37	36	33	66	56	48	42	39	37	69	61	54	46	43	42
250	0.250	57	47	36	30	29	28	65	52	44	35	34	35	65	57	50	44	40	42
	0.350	63	49	41	32	31	30	66	55	46	39	36	37	68	59	52	45	42	44
	0.450	65	51	44	36	34	34	67	57	49	39	39	40	72	62	54	47	44	46
	0.550	66	55	48	41	38	38	69	59	51	42	41	42	75	64	56	50	46	48
	0.625	67	57	50	43	42	42	70	60	53	45	43	45	76	66	58	52	48	49
300	0.400	59	48	38	32	28	31	62	54	44	35	33	39	62	58	51	44	41	46
	0.550	62	52	42	38	35	35	62	57	48	40	37	42	66	61	54	45	43	49
	0.700	65	55	46	43	41	39	65	59	51	44	41	45	70	63	56	47	44	51
	0.850	67	60	49	48	46	43	70	62	54	48	46	47	72	66	57	49	47	53
	1.000	70	66	52	51	50	48	71	66	55	52	50	49	74	68	60	53	51	55
350	0.600	62	51	42	39	34	36	64	55	47	42	38	38	65	58	51	46	41	45
	0.825	65	55	47	44	41	40	66	58	50	46	47	48	68	61	55	51	47	48
	1.050	68	59	50	48	46	46	69	61	53	49	49	48	70	63	58	52	50	50
	1.275	71	67	52	49	48	46	72	69	54	50	50	51	73	71	60	53	51	52
	1.500	73	70	55	52	50	48	74	72	57	53	51	52	75	74	61	55	52	53
400	0.750	63	53	44	40	35	36	66	56	48	43	39	40	68	59	52	48	43	44
	1.000	66	57	50	47	42	42	68	58	52	48	46	47	70	61	57	52	49	48
	1.250	70	62	53	50	48	47	70	63	54	51	49	49	72	65	60	54	52	51
	1.500	72	67	56	52	50	48	73	70	56	54	52	51	74	71	62	56	54	53
	1.900	74	70	62	55	52	50	75	73	60	57	55	55	76	74	65	59	58	57

Refer to Performance Notes on previous page.

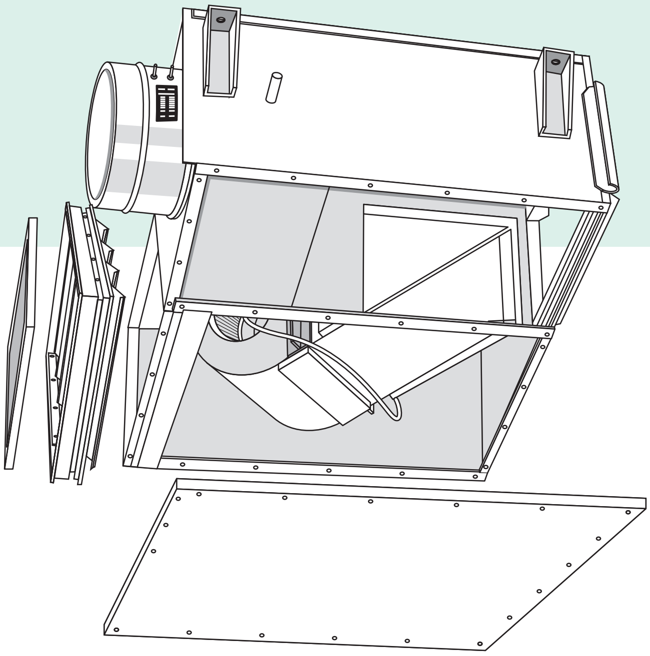
HFC – Fan Assisted VAV Terminals

Suggested Specifications

Fan assisted VAV assemblies shall be Holyoake Type (HFCP-Variable Flow, HFCS-Constant Flow) supplied with or without controls, matching factory furnished accessories (electric heater, HW heater coil, inlet/outlet attenuator, outlet adapter) and secondary air filter, as shown elsewhere in this specification or on the drawings. Primary air flow shall be pressure independent and capable of temperature controlled velocity re-set between zero and maximum catalogued air flow.

Primary air valves shall consist of extruded aluminium blades on stainless steel shafts in acetal anti-rotation bearings, mounted in a 0.75 galv. mild steel high pressure enclosure with PDI type averaging flow sensor in the inlet. The leakage of the high pressure enclosure with closed damper shall not exceed 2% of maximum rated primary flow at 750 Pa inlet static pressure. Secondary air fans shall be statically and dynamically balanced, with resiliently mounted, electronically speed controlled, permanently lubricated motors.

Fan and valve shall be mounted in a single casing of 0.75 galv. steel. No internal components shall be fixed to the bottom panel which shall be completely removable. The casing shall be internally insulated with a minimum of 25 mm non-woven accoustic polyester insulation and all shall be as manufactured by Holyoake.



Model: Number Key

Parallel HFCP See Page 287G

Series HFCS See Page 289G