



CONTROLLED VOLUME ASSEMBLIES

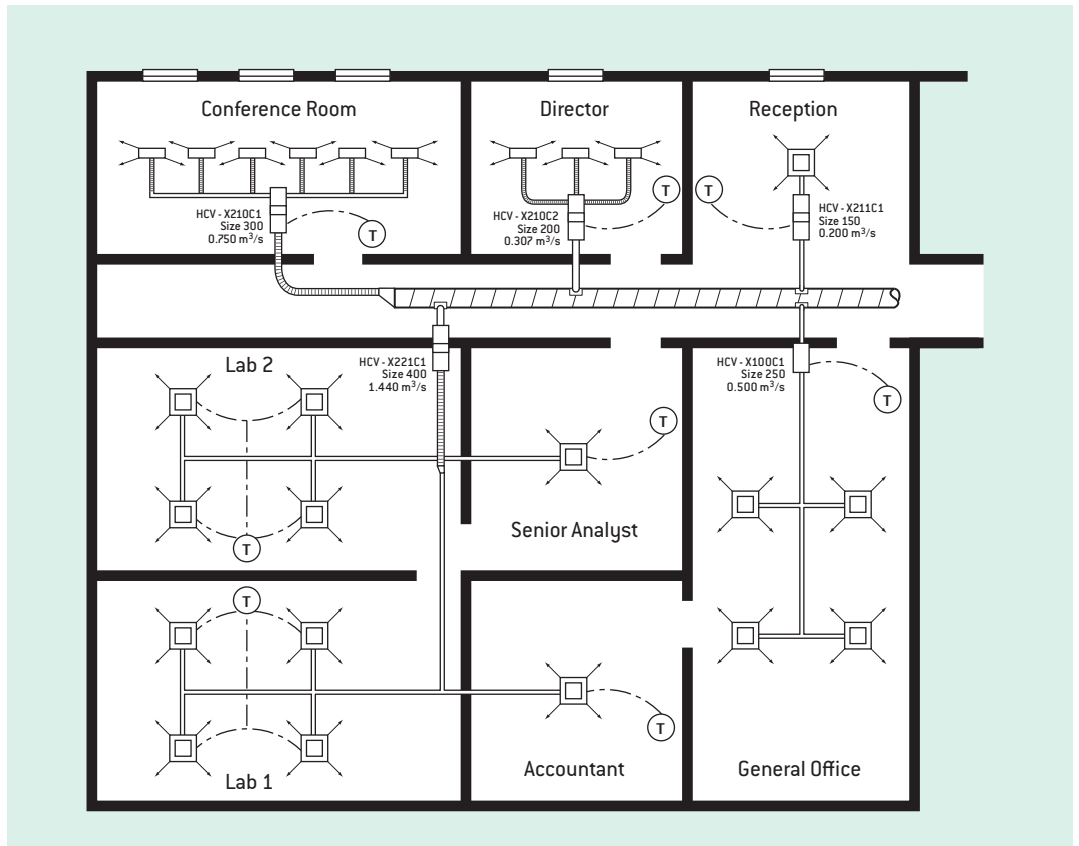
HCV	Pressure Independent VAV Assembly Ordering Codes and Specification	260 - 278G 278G
HDC	Dual Duct Pressure Independent VAV Assembly Ordering Codes and Specification	279 - 282G 282G
HFC	Fan Assisted VAV Control Assembly	283 - 296G
	Ordering Codes HFCP (Parallel Type)	287G
	Ordering Codes HFCS (Series Type)	289G
	Specifications	296G

- Single duct, dual duct and fan assisted
- Selected volume flow irrespective of upstream pressure variations
- Low noise level

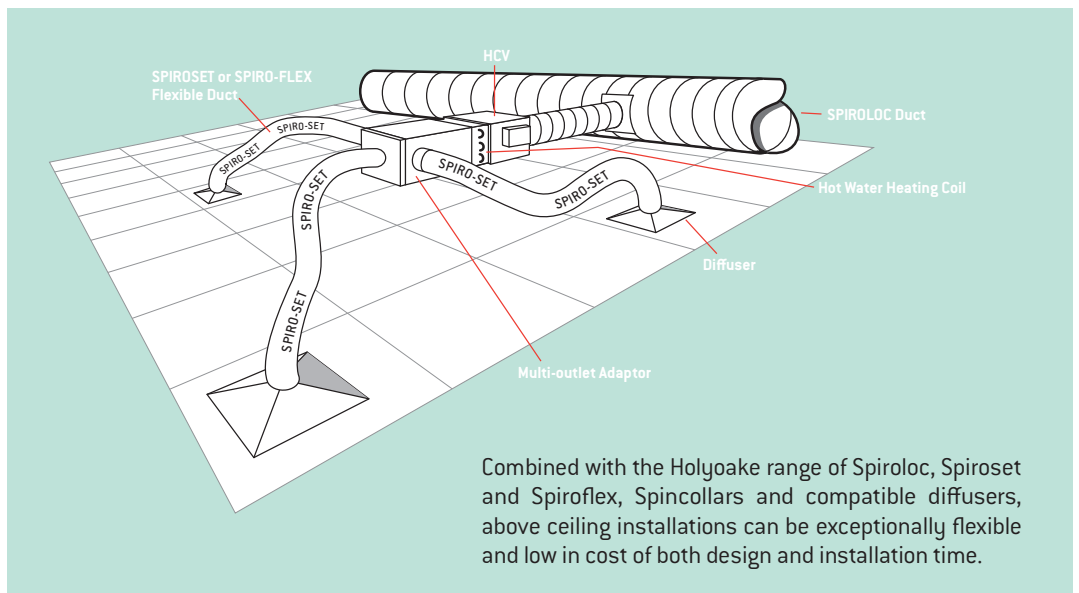
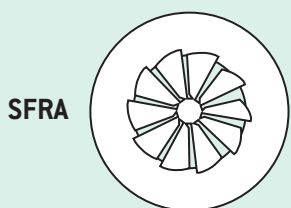
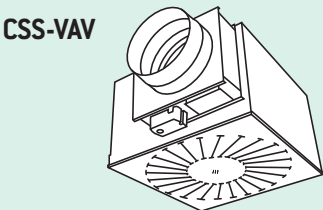
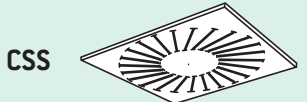
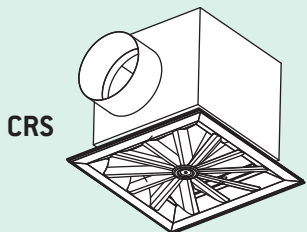
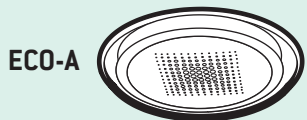
- Single duct models available for either velocity or static pressure controls
 - Choice of analogue or DDC electronic systems
 - Building block construction from basic module to complete air distribution assembly
-

HCV – Applications

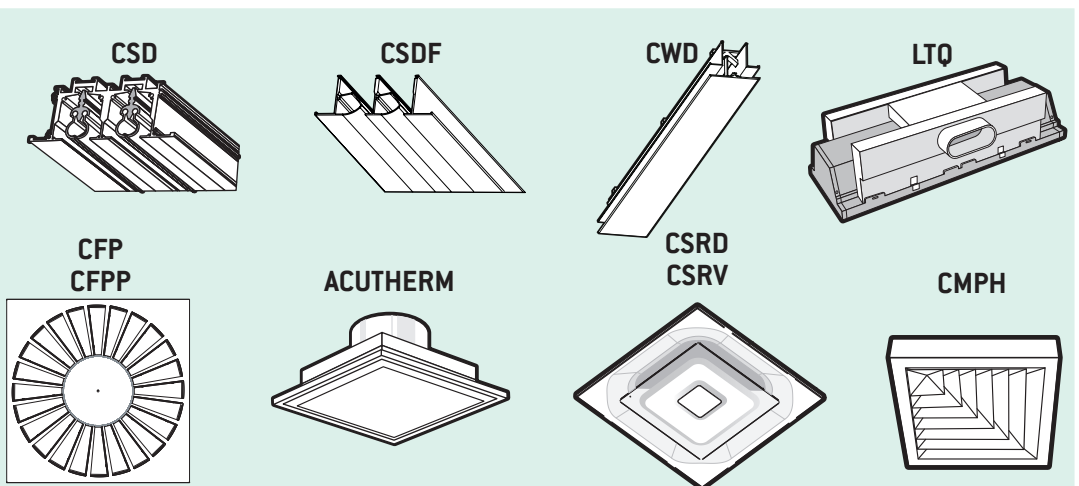
- Holyoake HCV assemblies may be used to control temperature in the space served by one, or more air diffusers.
- Systems may be designed for volume control by velocity reset at the assembly, or for static pressure control in response to variable orifice air diffusers.
- Matching components provide re-heat, noise attenuation and balanced air distribution plenums.
- With Holyoake HCV assemblies, duct systems can be more simply designed with flexibility to accommodate subsequent tenancy changes.
- The floor plan shows some typical applications, with a variety of compatible air diffusers.



Compatible Diffusers



Combined with the Holyoake range of Spiroloc, Spiroset and Spiroflex, Spincollars and compatible diffusers, above ceiling installations can be exceptionally flexible and low in cost of both design and installation time.



VAV Control Assemblies

The Holyoake Series HCV range of controlled volume assemblies and accessories has been specifically designed to meet the requirements of either of two major design concepts commonly used:

(1) Velocity Reset Control

Controlled flow through fixed orifice diffusers.

The assembly may be set to maintain constant volume flow, irrespective of fluctuations in upstream static pressures. The selected flow may be automatically reset, as directed by a space temperature thermostat, or sensor, with minimum flow pre-determined by factory, or field adjustment, down to zero if required.

Refer to Section B (Ceiling Slot Diffusers), Section C (Light Air Boots) and Section D (Ceiling Round Adjustable), (Ceiling Swirl), (Ceiling Multi-Pattern), (Square Face Round Neck) and (Ceiling Perforated), for diffusers compatible with above.

(2) Static Pressure Control

Flow controlled by constant static pressure behind variable orifice diffusers.

The assembly may be set to maintain constant downstream static pressure, irrespective of fluctuations in upstream pressures, or the rate of draw off required by thermostatically controlled variable orifice diffusers.

CSS VAV within Section D (Swirl) are variable orifice diffusers compatible with above. Other fixed orifice diffuser types may be used, but generally with restricted turndown ratios, to avoid dumping.

Construction

Special attention is given to construction of the basic assembly to minimise radiated and airborne noise generation and air leakage. Extruded full airfoil aluminium damper blades are mounted with mechanically locked acetal two piece bearings. This high precision damper offers extremely low leakage, whilst providing optimum control performance. Low profile units may also be available by special request.

Outer Casing: 0.75mm Galvanised Steel with 0.55 mm inlet neck.

Insulation: 25 mm Non-Woven Acoustic Polyester Insulation.

Damper: Multi blade damper. Blades 6063 T5 full airfoil extruded aluminium with inflatable blade edge seals and convex aluminium side seals. Stainless Steel Axles.

Bearings: Two piece acetal with locating ribs.

Note: Your local Holyoake branch has automatic calculation programmes to input raw data and assist in making accurate product selections.

Note

Velocity Reset or Static Pressure control are/may be a feature of the selected controls.

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.



Accessories

To accommodate varying design requirements, HCV assemblies are available as basic volume, or static pressure control units only, or with any, or all of the following accessories:

- Attenuator
- One, or two row hot water heating coil
- Electric heater
- Multiple dampered outlet adapter
- Round outlet adapter

Each accessory is finished ready to accommodate standard slip and drive cleats matching the basic unit. Cleats are furnished for field assembly. If drive cleat, or duct flange are required on all four sides of the components, please contact the factory.

Controls

A range of controls can be provided, from stand alone analogue control to a full DDC set up:

Code 1 Siemens

Code 2 Honeywell

Code 3 Alerton

Code 4 Belimo

Code 5 KMC

Code 6 Delta

Code 7 Schneider Electric

Code 8 CSI

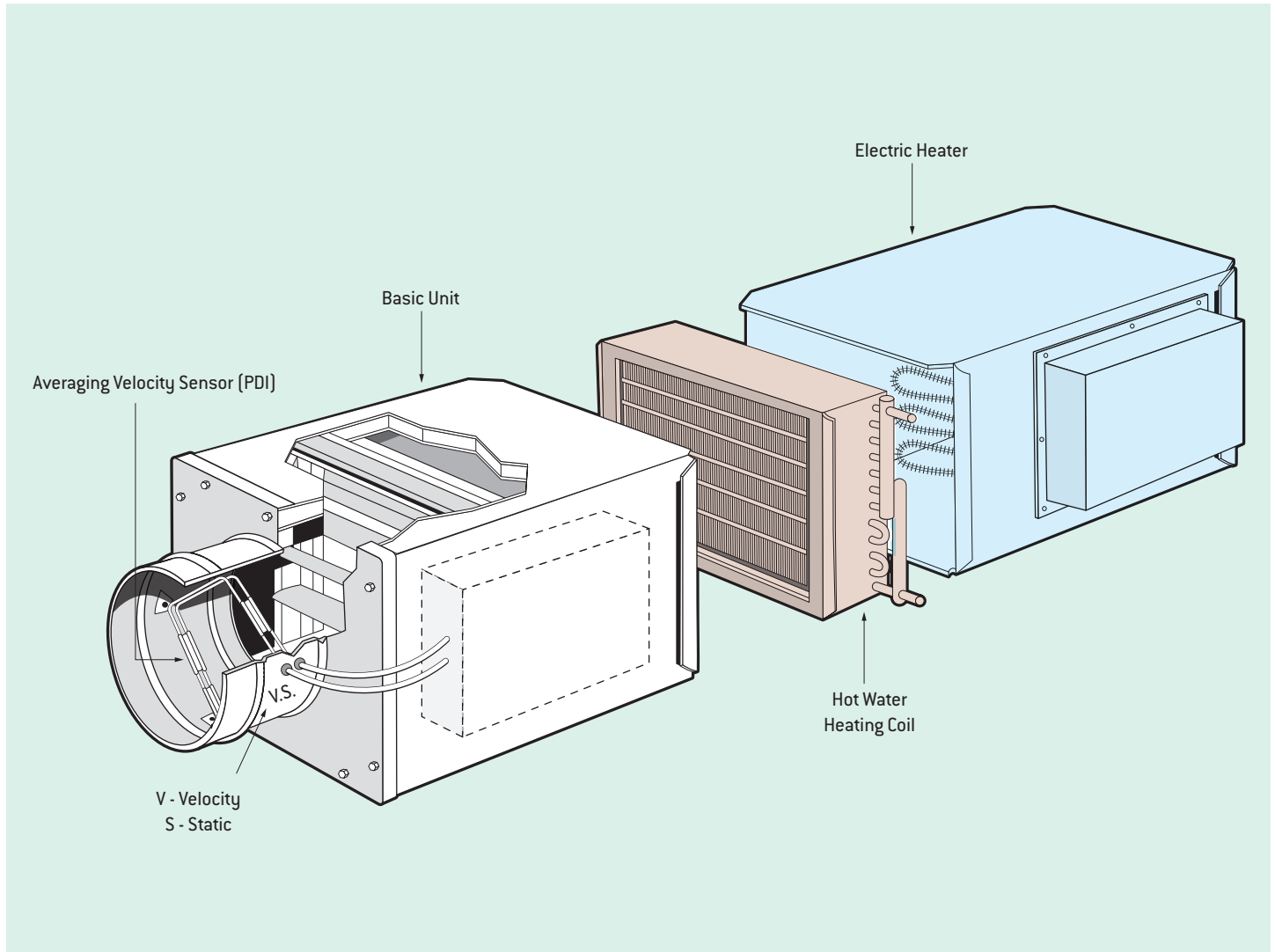
Code 9 Other Manufacturers (Please Specify).

The following pages detail the more common control applications. Other control methods are available to special order – contact factory.

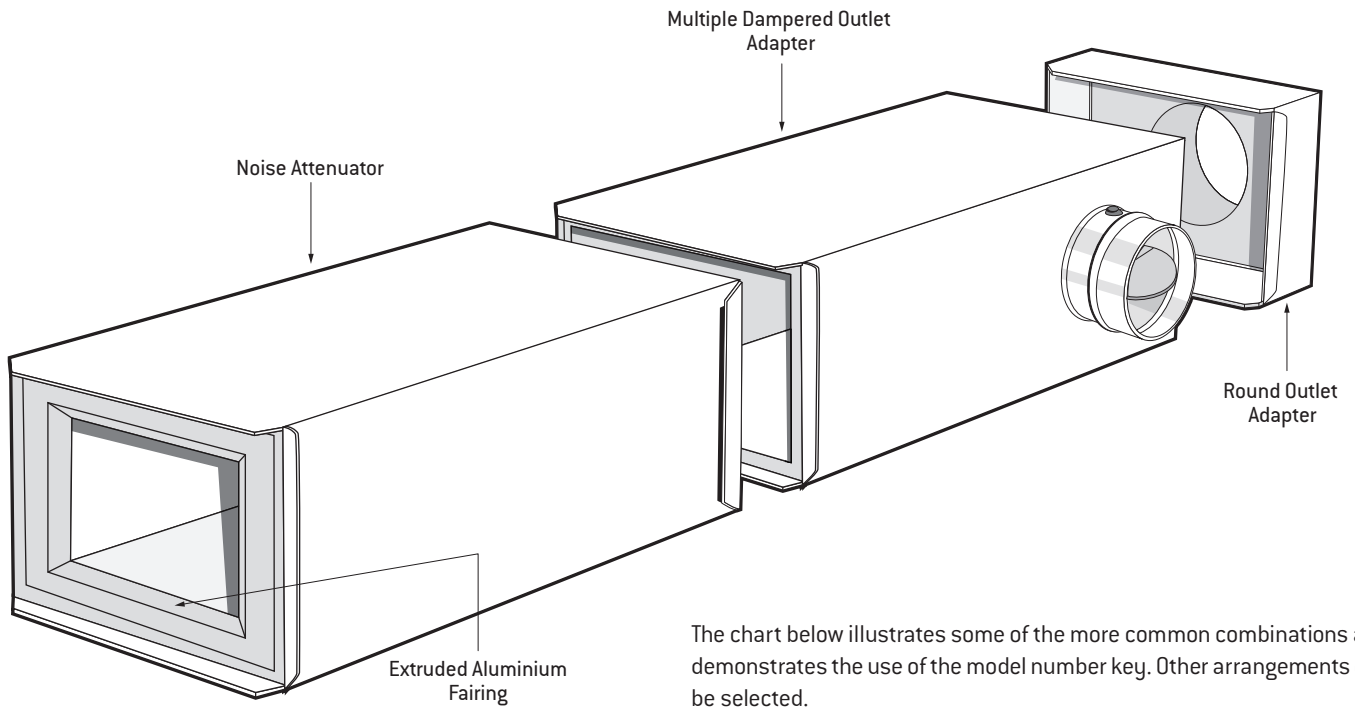
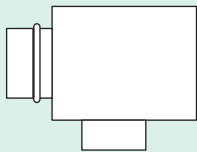
Note that control requirements are included in the model number key.

Variable Air Volume Control Assemblies

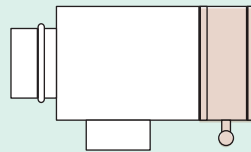
An HCV terminal can consist of a basic unit alone or with any combination of accessories.



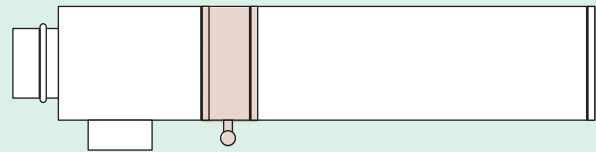
Guide Product Weights		
Case Size	Description	Approximate Weight in Kg.
150	HCV (Inc Square Flange)	6
200	HCV (Inc Square Flange)	7
250	HCV (Inc Square Flange)	9
300	HCV (Inc Square Flange)	11
200	HWC Hot Water Coil - 1 Row	3
350	HWC Hot Water Coil - 1 Row	6
200	HWC Hot Water Coil - 2 Row	4
350	HWC Hot Water Coil - 2 Row	7
350	HCV + Electric Heater (Square Inlet)	37
200	Electric Heater - 3.75 Kw (inc Flanges x 4)	22
250	Electric Heater - 6.00 Kw (inc Flanges x 4)	27
200	Discharge Attenuator	10
250	Discharge Attenuator	11
350	Discharge Attenuator	15


HCV - XX00C0


Basic Unit

HCV - XX10C0


With 1 Row H.W. Coil

HCV - XX11C0


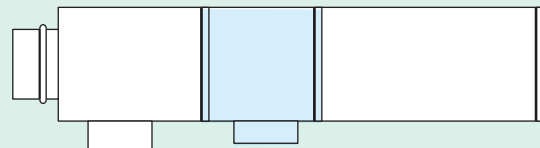
With 1 Row H.W. Coil and Open End Attenuator

HCV - XX11C2


With 1 Row H.W. Coil, Attenuator and Multiple Dampened Outlet

HCV - XX00C1


With Round Outlet Adapter Only

HCV - XX31C0


With Electric Heater and Attenuator

Notes

1. All diagrams are plan views.
2. For these examples, model numbers show no actuators.
3. Unless specifically requested, HCV terminals are dispatched unassembled. Handing is standard as shown. Opposite handing of basic unit available to special order and HW Coil may be inverted.

Basic Control Assembly, All Models

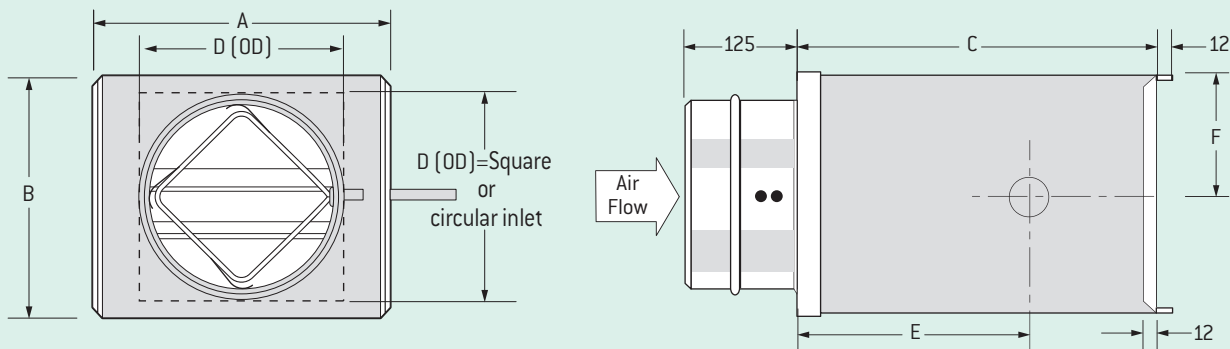
Case Size	Circular Inlet							Square / Rectangular Inlet							
	Range	Minimum* Controllable Settings	Approximate Velocity	Maximum Controllable Settings	Approximate Velocity	Maximum Rated Air Flow	Approximate Velocity	Range	Minimum* Controllable Settings	Approximate Velocity	Maximum Controllable Settings	Approximate Velocity	Maximum Rated Air Flow	Approximate Velocity	
	m ³ /s	m ³ /s	m/s	m ³ /s	m/s	m ³ /s	m/s	m ³ /s	m ³ /s	m/s	m/s	m ³ /s	m/s	m ³ /s	m/s
100	0-0.105	0.030	4	0.105	15	0.100	14	0-0.138	0.040	5	0.138	15	0.100	11	
125	0-0.166	0.046	4	0.166	15	0.150	13	0-0.220	0.061	4	0.220	15	0.150	10	
150	0-0.239	0.067	4	0.239	14	0.200	12	0-0.320	0.088	4	0.320	15	0.200	10	
175	0-0.343	0.095	4	0.343	15	0.300	13	0-0.439	0.124	4	0.439	15	0.300	10	
200	0-0.454	0.127	4	0.454	15	0.350	12	0-0.576	0.165	4	0.576	15	0.350	9	
225	0-0.574	0.160	4	0.574	15	0.500	13	0-0.733	0.208	4	0.733	15	0.500	10	
250	0-0.733	0.205	4	0.733	16	0.625	13	0-0.908	0.262	4	0.908	15	0.625	10	
300	0-1.076	0.300	4	1.076	16	1.000	15	0-1.314	0.387	4	1.314	15	1.000	11	
350	0-1.498	0.420	4	1.498	16	1.400	15	0-1.796	0.543	5	1.796	15	1.500	13	
400	0-1.976	0.550	5	1.976	16	1.900	15	0-2.352	0.710	5	2.352	15	1.900	12	
600x400	-	-	-	-	-	-	-	0-4.000	1.031	4	4.000	17	3.750	16	

Selection Guide Notes

This table is for approximate guidance only. For correct sizing of HCV units please follow the selection information on pages 266G to 278G, or contact your local Holyoake branch which has automatic selection programmes, to input raw data and assist in making accurate product selections.

- Select the required "Maximum Rated Air Flow".
- Select the corresponding sized HCV unit.
- Refer to tables for suitability of:
 - Noise Criteria.
 - Air Quantity – Minimum and Maximum Air Flow.
 - Static Pressure (where applicable).
- When an auxiliary setting is specified the value must be within the Minimum – Maximum range.
- ±5% tolerances may not be maintained below the Minimum Air Flow rate. However, control will be maintained down to positive shutoff.
- For electronic systems the "Minimum to Maximum" Settings are the controllable range.

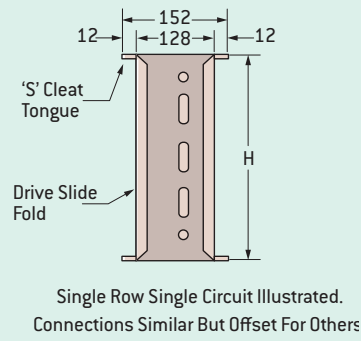
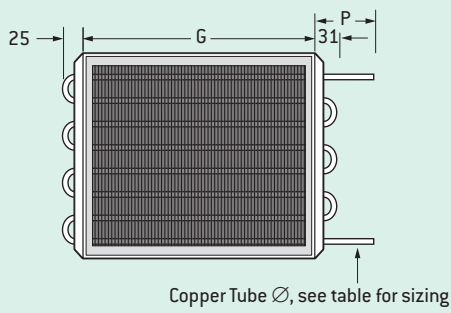
Dimensional Data



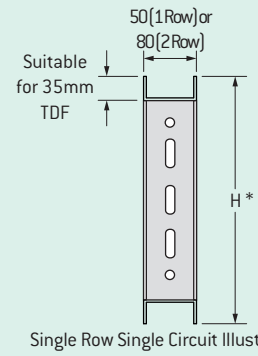
CASE SIZE	A	B	C	D	E*	F	G	H	J	K*	L	M	N	Ø _{Single}	Ø _{Multi}	P _{Single}	P _{Multi}
100	286	223	301	95	177	148	286	223	183	120	3	150	150	1/2"	1/2"	75	75
125	286	223	301	120	177	148	286	223	183	120	3	150	150	1/2"	1/2"	75	75
150	286	223	301	145	177	148	286	223	183	120	3	150	150	1/2"	1/2"	75	75
175	286	296	301	170	177	148	286	296	183	193	4	175	250	1/2"	7/8"	75	115
200	286	296	301	195	177	148	286	296	183	193	4	175	250	1/2"	7/8"	75	115
225	286	296	301	220	177	148	286	296	183	193	5	200	250	1/2"	7/8"	75	115
250	428	296	301	245	177	148	428	296	325	193	5	200	250	7/8"	7/8"	115	115
300	428	369	371	295	247	148	428	369	325	266	5	200	300	7/8"	7/8"	115	115
350	512	398	371	345	247	148	512	398	409	295	-	-	-	7/8"	7/8"	115	115
400	636	442	371	395	247	148	636	442	533	339	-	-	-	7/8"	7/8"	115	115
600 x 400	965	442	371	597 x 397	247	148	965	442	862	339	-	-	-	7/8"	7/8"	115	115

*On Australian manufactured HCV Coils with 35 mm TDF flanges, D = Actual 'Case Size', H = H + 70 mm; except Case Size 400, H = 446 mm and Case Size 600 x 400, H = 468 mm.

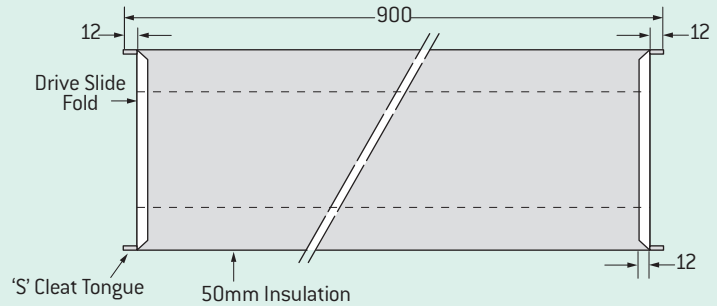
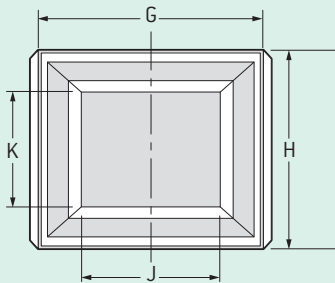
Hot Water Heating Coil



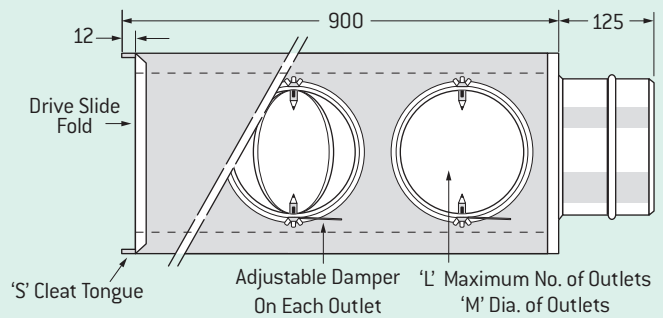
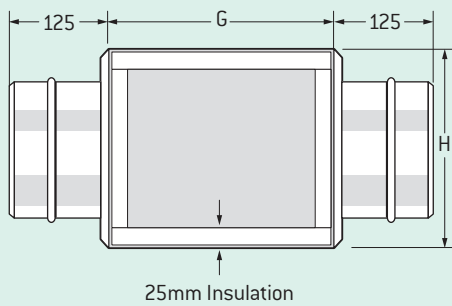
Australian Manufactured VAV Boxes Only



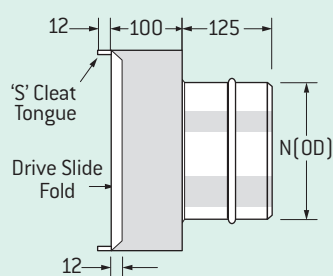
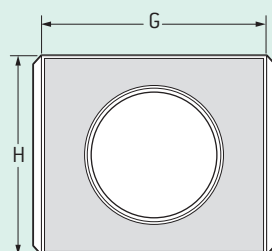
Attenuator



Multi Outlet Adaptor



Round Outlet Adaptor



HCV – HCV Pressure Data

Performance Notes For Pages 266 - 272G

1. ΔP_s is the difference in static pressure from inlet to discharge.
2. Minimum ΔP_s is the lowest inlet-to-discharge static pressure at which controls can be pressure independent.
3. ΔP_t is the difference in total pressure from inlet-to-discharge.
4. Lw is the sound power level, re 10^{-12} watts.

Correction Factors For Minimum Overall Pressure Drop With Accessories

SIZE	100-150	175-250	300-400
Pressure Drop	ΔP_s	ΔP_s	ΔP_s
Basic Assembly	1.0	1.0	1.0
Attenuator	1.1	2.1	6.8
1 Row Coil	1.03	2.0	6.4
2 Row Coil	2.06	3.75	12.0
Multi Discharge	0.7	0.9	2.8
Round Discharge	3.21	2.4	9.0

ΔP_s For Optional Electric Heater Banks

Size	ΔP_s [Pa]
100-150	2.2
175-225	2.1
250	1.0
300	1.5
350	1.5
400	1.1

Above static pressure ΔP_s to be added to the minimum ΔP_s from the performance table on this page.
These are approximations only as actual ΔP_s will depend on the number of elements used.

To obtain minimum ΔP_s for basic assembly with accessories:

1. From factor table, start with 1.0 for the basic assembly.
2. Select correction factor for each accessory. Add all factors together, including 1.0 for the basic assembly.
3. Multiply the minimum ΔP_s from the performance table on this page by the sum of the factors to obtain the overall minimum ΔP_s .

Example:

A 150 Circular Inlet Assembly with attenuator, 2 row coil and round discharge handles $0.189\text{m}^3/\text{s}$.

	ΔP_s
Basic Assembly	1.0
Attenuator	1.1
2 Row Coil	2.06
Round Discharge	3.21
	7.37

From the performance table, minimum $\Delta P_s = 34$ Pa.
 $7.37 \times 34 = 251$ Pa minimum ΔP_s with options added.

CASE SIZE	VOLUME m^3/s	MIN ΔP_s		MIN ΔP_t	
		Circular Inlet	Square Inlet	Circular Inlet	Square Inlet
HCV 100	0.040	9	6	23	17
	0.055	16	12	44	32
	0.070	27	19	72	52
	0.085	39	28	106	76
	0.100	54	39	146	105
HCV 125	0.050	5	3	13	8
	0.075	12	8	31	20
	0.100	22	14	56	35
	0.125	31	20	84	53
	0.150	44	28	121	76
HCV 150	0.080	8	6	17	12
	0.110	14	10	31	22
	0.140	21	15	49	35
	0.170	28	20	70	50
	0.200	37	27	95	68
HCV 175	0.120	5	4	16	12
	0.165	10	8	31	23
	0.210	15	11	49	37
	0.255	20	15	70	53
	0.300	27	20	96	72
HCV 200	0.150	4	3	13	8
	0.200	8	5	23	15
	0.250	12	8	36	23
	0.300	17	11	52	33
	0.350	22	14	69	44
HCV 225	0.200	4	3	11	8
	0.275	7	5	21	15
	0.350	12	9	35	25
	0.425	16	12	49	35
	0.500	22	16	68	49
HCV 250	0.250	7	5	17	12
	0.350	13	9	32	23
	0.450	19	13	50	36
	0.550	27	19	74	53
	0.625	35	25	96	68
HCV 300	0.400	4	6	15	12
	0.550	8	6	28	22
	0.700	14	11	47	36
	0.850	19	15	68	52
	1.000	26	20	93	72
HCV 350	0.600	4	3	15	10
	0.825	6	4	26	18
	1.050	9	6	41	28
	1.275	13	9	61	42
	1.500	20	14	86	59
HCV 400	0.750	3	2	15	9
	1.000	5	3	27	17
	1.250	8	5	42	26
	1.500	13	8	62	38
	1.900	25	16	104	64
HCV 600 x 400	1.250		4		10
	2.000		11		28
	2.500		16		42
	3.000		24		61
	3.750		40		98

Circular Inlet

CASE SIZE	VOLUME m³/s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw					
		OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS					
		125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K
HCV 100	0.040	44	37	32	26	21	19	56	50	40	30	24	21	57	51	42	36	31	28	58	50	38	37	33	29
	0.055	49	41	36	30	24	23	57	51	41	31	25	23	58	53	44	37	32	30	59	53	42	39	34	30
	0.070	59	47	43	38	31	32	59	51	41	32	27	27	59	58	47	39	35	34	62	58	49	43	34	31
	0.085	59	50	44	39	36	37	58	53	43	33	30	33	63	59	47	41	33	36	63	61	52	45	35	33
	0.100	59	53	47	43	40	41	59	54	45	36	33	36	63	60	49	42	35	38	64	64	54	46	37	35
HCV 125	0.050	40	33	29	23	18	17	54	45	34	28	20	18	58	52	41	36	31	24	60	47	39	36	29	28
	0.075	44	35	29	24	18	18	59	49	40	30	22	19	58	53	44	38	26	24	60	56	48	43	35	35
	0.100	51	37	31	26	22	20	59	50	41	30	26	22	61	55	45	38	30	26	62	59	50	43	39	34
	0.125	60	42	33	29	28	27	61	52	42	33	29	27	62	56	47	38	32	29	64	61	53	46	39	35
	0.150	60	47	37	33	33	33	63	54	44	36	34	34	64	57	48	38	34	32	66	63	54	47	39	37
HCV 150	0.080	48	37	30	24	18	17	57	45	33	27	22	20	59	51	42	35	30	26	59	56	48	41	39	39
	0.110	51	39	30	24	20	17	60	47	35	28	23	20	61	51	42	36	31	28	62	56	49	42	39	39
	0.140	60	46	32	27	24	19	63	49	39	29	27	22	64	53	43	36	32	31	65	58	49	42	39	39
	0.170	63	49	36	30	28	24	64	51	41	32	30	27	66	55	44	36	35	33	67	59	49	43	40	40
	0.200	64	51	42	34	33	33	65	53	43	35	33	33	68	57	46	37	37	36	70	61	51	44	41	41
HCV 175	0.120	50	36	30	23	18	18	59	49	36	30	27	23	61	51	43	37	35	32	61	56	48	43	42	42
	0.165	61	38	32	26	21	18	61	51	41	34	30	23	63	56	47	38	36	34	65	59	51	45	43	42
	0.210	62	44	35	30	28	23	62	54	43	35	33	30	65	59	50	41	37	35	66	63	55	47	44	43
	0.255	62	50	40	35	33	30	62	55	45	37	36	32	66	62	50	43	40	36	67	65	57	48	45	43
	0.300	64	56	42	40	38	36	64	58	48	42	39	36	66	63	52	44	41	39	72	67	59	50	46	44
HCV 200	0.150	41	33	28	22	17	15	55	41	34	28	27	22	58	48	41	34	32	29	59	53	47	40	34	33
	0.200	43	35	30	24	19	17	57	44	37	30	29	25	60	51	43	36	34	31	62	56	49	42	37	35
	0.250	45	36	32	26	22	18	59	46	40	32	31	27	63	53	45	38	36	32	65	58	51	43	40	37
	0.300	51	38	35	30	27	22	63	50	43	35	34	30	65	55	46	40	37	35	68	60	53	45	42	41
	0.350	56	41	39	33	32	28	64	52	46	37	36	33	66	56	48	42	39	37	69	61	54	46	43	42
HCV 225	0.200	39	34	30	24	18	17	56	41	35	35	31	29	63	52	43	40	39	38	63	58	50	45	44	46
	0.275	43	36	32	26	21	18	59	44	38	36	33	31	64	52	44	41	39	39	67	59	51	46	45	47
	0.350	50	38	37	30	26	21	61	47	42	36	34	33	65	52	45	42	40	41	69	60	52	47	46	48
	0.425	57	41	43	34	32	26	63	50	45	37	36	35	65	53	47	42	42	42	69	61	53	48	47	49
	0.500	61	46	46	39	37	31	64	53	48	40	38	38	67	55	50	42	44	44	70	61	54	48	48	50
HCV 250	0.250	43	35	30	24	18	17	57	47	36	30	29	28	65	52	44	35	34	35	65	57	50	44	40	42
	0.350	46	37	33	28	22	18	63	49	41	32	31	30	66	55	46	39	36	37	68	59	52	45	42	44
	0.450	57	42	37	34	30	23	65	51	44	36	34	34	67	57	49	39	39	40	72	62	54	47	44	46
	0.550	59	46	41	39	37	31	66	55	48	41	38	38	69	59	51	42	41	42	75	64	56	50	46	48
	0.625	63	51	44	43	41	36	67	57	50	43	42	42	70	60	53	45	43	45	76	66	58	52	48	49
HCV 300	0.400	49	37	33	29	24	20	59	48	38	32	28	31	62	54	44	35	33	39	62	58	51	44	41	46
	0.550	58	43	38	36	33	28	62	52	42	38	35	35	62	57	48	40	37	42	66	61	54	45	43	49
	0.700	63	48	44	42	40	36	65	55	46	43	41	39	65	59	51	44	41	45	70	63	56	47	44	51
	0.850	67	53	48	47	46	42	67	60	49	48	46	43	70	62	54	48	46	47	72	66	57	49	47	53
	1.000	70	60	51	51	50	47	70	66	52	51	50	48	71	66	55	52	50	49	74	68	60	53	51	55
HCV 350	0.600	55	47	41	36	31	26	62	51	42	39	34	36	64	55	47	42	38	38	65	58	51	46	41	45
	0.825	64	51	44	40	36	29	65	55	47	44	41	40	66	58	50	46	47	48	68	61	55	51	47	48
	1.050	67	53	48	44	40	33	68	59	50	48	46	46	69	61	53	49	49	48	70	63	58	52	50	50
	1.275	70	58	50	46	42	36	71	67	52	49	48	46	72	69	54	50	50	51	73	66	60	53	51	52
	1.500	71	65	52	49	44	37	73	70	55	52	50	48	74	72	57	53	51	52	75	68	61	55	52	53
HCV 400	0.750	57	48	42	37	32	29	63	53	44	40	35	36	66	56	48	43	39	40	68	59	52	48	43	44
	1.000	65	53	46	42	37	31	66	57	50	47	42	42	68	58	52	48	46	47	70	61	57	52	49	48
	1.250	69	56	50	44	39	33	70	62	53	50	48	47	70	63	54	51	49	49	72	65	60	54	52	51
	1.500	71	61	52	46	41	36	72	67	56	52	50	48	73	70	56	54	52	51	74	71	62	56	54	53
	1.900	74	66	54	48	43	40	74	70	62	55	52	50	75	73	60	57	55	55	76	74	65	59	58	57

HCV – Discharge Noise Levels

Circular Inlet

CASE SIZE	VOLUME m ³ /s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw					
		OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS					
		125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K
HCV 100	0.040	44	45	36	26	18	18	56	50	56	48	43	39	55	59	59	53	51	45	56	61	58	56	52	53
	0.055	47	47	40	29	21	21	58	58	57	49	45	41	57	60	61	54	51	47	58	63	62	59	54	55
	0.070	54	52	47	36	28	26	62	63	60	51	48	45	61	62	64	55	53	51	61	66	68	65	59	58
	0.085	59	56	52	41	35	31	63	66	61	52	51	49	67	68	65	58	55	54	65	68	71	66	60	59
	0.100	61	59	54	45	39	36	65	66	61	53	50	49	67	68	67	58	56	56	67	68	71	67	62	61
HCV 125	0.050	42	38	32	24	17	17	50	53	52	48	43	38	54	56	57	51	48	47	54	57	57	57	53	55
	0.075	47	42	35	26	19	18	54	58	57	50	46	42	59	61	59	55	54	50	60	65	65	64	66	62
	0.100	51	48	44	36	28	22	59	61	59	51	48	46	61	65	63	58	54	53	62	68	67	65	64	62
	0.125	58	55	49	42	35	30	61	63	60	52	50	48	63	64	64	59	56	55	64	69	71	66	62	63
	0.150	62	59	54	47	41	35	62	65	61	54	51	49	65	65	66	60	56	56	67	69	73	67	63	64
HCV 150	0.080	48	47	35	26	18	18	55	58	56	48	45	43	59	59	58	56	52	51	61	62	62	60	59	60
	0.110	52	52	39	31	23	19	58	60	56	48	46	44	60	60	57	56	52	52	62	63	62	61	60	60
	0.140	57	57	46	38	31	23	61	61	57	50	48	46	62	63	58	56	53	54	64	65	64	64	60	62
	0.170	58	57	51	43	37	32	62	62	59	52	49	48	64	64	59	57	55	55	66	67	65	64	60	62
	0.200	59	59	56	48	42	38	63	62	61	54	51	50	65	64	59	58	56	56	67	68	67	65	61	63
HCV 175	0.120	43	39	32	25	20	19	56	55	52	48	48	45	58	59	57	54	54	53	62	62	62	60	60	62
	0.165	45	44	39	29	23	20	59	58	55	50	50	48	58	59	60	56	55	55	61	63	64	62	61	62
	0.210	48	47	44	38	31	25	60	59	57	52	52	50	63	64	62	57	57	57	66	66	68	64	62	63
	0.255	54	50	46	43	36	32	61	60	58	54	54	52	65	66	63	59	58	58	67	67	68	65	63	64
	0.300	59	53	51	47	41	38	63	62	59	56	56	54	66	68	64	60	60	59	69	70	70	66	65	66
HCV 200	0.150	43	37	35	25	18	16	57	56	52	47	47	46	59	60	56	53	53	54	61	62	61	60	58	60
	0.200	46	41	38	29	21	19	59	58	54	50	50	49	61	62	58	55	55	56	63	64	63	62	60	62
	0.250	53	47	44	37	30	23	61	59	56	52	51	50	63	64	60	57	56	57	66	67	64	63	62	64
	0.300	57	51	49	42	36	31	63	60	58	54	53	52	64	65	61	58	58	59	68	68	65	64	63	65
	0.350	59	55	53	46	41	37	65	61	59	56	55	54	66	65	62	60	59	60	68	69	67	66	64	66
HCV 225	0.200	51	37	30	26	17	17	59	55	51	49	51	49	61	60	59	55	56	57	63	62	62	63	60	63
	0.275	55	43	39	34	26	21	61	56	53	51	52	51	62	61	60	56	57	58	64	63	63	63	62	65
	0.350	58	48	47	41	34	28	62	59	56	54	54	53	64	62	61	58	59	60	66	65	64	64	63	66
	0.425	60	52	51	47	41	37	65	61	58	56	56	55	66	63	63	60	60	61	69	68	67	65	65	67
	0.500	62	56	53	52	47	43	67	63	60	59	58	57	67	66	65	62	62	62	70	69	68	66	66	68
HCV 250	0.250	49	45	38	28	20	18	59	56	54	52	50	50	63	62	59	58	55	58	65	65	65	65	64	64
	0.350	51	47	44	37	31	22	60	59	59	54	52	52	65	63	62	60	59	59	67	66	66	65	65	66
	0.450	60	53	50	44	40	34	62	61	60	57	56	55	66	65	64	62	61	62	68	67	67	66	66	68
	0.550	62	57	55	50	46	41	64	62	61	59	58	58	68	67	66	64	63	63	70	69	68	68	67	69
	0.625	64	60	58	54	50	46	66	63	61	60	58	59	70	69	67	65	64	65	72	70	69	69	69	69
HCV 300	0.400	54	42	35	26	19	17	61	58	55	52	52	50	63	62	61	58	57	56	67	67	68	66	63	64
	0.550	59	49	45	39	32	29	63	60	58	55	55	53	66	64	63	60	59	59	69	69	68	67	65	66
	0.700	63	55	52	48	43	39	65	61	61	58	57	56	68	66	65	62	61	62	70	70	69	69	66	68
	0.850	66	59	56	54	49	46	67	64	63	61	60	59	70	68	67	65	63	64	72	71	71	70	68	69
	1.000	69	62	60	59	54	51	70	65	64	64	62	61	71	70	69	67	65	66	73	72	72	72	69	70
HCV 350	0.600	58	49	43	39	38	34	65	60	58	55	56	53	69	66	65	60	60	60	71	70	72	68	65	66
	0.825	63	54	50	48	45	44	67	63	61	59	59	57	72	68	68	64	63	63	74	73	73	70	68	69
	1.050	66	59	55	53	50	51	70	64	62	63	61	60	74	70	69	66	65	66	76	74	76	71	70	71
	1.275	69	62	60	58	55	56	73	67	64	64	62	61	75	73	71	68	67	67	77	75	77	73	71	70
	1.500	72	65	64	63	60	58	74	68	66	66	64	62	76	74	72	70	69	69	78	76	78	74	73	72
HCV 400	0.750	62	51	49	46	43	41	69	63	61	59	56	55	71	69	67	64	63	62	72	70	70	68	67	66
	1.000	66	57	52	50	49	47	72	65	63	62	59	58	74	72	69	67	66	64	74	73	71	69	68	67
	1.250	69	60	57	54	52	50	74	66	65	63	61	59	76	74	71	69	67	66	77	75	73	71	69	68
	1.500	71	64	60	59	56	55	75	68	67	64	63	61	77	74	72	71	68	67	78	76	74	72	71	69
	1.900	75	68	65	63	60	58	77	70	68	67	65	64	79	76	74	73	70	69	80	78	76	74	73	71

Controlled Volume Assemblies/HCV

Circular Inlet

CASE SIZE	VOLUME m ³ /s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS					
		125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K
HCV 100	0.040	39	39	32	24	17	18	56	50	34	21	17	18	49	48	35	21	17	19	54	51	35	26	20	23
	0.055	43	40	32	24	17	18	52	46	35	22	17	18	52	49	37	21	18	19	55	52	38	26	20	25
	0.070	50	41	32	24	17	18	58	51	37	24	18	18	57	50	42	22	19	20	57	55	45	27	21	28
	0.085	54	42	33	24	17	18	58	54	41	24	18	18	58	56	43	23	18	20	65	57	49	27	22	30
	0.100	56	46	34	24	18	18	61	56	41	25	18	18	59	56	44	23	19	21	64	57	48	28	22	30
HCV 125	0.050	38	36	31	24	17	17	48	41	29	20	17	18	49	45	33	21	17	21	59	45	34	26	19	22
	0.075	43	37	32	23	16	17	50	45	33	25	18	18	54	47	34	21	18	19	52	58	44	25	21	31
	0.100	45	39	32	24	17	17	53	49	35	24	18	18	56	53	40	25	19	20	59	60	45	25	21	29
	0.125	52	43	32	24	18	18	57	51	36	25	18	19	58	53	41	26	20	21	60	59	48	28	22	29
	0.150	57	47	33	25	19	19	60	53	38	26	19	19	61	54	43	27	21	21	64	58	50	29	23	31
HCV 150	0.080	44	38	33	28	25	19	52	48	34	25	18	18	53	48	36	26	18	19	58	50	39	26	21	29
	0.110	47	41	33	28	25	20	54	50	35	25	19	18	57	50	35	26	19	20	52	51	38	26	21	27
	0.140	51	44	33	25	19	18	59	50	35	26	19	18	60	52	37	26	20	20	59	55	42	28	23	26
	0.170	53	44	33	27	20	19	59	50	36	27	21	19	61	53	38	28	22	22	63	56	45	30	24	27
	0.200	55	46	35	28	23	21	59	50	36	28	23	21	62	53	38	29	24	23	63	57	47	31	25	28
HCV 175	0.120	39	37	31	25	20	19	56	46	35	27	23	22	57	49	39	28	23	28	61	54	44	29	25	36
	0.165	41	39	31	27	23	20	58	49	39	27	23	22	58	49	43	28	24	30	59	53	44	29	26	36
	0.210	43	40	32	27	23	20	61	50	40	28	23	23	62	54	44	28	24	31	60	55	48	30	27	37
	0.255	49	43	31	28	23	21	61	50	40	28	24	24	65	57	45	29	25	32	63	55	49	31	28	38
	0.300	54	47	33	29	24	22	61	51	40	29	25	25	66	58	46	30	27	33	66	57	51	32	29	40
HCV 200	0.150	39	35	29	22	16	16	57	47	33	23	16	19	55	50	38	25	19	28	56	50	41	26	21	34
	0.200	42	37	31	25	18	18	59	49	35	25	19	21	58	52	40	27	21	31	59	52	43	28	24	36
	0.250	48	40	32	26	19	19	61	50	36	26	20	22	59	54	42	27	22	31	60	55	45	30	25	37
	0.300	51	42	33	27	21	20	61	50	38	27	22	23	62	55	43	28	23	32	63	57	47	31	27	39
	0.350	53	45	35	28	23	22	61	50	39	29	24	24	65	56	44	30	25	33	65	59	48	33	28	39
HCV 225	0.200	48	37	28	24	17	18	57	47	33	25	19	21	58	51	43	25	20	31	58	49	42	29	24	37
	0.275	50	38	31	25	19	19	58	47	34	26	21	22	58	52	43	27	22	31	58	52	45	30	26	38
	0.350	52	41	34	28	22	22	59	49	35	28	23	23	61	53	44	29	25	32	60	55	48	32	28	39
	0.425	54	46	36	31	26	25	59	51	37	31	26	26	65	54	45	32	28	33	64	58	50	35	30	40
	0.500	56	49	37	35	30	29	59	52	38	35	29	29	64	55	47	35	30	32	67	59	50	36	32	41
HCV 250	0.250	44	38	32	24	17	18	56	48	39	26	22	30	59	54	43	28	29	38	59	56	48	31	37	44
	0.350	45	38	33	26	19	18	57	51	42	27	23	30	65	56	46	29	33	39	63	57	49	31	38	46
	0.450	53	45	35	29	22	20	60	52	43	30	26	32	65	57	48	31	34	40	65	58	50	35	40	48
	0.550	57	51	39	33	27	24	62	52	44	33	29	33	66	59	50	34	36	41	68	61	52	37	41	49
	0.625	58	51	42	35	30	27	62	54	44	34	29	34	67	60	50	37	36	41	70	62	53	37	42	48
HCV 300	0.400	50	41	33	26	18	17	57	52	41	28	31	31	63	56	47	30	36	39	64	60	53	34	42	45
	0.550	54	45	37	32	26	23	62	54	45	33	33	34	65	59	49	34	39	41	67	62	54	37	44	48
	0.700	57	49	41	37	32	28	64	56	46	37	36	37	68	61	51	38	42	43	69	64	55	40	45	49
	0.850	61	53	45	42	37	34	66	58	47	42	39	40	69	63	53	42	44	46	71	65	57	44	48	50
	1.000	65	56	48	46	41	38	69	60	48	46	43	40	70	66	56	46	44	48	72	66	59	47	50	52
HCV 350	0.600	54	43	32	28	26	24	60	56	46	34	36	36	65	61	53	36	42	43	66	64	58	43	47	50
	0.825	58	49	39	36	31	31	61	59	49	38	39	41	67	63	57	41	45	46	68	67	60	44	49	52
	1.050	60	52	44	41	36	37	65	60	48	43	42	43	70	66	58	42	47	49	72	69	62	47	52	54
	1.275	64	56	49	45	42	42	69	62	50	44	42	43	71	67	58	45	48	49	71	69	64	48	53	53
	1.500	68	58	53	51	46	44	69	62	53	45	44	44	71	68	60	46	51	51	73	70	64	49	55	55
HCV 400	0.750	57	45	38	36	33	30	63	58	47	39	40	41	67	63	54	41	47	48	67	63	56	45	51	54
	1.000	60	50	42	40	38	36	67	59	50	44	43	43	69	66	57	46	49	51	69	66	58	46	51	54
	1.250	63	53	46	42	40	38	69	60	51	43	43	43	70	68	57	47	50	51	71	68	59	47	52	54
	1.500	66	57	50	47	45	43	69	61	54	44	45	45	72	68	59	48	51	53	73	69	59	49	54	55
	1.900	70	61	54	51	47	46	71	63	54	46	47	48	73	70	59	50	52	55	75	72	62	50	55	57

HCV – Case Radiated Noise Levels

Square Inlet

CASE SIZE	VOLUME m ³ /s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS					
		125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
HCV 100	0.040	39	29	23	16	11	7	51	42	31	20	14	9	52	43	33	26	21	15	53	42	29	27	23	17
	0.055	44	33	27	20	14	11	52	43	32	21	15	11	53	45	35	27	22	18	54	45	33	29	24	18
	0.070	54	39	34	28	21	20	54	43	32	22	17	15	54	50	38	29	25	22	57	50	40	33	24	19
	0.085	54	42	35	29	26	25	53	45	34	23	20	21	58	51	38	31	23	24	58	53	43	35	25	21
	0.100	54	45	38	33	30	29	54	46	36	26	23	24	58	52	40	32	25	26	59	58	45	36	27	23
HCV 125	0.050	35	25	20	13	8	5	49	37	25	18	10	6	53	44	32	26	21	12	55	39	30	26	19	16
	0.075	39	27	20	14	8	6	54	41	31	20	12	7	53	45	35	28	16	12	55	48	39	33	25	23
	0.100	46	29	22	16	12	8	54	42	32	20	16	10	56	47	35	28	20	14	57	51	41	33	29	22
	0.125	55	34	24	19	18	15	56	44	33	23	19	15	57	48	38	28	22	17	59	53	44	36	29	23
	0.150	55	39	28	23	23	21	58	46	35	26	24	22	59	49	39	28	24	20	61	55	45	37	29	25
HCV 150	0.080	43	29	21	14	8	5	52	37	24	17	12	8	54	43	33	25	20	14	54	48	39	31	29	27
	0.110	46	31	21	14	10	5	55	39	26	18	13	8	56	43	33	26	21	16	57	48	40	32	29	27
	0.140	55	38	23	17	14	7	58	41	30	19	17	10	59	45	34	26	22	19	60	50	40	32	29	27
	0.170	58	41	27	20	18	12	59	43	32	22	20	15	61	47	35	26	25	21	62	51	40	33	30	28
	0.200	59	43	33	24	23	21	60	45	34	25	23	21	63	49	37	27	27	24	65	53	42	34	31	29
HCV 175	0.120	45	28	21	13	8	6	54	41	27	20	17	11	56	43	34	27	25	20	56	48	39	33	32	30
	0.165	56	30	23	16	11	6	56	43	32	24	20	11	58	48	38	28	26	22	60	51	42	35	33	30
	0.210	57	36	26	20	18	11	57	46	34	25	23	18	60	51	41	31	27	23	61	55	46	37	34	31
	0.255	57	42	31	25	23	18	57	47	36	27	26	20	51	54	41	33	30	24	62	57	48	38	35	31
	0.300	59	48	33	30	28	24	59	50	39	32	29	24	61	55	43	34	31	27	67	59	50	40	36	32
HCV 200	0.150	36	25	19	12	7	3	50	33	25	18	17	10	53	40	32	24	22	17	54	45	38	30	24	21
	0.200	38	27	21	14	9	5	52	36	28	20	19	13	55	43	34	26	24	19	57	48	40	32	27	23
	0.250	40	28	23	16	12	6	54	38	31	32	21	15	58	45	36	28	26	20	60	50	42	33	30	25
	0.300	46	30	26	20	17	10	58	42	34	25	24	18	50	47	37	30	27	23	53	52	44	35	32	29
	0.350	51	33	30	23	22	15	59	44	37	27	26	21	61	48	39	32	29	25	54	53	45	36	33	30
HCV 225	0.200	34	26	21	14	8	5	51	33	26	25	21	17	58	44	34	30	29	26	58	50	41	35	34	34
	0.275	38	28	23	16	11	6	54	36	29	26	23	19	55	44	35	31	29	27	62	51	42	36	35	35
	0.350	45	30	28	20	15	9	56	39	33	26	24	21	60	44	36	32	30	29	64	52	43	37	36	36
	0.425	52	33	34	24	22	14	58	42	36	27	25	23	60	45	38	32	32	30	64	53	44	38	37	37
	0.500	56	28	37	29	27	19	59	45	39	30	28	26	62	47	41	32	34	32	65	53	45	38	38	38
HCV 250	0.250	38	27	21	14	8	5	52	39	27	20	19	16	60	44	35	25	24	23	60	49	41	34	30	30
	0.350	41	29	24	18	12	6	58	41	32	22	21	18	51	47	37	29	26	25	63	51	43	35	32	32
	0.450	52	34	28	24	20	11	60	43	35	26	24	22	62	49	40	29	29	28	67	54	45	37	34	34
	0.550	54	38	32	29	27	19	61	47	39	31	28	26	64	51	42	32	31	30	70	56	47	40	36	36
	0.625	58	43	35	33	31	24	62	49	41	33	32	30	65	52	44	35	33	33	71	58	49	42	38	37
HCV 300	0.400	44	29	24	19	14	8	54	40	29	22	18	19	54	46	35	25	23	27	57	50	42	34	31	34
	0.550	53	35	29	26	23	16	57	44	33	28	25	23	57	49	39	30	27	30	61	53	45	35	33	37
	0.700	58	40	35	32	30	24	60	47	37	33	31	27	60	51	42	34	31	33	65	55	47	37	34	39
	0.850	62	45	39	37	36	30	62	52	40	38	36	31	65	54	45	38	36	35	67	58	48	39	37	41
	1.000	65	52	42	41	40	35	65	58	43	41	40	36	65	58	46	42	40	37	69	60	51	43	41	43
HCV 350	0.600	50	39	32	26	21	14	57	43	33	29	24	24	59	47	38	32	28	26	60	50	42	36	31	33
	0.825	59	43	35	30	26	17	60	47	38	34	31	28	61	50	41	36	37	36	63	53	46	41	37	36
	1.050	62	45	39	34	30	21	63	51	41	38	36	34	64	53	44	39	39	36	65	55	49	42	40	38
	1.275	65	50	41	36	32	24	55	59	43	39	38	34	67	61	45	40	40	39	68	63	51	43	41	40
	1.500	65	57	43	39	34	25	68	62	46	42	40	36	69	54	48	43	41	40	70	66	52	45	42	41
HCV 400	0.750	52	40	33	27	22	17	58	45	35	30	25	24	61	48	39	33	29	28	63	51	43	38	33	32
	1.000	60	45	37	32	27	19	61	49	41	37	32	30	63	50	43	38	36	35	65	53	48	42	39	36
	1.250	64	48	41	34	29	21	65	54	44	40	38	35	65	55	45	41	39	37	67	57	51	44	42	39
	1.500	55	53	43	36	31	24	67	59	47	42	40	36	68	62	47	44	42	39	69	63	53	46	44	41
	1.900	69	58	45	38	33	28	69	52	53	45	42	38	70	65	51	47	45	43	71	65	56	49	48	45
HCV 600 x 400	1.250	59	49	43	38	34	32	64	55	47	43	37	37	69	57	50	44	40	42	71	60	53	50	45	43
	2.000	71	58	50	44	38	32	71	62	55	51	49	48	70	61	55	53	48	50	72	64	60	56	54	52
	2.500	71	62	53	44	39	35	73	66	59	55	52	50	73	69	56	58	53	50	74	69	63	58	56	54
	3.000	74	62	54	45	41	39	74	69	61	54	53	50	75	70	57	57	55	52	76	71	65	60	61	59
	3.750	76	64	56	47	43	41	77	71	64	57	55	52	79	73	59	58	57	54	80	75	68	62	62	61

Controlled Volume Assemblies/HCV

Square Inlet

CASE SIZE	VOLUME m³/s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw						SOUND POWER Lw					
		OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS						OCTAVE BANDS					
		125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k	125	250	500	1k	2k	4k
HCV 100	0.040	40	39	31	19	10	10	52	44	51	41	35	31	51	53	54	46	43	37	52	55	53	49	44	45
	0.055	43	41	35	22	13	13	54	52	52	42	37	33	53	54	56	47	43	39	54	57	57	52	46	47
	0.070	50	46	42	29	20	18	58	57	55	44	40	37	57	56	59	48	45	43	57	60	63	58	51	50
	0.085	55	50	47	34	27	23	59	60	56	45	43	41	63	62	60	51	47	46	61	62	66	59	52	51
	0.100	57	53	49	38	31	28	61	60	56	48	42	41	63	62	62	51	48	48	63	62	55	60	54	53
HCV 125	0.050	38	32	27	17	9	9	46	47	47	41	35	30	50	50	52	44	40	39	50	51	52	50	45	47
	0.075	43	36	30	19	11	10	50	52	52	43	38	34	55	55	54	48	46	42	56	59	60	57	58	54
	0.100	47	42	39	29	20	14	55	55	54	44	40	38	57	59	58	51	46	45	58	62	62	58	56	54
	0.125	54	49	44	35	27	22	57	57	55	45	42	40	59	58	59	52	48	47	60	63	66	59	54	55
	0.150	58	53	49	40	33	27	58	59	56	47	43	41	61	59	61	53	48	48	63	63	68	60	55	56
HCV 150	0.080	44	41	30	19	10	10	51	52	51	41	37	35	55	53	53	49	44	43	57	56	57	53	51	52
	0.110	48	46	34	24	15	11	54	54	51	41	38	36	56	54	52	49	44	44	58	57	57	54	52	52
	0.140	53	51	41	31	23	15	57	55	52	43	40	38	58	57	53	49	45	46	60	59	59	57	52	54
	0.170	54	51	46	36	29	24	58	56	54	45	41	40	60	58	54	50	47	47	62	61	60	57	52	54
	0.200	55	53	51	41	34	30	59	56	56	47	43	42	61	58	54	51	48	48	63	62	62	58	53	55
HCV 175	0.120	39	33	27	18	12	11	52	49	47	41	40	37	54	53	52	47	46	45	58	56	57	53	52	54
	0.165	41	38	34	22	15	12	55	52	50	43	42	40	54	53	55	49	47	47	57	57	59	55	53	54
	0.210	44	41	39	31	23	17	56	53	52	45	44	42	59	58	57	50	49	49	62	60	63	57	54	55
	0.255	50	44	41	36	28	24	57	54	53	47	46	44	61	60	58	52	50	50	63	61	63	58	55	56
	0.300	55	47	46	40	33	30	59	56	54	49	48	46	62	62	59	53	52	51	65	64	65	59	57	58
HCV 200	0.150	39	31	30	16	10	8	53	50	47	40	39	38	55	54	51	46	45	46	57	56	56	53	50	52
	0.200	42	35	33	22	13	11	55	52	49	43	42	41	57	56	53	48	47	48	59	58	58	55	52	54
	0.250	49	41	39	30	22	15	57	53	51	45	43	42	59	58	55	50	48	49	62	61	59	56	54	56
	0.300	53	45	44	35	28	23	59	54	53	47	45	44	60	59	56	51	50	51	64	62	60	57	55	57
	0.350	55	49	48	39	33	29	61	55	54	49	47	46	62	59	57	53	51	52	64	63	62	59	56	58
HCV 225	0.200	47	31	25	19	9	9	55	49	46	47	43	41	57	54	54	48	48	49	59	58	57	56	52	55
	0.275	51	37	34	27	18	13	57	50	48	44	44	43	58	55	55	49	49	50	60	57	58	56	54	57
	0.350	54	42	42	34	26	20	58	53	51	47	46	45	60	56	56	51	51	52	62	59	59	57	55	58
	0.425	56	46	45	40	33	29	61	55	53	49	48	47	62	57	58	53	52	53	65	62	62	58	57	59
	0.500	58	50	48	45	39	35	63	57	55	52	50	49	63	60	60	55	54	54	66	63	63	59	58	60
HCV 250	0.250	45	39	22	21	12	10	55	50	49	45	42	42	55	56	54	51	47	50	61	59	60	58	56	56
	0.350	47	41	39	30	23	14	56	53	54	47	44	44	61	57	57	53	51	51	63	60	61	58	57	58
	0.450	56	47	45	37	32	26	58	55	55	50	48	47	62	59	59	55	53	54	64	61	62	59	58	60
	0.550	58	51	50	43	38	33	60	56	56	52	50	50	64	61	61	57	55	55	66	63	63	61	59	61
	0.625	60	54	53	47	42	38	62	57	56	53	50	51	86	63	62	58	56	57	68	64	64	62	61	61
HCV 300	0.400	50	36	30	19	11	9	57	52	50	45	44	42	59	56	56	51	49	48	63	61	53	59	55	56
	0.550	55	43	40	32	24	21	59	54	53	48	47	45	62	58	58	53	51	51	65	63	63	60	57	58
	0.700	59	49	47	41	35	31	61	55	56	51	49	48	64	60	60	55	53	54	66	64	64	62	58	60
	0.850	62	53	51	47	41	38	63	58	58	54	52	51	66	62	62	58	55	56	68	65	66	63	60	61
	1.000	65	56	55	52	46	43	66	59	59	57	54	53	67	64	64	60	57	58	69	66	67	65	61	62
HCV 350	0.600	54	43	38	32	30	26	61	54	53	48	48	45	65	60	60	53	52	52	67	64	67	61	57	58
	0.825	59	48	45	41	37	36	63	57	56	52	51	49	68	62	63	57	55	55	70	67	68	63	60	61
	1.050	62	53	50	46	42	43	66	58	57	56	53	52	70	64	64	59	57	58	72	68	71	64	62	63
	1.275	65	56	55	51	47	48	69	61	58	57	54	53	71	67	66	61	59	59	73	69	72	66	63	62
	1.500	68	59	59	56	52	50	70	62	61	59	56	54	72	68	67	63	61	61	74	70	73	67	65	64
HCV 400	0.750	58	45	44	39	35	33	65	57	56	52	48	47	67	63	62	57	55	54	68	64	65	61	59	58
	1.000	62	51	47	43	41	39	68	59	58	55	51	50	70	68	64	60	58	56	70	67	66	62	60	59
	1.250	65	64	52	47	44	42	70	60	60	58	53	51	72	68	66	62	59	58	73	69	68	64	61	60
	1.500	67	58	55	52	48	47	71	62	62	57	55	53	73	68	67	64	60	59	74	70	69	65	63	61
	1.900	71	52	60	56	52	50	73	64	63	60	57	56	75	70	69	66	62	61	76	72	71	67	65	63
HCV 600 x 400	1.250	63	43	41	41	38	36	70	62	61	60	56	55	73	68	67	67	64	64	76	71	68	68	66	67
	2.000	66	54	51	49	50	48	74	65	67	65	61	59	75	70	71	70	68	69	78	73	73	74	71	70
	2.500	67	58	57	56	57	56	75	68	68	67	64	62	77	73	73	73	71	71	81	76	75	75	74	72
	3.000	69	61	62	60	59	58	77	69	69	70	66	64	79	75	74	75	73	72	82	79	76	76	75	73
	3.750	76	67	67	64	63	61	78	72	71	71	68	66	80	76	75	75	74	73	83	81	78	77	76	75

HCV – Discharge Noise Levels with Attenuators

Square Inlet

CASE SIZE	VOLUME m ³ /s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs					
		SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS						SOUND POWER Lw OCTAVE BANDS					
		125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K	125	250	500	1K	2K	4K
HCV 100	0.040	35	33	27	17	9	10	52	44	29	14	9	10	45	42	30	14	9	11	50	45	30	19	12	15
	0.055	39	34	27	17	9	10	48	40	30	15	9	10	48	43	32	14	10	11	51	46	33	19	12	17
	0.070	46	35	27	17	9	10	54	45	32	17	10	10	53	44	37	15	11	12	53	49	40	20	13	20
	0.085	50	36	28	17	9	10	54	48	36	17	10	10	54	50	38	16	10	12	61	51	44	20	14	22
	0.100	52	40	29	17	10	10	57	50	36	20	10	10	55	50	39	16	11	13	60	51	32	21	14	22
HCV 125	0.050	34	30	26	17	9	9	44	35	24	13	9	10	45	39	28	14	9	13	55	39	29	19	11	14
	0.075	39	31	27	16	8	9	46	39	28	18	10	10	50	41	29	14	10	11	48	52	39	18	13	23
	0.100	41	33	27	17	9	9	49	43	30	17	10	10	52	47	35	18	11	12	55	54	40	18	13	21
	0.125	48	37	27	17	10	10	53	45	31	18	10	11	54	47	36	19	12	13	56	53	43	21	14	21
	0.150	53	41	28	18	11	11	56	47	33	19	11	11	57	48	38	20	13	13	60	52	45	22	15	23
HCV 150	0.080	40	32	28	21	17	11	48	42	29	18	10	10	49	42	31	19	10	11	54	44	34	19	13	21
	0.110	43	35	28	21	17	12	50	44	30	18	11	10	53	44	30	19	11	12	48	45	33	19	13	19
	0.140	47	38	28	18	11	10	55	44	30	19	11	10	56	46	32	19	12	12	55	49	37	21	15	18
	0.170	49	38	28	20	12	11	55	44	31	20	13	11	57	47	33	21	14	14	59	50	40	23	16	19
	0.200	51	40	30	21	15	13	55	44	31	21	15	13	58	47	33	22	16	15	59	51	42	24	17	20
HCV 175	0.120	35	31	26	18	12	11	52	40	30	20	15	14	53	43	34	21	15	20	57	48	39	22	17	28
	0.165	37	33	26	20	15	12	54	43	34	20	15	14	54	43	38	21	16	22	55	47	39	22	18	28
	0.210	39	34	27	20	15	12	57	44	35	21	15	15	58	48	39	21	16	23	56	49	43	23	19	29
	0.255	45	37	26	21	15	13	57	44	35	21	16	16	61	51	40	22	17	24	59	49	44	24	20	30
	0.300	50	41	28	22	16	14	57	45	35	22	17	17	62	52	41	23	19	25	62	51	46	25	21	32
HCV 200	0.150	35	29	24	13	8	8	53	41	28	16	8	11	51	44	33	18	11	20	52	44	36	19	13	26
	0.200	38	31	26	18	10	10	55	43	30	18	11	13	54	46	35	20	13	23	55	46	38	21	16	28
	0.250	44	34	27	19	11	11	57	44	31	19	12	14	55	48	37	20	14	23	56	49	40	23	17	29
	0.300	47	36	28	20	13	12	57	44	33	20	14	15	58	49	38	21	15	24	59	51	42	24	19	31
	0.350	49	39	30	21	15	14	57	44	34	22	16	16	51	50	39	23	17	25	61	53	43	26	20	31
HCV 225	0.200	44	31	23	17	9	10	53	41	28	23	11	13	54	45	38	18	12	23	54	45	37	22	16	29
	0.275	46	32	26	18	11	11	54	41	29	19	13	14	54	46	38	20	14	23	54	46	40	23	18	30
	0.350	48	35	29	21	14	14	55	43	30	21	15	15	57	47	39	22	17	24	56	49	43	25	20	31
	0.425	50	40	30	24	18	17	55	45	32	24	18	18	61	48	40	25	20	25	60	52	45	28	22	32
	0.500	52	43	32	28	22	21	55	46	33	28	21	21	60	49	42	28	22	24	63	43	45	29	24	33
HCV 250	0.250	40	32	16	17	9	10	52	42	34	19	14	22	51	48	38	21	21	30	55	50	43	24	29	36
	0.350	41	32	28	19	11	10	53	45	37	20	15	22	61	50	41	22	25	31	59	51	44	24	30	38
	0.450	49	39	30	22	14	12	56	46	38	23	18	24	61	51	43	24	26	32	61	52	45	28	32	40
	0.550	53	45	34	26	19	16	58	46	39	26	21	25	62	53	45	27	28	33	64	55	47	30	33	41
	0.625	54	45	37	28	22	19	58	48	39	27	21	26	83	54	45	30	28	33	66	56	48	30	34	40
HCV 300	0.400	46	35	28	19	10	9	53	46	36	21	23	23	59	50	42	23	28	31	60	54	38	27	34	37
	0.550	50	39	32	25	18	15	58	48	40	26	25	26	61	53	44	27	31	33	63	56	49	30	36	40
	0.700	53	43	36	30	24	20	60	50	41	30	28	29	64	55	46	31	34	35	65	58	50	33	37	41
	0.850	57	47	40	35	29	26	62	52	42	35	31	32	65	57	48	35	36	38	67	59	52	37	40	42
	1.000	61	50	43	39	33	30	65	54	43	39	35	32	66	60	51	39	36	40	68	60	54	40	42	44
HCV 350	0.600	50	37	27	21	18	16	56	50	41	27	28	28	61	55	48	29	34	35	62	58	53	36	39	42
	0.825	54	43	34	29	23	23	57	53	44	31	31	33	63	57	52	34	37	38	64	61	55	37	41	44
	1.050	56	46	39	34	28	29	61	54	43	36	34	35	66	60	53	35	39	41	68	63	57	40	44	46
	1.275	60	50	44	38	34	34	65	56	44	37	34	35	67	61	53	38	40	41	67	63	59	41	45	45
	1.500	64	52	48	44	38	36	65	56	48	38	36	36	67	62	55	39	43	43	69	64	59	42	47	47
HCV 400	0.750	53	39	33	29	25	22	59	52	42	32	32	33	63	57	49	34	39	40	63	57	51	38	43	46
	1.000	56	44	37	33	30	28	63	53	45	37	35	35	65	62	52	39	41	43	65	60	53	39	43	46
	1.250	59	57	41	35	32	30	65	54	46	38	35	35	66	62	52	40	42	43	67	62	54	40	44	46
	1.500	62	51	45	40	37	35	65	55	49	37	37	37	68	62	54	41	43	45	69	63	54	42	46	47
	1.900	66	45	49	44	39	38	67	57	49	39	39	40	69	64	54	43	44	47	71	66	57	43	47	49
HCV 600 x 400	1.250	57	37	31	31	27	25	64	57	48	41	40	41	69	62	55	44	48	51	70	64	54	46	50	54
	2.000	60	47	40	38	37	37	69	58	53	46	43	43	70	63	57	48	51	55	73	66	59	50	53	56
	2.500	61	51	47	44	46	44	69	62	55	46	46	46	72	66	59	50	54	56	75	68	60	51	57	57
	3.000	63	55	51	48	47	46	71	62	55	48	49	48	73	69	61	51	55	58	77	72	62	52	58	59
	3.750	71	60	56	52	51	49	72	66	58	49	50	50	75	70	61	52	56	59	78	75	64	54	58	61

Controlled Volume Assemblies/HCV

Hot Water Coils

INLET SIZES 100, 125 & 150											
ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m ³ /s								
	litres/s	kPa	0.035	0.050	0.060	0.075	0.100	0.125	0.150	0.175	0.200
One Row Single Circuit	0.032	0.5	1.4	1.7	1.8	2.0	2.3	2.5	2.7	2.8	3.0
	0.063	1.6	1.5	1.8	2.0	2.3	2.7	3.0	3.2	3.5	3.7
	0.125	5.3	1.6	2.0	2.2	2.5	2.9	3.3	3.6	3.9	4.2
	0.250	17.3	1.6	2.0	2.2	2.6	3.1	3.5	3.8	4.2	4.5
Two Rows Single Circuit	0.375	34.0	1.6	2.0	2.3	2.6	3.1	3.6	3.9	4.3	4.6
	0.032	0.9	1.9	2.4	2.7	3.0	3.4	3.7	4.0	4.2	4.4
	0.063	3.0	2.1	2.7	3.0	3.4	4.0	4.5	4.9	5.3	5.6
	0.125	9.4	2.1	2.8	3.2	3.7	4.4	5.0	5.6	6.1	6.6
Two Rows Single Circuit	0.250	31.0	2.2	2.9	3.3	3.8	4.6	5.4	6.0	6.6	7.1
	0.375	61.1	2.2	2.9	3.3	3.9	4.8	5.5	6.2	6.8	7.3

INLET SIZES 175, 200 & 225											
ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m ³ /s								
	litres/s	kPa	0.120	0.150	0.200	0.225	0.250	0.275	0.300	0.350	0.500
One Row Single Circuit	0.032	0.5	2.5	2.7	3.0	3.1	3.2	3.3	3.3	3.5	3.8
	0.063	1.7	2.9	3.2	3.7	3.8	4.0	4.2	4.3	4.5	5.1
	0.125	5.3	3.2	3.6	4.2	4.4	4.6	4.8	5.0	5.3	6.3
	0.250	17.3	3.4	3.8	4.5	4.7	5.0	5.3	5.5	6.0	7.0
Two Rows Single Circuit	0.375	34.0	3.4	3.9	4.6	4.9	5.2	5.5	5.7	6.2	7.4
	0.032	0.5	4.3	4.8	5.4	5.6	5.9	6.0	6.2	6.6	7.3
	0.063	1.6	4.9	5.6	6.5	6.9	7.3	7.6	7.9	8.3	9.6
	0.125	5.4	5.4	6.1	7.2	7.7	8.2	8.6	9.0	9.8	11.6
Two Rows Single Circuit	0.250	7.8	5.4	6.2	7.5	8.0	8.4	8.9	9.3	10.0	12.1
	0.375	10.5	5.5	6.3	7.6	8.1	8.6	9.1	9.5	10.3	12.4

INLET SIZE 250											
ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m ³ /s								
	litres/s	kPa	0.250	0.300	0.325	0.350	0.375	0.400	0.450	0.550	0.625
One Row Single Circuit	0.032	0.1	3.4	3.5	3.6	3.6	3.7	3.8	3.8	4.0	4.1
	0.063	0.3	4.4	4.7	4.8	4.9	5.0	5.1	5.4	5.6	5.8
	0.125	1.0	5.2	5.7	5.9	6.0	6.2	6.4	6.7	7.2	7.5
	0.250	3.3	5.8	6.3	6.7	6.8	7.1	7.3	7.7	8.4	9.0
Two Rows Single Circuit	0.375	6.4	6.0	6.6	6.9	7.2	7.4	7.7	8.1	8.9	9.5
	0.500	10.6	6.2	6.8	7.1	7.4	7.7	7.9	8.4	9.2	9.9
	0.063	0.7	6.9	7.4	7.6	7.8	8.0	8.2	8.5	8.9	9.3
	0.125	2.1	8.6	9.3	9.6	10.0	10.3	10.5	11.1	11.9	12.6
Two Rows Single Circuit	0.250	6.9	9.6	10.6	11.1	11.5	11.9	12.5	13.2	14.4	15.3
	0.375	13.5	10.0	11.2	11.7	12.2	12.6	13.2	14.0	15.5	16.6
	0.500	22.1	10.2	11.5	12.0	12.6	13.1	13.4	14.4	16.1	17.2
	0.625	32.3	10.4	11.5	12.2	12.8	13.3	13.8	14.8	16.5	17.8

INLET SIZE 300											
ROWS	WATER		Performance (kW)								
	Flow	Resistance	Air Flow Rate m ³ /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	0.2	5.7	6.0	6.2	6.3	6.5	6.9	7.0	7.1	7.3
	0.125	0.5	7.3	7.7	7.9	8.2	8.5	9.2	9.4	9.8	10.1
	0.250	1.6	8.6	8.9	9.5	9.8	10.3	11.2	11.5	12.1	12.5
	0.375	3.2	9.0	9.5	10.1	10.4	11.0	12.1	12.5	13.2	13.7
Two Rows Single Circuit	0.500	5.3	9.3	9.9	10.4	10.9	11.4	12.6	13.1	13.7	14.5
	0.625	7.8	9.4	10.0	10.7	11.1	11.7	13.1	13.4	14.3	15.0
	0.063	0.3	8.7	8.9	9.2	9.4	9.6	10.1	10.2	10.4	10.6
	0.125	0.9	11.5	12.0	12.5	12.9	13.4	14.4	14.7	15.1	15.6
Two Rows Single Circuit	0.250	3.0	13.6	14.4	15.3	15.8	16.5	18.3	18.8	19.8	20.5
	0.375	5.9	14.4	15.4	16.3	17.1	18.0	19.9	20.5	21.7	22.9
	0.500	9.7	14.9	15.9	16.9	17.8	18.7	21.1	21.7	23.1	24.1
	0.625	14.1	15.3	16.4	17.4	18.5	19.2	21.8	22.5	23.9	25.0

Note See notes on page 274G.

Hot Water Coils

INLET SIZE 350			Performance [kW]								
ROWS	WATER		Air Flow Rate m ³ /s								
	Flow	Resistance									
	litres/s	kPa	0.600	0.650	0.700	0.750	0.800	0.900	1.000	1.250	1.500
One Row Multi Circuits	0.063	0.2	7.1	7.1	7.3	7.4	7.6	7.8	7.9	8.3	8.6
	0.125	0.6	9.3	9.5	9.8	10.0	10.3	10.6	11.0	11.6	12.4
	0.250	1.9	11.0	11.5	11.8	12.1	12.5	13.2	13.7	14.9	16.0
	0.375	3.6	11.9	12.3	12.7	13.1	13.4	14.3	15.0	16.4	17.9
	0.500	6.0	12.3	12.7	13.3	13.7	14.2	14.8	15.7	17.4	18.8
Two Rows Multi Circuits	0.063	0.4	10.5	10.7	10.9	11.1	11.2	11.4	11.6	12.0	12.4
	0.125	1.2	14.8	15.2	15.6	15.9	16.2	16.8	17.4	18.3	19.2
	0.250	3.9	18.3	19.1	19.7	20.2	20.8	22.0	22.9	24.8	26.6
	0.375	7.6	19.8	20.6	21.4	22.2	23.0	24.2	25.3	28.2	30.2
	0.500	12.6	20.7	21.6	22.4	23.4	24.2	25.6	26.4	30.2	32.5
	0.625	18.4	21.3	22.2	23.1	24.1	24.9	26.4	28.1	31.3	33.9

INLET SIZE 400			Performance [kW]								
ROWS	WATER		Air Flow Rate m ³ /s								
	Flow	Resistance									
	litres/s	kPa	0.750	0.800	0.850	0.900	1.000	1.250	1.500	1.750	1.900
One Row Multi Circuits	0.063	0.2	8.2	8.4	8.4	8.6	8.8	9.2	9.5	9.8	9.9
	0.125	0.7	11.1	11.4	11.6	11.8	12.2	13.0	13.7	14.3	14.5
	0.250	2.2	13.5	13.9	14.3	14.6	15.3	16.6	17.9	19.0	19.4
	0.375	4.3	14.7	14.9	15.4	15.9	16.5	18.3	19.7	21.1	21.8
	0.500	7.1	15.1	15.6	16.1	16.5	17.4	19.5	21.1	22.4	23.2
Two Rows Multi Circuits	0.063	0.5	11.9	12.1	12.2	12.3	12.5	12.9	13.2	13.4	13.6
	0.125	1.4	17.4	17.6	18.0	18.4	18.9	20.0	20.8	21.6	22.0
	0.250	4.6	22.0	22.7	23.4	23.9	25.0	27.3	29.3	30.7	31.6
	0.375	8.9	24.3	24.9	25.7	26.4	27.8	30.9	33.4	35.3	36.6
	0.500	14.8	25.4	26.4	27.0	28.0	29.3	32.8	35.7	38.5	39.5
	0.625	21.4	26.1	27.1	28.0	28.9	30.5	34.4	37.6	40.1	41.8

INLET SIZE 600 x 400			Performance [kW]								
ROWS	WATER		Air Flow Rate m ³ /s								
	Flow	Resistance									
	litres/s	kPa	1.250	1.500	1.750	2.000	2.250	2.500	3.000	3.500	3.750
One Row Multi Circuits	0.125	0.9	15.7	16.5	17.1	17.7	18.2	18.7	19.5	20.0	20.3
	0.250	3.1	20.2	21.5	23.0	24.1	25.1	26.0	27.5	28.6	29.2
	0.375	6.1	22.2	24.1	25.7	26.9	28.2	29.4	31.6	33.1	34.4
	0.500	9.9	23.3	25.7	27.3	28.7	30.2	31.7	33.9	36.3	37.2
	0.625	14.4	24.1	26.6	28.3	29.9	31.6	33.2	35.7	38.5	39.5
Two Rows Multi Circuits	0.125	2.0	22.9	23.8	24.6	25.2	25.8	26.1	26.8	27.3	27.5
	0.250	6.4	31.9	33.9	35.8	37.3	38.8	40.1	41.7	43.3	44.1
	0.375	12.6	36.3	38.9	41.7	44.0	46.0	47.7	50.4	53.4	54.4
	0.500	20.4	38.6	42.1	45.4	47.6	50.2	52.7	56.3	59.9	60.7
	0.625	29.6	40.5	44.0	47.6	50.7	53.6	55.7	60.5	64.1	65.9

Notes

1. Tabulated values are in kW and for hot water only.
2. Data is for the coil type specified. 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 m³/s)
5. Water temperature drop (°K) = kW / (4.187 x l/s)
6. Connections: Single Circuit 12.5 O.D. male solder. Multi- Circuit 22.2 O.D. male solder.
7. Use tables above and on previous page to calculate suitable coil selection, or contact your local Holyoake branch, which can offer a coil calculation service.

ΔT (°K)	20	30	40	50	60	64	70	80	90
Factors	0.30	0.47	0.63	0.81	0.97	1.00	1.13	1.31	1.47

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.

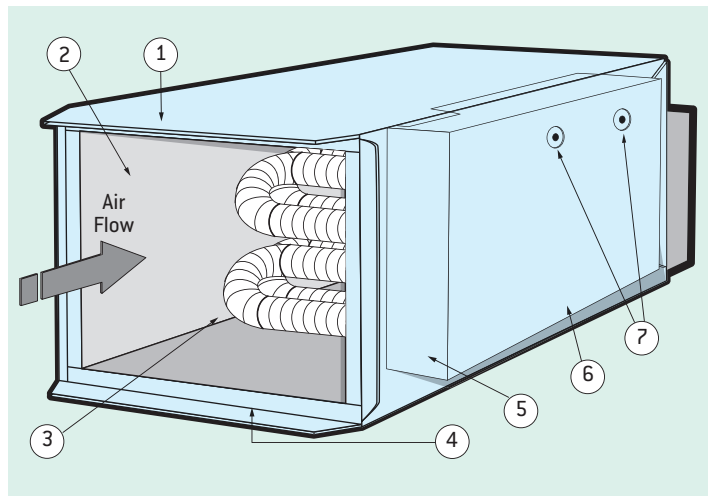
Installers must take special consideration of AS/NZS 3102, clause 7.2, Interlocking of supply to heater unit and blower motor and clause 7.3, Devices to prevent overheating.

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).

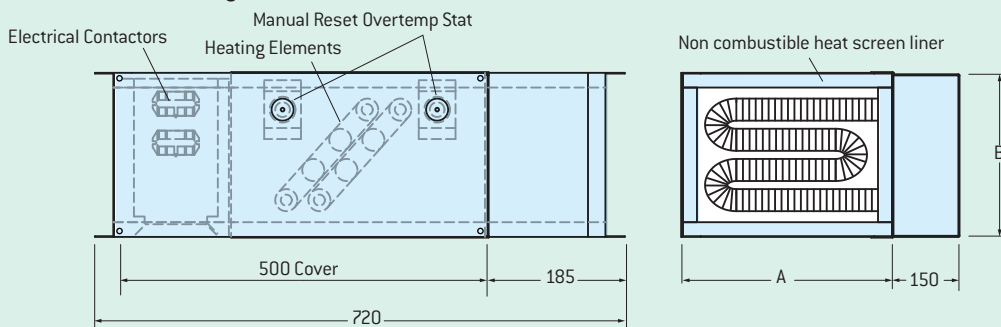


5. Electrical box containing heater terminals, contactors (or power relays), over-temp stat and wiring to terminal block. If required an isolating switch may be added.
6. Cover held by screws accessible from the sides.
7. Manual reset over-temp stats.

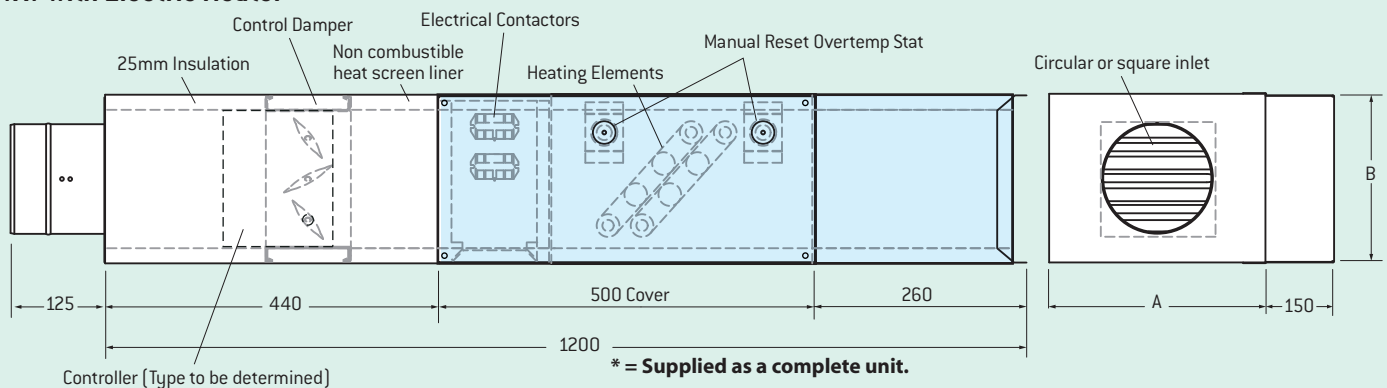
Option

Solid state control for pulsed heater control.

Heater Section Only



VAV with Electric Heater*



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 guidelines only. Larger ratings can be accommodated.

HCV – Acoustic Selection Procedure

Where a pre-determined room noise level is to be met, the following procedure is suggested. These examples ignore fan and air outlet generated noise, which would be established and allowed for in practice.

Example 1: Lined Duct, No Attenuator

A circular inlet series HCV assembly supplies three offices with a total of 0.614 m³/s at 250 Pa ΔPs. The most critical of these is supplied with air from two 200 mm I.D. ducts, each 3 metres long, internally lined with acoustic material, terminating with a 200 mm neck diameter ceiling diffuser. Each handles 0.123 m³/s. Select a suitable assembly size and model for a room level of NC 30.

ITEM	Octave Band & Centre Frequency, Hz					
	2	3	4	5	6	7
	125	250	500	1000	2000	4000
1. Room sound pressure level at NC 30 (Table 1)	-48	-42	-35	-31	-30	-28
2. Room attenuation (by calculation)	-10	-10	-10	-10	-10	-10
3. Duct attenuation (Table 2 interpolation)	-4	-9	-17	-22	-22	-18
4. Flow division (Table 3)	-7	-7	-7	-7	-7	-7
5. End reflection (Table 4)	-10	-6	-2	0	0	0
6. Total attenuation including room Lp	-79	-74	-71	-70	-69	-63
7. Allowance for number of outlets (Table 5)	+3	+3	+3	+3	+3	+3
8. Nett attenuation including room Lp	-76	-71	-68	-67	-66	-60
9. Select model HCV-X200C2, size 300 with Lw = (Page 268G)	67	65	64	61	60	60

Example 2: With Attenuator and Lined Duct Alternative

A circular inlet series HCV assembly supplies a conference room with a total of 0.142 m³/s at 250 Pa ΔPs. It discharges directly into the room through a short rectangular duct and a high sidewall diffuser. Select a suitable assembly size and model for an approximate room level of NC 25. As an alternative, what size and model could be selected if the assembly supplied the room through a 200 I.D. insulated duct, 3 metres long.

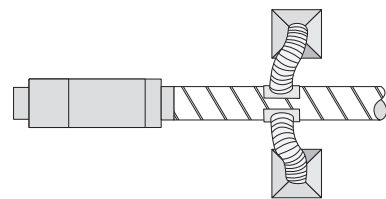
The above data is shown graphically on the following pages. The curves shown are in accordance with data presented in the ASHRAE Fundamentals Handbook, 2005.

ITEM	Octave Band & Centre Frequency, Hz					
	2	3	4	5	6	7
	125	250	500	1000	2000	4000
1. Room sound pressure level at NC 25 (Table 1)	-45	-38	-31	-27	-24	-22
2. Room attenuation (by calculation)	-10	-10	-10	-10	-10	-10
3. End reflection (Table 4)	-11	-7	-3	-1	0	0
4. Total attenuation including room Lp	-66	-55	-44	-38	-34	-32
5. Select model HCV-X201C0, Size 150 with Lw = (Page 269G) If room is supplied through insulated duct:	60	52	37	26	20	20
6. Duct attenuation	-4	-9	-17	-22	-22	-18
7. End reflection	-10	-6	-2	0	0	0
8. Total attenuation including room Lp	-69	-63	-60	-59	-56	-50
9. Select model HCV-X200C1, size 150 with Lw = (Page 268G)	62	63	58	56	53	54

NC Index	Octave Band & Centre Frequency, Hz					
	2	3	4	5	6	7
	125	250	500	1000	2000	4000
15	36	29	22	17	14	12
20	40	33	26	22	20	17
25	45	38	31	27	24	22
30	48	42	35	31	30	28
35	53	46	40	36	34	33
40	57	51	45	41	39	38
45	60	54	49	46	44	43
50	64	59	54	51	49	48
55	67	63	58	56	54	53
60	71	67	63	61	59	58

Duct Dia. mm	Octave Band & Centre Frequency, Hz					
	2	3	4	5	6	7
	125	250	500	1000	2000	4000
150	1.64	3.28	5.91	7.22	7.22	6.56
300	0.98	2.30	4.92	7.22	7.22	4.92
600	0.66	1.64	3.28	5.58	2.95	1.64
1200	0.33	0.98	1.97	1.97	1.64	1.64

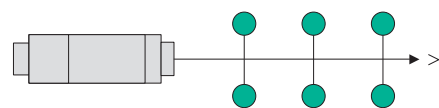
(Data based on 0.45 to 0.75 mm Spiroloc with 25 mm fibreglass and perforated steel liner. Test duct was 7 m long, no air flow.)



% Total Flow	5	10	15	20	30	40	50	80
dB Attenuation	13	10	8	7	5	4	3	1

% Total Flow = (m³/s for one diffuser) / (m³/s total for assembly) x 100.

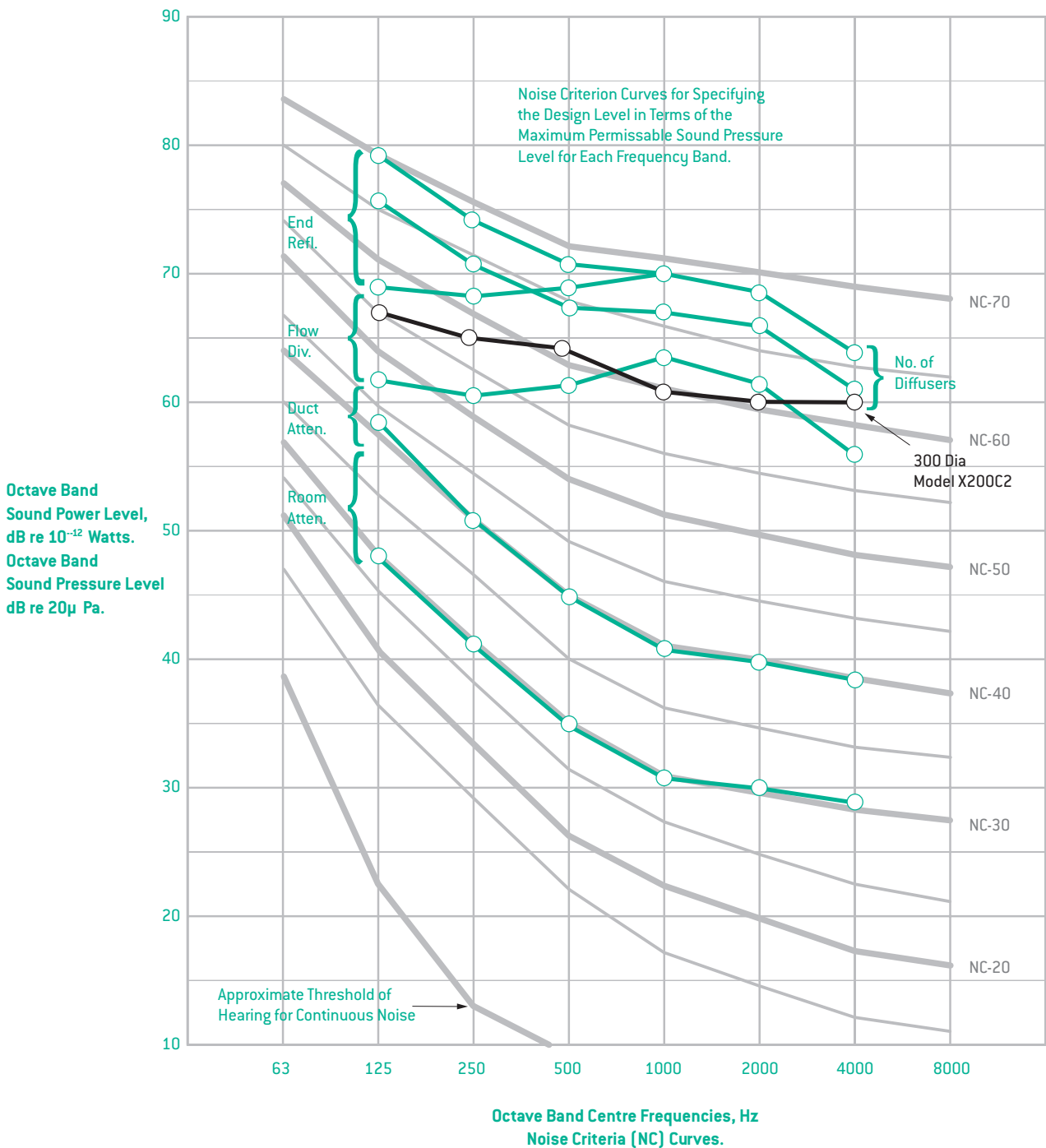
Duct Dia. mm	Octave Band & Centre Frequency, Hz					
	2	3	4	5	6	7
	125	250	500	1000	2000	4000
125	12	8	4	1	0	0
250	8	4	1	0	0	0
500	4	1	0	0	0	0
1000	1	0	0	0	0	0



No. of Outlets	1	2	3	4	8	10	20	40
dB Increase	0	3	5	6	9	10	13	16

Refer to page 13A of Engineering Data 'Noise Criteria', for corrections for room conditions.

The curves below are based on data published in the ASHRAE Fundamentals Handbook 2005 and will be useful for noise criteria calculations. Superimposed are the plots derived from Example 1 worked on the previous page.



HCV – Selection Code and Specification

Model Number Key

HCV	X	X	X	X	X	X	XXX
Model:	CONTROLLER MAKE.	CONTROL TYPE AND ACTION. COLD DECK.	HEATING COIL.	ATTENUATOR.	INLET:	OUTLET ADAPTER.	CASE SIZE.
Pressure Independent 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 Attenuator. 9 Special.	C Circular. S Square.	0 None. 1 Round (undampered). 2 Multiple (dampered). 9 Special.	100 125 150 175 200 225 250 300 350 400 600 x 400
			** Separately schedule voltage, phases, kW & stages.				

Suggested Specifications

Variable air volume air distribution assemblies shall be Holyoake Series HCV supplied with, or without controls and matching factory furnished accessories (electric heater, HW reheat coils, attenuators, outlet adapters) as shown elsewhere in this specification, or on the drawings. They shall be pressure independent and shall be capable of temperature controlled velocity re-set between zero and the maximum catalogued air flow.

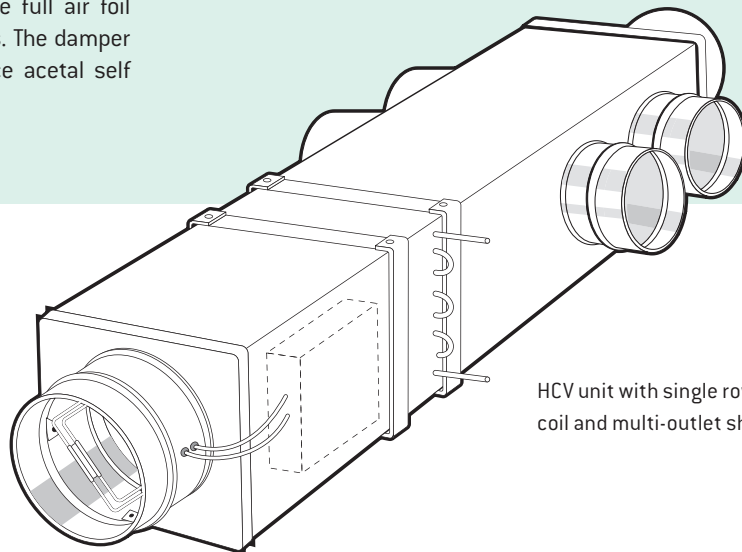
At an inlet velocity of 10 m/s, the differential static pressure for any size shall not exceed 37 Pa for the basic unit. Each assembly shall be constructed to minimise noise generation and shall not exceed NC... at...Pa inlet static pressure.

Basic assemblies shall consist of a casing insulated with 25mm non-woven acoustic polyester insulation and constructed of 0.75 galvanised steel. The controlling damper shall have full air foil extruded aluminium blades with inflating edge seals. The damper shafts shall be stainless steel, pivoted in two piece acetal self lubricating bearings locked in place, with locating ribs.

The combined leakage of the closed damper and the high pressure casing shall not exceed 2% of maximum rated flow at 750 Pa inlet static pressure.

Assemblies shall be furnished with flow averaging Δp velocity sensors of the PDI type, as manufactured by Holyoake. Single point electronic sensors are not acceptable.

Each flow sensor shall be furnished with capped Tees for independent site measurement of Δp . Each sensor shall be provided with a label showing its formula for flow calculation. Such calculated air flow shall be within $\pm 5\%$ of actual, provided inlet connections are in non-deforming rigid, or semi rigid duct of the same size as the assembly inlet, irrespective of inlet angles from zero to 90°.



HCV unit with single row hot water coil and multi-outlet shown.

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.

Dual Duct Assemblies. Pressure Independent. Variable Volume. Separate Controls on Hot & Cold Decks.

The HDC series provides full variable volume control in both the hot deck and cold deck of a dual duct system. The air flow rate can be varied between a regulated pre-set minimum and a regulated pre-set maximum. See table on page 281G.

At any system static pressure above the minimum required for signaling the controller, the flow rate anywhere in the operating range is pressure independent. For example, if the thermostat is calling for $0.5 \text{ m}^3/\text{s}$ the HDC controls will hold the flow rate at $0.5 \text{ m}^3/\text{s}$, regardless of fluctuations in system pressure between the minimum and 500 Pa.

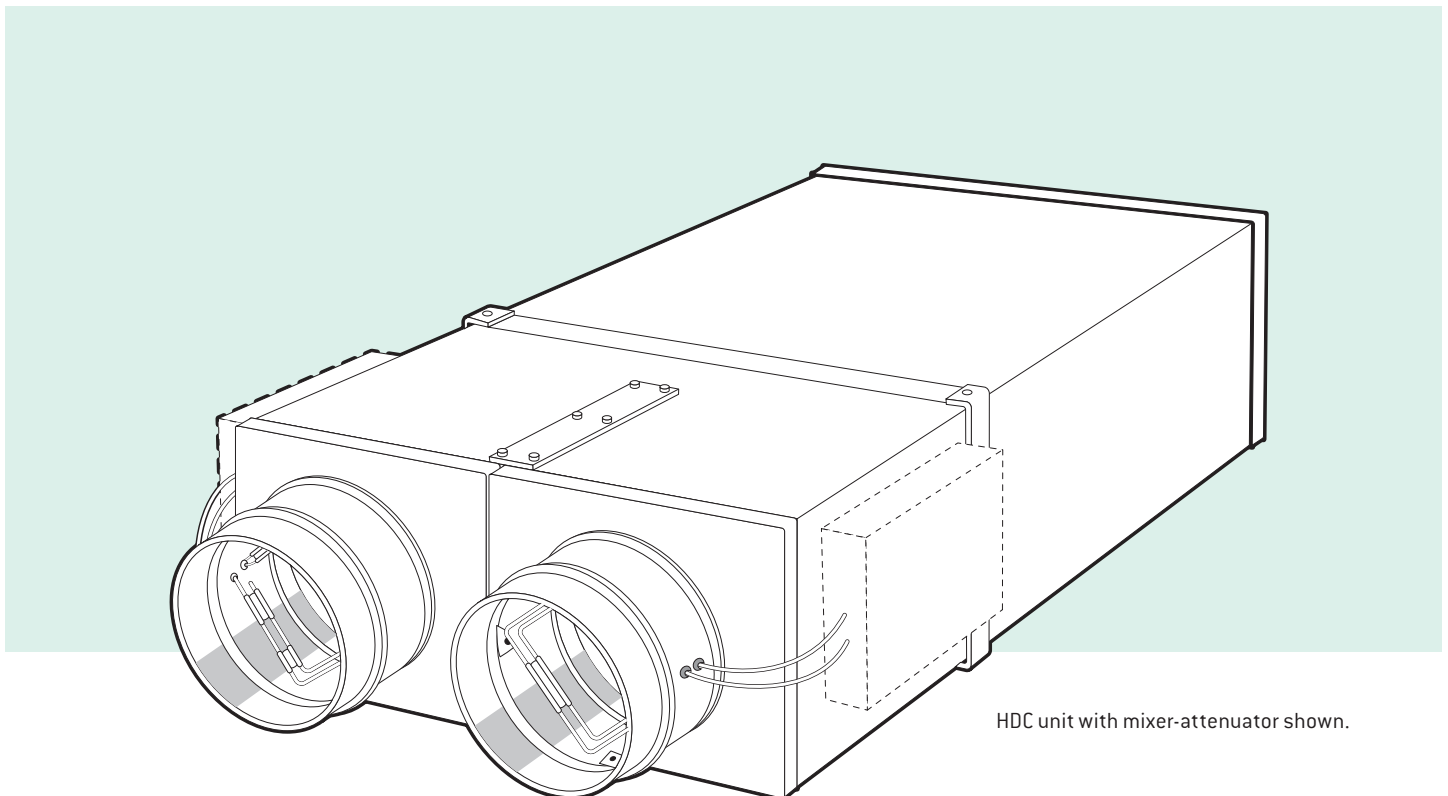
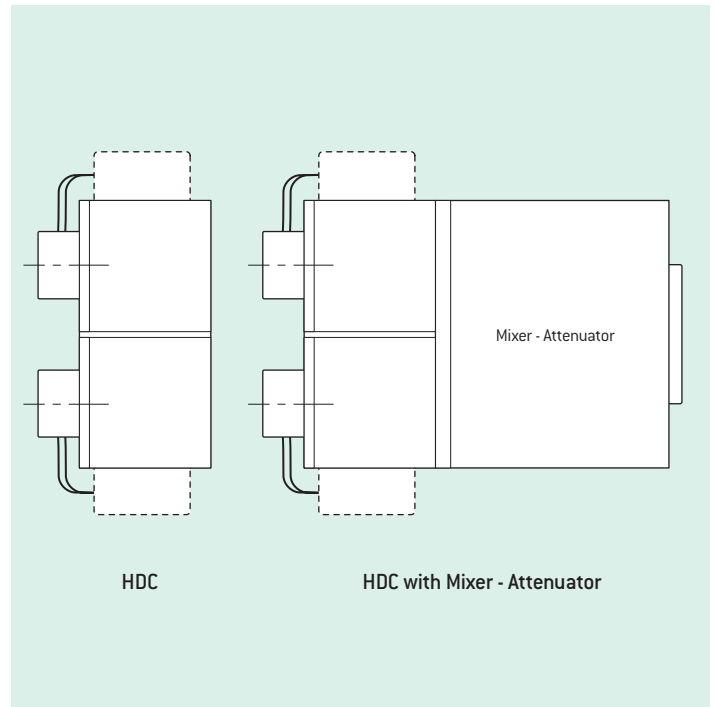
In addition to pressure independent variable volume, the HDC controls provide numerous combinations of settings for hot-cold air mixture proportions.

The HDC control functions are the same as those described for the HCV single duct assembly on preceding pages. Standard construction includes a mixer-attenuator. Basic units without this component are available.

Flow averaging ΔP velocity sensors are standard. Single point sensing as required by some control types can be substituted where necessary.

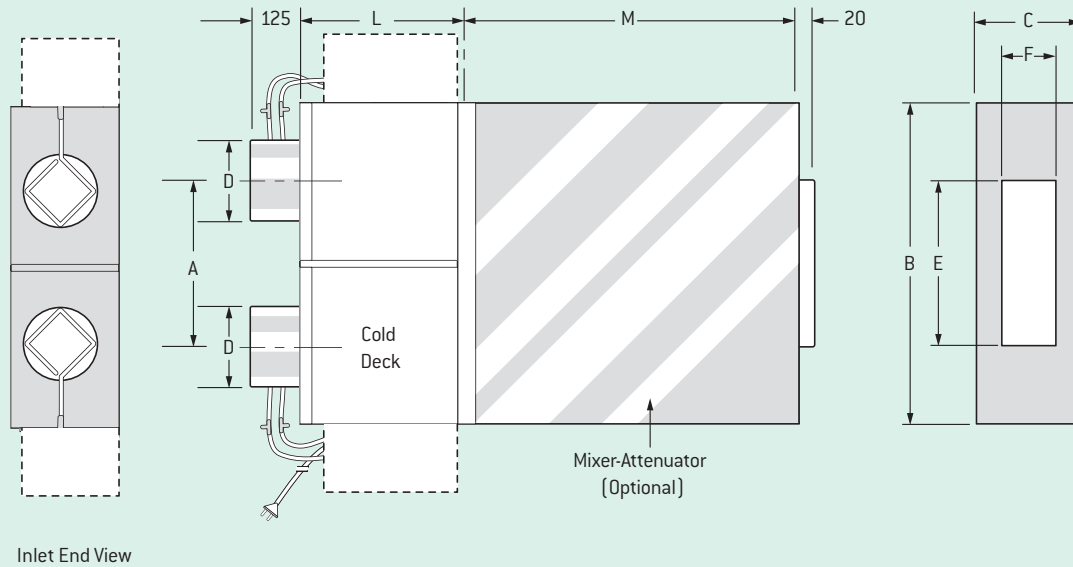
Note

The control capabilities are dependent on the type of controls specified.



HDC unit with mixer-attenuator shown.

Dual Duct Assemblies



Casing Size	Inlet Size	Max. Air Flow, m ³ /s		A	B(1)	C(1)	D	E	F	L	M
		[per deck]									
		Controllable	Rated								
A	100	0.105	0.100	289	575	223	95	283	170	301	762
	125	0.166	0.150	289	575	223	120	283	170	301	762
	150	0.239	0.200	289	575	223	145	283	170	301	762
B	175	0.343	0.300	289	575	296	170	283	243	301	762
	200	0.454	0.350	289	575	296	195	283	243	301	762
	225	0.574	0.500	289	575	296	220	283	243	301	762
C	250	0.733	0.625	431	859	296	245	425	243	301	762
D	300	1.076	1.000	431	859	369	295	425	316	371	762
E	350	1.498	1.400	515	1027	398	345	509	345	371	915
F	400	1.976	1.900	639	1275	442	395	633	389	371	1220

Case Size	Guide Product Weights	
	Description	Approximate Weight in Kg.
125	HDC Dual Duct (Inc Round Flange)	20

Notes

- Model HDC (without attenuator) discharge opening is B x C.
- Drawing above depicts Model HDC with mixer-attenuator included. Assembly can be furnished either as shown, or as basic Model HDC without attenuator.
- Standard units are furnished right handed as shown. Opposite handing can be furnished at no extra cost if order is detailed accordingly. Handing is determined by location of the cold deck.
- For dimensional details of each deck, not shown on this sheet, refer to single duct assembly data, page 264G.
- Also available with square inlets.

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.

Inlet Dia. mm	Flow m ³ /s	Minimum ΔPs		Minimum	Room N.C. at Nominated ΔΔPs											% Flow for N.C. [Note 3]
		Basic Unit Only Pa	With Mixer Atten. Pa	ΔPt	Min.		125 Pa			250 Pa			500 Pa			
				Basic Unit Only Pa	Basic Unit Only	With Mixer Atten.	Basic Unit Only	With Mixer Atten.	Radiated	Basic Unit Only	With Mixer Atten.	Radiated	Basic Unit Only	With Mixer Atten.	Radiated	
100	0.040	9	19	23	-	-	31	-	15	34	-	16	36	-	16	100
	0.070	27	49	72	20	-	35	-	17	39	19	24	44	24	24	100
	0.085	39	79	106	26	-	36	-	18	41	22	25	47	26	28	100
	0.100	54	113	146	29	-	36	17	19	42	23	26	47	27	31	100
125	0.050	5	15	13	-	-	26	-	-	32	-	17	38	24	18	100
	0.075	12	29	31	-	-	31	-	17	34	18	18	45	26	22	100
	0.100	22	57	56	18	-	34	17	18	39	20	21	46	29	25	100
	0.150	44	94	121	28	-	36	18	22	41	22	23	49	31	30	100
150	0.080	8	15	17	-	-	27	-	15	31	-	17	40	21	21	50
	0.110	14	34	31	16	-	28	-	19	32	-	20	40	23	22	50
	0.170	28	60	70	22	-	31	-	23	35	18	26	42	25	27	50
	0.200	37	77	95	27	-	33	-	25	36	19	29	43	26	31	50
175	0.120	5	28	16	-	-	25	-	17	33	-	19	41	27	21	50
	0.165	10	45	31	-	-	28	-	19	35	19	22	42	28	25	50
	0.210	15	65	49	15	-	30	-	20	37	19	26	43	29	29	50
	0.300	27	94	96	22	-	33	-	24	39	21	30	45	30	35	50
200	0.150	4	21	13	-	-	26	-	-	33	19	16	39	27	18	40
	0.200	8	43	23	-	-	28	-	15	35	22	19	41	29	21	40
	0.250	12	60	36	-	-	30	-	18	37	22	23	43	30	25	40
	0.350	22	82	69	23	-	33	-	24	39	23	26	45	31	30	40
225	0.200	4	17	11	-	-	28	-	13	36	21	22	42	26	25	40
	0.350	12	42	35	16	-	32	-	20	39	24	24	45	31	30	40
	0.425	16	66	49	20	-	34	-	22	40	24	25	46	32	30	40
	0.500	22	99	68	25	-	36	22	24	41	24	27	47	33	31	40
250	0.350	13	38	32	-	-	31	-	23	37	23	26	44	32	28	30
	0.450	19	61	50	18	-	33	-	25	40	25	27	46	33	34	30
	0.550	27	90	74	24	-	36	19	26	41	26	30	47	34	38	30
	0.625	35	127	96	28	21	37	21	28	42	27	32	47	35	39	30
300	0.400	4	27	15	-	-	26	-	17	33	21	20	40	31	25	20
	0.550	8	50	28	-	-	29	-	21	35	24	23	42	32	28	20
	0.850	19	92	68	24	-	35	18	27	40	25	31	45	34	35	20
	1.000	26	135	93	29	22	37	21	33	42	27	33	46	35	36	20
350	0.825	6	48	26	20	-	33	21	25	38	27	27	44	35	29	15
	1.050	9	82	41	27	-	35	21	29	41	29	28	46	36	32	15
	1.275	13	122	61	31	25	36	23	35	42	30	37	46	36	40	15
	1.500	20	172	86	33	27	37	29	38	44	31	41	47	38	43	15
400	0.750	3	38	15	15	-	29	18	23	35	26	27	39	33	29	10
	1.000	5	82	27	21	16	31	21	26	37	29	29	40	35	32	10
	1.500	13	120	62	28	23	34	26	35	40	31	38	42	36	38	10
	1.900	25	159	104	31	25	37	28	38	42	32	42	44	37	43	10

Controlled Volume Assemblies/HDC

Notes

- Ratings are for one deck (hot or cold) of a dual duct assembly.
- For octave band sound power data refer to pages 267G and 268G of this section.
- NC values are based on a room served by one diffuser handling the listed percentage of total flow.
- ΔPs is the difference between inlet and discharge static pressure.
- Minimum ΔPs is the lowest inlet to discharge static pressure for pressure independent flow control.
- ΔPt is the total pressure difference between inlet and discharge.
- Room N.C. listed is the N.C. curve which will not be exceeded by the assembly due to noise generated by it and transmitted along the downstream ductwork, based on:
 - 10 dB room absorption re 10⁻¹² watts.
 - 250 mm dia. lined discharge duct, 1.5 m long.
- Radiated NC listed is the NC curve which will not be exceeded by noise generated by the assembly and transmitted through the casing, based on:
 - 10 dB room absorption re 10⁻¹² watts.
 - Ceiling sound transmission class 35-39.
- If the assembly is exposed, add 13 NC to radiated N.C. ratings listed.

HDC – Selection Code and Specification

Model: Number Key

HDC	X	X	X	X	X	X	X	XXX
	CONTROLLER MAKE.	CONTROL TYPE AND ACTION. COLD DECK.	CONTROL TYPE AND ACTION. HOT DECK.	MIXER ATTENUATOR.	INLET:	OUTLET ADAPTER.	CASE SIZE.	INLET SIZE.
Model:	1 Siemens.	1 Pneumatic.	1 Pneumatic.	0 None.	C Circular	0 None.	A	100
Pressure Independent Dual VAV Assembly.	2 Honeywell.	2 Electronic.	2 Electronic.	1 With Mixer Attenuator.	S Square*.	9 Special.	A	125
	3 Alerton.	9 Other.	9 Other.				A	150
	4 Belimo.						B	175
	5 KMC.						B	200
	6 Delta.						B	225
	7 Schneider Electric.						C	250
	8 CSI.						D	300
	9 Other Manufacturers (Please Specify).						E	350
							F	400

*Contact your local Holyoake branch if square inlets required.

Suggested Specifications

Dual duct assemblies shall be Holyoake Series HDC supplied with or without controls, as described elsewhere in this specification, fitted with matching mixer attenuator.

They shall be pressure independent and both hot and cold decks shall be capable of temperature controlled velocity re-set between zero and the maximum catalogued air flow.

At an inlet velocity of 10 m/s, the differential static pressure for any size shall not exceed 37 Pa for the basic unit, or 112 Pa, with mixer-attenuator included.

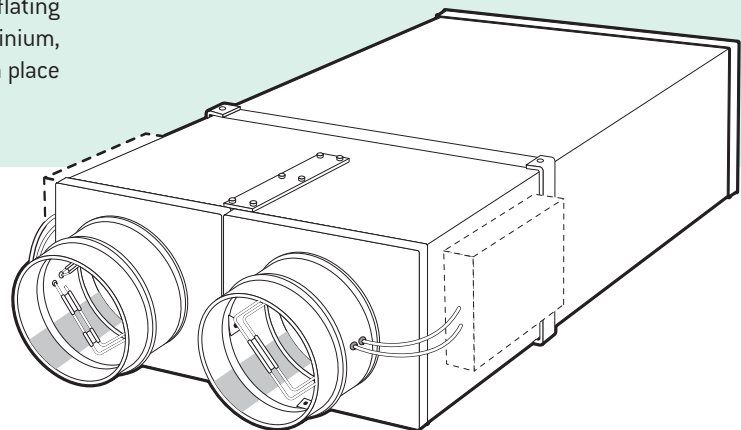
Each assembly shall be constructed to minimise noise generation and shall not exceed NC...at...Pa inlet static pressure.

Basic assemblies shall consist of two VAV elements locked together to form a single operating unit, and each of these elements shall consist of a casing insulated with 25 mm non-woven acoustic polyester fabric and constructed of 0.75 galvanised steel. The controlling damper shall have full air foil extruded aluminium blades with inflating edge seals. The damper shafts shall be bright anodised aluminium, pivoted in two piece acetal self-lubricating bearings locked in place with locating ribs.

The combined leakage of the closed damper and the high pressure casing shall not exceed 2% of maximum rated flow at 750 Pa inlet static pressure.

Assemblies shall be furnished with flow averaging ΔP velocity sensors of the PDI type as manufactured by Holyoake. Single point electronic sensors are not acceptable.

Each flow sensor shall be furnished with capped Tees for independent site measurement of ΔP . Each sensor shall be provided with a label showing its formula for flow calculation. Such calculated air flow shall be within $\pm 5\%$ of actual, provided inlet connections are in non-deforming rigid or semi rigid duct of the same size as the assembly inlet, irrespective of inlet angles from zero to 90°.



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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 90° 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 $\pm 2.5\%$ in straight duct and $\pm 5\%$ after a hard 90° 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.

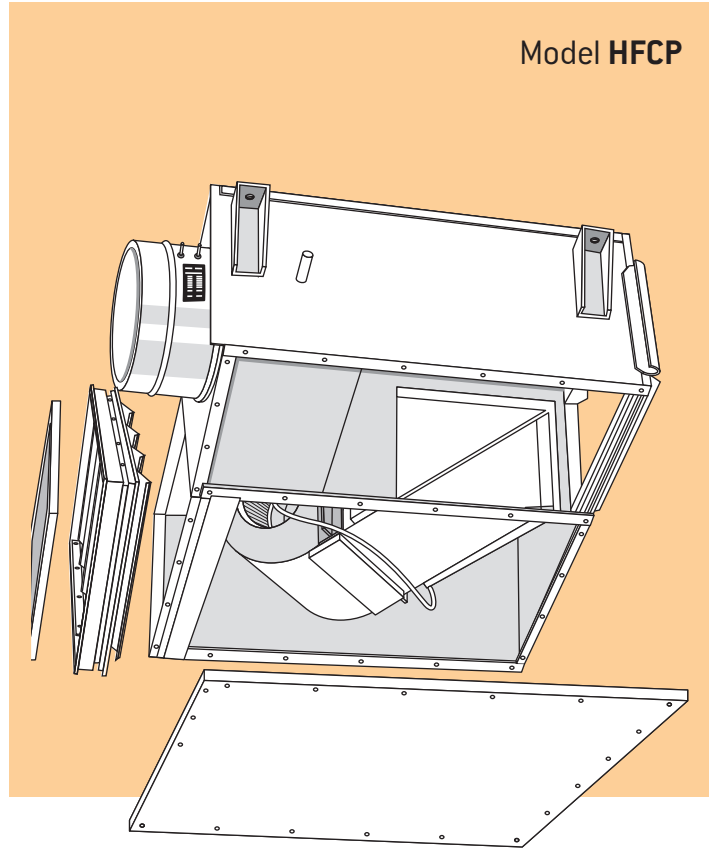
Secondary Air Filters are furnished with 'EU2' washable type media as standard.

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.

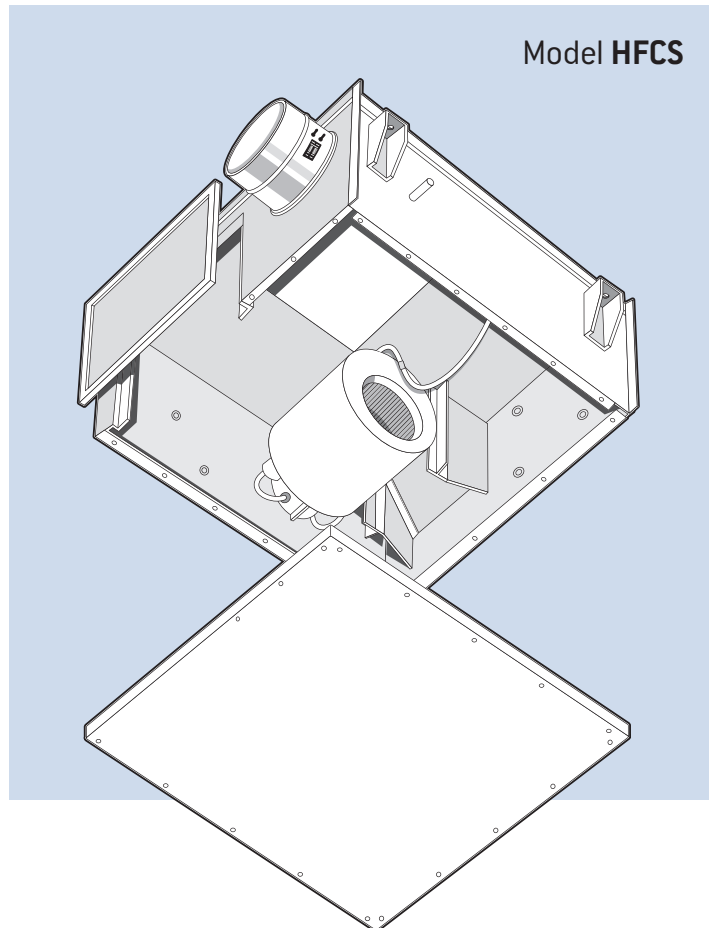
Guide Product Weights

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.

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.

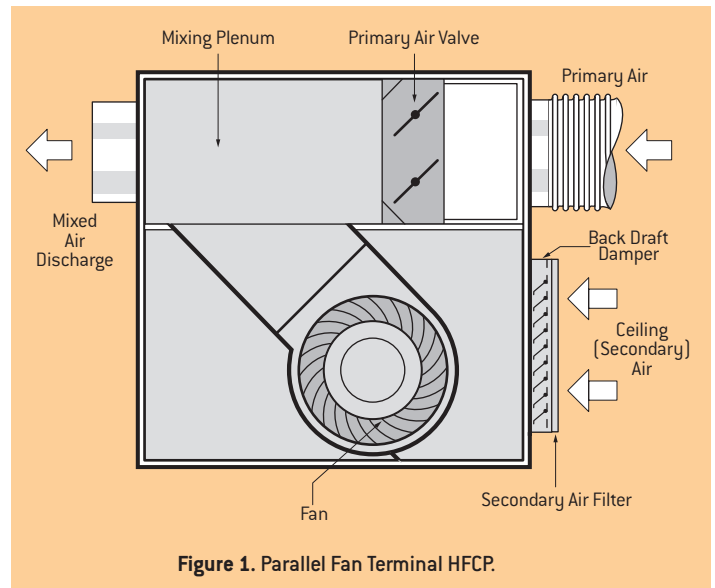


Figure 1. Parallel Fan Terminal HFPC.

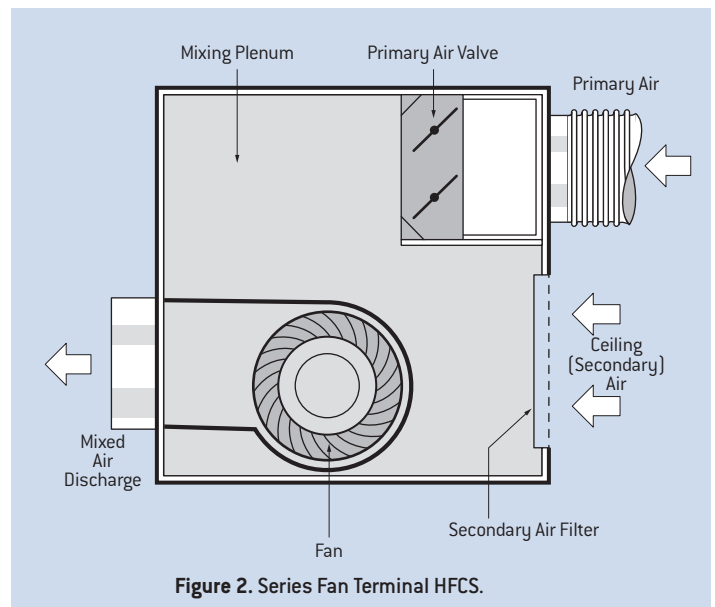


Figure 2. Series Fan Terminal HFCS.

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 m³/s at 19 Pa external.

A **Series** fan selected for 0.500 m³/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 m³/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.

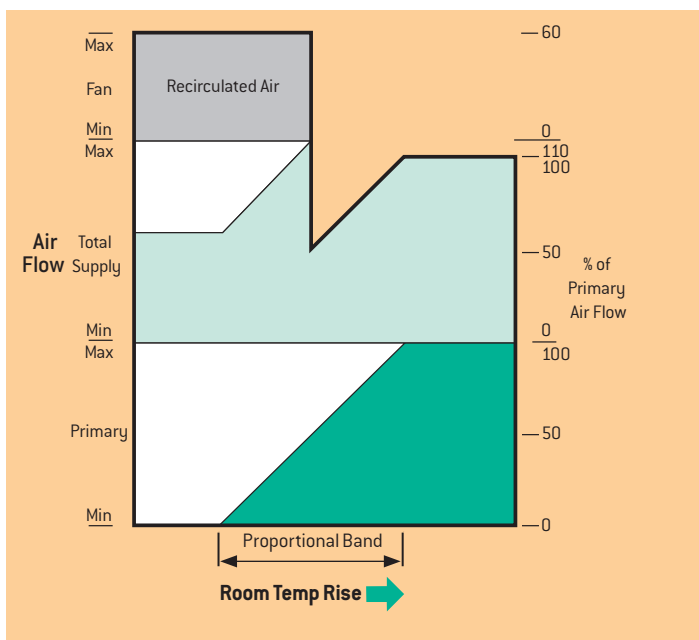
None of the above considers the effect with **Series** fans of unwanted reheat at part load, the effect of any over supply of secondary air at full cooling, or the possibility of ceiling pressurisation with treated primary air in the event of a fault.

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.

Parallel HFCP



- 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

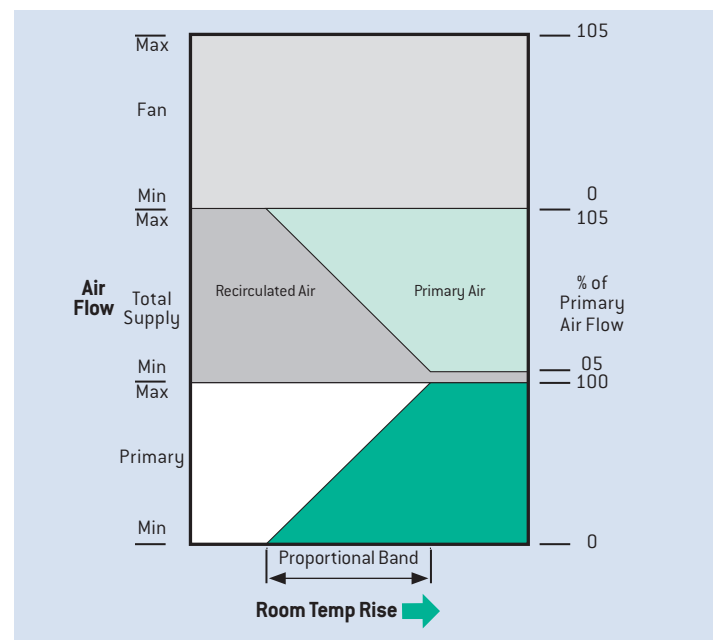
- As an option Holyoake fan assisted units can be furnished with one metre of electrical flex from the fan speed selector / speed controller panel, terminating in a three pin plug. Local power wiring should terminate in a matching socket.

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.

- **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.

Series HFCS



- 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.

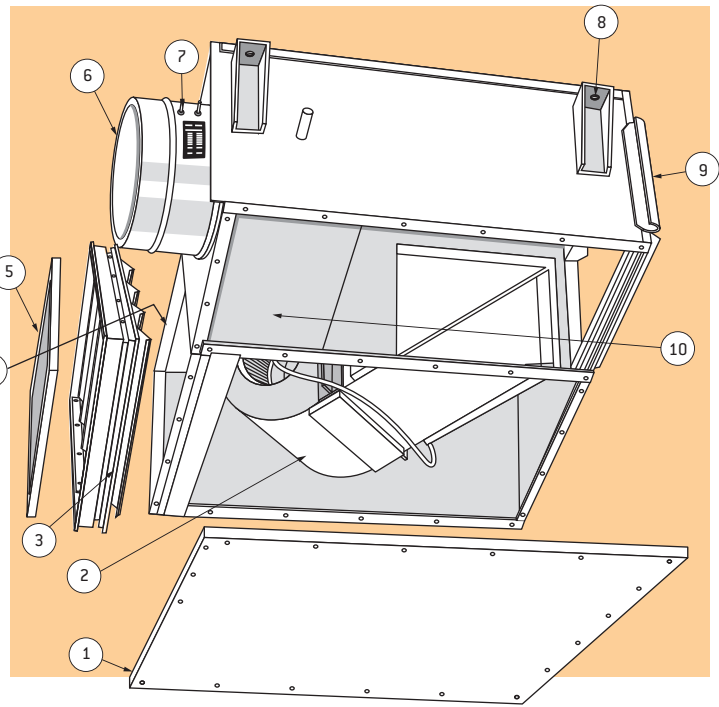
Control Damper: 6063-T5 extruded aluminium frame and blades on hexagonal axles. Sizes 100 to 200 double blade, larger sizes multi-blade opposed action.

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

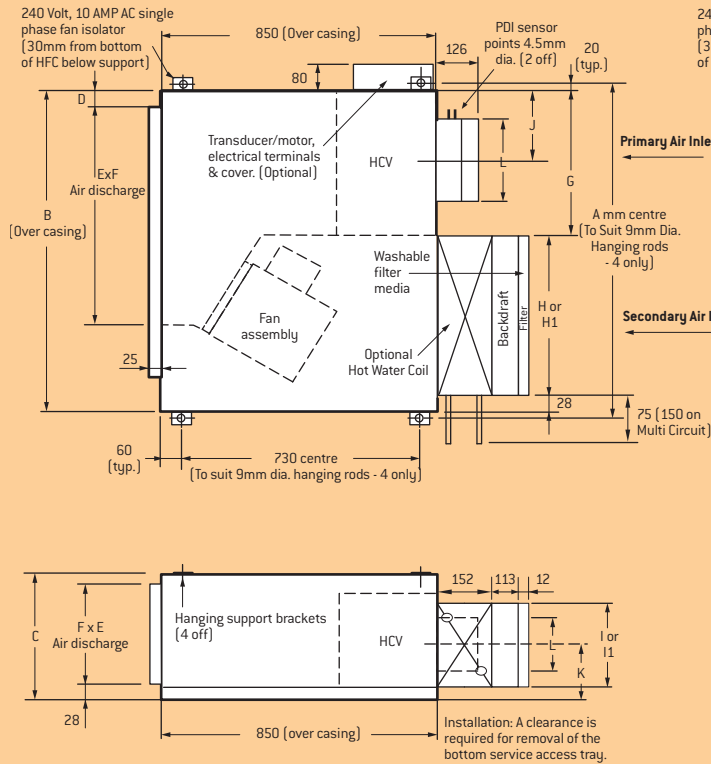
HFCP	X	X	X	X	X	INLET:	xxx	X
	CONTROLLER MAKE	CONTROL TYPE AND ACTION.	HEATING COIL	ATTENUATOR	OUTLET ADAPTER	HCV SIZE (PRIMARY AIR)		CASING SIZE
						Inlet Diameter in mm.		
Parallel Fan Assisted VAV Assembly	1 Siemens 2 Honeywell 3 Alerton 4 Belimo 5 KMC 6 Delta 7 Schneider Electric 8 CSI 9 Other Manufacturers (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	150 200 250 300 300*		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."			350 400		
			** Separately schedule voltage, phases, kW & stages.					

HFC – Fan Assisted VAV (Parallel)

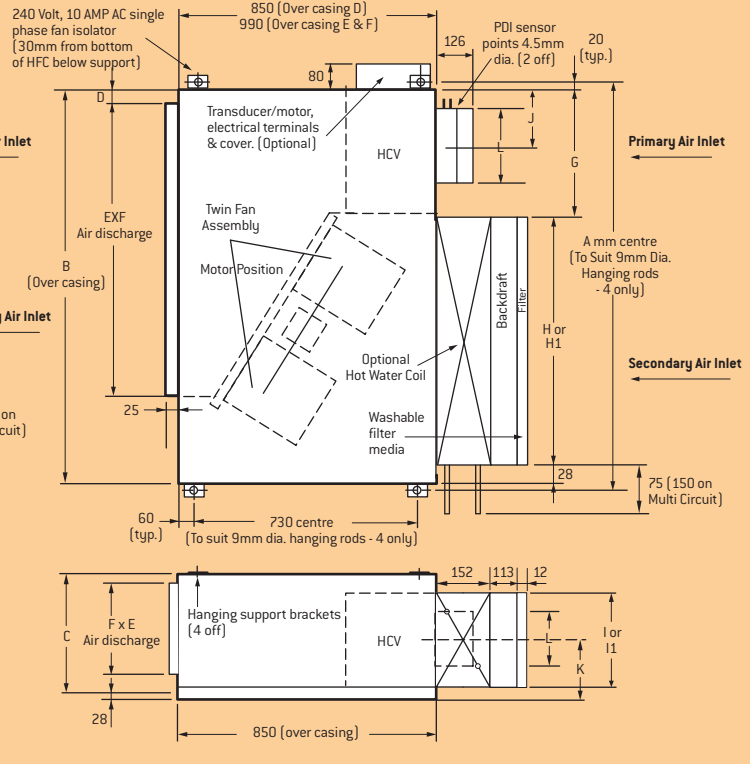
Model: HFCP

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.

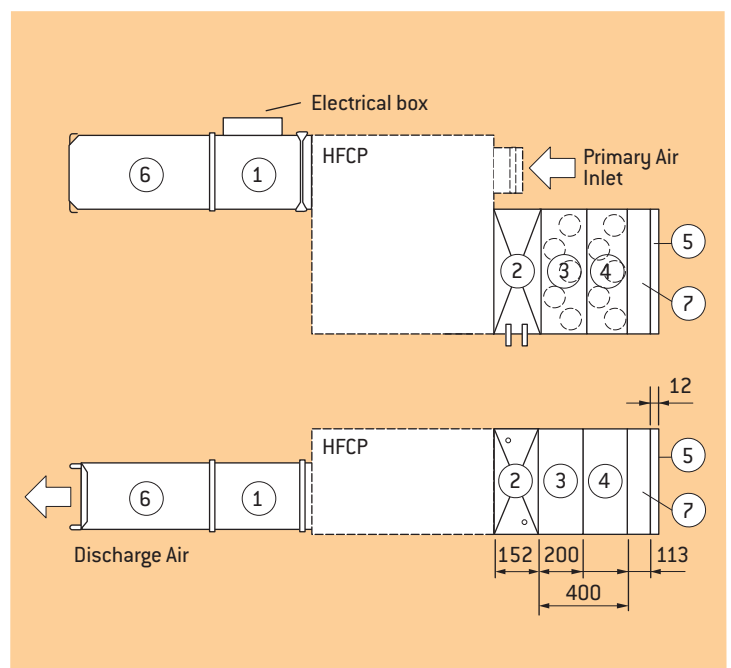
* Casing size D is a low profile size 300 inlet diameter which uses a double fan deck.

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

Accessories

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.



Fan Assisted VAV Control Assemblies

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

- Provides continuous fan operation.
- Reduces airborne and radiated noise levels to a minimum.
- Offers compatibility with all accessories available for the HCV series.

All HFCS terminals are furnished with:

- Secondary air inlet filter.
- Two, or three speed fan motor.
- Solid state 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. 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 bright anodised aluminium axles. Sizes 100 to 200 double blade, larger sizes multi-blade opposed action.

Bearings: Acetal

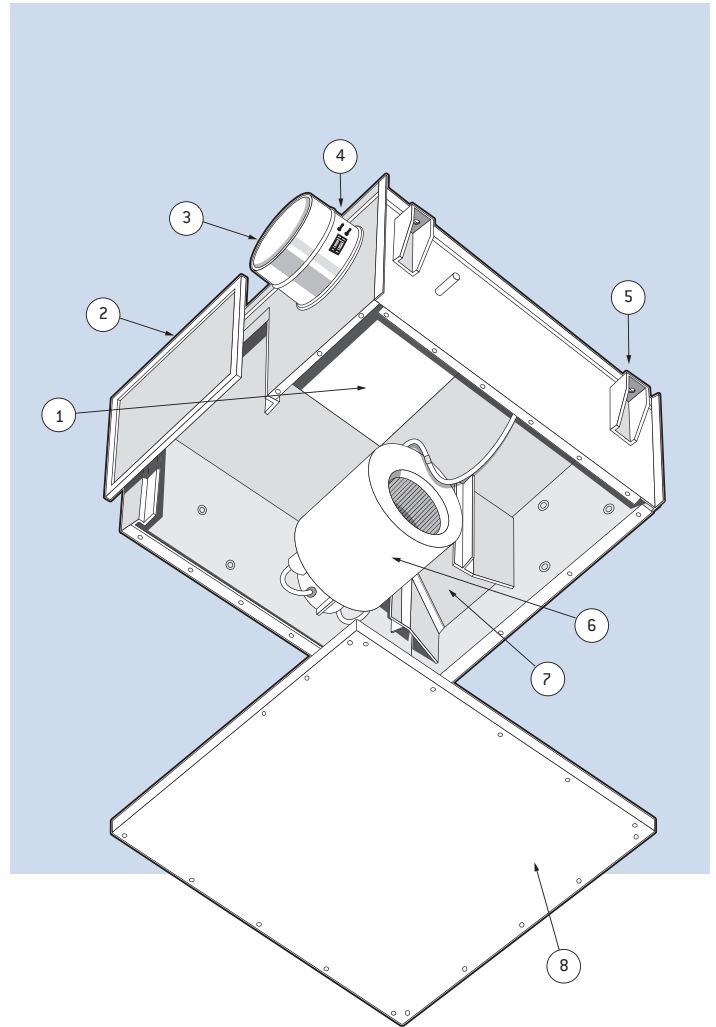
Filter: 'EU2' washable type filter media, fitted to the front of Hot Water Coil, or Attenuator, if applicable.

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

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].



View Of Model HFCS From Below With Bottom Panel Removed.

1. Primary air control valve assembly.
2. Secondary air filter (lift and drop fixing).
3. Primary air inlet.
4. Averaging velocity sensor with capped Tees for independent flow measurement.
5. Suspension brackets.
6. Secondary air fan and direct drive motor.
7. Discharge duct with slip and drive connections.
8. Removable bottom panel.

Model: Number Key

HFCS	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
Series	1 Siemens	0 None	0 None	0 None	0 None	Inlet Diameter in mm.		
Fan Assisted VAV Assembly	2 Honeywell	1 Pneumatic	1 1 Row HW	1 Outlet Attenuator.	1 Round (undampered)	100-125-150		A1
	3 Alerton	2 Electronic.	2 2 Row HW	2 Inlet Attenuator.	2 Multiple (dampered)	175-200-225		A2
	4 Belimo		3 Electric**	3 Both.	9 Special	250		B
	5 KMC		9 Special.			300		C
	6 Delta					300*		D*
	7 Schneider Electric					350		E
	8 CSI					400		F
	9 Other Manufacturers (Please Specify).							

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."

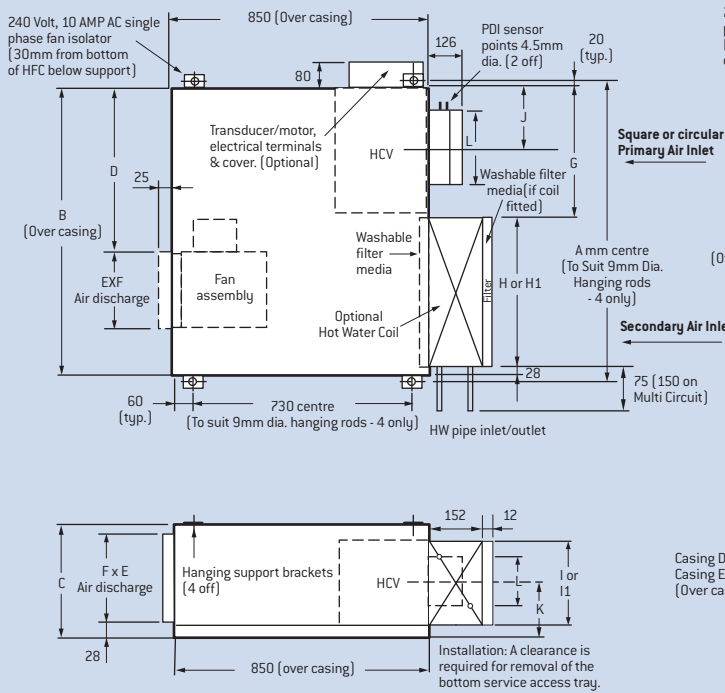
** Separately schedule voltage, phases, kW & stages.

HFC – Fan Assisted VAV (Series)

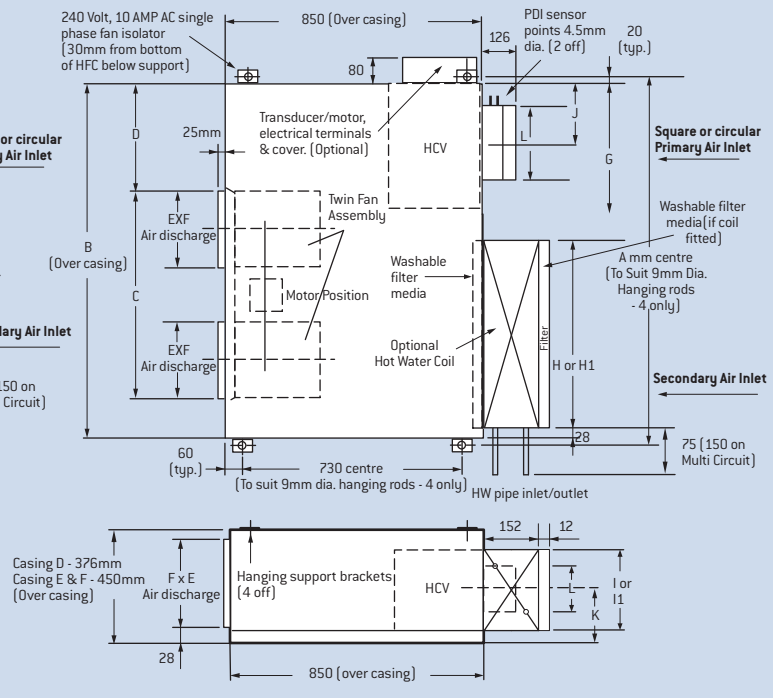
Model: HFCS

Dimensions

HFCS 100-300 Dimensions



HFCS 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	413	254	166	315	482	286	316	223	145	138	100-125-150
175-200-225	A2	865	825	376	413	254	166	315	482	286	316	286	145	174	175-200-225
250	B	1015	975	376	553	254	166	431	516	428	316	286	216	174	250
300	C	990	950	450	486	300	262	431	491	428	390	369	216	210	300
300	D*	1365	1325	706	455	248	166	431	866	428	316	369	216	186	300
350	E	1545	1505	826	503	297	185	515	962	512	390	398	258	225	350
400	F	1770	1730	934	620	297	185	640	1062	636	390	442	320	222	400

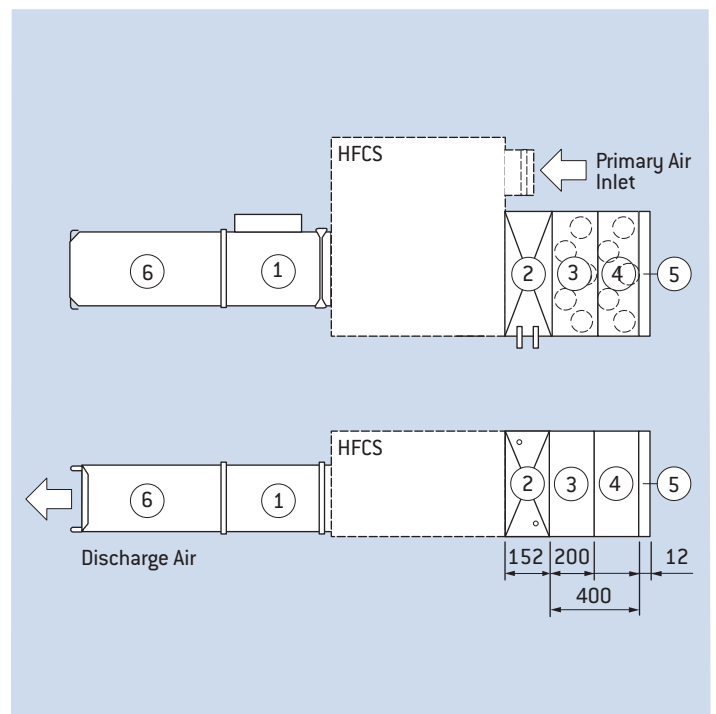
NOTE: Casing sizes D, E and F have double fan decks.

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

x H1 and I1 dimensions applicable when Hot Water Coils fitted.

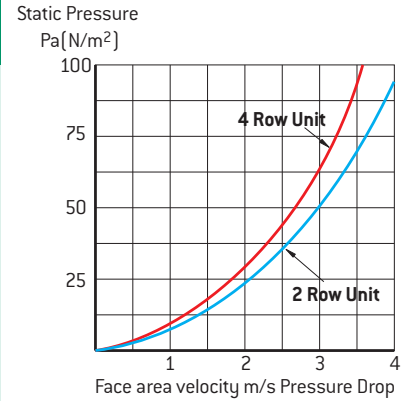
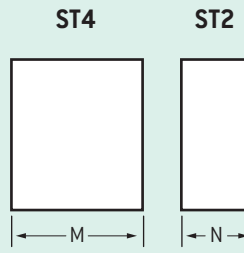
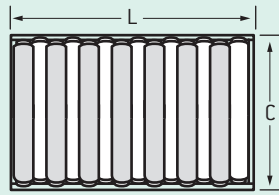
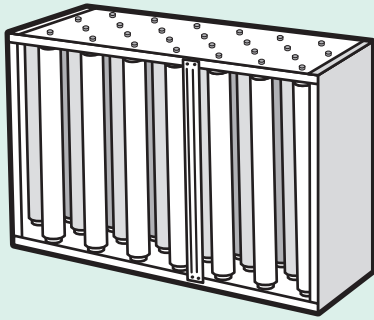
Accessories

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



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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.

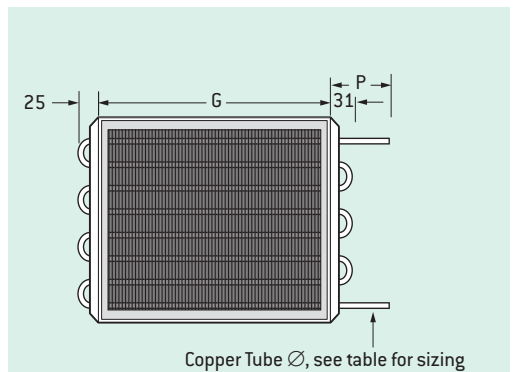
Hot Water Coils

CASING SIZES A, B, C & D

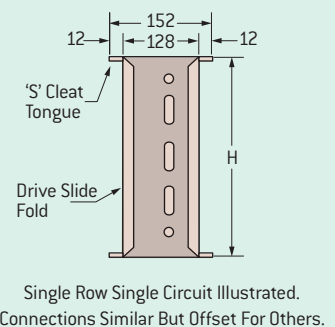
ROWS	WATER		Performance [kW]								
	Flow litres/s	Resistance kPa	Air Flow Rate m ³ /s								
			0.400	0.450	0.500	0.550	0.600	0.750	0.800	0.900	1.000
One Row Single Circuit	0.063	0.40	5.67	5.88	6.08	6.27	6.45	6.81	6.92	7.13	7.36
	0.126	1.39	6.96	7.30	7.61	7.91	8.24	8.81	9.02	9.38	9.77
	0.252	4.77	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
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 litres/s	Resistance kPa	Air Flow Rate m ³ /s								
			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



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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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					Flow m ³ /s	Disch. Ps, Pa	Octave Band, Lw				
		125	250	500	1K	2K			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. ΔP_s : Difference in static pressure, inlet to discharge.
2. ΔP_t : Difference in total pressure, inlet to discharge.
3. Minimum P_s : 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).	m ³ /s	MIN ΔPs						125 ΔPs						250 ΔPs						500 ΔPs																		
		BASIC UNIT						Disch. NC		BASIC UNIT						Disch. NC		BASIC UNIT						Disch. NC														
		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	49	48	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).	m ³ /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		

Radiated Sound Power

SIZE A		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	0.475	60	57	58	50	48	65	62	59	53	52	67	63	60	53	51	67	64	62	54	52	70	68	65	56	56
	0.350	60	50	48	45	40	64	52	46	45	40	65	53	50	46	42	68	61	52	48	46	72	63	55	51	50
	0.250	59	53	48	41	40	61	54	48	42	41	64	57	51	43	43	64	60	53	45	47	68	65	56	49	51
125	0.450	62	59	60	52	50	66	65	62	54	52	67	66	63	53	52	68	67	65	53	54	71	70	67	57	58
	0.300	62	52	50	47	42	63	57	50	48	44	65	57	52	49	46	66	59	54	50	48	70	62	57	52	50
	0.225	61	55	50	43	42	61	52	49	43	42	63	56	52	45	45	64	58	52	46	48	66	61	56	49	52

SIZE B		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	0.500	68	62	54	41	47	73	67	56	54	49	75	67	58	54	50	73	70	59	55	53	78	73	61	57	54
	0.400	66	56	53	49	42	69	60	54	51	43	71	61	56	51	45	68	64	56	52	48	75	67	60	55	50
	0.300	60	54	50	45	41	62	56	50	46	40	65	59	62	47	43	66	65	55	49	47	69	66	59	53	52
125	0.500	70	64	59	50	45	71	66	59	51	46	72	67	57	51	48	72	69	61	52	51	78	73	65	55	53
	0.400	68	61	54	50	43	71	63	55	51	44	72	64	53	50	45	68	67	57	51	48	76	69	60	54	50
	0.300	65	61	52	48	43	68	63	52	49	44	70	64	51	49	45	65	66	55	50	48	73	69	68	53	50

SIZE C		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	0.850	67	63	52	52	47	71	68	57	53	50	72	69	58	54	50	73	70	59	55	51	76	74	64	59	54
	0.700	62	59	51	51	49	65	64	55	51	51	66	65	56	53	52	68	67	59	55	53	71	71	63	59	58
	0.550	59	54	49	48	44	62	59	52	49	45	64	61	55	51	48	66	64	58	55	51	69	67	63	60	57
125	0.850	66	62	55	51	53	69	67	60	52	55	66	65	60	53	56	72	70	63	54	57	75	73	67	58	60
	0.700	61	59	54	52	59	64	63	57	52	60	66	65	59	54	62	68	68	62	56	64	71	71	66	61	68
	0.550	58	57	47	48	45	61	61	50	49	45	63	63	52	52	48	65	66	56	55	51	69	70	61	60	56

SIZE D		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	0.850	59	68	56	54	49	63	73	61	55	52	64	74	62	56	52	65	75	63	57	53	68	79	68	61	56
	0.700	57	59	54	51	41	60	64	58	51	43	61	65	59	53	44	63	67	62	55	45	66	71	66	59	50
	0.550	56	54	53	46	39	59	59	56	47	40	61	61	59	49	43	63	64	62	53	46	66	67	67	58	52
125	0.850	62	60	63	59	56	65	65	68	60	58	66	66	68	61	59	68	68	71	62	60	71	71	75	66	63
	0.700	60	61	57	60	56	63	65	60	60	57	65	67	62	62	59	67	70	65	64	61	70	73	69	69	65
	0.550	59	61	58	59	55	62	65	61	60	55	64	67	63	63	58	66	70	67	66	61	70	74	72	71	66

SIZE E		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	1.600	73	67	64	59	56	77	72	69	60	59	78	73	70	61	59	79	74	71	62	60	82	78	76	66	63
	1.450	64	68	63	58	51	67	73	67	58	53	68	74	68	60	54	70	76	71	62	55	73	80	75	66	60
	1.200	61	66	61	53	49	64	71	64	54	50	66	73	67	56	53	68	76	70	60	56	71	79	75	65	62
125	1.600	76	66	67	64	63	79	71	72	65	65	80	72	72	66	66	82	74	75	67	67	85	77	79	71	70
	1.450	70	67	66	67	66	73	71	69	67	67	75	73	71	69	69	77	76	74	71	71	80	79	78	76	75
	1.200	69	68	66	68	65	72	72	69	69	65	74	74	71	72	68	76	77	75	75	71	80	81	80	80	76

SIZE F		*Fan Only					*Min. Inlet SP					125 Pa Inlet					250 Pa Inlet					500 Pa Inlet				
Discharge Static Pa	Flow m ³ /s	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K	125	250	500	1K	2K
75	2.180	75	68	62	57	51	79	73	67	58	54	80	74	68	59	54	81	75	69	60	55	84	79	74	64	58
	1.920	68	67	63	59	51	71	72	67	59	53	72	73	68	61	54	74	75	71	63	55	77	79	75	67	60
	1.480	63	67	62	54	51	66	72	65	55	52	68	74	68	57	55	70	77	71	61	58	73	80	76	66	64
125	2.180	78	67	65	62	58	81	72	70	63	60	82	73	70	64	61	84	75	73	65	62	87	78	77	69	65
	1.920	74	69	66	68	66	77	73	69	68	67	79	75	71	70	69	81	78	74	72	71	84	81	78	77	75
	1.480	71	69	67	69	67	74	73	70	70	67	76	75	72	73	70	78	78	76	76	73	82	82	81	81	78

Notes

1. Sound Power levels are expressed in decibels = Lw & 10⁻¹² Watts.
2. Above data does not include allowance for ceiling transmission loss, room absorption, or duct attenuation.
3. Sound power levels shown are for Primary flow = Total flow. These levels decrease as the percentage of primary flow reduces, until a minimum is reached at "fan only" where Secondary flow = Total flow.

* Flow at these conditions may rise by up to 10 percent above listed values. [See also variations caused by different discharge static pressures].

Discharge Sound Power

SIZE A						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
0.170	100	61	54	48	49	41
0.360	50	59	43	47	46	46
0.447	20	57	57	58	61	57

SIZE B						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
0.195	300	65	54	53	57	55
0.530	200	69	52	56	57	56
0.720	20	77	58	60	63	61

SIZE C						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
0.600	330	65	65	64	66	63
0.800	250	70	65	64	66	63
1.000	20	71	64	67	68	64

SIZE D						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
0.800	200	60	58	58	60	58
0.850	130	58	56	56	59	55
0.720	20	61	54	56	58	53

SIZE E						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
1.200	350	66	66	64	65	63
1.450	250	68	67	65	66	65
1.600	20	76	64	66	65	65

SIZE F						
Flow m ³ /s	Disch. Press. Pa	Octave Band				
		125	250	500	1K	2K
1.450	350	68	67	65	66	65
1.920	250	72	66	65	67	65
2.180	20	78	61	64	63	60

Refer to Performance Notes on previous page.

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.

HFC – Fan Assisted VAV Terminals

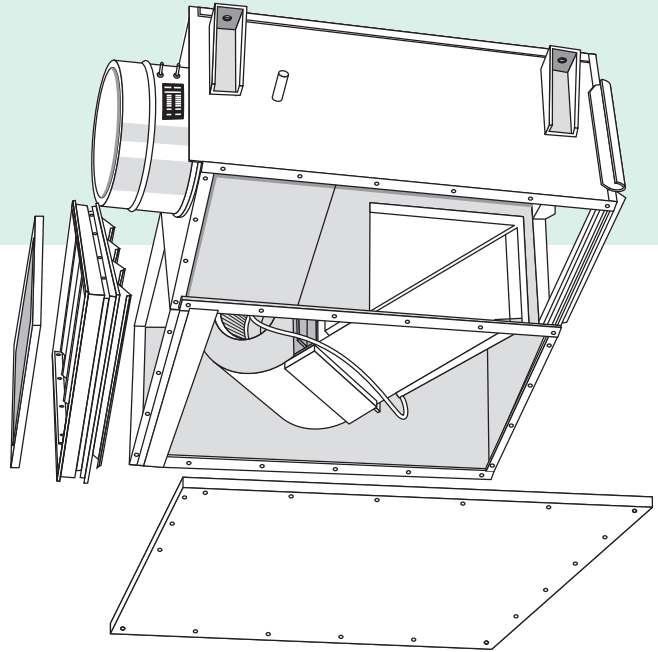
Suggested Specifications

Fan assisted VAV assemblies shall be Holyoake Type (HFCS-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 acoustic polyester insulation and all shall be as manufactured by Holyoake.



Model: Number Key

Parallel HFCS
Series HFCS

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