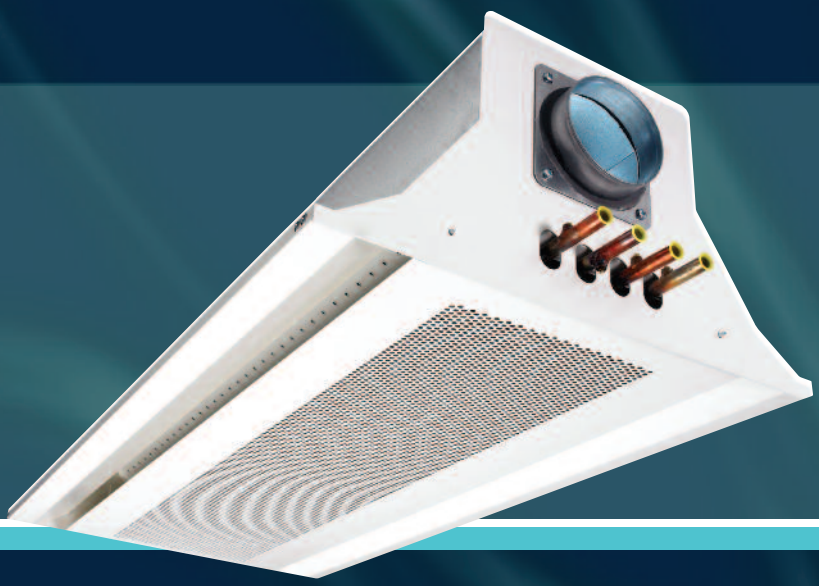
Issue A, October 2010

Active Chilled Beams

Imperial



"ACTICOOL" – High induction, high performance active chilled beam

Advanced Air

Advanced Air

Company Profile

Advanced Air UK factory and technical centre of just over 60,000 sq ft

Advanced Air are part of the Nailor Industries Group in the USA and some of the key factors are:-

Turnover	£80m
Employees	750
Laboratories and Test Cells	6
Total factory area	600,000 ft^2

In the UK Advanced Air manufacture:-

- Chilled Beams
- Fan Coil Units
- Grilles and Diffusers
- Fire and Smoke Dampers
- Volume Control Dampers
- Electrical Control Panels
- VAV Terminal Units

The investment in R & D means there is a continuous flow of new products and upgrades to existing units. Specialist customer testing and mock ups undertaken in Advanced Airs specialist laboratories

R & D Facilities

Chilled Beam Overview

Advanced Air and Nailor Industries have over 40 years experience in the design development and manufacture of terminal air conditioning products and systems. Through Advanced Air's continuing investment in research and development facilities an extensive range of chilled beams has been created.

Advanced air is one of only a few UK manufacturers who have developed their beams in the UK, specifically for the UK market.

Acticool

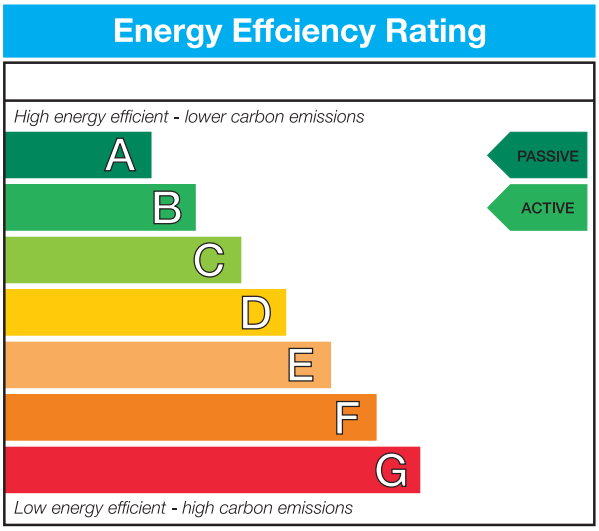
A high induction active beam with specially designed nozzles to create higher cooling outputs.

Advanced Air pursues a policy of continuous product development and we therefore reserve the right to change any of the information in this publication without notice. Please consult your local Advanced Air representative to verify current information.

Active Chilled Beam - Benefits

With the introduction of high induction active chilled beams a wide range of cooling loads can be achieved up to 64 btu/hr/ft^2 which in today's modern buildings should cover virtually all the cooling loads. When load above 38 btu/hr/ft^2 are being considered the air distribution within the occupied space needs to be checked by specialist air distribution engineers such as Advanced Air. The chilled beam can therefore replace the fan coil unit and bring about significant benefits.

Display Energy Certificates (DEC) show the specific buildings carbon emissions as calculated by approved software. The appearance is similar to the energy labelling of domestic electrical appliances. If a similar labelling system was used for individual components in an air conditioning system the ratings for chilled beams could look like the label below.



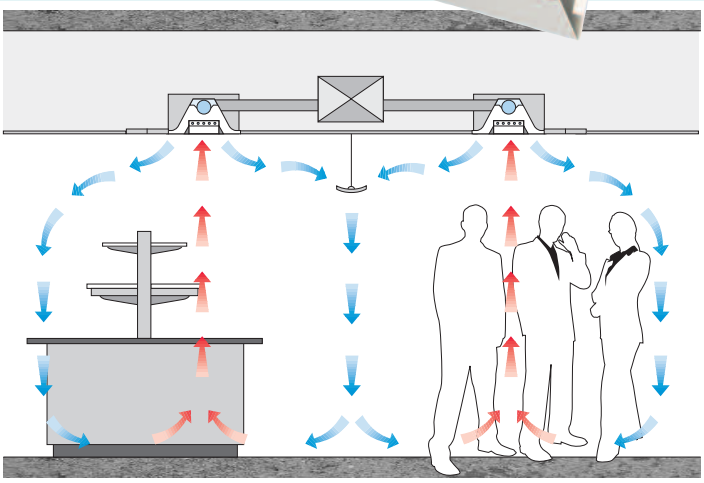
Energy

The chilled beam has two important energy considerations when compared to the fan coil unit.

Firstly there is no secondary or terminal fan unit since the beam operates by inducing air with nozzles (active). Usually a large quantity of fan coils are used even on an average sized project so the total btu/hr consumption of these terminal fan units can be significant particularly where they are left running all the time (i.e. constant speed as opposed to variable volume VAV fan coils).

Secondly elevated chilled water temperatures of 57/63^0 are utilised as opposed to 48/57^0 usually associated with fan coils. This provides a further opportunity for "free cooling" thereby reducing energy usage.

Active Chilled Beams - Benefits



Comfort Levels

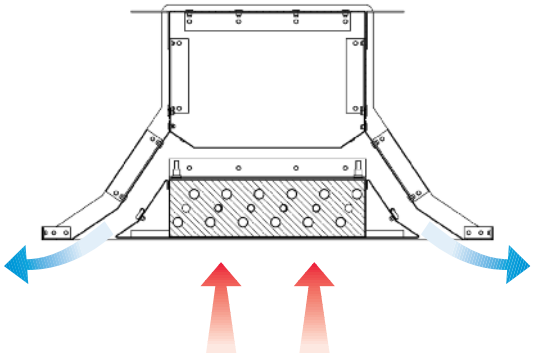
Very good comfort levels can be achieved utilising chilled beams. The air velocities are low within the occupied space and since the supply air temperature is around 61^0 there is not a high temperature gradient with chilled beams.

Noise levels are also very low with NR35 being easily achieved in the absence of a fan in the unit.

Maintenance and Whole Life Costs

One of the main advantages of chilled beams is the low level of maintenance required. This generally leads to low whole life costs as can be seen in the summary below:-

- No condensate pump
- No fans
- No motors
- No moving parts
- No filter
- No consumables
- Simple on/off control valves
- 3 year inspection
- 20 year life span



Chilled Beam Operation

As can be seen from the diagram the operation of the active chilled beams is relatively simple. Fresh air is supplied along a horizontal duct at the top of the unit. The air is forced through nozzles which are mounted in this horizontal duct and positioned to get maximum air entrainment.

As these jets of air dissipate in the chilled beam exit diffuser they induce room air to pass through the centrally mounted perforated diffuser and over the coils. These coils are normally used for cooling but they can provide heating as well. The 4 pipe heating and cooling chilled beam has coils with twin circuits. Since cooling is the main requirement the coil is designed to meet the maximum cooling load. On the heating cycle the hot water is conveyed to the centre of the coil by a separate micro bore copper pipe and achieves the relevant heating with no impact on the cooling potential.

Active Chilled Beams - Technology

Induction Nozzles

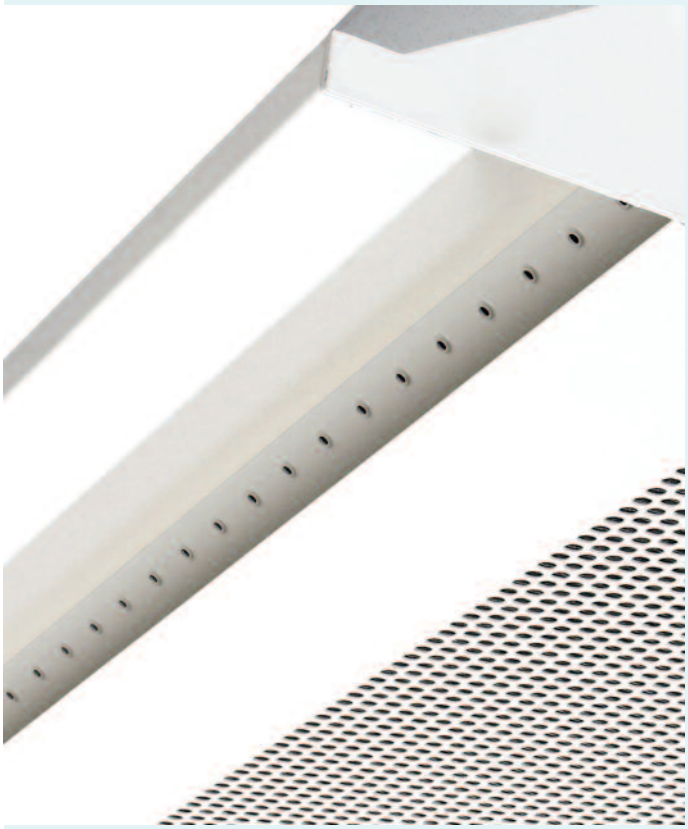
These are probably the most critical part of the beam since they control the induction rate which needs to be as high as possible. The induction rate for a given airflow is a measure of the efficiency of the beam and ultimately the overall cooling which can be achieved.

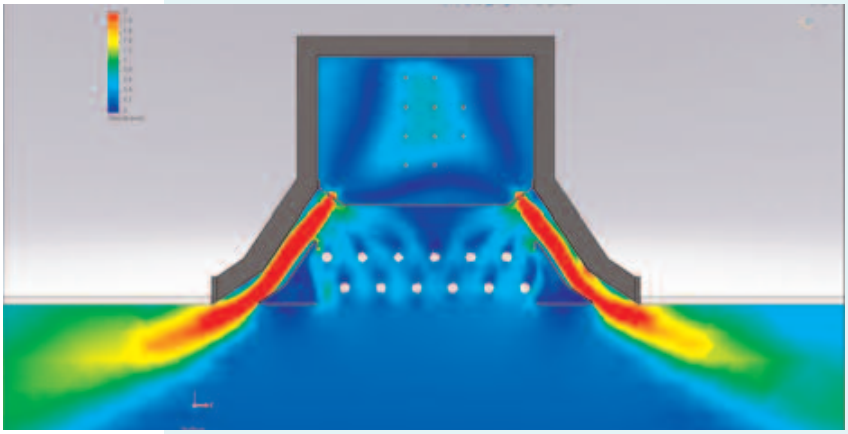
To say the nozzle can come in various “shapes and sizes” is somewhat of an understatement when the induction rate can be influenced by many factors in the nozzle design which include:-

- Shape - e.g. circular, oval, slot, star shape, etc
- Diameter - measurement of nozzle
- Spacing - distance between nozzles
- Configuration - pattern of an array of nozzles
- Position - in relation to the beam discharge slot
- Angle - the angle of discharge

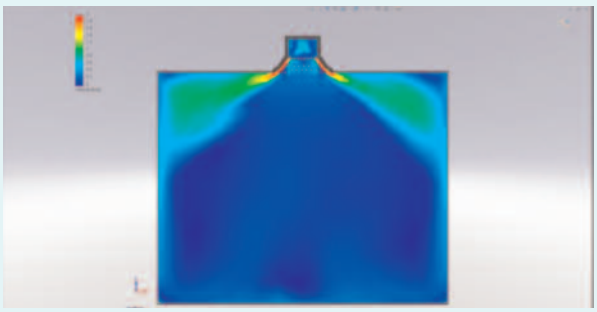
If there were 10 options for each category there would be 1 million variations that needed to be tested to explore the most effective combination.

Engineering fluid dynamics EFD was used to narrow the wide range of option and to create a short list of the most effective combinations for actual testing. It was found later that the EFD predictions on beam velocities, beam temperatures and room velocities were very close to those measured in actual test.



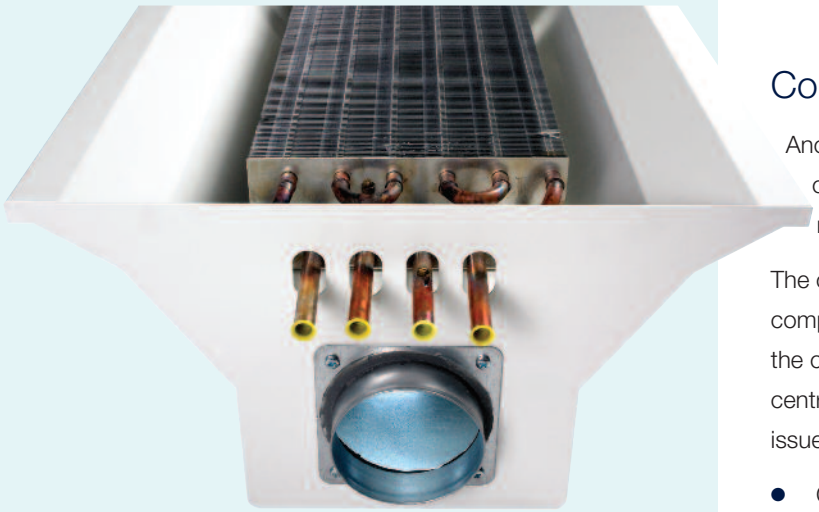


Beam velocity map



Beam function within a room

Active Chilled Beams - Technology



Coil Design

Another very important component is the coil where the objective is to maximise the cooling output and minimise the energy consumption.

The coils used are not a standard "off the shelf" component but have been specially developed jointly by the coil manufacturer and the Advanced Air technical centre. To achieve the objective mentioned above many issues had to be investigated typically:-

- Coil circuits
- Copper pipe diameter
- Fin design and shape
- Fin spacing
- Pipe spacing
- Reynolds number

Each coil configuration was tested against a specific airflow and the output and pressure drop were measured. The best of these were fitted and tested in the beam so that the most effective coil configuration could be selected.

Air Distribution

The discharge air slot needs careful design to minimise any aerodynamic resistance whilst still maintaining coanda effect on the ceiling. In addition the discharge velocities have to be sufficient to give the beam a reasonable throw and maintain comfort conditions within the room at a typical 6-10ft spacing.

The air distribution can be significantly affected by the shape and dimension of the slot and it is therefore essential all beams have been tested in specialist air distribution laboratories BSRIA approved similar to those in the Advanced Air Technical Centre.

Active Chilled Beams

Beam performance Nozzle A - 2 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F

Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	13 cfm	17 cfm	21 cfm	25 cfm	30 cfm				
4	btu/h/ft	279 b/h/ft	372 b/h/ft	462 b/h/ft	545 b/h/ft	631 b/h/ft				
	Throw ft	0.9-2.9-4.9	1.3-3.9-6.5	1.9-4.9-8.2	2.2-5.5-9.8	2.6-6.5-11.4				
	Static in/wg	0.14 in/wg	0.26 in/wg	0.40 in/wg	0.58 in/wg	0.78 in/wg				
	dB(A)	31	37	42	48	53				
	Water btu/h	836 btu/h	1113 btu/h	1382 btu/h	1621 btu/h	1870 btu/h				
	Water Flow	0.3 gpm	0.4 gpm	0.5 gpm	0.6 gpm	0.7 gpm				
	Water ΔP	0.16 ft	0.29 ft	0.45 ft	0.62 ft	0.82 ft				
	Heating btu/h	461 btu/h	613 btu/h	762 btu/h	894 btu/h	1031 btu/h				
	btu/h/ft	64 cfm	85 cfm	106 cfm	127 cfm	148 cfm				
	Primary Air btu/h	262 btu/h	350 btu/h	437 btu/h	524 btu/h	612 btu/h				
	Total btu/h	1099 btu/h	1463 btu/h	1819 btu/h	2146 btu/h	2482 btu/h				
6		**21 cfm**	**25 cfm**	**30 cfm**	**34 cfm**	**38 cfm**	**42 cfm**	**47 cfm**		
	btu/h/ft	320 b/h/ft	383 b/h/ft	446 b/h/ft	508 b/h/ft	562 b/h/ft	619 b/h/ft	675 b/h/ft		
	Throw ft	1.3-3.2-5.5	1.6-3.9-6.8	1.6-4.5-7.8	1.9-5.2-9.1	2.2-5.9-10.1	2.6-6.5-11.1	2.6-7.2-12.1		
	Static in/wg	0.18 in/wg	0.26 in/wg	0.35 in/wg	0.46 in/wg	0.58 in/wg	0.71 in/wg	0.86 in/wg		
	dB(A)	23	26	29	31	34	36	37		
	Water btu/h	1450 btu/h	1736 btu/h	2021 btu/h	2299 btu/h	2529 btu/h	2778 btu/h	3021 btu/h		
	Water Flow	0.5 gpm	0.6 gpm	0.7 gpm	0.9 gpm	0.9 gpm	1.0 gpm	1.1 gpm		
	Water ΔP	0.64 ft	0.92 ft	1.24 ft	1.61 ft	1.94 ft	2.34 ft	2.77 ft		
	Heating btu/h	799 btu/h	957 btu/h	1114 btu/h	1267 btu/h	1394 btu/h	1531 btu/h	1665 btu/h		
	Total Air cfm	106 cfm	127 cfm	148 cfm	170 cfm	191 cfm	212 cfm	233 cfm		
	Primary Air btu/h	437 btu/h	524 btu/h	612 btu/h	699 btu/h	787 btu/h	874 btu/h	962 btu/h		
	Total btu/h	1887 btu/h	2261 btu/h	2633 btu/h	2999 btu/h	3316 btu/h	3653 btu/h	3983 btu/h		
8		**25 cfm**	**30 cfm**	**34 cfm**	**38 cfm**	**42 cfm**	**47 cfm**	**51 cfm**	**55 cfm**	**59 cfm**
	btu/h/ft	298 b/h/ft	348 b/h/ft	397 b/h/ft	446 b/h/ft	494 b/h/ft	538 b/h/ft	582 b/h/ft	631 b/h/ft	673 b/h/ft
	Throw ft	0.9-2.9-5.2	1.3-3.6-6.2	1.6-4.2-7.2	1.6-4.5-7.8	1.9-5.2-8.8	2.2-5.5-9.8	2.2-6.2-10.4	2.6-6.5-11.4	2.6-7.2-12.1
	Static in/wg	0.14 in/wg	0.20 in/wg	0.26 in/wg	0.32 in/wg	0.40 in/wg	0.48 in/wg	0.58 in/wg	0.68 in/wg	0.78 in/wg
	dB(A)	23	24	26	28	30	33	35	36	38
	Water btu/h	1824 btu/h	2127 btu/h	2426 btu/h	2723 btu/h	3012 btu/h	3277 btu/h	3535 btu/h	3829 btu/h	4077 btu/h
	Water Flow	0.7 gpm	0.8 gpm	0.9 gpm	1.0 gpm	1.1 gpm	1.2 gpm	1.3 gpm	1.4 gpm	1.5 gpm
	Water ΔP	1.32 ft	1.80 ft	2.33 ft	2.94 ft	3.60 ft	4.26 ft	4.96 ft	5.82 ft	6.59 ft
	Heating btu/h	1005 btu/h	1172 btu/h	1337 btu/h	1501 btu/h	1660 btu/h	1806 btu/h	1948 btu/h	2110 btu/h	2247 btu/h
	Total Air cfm	127 cfm	148 cfm	170 cfm	191 cfm	212 cfm	233 cfm	254 cfm	275 cfm	297 cfm
	Primary Air btu/h	524 btu/h	612 btu/h	699 btu/h	787 btu/h	874 btu/h	962 btu/h	1049 btu/h	1136 btu/h	1224 btu/h
	Total btu/h	2348 btu/h	2739 btu/h	3125 btu/h	3510 btu/h	3887 btu/h	4238 btu/h	4584 btu/h	4966 btu/h	5301 btu/h
10		**34 cfm**	**38 cfm**	**42 cfm**	**47 cfm**	**51 cfm**	**55 cfm**	**59 cfm**	**64 cfm**	**68 cfm**
	btu/h/ft	301 b/h/ft	339 b/h/ft	379 b/h/ft	417 b/h/ft	455 b/h/ft	495 b/h/ft	530 b/h/ft	564 b/h/ft	604 b/h/ft
	Throw ft	0.9-2.9-5.2	1.3-3.6-5.9	1.3-3.9-6.8	1.6-4.2-7.5	1.6-4.5-8.2	1.9-5.2-8.8	1.9-5.5-9.5	2.2-5.9-10.1	2.2-6.2-10.8
	Static in/wg	0.16 in/wg	0.21 in/wg	0.26 in/wg	0.31 in/wg	0.37 in/wg	0.43 in/wg	0.50 in/wg	0.58 in/wg	0.66 in/wg
	dB(A)	22	25	28	30	32	33	35	37	38
	Water btu/h	2723 btu/h	3057 btu/h	3396 btu/h	3728 btu/h	4049 btu/h	4386 btu/h	4671 btu/h	4948 btu/h	5278 btu/h
	Water Flow	1.0 gpm	1.1 gpm	1.3 gpm	1.4 gpm	1.5 gpm	1.6 gpm	1.7 gpm	1.8 gpm	2.0 gpm
	Water ΔP	3.56 ft	4.49 ft	5.54 ft	6.67 ft	7.87 ft	9.23 ft	10.47 ft	11.75 ft	13.37 ft
	Heating btu/h	1501 btu/h	1685 btu/h	1872 btu/h	2054 btu/h	2231 btu/h	2417 btu/h	2574 btu/h	2727 btu/h	2909 btu/h
	Total Air cfm	170 cfm	191 cfm	212 cfm	233 cfm	254 cfm	275 cfm	297 cfm	318 cfm	339 cfm
	Primary Air btu/h	699 btu/h	787 btu/h	874 btu/h	962 btu/h	1049 btu/h	1136 btu/h	1224 btu/h	1311 btu/h	1399 btu/h
	Total btu/h	2959 btu/h	3338 btu/h	3726 btu/h	4108 btu/h	4482 btu/h	4875 btu/h	5217 btu/h	5554 btu/h	5945 btu/h

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
Water Flow	Water flow rate gpm
Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
17	1.06
16	1.00
15	0.94
14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams
Beam performance Nozzle B - 2 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F
Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	30 cfm	36 cfm	42 cfm	49 cfm	55 cfm	61 cfm			
4	btu/h/ft	494 b/h/ft	593 b/h/ft	721 b/h/ft	797 b/h/ft	893 b/h/ft	974 b/h/ft	1054 b/h/ft		
	Throw ft	1.9-5.2-8.8	2.2-6.2-10.8	2.9-7.5-13.1	3.2-8.5-14.4	3.6-9.5-16	3.9-10.1-17.7	4.2-11.1-19		
	Static in/wg	0.20 in/wg	0.29 in/wg	0.40 in/wg	0.53 in/wg	0.68 in/wg	0.84 in/wg	1.02 in/wg		
	dB(A)	31	37	42	48	53	53	53		
	Water btu/h	1333 btu/h	1592 btu/h	1931 btu/h	2133 btu/h	2379 btu/h	2565 btu/h	2751 btu/h		
	Water Flow	0.5 gpm	0.6 gpm	0.7 gpm	0.8 gpm	0.9 gpm	0.9 gpm	1.0 gpm		
	Water ΔP	0.42 ft	0.60 ft	0.88 ft	1.07 ft	1.33 ft	1.55 ft	1.78 ft		
	Heating btu/h	734 btu/h	877 btu/h	1064 btu/h	1176 btu/h	1311 btu/h	1413 btu/h	1516 btu/h		
	btu/h/ft	104 cfm	126 cfm	154 cfm	171 cfm	193 cfm	215 cfm	237 cfm		
	Primary Air btu/h	612 btu/h	743 btu/h	874 btu/h	1005 btu/h	1136 btu/h	1268 btu/h	0 btu/h		
	Total btu/h	1945 btu/h	2335 btu/h	2838 btu/h	3138 btu/h	3516 btu/h	3832 btu/h	4150 btu/h		
		42 cfm	**49 cfm**	**55 cfm**	**61 cfm**	**68 cfm**	**74 cfm**	**81 cfm**	**87 cfm**	
6	btu/h/ft	502 b/h/ft	550 b/h/ft	621 b/h/ft	690 b/h/ft	761 b/h/ft	831 b/h/ft	894 b/h/ft	958 b/h/ft	
	Throw ft	1.9-5.2-8.8	2.2-5.9-9.8	2.6-6.5-11.1	2.9-7.2-12.4	2.9-7.8-13.7	3.2-8.8-15	3.6-9.5-16	3.9-10.1-17.3	
	Static in/wg	0.18 in/wg	0.24 in/wg	0.30 in/wg	0.37 in/wg	0.46 in/wg	0.54 in/wg	0.64 in/wg	0.75 in/wg	
	dB(A)	32	36	40	42	45	47	50	52	
	Water btu/h	2054 btu/h	2240 btu/h	2533 btu/h	2806 btu/h	3097 btu/h	3376 btu/h	3616 btu/h	3863 btu/h	
	Water Flow	0.8 gpm	0.8 gpm	0.9 gpm	1.0 gpm	1.1 gpm	1.2 gpm	1.3 gpm	1.4 gpm	
	Water ΔP	1.28 ft	1.52 ft	1.95 ft	2.39 ft	2.91 ft	3.46 ft	3.97 ft	4.53 ft	
	Heating btu/h	1132 btu/h	1235 btu/h	1396 btu/h	1547 btu/h	1707 btu/h	1860 btu/h	1993 btu/h	2129 btu/h	
	Total Air cfm	154 cfm	171 cfm	193 cfm	215 cfm	237 cfm	260 cfm	282 cfm	304 cfm	
	Primary Air btu/h	874 btu/h	1005 btu/h	1136 btu/h	1268 btu/h	1399 btu/h	1530 btu/h	1661 btu/h	1792 btu/h	
	Total btu/h	2961 btu/h	3246 btu/h	3669 btu/h	4074 btu/h	4495 btu/h	4905 btu/h	5277 btu/h	5655 btu/h	
		61 cfm	**68 cfm**	**74 cfm**	**81 cfm**	**87 cfm**	**93 cfm**	**100 cfm**	**106 cfm**	**112 cfm**
8	btu/h/ft	537 b/h/ft	593 b/h/ft	648 b/h/ft	704 b/h/ft	756 b/h/ft	809 b/h/ft	864 b/h/ft	915 b/h/ft	959 b/h/ft
	Throw ft	2.2-5.5-9.5	2.2-6.2-10.8	2.6-6.8-11.8	2.9-7.5-12.7	2.9-7.8-13.7	3.2-8.5-14.7	3.6-9.1-15.7	3.9-9.8-16.7	3.9-10.1-17.3
	Static in/wg	0.21 in/wg	0.26 in/wg	0.31 in/wg	0.36 in/wg	0.42 in/wg	0.48 in/wg	0.55 in/wg	0.63 in/wg	0.70 in/wg
	dB(A)	37	40	43	45	46	48	50	52	54
	Water btu/h	2961 btu/h	3267 btu/h	3573 btu/h	3879 btu/h	4158 btu/h	4448 btu/h	4751 btu/h	5021 btu/h	5233 btu/h
	Water Flow	1.1 gpm	1.2 gpm	1.3 gpm	1.4 gpm	1.5 gpm	1.6 gpm	1.8 gpm	1.9 gpm	1.9 gpm
	Water ΔP	3.48 ft	4.23 ft	5.06 ft	5.97 ft	6.86 ft	7.85 ft	8.95 ft	10.00 ft	10.86 ft
	Heating btu/h	1632 btu/h	1800 btu/h	1969 btu/h	2138 btu/h	2292 btu/h	2451 btu/h	2618 btu/h	2767 btu/h	2884 btu/h
	Total Air cfm	215 cfm	237 cfm	260 cfm	282 cfm	304 cfm	326 cfm	349 cfm	371 cfm	393 cfm
	Primary Air btu/h	1268 btu/h	1399 btu/h	1530 btu/h	1661 btu/h	1792 btu/h	1923 btu/h	2054 btu/h	2185 btu/h	2317 btu/h
	Total btu/h	4228 btu/h	4665 btu/h	5103 btu/h	5540 btu/h	5950 btu/h	6371 btu/h	6805 btu/h	7206 btu/h	7550 btu/h
		74 cfm	**81 cfm**	**87 cfm**	**93 cfm**	**100 cfm**	**106 cfm**	**112 cfm**		
10	btu/h/ft	569 b/h/ft	610 b/h/ft	659 b/h/ft	707 b/h/ft	755 b/h/ft	799 b/h/ft	847 b/h/ft		
	Throw ft	2.2-5.9-10.1	2.6-6.5-11.1	2.6-6.8-11.8	2.9-7.5-12.7	2.9-7.8-13.7	3.2-8.5-14.4	3.6-8.8-15.4		
	Static in/wg	0.20 in/wg	0.23 in/wg	0.27 in/wg	0.31 in/wg	0.35 in/wg	0.40 in/wg	0.45 in/wg		
	dB(A)	40	42	44	46	48	50	52		
	Water btu/h	4067 btu/h	4345 btu/h	4688 btu/h	5031 btu/h	5374 btu/h	5679 btu/h	6020 btu/h		
	Water Flow	1.5 gpm	1.6 gpm	1.7 gpm	1.9 gpm	2.0 gpm	2.1 gpm	2.2 gpm		
	Water ΔP	7.94 ft	9.06 ft	10.55 ft	12.15 ft	13.86 ft	15.48 ft	17.40 ft		
	Heating btu/h	2242 btu/h	2395 btu/h	2584 btu/h	2773 btu/h	2962 btu/h	3130 btu/h	3318 btu/h		
	Total Air cfm	260 cfm	282 cfm	304 cfm	326 cfm	349 cfm	371 cfm	393 cfm		
	Primary Air btu/h	1530 btu/h	1661 btu/h	1792 btu/h	1923 btu/h	2054 btu/h	2185 btu/h	2317 btu/h		
	Total btu/h	5597 btu/h	6006 btu/h	6480 btu/h	6954 btu/h	7428 btu/h	7865 btu/h	8337 btu/h		

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
Water Flow	Water flow rate gpm
Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
17	1.06
16	1.00
15	0.94
14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams
Beam performance Nozzle C - 2 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F
Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	42 cfm	53 cfm	64 cfm	74 cfm	85 cfm			
4	btu/h/ft	573 b/h/ft	716 b/h/ft	860 b/h/ft	976 b/h/ft	1068 b/h/ft			
	Throw ft	2.2-5.9-10.1	2.9-7.5-12.7	3.6-9.1-15.4	3.9-10.4-17.7	4.5-11.4-19.3			
	Static in/wg	0.18 in/wg	0.28 in/wg	0.40 in/wg	0.54 in/wg	0.71 in/wg			
	dB(A)	31	37	42	48	53			
	Water btu/h	1382 btu/h	1727 btu/h	2073 btu/h	2311 btu/h	2457 btu/h			
	Water Flow	0.5 gpm	0.6 gpm	0.8 gpm	0.9 gpm	0.9 gpm			
	Water ΔP	0.45 ft	0.70 ft	1.01 ft	1.26 ft	1.42 ft			
	Heating btu/h	762 btu/h	952 btu/h	1142 btu/h	1273 btu/h	1354 btu/h			
	btu/h/ft	119 cfm	148 cfm	178 cfm	208 cfm	237 cfm			
	Primary Air btu/h	874 btu/h	1093 btu/h	1311 btu/h	1530 btu/h	1748 btu/h			
	Total btu/h	2256 btu/h	2820 btu/h	3384 btu/h	3841 btu/h	4205 btu/h			
6		**64 cfm**	**74 cfm**	**85 cfm**	**95 cfm**	**106 cfm**	**117 cfm**	**127 cfm**	
	btu/h/ft	587 b/h/ft	685 b/h/ft	783 b/h/ft	881 b/h/ft	1154 b/h/ft	1032 b/h/ft	1093 b/h/ft	
	Throw ft	2.2-6.2-10.4	2.6-7.2-12.4	3.2-8.2-14.1	3.6-9.1-16	4.9-12.1-20.9	4.2-10.8-18.6	4.5-11.4-20	
	Static in/wg	0.18 in/wg	0.24 in/wg	0.32 in/wg	0.40 in/wg	0.49 in/wg	0.60 in/wg	0.71 in/wg	
	dB(A)	35	40	43	46	50	52	54	
	Water btu/h	2156 btu/h	2515 btu/h	2874 btu/h	3234 btu/h	4631 btu/h	3689 btu/h	3832 btu/h	
	Water Flow	0.8 gpm	0.9 gpm	1.1 gpm	1.2 gpm	1.7 gpm	1.4 gpm	1.4 gpm	
	Water ΔP	1.41 ft	1.92 ft	2.51 ft	3.18 ft	6.51 ft	4.13 ft	4.46 ft	
	Heating btu/h	1188 btu/h	1386 btu/h	1584 btu/h	1782 btu/h	2552 btu/h	2033 btu/h	2112 btu/h	
	Total Air cfm	178 cfm	208 cfm	237 cfm	267 cfm	297 cfm	326 cfm	356 cfm	
	Primary Air btu/h	1311 btu/h	1530 btu/h	1748 btu/h	1967 btu/h	2185 btu/h	2404 btu/h	2622 btu/h	
	Total btu/h	3467 btu/h	4045 btu/h	4623 btu/h	5200 btu/h	6816 btu/h	6093 btu/h	6455 btu/h	
8		**85 cfm**	**95 cfm**	**106 cfm**	**117 cfm**	**127 cfm**	**138 cfm**	**148 cfm**	**159 cfm**
	btu/h/ft	605 b/h/ft	680 b/h/ft	756 b/h/ft	832 b/h/ft	907 b/h/ft	1162 b/h/ft	1029 b/h/ft	1086 b/h/ft
	Throw ft	2.2-6.2-10.8	2.6-7.2-12.1	2.9-7.8-13.7	3.2-8.8-15	3.6-9.5-16.4	4.9-12.4-20.9	4.2-10.8-18.6	4.5-11.4-19.6
	Static in/wg	0.18 in/wg	0.23 in/wg	0.28 in/wg	0.34 in/wg	0.40 in/wg	0.47 in/wg	0.54 in/wg	0.63 in/wg
	dB(A)	41	44	47	50	51	54	57	5
	Water btu/h	3012 btu/h	3389 btu/h	3766 btu/h	4142 btu/h	4519 btu/h	6309 btu/h	5037 btu/h	5272 btu/h
	Water Flow	1.1 gpm	1.3 gpm	1.4 gpm	1.5 gpm	1.7 gpm	2.3 gpm	1.9 gpm	2.0 gpm
	Water ΔP	3.60 ft	4.56 ft	5.63 ft	6.81 ft	8.10 ft	15.79 ft	10.07 ft	11.03 ft
	Heating btu/h	1660 btu/h	1868 btu/h	2075 btu/h	2283 btu/h	2490 btu/h	3477 btu/h	2776 btu/h	2905 btu/h
	Total Air cfm	237 cfm	267 cfm	297 cfm	326 cfm	356 cfm	386 cfm	415 cfm	445 cfm
	Primary Air btu/h	1748 btu/h	1967 btu/h	2185 btu/h	2404 btu/h	2622 btu/h	2841 btu/h	3060 btu/h	3278 btu/h
	Total btu/h	4761 btu/h	5356 btu/h	5951 btu/h	6546 btu/h	7141 btu/h	9150 btu/h	8097 btu/h	8550 btu/h
10		**106 cfm**	**117 cfm**	**127 cfm**	**138 cfm**	**148 cfm**	**159 cfm**	**170 cfm**	**180 cfm**
	btu/h/ft	651 b/h/ft	716 b/h/ft	781 b/h/ft	846 b/h/ft	911 b/h/ft	976 b/h/ft	1239 b/h/ft	1074 b/h/ft
	Throw ft	2.6-6.8-11.8	2.9-7.5-12.7	3.2-8.2-14.1	3.6-8.8-15.4	3.6-9.5-16.4	3.9-10.4-17.7	5.2-13.1-22.6	4.5-11.4-19.3
	Static in/wg	0.18 in/wg	0.22 in/wg	0.26 in/wg	0.30 in/wg	0.35 in/wg	0.40 in/wg	0.46 in/wg	0.51 in/wg
	dB(A)	44	47	50	53	55	55	58	60
	Water btu/h	4217 btu/h	4639 btu/h	5061 btu/h	5483 btu/h	5904 btu/h	6326 btu/h	8697 btu/h	6851 btu/h
	Water Flow	1.6 gpm	1.7 gpm	1.9 gpm	2.0 gpm	2.2 gpm	2.3 gpm	3.2 gpm	2.5 gpm
	Water ΔP	8.54 ft	10.33 ft	12.29 ft	14.43 ft	16.73 ft	19.21 ft	36.31 ft	22.53 ft
	Heating btu/h	2324 btu/h	2557 btu/h	2789 btu/h	3022 btu/h	3254 btu/h	3486 btu/h	4793 btu/h	3776 btu/h
	Total Air cfm	297 cfm	326 cfm	356 cfm	386 cfm	415 cfm	445 cfm	475 cfm	504 cfm
	Primary Air btu/h	2185 btu/h	2404 btu/h	2622 btu/h	2841 btu/h	3060 btu/h	3278 btu/h	3497 btu/h	3715 btu/h
	Total btu/h	6403 btu/h	7043 btu/h	7683 btu/h	8324 btu/h	8964 btu/h	9604 btu/h	12194 btu/h	10566 btu/h

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
Water Flow	Water flow rate gpm
Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
17	1.06
16	1.00
15	0.94
14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams
Beam performance Nozzle A - 1 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F
Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	6 cfm	8 cfm	11 cfm	13 cfm	15 cfm				
4	btu/h/ft	147 b/h/ft	194 b/h/ft	239 b/h/ft	282 b/h/ft	323 b/h/ft				
	Throw ft	0.9-2.9-5.2	1.6-3.9-6.8	1.9-4.9-8.5	2.2-5.9-10.1	2.6-6.8-11.8				
	Static in/wg	0.14 in/wg	0.26 in/wg	0.40 in/wg	0.58 in/wg	0.78 in/wg				
	dB(A)	31	37	42	48	53				
	Water btu/h	447 btu/h	590 btu/h	722 btu/h	848 btu/h	967 btu/h				
	Water Flow	0.2 gpm	0.2 gpm	0.3 gpm	0.3 gpm	0.4 gpm				
	Water ΔP	0.05 ft	0.08 ft	0.12 ft	0.17 ft	0.22 ft				
	Heating btu/h	246 btu/h	325 btu/h	398 btu/h	467 btu/h	533 btu/h				
	btu/h/ft	32 cfm	42 cfm	53 cfm	64 cfm	74 cfm				
	Primary Air btu/h	131 btu/h	175 btu/h	219 btu/h	262 btu/h	306 btu/h				
	Total btu/h	578 btu/h	764 btu/h	940 btu/h	1110 btu/h	1273 btu/h				
6		**11 cfm**	**13 cfm**	**15 cfm**	**17 cfm**	**19 cfm**	**21 cfm**	**23 cfm**		
	btu/h/ft	168 b/h/ft	200 b/h/ft	232 b/h/ft	263 b/h/ft	291 b/h/ft	317 b/h/ft	349 b/h/ft		
	Throw ft	1.3-3.6-5.9	1.6-4.2-7.2	1.9-4.9-8.2	1.9-5.5-9.5	2.2-6.2-10.4	2.6-6.5-11.4	2.9-7.2-12.4		
	Static in/wg	0.18 in/wg	0.26 in/wg	0.35 in/wg	0.46 in/wg	0.58 in/wg	0.71 in/wg	0.86 in/wg		
	dB(A)	23	26	26	31	34	36	37		
	Water btu/h	774 btu/h	920 btu/h	1062 btu/h	1201 btu/h	1322 btu/h	1437 btu/h	1581 btu/h		
	Water Flow	0.3 gpm	0.3 gpm	0.4 gpm	0.4 gpm	0.5 gpm	0.5 gpm	0.6 gpm		
	Water ΔP	0.18 ft	0.26 ft	0.34 ft	0.44 ft	0.53 ft	0.63 ft	0.76 ft		
	Heating btu/h	427 btu/h	507 btu/h	585 btu/h	662 btu/h	729 btu/h	792 btu/h	871 btu/h		
	Total Air cfm	53 cfm	64 cfm	74 cfm	85 cfm	95 cfm	106 cfm	117 cfm		
	Primary Air btu/h	219 btu/h	262 btu/h	306 btu/h	350 btu/h	393 btu/h	437 btu/h	481 btu/h		
	Total btu/h	993 btu/h	1182 btu/h	1368 btu/h	1550 btu/h	1716 btu/h	1874 btu/h	2062 btu/h		
8		**13 cfm**	**15 cfm**	**17 cfm**	**19 cfm**	**21 cfm**	**23 cfm**	**25 cfm**	**27 cfm**	**29 cfm**
	btu/h/ft	157 b/h/ft	183 b/h/ft	208 b/h/ft	232 b/h/ft	255 b/h/ft	279 b/h/ft	301 b/h/ft	326 b/h/ft	346 b/h/ft
	Throw ft	1.3-3.2-5.5	1.3-3.9-6.5	1.6-4.2-7.5	1.9-4.9-8.2	1.9-5.2-9.1	2.2-5.9-10.1	2.2-6.2-10.8	2.6-6.8-11.8	2.9-7.2-12.4
	Static in/wg	0.14 in/wg	0.20 in/wg	0.26 in/wg	0.32 in/wg	0.40 in/wg	0.48 in/wg	0.58 in/wg	0.68 in/wg	0.78 in/wg
	dB(A)	23	24	26	28	30	33	35	36	38
	Water btu/h	974 btu/h	1136 btu/h	1285 btu/h	1431 btu/h	1573 btu/h	1712 btu/h	1848 btu/h	2002 btu/h	2109 btu/h
	Water Flow	0.4 gpm	0.4 gpm	0.5 gpm	0.5 gpm	0.6 gpm	0.6 gpm	0.7 gpm	0.7 gpm	0.8 gpm
	Water ΔP	0.38 ft	0.51 ft	0.66 ft	0.81 ft	0.98 ft	1.16 ft	1.35 ft	1.59 ft	1.76 ft
	Heating btu/h	537 btu/h	626 btu/h	708 btu/h	789 btu/h	867 btu/h	944 btu/h	1018 btu/h	1103 btu/h	1162 btu/h
	Total Air cfm	64 cfm	74 cfm	85 cfm	95 cfm	106 cfm	117 cfm	127 cfm	138 cfm	148 cfm
	Primary Air btu/h	262 btu/h	306 btu/h	350 btu/h	393 btu/h	437 btu/h	481 btu/h	524 btu/h	568 btu/h	612 btu/h
	Total btu/h	1236 btu/h	1442 btu/h	1635 btu/h	1824 btu/h	2010 btu/h	2193 btu/h	2372 btu/h	2570 btu/h	2721 btu/h
10		**17 cfm**	**19 cfm**	**21 cfm**	**23 cfm**	**25 cfm**	**27 cfm**	**29 cfm**	**31 cfm**	**33 cfm**
	btu/h/ft	156 b/h/ft	175 b/h/ft	195 b/h/ft	213 b/h/ft	230 b/h/ft	250 b/h/ft	268 b/h/ft	285 b/h/ft	304 b/h/ft
	Throw ft	1.3-3.2-5.5	1.3-3.6-6.2	1.6-3.9-6.8	1.6-4.2-7.5	1.9-4.9-8.2	1.9-5.2-8.8	2.2-5.5-9.5	2.2-5.9-10.1	2.2-6.2-10.8
	Static in/wg	0.16 in/wg	0.21 in/wg	0.26 in/wg	0.31 in/wg	0.37 in/wg	0.43 in/wg	0.50 in/wg	0.58 in/wg	0.66 in/wg
	dB(A)	22	25	28	30	32	33	35	37	38
	Water btu/h	1455 btu/h	1619 btu/h	1799 btu/h	1959 btu/h	2114 btu/h	2291 btu/h	2440 btu/h	2587 btu/h	2759 btu/h
	Water Flow	0.5 gpm	0.6 gpm	0.7 gpm	0.7 gpm	0.8 gpm	0.8 gpm	0.9 gpm	1.0 gpm	1.0 gpm
	Water ΔP	1.02 ft	1.26 ft	1.55 ft	1.84 ft	2.15 ft	2.52 ft	2.86 ft	3.21 ft	3.65 ft
	Heating btu/h	802 btu/h	893 btu/h	992 btu/h	1079 btu/h	1165 btu/h	1262 btu/h	1345 btu/h	1426 btu/h	1521 btu/h
	Total Air cfm	85 cfm	95 cfm	106 cfm	117 cfm	127 cfm	138 cfm	148 cfm	159 cfm	170 cfm
	Primary Air btu/h	350 btu/h	393 btu/h	437 btu/h	481 btu/h	524 btu/h	568 btu/h	612 btu/h	656 btu/h	699 btu/h
	Total btu/h	1538 btu/h	1719 btu/h	1916 btu/h	2093 btu/h	2267 btu/h	2463 btu/h	2633 btu/h	2801 btu/h	2995 btu/h

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
Water Flow	Water flow rate gpm
Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
17	1.06
16	1.00
15	0.94
14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams

Beam performance Nozzle B - 1 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F

Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	13 cfm	17 cfm	21 cfm	25 cfm	30 cfm	34 cfm		
4	btu/h/ft	254 b/h/ft	335 b/h/ft	415 b/h/ft	494 b/h/ft	571 b/h/ft	646 b/h/ft		
	Throw ft	1.9-5.2-9.1	2.6-7.2-12.1	3.2-8.8-15	3.9-10.4-18	4.5-12.1-20.6	5.2-13.7-23.6		
	Static in/wg	0.14 in/wg	0.26 in/wg	0.40 in/wg	0.58 in/wg	0.78 in/wg	1.02 in/wg		
	dB(A)	31	37	42	48	53	53		
	Water btu/h	737 btu/h	970 btu/h	1198 btu/h	1419 btu/h	1634 btu/h	1842 btu/h		
	Water Flow	0.3 gpm	0.4 gpm	0.4 gpm	0.5 gpm	0.6 gpm	0.7 gpm		
	Water ΔP	0.13 ft	0.22 ft	0.34 ft	0.47 ft	0.63 ft	0.80 ft		
	Heating btu/h	406 btu/h	535 btu/h	660 btu/h	782 btu/h	900 btu/h	1015 btu/h		
	btu/h/ft	53 cfm	71 cfm	89 cfm	107 cfm	125 cfm	142 cfm		
	Primary Air btu/h	262 btu/h	350 btu/h	437 btu/h	524 btu/h	612 btu/h	699 btu/h		
	Total btu/h	999 btu/h	1320 btu/h	1635 btu/h	1943 btu/h	2246 btu/h	2542 btu/h		
6		**21 cfm**	**25 cfm**	**30 cfm**	**34 cfm**	**38 cfm**	**42 cfm**	**47 cfm**	**51 cfm**
	btu/h/ft	290 b/h/ft	345 b/h/ft	403 b/h/ft	456 b/h/ft	508 b/h/ft	559 b/h/ft	615 b/h/ft	665 b/h/ft
	Throw ft	2.2-6.2-10.4	2.9-7.2-12.4	3.2-8.5-14.4	3.6-9.5-16.4	4.2-10.8-18.3	4.5-11.8-20.3	5.2-13.1-22.3	5.5-14.1-24.2
	Static in/wg	0.18 in/wg	0.26 in/wg	0.35 in/wg	0.46 in/wg	0.58 in/wg	0.71 in/wg	0.86 in/wg	1.02 in/wg
	dB(A)	32	37	40	45	48	51	53	56
	Water btu/h	1277 btu/h	1514 btu/h	1766 btu/h	1993 btu/h	2213 btu/h	2427 btu/h	2670 btu/h	2874 btu/h
	Water Flow	0.5 gpm	0.6 gpm	0.7 gpm	0.7 gpm	0.8 gpm	0.9 gpm	1.0 gpm	1.1 gpm
	Water ΔP	0.50 ft	0.70 ft	0.95 ft	1.21 ft	1.49 ft	1.79 ft	2.17 ft	2.51 ft
	Heating btu/h	704 btu/h	834 btu/h	973 btu/h	1098 btu/h	1220 btu/h	1338 btu/h	1471 btu/h	1584 btu/h
	Total Air cfm	89 cfm	107 cfm	125 cfm	142 cfm	160 cfm	178 cfm	196 cfm	214 cfm
	Primary Air btu/h	437 btu/h	524 btu/h	612 btu/h	699 btu/h	787 btu/h	874 btu/h	962 btu/h	1049 btu/h
	Total btu/h	1715 btu/h	2038 btu/h	2378 btu/h	2692 btu/h	3000 btu/h	3301 btu/h	3631 btu/h	3923 btu/h
8		**34 cfm**	**38 cfm**	**42 cfm**	**47 cfm**	**51 cfm**	**55 cfm**	**59 cfm**	
	btu/h/ft	358 b/h/ft	402 b/h/ft	443 b/h/ft	487 b/h/ft	526 b/h/ft	570 b/h/ft	608 b/h/ft	
	Throw ft	2.9-7.5-12.7	3.2-8.5-14.4	3.6-9.5-16	3.9-10.1-17.7	4.2-11.1-19	4.5-12.1-20.6	4.9-12.7-21.9	
	Static in/wg	0.26 in/wg	0.32 in/wg	0.40 in/wg	0.48 in/wg	0.58 in/wg	0.68 in/wg	0.78 in/wg	
	dB(A)	40	44	45	48	50	54	58	
	Water btu/h	2115 btu/h	2380 btu/h	2611 btu/h	2872 btu/h	3093 btu/h	3351 btu/h	3561 btu/h	
	Water Flow	0.8 gpm	0.9 gpm	1.0 gpm	1.1 gpm	1.1 gpm	1.2 gpm	1.3 gpm	
	Water ΔP	1.78 ft	2.25 ft	2.70 ft	3.27 ft	3.79 ft	4.45 ft	5.03 ft	
	Heating btu/h	1166 btu/h	1312 btu/h	1439 btu/h	1583 btu/h	1704 btu/h	1847 btu/h	1963 btu/h	
	Total Air cfm	142 cfm	160 cfm	178 cfm	196 cfm	214 cfm	231 cfm	249 cfm	
	Primary Air btu/h	699 btu/h	787 btu/h	874 btu/h	962 btu/h	1049 btu/h	1136 btu/h	1224 btu/h	
	Total btu/h	2815 btu/h	3167 btu/h	3485 btu/h	3833 btu/h	4142 btu/h	4487 btu/h	4785 btu/h	
10		**42 cfm**	**47 cfm**	**51 cfm**	**55 cfm**	**59 cfm**	**64 cfm**	**68 cfm**	
	btu/h/ft	390 b/h/ft	429 b/h/ft	463 b/h/ft	502 b/h/ft	540 b/h/ft	573 b/h/ft	612 b/h/ft	
	Throw ft	3.2-8.2-14.1	3.6-9.1-15.4	3.9-9.8-16.7	4.2-10.4-18.3	4.5-11.4-19.6	4.9-12.1-20.6	5.2-13.1-22.3	
	Static in/wg	0.26 in/wg	0.31 in/wg	0.37 in/wg	0.43 in/wg	0.50 in/wg	0.58 in/wg	0.66 in/wg	
	dB(A)	43	46	49	51	54	58	60	
	Water btu/h	2962 btu/h	3258 btu/h	3509 btu/h	3801 btu/h	4094 btu/h	4330 btu/h	4619 btu/h	
	Water Flow	1.1 gpm	1.2 gpm	1.3 gpm	1.4 gpm	1.5 gpm	1.6 gpm	1.7 gpm	
	Water ΔP	4.21 ft	5.09 ft	5.91 ft	6.94 ft	8.04 ft	9.00 ft	10.24 ft	
	Heating btu/h	1632 btu/h	1795 btu/h	1934 btu/h	2095 btu/h	2256 btu/h	2386 btu/h	2545 btu/h	
	Total Air cfm	178 cfm	196 cfm	214 cfm	231 cfm	249 cfm	267 cfm	285 cfm	
	Primary Air btu/h	874 btu/h	962 btu/h	1049 btu/h	1136 btu/h	1224 btu/h	1311 btu/h	1399 btu/h	
	Total btu/h	3836 btu/h	4219 btu/h	4558 btu/h	4938 btu/h	5318 btu/h	5641 btu/h	6017 btu/h	

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
Water Flow	Water flow rate gpm
Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
17	1.06
16	1.00
15	0.94
14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams
Beam performance Nozzle C - 1 way discharge

Performance Parameters

Return Air 76.1 °F Room Air 75.2 °F Primary Air 57.2 °F Supply Water 57.2 °F Return Water 62.6 °F
Supply Water Heating 113.0 °F Return Water Heating 95.0 °

Beam Length (ft)	Primary Air cfm	21 cfm	28 cfm	34 cfm	40 cfm	47 cfm	53 cfm		
4	btu/h/ft	353 b/h/ft	459 b/h/ft	558 b/h/ft	656 b/h/ft	733 b/h/ft	814 b/h/ft		
	Throw ft	2.9-7.5-12.7	3.9-9.8-16.7	4.5-11.8-20.3	5.5-14.1-23.9	6.2-15.7-26.5	6.8-17.3-29.5		
	Static in/wg	0.18 in/wg	0.30 in/wg	0.46 in/wg	0.64 in/wg	0.86 in/wg	1.11 in/wg		
	dB(A)	31	37	42	48	53	53		
	Water btu/h	952 btu/h	1238 btu/h	1499 btu/h	1750 btu/h	1925 btu/h	2111 btu/h		
	Water Flow	0.4 gpm	0.5 gpm	0.6 gpm	0.6 gpm	0.7 gpm	0.8 gpm		
	Water ΔP	0.21 ft	0.36 ft	0.53 ft	0.72 ft	0.87 ft	1.05 ft		
	Heating btu/h	525 btu/h	682 btu/h	826 btu/h	965 btu/h	1061 btu/h	1163 btu/h		
	btu/h/ft	72 cfm	94 cfm	115 cfm	137 cfm	159 cfm	180 cfm		
	Primary Air btu/h	437 btu/h	568 btu/h	699 btu/h	830 btu/h	962 btu/h	1093 btu/h		
	Total btu/h	1389 btu/h	1806 btu/h	2198 btu/h	2581 btu/h	2887 btu/h	3204 btu/h		
		34 cfm	**40 cfm**	**47 cfm**	**53 cfm**	**59 cfm**	**66 cfm**	**72 cfm**	
6	btu/h/ft	387 b/h/ft	459 b/h/ft	526 b/h/ft	598 b/h/ft	662 b/h/ft	716 b/h/ft	776 b/h/ft	
	Throw ft	3.2-8.2-14.1	3.9-9.8-16.7	4.2-11.1-19	4.9-12.7-21.6	5.5-14.1-23.9	5.9-15.4-25.9	6.5-16.4-28.2	
	Static in/wg	0.20 in/wg	0.29 in/wg	0.38 in/wg	0.49 in/wg	0.62 in/wg	0.76 in/wg	0.91 in/wg	
	dB(A)	45	42	45	50	52	55	60	
	Water btu/h	1584 btu/h	1881 btu/h	2143 btu/h	2435 btu/h	2683 btu/h	2871 btu/h	3095 btu/h	
	Water Flow	0.6 gpm	0.7 gpm	0.8 gpm	0.9 gpm	1.0 gpm	1.1 gpm	1.1 gpm	
	Water ΔP	0.76 ft	1.07 ft	1.39 ft	1.80 ft	2.19 ft	2.50 ft	2.91 ft	
	Heating btu/h	873 btu/h	1037 btu/h	1181 btu/h	1342 btu/h	1478 btu/h	1582 btu/h	1705 btu/h	
	Total Air cfm	115 cfm	137 cfm	159 cfm	180 cfm	202 cfm	223 cfm	245 cfm	
	Primary Air btu/h	699 btu/h	830 btu/h	962 btu/h	1093 btu/h	1224 btu/h	1355 btu/h	1486 btu/h	
	Total btu/h	2283 btu/h	2711 btu/h	3104 btu/h	3528 btu/h	3906 btu/h	4226 btu/h	4581 btu/h	
		47 cfm	**53 cfm**	**59 cfm**	**66 cfm**	**72 cfm**	**78 cfm**	**85 cfm**	**91cfm**
8	btu/h/ft	412 b/h/ft	468 b/h/ft	525 b/h/ft	574 b/h/ft	622 b/h/ft	677 b/h/ft	724 b/h/ft	769 b/h/ft
	Throw ft	3.2-8.8-15	3.9-9.8-17	4.2-11.1-19	4.9-12.1-20.9	5.2-13.1-22.6	5.5-14.4-24.6	6.2-15.4-26.2	6.5-16.4-27.8
	Static in/wg	0.22 in/wg	0.28 in/wg	0.35 in/wg	0.43 in/wg	0.51 in/wg	0.61 in/wg	0.71 in/wg	0.82 in/wg
	dB(A)	42	47	50	52	56	58	61	64
	Water btu/h	2283 btu/h	2594 btu/h	2905 btu/h	3165 btu/h	3414 btu/h	3715 btu/h	3950 btu/h	4174 btu/h
	Water Flow	0.8 gpm	1.0 gpm	1.1 gpm	1.2 gpm	1.3 gpm	1.4 gpm	1.5 gpm	1.5 gpm
	Water ΔP	2.07 ft	2.67 ft	3.35 ft	3.97 ft	4.62 ft	5.48 ft	6.19 ft	6.91 ft
	Heating btu/h	1258 btu/h	1430 btu/h	1601 btu/h	1744 btu/h	1882 btu/h	2048 btu/h	2177 btu/h	2300 btu/h
	Total Air cfm	159 cfm	180 cfm	202 cfm	223 cfm	245 cfm	267 cfm	288 cfm	310 cfm
	Primary Air btu/h	962 btu/h	1093 btu/h	1224 btu/h	1355 btu/h	1486 btu/h	1617 btu/h	1748 btu/h	1879 btu/h
	Total btu/h	3244 btu/h	3687 btu/h	4129 btu/h	4520 btu/h	4900 btu/h	5333 btu/h	5698 btu/h	6053 btu/h
		59 cfm	**66 cfm**	**72 cfm**	**78 cfm**	**85 cfm**	**91 cfm**	**97 cfm**	**104 cfm**
10	btu/h/ft	455 b/h/ft	504 b/h/ft	553 b/h/ft	594 b/h/ft	642 b/h/ft	682 b/h/ft	730 b/h/ft	768 b/h/ft
	Throw ft	3.6-9.5-16.4	4.2-10.8-18.3	4.5-11.8-20	4.9-12.7-21.6	5.2-13.7-23.2	5.5-14.4-24.9	6.2-15.4-26.5	6.5-16.4-27.8
	Static in/wg	0.22 in/wg	0.27 in/wg	0.33 in/wg	0.39 in/wg	0.46 in/wg	0.53 in/wg	0.60 in/wg	0.68 in/wg
	dB(A)	46	50	54	54	58	60	63	65
	Water btu/h	3254 btu/h	3603 btu/h	3951 btu/h	4231 btu/h	4574 btu/h	4836 btu/h	5173 btu/h	5419 btu/h
	Water Flow	1.2 gpm	1.3 gpm	1.5 gpm	1.6 gpm	1.7 gpm	1.8 gpm	1.9 gpm	2.0 gpm
	Water ΔP	5.08 ft	6.23 ft	7.49 ft	8.59 ft	10.04 ft	11.23 ft	12.85 ft	14.10 ft
	Heating btu/h	1793 btu/h	1985 btu/h	2178 btu/h	2332 btu/h	2521 btu/h	2665 btu/h	2851 btu/h	2986 btu/h
	Total Air cfm	188 cfm	219 cfm	252 cfm	286 cfm	322 cfm	358 cfm	397 cfm	436 cfm
	Primary Air btu/h	1224 btu/h	1355 btu/h	1486 btu/h	1617 btu/h	1748 btu/h	1879 btu/h	2011 btu/h	2142 btu/h
	Total btu/h	4478 btu/h	4958 btu/h	5437 btu/h	5848 btu/h	6322 btu/h	6715 btu/h	7184 btu/h	7561 btu/h

Recommended maximum heating capacity for the above beams is equal to 50% of the indicated cooling potential.
The return air to the beam is taken as 1 °F above the average room for the values above.

Notations

b/h/ft	Cooling capacity per linear foot of chilled beam
Throw ft	Throw values are to 150 - 100 - and 50 fpm respectively.
Static in/wg	Static pressure in beam plenum chamber in/wg
dB(A)	Air regenerated sound power level
Water btu/h	Cooling output of coil btu/h
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Water ΔP	Coil pressure drop in/wg
Total Air cfm	Total discharge air volume from beam cfm
Primary Air btu/h	Cooling capacity of the primary air btu/h
Total btu/h	Total cooling capacity of the chilled beam btu/h

Correction Table	
K	Water W
20	1.25
19	1.18
18	1.12
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14	0.88
13	0.82
12	0.75

The thermal data is based on 16 K between mean water and return air to the beam.
For example - If the room temperature of the design in question is 76 °F the K is increased to 17 as the data above is based on a room of 75 °F.

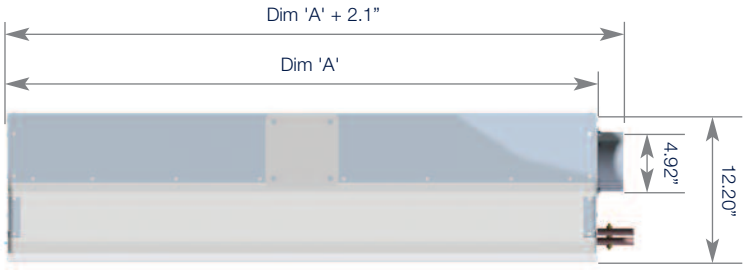
dB(A)	fpm
40	800
35	700
30	600
25	500
20	400

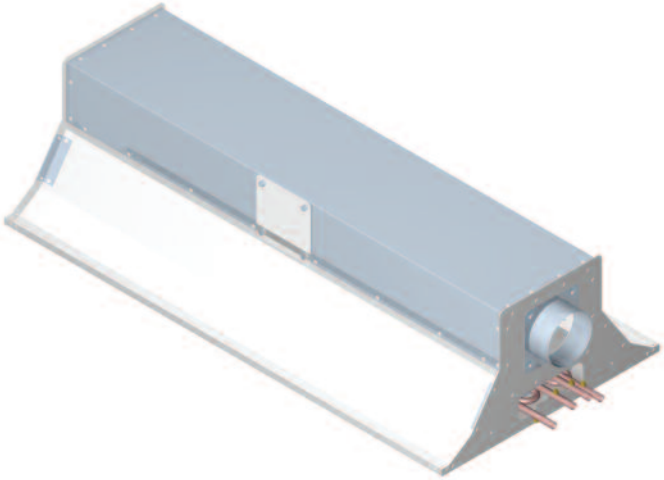
The sound power dB(A) levels are achieved by limiting the primary air spigot velocity as per the table above.

Active Chilled Beams - Dimensional Data

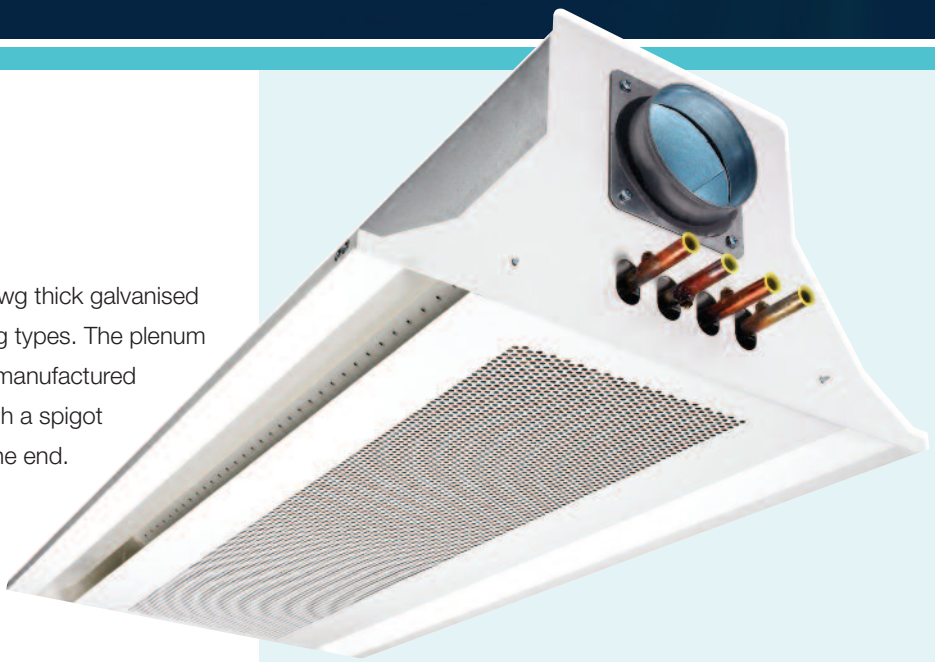
Active Chilled Beams

Nominal Size	Dim A	Wet Weight (lb)
4	47 3/4”	71
6	71 3/4”	97
8	95 3/4”	126
10	119 3/4”	152





Active Chilled Beams - Specification



Frame & Casing

The frame is manufactured from 16 swg thick galvanised mild steel and suitable for most ceiling types. The plenum section is fitted to the top of the unit manufactured from 20 swg galvanised mild steel with a spigot connection mounted on the side or the end.

Fixed hanger supports brackets are mounted on the top of the unit as standard. Adjustable sliding brackets are available as an option.

The unit is supplied with a powder coated finish RAL 9010 Semi Gloss as standard other colours are available as an option.

Access Panel

Access panel is manufactured from 20 swg thick galvanised mild steel.
The free area of the perforated sections are 50% & the whole size of the perforations is approx. 0.19”.
The access panel has safety wires that are attached to the main body of the unit. These are designed to stop the panel falling & can also be used to suspend the panel for access to the coil for maintenance.

Coil

Manufactured from copper tubes with mechanically bonded aluminium fins. Available in both 2 pipe, cooling only & 4 pipe, heating & cooling. The coil is supported at either end of the unit, on longer units the coil is also supported in the middle. Coils are supplied as standard with vent & drain points.

Controls

Controls, including water valves can be factory fitted as required on individual projects. Free issue components can be fitted and/or full control packages can be supplied.

Other products from Advanced Air

Air Distribution Equipment

- Grilles and diffusers including louvre face diffusers
- Linear slot diffusers
- Linear bar grilles
- Eggcrate grilles and door transfer grilles
- A variety of finishes, powder coated to RAL9010 as standard, with other colours available
- Floor swirl diffusers which supply a low velocity, helical discharge air pattern
- “Twister” ceiling swirl diffuser
- External weather louvers suitable for most wall configurations

Air Control Products

- Low leakage fire smoke dampers, tested to BS ISO 10294
- Smoke and high temperature smoke dampers, which can be used up to 300°C for 120 minutes
- Curtain fire dampers provide a wide range of models suitable for most applications
- Control dampers from value solutions to a low leakage, low pressure drop, airfoil blade type

VAV Terminal Units

- Single duct and dual duct units for different types of variable air volume systems
- Fan Powered VAV units that use advance Brushless DC motors to give lower energy consumption and simpler commissioning

Control Panels

- Fire smoke damper control panels are available to provide solutions to suit all requirements
- Bespoke units, which can be manufactured to suit specific customer requirements

For more information on these products, please contact Advanced Air Sales

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