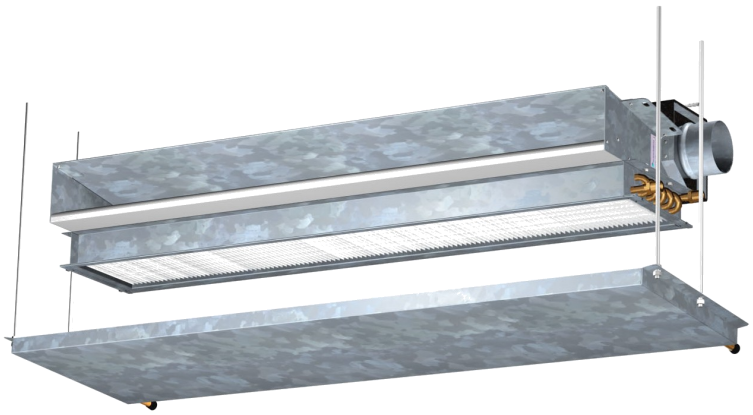
DADANCO

Breathing Life Into Your Building

Active Chilled Beams



ACB10 Bulkhead-Mounted Concealed
(Horizontal discharge)

Technical Data — Bulkhead-Mounted Concealed Model With Horizontal Coil and Auxiliary Drain Pan

APPLICATION CONSIDERATIONS

The general design intent of an Active Chilled Beam system is for the central system to circulate only the amount of primary air needed for ventilation and latent load purposes, with the Active Chilled Beams providing the additional sensible cooling (and heating) and air movement required through the induced room air and secondary water coil.

Active Chilled Beam systems transfer a large portion of the cooling (and heating loads) from the less efficient air distribution system (fans and ductwork) to the more efficient water distribution system (pumps and pipes). The net result of this shift in loads is lower energy consumption and operating costs.

Primary Air System

There are a number of important issues affected by the primary airflow rates, pressure and temperature chosen in the primary air system design as follows:

- Ventilation Air Requirements
- Primary Air Latent Cooling Capacities
- Risk of Over-cooling/Reheating
- Building Pressurization Control

Choosing the primary air flow rates and temperature requires considerable thought and judgment. Decreasing the primary air temperatures offers the opportunity to decrease fan energy consumption (within the limits of the ventilation air requirement) and increasing latent cooling capacities, while potentially increasing the risks of over-cooling/reheating.

Other design concerns with the primary air system design include:

- Air Handler/Ductwork Zoning and Resetting of Primary Air Temperatures
- Air Distribution Considerations
- Noise Level Requirements
- Heating

Secondary Water System

The chilled water temperature entering the Active Chilled Beam secondary water coils must be at or above the room design dew point temperature to avoid formation of condensate on the coil. Using the room design temperature of 75 °F db/ 62.5°F wb (50% relative humidity), the room air dew point temperature is 55.0 °F. In this case the minimum entering chilled water temperature to the Active Chilled Beams should be 55.0 °F or higher (typically around 56-58 °F is used in North America).

Choosing the secondary chilled water temperature is another area requiring considerable thought and judgment. A higher chilled water temperature will add to the margin of safety relative to condensation concerns and increase the hours when a water-side economizer can be used to serve the active chilled beams, but could have the effect of increasing the fan and pump energy requirements and unit costs.

Heating

The suitability of the use of overhead heating from the ceiling in any system (Active Chilled Beam, VAV, etc) is dependent on the extent of heat losses along the perimeter. In general overhead heating is acceptable if the heat losses are less than 400 Btuh/linear foot along the perimeter. The air distribution discharge arrangements employed vary based on the extent of heat losses along the perimeter.

UNIT SELECTION

There are two methods for selecting DADANCO Active Chilled Beams – a manual method using the enclosed tables and an optimized design method using the DADANCO Specifier™ computerized product selection program. The following will demonstrate the manual selection method using the data from the Quick Selection Capacity and Sound Level tables. For optimized unit selections using the DADANCO Specifier™ computerized product selection program or for special selection assistance, contact Dadanco LLC via phone (413) 564 — 5657, fax (413) 568—5384 or e-mail at info@dadanco.com.

MANUAL SELECTION METHOD

The unit performance data in the Quick Selection Capacity tables in this publication is given for the ACB10 (horizontal discharge) bulkhead-mounted concealed model in both 2-pipe and 4-pipe coil configurations. The capacity ratings are based on a "typical" nozzle selections. With the optimized design method using the DADANCO Specifier™ computerized selection program, both the size/number of nozzles will vary and will be optimized to provide the exact performance required.

Ventilation Air

To begin your unit selections determine the minimum ventilation air required for each zone (using as a minimum that prescribed by ASHRAE 62). This would be the minimum amount of primary air that could delivered to the Active Chilled Beams in each zone.

Latent Cooling

Prior to selecting the Active Chilled Beams the primary air quantity and temperature must be determined to provide for adequate ventilation air, as well as for the latent cooling capacity required. It is very important that both of these requirements are determined and satisfied by the primary air in every zone before selecting the Active Chilled Beams.

Using the ventilation air quantity as the primary air quantity, determine the latent cooling being provided by the primary air based on the airflow, room design and primary air temperatures chosen. Compare the latent cooling capacity being provided by the primary air to the latent load in each zone. Often times the primary air quantity and temperature will be driven by the latent cooling loads and more (or preferably colder/drier) primary air will be required than that needed solely for ventilation air purposes to satisfy the zone latent loads.

Remember that the latent loads in an Active Chilled Beam system must be fully satisfied by the primary air as insufficient latent cooling capacities can lead to condensation issues.

Active Chilled Beam Unit Type

The type of unit (s) to be selected must be chosen. This publication includes data for the bulkhead-mounted concealed models.

Bulkhead-Mounted Concealed Models		
Model	Air Discharge	Coil Configuration
ACB10	Horizontal	2-Pipe
ACB10	Horizontal	4-Pipe

Quick Selection Cooling and Heating Capacity Tables

The performance data in the Quick Selection Capacity tables are based on assumed operating conditions of:

- 0.5 "w.c. inlet static pressure
- 75 °F db/62.5 °F wb room design temperature (50% relative humidity, 0.00925 Lb $_{Water}$/Lb $_{Dry\ Air}$ humidity ratio)
- 54.0 °F db/ 52.4 °F wb primary air temperature (90% relative humidity, 0.00800 Lb $_{Water}$/Lb $_{Dry\ Air}$ humidity ratio)
- 56.0 °F entering chilled water temperature for cooling
- 130.0 °F entering hot water temperature for heating
- 1.6 GPM water flow rate
- Sea level elevation

The correction factor tables can be used to adjust the cooling and heating capacities shown in the Quick Selection Capacity tables for operating conditions that differ from the above assumptions.

Sensible Cooling

The Quick Selection Cooling Capacity tables show the sensible and latent cooling capacity being provided by the primary air, the sensible cooling capacity being provided by the secondary water coil and the total unit sensible cooling capacity.

Example

Assume we want to select an ACB10 2-pipe unit and that the total sensible cooling capacity required was 5,000 Btuh with a minimum primary airflow of 60 CFM. Using the correct Quick Selection Cooling Capacity table on page 7, a total sensible cooling capacity of 5,115 Btuh (1,365 Btuh from the primary air and 3,750 Btuh from the secondary water coil) could be provided by a 5 foot unit using 60 CFM of primary air. Remember this amount of primary air must be sufficient to provide the necessary ventilation air and latent cooling capacities required.

The performance data in the Quick Selection Cooling Capacity tables is based on $T_{RA} - T_{PA}$ of 21 °F (75 ºF — 54 ºF).

Use the correction factor for primary air temperature less room design temperature differences other than the 21 °F ΔT temperature difference used in the Quick Selection Cooling Capacity tables.

Primary Air Temperature Correction Factor — Cooling		
Primary Air Temperature T_{PA} (° F)	Δ Temperature Room Air — Primary Air $T_{RA} - T_{PA}$ (° F)	Correction Factor Applied to Primary Air Sensible Cooling Capacity K_{PA}
50	25	1.19
52	23	1.10
54	21	1.00
56	19	0.90
58	17	0.81
60	15	0.71
62	13	0.62
64	11	0.52
66	9	0.43
68	7	0.33

Example

Using the above base unit selection, the sensible cooling being provided by the primary air is 1,365 Btuh. If the primary air temperature was 52 °F (rather than the 54 ° F assumed in the tables), the actual temperature difference is 23 °F (rather than the 21 °F used in the tables). The corrected sensible cooling capacity of the primary air at the 23 °F ΔT is 1,502 Btuh (1,365 Btuh x 1.10).

The performance data in the Quick Selection Cooling Capacity tables is based on a $T_{RA} - T_{CHW}$ of 19 °F ΔT (75 ºF — 56 ºF).

Use the correction factor for room design temperature less chilled water temperatures other than the 19 °F ΔT temperature difference used in the Quick Selection Cooling Capacity tables.

Water Temperature Correction Factor — Cooling		
Chilled Water Temperature T_{CHW} (° F)	Δ Temperature Room Air — Chilled Water $T_{RA} - T_{CHW}$ (° F)	Correction Factor Applied to Secondary Coil Sensible Cooling Capacity K_{CHW}
56	19	1.00
57	18	0.95
58	17	0.89
59	16	0.84
60	15	0.79

Example

Using the above base unit selection, the sensible cooling capacity being provided by the secondary water coil is 3,750 Btuh. If the chilled water temperature was 58 °F (rather than the 56 ºF assumed in the tables), the actual temperature difference is 17 °F (rather than the 19 °F used in the tables). The corrected sensible cooling capacity of the secondary water coil at the 17 °F ΔT is 3,338 Btuh (3,750 Btuh x 0.89). Remember that the chilled water temperature must be above the room dew point temperature to avoid condensation issues.

Throw and Sound Levels

Consult the Throw and Sound Level tables to ensure proper air distribution and noise levels within each zone. Use conventional air distribution application guidelines when considering placement of the Active Chilled Beams. Throw performance will be determined depending on the supply air outlet diffuser chosen for use with the ACB10.

Heating

The Quick Selection Heating Capacity tables show the sensible heating being provided by the primary air, the sensible heating being provided by the secondary water coil and the total unit sensible heating capacity. Remember that if the primary in the heating mode is being delivered at a temperature below the room design temperature, the heating required to bring the primary air up to the room design temperature must be added to the heating load that must be satisfied by the Active Chilled Beam's secondary water coil.

Example

Using the same base unit selection and the correct Quick Selection Capacity table on page 8, the unit would provide a total sensible heating capacity of 10,280 Btuh (-1,170 Btuh from the primary air and 11,450 Btuh from the secondary water coil) using 60 CFM of primary air (based on the operating condition assumptions used in the Quick Selection Heating Capacity tables).

The performance data in the Quick Selection Heating Capacity tables are based on a room design temperature less primary air temperature of 18°F ΔT temperature difference (72 °F — 54 °F). For primary air temperatures other than the 54 °F adjust the amount of heating being provided by the primary air using the formula of:

$$Q_{PA} = 1.085 \times PA \times (T_{PA} - T_{RA})$$

Example

Using the above base unit selection, the sensible heating being provided by the primary air is -1,170 Btuh. If the primary air temperature was 65 °F (rather than the 54 ° F assumed in the tables), the corrected sensible heating capacity of the primary air is –456 Btuh. The heating provided by the active chilled beam would increase to 10,994 Btuh (-456 Btuh from the primary air and 11,450 Btuh from the secondary water coil).

The performance data in the Quick Selection Heating Capacity tables is based on a T_{HW}—T_{RA} OF 58 °F (130 °F — 72 °F).

Use the correction factor for hot water temperature less room design temperature other than the 58 °F ΔT temperature difference used in the Quick Selection Heating Capacity tables.

Water Temperature Correction Factor — Heating		
Hot Water Temperature T_{HW} (° F)	Δ Temperture Hot Water—Room Air $T_{HW} - T_{RA}$ (° F)	Correction Factor Applied to Secondary Coil Heating Capacity K_{HW}
100	28	0.48
110	38	0.66
120	48	0.83
130	58	1.00
140	68	1.17
150	78	1.34
160	88	1.52

Example

Using the above base unit selection, the sensible heating being provided by the secondary water coil is 11,450 Btuh. If the hot water temperature was 120 °F (rather than the 130 °F assumed in the tables), the actual temperature difference is 48 °F (rather than the 58 °F used in the tables). The corrected sensible heating capacity of the secondary water coil at the 48 °F ΔT is 9,504 Btuh (11,450 Btuh x 0.83) and the active chilled beam heating capacity would decrease to 8,334 Btuh (-1,170 Btuh from the primary air and 9,504 Btuh from the secondary water coil).

WATER FLOW RATES

The cooling and heating capacities shown in the Quick Selection Capacity tables are based on water flows rates of 1.6 GPM. Use the water flow correction factor for water flow rates other than 1.6 GPM.

Water Flow Capacity Correction Factor — Cooling & Heating													
Water Flow (GPM)	2.4	2.2	2.1	1.9	1.7	1.6	1.4	1.3	1.1	1.0	0.8	0.6	0.5
2' Length	1.02	1.02	1.01	1.01	1.01	1.00	0.99	0.98	0.96	0.96	0.94	0.90	0.85
3' Length	1.02	1.02	1.02	1.01	1.01	1.00	0.99	0.98	0.96	0.95	0.93	0.89	0.82
4' Length	1.03	1.03	1.02	1.02	1.01	1.00	0.99	0.98	0.96	0.93	0.90	0.85	0.77
5' Length	1.04	1.03	1.03	1.02	1.01	1.00	0.99	0.97	0.95	0.92	0.88	0.82	0.72
6' Length	1.05	1.04	1.03	1.02	1.01	1.00	.098	0.96	0.94	0.90	0.85	0.78	0.67

Elevation

The performance data in the Quick Selection Capacity tabes is based air densities at sea level. Use the correction factor for elevations other than sea level.

Example

Using the previous example, the total sensible cooling being provided by the active chilled beam at sea level is 5,065 Btuh. If the installation was at 4,000 feet above sea level, the total unit sensible cooling capacity is 4,355 Btuh (5,065 Btuh x 0.86).

Elevation Correction Factor — Cooling & Heating	
Elevation Above Sea Level (Feet)	Correction Factor Applied to Capacities K_E
1000	0.96
2000	0.93
3000	0.90
4000	0.86
5000	0.83
6000	0.80

COMPUTERIZED SELECTION METHOD

The Dadanco's Specifier™ computerized selection program can be accessed on our website (www.dadanco.com). To request a selection, please contact your local sales representative (see our website for a listing of representatives). A list of the typical inputs needed for a unit selection is as follows:

Zone Information	IP Units	Range	Default	Input
Project Elevation	Feet		0	
Identification				
Floor Area	Sq. Ft.			
Sensible Cooling Load	Btuh			
Latent Cooling Load	Btuh			
Maximum NC Level *(Optional)*	NC	20 - 45	35	
Zone Attenuation Effect *(Optional)*	dB	4 - 10	10	
Ceiling Space Available *(Optional)*	In.			
Design Conditions				
Room Design Dry Bulb Temperature	° F	60 - 85	75	
Room Design Wet Bulb Temperature *OR*	° F			
Room Design Relative Humidity	%	0 - 100	50	
Primary Air Dry BulbTemperature	° F	42 - 68	54	
Primary Air Wet Bulb Temperature *OR*	° F			
Primary Air Relative Humidity	%	0 - 100	90	
Maximum Inlet Static Pressure	" w.c.	0.1 - 1.0	0.4	
Minimum Primary Airflow *OR*	CFM			
Minimum Primary Airflow (i.e. Ventilation Air Requirement)	CFM/Sq. Ft.			
Chilled Water Temperature	° F	53 - 60	56	
Maximum Chilled Water Flow Rate *(Optional)*	GPM	0.5 - 2.4	2.4	
Minimum Chilled Water Temperature Rise *(Optional)*	° F			
Maximum Chilled Water Pressure Drop *(Optional)*	FT			
Hot Water Temperature *(Optional if used for heating)*	° F			
Unit Information				
Nominal Unit Length *(Optional)*	FT		4 or 6	
Model *(Chose One or More to Consider)*:				*Check*
ACB10 – Horizontal Coil Concealed Bulkhead				
ACB30 – Vertical Coil 2-way Discharge Concealed Ceiling				
ACB35 – Vertical Coil 1-way Discharge Concealed Ceiling				
ACB40 – Horizontal Coil 2-Way Discharge Cassette Ceiling				
ACB50 – Horizontal Coil 1-way Discharge Cassette Ceiling				
Coil Configuration *(Chose One)*:				*Check*
2-pipe				
4-pipe				

ACB10 - 2-Pipe Quick Selection Cooling Capacity												
Primary Airflow (CFM)	Primary Air Cooling		Sensible Cooling (Btuh)									
	Sensible (Btuh)	Latent (Btuh)	Nominal 2 Foot Coil		Nominal 3 Foot Coil		Nominal 4 Foot Coil		Nominal 5 Foot Coil		Nominal 6 Foot Coil	
			Coil	Total	Coil	Total	Coil	Total	Coil	Total	Coil	Total
15	340	90	1175	1515								
20	455	120	1370	1825	1670	2125						
25	570	150	1525	2095	1875	2445	2090	2660				
30	685	180	1545	2230	2090	2775	2295	2980				
35	800	210			2335	3135	2500	3300	2810	3610		
40	910	240			2425	3335	2720	3630	3005	3915	3310	4220
45	1025	270			2475	3500	2960	3985	3200	4225	3510	4535
50	1140	300			2495	3635	3010	4150	3410	4550	3695	4835
55	1255	330					3070	4325	3625	4880	3860	5115
60	1365	365					3080	4445	3750	5115	4065	5430
65	1480	395							3860	5340	4280	5760
70	1595	425							3920	5515	4505	6100
75	1710	455							3950	5660	4575	6285
80	1825	485							3940	5765	4670	6495
85	1935	515									4735	6670
90	2050	545									4775	6825
95	2165	575									4780	6945
100	2280	605									4790	7070

Operating Conditions	
Room Design Dry Bulb Temperature	75.0 °F
Room Design Wet Bulb Temperature	62.5 °F
Room Design Relative Humidity	50.0 %
Room Design Dew Point Temperature	55.0 °F
Room Design Humidity Ratio	0.00925Lb $_{Water}$/Lb $_{Dry\ Air}$
Chilled Water Supply Temperature	56.0 °F
Chilled Water Flow Rate	1.6 GPM
Primary Air Dry Bulb Supply Temperature	54.0 °F
Primary Air Wet Bulb Temperature	52.4 °F
Primary Air Relative Humidity	90.0 %
Primary Air Humidity Ratio	0.00800Lb $_{Water}$/Lb $_{Dry\ Air}$
Primary Air Static Pressure	0.50 In. w.c.

ACB10 - 2-Pipe Quick Selection Heating Capacity												
Primary Airflow (CFM)	Primary Air Sensible (Btuh)	Sensible Heating (Btuh)										
		Nominal 2 Foot Coil		Nominal 3 Foot Coil		Nominal 4 Foot Coil		Nominal 5 Foot Coil		Nominal 6 Foot Coil	
		Coil	Total	Coil	Total	Coil	Total	Coil	Total	Coil	Total
15	-295	3590	3295								
20	-390	4175	3785	5095	4705						
25	-490	4650	4160	5725	5235	6375	5885				
30	-585	4715	4130	6380	5795	7000	6415				
35	-685			7125	6440	7620	6935	8585	7900		
40	-780			7400	6620	8300	7520	9175	8395	10095	9315
45	-880			7555	6675	9040	8160	9770	8890	10715	9835
50	-975			7580	6605	9190	8215	10405	9430	11285	10310
55	-1075					9670	8595	11065	9990	11790	10715
60	-1170					9395	8225	11450	10280	12410	11240
65	-1270							11775	10505	13065	11795
70	-1365							11970	10605	13745	12380
75	-1465							12050	10585	13960	12495
80	-1560							12070	10510	14260	12700
85	-1660									14460	12800
90	-1750									14570	12820
95	-1855									14590	12735
100	-1955									14610	12655

Operating Conditions	
Room Design Dry Bulb Temperature	72.0 °F
Room Design Wet Bulb Temperature	
Room Design Relative Humidity	
Room Design Dew Point Temperature	
Room Design Humidity Ratio	
Hot Water Supply Temperature	130.0 °F
Hot Water Flow Rate	1.6 GPM
Primary Air Dry Bulb Supply Temperature	54.0 °F
Primary Air Wet Bulb Temperature	
Primary Air Relative Humidity	
Primary Air Humidity Ratio	
Primary Air Static Pressure	0.50 In. w.c.

ACB10 - 4-Pipe Quick Selection Cooling Capacity												
Primary Airflow (CFM)	Primary Air Cooling		Sensible Cooling (Btuh)									
	Sensible (Btuh)	Latent (Btuh)	Nominal 2 Foot Coil		Nominal 3 Foot Coil		Nominal 4 Foot Coil		Nominal 5 Foot Coil		Nominal 6 Foot Coil	
			Coil	Total	Coil	Total	Coil	Total	Coil	Total	Coil	Total
15	340	90	1075	1415								
20	455	120	1240	1695	1495	1950						
25	570	150	1365	1935	1665	2235	1840	2410				
30	684	180	1385	2070	1835	2520	2005	2690				
35	800	210			2030	2830	2165	2965	2415	3215		
40	910	240			2100	3010	2335	3245	2570	3480	2810	3720
45	1025	270			2140	3165	2525	3550	2720	3745	2965	3990
50	1140	300			2150	3290	2565	3705	2880	4020	3110	4250
55	1255	330					2610	3865	3050	4305	3240	4495
60	1365	365					2615	3980	3145	4510	3395	4760
65	1480	395							3230	4710	3565	5045
70	1595	425							3280	4875	3740	5335
75	1710	455							3295	5005	3795	5505
80	1825	485							3305	5130	3870	5695
85	1935	515									3920	5855
90	2050	545									3950	6000
95	2165	575									3960	6125
100	2280	605									3970	6250

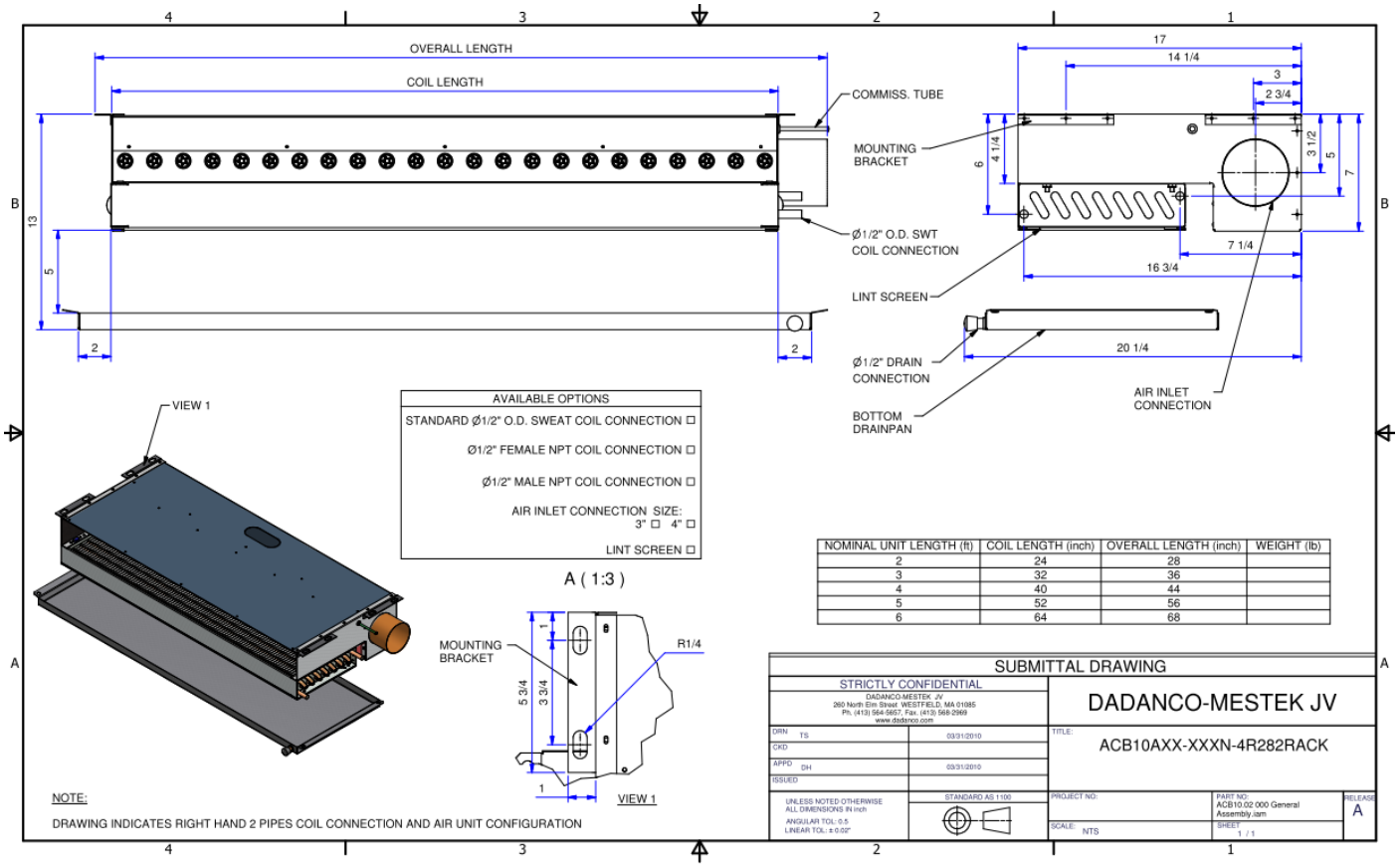
Operating Conditions	
Room Design Dry Bulb Temperature	75.0 °F
Room Design Wet Bulb Temperature	62.5 °F
Room Design Relative Humidity	50.0 %
Room Design Dew Point Temperature	55.0 °F
Room Design Humidity Ratio	0.00925Lb $_{Water}$/Lb $_{Dry\ Air}$
Chilled Water Supply Temperature	56.0 °F
Chilled Water Flow Rate	1.6 GPM
Primary Air Dry Bulb Supply Temperature	54.0 °F
Primary Air Wet Bulb Temperature	52.4 °F
Primary Air Relative Humidity	90.0 %
Primary Air Humidity Ratio	0.00800Lb $_{Water}$/Lb $_{Dry\ Air}$
Primary Air Static Pressure	0.50 In. w.c.

ACB10 - 4-Pipe Quick Selection Heating Capacity											
Primary Airflow (CFM)	Primary Air Heating	Sensible Heating (Btuh)									
	Sensible (Btuh)	Nominal 2 Foot Coil		Nominal 3 Foot Coil		Nominal 4 Foot Coil		Nominal 5 Foot Coil		Nominal 6 Foot Coil	
		Coil	Total	Coil	Total	Coil	Total	Coil	Total	Coil	Total
15	-295	1465	1170								
20	-390	1480	1090	1815	1425						
25	-490	1590	1100	1975	1485	2205	1715				
30	-585	1605	1020	2140	1555	2370	1785				
35	-685			2325	1640	2530	1845	2885	2200		
40	-780			2395	1615	2705	1925	3045	2265	3385	2605
45	-880			2435	1555	2900	2020	3205	2325	3560	2680
50	-975			2425	1450	2940	1965	3380	2405	3715	2740
55	-1075					2985	1910	3560	2485	3860	2785
60	-1170					2990	1820	3665	2495	4035	2865
65	-1270							3755	2485	4225	2955
70	-1365							3810	2445	4420	3055
75	-1465							3830	2365	4480	3015
80	-1560							3840	2280	4570	3010
85	-1660									4625	2965
90	-1750									4660	2910
95	-1855									4670	2815
100	-1955									4680	2725

Operating Conditions	
Room Design Dry Bulb Temperature	72.0 °F
Room Design Wet Bulb Temperature	
Room Design Relative Humidity	
Room Design Dew Point Temperature	
Room Design Humidity Ratio	
Hot Water Supply Temperature	130.0 °F
Hot Water Flow Rate	1.6 GPM
Primary Air Dry Bulb Supply Temperature	54.0 °F
Primary Air Wet Bulb Temperature	
Primary Air Relative Humidity	
Primary Air Humidity Ratio	
Primary Air Static Pressure	0.50 In. w.c.

ACB10 - 4 Foot Unit Sound Data						
Primary Airflow (CFM)	0.4" wc Inlet Static Pressure		0.6" wc Inlet Static Pressure		0.8" wc Inlet Static Pressure	
	NC	dB (A)	NC	dB (A)	NC	dB (A)
High Nozzle Pitch						
30	-	14				
35			-	19		
40					16	24
Medium Nozzle Pitch						
40	-	16				
50			15	22		
60					20	26
Low Nozzle Pitch						
55	16	23				
70			22	27		
80					26	31

Note: Room Attenuation effect of 10 dB has been applied when calculating NC levels.



Note: While every effort is made to ensure the details contained in this publication are current and up-to-date, in the interest of ongoing product development DADANCO reserves the right to alter the same without notice.

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DADANCO—MESTEK Joint Venture LLC (DADANCO)

is jointly owned by subsidiaries of Dadanco Pty Ltd headquartered in Adelaide, Australia and Mestek, Inc. headquartered in Westfield, MA. Mestek is a diversified manufacturer of HVAC products with sales of over $400m. Mestek's HVAC companies include Smith Cast Iron Boilers, Hydrotherm, RBI Boilers & Water Heaters, Sterling, Vulcan, Airtherm, Applied Air, Anemostat, Air Balance, Arrow United, L. J. Wing, Lockformer and many others.

MESTEK, INC.

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