

# Air Handling Unit



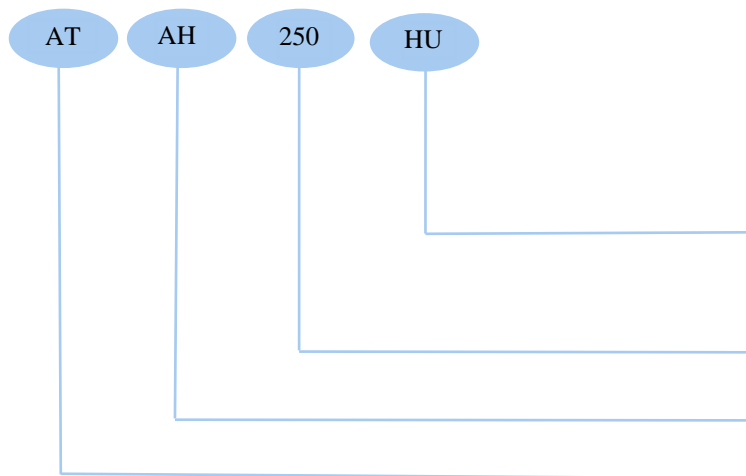
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## Nomenclature



Type:  
 HS=Horizontal-Sectional  
 HU=Horizontal-Unitary  
 MZ=Multi-Zone  
 A W\*=Air Washer  
 \*Indicates Class of Air Washer (4, 6, 8)

MODEL  
 AIR HANDLING  
 UNIT

Allan Tahviah

## Features

### Unitary Air Handling Unit

In all Allan Tahviah air handling units the frames are from aluminum profiles while the chassis and body panels are made from galvanized steel sheets in appropriate thicknesses. All units are completely painted in the proper thickness.

#### Blower(S):

Double width-double inlet centrifugal fans with forward curved blades are normally used for low pressure drop requirements as opposed to fans with backward curved blades which are for high pressure drop applications. Fans and housings are made of galvanized steel each set off a plus other related components such as shafts are statically and dynamically balanced, shafts are selected from proper material and size. Other power transmission components such as pulleys and belts are also suit ably chosen depending on the required fan speed and electric motor power.

Fan(s) and the corresponding electric motor(s) are installed on an independent chassis which is itself installed on the main chassis using vibration dampers in order to eliminate transfer of vibrations to the structure. To further reduce the effects of vibrations, fan outlet (s) are also connected to the structure via flexible material such as canvas.

All 380V/3Ø/50Hz electric motors are selected with insulation class of (f) and ingress protection of (IP- 54). Electric motors with ingress protection of (IP- 55) are also available upon request.

#### Coil (S):

Cooling and heating coils or either one of the two depending on the Requirement May be installed. Cooling coils are available in two, types of chilled water and direct expansion (D.X.) as per client's requirements. The chilled water coils are constructed of 5/8"O.D copper tubes plate finned (8, 10, 12 or 14 FPI) in aluminum or copper upon request.

The D.X. Coils are constructed of 3/8" OD copper tubes also plate finned (10, 12 or 14 FPI) in aluminum or copper as required.

The chilled water for cooling coils in to be supplied by a water chiller and in the D.X. coils cooling is provided through the use of refrigerant such as R-22, R-407c or R-134a.

Chilled water coils may be requested in 4 or 6 rows and as to the D.X. coils, they are available in 4 or 6 row configurations.

Heating coils are available in two types of hot water and steam. The hot water coil similar to chilled water coil is offered in 1 or 2 row configurations. Steam heating coils are constructed of 1/2" seamless steel pipe spiral finned in aluminum or copper. Coils in 1 & 2 -row configurations are available upon request.

#### Mixing box:

Fresh and return air streams are mixed in the mixing box .An independent air damper is included for each air stream.

Air Dampers are manufactured from aluminum in opposed blade configuration and are air sealed through the use of rubber strip gasket. Damper actuators may be easily installed when required. Washable aluminum filter modules 2 inches in thickness are arranged in (V) type configuration inside these boxes.

Housing for pleated type air filters may also be considered in the mixing box.

## Features

### Sectional Air Handling Unit

In all Allan Tahviah air handling units the frames are from aluminum profiles while the chassis and body panels are made from galvanized steel sheets in appropriate thicknesses. Allan Tahviah air handling units are manufactured in sections descriptions of which are offered below. All units are completely painted in the proper thickness.

#### 1- Fan section:

In this section double width-double inlet centrifugal fans with forward curved blades are normally used for low pressure drop requirements as opposed to fans with backward curved blades which are for high pressure drop applications. Fans and housings are made of galvanized steel each set of fan plus other related components such as shafts are statically and dynamically balanced, shafts are selected from proper material and size. Other power transmission components such as pulleys and belts are also suit ably chosen depending on the required fan speed and electric motor power. Fan(s) and the corresponding electric motor(s) are installed on an independent chassis which is itself installed on the main chassis using vibration dampers in order to eliminate transfer of vibrations to the structure. To further reduce the effects of vibrations, fan outlet (s) are also connected to the structure via flexible material such as canvas. In cases where an air washer section is included, the blower electric motor is installed outside of this section to prevent adverse effects of moisture. In other cases, blower electric motor is installed in the fan section. All 380V/3Ø/50Hz electric motors are selected with insulation class of F and ingress protection of IP-54. Electric motors with ingress protection of IP-55 are also available upon request.

#### 2- Coil Section

This section may include cooling and heating coils or either one of the two depending on the Requirement. Cooling coils are available in two, types of chilled water and direct expansion (D.X.) As per client's requirements. The chilled water coils are constructed of 5/8" O.D copper tubes plate finned (8,10,12 or 14 FPI) in aluminum or copper upon request.

The D.X. Coils are constructed of 3/8" OD copper tubes also plate finned (10,12 or 14 FPI) in aluminum or copper as required.

The chilled water for cooling coils in to be supplied by a water chiller and in the D.X. coils cooling is provided through the use of refrigerant such as R-22, R-407c or R-134a.

Chilled water coils may be requested in 4,6 & 8 rows fans as to the D.X. coils, they are available in 4 or 6 rows configurations.

Heating coils are available in two types of hot water and steam. The hot water coil similar to chilled water coil is offered in 1, 2, 3 & 4 -rows configurations. Steam heating coils are constructed of 1/2" seamless steel pipe spiral finned in aluminum or copper. Coils in 1 & 2 -row configurations are available upon request.

#### 3- Mixing Box Section

This section is where the fresh and return air streams are mixed in the mixing box. An independent air damper is included for each air stream.

Dampers are manufactured from aluminum in opposed blade configuration and air sealed through the use of rubber strip gasket. Damper actuators may be easily installed when required.

Washable aluminum filter modules 2 inches in thickness are arranged in (V) type configuration inside these boxes.

Housing for pleated type air filters may also be considered in the mixing box.



#### 4- Special filter section:

This section may include pleated or bag filter which are installed as per customer requirements. Efficiency and class of special filters are specified by the client.

#### Notes:

- 1 - Allowable air velocity over the special filter section must be less than or equal to 500 fpm.
- 2 - In cases where only pleated filters are required they are easily installed in the mixing box and not in the special filter section.

#### 5- Multi - Zone Section

In some cases the air conditioning design of a building defines different zones to be air conditioned, each zone requiring its own air flow rate and air temperature. In these cases instead of using a few air handling units, a multi -zone unit is usually chosen.

In the multi- zone air handling unit, cooling and the heating coils are paralleled with each other which means that some of the air passes over the cooling coil and the remainder passes over the heating coil and at the outlet the result is a mixture of the two which has the suitable temperature for each zone.

In multi-zone units the cooling coil area is the same size as that of a regular air handling unit while the size of the heating coil is less.

For each zone two outlet dampers one which is on the cooling coil side and one that is on the heating coil side activate. Of these two outlet dampers as one opens the other one closes the same amount therefore, by adjusting the outlet dampers for each zone, the desired zone temperature is controlled.

Number and the effective area of dampers for each zone are dependent on the number of zones and the air flow rate needed for that zone. These aluminum dampers are located either on top or the back side of this section depending on whether the type of air handling unit is up-blast or horizontal blast discharge.

Multi-zone section is usually installed after the fan section and in order to have the proper air flow over the coils, an air diffuser is also installed.

Humidifiers are also installed in this section when required.

## Selection Procedure

The first parameter to consider in the selection of an air handling unit is the required air flow rate (CFM) therefore, by having the required air flow rate, coil face area and the available nominal air flow rate for the unit, the appropriate model may be chosen.

### Note:

Allowable air velocity over cooling coil is less than 550FPM. In air handling units equipped with air washers this allowable air velocity must be reduced further to less than 500 FPM.

Considering the cooling and heating loads and the entering air conditions, the number of coil rows, pressure drops on both water and air sides and the required model of fan may be determined using the data available in the catalogue.

Other components and accessories such as air mixing box, special filters, humidifier, etc, may also be selected from the catalogue as needed.

### (Chilled Water Cooling, Hot Water Heating)

#### Given:

Required Air Flow Rate = 10000 CFM

Cooling Entering Air Condition = 80° F DB, 67° F WB

Heating Entering Air Condition = 60° F DB

Entering Chilled Water Temp. = 45° F

Leaving Chilled Water Temp. = 55° F

Entering Hot Water Temp. = 180° F

Leaving Hot Water Temp. = 160° F

Total Cooling Load = 480 KBH

Total Heating Load = 700 KBH

Cooling & Heating Coil FPI = 14

External Static Pressure Drop = 0.78 Inch W.G

Maximum coil face velocity = 500 FPM

Filter arrangement=V- type

Considering the required airflow rate in CFM and the unit nominal airflow rate, model ATAH-1000 is chosen. From table 2, the given cooling capacity and the chilled water temp. A 6-rows coil is chosen. (Cooling capacity of the unit is 498 KBH) From table 5, the given heating capacity and the hot water temp. A 2 - Rows coil is chosen. (Heating capacity of the unit is 726 KBH).

### NOTE:

In cases where the requirement for number of fin per inch is not specified, a coil with the least number of rows with 8, 10, 12 or 14FPI which satisfies the requirement is chosen. Preference is usually given to 14FPI.

-Determine the actual coil face velocity.

$$F.V. \text{ Actual} = \frac{CFM}{F.A.} = \frac{10000}{20} = 500 \text{ F.P.M.}$$

-Knowing the actual coil velocity and the coils chosen, determine the total internal air side pressure drop for the unit. From the table:

P.D. Cooling coil = P.D. (Table 10) × C.F. (Table 10A) = 0.85 × 1.45 = 1.19 In.W.G.

P.D. Heating coil = P.D. (Table 10) × C.F. (Table 10A) = 0.22 × 1.45 = 0.32 In.W.G.

P.D. Filter = 0.099 In.W.G.

P.D. Accessories = 0.05 + 0.06 = 0.11 In W.G (damper & mixing box from Table 11).

Total Internal Pressure Drop (T. I.P. D)

Total External Pressure Drop (T.E.P.D)

T.I.P.D = P.D. Cooling coil + P.D. Heating coil + P.D. Filter + P.D. Accessories

T.I.P.D = 1.19 + 0.32 + 0.099 + 0.11 = 1.719 In W.G

Total Static Pressure (T.S.P) = T.I.P.D + T.E.P.D = 1.719 + 0.78 = 2.5 In.W.G

Therefore, by using table 18A and performing interpolation the required fan size is determined as 22" at the speed of 703 RPM and electric motor power requirement of 10 HP.

- Determine the water side P.D. (Cooling Coil):

$$\text{Water flow rate (GPM)} = \frac{\text{Total heating load}}{500 \times \Delta T} = \frac{498000}{500 \times 10} = 99.6 \text{ GPM}$$

$$\begin{aligned} \text{Water velocity inside the tubes} &= \frac{\text{Water flow rate (GPM)}}{\text{No. of coils} \times \text{No. of circuits (Table 19)}} \times 1.235 \\ &= \frac{99.6}{1 \times 28} \times 1.235 = 4.39 \text{ Ft/Sec} \end{aligned}$$

From table 21 considering the 6 row cooling coil, the water velocity of 4.39 Ft/Sec the pressure drop is given as 10.52 Ft. W.G.

-Determine the water side pressure drop (Heating Coil):

$$\text{Water flow rate (GPM)} = \frac{\text{Total heating load}}{500 \times \Delta T} = \frac{726000}{500 \times 20} = 72.6 \text{ GPM}$$

$$\begin{aligned} \text{Water velocity inside the tubes} &= \frac{\text{Water flow rate (GPM)}}{\text{No. of coils} \times \text{No. of circuits (Table 19)}} \times 1.235 \\ &= \frac{72.6}{1 \times 28} \times 1.235 = 3.2 \text{ Ft/Sec} \end{aligned}$$

From Table 21 considering the 2 rows heating coil, the water velocity of 3.2 Ft/Sec, the pressure drop is given 2.62 Ft W.G. The average water temp, of 170 F correction factor is 0.77 therefore, the actual P.D. is 2.02 Ft W.G.

## (D.X. Cooling, Steam Heating)

Given:

Require air flow rate = 9500 CFM

Cooling entering air condition = 80°F DB, 67°F WB

Heating entering air condition = 60°F DB

Total cooling load = 450 KBH

Total heating load = 950 KBH Cooling coil FPI = 14

Heating coil FPI = 8

Evaporating temperature = 45°F

Steam pressure = 5 psig

External static pressure drop. = 0.5 in W.G

Maximum coil face velocity = 500 FPM

Filter arrangement = flat type

Considering the required air flow rate in CFM and the unit available nominal air flow rate, air handling unit model ATAH-1000 is chosen.

-From table3 the given cooling capacity and the evap. temp. a 6-rows coil is chosen (cooling capacity of the units is 471 KBH)

-From table6 @ the given heating capacity and the steam pressure of 5 psig, a 2 -rows heating coil is chosen. (Heating capacity of the unit is 980 KBH)

Determine the actual coil face velocity.

$$F.V. \text{ Actual} = \frac{CFM}{F.A.} = \frac{9500}{20} = 475 \text{ F.P.M.}$$

Referring to the correction factors in table12, the cooling and the heating capacity correction factors are given as 0.97 and 0.98 respectively.

-Corrected cooling capacity =  $471 \times 0.97 = 456.8 \text{ KBH}$

-Corrected heating capacity =  $980 \times 0.98 = 960.4 \text{ KBH}$

Therefore, the chosen cooling and heating coils satisfy the requirements.

-Knowing the actual coil face velocity and the coils chosen, determine the total internal air side pressure drop for the unit.

P.D. DX coil = P.D. (Table 10)  $\times$  C.F. (Table 10A) =  $0.79 \times 1.45 = 1.15 \text{ In W.G}$

P.D. Heating coil = P.D. (Table 10)  $\times$  C.F. (Table 10A) =  $0.21 \times 1 = 0.21 \text{ In W.G}$

P.D. Filter = 0.09 in W.G (Table 9)

P.D. Accessories = 0.05 in W.G (Table 11) Total internal pressure drop (T.I.P.D)

Total external pressure drop (T.E.P .D)

T.I.P.D = P.D. DX Coil + P.D. Heating coil + P. D. Filter accessories

=  $1.15 + 0.2 + 0.09 + 0.05 = 1.5 \text{ in W.G}$

Total static pressure (T.S.P) = T.I.P .D + T.E.P .D =  $1.5 + 0.5 = 2 \text{ In W.G}$

Therefore, by using table18 and performing interpolation the required fan size is determined as 22" at the speed of 629 RPM and electric motor power requirement of 7.5 HP.

Chilled Water Rating “8FPI”

Table 1

Model	Nominal CFM	EDB (°F)	EWB (°F)	4 Rows				6 Rows				8 Rows			
				Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)	Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)	Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)
250	2500	80	67	59	54	61	60	88	68	57	56	110	78	53	53
		90	71	84	76	63	61	120	94	58	57	146	106	54	54
		100	75	111	98	66	63	154	119	59	58	184	133	54	54
350	3500	80	67	82	75	61	60	122	95	57	56	153	108	54	53
		90	71	117	106	64	61	168	131	58	57	204	147	54	54
		100	75	154	136	66	63	215	166	59	58	257	185	54	54
500	5000	80	67	140	116	60	58	198	145	55	55	238	163	52	52
		90	71	193	161	62	60	263	197	56	55	312	220	52	52
		100	75	249	205	64	61	333	248	57	56	388	273	53	53
700	7000	80	67	196	163	60	58	277	203	55	55	334	229	52	52
		90	71	270	226	62	60	369	276	56	55	436	307	52	52
		100	75	348	288	64	61	466	347	57	56	543	383	53	53
1000	10000	80	67	306	242	59	58	420	299	54	54	498	336	51	51
		90	71	414	334	61	59	552	404	55	55	643	448	52	52
		100	75	527	422	63	61	692	506	56	55	796	556	52	52
1250	12500	80	67	378	301	59	58	520	372	55	54	617	418	52	51
		90	71	512	414	62	59	684	502	56	55	798	557	52	52
		100	75	652	523	64	61	857	629	57	56	989	692	52	52
1500	15000	80	67	451	359	59	58	621	445	55	54	737	500	52	52
		90	71	609	494	62	59	816	600	56	55	954	667	52	52
		100	75	776	625	64	61	1023	752	57	56	1182	828	53	52
1750	17500	80	67	513	358	58	57	689	435	54	53	802	483	51	51
		90	71	693	491	60	58	904	585	54	54	1033	640	51	51
		100	75	886	621	61	59	1132	730	55	54	1278	793	51	51
2000	20000	80	67	652	501	58	57	875	614	54	53	1024	684	51	51
		90	71	750	638	62	60	1035	781	56	56	1229	871	53	53
		100	75	970	813	65	62	1310	983	58	57	1535	1088	53	53
2250	25000	80	67	681	467	58	57	904	566	53	53	1044	626	51	50
		90	71	916	634	59	58	1180	758	54	53	1342	828	51	50
		100	75	1161	805	61	59	1471	945	55	54	1656	1024	51	51
2500	25000	80	67	757	602	59	58	1041	745	55	54	1235	836	52	51
		90	71	1024	828	61	59	1368	1005	56	55	1596	1114	52	52
		100	75	1304	1047	64	61	1715	1258	57	56	1978	1384	52	52
3000	30000	80	67	902	719	59	58	1242	890	55	54	1475	1000	52	52
		90	71	1219	989	62	59	1632	1201	56	55	1908	1334	52	52
		100	75	1553	1251	64	61	2046	1504	57	56	2365	1657	53	52
3500	35000	80	67	996	703	59	57	1350	859	54	54	1578	955	51	51
		90	71	1346	965	60	59	1775	1156	55	54	2038	1268	51	51
		100	75	1720	1220	62	60	2220	1443	55	55	2522	1571	52	51
4000	40000	80	67	1305	1003	58	57	1750	1228	54	53	2048	1369	51	51
		90	71	1500	1277	62	60	2071	1562	56	56	2458	1743	53	53
		100	75	1941	1627	65	62	2620	1966	58	57	3070	2176	53	53
4500	45000	80	67	1333	922	58	57	1780	1121	53	53	2060	1240	51	51
		90	71	1786	1260	60	58	2328	1504	54	54	2653	1644	51	51
		100	75	2275	1590	61	59	2900	1872	55	54	3279	2035	51	51

NOTE:

- Values based on entering chilled water temperature of 45°F and Leaving Water Temperature of 55°F
- E.D.B = Entering air dry bulb temperature
- E.W.B = Entering air wet bulb temperature
- L VG = Leaving air temperature
- KBH = 1000 Btu/hr



Chilled Water Rating “14FPI”

Table 2

Model	Nominal CFM	EDB (°F)	EWB (°F)	4 Rows				6 Rows				8 Rows			
				Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)	Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)	Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)
250	2500	80	67	72	59	58	58	104	73	53	53	125	82	50	50
		90	71	102	83	59	58	139	99	53	53	162	109	50	50
		100	75	132	106	60	59	175	124	54	53	200	136	50	50
350	3500	80	67	100	82	58	58	146	102	53	53	175	115	50	50
		90	71	141	115	59	59	194	138	53	53	227	153	50	50
		100	75	183	147	60	60	244	174	54	54	280	189	50	50
500	5000	80	67	177	131	56	55	237	158	51	51	274	175	48	48
		90	71	237	179	57	56	307	211	51	51	346	228	48	48
		100	75	300	226	58	57	380	261	51	51	422	281	48	48
700	7000	80	67	243	182	56	56	328	220	51	51	380	243	48	48
		90	71	327	249	57	56	425	293	51	51	481	318	48	48
		100	75	415	313	58	57	526	363	52	51	587	391	48	48
1000	10000	80	67	385	275	55	54	498	327	50	50	564	357	47	47
		90	71	506	371	56	55	663	431	50	50	707	464	47	47
		100	75	633	463	57	56	781	532	50	50	858	568	47	47
1250	12500	80	67	477	341	55	54	619	407	50	50	701	445	48	48
		90	71	626	460	56	55	791	537	50	50	881	579	47	47
		100	75	785	576	57	56	971	663	51	50	1070	709	47	47
1500	15000	80	67	569	408	55	54	741	487	50	50	839	532	48	48
		90	71	747	550	56	55	945	642	50	50	1053	693	47	47
		100	75	936	688	57	56	1160	793	51	51	1280	849	47	47
1750	17500	80	67	634	415	55	54	804	484	51	51	900	524	48	48
		90	71	853	567	55	55	1047	646	50	50	1144	687	48	48
		100	75	1181	713	56	55	1299	802	51	50	1404	846	48	48
2000	20000	80	67	820	570	54	53	1036	671	49	49	1157	727	47	47
		90	71	1065	763	55	54	1310	879	49	49	1442	941	47	47
		100	75	1321	949	56	55	1599	1081	50	50	1743	1149	47	47
2250	25000	80	67	848	546	54	54	1058	632	50	50	1170	679	48	48
		90	71	1127	740	55	54	1364	838	50	50	1485	890	48	48
		100	75	1422	928	55	55	1687	1038	50	50	1817	1093	48	48
2500	25000	80	67	953	682	55	54	1238	813	50	50	1402	889	48	48
		90	71	1253	921	56	55	1582	1074	50	50	1761	1157	47	47
		100	75	1570	1152	57	56	1941	1325	51	50	2139	1417	47	47
3000	30000	80	67	1137	715	55	55	1481	973	50	50	1678	1064	48	48
		90	71	1494	1100	56	55	1889	1284	50	50	2106	1385	47	47
		100	75	1871	1377	57	56	2319	1585	51	51	2559	1697	47	47
3500	35000	80	67	1238	818	55	55	1581	958	51	51	1774	1037	49	49
		90	71	1665	1117	56	55	2058	1279	51	51	2265	1365	48	48
		100	75	2115	1407	56	56	2561	1590	51	51	2783	1683	48	48
4000	40000	80	67	1640	1140	54	53	2072	1342	49	49	2313	1455	47	47
		90	71	2129	1526	55	54	2620	1758	49	49	288	1882	47	47
		100	75	2641	1899	56	55	3199	2162	50	50	3486	2298	47	47
4500	45000	80	67	1387	877	53	53	1701	1007	50	50	1862	1074	48	48
		90	71	1834	1185	54	53	2184	1331	49	49	2354	1403	47	47
		100	75	2310	1484	54	54	2698	1646	49	49	2871	1720	47	47

NOTE:

- Values based on entering chilled water temperature of 45°F and Leaving Water Temperature of 55°F.
- E.D.B = Entering air dry bulb temperature
- E.W.B = Entering air wet bulb temperature
- L VG = Leaving air temperature
- KBH = 1000 Btu/hr

D.X. Coil Rating “14FPI”

Table 3

Model	Nominal CFM	EDB (°F)	EWB (°F)	4 Rows				6 Rows			
				Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)	Total Load (KBH)	Sensible Load (KBH)	LVG D.B. (°F)	LVG W.B. (°F)
250	2500	80	67	89	62	57	55	118	78	51	50
		90	71	102	79	61	58	137	99	54	52
		100	75	117	96	65	60	157	119	56	55
350	3500	80	67	123	86	57	55	163	109	51	50
		90	71	147	112	60	57	196	140	53	52
		100	75	162	134	65	61	217	166	57	55
500	5000	80	67	178	125	57	55	237	157	51	50
		90	71	205	159	61	58	274	198	54	52
		100	75	235	193	65	60	315	239	56	55
700	7000	80	67	250	175	57	55	332	221	51	50
		90	71	288	223	61	58	384	277	54	52
		100	75	329	270	65	60	441	334	56	55
1000	10000	80	67	354	249	57	55	471	314	51	50
		90	71	408	317	61	58	545	395	54	52
		100	75	467	384	65	61	626	476	56	55
1250	12500	80	67	434	307	57	55	578	387	51	50
		90	71	500	391	61	58	668	488	54	53
		100	75	572	474	65	61	767	588	57	55
1500	15000	80	67	513	365	57	55	684	460	52	51
		90	71	591	465	61	58	791	580	54	53
		100	75	676	564	65	61	908	700	57	55
1750	17500	80	67	583	477	59	57	813	602	53	51
		90	71	666	588	63	60	929	737	55	54
		100	75	726	700	67	64	1069	872	59	57
2000	20000	80	67	718	503	57	55	953	634	51	50
		90	71	827	639	61	57	1103	797	53	52
		100	75	946	774	65	60	1267	960	56	54
2250	22500	80	67	756	616	54	53	1054	718	52	51
		90	71	864	760	61	60	1204	951	56	55
		100	75	962	839	66	64	1385	1027	58	57
2500	25000	80	67	868	615	57	55	1156	775	51	50
		90	71	1000	782	61	58	1337	976	54	53
		100	75	1144	949	65	61	1535	1177	57	55
3000	30000	80	67	1027	730	57	55	1369	921	52	51
		90	71	1182	930	61	58	1583	1160	54	53
		100	75	1352	1129	65	61	1817	1400	57	55
3500	35000	80	67	1166	953	59	57	1326	1204	53	51
		90	71	1332	1176	63	60	1858	1474	55	54
		100	75	1452	1400	67	64	2138	1744	59	57
4000	40000	80	67	1436	1007	57	55	1907	1268	51	50
		90	71	1655	1278	61	57	2207	1594	53	52
		100	75	1893	1549	65	60	2534	1920	56	54
4500	45000	80	67	1512	1232	54	53	2108	1436	52	51
		90	71	1728	1520	61	60	2408	1902	56	55
		100	75	1924	1678	66	64	2770	2054	58	57

NOTE:

- Values based on entering chilled water temperature of 45°F
- E.D.B = Entering air dry bulb temperature
- E.W.B = Entering air wet bulb temperature
- L VG = Leaving air temperature
- KBH = 1000 Btu/hr

Hot Water Rating “8FPI”

Table 4

Model	Nominal CFM	EDB (°F)	1 Row		2 Rows		3 Rows		4 Rows	
			Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)
250	2500	0	126	42	211	73	281	100	330	120
		20	109	58	183	85	245	110	289	128
		40	92	73	155	97	209	119	248	135
		60	76	88	127	108	174	127	207	141
350	3500	0	175	42	293	72	391	99	461	119
		20	151	57	254	85	341	109	402	127
		40	128	73	215	97	292	118	345	160
		60	105	88	177	108	243	127	288	160
500	5000	0	262	44	438	76	576	103	673	122
		20	228	60	382	88	504	113	589	130
		40	195	75	326	100	433	122	507	137
		60	161	90	271	111	362	130	425	143
700	7000	0	367	44	614	76	807	103	942	122
		20	320	60	535	88	706	113	825	130
		40	273	75	457	100	606	122	710	137
		60	226	90	379	111	507	130	596	143
1000	10000	0	535	45	893	78	1166	104	1356	124
		20	467	60	781	90	1022	114	1190	131
		40	400	76	669	102	880	123	1025	138
		60	333	91	558	113	738	131	862	144
1250	12500	0	660	44	1104	77	1445	103	1683	122
		20	576	60	965	89	1266	113	1476	130
		40	493	75	827	101	1090	122	1272	137
		60	410	90	690	112	914	131	1070	144
1500	15000	0	784	44	1315	76	1723	102	2009	122
		20	685	60	1150	89	1510	112	1763	130
		40	587	75	986	101	1300	122	1518	137
		60	488	90	822	112	1090	130	1277	143
1750	17500	0	896	50	1536	89	1954	117	2227	136
		20	779	65	1344	101	1713	125	1953	142
		40	662	80	1154	111	1476	133	1683	147
		60	546	94	964	121	1240	140	1417	152
2000	20000	0	1091	46	111	79	2363	106	2739	125
		20	955	61	1593	91	2073	115	2404	132
		40	819	77	1368	103	1786	124	2073	139
		60	684	92	1145	114	1502	133	1746	145
2250	22500	0	1163	50	1979	90	2512	117	2862	136
		20	1012	65	1732	101	2204	125	2511	142
		40	863	80	1489	111	1900	133	2164	147
		60	715	94	1246	121	1598	140	1824	153
2500	25000	0	1320	44	2209	77	2890	103	3366	122
		20	1153	60	1931	89	2533	113	2953	130
		40	987	75	1655	101	2180	122	2544	137
		60	821	90	1381	112	1829	131	2140	144
3000	30000	0	1569	44	2631	76	3446	102	4019	122
		20	1371	60	2300	89	3021	112	3526	130
		40	1174	75	1972	101	2600	122	3037	137
		60	977	90	1645	112	2181	130	2555	143
3500	35000	0	1743	49	3010	88	3847	115	4400	134
		20	1515	64	2633	99	3373	124	3858	141
		40	1285	79	2259	110	2904	132	3324	146
		60	1059	93	1887	120	2440	139	2798	152
4000	40000	0	2183	46	3639	79	4726	106	2479	125
		20	1911	61	3187	91	4147	115	4809	132
		40	1639	77	2737	103	3573	124	4147	139
		60	1368	92	2290	114	3004	133	3492	145
4500	45000	0	2271	50	3891	88	4960	115	5665	134
		20	1977	65	3407	100	4352	124	4971	141
		40	1684	79	2926	110	3750	132	4286	147
		60	1392	94	2450	121	3154	139	3611	152

NOTES:

- Hot Water Entering@180°F and leaving@160°F
- E.D.B = Entering air dry bulb temperature.
- L.V .G = Leaving air temperature.
- KBH = 1000 Btu/hr

Hot Water Rating “14FPI”

Table 5

Model	Nominal CFM	EDB (°F)	1 Row		2 Rows		3 Rows		4 Rows	
			Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)	Capacity (KBH)	L.V.G DB (°F)
250	2500	0	176	60	274	97	346	127	390	145
		20	152	74	237	107	302	133	340	149
		40	128	87	201	115	258	139	291	153
		60	105	99	165	123	214	144	243	156
350	3500	0	245	60	381	97	483	126	544	145
		20	212	73	330	106	420	132	475	149
		40	179	86	280	115	359	138	407	153
		60	146	99	230	123	299	143	340	156
500	5000	0	368	63	571	102	710	130	793	148
		20	320	77	497	111	621	137	694	152
		40	273	90	424	120	532	142	596	156
		60	225	102	352	128	445	147	500	159
700	7000	0	516	63	799	102	995	130	1110	148
		20	449	77	696	111	869	137	971	152
		40	382	90	594	120	746	142	834	156
		60	316	102	493	128	624	147	700	157
1000	10000	0	752	64	1165	104	1438	132	1599	149
		20	656	78	1017	113	1259	138	1400	154
		40	561	91	871	122	1082	144	1205	157
		60	466	104	726	130	908	149	1013	161
1250	12500	0	929	64	1443	103	1786	131	1989	148
		20	811	77	1261	112	1564	138	1742	153
		40	693	91	1080	121	1344	143	1499	157
		60	576	103	900	129	1128	149	1260	160
1500	15000	0	1106	63	1722	102	2134	130	2379	148
		20	965	77	1504	112	1868	137	2083	152
		40	825	90	1288	121	1606	143	1793	156
		60	686	103	1073	129	1347	148	1507	160
1750	17500	0	1234	71	1950	117	2338	144	2546	159
		20	1070	83	1705	125	2047	149	2228	162
		40	909	95	1461	132	1761	153	1918	164
		60	748	107	1222	139	1480	157	1614	167
2000	20000	0	1537	66	2373	106	2910	134	3224	151
		20	1343	79	2076	115	2550	140	2824	155
		40	1151	93	1781	124	2195	146	2432	159
		60	960	105	1489	132	1845	151	2048	162
2250	22500	0	1603	72	2516	117	3011	144	3276	159
		20	1393	84	2201	125	2638	149	2868	162
		40	1186	96	1889	133	2270	154	2470	165
		60	980	107	1582	140	1910	158	2080	167
2500	25000	0	1857	64	2887	103	3573	131	3979	148
		20	1623	77	2522	112	3128	138	3484	153
		40	1388	91	2160	121	2689	143	2998	157
		60	1153	103	1800	129	2256	149	2521	160
3000	30000	0	2213	63	3444	102	4268	130	4759	148
		20	1931	77	3008	112	3736	137	4167	152
		40	1651	90	2576	121	3212	143	3586	156
		60	1372	103	2147	129	2695	148	3015	160
3500	35000	0	2405	70	3839	115	4625	142	5054	157
		20	2058	82	3353	123	4049	147	4423	161
		40	1768	94	2873	131	3482	152	3807	164
		60	1452	106	2398	137	2924	156	3203	166
4000	40000	0	3074	66	4746	106	5821	134	6448	151
		20	2687	79	4152	115	5101	140	5649	155
		40	2302	93	3562	124	4391	146	4865	159
		60	1920	105	2978	132	3690	151	4096	162
4500	45000	0	3139	70	4967	116	5968	143	6511	158
		20	2728	83	4344	124	5227	148	5701	161
		40	2320	95	3728	131	4499	152	4909	164
		60	1916	106	3118	138	3783	156	4134	166

NOTES:

- Hot Water Entering@180°F and leaving@160°F
- E.D.B = Entering air dry bulb temperature.
- L.V .G = Leaving air temperature.
- KBH = 1000 Btu/hr

Steam Heating Rating

Table 6

Model	Nominal CFM	EDB (°F)	8 Fin Per Inch			
			1 Row Coil		2 Rows Coil	
			Capacity (KBH)	L.V.G. DB (°F)	Capacity (KBH)	L.V.G. DB (°F)
250	2500	0	184	68	326	120
		20	168	82	297	130
		40	153	96	270	140
		60	136	110	240	148
350	3500	0	274	72	495	130
		20	250	86	452	139
		40	227	100	410	148
		60	202	113	365	156
500	5000	0	366	68	665	123
		20	334	82	606	132
		40	303	96	551	142
		60	270	110	490	150
700	7000	0	509	67	923	122
		20	464	81	842	131
		40	421	95	756	140
		60	375	109	680	149
1000	10000	0	726	67	1331	123
		20	662	81	1213	132
		40	601	95	1102	142
		60	535	109	980	150
1250	12500	0	907	67	1663	123
		20	826	81	1516	132
		40	751	95	1378	142
		60	668	109	1225	150
1500	15000	0	1093	67	1996	123
		20	996	81	1819	132
		40	905	96	1654	142
		60	805	109	1470	150
1750	17500	0	1282	67	2332	123
		20	1168	81	2126	132
		40	1062	96	1932	142
		60	944	109	1718	151
2000	20000	0	1470	68	2668	123
		20	1340	82	2433	132
		40	1218	96	2210	142
		60	1083	110	1965	151
2250	22500	0	1562	64	2997	122
		20	1497	81	2733	132
		40	1657	107	2483	141
		60	1473	120	2208	150
2500	25000	0	1814	67	3327	123
		20	1654	81	3033	132
		40	1503	95	2756	142
		60	1336	109	2450	150
3000	30000	0	2186	67	3992	123
		20	1993	81	3639	132
		40	1811	96	3307	142
		60	1610	109	2940	150
3500	35000	0	2564	67	4664	123
		20	2336	81	4252	132
		40	6796	96	3864	142
		60	1888	109	3436	151
4000	40000	0	2941	68	5337	123
		20	2681	82	4865	132
		40	2436	96	4421	142
		60	2166	110	3930	153
4500	45000	0	3124	64	5994	122
		20	2994	81	5466	132
		40	3314	107	4966	141
		60	2946	120	4416	150

NOTES:

- Values ratings based on steam pressure of 5 PSIG.
- E.D.B = Entering air dry bulb temperature.
- KBH = 1000 Btu/hr



Steam Heating Rating, Multi Zone

Table 8

Model	Nominal CFM	EDB (°F)	8 Fin Per Inch			
			1 Row Coil		2 Rows Coil	
			Capacity (KBH)	L.V.G. DB (°F)	Capacity (KBH)	L.V.G. DB (°F)
250	2500	0	165	61	293	108
		20	151	76	267	119
		40	137	91	243	130
		60	122	105	216	140
350	3500	0	246	65	445	117
		20	225	80	406	127
		40	204	94	369	137
		60	181	108	328	147
500	5000	0	329	61	598	110
		20	300	75	545	121
		40	272	90	495	131
		60	243	105	441	141
700	7000	0	458	60	830	109
		20	417	75	757	120
		40	378	90	680	130
		60	337	104	612	141
1000	10000	0	653	60	1197	110
		20	595	75	1091	121
		40	540	90	991	131
		60	481	104	882	141
1250	12500	0	816	60	1496	110
		20	743	75	1364	121
		40	675	90	1240	131
		60	601	104	1102	141
1500	15000	0	983	60	1796	110
		20	896	75	1637	121
		40	814	90	1488	131
		60	724	105	1323	141
1750	17500	0	1153	60	2099	110
		20	1051	75	1913	120
		40	955	90	1739	131
		60	849	104	1546	141
2000	20000	0	1323	61	2401	111
		20	1206	76	2189	121
		40	1096	91	1989	132
		60	974	105	1768	141
2250	22500	0	1478	60	2698	110
		20	1347	75	2459	120
		40	1224	90	2235	131
		60	1088	104	1987	141
2500	25000	0	1632	60	2994	110
		20	1488	75	2729	121
		40	1352	90	2480	131
		60	1202	104	2205	141
3000	30000	0	1967	61	3592	110
		20	1793	75	3275	121
		40	1629	90	2976	131
		60	1449	105	2646	141
3500	35000	0	2306	60	4198	110
		20	2102	75	3826	120
		40	1910	90	3478	131
		60	1698	104	3092	141
4000	40000	0	2646	61	4803	111
		20	2412	76	4378	121
		40	2192	91	3978	132
		60	1949	105	3537	142
4500	45000	0	2956	61	5396	111
		20	2694	76	4918	121
		40	2448	91	4470	132
		60	2176	105	3974	142

NOTES:

- Values ratings based on steam pressure of 5 PSIG.
- E.D.B = Entering air dry bulb temperature.
- KBH = 1000 Btu/hr

Hot Water Rating, Multi Zone

Table 7

Model	Nominal CFM	EDB (°F)	8 Fin Per Inch				14 Fin Per Inch			
			1 Row Coil		2 Rows Coil		1 Row Coil		2 Rows Coil	
			Capacity (KBH)	L.V.G. DB (°F)	Capacity (KBH)	L.V.G. DB (°F)	Capacity (KBH)	L.V.G. DB (°F)	Capacity (KBH)	L.V.G. DB (°F)
250	2500	0	110	36	188	64	155	53	249	88
		20	95	53	163	78	134	67	216	98
		40	80	69	138	90	113	81	182	108
		60	66	84	113	103	93	95	150	117
350	3500	0	159	38	270	66	225	54	357	90
		20	138	54	235	80	194	69	309	100
		40	116	70	199	92	164	82	262	110
		60	95	85	164	104	134	96	215	119
500	5000	0	238	39	402	69	335	57	532	94
		20	205	55	350	82	292	71	463	104
		40	175	71	299	95	248	85	395	114
		60	145	87	249	107	205	98	327	123
700	7000	0	328	39	560	69	465	56	740	93
		20	286	55	487	82	405	71	644	104
		40	243	71	417	94	345	85	549	113
		60	201	86	345	106	285	98	455	122
1000	10000	0	478	40	813	70	680	58	1080	96
		20	417	56	711	83	593	72	942	106
		40	357	72	609	96	507	86	808	116
		60	297	87	508	108	421	99	672	124
1250	12500	0	602	40	1023	71	857	58	1357	96
		20	527	56	895	84	748	73	1185	106
		40	450	72	768	96	639	86	1015	116
		60	375	88	640	108	531	100	846	125
1500	15000	0	706	39	1204	69	1007	57	1603	94
		20	617	55	1055	83	878	72	1400	105
		40	528	71	902	95	750	85	1198	115
		60	439	87	753	107	624	99	998	124
1750	17500	0	809	45	1418	82	1128	64	1833	109
		20	704	61	1241	94	979	77	1602	118
		40	599	76	1065	105	831	90	1373	126
		60	493	90	890	116	682	102	1147	133
2000	20000	0	968	40	1647	71	1380	59	2189	97
		20	847	57	1442	84	1209	73	1915	107
		40	728	72	1239	97	1035	87	1642	117
		60	607	88	1032	109	864	100	1373	126
2250	22500	0	1041	45	1814	82	1457	64	2353	109
		20	906	61	1589	94	1256	78	2059	118
		40	773	76	1365	105	1077	91	1767	126
		60	639	90	1143	116	890	103	1478	134
2500	25000	0	1204	40	2046	71	1714	58	2714	96
		20	1054	56	1790	84	1496	73	2370	106
		40	900	72	1536	96	1278	86	2030	116
		60	750	88	1280	108	1062	100	1692	125
3000	30000	0	1412	39	2408	69	2014	57	3206	94
		20	1234	55	2110	83	1756	72	2800	105
		40	1056	71	1804	95	1500	85	2396	115
		60	878	87	1506	107	1248	99	1996	124
3500	35000	0	1573	44	2774	81	2197	63	3601	107
		20	1365	60	2426	93	1904	76	3146	116
		40	1159	75	2081	104	1613	89	2695	125
		60	954	89	1738	115	1324	101	2249	133
4000	40000	0	1936	40	3294	71	2760	59	4378	97
		20	1694	57	2884	84	2418	73	3830	107
		40	1456	72	2478	97	2070	87	3284	117
		60	1214	88	2064	109	1728	100	2746	126
4500	45000	0	2047	44	3582	81	2865	63	4656	108
		20	1781	60	3137	93	2490	77	4073	117
		40	1517	75	2695	105	2116	90	3495	125
		60	1254	90	2255	115	1745	102	2922	133

NOTES:

- Hot Water Entering@180°F and leaving@160°F
- E.D.B = Entering air dry bulb temperature.
- L.V.G = Leaving air temperature.
- KBH = 1000 Btu/hr

## Filter Air Pressure Drop (In.W.G)

Table 9

Filter	Face Velocity F.P.M.									
	300	350	400	450	500	550	600	650	700	800
Cleanable	0.037	0.050	0.065	0.081	0.099	0.120	0.156	0.182	0.235	0.325

## Coil Air Pressure Drop (In.W.G)

Table 10

Fin Per Inch	Rows Deep	Coil Face Velocity F.P.M.									
		300		400		500		600	700	800	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Dry	Dry	
8	1	0.05	0.07	0.07	0.1	0.10	0.14	0.14	0.19	0.22	
	2	0.09	0.14	0.15	0.2	0.22	0.29	0.3	0.39	0.48	
	3	0.11	0.2	0.16	0.31	0.28	0.44	0.39	0.5	0.62	
	4	0.15	0.25	0.24	0.4	0.35	0.58	0.48	0.61	0.77	
	6	0.24	0.39	0.34	0.61	0.52	0.85	0.71	0.92	1.15	
	8	0.30	0.5	0.47	0.82	0.71	1.05	0.95	1.18	1.46	

Table 10A

Coil FPI			
8	10	12	14
1	1.16	1.32	1.45

**Notes:**

In order to determine air-side coil pressure drop for cases where the number of fins per inch are greater than 8 FPI, multiply the values by the corresponding correction factor given in the table above.

## Accessories Air Side Pressure Drop (In.W.G)

(At 500 FPM Velocity)

Table 11

Model	Diffuser	Air Washer		Face & Bypass Damper	Damper	Mixing Box without Filter	Electrical Heater	Eliminator	Back Draft Damper
		Class 4	Class 6, 8						
250~1250	0.03	0.22	0.4	0.21	0.05	0.06	0.02	0.1	0.2
1500~4000	0.04	0.25	0.45	0.25					

## Velocity Correction Factor

Table 12

Coil Face Velocity	350	400	450	500	550	600	700	800
Cooling Coil	0.8	0.88	0.94	1.0	1.05	1.11	1.19	1.28
Heating Coil	0.86	0.92	0.96	1.0	1.03	1.06	1.11	1.15

## Capacity Correction Factor

Table 13

No. of Rows	Fin Per Inch		
	8	10	12
4	1	1.1	1.19
6	1	1.08	1.15
8	1	1.06	1.1

**NOTE:**

In order to determine capacity of coils with 10 or 12 FPI, multiply the capacity relative to 8 FPI by the corresponding correction factor given in the table 13.

## Correction Factor for Ethylene Glycol Mixture

Table 14

Mixture (By Weight)		Freezing Point (°C)	Correction Factor For Cooling
Water (%)	Ethylene Glycol (%)		
100	0	0	1
90	10	- 4	1.02
85	15	-6.1	1.03
80	20	- 9	1.05
75	25	-12	1.07
70	30	-15.6	1.09
65	35	-19.4	1.11
60	40	- 24	1.14
55	45	-29.4	1.17
50	50	-36.1	1.2
45	55	- 45	1.23

$$\text{Flow Rate} = \text{GPM} \times \text{Correction Factor (Table 14)}$$

## Steam Correction Factor

Table 15

<b>Pressure PSIG</b>	2	5	10	15	20	30	40	50	60
<b>Correction Factor</b>	0.95	1	1.07	1.14	1.19	1.28	1.35	1.42	1.48

## Hot Water Correction Factor

Table 16

<b>Entering Water Temperature(°F)</b>	160	180	200	220
<b>Correction Factor</b>	0.75	1	1.25	1.5

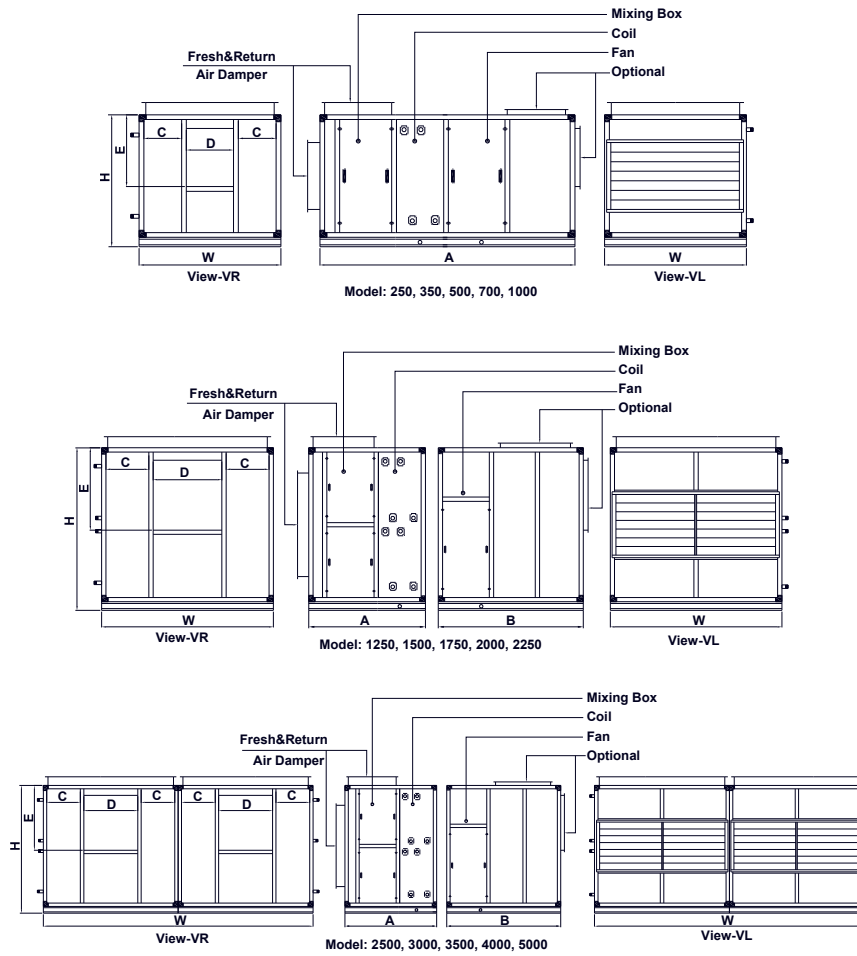
## Chilled Water Correction Factor

Table 17

<b>Entering Water Temperature(°F)</b>	42	44	45	46
<b>Correction Factor</b>	1.09	1.04	1	0.97



# Horizontal Air Handling Unit- Unitary

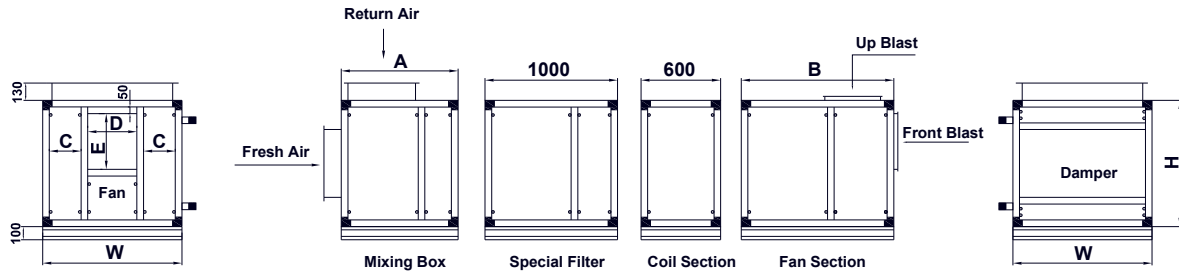


## Dimensions

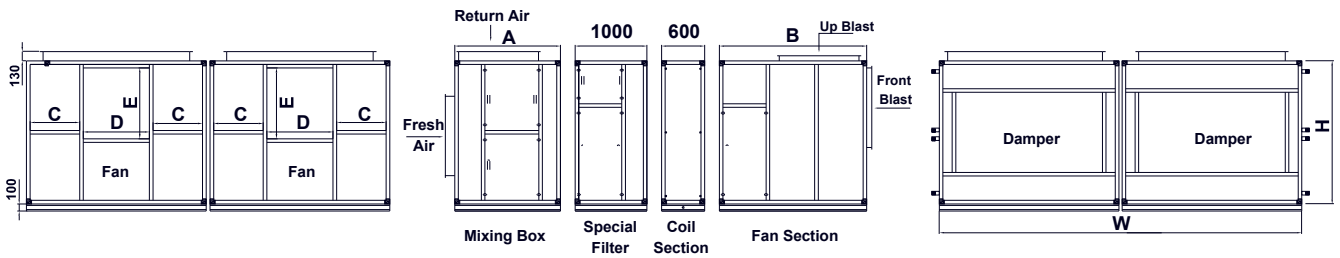
Model	Pos	A	B	C	D	E	H	W
250		2250	-	240	370	420	1050	1050
350		2300	-	195	480	480	1160	1050
500		2550	-	410	510	580	1310	1500
700		2700	-	380	570	625	1410	1500
1000		2900	-	590	650	740	1510	2000
1250		1400	1800	540	760	840	1710	2000
1500		1700	1900	485	860	920	2010	2000
1750		1900	1900	610	860	920	2010	2250
2000		1750	2050	695	930	990	2110	2500
2250		1850	2050	775	930	990	2110	2650
2500		1400	1800	540	750	840	1710	4000
3000		1700	1900	485	860	920	2010	4000
3500		1900	1900	610	860	920	2010	4500
4000		1700	2050	695	930	990	2110	5000
4500		1850	2050	775	930	990	2110	5500

NOTE: All dimensions in mm.

# Horizontal Air Handling Unit- Sectional



Models : 250 ~ 2250



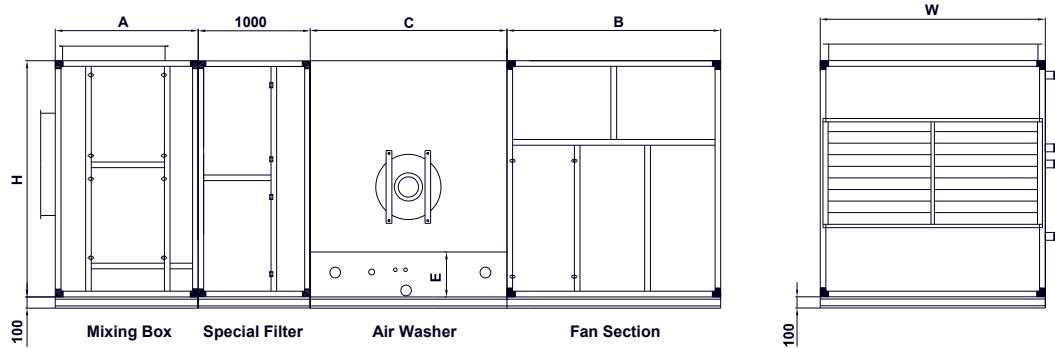
Models : 2500 ~ 4500

## Dimensions

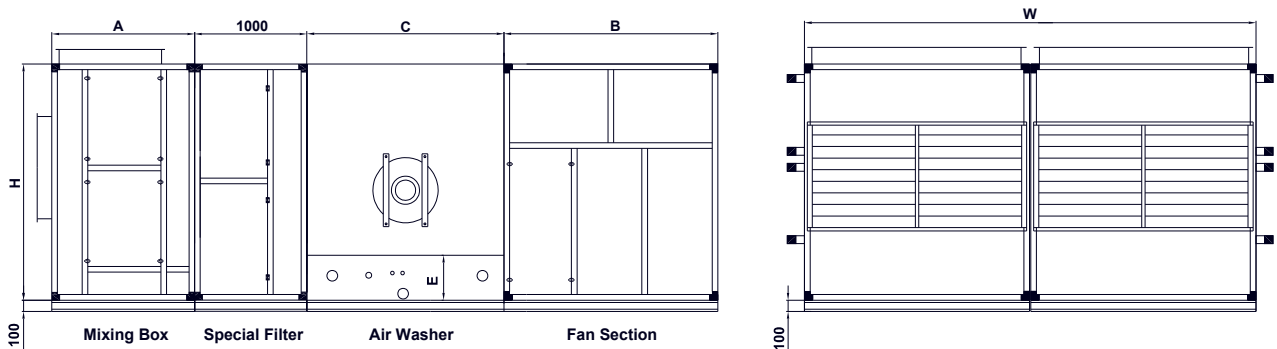
Model	Pos	A	B	C	D	E	H	W
250		880	1150	250	370	420	960	1050
350		880	1200	200	470	470	1060	1050
500		980	1350	410	500	570	1210	1500
700		1070	1400	380	560	615	1310	1500
1000		1070	1600	590	640	730	1410	2000
1250		1070	1800	540	740	830	1610	2000
1500		1270	1900	485	850	910	1910	2000
1750		1470	1900	610	850	910	1910	2250
2000		1470	2050	695	920	990	2010	2500
2250		1570	2050	775	920	990	2010	2650
2500		1070	1800	540	740	830	1610	4000
3000		1270	1900	485	850	910	1910	4000
3500		1470	1900	610	850	910	1910	4500
4000		1470	2050	695	920	990	2010	5000
4500		1570	2050	775	920	990	2010	5300

NOTE: All dimensions in mm.

# Air Washer



Models : 250 ~ 2250



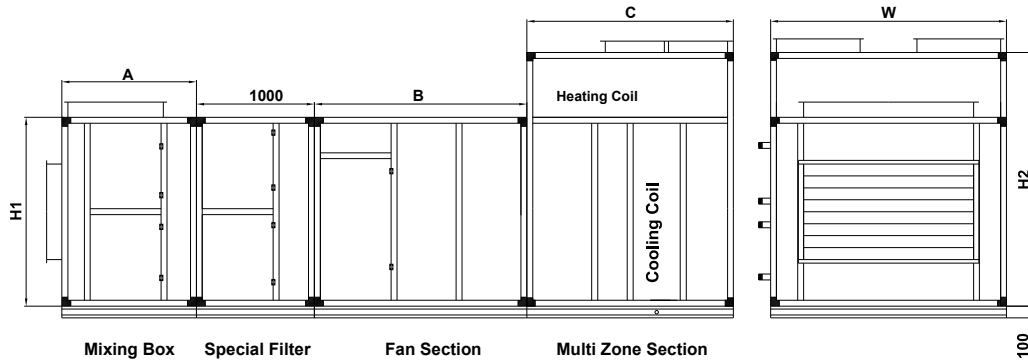
Models : 2500 ~ 4500

## Dimensions

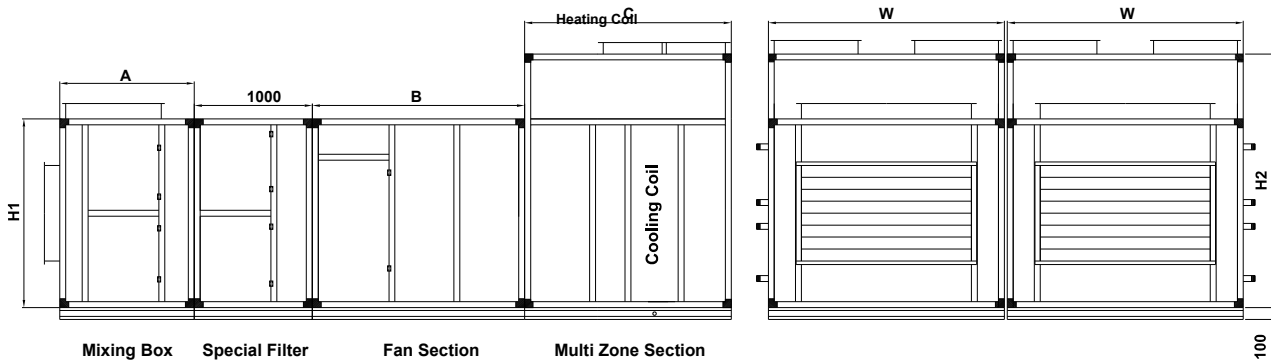
Model	Pos	A	B	C			E			H			W
				(Class 4)	(Class 6)	(Class 8)	(Class 4)	(Class 6)	(Class 8)	(Class 4)	(Class 6)	(Class 8)	
250		880	1150	1000	1750	2200	300	300	400	1120	1120	1220	1050
350		880	1200	1000	1750	2200	300	300	400	1260	1260	1360	1050
500		980	1350	1000	1750	2200	300	300	400	1190	1190	1290	1500
700		1070	1400	1000	1750	2200	300	300	400	1490	1490	1590	1500
1000		1070	1600	1000	1750	2200	300	300	400	1500	1500	1600	2000
1250		1070	1800	1000	1750	2200	300	300	400	1830	1830	1930	2000
1500		1270	1900	1000	1750	2200	300	300	400	2100	2100	2200	2000
1750		1470	1900	1000	1750	2200	300	300	400	2130	2130	2230	2250
2000		1470	2050	1000	1750	2200	300	300	400	2160	2160	2260	2500
2250		1570	2050	1000	1750	2200	300	300	400	2200	2200	2300	2650
2500		1070	1800	1000	1750	2200	300	300	400	1830	1830	1930	4000
3000		1270	1900	1000	1750	2200	300	300	400	2100	2100	2200	4000
3500		1470	1900	1000	1750	2200	300	300	400	2130	2130	2230	4500
4000		1470	2050	1000	1750	2200	300	300	400	2160	2160	2260	5000
4500		1570	2050	1000	1750	2200	300	300	400	2200	2200	2300	5300

NOTE: All dimensions in mm.

# Multi Zone Air Handling Unit



Models : 250 ~ 2250



Models : 2500 ~ 4500

## Dimensions

Model \ Pos	A	B	C	H1	H2	W
250	880	1150	1150	1050	1500	1050
350	880	1200	1350	1150	1600	1050
500	980	1350	1350	1200	1650	1500
700	1070	1400	1550	1300	1750	1500
1000	1070	1600	1600	1400	1850	2000
1250	1140	1800	1750	1600	2150	2000
1500	1470	1900	2000	1900	2450	2000
1750	1470	1900	2000	1900	2450	2250
2000	1470	2050	2000	2000	2550	2500
2250	1570	2050	2150	2000	2600	2650
2500	1140	1800	1750	1600	2150	2000
3000	1470	1900	2000	1900	2450	2000
3500	1470	1900	2000	1900	2450	2250
4000	1470	2050	2000	2000	2550	2500
4500	1570	2050	2150	2000	2600	2650

NOTE: All dimensions in mm.

# Fan Performance

Table 18

Model	Fan Size	Coil Face Area (Sq.Ft.)	Coil Face Velocity (F.P.M.)	CFM	Total Static Pressure in Inch of Water											
					0.5"		0.75"		1"		1.25"		1.5"		2"	
					RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.
250	1x13"	5	400	2000	642	0.5	727	0.75	814	0.75	903	1	994	1	--	--
			450	2250	665	0.5	75	0.75	832	1	211	1	920	1	1148	1.5
			500	2500	714	0.75	790	0.75	860	1	929	1	999	1.5	1141	2
			550	2750	753	1	827	1	893	1	956	1.5	1020	1.5	1149	2
			600	3000	761	1	865	1.5	229	1.5	990	1.5	1046	2	1167	2
			700	3500	--	--	943	2	1004	2	1060	2	1112	2	1212	3
			800	4000	--	--	--	--	--	--	1137	2	1186	3	1280	4
			800	4000	--	--	--	--	--	--	1137	2	1186	3	1280	4
350	1x14"	7	400	2800	570	0.75	640	0.75	706	1	773	1.5	842	1.5	972	2
			450	3150	606	0.75	672	1	730	1.5	796	1.5	850	1.5	972	2
			500	3500	623	1	696	1	762	1.5	811	1.5	864	2	976	3
			550	3850	680	1	741	2	796	2	859	2	895	2	972	3
			600	4200	718	1.5	778	2	831	2	890	2	926	3	1015	3
			700	4900	--	--	853	3	904	3	950	3	993	4	1083	4
			800	5600	--	--	--	--	979	4	1023	4	1065	5.5	1141	5.5
			800	5600	--	--	--	--	979	4	1023	4	1065	5.5	1141	5.5
500	1x17"	10	400	4000	454	1	515	1	571	1.5	631	1.5	692	2	803	3
			450	4500	478	1.5	539	1.5	592	1.5	641	2	693	2	798	3
			500	5000	535	1.5	566	1.5	610	2	656	3	702	3	798	4
			550	5500	541	1.5	591	2	636	3	682	3	722	3	803	4
			600	6000	--	--	621	2	665	3	732	4	723	3	818	4
			700	7000	--	--	677	3	721	4	757	4	796	5.5	858	5.5
			800	8000	--	--	--	--	778	5.5	818	5.5	848	5.5	914	5.5
			800	8000	--	--	--	--	778	5.5	818	5.5	848	5.5	914	5.5
700	1x19"	14	400	5600	414	1.5	474	1.5	530	2	543	3	648	3	760	4
			450	6300	436	1.5	491	2	542	3	593	3	645	3	751	4
			500	7000	--	--	512	3	560	3	605	3	651	4	745	5.5
			550	7700	--	--	533	3	580	4	621	4	664	4	747	5.5
			600	8400	--	--	557	4	601	4	642	4	681	5.5	757	5.5
			700	9800	--	--	--	--	646	5.5	684	5.5	722	7.5	791	7.5
			800	11200	--	--	--	--	--	--	729	7.5	763	10	888	10
			800	11200	--	--	--	--	--	--	729	7.5	763	10	888	10
1000	1x22"	19.7	400	7880	353	2	401	3	448	3	497	4	545	4	637	5.5
			450	8865	373	3	418	3	459	4	502	4	545	5.5	630	7.5
			500	9850	395	3	436	4	475	4	513	5.5	551	5.5	628	7.5
			550	10835	417	4	457	4	493	5.5	528	5.5	563	7.5	632	7.5
			600	11820	--	--	478	5.5	512	5.5	546	7.5	577	7.5	641	10
			700	13790	--	--	525	7.5	554	7.5	585	10	614	10	669	15
			800	15760	--	--	--	--	601	15	628	15	655	15	705	15
			800	15760	--	--	--	--	601	15	628	15	655	15	705	15
1250	1x26"	25.8	400	10320	308	3	347	3	384	4	423	4	462	5.5	543	7.5
			450	11610	329	3	363	4	397	4	430	5.5	464	5.5	535	7.5
			500	12900	348	4	381	5.5	412	5.5	463	5.5	473	7.5	534	10
			550	14190	370	5.5	528	5.5	430	7.5	458	7.5	486	7.5	540	10
			600	15480	376	5.5	422	7.5	449	7.5	476	10	501	10	552	15
			700	18060	--	--	464	10	489	10	513	15	534	15	581	15
			800	20640	--	--	--	--	532	15	554	15	576	20	616	20
			800	20640	--	--	--	--	532	15	554	15	576	20	616	20
1500	1x29"	29.5	400	11800	261	3	299	3	336	4	375	5.5	415	5.5	487	10
			450	13275	275	3	310	4	342	5.5	373	5.5	411	7.5	482	10
			500	14750	291	4	323	5.5	353	5.5	382	7.5	413	7.5	475	10
			550	16225	299	5.5	338	5.5	365	7.5	392	7.5	420	10	475	10
			600	17700	325	5.5	353	7.5	380	7.5	405	10	430	10	480	15
			700	20650	342	7.5	386	10	410	10	433	15	455	15	498	15
			700	20650	342	7.5	386	10	410	10	433	15	455	15	498	15
			700	20650	342	7.5	386	10	410	10	433	15	455	15	498	15
1750	1x29"	35.3	400	14120	284	4	317	4	348	5.5	379	5.5	412	7.5	479	10
			450	15885	304	5.5	334	5.5	362	7.5	390	7.5	418	7.5	474	10
			500	17650	325	5.5	353	7.5	379	7.5	404	10	429	10	480	15
			550	19415	342	7.5	372	10	397	10	421	10	443	15	489	15
			600	21180	--	--	393	10	415	15	438	15	460	15	502	15
			700	24710	--	--	415	15	456	15	476	20	496	20	534	20
			700	24710	--	--	415	15	456	15	476	20	496	20	534	20
			700	24710	--	--	415	15	456	15	476	20	496	20	534	20

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NOTE: Selections in shaded areas not recommended for cooling applications.



# Fan Performance

Table18 (Cont.)

Model	Fan Size	Coil Face Area (Sq.Ft.)	Coil Face Velocity (F.P.M.)	CFM	Total Static Pressure in Inch of Water											
					0.5"		0.75"		1"		1.25"		1.5"		2"	
					RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.
2000	1×32"	40	400	16000	306	5.5	336	5.5	364	7.5	391	7.5	419	10	475	10
			450	18000	329	5.5	357	7.5	383	7.5	408	10	432	10	482	15
			500	20000	--	--	379	10	403	10	427	15	449	15	494	15
			550	22000	--	--	403	15	425	15	447	15	469	15	509	20
			600	24000	--	--	--	--	448	15	469	15	489	20	537	20
			700	28000	--	--	--	--	--	--	514	25	533	25	567	30
2250	1×32"	44.4	400	17760	260	5.5	289	5.5	317	7.5	344	10	371	10	429	15
			450	19980	278	5.5	305	7.5	330	7.5	354	10	379	10	428	15
			500	22200	296	5.5	322	10	345	10	361	15	390	15	433	15
			550	24420	302	7.5	340	10	363	15	383	15	403	15	443	20
			600	26640	--	--	359	15	381	15	400	15	419	20	456	20
			700	31080	--	--	--	--	415	20	436	25	453	25	486	30
2500	2×26"	51.6	400	20640	308	2×3	347	2×3	384	2×4	423	2×5.5	462	2×5.5	543	2×7.5
			450	23220	329	2×3	363	2×4	397	2×4	430	2×5.5	464	2×5.5	535	2×7.5
			500	25800	348	2×4	381	2×5.5	412	2×5.5	443	2×7.5	473	2×7.5	534	2×10
			550	28380	370	2×5.5	401	2×5.5	430	2×7.5	458	2×10	486	2×7.5	540	2×10
			600	30960	376	2×5.5	422	2×7.5	449	2×7.5	476	2×10	501	2×10	552	2×15
			700	36120	--	--	464	2×10	489	2×10	513	2×15	534	2×15	581	2×15
3000	2×29"	59	400	23600	261	2×3	299	2×3	336	2×4	375	2×5.5	415	2×5.5	487	2×10
			450	26550	275	2×3	310	2×4	342	2×5.5	373	2×5.5	411	2×7.5	482	2×10
			500	29500	291	2×4	323	2×5.5	353	2×5.5	382	2×7.5	413	2×7.5	475	2×10
			550	32450	299	2×5.5	338	2×5.5	365	2×7.5	392	2×7.5	420	2×10	475	2×10
			600	35400	325	2×5.5	353	2×7.5	380	2×7.5	405	2×10	430	2×10	480	2×15
			700	41300	342	2×7.5	386	2×10	410	2×10	433	2×15	455	2×15	498	2×15
3500	2×29"	67.1	400	26840	277	2×4	312	2×4	343	2×5.5	377	2×5.5	411	2×7.5	482	2×10
			450	30195	296	2×5.5	327	2×5.5	356	2×7.5	385	2×7.5	414	2×7.5	475	2×10
			500	33550	314	2×5.5	344	2×7.5	371	2×7.5	397	2×10	423	2×10	476	2×15
			550	36905	335	2×7.5	362	2×7.5	388	2×10	412	2×10	436	2×15	484	2×15
			600	40260	--	--	381	2×10	405	2×10	428	2×15	451	2×15	495	2×15
			700	46970	--	--	--	--	442	2×15	463	2×20	484	2×20	523	2×20
4000	2×32"	80	400	32000	306	2×5.5	336	2×5.5	364	2×7.5	391	2×7.5	419	2×10	475	2×10
			450	36000	329	2×5.5	357	2×7.5	383	2×7.5	408	2×10	432	2×10	482	2×15
			500	40000	--	--	379	2×10	403	2×10	427	2×15	449	2×15	494	2×15
			550	44000	--	--	403	2×15	425	2×15	447	2×15	469	2×15	509	2×20
			600	48000	--	--	--	--	448	2×15	469	2×15	489	2×20	537	2×20
			700	56000	--	--	--	--	--	--	514	2×25	533	2×25	567	2×30
4500	2×32"	85.1	400	34040	253	2×5.5	284	2×5.5	312	2×7.5	341	2×7.5	370	2×10	431	2×15
			450	38295	270	2×5.5	298	2×7.5	324	2×7.5	349	2×10	375	2×10	427	2×15
			500	42550	287	2×7.5	313	2×10	338	2×10	361	2×10	385	2×15	460	2×15
			550	46805	306	2×10	330	2×10	353	2×15	375	2×15	396	2×15	438	2×20
			600	51060	--	--	348	2×15	370	2×15	390	2×15	410	2×20	448	2×20
			700	59570	--	--	--	--	405	2×20	423	2×20	441	2×25	475	2×25

NOTE: Selections in shaded areas not recommended for cooling applications.

# Fan Performance

Table18 (Cont.)

Model	Fan Size	Coil Face Area (Sq.Ft.)	Coil Face Velocity (F.P.M.)	CFM	Total Static Pressure in Inch of Water											
					2.5"		3"		3.5"		4"		5"		6"	
					RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.
250	1×13"	5	450	2250	--	--	--	--	--	--	--	--	--	--	--	--
			500	2500	1284	2	1422	3	--	--	--	--	--	--	--	--
			550	2750	1275	3	1407	3	1533	4	--	--	--	--	--	--
			600	3000	1279	3	1398	3	1518	4	1630	4	--	--	--	--
			700	3500	1310	3	1410	4	1510	4	1613	5.5	1817	5.5	--	--
			800	4000	1368	4	1455	5.5	1541	5.5	1629	5.5	1807	7.5	1982	10
350	1×14"	7	400	2800	--	--	--	--	--	--	--	--	--	--	--	--
			450	3150	--	--	--	--	--	--	--	--	--	--	--	--
			500	3500	1085	3	--	--	--	--	--	--	--	--	--	--
			550	3850	1090	4	1189	4	--	--	--	--	--	--	--	--
			600	4200	1104	4	1194	4	1283	5.5	--	--	--	--	--	--
			700	4900	1149	5.5	1222	4.5	1300	5.5	1379	7.5	1532	10	--	--
500	1×17"	10	400	4000	980	4	--	--	--	--	--	--	--	--	--	
			450	4500	978	4	1073	5.5	1168	5.5	1252	7.5	--	--	--	
			500	5000	986	4	1071	5.5	1156	5.5	1242	7.5	--	--	--	
			550	5500	1005	5.5	1081	5.5	1157	7.5	1235	7.5	1389	10	--	--
			600	6000	1031	5.5	1100	7.5	1169	7.5	1239	10	1383	10	--	--
			700	7000	1095	7.5	1155	10	1214	10	1237	10	1391	15	--	--
700	1×19"	14	400	5600	860	5.5	947	7.5	--	--	--	--	--	--	--	
			450	6300	850	5.5	940	7.5	1020	10	--	--	--	--	--	
			500	7000	840	7.5	930	7.5	1012	10	1089	10	--	--	--	
			550	7700	833	7.5	920	7.5	1003	10	1081	15	--	--	--	
			600	8400	834	7.5	913	10	993	10	1070	15	1211	15	--	--
			700	9800	853	10	919	10	986	15	1054	15	1190	20	--	--
1000	1×22"	19.7	400	7880	--	--	--	--	--	--	--	--	--	--	--	
			450	8865	711	7.5	--	--	--	--	--	--	--	--	--	
			500	9850	704	10	778	10	--	--	--	--	--	--	--	
			550	10835	701	10	771	15	839	15	--	--	--	--	--	
			600	11820	704	10	768	15	832	15	895	20	--	--	--	
			700	13790	723	15	777	15	832	20	886	20	996	25	--	--
1250	1×26"	25.8	400	10320	619	7.5	--	--	--	--	--	--	--	--	--	
			450	11385	608	10	665	10	--	--	--	--	--	--	--	
			500	12650	599	15	662	15	719	15	--	--	--	--	--	
			550	13915	597	15	655	15	714	20	768	20	--	--	--	
			600	15180	602	15	654	15	707	20	761	25	847	30	935	30
			700	17710	624	20	667	20	710	20	755	25	848	35	925	40
1500	1×29"	29.5	400	11800	--	--	--	--	--	--	--	--	--	--	--	
			450	13275	548	15	--	--	--	--	--	--	--	--	--	
			500	14750	539	15	597	15	--	--	--	--	--	--	--	
			550	16225	533	15	592	15	638	15	--	--	--	--	--	
			600	17700	531	15	584	20	635	20	677	25	--	--	--	
			700	20650	541	20	583	20	628	25	672	25	759	35	--	--
1750	1×29"	35.3	400	14120	543	15	--	--	--	--	--	--	--	--	--	
			450	15885	533	15	594	15	638	20	--	--	--	--	--	
			500	17650	531	15	585	20	635	20	677	25	--	--	--	
			550	19415	535	20	681	20	630	25	675	25	759	35	--	--
			600	21180	544	20	584	20	628	25	672	30	758	35	830	50
			700	24710	570	25	605	25	641	30	677	35	750	40	825	50

NOTE: Selections in shaded areas not recommended for cooling applications.

## Fan Performance

Table18 (Cont.)

Model	Fan Size	Coil Face Area (Sq.Ft.)	Coil Face Velocity (F.P.M.)	CFM	Total Static Pressure in Inch of Water											
					2.5"		3"		3.5"		4"		5"		6"	
					RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.	RPM	H.P.
2000	1×32"	40	400	16000	534	15	594	15	--	--	--	--	--	--	--	--
			450	18000	532	15	584	20	634	20	--	--	--	--	--	--
			500	20000	538	20	582	20	629	25	674	25	--	--	--	--
			550	22000	549	20	589	25	630	25	672	30	756	40	--	--
			600	24000	564	25	601	25	638	30	675	30	751	40	827	50
			700	28000	601	30	633	25	664	35	696	40	758	50	823	60
2250	1×32"	44.4	400	17920	485	15	534	20	--	--	--	--	--	--	--	--
			450	20160	479	20	529	20	575	25	--	--	--	--	--	--
			500	22400	478	20	524	25	570	25	613	30	--	--	--	--
			550	24640	483	20	523	25	565	30	608	30	--	--	--	--
			600	26880	492	25	528	30	565	30	604	35	680	50	--	--
			700	31360	518	30	549	35	580	40	611	40	675	50	742	60
2500	2×26"	51.6	400	20240	619	2×7.5	--	--	--	--	--	--	--	--	--	--
			450	22770	608	2×10	665	2×10	--	--	--	--	--	--	--	--
			500	25300	599	2×15	662	2×15	719	2×15	--	--	--	--	--	--
			550	27830	597	2×15	655	2×15	714	2×20	768	2×20	--	--	--	--
			600	30360	602	2×15	654	2×15	707	2×20	761	2×25	847	2×30	935	2×50
			700	35420	624	2×20	667	2×20	710	2×20	755	2×25	848	2×35	925	2×50
3000	2×29"	59	400	23600	--	--	--	--	--	--	--	--	--	--	--	
			450	26550	548	2×15	--	--	--	--	--	--	--	--	--	
			500	29500	539	2×15	597	2×15	--	--	--	--	--	--	--	
			550	32450	533	2×15	592	2×15	638	2×15	--	--	--	--	--	
			600	35400	531	2×15	584	2×20	635	2×20	677	2×25	--	--	--	--
			700	41300	541	2×20	583	2×20	628	2×25	672	2×25	759	2×35	--	--
3500	2×29"	67.1	400	28240	543	2×15	--	--	--	--	--	--	--	--	--	
			450	31770	533	2×15	594	2×15	638	2×20	--	--	--	--	--	
			500	35300	531	2×15	585	2×20	635	2×20	677	2×25	--	--	--	--
			550	38830	535	2×20	681	2×20	630	2×25	675	2×25	759	2×35	--	--
			600	42360	544	2×20	584	2×20	628	2×25	672	2×30	758	2×35	830	2×50
			700	49420	570	2×25	605	2×25	641	2×30	677	2×35	750	2×40	825	2×50
4000	2×32"	80	400	32000	534	2×15	794	2×15	--	--	--	--	--	--	--	
			450	36000	532	2×15	784	2×20	634	2×20	--	--	--	--	--	
			500	40000	538	2×20	582	2×20	629	2×25	674	2×25	--	--	--	--
			550	44000	549	2×20	589	2×25	630	2×25	672	2×30	756	2×35	--	--
			600	48000	564	2×25	601	2×25	638	2×30	675	2×30	751	2×40	827	2×50
			700	56000	601	2×30	633	2×30	664	2×35	696	2×40	758	2×45	823	2×60
4500	2×32"	85.1	400	35840	485	2×15	534	2×20	--	--	--	--	--	--	--	
			450	40320	479	2×20	529	2×20	575	2×25	--	--	--	--	--	
			500	44800	478	2×20	524	2×25	570	2×25	613	2×30	--	--	--	
			550	49280	483	2×20	523	2×25	565	2×30	608	2×30	--	--	--	
			600	53760	492	2×25	528	2×30	565	2×30	604	2×35	680	2×50	--	--
			700	62720	518	2×30	549	2×35	580	2×40	611	2×40	675	2×50	741	2×60

NOTE: Selections in shaded areas not recommended for cooling applications.

Coils & Filters

Table 19

Model	Nominal CFM	Coils				Filter Face Area	
		No. of Coils × No. of Circuits	Face HG.T (mm)	Face LG.T (mm)	Face Area (Ft)	V Type (Ft)	Flat (Ft)
250	2500	1×16	600	790	5.1	10	6
350	3500	1×22	825	790	7.0	11	8
500	5000	1×20	750	1240	10.0	17	10
700	7000	1×28	1050	1240	14.0	22	14
1000	10000	1×28	1050	1740	19.7	31	20
1250	12500	2×18	1350	1740	25.8	36	26
1500	15000	2×21	1575	1740	29.5	48	30
1750	17500	2×21	825	1990	35.3	58	36
2000	20000	2×22	863	2240	41.6	60	40
2250	22500	2×22	863	2390	44.4	72	45
2500	25000	4×17	675	1640	47.7	80	50
3000	30000	4×21	825	1640	58.3	96	60
3500	35000	4×21	825	1890	67.1	115	72
4000	40000	4×22	863	2140	79.5	128	80
4500	45000	4×22	863	2290	85.0	144	90

Dampers

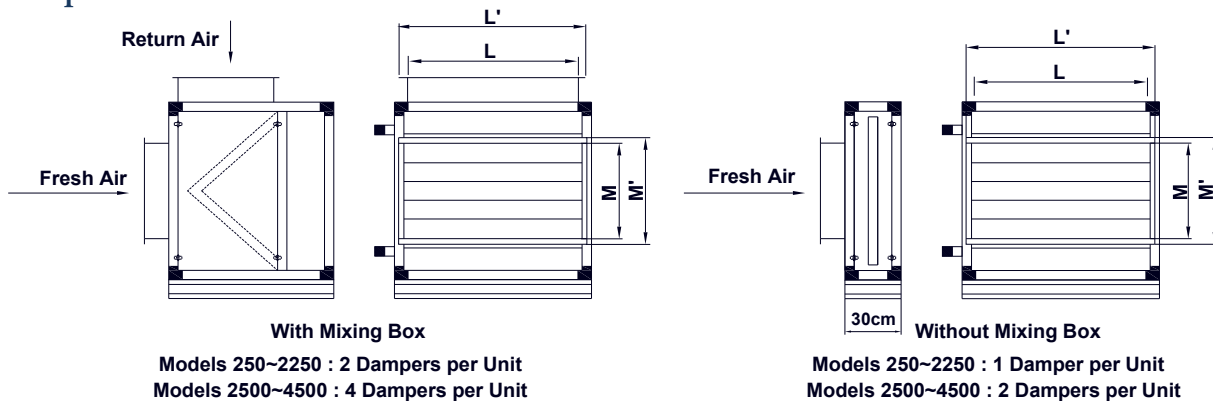


Table 20

Model	Nominal CFM	Inner Dimensions		Outer Dimensions	
		M(cm)	L(cm)	M'(cm)	L'(cm)
250	2500	510	910	570	1000
350	3500	510	910	570	1000
500	5000	610	1360	670	1450
700	7000	710	1360	770	1450
1000	10000	710	1860	770	1950
1250	12500	710	1860	770	1950
1500	15000	910	1860	970	1950
1750	17500	1110	1800	1170	1890
2000	20000	1110	2040	1170	2130
2250	22500	1210	2040	1270	2130
2500	25000	710	1860	770	1950
3000	30000	910	1860	970	1950
3500	35000	1110	1800	1170	1890
4000	40000	1110	2040	1170	2130
4500	45000	1210	2040	1270	2130

**NOTE:** The above figure is shown only for models up to 2250cfm ; higher models are constructed from two companion semi-capacity models.

## Water Pressure Drop in Tubes (Feet Water)

Table 21

Model	Water Velocity Feet Per Sec. 1Row											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.11	0.29	0.53	0.80	1.13	1.44	1.82	2.22	3.04	4.0	4.95	6.06
500, 700	0.14	0.36	0.65	0.95	1.35	1.75	2.20	2.70	3.70	4.75	5.90	7.30
1000, 1250, 1500,2500, 3000	0.16	0.42	0.75	1.02	1.60	2.08	2.62	3.16	4.38	5.73	7.17	8.85
1750, 3500	0.17	0.45	0.8	1.2	1.7	2.25	2.8	3.4	4.7	6.2	7.7	9.25
2000, 4000	0.20	0.49	0.88	1.30	1.85	2.43	3.03	3.67	5.10	6.68	8.36	10.32
2250, 4500	0.21	0.5	0.9	1.35	1.9	2.5	3.15	3.8	5.3	6.9	8.7	10.7

Model	Water Velocity Feet Per Sec. 2Rows											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.13	0.34	0.62	0.92	1.31	1.71	2.14	2.61	3.58	4.68	5.82	7.12
500, 700	0.15	0.41	0.75	1.10	1.56	2.04	2.55	3.12	4.30	5.57	6.90	8.54
1000, 1250, 1500,2500, 3000	0.18	0.49	0.88	1.29	1.85	2.40	2.95	3.66	5.13	6.70	8.38	10.35
1750, 3500	0.2	0.53	0.95	1.42	2.01	2.63	3.3	4	5.55	7.25	9.05	11.2
2000, 4000	0.21	0.57	1.02	1.51	2.05	2.83	3.54	4.28	5.97	7.81	9.78	12.07
2250, 4500	0.24	0.58	1.05	1.56	2.25	2.95	3.7	4.45	6.2	8.81	10.2	12.06

Model	Water Velocity Feet Per Sec. 3Rows											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.17	0.45	0.82	1.23	1.74	2.26	2.86	3.52	4.82	6.30	7.85	9.66
500, 700	0.21	0.55	1.00	1.48	2.13	2.80	3.48	4.30	5.90	7.70	9.65	11.95
1000, 1250, 1500,2500, 3000	0.24	0.67	1.16	1.80	2.54	3.33	4.21	5.15	7.15	9.37	11.7	14.15
1750, 3500	0.26	0.73	1.3	1.95	2.75	3.6	4.55	5.6	7.8	10.2	12.7	15.75
2000, 4000	0.28	0.79	1.40	2.07	2.98	3.90	4.93	6.05	8.40	11.05	13.8	16.7
2250, 4500	0.29	0.85	1.45	2.15	3.1	4.1	5.15	6.3	8.75	11.5	14.4	17.85

## Water Pressure Drop in Tubes (Feet Water)

Table 21(Cont.)

Model	Water Velocity Feet Per Sec. 4Rows											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.21	0.56	1.02	1.51	2.17	2.83	3.57	4.42	6.05	7.90	9.92	12.2
500, 700	0.26	0.70	1.25	1.87	2.70	3.50	4.40	5.45	7.45	9.80	12.25	15.2
1000, 1250, 1500,2500, 3000	0.29	0.85	1.51	2.23	3.21	4.22	5.36	6.60	9.15	12.0	15.0	18.63
1750, 3500	0.32	0.93	1.65	2.45	3.5	4.6	5.8	7.2	10	13.1	16.4	20.3
2000, 4000	0.35	1.01	1.78	2.62	3.81	4.98	6.32	7.76	10.83	14.24	17.83	22.09
2250, 4500	0.36	1.06	1.85	2.72	3.96	5.22	6.6	8.1	11.3	14.85	18.6	23.1

Model	Water Velocity Feet Per Sec. 6Rows											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.29	0.80	1.44	2.13	3.08	4.03	5.05	6.20	8.54	11.28	14.07	17.35
500, 700	0.36	0.98	1.80	2.65	3.83	5.00	6.30	7.77	10.7	14.14	17.78	21.93
1000, 1250, 1500,2500, 3000	0.43	1.18	2.19	3.20	4.70	6.11	7.73	8.80	13.21	17.4	22.9	27.04
1750, 3500	0.48	1.3	2.4	3.5	5.1	7.65	8.4	10.35	14.4	19	24	30
2000, 4000	0.52	1.39	2.56	3.78	5.53	7.25	9.15	11.26	15.66	20.7	26.11	32.2
2250, 4500	0.54	1.45	2.7	3.95	5.8	7.6	9.65	11.8	16.5	21.7	27.4	33.7

Model	Water Velocity Feet Per Sec. 8Rows											
	0.5	1	1.5	2	2.5	3	3.5	4	5	6	7	8
250, 350	0.38	1.04	1.86	2.73	3.97	5.23	6.53	7.98	10.3	14.65	18.22	22.5
500, 700	0.46	1.23	2.28	3.41	4.98	6.57	8.22	10.1	13.96	18.48	23.05	28.6
1000, 1250, 1500,2500, 3000	0.57	1.51	2.82	4.18	6.10	8.00	10.1	12.4	17.37	22.81	28.85	35.4
1750, 3500	0.64	1.64	3.1	4.55	6.65	8.7	11	13.5	18.9	24.9	31.5	38.8
2000, 4000	0.69	1.78	3.35	4.95	7.25	9.52	12.0	14.76	20.5	27.16	34.4	42.31
2250, 4500	0.71	1.85	3.5	5.2	7.65	10	12.7	15.5	21.6	28.6	36.3	44.4

## Coil water side Pressure Drop Correction Factor for Temperature Gradient

Table 21A

Average Water Temperature (°F)	40	50	60	80	100	120	140	150	160	180	200	220
Correction Factor	1.04	1	0.96	0.90	0.86	0.83	0.80	0.78	0.77	0.76	0.74	0.73

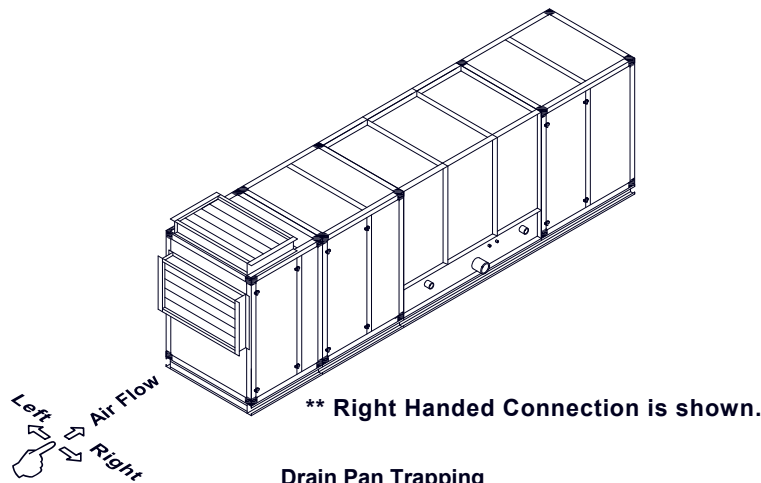
-Actual Water Side P.D. = P.D. (Table 21) x C.F. (Table 21A)

# Coil Connection

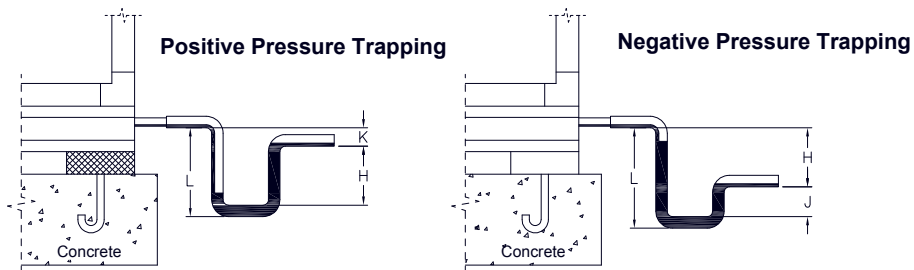
## Chilled & Hot Water & Steam Coil Connection

Table 22

Model	Chilled Water			Hot Water				Steam			
	4Rows	6Rows	8Rows	1Row	2Rows	3Rows	4Rows	Supply		Condenser	
								1Row	2Rows	1Row	2Rows
250	1 1/4"	1 1/2"	1 1/2"	1"	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/4"	1 1/4"
350	1 1/2"	2"	2"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/4"	1 1/4"
500	1 1/2"	2"	2"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	2"	2"	1 1/2"	1 1/2"
700	2"	2"	2 1/2"	1 1/2"	1 1/2"	2"	2"	2"	2"	1 1/2"	1 1/2"
1000	2"	2 1/2"	2 1/2"	1 1/2"	1 1/2"	2"	2"	2"	2"	1 1/2"	1 1/2"
1250	2x2"	2x2"	2x2 1/2"	2x1 1/2"	2x1 1/2"	2x2"	2x2"	2x2"	2x2"	2x1 1/2"	2x1 1/2"
1500	2x2"	2x2"	2x2 1/2"	2x1 1/2"	2x1 1/2"	2x2"	2x2"	2x2"	2x2"	2x1 1/2"	2x1 1/2"
1750	2x2 1/2"	2x2 1/2"	2x2 1/2"	2x1 1/2"	2x1 1/2"	2x2"	2x2 1/2"	2x2"	2x2"	2x1 1/2"	2x1 1/2"
2000	2x2 1/2"	2x2 1/2"	2x2 1/2"	2x1 1/2"	2x1 1/2"	2x2"	2x2 1/2"	2x2"	2x2"	2x1 1/2"	2x1 1/2"
2250	2x2 1/2"	2x2 1/2"	2x2 1/2"	2x1 1/2"	2x1 1/2"	2x2"	2x2 1/2"	2x2"	2x2"	2x1 1/2"	2x1 1/2"
2500	4x2"	4x2"	4x2 1/2"	4x1 1/2"	4x1 1/2"	4x2"	4x2"	4x2"	4x2"	4x1 1/2"	4x1 1/2"
3000	4x2"	4x2"	4x2 1/2"	4x1 1/2"	4x1 1/2"	4x2"	4x2"	4x2"	4x2"	4x1 1/2"	4x1 1/2"
3500	4x2 1/2"	4x2 1/2"	4x2 1/2"	4x1 1/2"	4x1 1/2"	4x2"	4x2 1/2"	4x2"	4x2"	4x1 1/2"	4x1 1/2"
4000	4x2 1/2"	4x2 1/2"	4x2 1/2"	4x1 1/2"	4x1 1/2"	4x2"	4x2 1/2"	4x2"	4x2"	4x1 1/2"	4x1 1/2"
4500	4x2 1/2"	4x2 1/2"	4x2 1/2"	4x1 1/2"	4x1 1/2"	4x2"	4x2 1/2"	4x2"	4x2"	4x1 1/2"	4x1 1/2"



Drain Pan Trapping



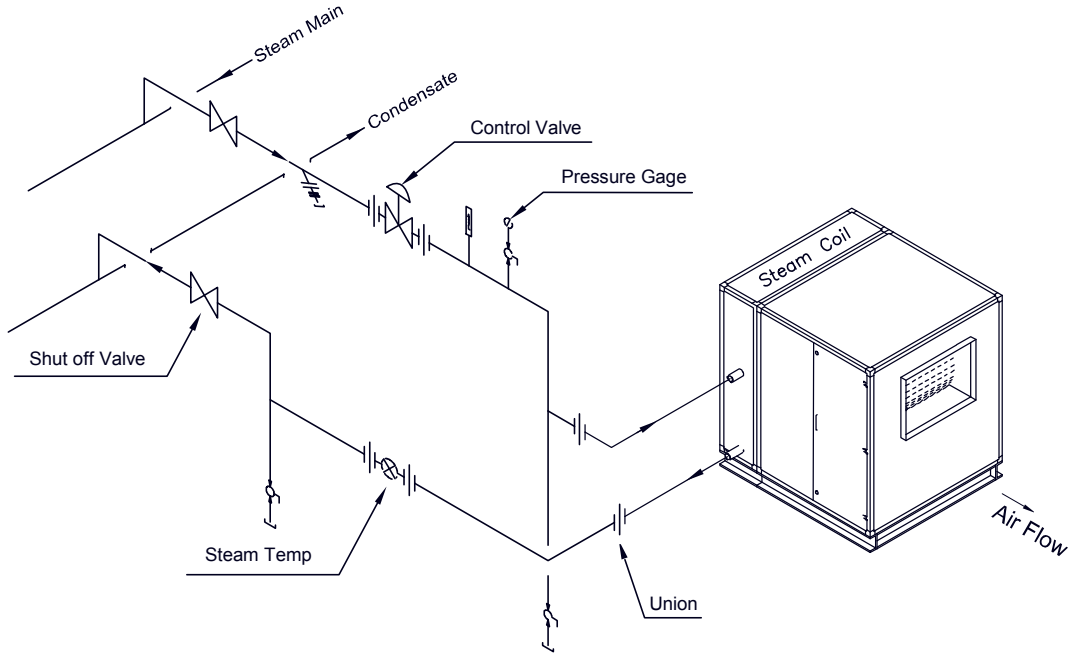
K = min. 1/2"  
 H = 1/2" Plus Maximum  
 Total Static Pressure

H = (1" For Each 1" of Maximum  
 Negative Static Pressure) + 1"  
 J = Half of H  
 L = H + J + Pipe Diameter + Insulation



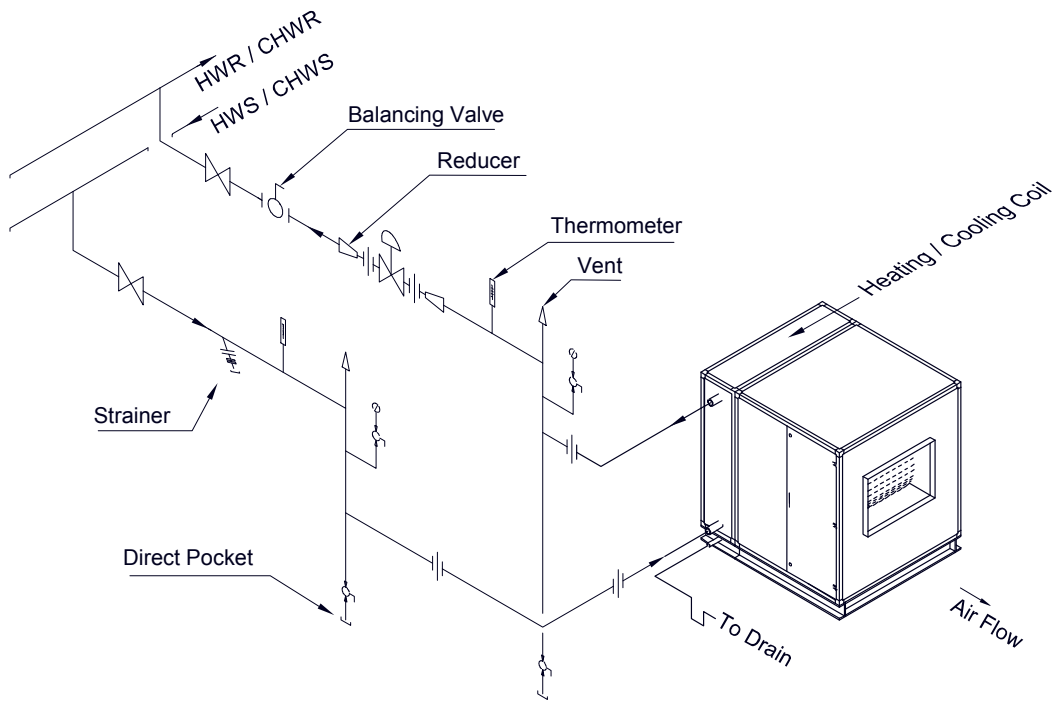
# Coil Connection Details

## Suggested Coil Connection Detail for Steam Coils



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## SUGGESTED COIL CONNECTION DETAIL FOR HEATING AND COOLING COILS



## AIR WASHER

### Evaporative Cooling Efficiency (E) / Class 4

Table A

Air Velocity	450	475	500	525	550
E	0.594	0.572	0.555	0.536	0.519

### Evaporative Cooling Efficiency (E) / Class 6&8

Table B

P.F.	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.0
E	0.60	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.92	0.95	1.0

### Air Washer Performance Factors (P.F)

Table C

Model	250		350		500		700		1000	
	C6	C8	C6	C8	C6	C8	C6	C8	C6	C8
P.F.	0.525	0.815	0.525	0.815	0.548	0.821	0.548	0.821	0.548	0.821
Model	1250		1500		1750		2000		2250	
	C6	C8	C6	C8	C6	C8	C6	C8	C6	C8
P.F.	0.548	0.821	0.571	0.854	0.571	0.854	0.571	0.854	0.571	0.854
Model	2500		3000		3500		4000		4500	
	C6	C8	C6	C8	C6	C8	C6	C8	C6	C8
P.F.	0.548	0.821	0.571	0.854	0.571	0.854	0.571	0.854	0.571	0.854

## Air Washer Selection Procedure

### GIVEN:

Entering air D.B temperature = 95 °F  
 Entering air W.B temperature = 63 °F  
 Sensible cooling load = 85 KBH  
 Design air flow rate = 10000 CFM  
 Room D.B temperature = 77 °F  
 Determine the required air washer model,  
 $Q = 1.085 \times \text{CFM} \times (\text{D.B. Room} - \text{D.B. Lvg.})$

$$\text{D.B. Lvg.} = \text{D.B. Room} - \frac{Q}{1.085 \times \text{CFM}} = 77 - \frac{85000}{1.085 \times 10000} = 69.16^\circ\text{F}$$

Considering the required air flow rate in CFM and the unit available nominal airflow rate, air handling unit model ATAH-1000 is chosen.

Evaporative cooling efficiency (E) is determined as,

$$E = \frac{\text{D.B. Ent.} - \text{D.B. Lvg.}}{\text{D.B. Ent.} - \text{W.B. Lvg.}} = \frac{95 - 69.16}{95 - 63} = 0.8$$

The coil face area for model 1000 is 20 FT therefore,

$$\text{F.V.} = \frac{10000}{20} = 500 \text{ F.P.M.}$$

Considering the air velocity and the values in table A the (E) value for class 4 air washer is equal to 0.555 which is less than the calculated value therefore class 4 air washer does not satisfy the requirement. In this case since the (E) value is known, the (P.F.) value from table B is determined as being equal to 0.75. Now, considering the unit model ATAH-1000, the (P.F.) value and table C the (P.F.) value for class 6 air washer is less than the value calculated therefore, class 8 washer satisfies the requirement.

We also notice that the (P.F.) value given is 0.821. Therefore, the actual (E) value is 0.856 (Table B) the Lvg. Air D.B. temperature is given as,

$$\text{D.B. Lvg.} = \text{D.B. Ent.} - E \times (\text{D.B. Ent.} - \text{W.B. Ent.}) = 95 - 0.821 \times (95 - 63) = 68.7^\circ\text{F}$$

Therefore, the actual air washer cooling capacity is given as,

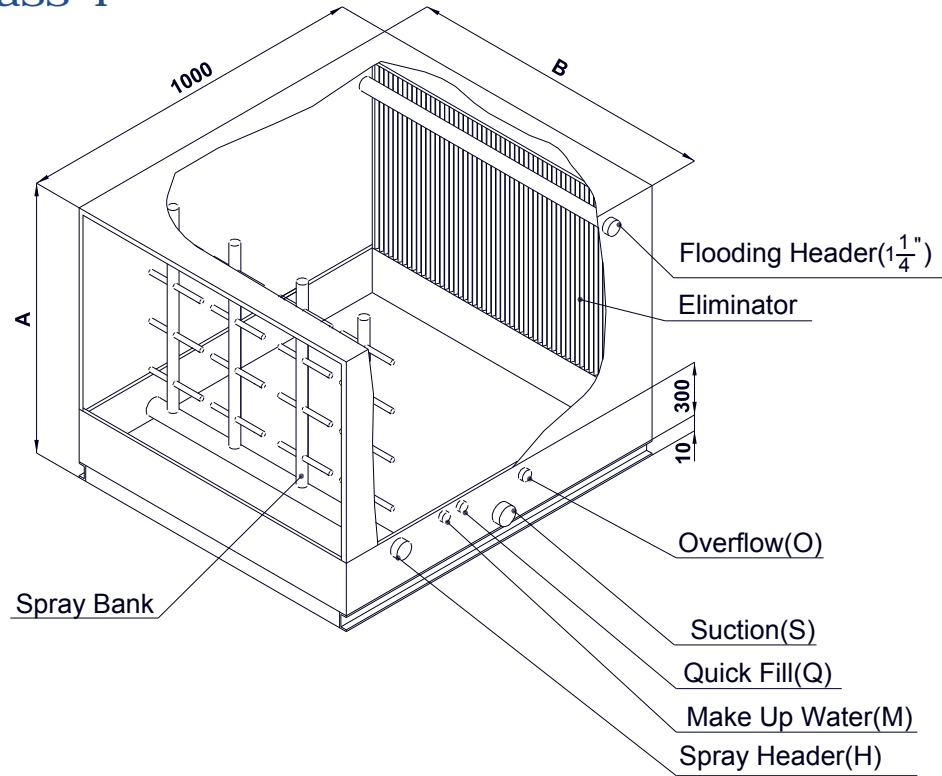
$$Q = 1.085 \times \text{CFM} \times (\text{D.B. Room} - \text{D.B. Lvg.}) = 1.085 \times 10000 \times (77 - 68.7) = 90055 \text{ BTU / HR} \sim 90 \text{ KBH}$$

Entering the psychometric chart with the leaving air D.B. and W.B. temperatures of 68.7°F and 63°F respectively, the relative humidity of the air is determined to be 73%.

### NOTE:

Abbreviations Ent. and Lvg. denote air Entering and Leaving air washer.

## Air Washer Class 4



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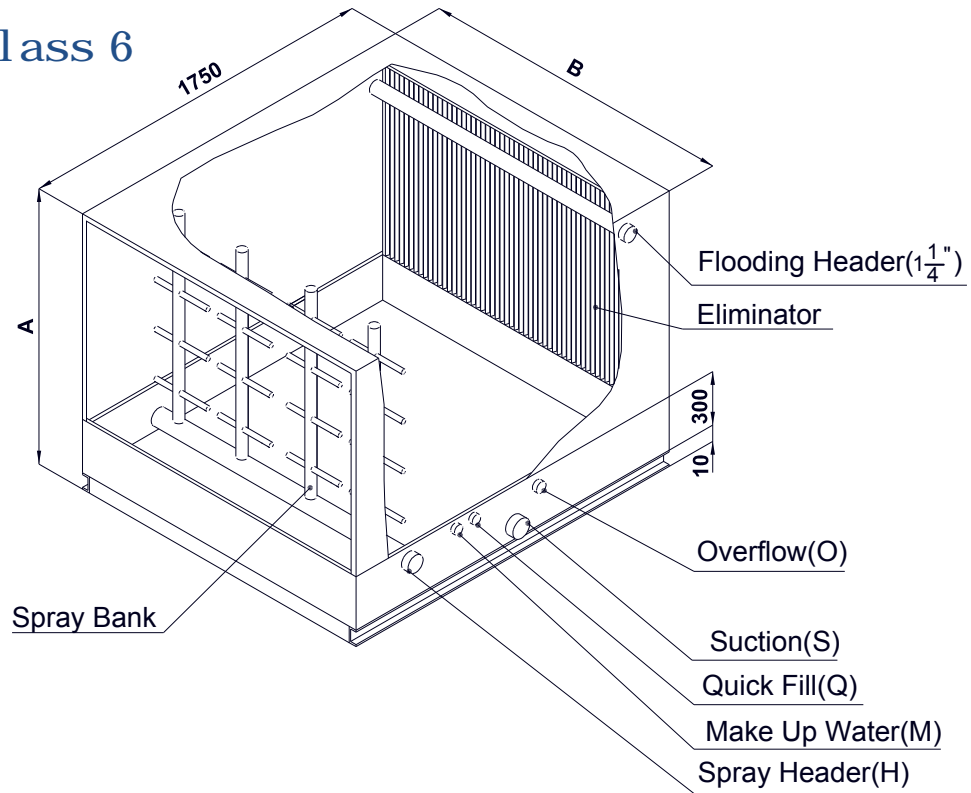
### Engineering Data

Model	Nomi. CFM	Face Area (Sq.Ft.)	GPM	Nozzle Head	Pump Head	Weight(Kg)		Dimensions(mm)		Connections(Inch)				
						Net	Oper.	A	B	S	H	O	M	Q
250	2500	5.1	11	55	59	250	510	1220	1050	2 1/2"	2"	1"	1/2"	1/2"
350	3500	7	15	55	60	300	560	1360	1050	2 1/2"	2"	1"	1/2"	1/2"
500	5000	10	24	55	60	350	730	1290	1500	2 1/2"	2"	1"	1/2"	1/2"
700	7000	14	35	55	61	400	780	1590	1500	2 1/2"	2"	1"	1/2"	1/2"
1000	10000	21.1	44	55	62	500	1025	1600	2000	2 1/2"	2"	2"	1/2"	1/2"
1250	12500	25.2	59	55	62	550	1075	1930	2000	3"	3"	2"	3/4"	3/4"
1500	15000	30.9	63	55	63	600	1125	2200	2000	3"	3"	2"	3/4"	3/4"
1750	17500	35.3	70	55	64	650	1250	2230	2250	3"	3"	2"	3/4"	3/4"
2000	20000	41.6	79	55	64	700	1360	2260	2500	3"	3"	2"	3/4"	3/4"
2250	22500	44.4	97	55	64	800	1550	2300	2650	3"	3"	2"	3/4"	3/4"
2500	25000	47.6	119	55	62	1100	2150	1930	4000	2x3"	2x3"	2x2"	2x3/4"	2x3/4"
3000	30000	58.2	126	55	63	1200	2250	2200	4000	2x3"	2x3"	2x2"	2x3/4"	2x3/4"
3500	35000	67.1	140	55	64	1300	2500	2230	4500	2x3"	2x3"	2x2"	2x3/4"	2x3/4"
4000	40000	79.5	158	55	64	1400	2720	2260	5000	2x3"	2x3"	2x2"	2x3/4"	2x3/4"
4500	45000	85	194	55	64	1600	3100	2300	5300	2x3"	2x3"	2x2"	2x3/4"	2x3/4"

**NOTE:**

- 1- Nozzle head and pump head in feet of water.
- 2- Rounding in dimensions and specifications.

## Air Washer Class 6



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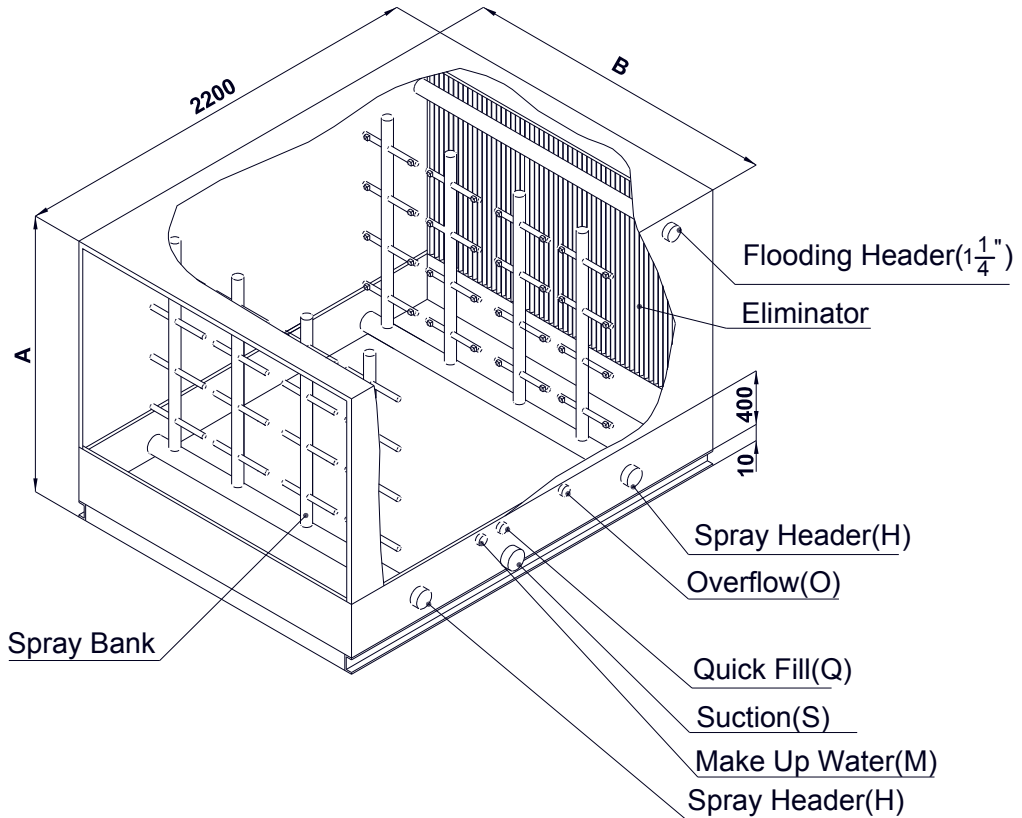
### Engineering Data

Model	Nominal CFM	Face Area (Sq.Ft.)	GPM	Nozzle Head	Pump Head	Weight(Kg)		Dimensions(mm)		Connections(Inch)				
						Net	Oper.	A	B	S	H	O	M	Q
250	2500	5.1	15	55	59	450	950	1220	1050	2 1/2"	2"	1"	1/2"	1/2"
350	3500	7	22	55	60	500	1000	1360	1050	2 1/2"	2"	1"	1/2"	1/2"
500	5000	10	35	55	60	550	1280	1290	1500	2 1/2"	2"	1"	1/2"	1/2"
700	7000	14	46	55	61	600	1330	1590	1500	2 1/2"	2"	1"	3/4"	3/4"
1000	10000	21.1	62	55	62	720	1700	1600	2000	3"	2"	2"	3/4"	3/4"
1250	12500	25.2	79	55	62	825	1800	1930	2000	3"	3"	2"	3/4"	3/4"
1500	15000	30.9	95	55	63	900	1900	2200	2000	3"	3"	2"	3/4"	3/4"
1750	17500	35.3	101	55	64	980	2100	2230	2250	4"	3"	2"	3/4"	3/4"
2000	20000	41.6	119	55	64	1050	2300	2260	2500	4"	3"	2"	3/4"	3/4"
2250	22500	44.4	143	55	64	1200	2600	2300	2650	4"	3"	2"	1"	1"
2500	25000	47.6	158	55	62	1650	3600	1930	4000	2×3"	2×3"	2×2"	2×3/4"	2×3/4"
3000	30000	58.2	190	55	63	1800	3800	2200	4000	2×3"	2×3"	2×2"	2×3/4"	2×3/4"
3500	35000	67.1	202	55	64	1960	4200	2230	4500	2×4"	2×3"	2×2"	2×3/4"	2×3/4"
4000	40000	79.5	238	55	64	2100	4600	2260	5000	2×4"	2×3"	2×2"	2×3/4"	2×3/4"
4500	45000	85	286	55	64	2400	5200	2300	5300	2×4"	2×3"	2×2"	2×1"	2×1"

**NOTE:**

- 1- Nozzle head and pump head in feet of water.
- 2- Rounding in dimensions and specifications.

## Air Washer Class 8



### Engineering Data

Model	Nominal CFM	Face Area (Sq.Ft.)	GPM	Nozzle Head	Pump Head	Weight(Kg)		Dimensions(mm)		Connections(Inch)				
						Net	Oper.	A	B	S	H	O	M	Q
250	2500	5.1	22	55	59	450	950	1320	1050	3"	2×2"	2"	1/2"	1/2"
350	3500	7	30	55	60	500	1000	1460	1050	3"	2×2"	2"	1/2"	1/2"
500	5000	10	48	55	60	550	1280	1390	1500	3"	2×2"	2"	1/2"	1/2"
700	7000	14	70	55	61	600	1330	1690	1500	3"	2×2"	2"	3/4"	3/4"
1000	10000	21.1	97	55	62	720	1700	1700	2000	3"	2×2"	2"	3/4"	3/4"
1250	12500	25.2	119	55	62	825	1800	2030	2000	4"	2×3"	2"	3/4"	3/4"
1500	15000	30.9	127	55	63	900	1900	2300	2000	4"	2×3"	2"	3/4"	3/4"
1750	17500	35.3	143	55	64	980	2100	2330	2250	4"	2×3"	2"	3/4"	3/4"
2000	20000	41.6	158	55	64	1050	2300	2360	2500	4"	2×3"	2"	3/4"	3/4"
2250	22500	44.4	191	55	64	1200	2600	2400	2650	4"	2×3"	2"	1"	1"
2500	25000	47.6	238	55	62	1650	3600	2030	4000	2×4"	4×3"	2×2"	2×3/4"	2×3/4"
3000	30000	58.2	254	55	63	1800	3800	2300	4000	2×4"	4×3"	2×2"	2×3/4"	2×3/4"
3500	35000	67.1	286	55	64	1960	4200	2330	4500	2×4"	4×3"	2×2"	2×3/4"	2×3/4"
4000	40000	79.5	316	55	64	2100	4600	2360	5000	2×4"	4×3"	2×2"	2×3/4"	2×3/4"
4500	45000	85	382	55	64	2400	5200	2400	5300	2×4"	4×3"	2×2"	2×1"	2×1"

**NOTE:**

- 1- Nozzle head and pump head in feet of water.
- 2- Rounding in dimensions and specifications.

## HUMIDIFIERS

### Spray Nozzle Humidifier

Model	Nominal CFM	Absorbed Moisture		Header Size (inch)
		$\Delta W=5$	$\Delta W=10$	
250	2500	8	15	1
350	3500	12	22	1
500	5000	16	31	1
700	7000	23	44	1 1/4
1000	10000	33	62	1 1/4
1250	12500	42	78	1 1/4
1500	15000	50	94	1 1/2
1750	17500	58	125	2
2000	20000	66	110	2
2250	22500	75	156	2x1 1/4
2500	25000	83	140	2x1 1/4
3000	30000	100	188	2x1 1/2
3500	35000	116	220	2x2
4000	40000	132	250	2x2
4500	45000	150	280	2x2

### Electrical Pan Humidifier

Model	Nominal CFM	Absorbed Moisture (Lb/Hr)	KW
250	2500	12	4
350	3500	18	6
500	5000	24	8
700	7000	33	10
1000	10000	49	16
1250	12500	60	20
1500	15000	71	24
1750	17500	83	28
2000	20000	95	32
2250	22500	106	36
2500	25000	120	40
3000	30000	142	48
3500	35000	166	56
4000	40000	190	64
4500	45000	212	72

#### Notes:

- $\Delta W$ : Moisture difference between air after and before humidifier [Grain/Lb (of dry air)] - Drain size = 0.5 inch

### Steam Grid Humidifier

Model	Nominal CFM	Steam Capacity (Lb/Hr)					
		$\Delta W=10$	$\Delta W=20$	$\Delta W=30$	$\Delta W=40$	$\Delta W=60$	$\Delta W=80$
250	2500	13	32	46	64	97	129
350	3500	18	45	64	89	135	180
500	5000	26	64	92	127	193	257
700	7000	36	89	128	178	271	361
1000	10000	52	128	183	255	387	515
1250	12500	65	160	230	318	481	645
1500	15000	79	192	275	382	581	773
1750	17500	92	223	320	445	677	900
2000	20000	105	256	367	510	775	1030
2250	22500	118	288	412	573	870	1158
2500	25000	130	320	460	636	962	1290
3000	30000	158	384	550	764	1162	1546
3500	35000	184	446	640	890	1354	1800
4000	40000	210	512	734	1020	1550	2060
4500	45000	236	576	824	1146	1740	2316

#### NOTES:

- $\Delta W$ : Moisture difference between air after and before humidifier [Grain/Lb(of dry air)] - Steam humidifier rating at 5 PSI pressure.



## FILTERS

### A. ALUMINUM WASHABLE

High capacity, low resistance, permanent metal filters, which can be cleaned in hot water with detergent. They can be used for air cleanliness required 65-70% arrestance or as an economical alternate to disposable type pre - filter of high efficiency filter.

EU Class	2
Arrestance (%)	65 - 80

### B. PANEL FILTER (DISPOSABLE)

Heavy duty disposable panel filters giving primary protection to the conditioned space or protect more expensive secondary filters. They are available in synthetic fiber pleated media consist of continuous filament glass fiber of progressive density.

EU Class	3	4	5
Arrestance (%)	80 - 90	90 - 95	--
Dust Spot Efficiency (%)	20 - 25	25 - 40	40 - 60

### C. BAG FILTER

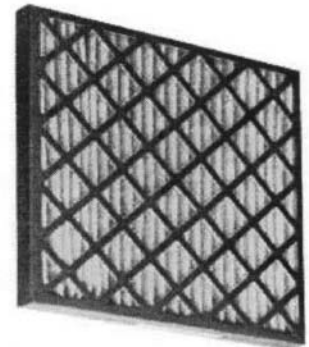
When high performance air filtration long service life and high dust holding capacity required in air handling, then extended surface pocket filters are selected. Filters are available in various efficiency depth, and number of pockets. Dust holding capacity is maximized because dirt is evenly loaded throughout the entire depth of the filter.

EU Class	6	7	8	9
Dust Spot Efficiency (%)	60 - 80	80 - 90	90 - 95	95 - 99

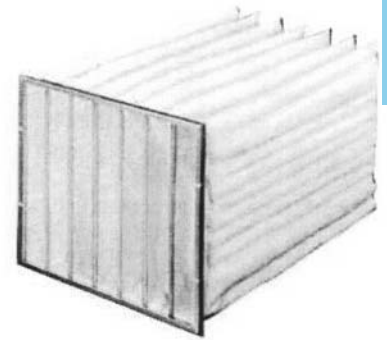
### D. HEPA FILTERS

Hepa filter are used to remove airborne biological contaminants in hospital critical area. Pharmaceutical processing industries as well as to meet exact requirements of the laboratories and precision manufacturing and micro electronic industries filters are available in 99.97 or 99.99% efficiency with plywood or galvanized steel casing. Hepa filters are installed on specially designed knife edge type seal framing system with pressure tight lock to prevent air bypass.

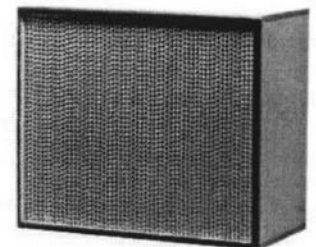
EU Class	11	12	13	14
Dust Spot Efficiency (%)	99.9-99.97	99.97-99.99	99.99-99.999	99.999-99.9995



Panel Filter



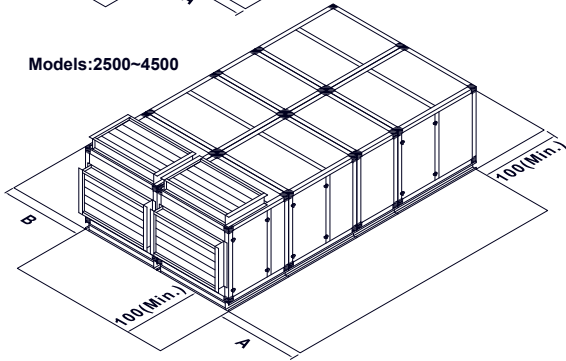
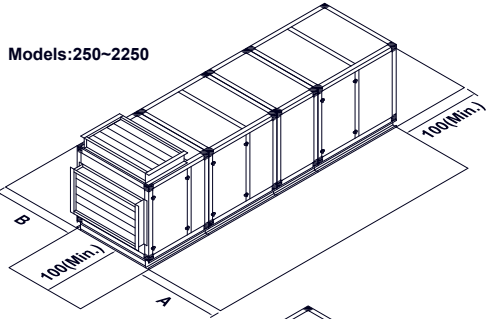
Bag Filter



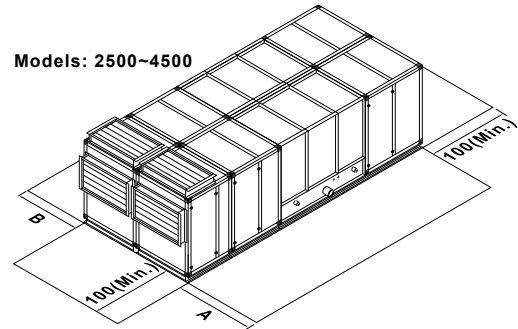
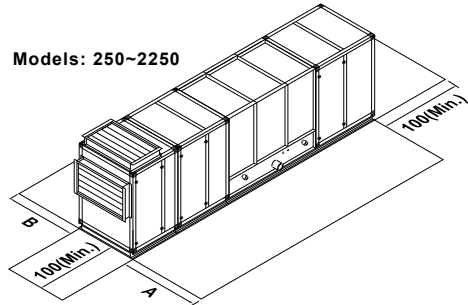
Hepa Filter

# Service Area Requirements

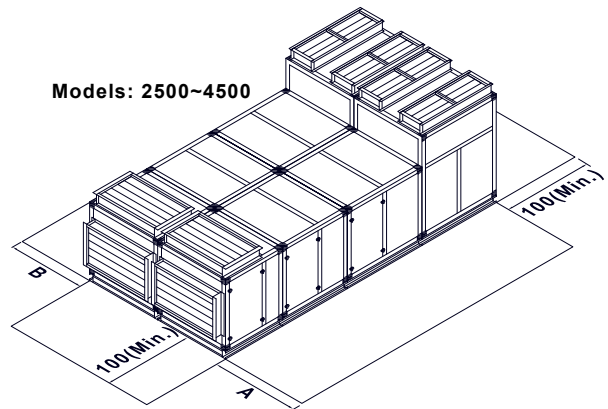
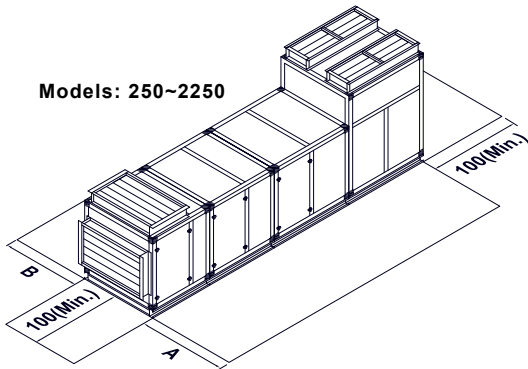
## Single Zone - Horizontal



## Air Washer



## Multi Zone



Model	250	350	500	750	1000	1250	1500	1750	2000	2250	2500	3000	3500	4000	4500
A	75	75	85	85	105	105	105	105	125	125	215	215	240	265	280
B	115	115	165	165	215	215	215	215	265	280	215	215	240	265	280

**NOTES:**

All dimensions are in cm.

Only left-handed connections are shown.

## Enthalpy / Altitude

Air Wet Bulb Temperature (°F)	Attitude (Ft)					
	0	1000	2000	3000	4000	5000
	Enthalpy (BTU/Lb)					
35	13.0	13.2	13.3	13.5	13.7	13.9
36	13.4	13.5	13.8	14.0	14.2	14.5
37	13.9	14.0	14.3	14.4	14.7	14.8
38	14.2	14.5	14.7	15.0	15.1	15.3
39	14.8	15.0	15.2	15.4	15.6	15.9
40	15.2	15.4	15.7	15.9	16.2	16.4
41	15.7	15.9	16.1	16.4	16.6	16.8
42	16.2	16.4	16.6	16.9	17.2	17.4
43	16.6	16.9	17.1	17.4	17.6	18.0
44	17.2	17.4	17.6	17.9	18.2	18.5
45	17.7	17.9	18.2	18.4	18.7	19.0
46	18.2	18.4	18.7	19.0	19.3	19.6
47	18.7	18.9	19.3	19.5	19.8	20.2
48	19.2	19.5	19.8	20.0	20.4	20.8
49	19.7	20.0	20.4	20.6	21.0	21.3
50	20.3	20.6	20.9	21.2	21.6	22.3
51	20.9	21.2	21.5	21.8	22.2	22.6
52	21.4	21.7	22.1	22.5	22.8	23.2
53	22.0	22.4	22.7	23.1	23.5	24.0
54	22.6	23.0	23.4	23.8	24.1	24.6
55	23.2	23.6	24.0	24.4	24.8	25.3
56	23.8	24.2	24.6	25.0	25.5	25.9
57	24.4	24.8	25.3	25.8	26.2	26.7
58	25.2	25.5	25.9	26.4	26.9	27.4
59	25.8	26.2	26.7	27.2	27.6	28.2
60	26.5	26.9	27.4	27.8	28.4	28.9
61	27.2	27.6	28.1	28.6	29.2	29.7
62	27.9	28.3	28.9	29.4	29.9	30.5
63	28.5	29.0	29.6	30.2	30.7	31.4
64	29.3	29.8	30.3	31.0	31.6	32.2
65	30.1	30.6	31.2	31.7	32.3	33.0
66	30.8	31.4	32.0	32.6	33.3	33.9
67	31.6	32.2	32.8	33.5	34.1	34.8
68	32.4	33.0	33.7	34.3	35.0	35.8
69	33.2	33.9	34.5	35.3	35.9	36.7
70	34.0	34.7	35.4	36.1	36.9	37.6
71	34.9	35.6	36.3	37.0	37.9	38.6
72	35.8	36.5	37.3	38.0	38.8	39.7
73	36.7	37.5	38.2	39.0	39.9	40.7
74	37.6	38.4	39.2	40.0	40.9	41.8
75	38.6	39.4	40.2	41.0	42.0	42.9
76	39.6	40.3	41.2	42.1	43.0	44.0
77	40.6	41.4	42.3	43.2	42.2	45.2
78	41.5	42.5	43.4	44.3	45.3	46.4
79	42.6	43.5	44.5	45.5	46.5	47.5
80	43.7	44.6	45.6	46.6	47.6	48.8
81	44.8	45.8	46.7	47.8	48.8	50.0
82	45.9	46.9	48.0	49.0	50.3	51.4
83	47.0	48.1	49.2	50.3	51.5	52.8
84	48.2	49.3	50.4	51.6	52.9	54.2
85	49.4	50.3	51.7	53.0	54.2	55.6