Engineering Data

FAN 12" BI DWDI

Wheel Diameter: 12.25 inches
Outlet Area: 1.55 square ft
Tip Speed: 3.21xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1550	1000	1153	0.21	1417	0.37	1910	0.82	2308	1.33								
1860	1200	1267	0.28	1514	0.46	1938	0.91	2335	1.48	2671	2.09						
2170	1400	1393	0.37	1622	0.58	1997	1.04	2363	1.63	2699	2.30	2994	3.00				
2480	1600	1528	0.48	1734	0.71	2092	1.21	2402	1.78	2727	2.50	3022	3.26	3289	4.05		
2790	1800	1670	0.63	1854	0.87	2196	1.42	2485	2.01	2761	2.68	3050	3.50	3318	4.36	3791	6.13
3100	2000	1815	0.80	1983	1.06	2305	1.66	2583	2.29	2833	2.96	3084	3.73	3345	4.64	3820	6.55
3410	2200	1964	1.00	2118	1.29	2417	1.92	2688	2.60	2927	3.31	3151	4.07	3381	4.93	3849	6.95
3720	2400	2115	1.24	2258	1.56	2533	2.21	2796	2.95	3029	3.71	3244	4.50	3448	5.33	3875	7.30
4030	2600	2268	1.52	2400	1.86	2657	2.55	2907	3.33	3136	4.14	3343	4.97	3540	5.83	3919	7.72
4340	2800	2422	1.84	2546	2.20	2786	2.94	3020	3.75	3245	4.61	3448	5.49	3638	6.39	3994	8.29
4650	3000	2578	2.20	2694	2.59	2920	3.38	3139	4.21	3355	5.12	3556	6.06	3742	7.00	4086	8.97

FAN 15" BI DWDI

Wheel Diameter: 15.00 inches
Outlet Area: 2.33 square ft
Tip Speed: 3.93xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4100	1760	1316	0.92	1473	1.31	1749	2.16	2005	3.11	2258	4.24	2490	5.48				
4600	1974	1437	1.18	1582	1.61	1841	2.55	2072	3.53	2301	4.65	2525	5.93	2736	7.31		
5100	2189	1562	1.49	1696	1.97	1938	2.99	2156	4.04	2360	5.16	2567	6.44	2770	7.87	3145	10.93
5500	2361	1663	1.79	1790	2.31	2020	3.39	2229	4.52	2422	5.67	2612	6.94	2804	8.37	3171	11.53
6000	2575	1790	2.22	1909	2.78	2127	3.94	2325	5.16	2509	6.39	2684	7.68	2858	9.08	3208	12.29
6500	2790	1919	2.72	2031	3.31	2236	4.56	2425	5.87	2602	7.19	2768	8.55	2928	9.95	3252	13.14
6900	2961	2023	3.18	2131	3.81	2327	5.11	2508	6.48	2679	7.88	2841	9.32	2994	10.76	3297	13.92
7400	3176	2154	3.83	2255	4.48	2442	5.88	2615	7.32	2779	8.81	2934	10.34	3082	11.86	3366	15.06
7900	3391	2286	4.55	2381	5.26	2560	6.73	2725	8.26	2881	9.83	3031	11.43	3175	13.07	***3445***	***16.36***
8800	3777	2525	6.11	2612	6.89	2777	8.50	2930	10.18	3075	11.90	3215	13.66	3350	15.44	***3606***	***19.09***
9780	4197	2787	8.18	2866	9.04	3019	10.82	3161	12.64	3296	14.53	***3426***	***16.45***	***3552***	***18.40***	***3792***	***22.37***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 18" BI DWDI

Wheel Diameter: 18.25 inches
Outlet Area: 3.45 square ft
Tip Speed: 4.78xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5520	1600	982	1.04	1131	1.56	1385	2.68	1587	3.83	1776	5.10						
6210	1800	1067	1.33	1204	1.90	1446	3.13	1647	4.41	1820	5.73	1988	7.17				
6900	2000	1157	1.69	1282	2.31	1510	3.64	1709	5.05	1877	6.47	2031	7.94	2183	9.55		
7590	2200	1249	2.12	1362	2.77	1578	4.21	1770	5.74	1939	7.29	2088	8.87	2227	10.49	2501	14.07
8280	2400	1344	2.62	1447	3.32	1649	4.86	1833	6.48	2000	8.17	2150	9.89	2284	11.59	2539	15.24
8970	2600	1439	3.21	1534	3.95	1723	5.58	1900	7.32	2062	9.11	2211	10.96	2346	12.81	2588	16.57
9660	2800	1536	3.88	1623	4.67	1801	6.40	1969	8.23	2126	10.14	2272	12.09	2408	14.10	2646	18.07
10350	3000	1634	4.66	1715	5.49	1881	7.30	2041	9.24	2193	11.25	2335	13.32	2468	15.42	2708	19.70
11040	3200	1733	5.54	1808	6.41	1964	8.32	2116	10.35	2262	12.46	2400	14.64	2530	16.85	2770	21.41
11730	3400	1832	6.53	1903	7.45	2048	9.43	2194	11.57	2334	13.79	2467	16.05	2594	18.38	***2831***	***23.18***
13110	3800	2032	8.87	2095	9.88	2224	12.03	2356	14.36	2484	16.77	2609	19.26	2729	21.79	***2955***	***27.01***
14490	4200	2233	11.73	2290	12.83	2406	15.16	2524	17.64	2643	20.26	2759	22.96	***2871***	***25.68***	***3087***	***31.33***

FAN 20" BI DWDI

Wheel Diameter: 20.00 inches
Outlet Area: 4.14 square ft
Tip Speed: 5.24xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7500	1812	978	1.62	1102	2.31	1322	3.79	1505	5.33	1663	6.92	1816	8.65				
8200	1981	1047	1.99	1162	2.72	1371	4.30	1553	5.99	1707	7.67	1849	9.44	1988	11.36		
9100	2198	1138	2.54	1242	3.32	1438	5.04	1613	6.86	1768	8.74	1904	10.62	2032	12.58	2282	16.87
9900	2391	1221	3.11	1316	3.95	1501	5.80	1669	7.74	1823	9.76	1959	11.81	2081	13.84	2315	18.24
10500	2536	1285	3.62	1373	4.50	1550	6.42	1714	8.46	1863	10.57	1999	12.74	2122	14.90	2347	19.38
11000	2657	1338	4.08	1422	4.98	1592	6.98	1751	9.09	1898	11.28	2033	13.54	2156	15.81	2376	20.40
11500	2778	1391	4.57	1471	5.50	1635	7.57	1789	9.75	1933	12.01	2067	14.37	2190	16.73	2408	21.49
12400	2995	1488	5.57	1562	6.56	1714	8.74	1860	11.05	1999	13.46	2129	15.94	2251	18.48	2469	23.57
13200	3188	1575	6.58	1644	7.63	1787	9.90	1926	12.33	2059	14.86	2186	17.46	2305	20.12	2524	25.56
14000	3382	1662	7.71	1727	8.81	1861	11.19	1994	13.74	2123	16.39	2245	19.11	2361	21.88	2577	27.60
15500	3744	1827	10.24	1885	11.42	2006	13.98	2127	16.73	2247	19.62	2361	22.54	2472	25.56	***2679***	***31.74***
17300	4179	2026	13.88	2079	15.19	2185	17.97	2294	20.95	2403	24.09	2509	27.28	***2612***	***30.56***	***2809***	***37.28***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 22" BI DWDI

Wheel Diameter: 22.25 inches
Outlet Area: 5.12 square ft
Tip Speed: 5.83xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9000	1758	860	1.89	974	2.71	1174	4.50	1340	6.36	1485	8.31	1622	10.44				
10000	1953	931	2.38	1035	3.28	1225	5.21	1389	7.27	1528	9.34	1657	11.51	1781	13.89		
11000	2148	1004	2.97	1099	3.93	1279	6.02	1438	8.25	1577	10.51	1699	12.79	1817	15.20	2042	20.48
12000	2344	1079	3.68	1166	4.69	1335	6.93	1488	9.30	1626	11.76	1748	14.23	1859	16.73	2073	22.13
13000	2539	1155	4.49	1234	5.56	1393	7.95	1540	10.47	1675	13.09	1797	15.78	1907	18.45	2110	24.00
14000	2734	1232	5.42	1306	6.57	1455	9.09	1595	11.76	1725	14.52	1847	17.40	1957	20.28	2154	26.08
15000	2930	1310	6.49	1379	7.70	1519	10.37	1652	13.18	1778	16.09	1896	19.12	2006	22.21	2202	28.38
16000	3125	1389	7.71	1453	8.98	1584	11.77	1711	14.73	1833	17.80	1947	20.97	2055	24.22	2252	30.81
17000	3320	1468	9.08	1528	10.42	1651	13.31	1773	16.43	1889	19.66	2000	22.96	2105	26.35	***2301***	***33.34***
19400	3789	1660	13.03	1712	14.52	1818	17.71	1926	21.15	2033	24.75	2135	28.41	2234	32.18	***2419***	***39.89***
21500	4199	1829	17.36	1876	19.00	1971	22.44	2068	26.13	2166	30.03	2261	34.02	***2353***	***38.07***	***2530***	***46.44***

FAN 27" BI DWDI

Wheel Diameter: 27.00 inches
Outlet Area: 7.54 square ft
Tip Speed: 7.07xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
13000	1724	682	2.48	766	3.57	917	5.93	1056	8.57	1182	11.29	1309	14.41				
15000	1989	762	3.47	836	4.69	974	7.30	1101	10.17	1220	13.18	1331	16.34	1441	19.81		
16000	2122	803	4.06	873	5.33	1005	8.08	1127	11.05	1241	14.22	1349	17.51	1454	21.00		
18000	2387	887	5.40	949	6.79	1070	9.81	1182	13.01	1289	16.44	1390	20.02	1486	23.68	1670	31.50
19500	2586	952	6.63	1009	8.10	1122	11.34	1228	14.71	1328	18.28	1426	22.09	1518	25.97	1692	34.02
21000	2785	1016	8.04	1069	9.60	1175	13.00	1275	16.59	1371	20.32	1463	24.28	1552	28.41	1721	36.90
22500	2984	1082	9.67	1131	11.29	1231	14.89	1326	18.69	1416	22.59	1505	26.71	1590	31.01	1752	39.96
24000	3183	1147	11.50	1194	13.21	1287	16.97	1379	21.01	1465	25.11	1548	29.35	1630	33.79	1787	43.21
25500	3382	1213	13.55	1257	15.38	1345	19.28	1432	23.54	1514	27.83	1595	32.27	1673	36.90	1824	46.61
28500	3780	1346	18.46	1385	20.45	1463	24.64	1542	29.27	1620	34.08	1693	38.89	1765	43.86	1904	54.13
31500	4178	1480	24.41	1516	26.63	1586	31.17	1658	36.09	1728	41.25	1797	46.57	***1864***	***51.95***	***1994***	***62.95***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 30" BI DWDI

Wheel Diameter: 30.00 inches
Outlet Area: 9.31 square ft
Tip Speed: 7.85xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	1719	612	3.09	688	4.44	826	7.36	951	10.58	1067	14.02	1175	17.84				
20000	2148	731	5.16	793	6.75	910	10.17	1019	13.88	1121	17.83	1218	21.92	1311	26.22	1489	35.74
25000	2685	885	9.05	935	10.90	1034	15.02	1126	19.31	1215	23.83	1300	28.63	1382	33.57	1536	43.79
28000	3008	980	12.18	1024	14.18	1113	18.64	1199	23.39	1281	28.29	1359	33.33	1435	38.70	1581	49.85
31000	3330	1076	16.05	1116	18.25	1197	23.05	1276	28.23	1352	33.52	1424	38.89	1495	44.52	1632	56.42
35000	3759	1206	22.49	1241	24.93	1312	30.13	1383	35.75	1452	41.65	1520	47.65	1584	53.70	1710	66.43

FAN 33" BI DWDI

Wheel Diameter: 33.00 inches
Outlet Area: 11.27 square ft
Tip Speed: 8.64xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
18000	1597	528	3.20	600	4.72	732	8.09	850	11.79	962	15.91						
20000	1775	571	4.01	638	5.68	760	9.29	871	13.25	974	17.45	1074	22.14				
25000	2218	683	6.76	737	8.71	842	12.98	938	17.54	1030	22.46	1115	27.49	1197	32.70	1358	44.28
30000	2662	799	10.71	844	12.94	935	17.88	1019	23.04	1100	28.48	1178	34.23	1253	40.23	1393	52.46
35000	3106	918	16.12	957	18.63	1035	24.15	1112	30.08	1184	36.08	1253	42.33	1321	48.90	1451	62.71
40000	3549	1039	23.32	1073	26.16	1142	32.19	1210	38.76	1276	45.57	1339	52.43	1401	59.50	1520	74.40
43000	3815	1111	28.30	1143	31.30	1207	37.69	1271	44.60	1333	51.86	1393	59.14	1452	66.63	***1565***	***82.09***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 36" BI DWDI

Wheel Diameter: 36.00 inches
Outlet Area: 13.79 square ft
Tip Speed: 9.65xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	1450	436	3.15	506	4.87	636	8.63										
25000	1813	511	4.98	570	7.03	679	11.44	781	16.23	877	21.09						
30000	2175	591	7.61	641	9.96	736	15.03	826	20.48	912	26.28	993	31.97	1070	37.88		
35000	2538	675	11.22	718	13.81	801	19.57	880	25.56	958	32.03	1032	38.69	1103	45.43	1239	59.15
40000	2901	760	15.85	798	18.76	871	25.07	943	31.84	1012	38.77	1079	46.07	1145	53.60	1271	68.98
45000	3263	846	21.71	880	24.91	945	31.77	1010	39.21	1073	46.86	1134	54.66	1194	62.81	***1312***	***79.93***
50000	3626	934	29.19	964	32.65	1023	40.02	1082	48.10	1140	56.49	1196	64.91	1251	73.62	***1359***	***91.80***
55000	3988	1022	38.04	1048	41.76	1102	49.68	1156	58.26	1210	67.40	1262	76.59	1313	85.94	***1413***	***105.16***

FAN 40" BI DWDI

Wheel Diameter: 40.25 inches
Outlet Area: 16.77 square ft
Tip Speed: 10.54xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	1789	459	5.88	512	8.32	613	13.67	707	19.46	793	25.22						
35000	2087	519	8.42	565	11.16	654	17.13	738	23.61	818	30.30	894	37.05	965	44.40		
40000	2385	580	11.60	621	14.66	701	21.28	776	28.29	849	35.80	920	43.51	986	51.06	1115	67.66
45000	2683	643	15.72	680	19.04	752	26.33	820	33.93	887	42.08	952	50.51	1015	59.15	1134	76.41
50000	2982	707	20.72	739	24.26	805	32.14	868	40.49	929	49.16	989	58.13	1048	67.64	1160	86.89
55000	3280	771	26.78	801	30.64	860	39.02	919	48.11	976	57.42	1031	67.00	1085	76.85	***1191***	***97.72***
60000	3578	836	34.20	863	38.35	918	47.30	972	56.97	1026	67.03	1077	77.29	1128	87.73	***1226***	***109.59***
65000	3876	902	42.60	926	46.99	977	56.54	1027	66.76	1077	77.57	1126	88.51	1173	99.60	***1265***	***122.43***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 44" BI DWDI

Wheel Diameter: 44.50 inches
Outlet Area: 20.49 square ft
Tip Speed: 11.65xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
36000	1757	409	6.93	459	9.88	551	16.38	637	23.25	715	30.17						
40000	1952	444	8.78	489	12.00	574	18.94	654	26.51	729	34.08	800	42.28				
45000	2196	489	11.57	529	15.07	606	22.67	680	30.82	750	39.44	816	48.00	880	56.95		
50000	2440	535	15.02	571	18.79	642	27.09	709	35.82	774	45.13	837	54.70	896	64.21	1012	84.60
55000	2684	581	19.21	614	23.21	679	32.14	742	41.50	802	51.35	861	61.69	918	72.34	1025	93.38
60000	2928	629	24.17	659	28.43	719	37.97	777	48.02	833	58.43	888	69.25	942	80.67	1045	103.84
65000	3172	677	29.91	704	34.44	759	44.45	815	55.37	867	66.40	918	77.84	969	89.76	***1067***	***114.53***
70000	3416	724	36.55	750	41.46	802	52.04	853	63.40	903	75.20	950	87.11	998	99.66	***1091***	***125.76***
75000	3660	772	44.44	796	49.62	845	60.66	893	72.74	940	85.30	986	97.90	1030	110.87	***1118***	***138.05***
85000	4148	869	62.67	891	68.67	933	80.66	975	93.73	1018	107.59	1060	122.01	1100	136.28	***1179***	***165.64***

FAN 49" BI DWDI

Wheel Diameter: 49.00 inches
Outlet Area: 24.85 square ft
Tip Speed: 12.83xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
45000	1811	381	8.98	425	12.68	506	20.67	582	29.19	653	37.89						
50000	2012	413	11.37	453	15.36	528	24.02	599	33.31	666	42.86	730	52.74				
55000	2213	447	14.31	483	18.54	553	27.81	618	37.69	682	48.27	742	58.76	800	69.61		
60000	2414	482	17.75	514	22.22	580	32.29	641	42.67	700	53.89	758	65.58	812	76.82	918	101.50
65000	2616	517	21.82	547	26.50	607	37.12	665	48.26	721	59.97	775	72.39	827	84.78	927	109.97
70000	2817	552	26.46	580	31.44	637	42.67	691	54.55	743	66.65	795	79.68	846	93.27	940	119.96
75000	3018	587	31.72	613	36.96	667	48.85	719	61.46	767	74.13	816	87.63	864	101.68	956	130.54
80000	3219	622	37.66	647	43.29	697	55.55	747	69.00	794	82.49	839	96.40	884	110.85	***973***	***141.49***
85000	3421	659	44.53	682	50.36	728	63.13	775	77.08	821	91.61	864	105.88	907	121.26	***991***	***152.76***
95000	3823	731	60.58	752	67.11	794	80.98	836	95.96	877	111.89	917	127.78	956	143.87	***1033***	***177.63***
100000	4024	767	70.23	787	77.06	827	91.49	867	106.97	907	123.43	945	140.28	983	157.03	***1056***	***191.97***
104000	4185	796	77.95	815	85.02	854	99.90	892	115.78	930	132.66	***968***	***150.28***	***1004***	***167.56***	***1075***	***203.44***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 54" BI DWDI

Wheel Diameter: 54.25 inches
Outlet Area: 30.46 square ft
Tip Speed: 14.20xRPM

		0.5" SP		1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		8" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
50000	1641	320	8.94	362	13.08	443	22.32	515	31.79								
55000	1806	343	10.89	383	15.45	457	25.21	525	35.69	589	46.30						
60000	1970	367	13.35	404	18.18	473	28.55	538	39.74	599	51.31						
65000	2134	392	16.13	426	21.25	491	32.27	552	44.16	610	56.56	665	68.97				
70000	2298	417	19.33	449	24.69	510	36.42	567	48.81	623	62.14	676	75.38	727	89.17		
75000	2462	443	22.95	472	28.57	530	41.00	584	53.90	638	68.01	688	82.17	737	96.72	830	126.71
80000	2626	468	26.98	496	32.91	550	45.99	602	59.59	653	74.13	701	89.16	749	104.80	838	135.26
85000	2791	494	31.47	520	37.67	572	51.46	621	65.72	669	80.82	715	96.34	761	112.87	847	145.30
90000	2955	520	36.68	544	43.11	594	57.53	641	72.40	686	87.97	731	104.18	775	121.47	859	156.01
95000	3119	546	42.41	569	49.21	616	64.01	661	79.83	705	95.84	747	112.72	790	130.38	871	166.78
100000	3283	572	48.62	595	55.88	639	71.04	683	87.78	724	104.34	765	121.84	805	139.89	***884***	***177.94***
105000	3447	599	55.53	620	63.14	662	78.83	704	96.23	744	113.56	784	131.65	822	150.27	***898***	***189.69***
110000	3611	625	63.52	646	71.01	686	87.54	726	105.37	765	123.69	803	142.31	840	161.61	***914***	***202.03***
115000	3775	652	72.27	672	79.92	710	97.05	748	115.39	786	134.47	823	153.80	859	173.74	***930***	***215.16***
120000	3940	679	81.02	697	88.83	734	106.55	771	125.40	807	145.26	***843***	***165.28***	***878***	***185.87***	***946***	***228.30***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = *Italic* face to right of Class II

FAN 12" FC

Wheel Diameter: 12.25 inches Outlet Area: 1.40 square ft Tip Speed: 3.14xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1600	1143	487	0.15	650	0.25								
1800	1286	507	0.18	657	0.29	795	0.43						
2000	1429	528	0.22	668	0.34	797	0.48						
2200	1571	552	0.27	684	0.39	804	0.54	918	0.69				
2400	1714	577	0.33	702	0.46	815	0.60	923	0.77				
2600	1857	601	0.39	722	0.53	830	0.68	932	0.85	1124	1.23		
2800	2000	630	0.47	744	0.62	847	0.77	943	0.94	1126	1.33		
3000	2143	662	0.56	767	0.71	866	0.87	958	1.05	1133	1.45	1298	1.89
3200	2286	696	0.66	792	0.82	886	0.98	975	1.17	1142	1.57	1300	2.03
3400	2429	731	0.78	816	0.93	908	1.11	993	1.30	1154	1.72	1305	2.17

FAN 15" FC

Wheel Diameter: 15.25 inches Outlet Area: 2.23 square ft Tip Speed: 3.93xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4000	1790	477	0.59	574	0.80	661	1.04	744	1.30	899	1.89		
4400	1969	506	0.75	596	0.97	678	1.22	756	1.49	901	2.09		
4800	2148	539	0.93	621	1.17	698	1.42	771	1.70	908	2.32	1039	3.03
5200	2327	574	1.15	646	1.39	720	1.66	789	1.95	919	2.59	1042	3.31
5600	2506	611	1.41	671	1.64	743	1.93	809	2.23	933	2.90	1050	3.63
6000	2685	648	1.70	699	1.93	768	2.24	831	2.55	949	3.23	1061	3.99
6400	2864	686	2.04	730	2.26	793	2.58	854	2.91	968	3.62	1075	4.39
6800	3043	724	2.42	763	2.64	818	2.95	878	3.31	988	4.04	1091	4.84
7200	3221	762	2.84	799	3.08	845	3.37	904	3.75	1009	4.50	1109	5.33
7600	3400	801	3.31	835	3.56	875	3.85	929	4.23	1032	5.02	1128	5.85
8000	3579	840	3.84	871	4.09	907	4.38	954	4.74	1056	5.59	1149	6.45
8400	3758	879	4.42	908	4.67	941	4.96	982	5.33	1080	6.19	1170	7.07
8800	3937	918	5.05	946	5.32	976	5.61	1012	5.96	1106	6.86	1193	7.77
9200	4116	957	5.74	984	6.03	1012	6.32	1044	6.66	1131	7.57	1217	8.53
9600	4295	997	6.51	1022	6.80	1049	7.11	1078	7.44	1156	8.33	1241	9.32
10000	4474	1036	7.32	1060	7.62	1086	7.95	1113	8.29	1182	9.14	1267	10.20

		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4800	2148												
5200	2327	1161	4.10										
5600	2506	1163	4.43	1272	5.30								
6000	2685	1169	4.81	1273	5.69	1374	6.62						
6400	2864	1178	5.23	1277	6.12	1374	7.07	1469	8.08				
6800	3043	1190	5.70	1285	6.60	1378	7.56	1469	8.58				
7200	3221	1203	6.19	1295	7.12	1385	8.11	1472	9.14	1642	11.35		
7600	3400	1219	6.75	1308	7.70	1394	8.69	1478	9.74	1642	11.98		
8000	3579	1237	7.35	1322	8.32	1406	9.35	1487	10.40	1645	12.67		
8400	3758	1256	8.01	1339	9.01	1419	10.04	1498	11.12	1651	13.43		
8800	3937	1277	8.74	1357	9.74	1435	10.81	1511	11.90	1659	14.23		
9200	4116	1298	9.50	1376	10.53	1452	11.62	1526	12.75	1670	15.12		
9600	4295	1320	10.33	1396	11.38	1470	12.48	1542	13.64	1682	16.06		
10000	4474	1343	11.23	1418	12.32	1490	13.44	1559	14.58	1695	17.04		

FAN 18" FC

Wheel Diameter: 18.25 inches Outlet Area: 3.00 square ft Tip Speed: 4.71xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	1999	424	0.97	490	1.24	549	1.52	605	1.83	712	2.50	810	3.20
6500	2166	449	1.18	511	1.47	567	1.77	620	2.09	722	2.80	816	3.54
7000	2333	473	1.42	532	1.74	586	2.05	637	2.39	733	3.12	824	3.91
7500	2499	499	1.71	554	2.03	606	2.37	655	2.73	746	3.48	833	4.30
8000	2666	524	2.02	577	2.37	627	2.73	674	3.10	761	3.88	844	4.72
8500	2832	550	2.38	601	2.75	648	3.12	693	3.50	777	4.32	857	5.19
9000	2999	577	2.80	625	3.17	671	3.57	714	3.97	795	4.81	871	5.70
9500	3166	603	3.24	650	3.64	693	4.05	735	4.47	814	5.35	887	6.27
10000	3332	630	3.74	675	4.15	717	4.59	757	5.03	833	5.93	904	6.89
10500	3499	657	4.30	700	4.70	740	5.16	779	5.62	853	6.57	922	7.56
11000	3665	684	4.90	725	5.31	765	5.80	802	6.28	873	7.25	941	8.28
11500	3832	711	5.55	751	5.98	789	6.47	825	6.98	895	8.02	960	9.06
12000	3999	739	6.29	777	6.71	814	7.22	849	7.75	916	8.81	980	9.90
13000	4332	794	7.91	830	8.38	864	8.88	897	9.44	961	10.61	1021	11.76
14000	4665	849	9.78	883	10.28	916	10.83	947	11.41	1007	12.66	1064	13.88
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000	2333	908	4.70	990	5.57								
7500	2499	916	5.16	993	6.02	1069	6.96						
8000	2666	924	5.63	1000	6.55	1072	7.48						
8500	2832	934	6.13	1008	7.10	1078	8.07	1145	9.06				
9000	2999	945	6.66	1017	7.68	1085	8.69	1151	9.73	1278	11.93		
9500	3166	958	7.25	1027	8.29	1094	9.37	1158	10.44	1281	12.68		
10000	3332	972	7.89	1039	8.96	1104	10.07	1167	11.21	1286	13.49	1400	15.91
10500	3499	987	8.57	1052	9.67	1115	10.82	1176	11.98	1293	14.38	1404	16.84
11000	3665	1004	9.33	1066	10.44	1127	11.61	1187	12.83	1301	15.30	1409	17.82
11500	3832	1022	10.15	1082	11.29	1140	12.45	1198	13.69	1310	16.27	1416	18.88
12000	3999	1040	11.00	1098	12.17	1155	13.38	1211	14.64	1320	17.27	1425	20.03
13000	4332	1079	12.95	1134	14.16	1188	15.44	1240	16.73	1343	19.46	1443	22.35

FAN 21" FC

Wheel Diameter: 21.25 inches Outlet Area: 4.28 square ft Tip Speed: 5.50xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	1871	353	1.19	412	1.54	469	1.96	524	2.44	628	3.56	723	4.82
9000	2105	382	1.58	436	1.98	488	2.41	538	2.90	634	4.04	724	5.34
10000	2339	413	2.07	462	2.50	509	2.95	555	3.45	644	4.61	729	5.95
11000	2573	445	2.67	490	3.14	533	3.61	576	4.13	658	5.30	738	6.68
12000	2807	478	3.37	519	3.88	559	4.39	599	4.93	676	6.14	750	7.51
13000	3041	511	4.19	549	4.74	587	5.30	623	5.85	695	7.08	765	8.49
14000	3275	545	5.14	580	5.73	615	6.31	650	6.94	717	8.18	783	9.62
15000	3509	578	6.20	612	6.87	645	7.50	677	8.13	741	9.47	802	10.87
16000	3743	613	7.46	644	8.14	675	8.82	706	9.51	766	10.90	824	12.33
17000	3977	647	8.83	677	9.58	706	10.30	735	11.02	792	12.49	847	13.96
18000	4211	682	10.40	710	11.18	737	11.92	765	12.71	819	14.24	872	15.82
19000	4444	717	12.15	743	12.94	769	13.75	796	14.60	847	16.18	898	17.86
20000	4678	752	14.08	777	14.93	802	15.79	827	16.65	876	18.33	924	20.04
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9000	2105	808	6.76	885	8.23								
10000	2339	809	7.41	885	8.99	956	10.63						
11000	2573	813	8.14	887	9.80	956	11.51	1022	13.30				
12000	2807	822	9.04	891	10.68	958	12.45	1023	14.34	1142	18.17		
13000	3041	833	10.04	899	11.72	962	13.48	1025	15.42	1143	19.49	1251	23.67
14000	3275	847	11.19	909	12.87	970	14.69	1029	16.59	1144	20.78	1252	25.25
15000	3509	863	12.48	923	14.23	981	16.07	1038	18.03	1147	22.18	1253	26.81
16000	3743	882	13.97	938	15.70	994	17.60	1048	19.55	1153	23.77	1255	28.42
17000	3977	902	15.61	956	17.40	1009	19.30	1061	21.30	1162	25.58	1260	30.25
18000	4211	924	17.47	975	19.24	1026	21.19	1076	23.23	1173	27.55	1267	32.25
19000	4444	947	19.51	996	21.32	1045	23.30	1092	25.31	1186	29.74		
20000	4678	972	21.82	1018	23.59	1065	25.59	1111	27.68	1201	32.15		

FAN 24" FC

Wheel Diameter: 24.25 inches Outlet Area: 5.50 square ft Tip Speed: 6.28xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9000	1636	282	1.09	341	1.53	397	2.06	450	2.67	548	4.07		
10000	1818	300	1.39	354	1.85	406	2.40	455	3.01	548	4.45	632	6.05
11000	2000	320	1.77	369	2.24	417	2.80	463	3.43	551	4.89	633	6.58
12000	2182	340	2.19	386	2.71	430	3.27	473	3.91	556	5.40	634	7.11
13000	2364	360	2.67	403	3.23	445	3.83	485	4.47	563	5.99	637	7.71
14000	2545	382	3.27	422	3.86	461	4.48	498	5.11	572	6.66	643	8.43
15000	2727	403	3.90	441	4.55	478	5.21	513	5.86	583	7.43	650	9.21
16000	2909	425	4.64	461	5.34	495	6.01	529	6.72	595	8.29	659	10.10
17000	3091	448	5.50	481	6.21	514	6.94	546	7.68	608	9.24	670	11.13
18000	3273	470	6.41	502	7.20	533	7.96	563	8.71	623	10.35	681	12.20
19000	3455	493	7.47	523	8.28	552	9.05	582	9.91	638	11.54	694	13.43
20000	3636	515	8.57	544	9.46	572	10.29	600	11.14	655	12.92	708	14.79
21000	3818	538	9.83	566	10.78	593	11.68	619	12.52	672	14.39	723	16.30
22000	4000	562	11.27	588	12.22	613	13.11	639	14.06	689	15.95	738	17.90
23000	4182	585	12.77	610	13.77	634	14.70	659	15.71	707	17.66	754	19.66
24000	4364	608	14.40	632	15.44	656	16.49	679	17.46	726	19.54	771	21.60
25000	4545	631	16.16	654	17.23	677	18.32	700	19.41	745	21.54	789	23.72

		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	2182	707	8.99	774	10.92								
13000	2364	708	9.65	775	11.73	836	13.80						
14000	2545	710	10.35	775	12.48	837	14.74	894	16.98				
15000	2727	715	11.19	777	13.32	837	15.61	894	17.99	999	22.85		
16000	2909	721	12.10	781	14.27	839	16.59	895	19.05	1000	24.21		
17000	3091	729	13.13	786	15.29	842	17.64	897	20.17	1000	25.47	1095	30.97
18000	3273	738	14.25	794	16.51	847	18.82	900	21.37	1001	26.79	1095	32.51
19000	3455	749	15.54	802	17.76	854	20.16	904	22.64	1002	28.11	1096	34.10
20000	3636	760	16.87	812	19.20	862	21.61	911	24.17	1005	29.60	1097	35.68
21000	3818	773	18.40	822	20.68	871	23.17	918	25.72	1010	31.28	1098	37.26
22000	4000	786	20.01	834	22.37	881	24.87	926	27.40	1016	33.08	1102	39.15
23000	4182	801	21.85	846	24.12	892	26.71	936	29.31	1023	35.01	1106	41.07
24000	4364	816	23.79	860	26.13	904	28.70	947	31.37	1031	37.09	1112	43.23
25000	4545	832	25.93	874	28.23	916	30.76	958	33.50	1040	39.32		

FAN 27" FC

Wheel Diameter: 27.00 inches Outlet Area: 6.95 square ft Tip Speed: 7.07xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
14000	2014	278	2.39	320	3.00	359	3.64	397	4.35	469	5.96	535	7.72
15000	2158	293	2.88	331	3.48	369	4.18	405	4.91	473	6.52	537	8.33
16000	2302	307	3.40	343	4.02	379	4.75	413	5.49	479	7.18	541	9.05
17000	2446	322	4.01	356	4.66	390	5.40	423	6.20	485	7.87	545	9.80
18000	2590	337	4.68	369	5.35	401	6.10	433	7.74	501	9.56	556	11.52
19000	2734	352	5.42	383	6.14	413	6.90	443	7.74	501	9.56	556	11.52
20000	2878	367	6.22	397	7.00	425	7.75	454	8.63	510	10.52	563	12.52
21000	3022	383	7.16	411	7.93	438	8.72	466	9.64	519	11.53	570	13.56
22000	3165	398	8.12	425	8.93	452	9.82	478	10.71	529	12.65	579	14.79
24000	3453	430	10.42	455	11.30	479	12.18	503	13.13	551	15.22	597	17.40
26000	3741	461	13.01	484	13.95	507	14.95	529	15.92	574	18.14	617	20.42
28000	4029	493	16.10	515	17.15	536	18.17	557	19.24	598	21.46	639	23.90
30000	4317	526	19.73	546	20.79	566	21.90	585	22.96	624	25.34	662	27.81
32000	4604	558	23.73	577	24.88	596	26.08	614	27.21	650	29.61	686	32.20

		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
17000	2446	601	11.83	655	14.05								
18000	2590	605	12.74	657	14.97	707	17.34						
19000	2734	609	13.67	660	15.97	708	18.33	755	20.85				
20000	2878	614	14.69	664	17.07	711	19.48	757	22.08				
21000	3022	620	15.81	668	18.19	715	20.74	759	23.31				
22000	3165	627	17.04	673	19.41	719	22.04	762	24.64	845	30.24		
24000	3453	642	19.74	686	22.24	729	24.90	770	27.59	850	33.41	926	39.64
26000	3741	660	22.93	701	25.46	741	28.10	781	30.99	858	37.06	931	43.45
28000	4029	679	26.46	718	29.11	756	31.85	794	34.80	867	40.97	938	47.65
30000	4317	700	30.51	737	33.27	774	36.23	809	39.10	879	45.45	946	52.14
32000	4604	722	35.00	758	38.00	792	40.88	826	43.95	893	50.48	957	57.27

FAN 30" FC

Wheel Diameter: 30.25 inches Outlet Area: 8.50 square ft Tip Speed: 7.85xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	1882	238	2.45	277	3.12	315	3.90	351	4.75	419	6.69		
17000	2000	248	2.86	285	3.55	321	4.35	356	5.23	421	7.18	481	9.35
18000	2118	258	3.30	294	4.05	328	4.86	361	5.74	424	7.74	482	9.94
20000	2353	279	4.34	311	5.12	343	6.02	374	6.98	432	9.02	487	11.32
22000	2588	301	5.63	330	6.44	359	7.37	388	8.40	442	10.52	494	12.91
24000	2824	323	7.13	350	8.02	377	9.01	403	10.03	454	12.28	503	14.74
26000	3059	345	8.87	370	9.81	395	10.84	420	11.97	468	14.35	514	16.88
28000	3294	368	10.94	392	12.00	415	13.06	437	14.11	483	16.68	526	19.26
30000	3529	391	13.29	413	14.37	435	15.54	456	16.68	499	19.31	540	22.02
32000	3765	414	15.95	435	17.13	455	18.27	475	19.49	515	22.14	555	25.11
34000	4000	437	18.94	457	20.21	476	21.42	495	22.70	533	25.48	571	28.56
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	2353	539	13.81										
22000	2588	544	15.53	591	18.28	636	21.17						
24000	2824	550	17.42	595	20.24	639	23.32	680	26.38				
26000	3059	558	19.56	602	22.60	643	25.62	683	28.84				
28000	3294	568	22.04	610	25.17	650	28.37	688	31.60	762	38.66		
30000	3529	580	24.91	619	27.98	657	31.22	695	34.76	766	41.90	834	49.63
32000	3765	593	28.09	630	31.21	667	34.62	702	38.00	772	45.59	837	53.32
34000	4000	607	31.61	643	34.93	677	38.18	712	41.87	778	49.37	842	57.46

FAN 33" FC

Wheel Diameter: 33.25 inches Outlet Area: 10.44 square ft Tip Speed: 8.64xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
18000	1722	206	2.46	245	3.29	281	4.18	315	5.17	379	7.44		
20000	1914	221	3.21	256	4.06	289	4.99	321	6.03	382	8.42	437	10.99
22000	2105	236	4.08	268	4.97	299	5.97	329	7.06	386	9.50	439	12.20
24000	2297	252	5.14	282	6.12	311	7.18	339	8.31	392	10.77	443	13.61
26000	2488	268	6.35	296	7.40	323	8.51	349	9.67	399	12.21	447	15.07
28000	2679	285	7.81	310	8.82	335	9.96	360	11.22	408	13.92	454	16.89
30000	2871	301	9.37	325	10.49	349	11.73	372	12.99	418	15.85	461	18.81
32000	3062	318	11.23	341	12.45	363	13.68	385	15.01	428	17.91	470	21.09
34000	3254	336	13.42	357	14.62	378	15.93	399	17.34	440	20.36	479	23.49
36000	3445	353	15.73	373	17.01	393	18.38	412	19.72	451	22.83	489	26.17
38000	3636	370	18.29	389	19.62	408	21.06	427	22.59	464	25.77	500	29.16
40000	3828	388	21.26	406	22.65	424	24.12	442	25.69	477	28.92	512	32.51
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
26000	2488	493	18.21	536	21.48								
28000	2679	497	20.01	539	23.42	579	27.00						
30000	2871	503	22.10	543	25.55	582	29.26	619	33.06				
32000	3062	510	24.43	548	27.89	586	31.74	622	35.64	691	43.96		
34000	3254	517	26.86	555	30.63	591	34.46	626	38.47	693	46.99		
36000	3445	526	29.72	562	33.47	597	37.44	631	41.57	696	50.23	758	59.54
38000	3636	536	32.90	570	36.63	603	40.51	636	44.74	700	53.77	760	63.16
40000	3828	546	36.25	579	40.12	611	44.11	643	48.44	705	57.64	763	67.06

FAN 36" FC

Wheel Diameter: 36.25 inches Outlet Area: 12.69 square ft Tip Speed: 9.42xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24000	1890	200	3.40	232	4.32	264	5.34	294	6.46	352	9.14		
26000	2047	211	4.14	241	5.11	271	6.23	300	7.38	354	10.06		
28000	2205	222	4.98	251	6.05	278	7.16	306	8.40	357	11.06	407	14.27
30000	2362	234	5.98	261	7.07	287	8.30	312	9.50	362	12.28	409	15.50
32000	2520	246	7.10	272	8.29	296	9.50	320	10.83	367	13.57	412	16.84
34000	2677	259	8.44	282	9.53	306	10.90	328	12.22	373	15.09	416	18.32
36000	2835	271	9.82	294	11.10	316	12.41	337	13.79	380	16.84	422	20.15
38000	2992	284	11.45	305	12.69	326	14.04	347	15.58	387	18.67	427	21.95
40000	3150	296	13.11	317	14.55	337	15.94	357	17.50	395	20.71	434	24.20
42000	3307	309	15.07	329	16.56	348	17.99	367	19.55	404	22.98	440	26.39
44000	3465	322	17.20	341	18.74	359	20.19	377	21.75	413	25.34	448	29.03
46000	3622	335	19.52	353	21.09	371	22.73	388	24.28	422	27.82	455	31.55
48000	3780	348	22.03	365	23.61	382	25.25	399	26.98	432	30.63	464	34.55
52000	4094	374	27.66	390	29.42	406	31.25	422	33.14	452	36.75	482	40.90

		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
34000	2677	458	22.05	498	25.92								
36000	2835	461	23.72	500	27.75	537	31.87						
38000	2992	466	25.74	502	29.60	539	33.99	574	38.43				
40000	3150	471	27.85	506	31.78	541	36.14	575	40.64				
42000	3307	476	30.08	511	34.22	544	38.48	577	43.09	642	53.15		
44000	3465	482	32.64	516	36.76	549	41.27	580	45.76	643	55.93		
46000	3622	489	35.55	522	39.66	553	43.92	584	48.68	645	58.97	703	69.77
48000	3780	496	38.56	528	42.74	559	47.17	589	51.91	647	62.06	704	73.10
52000	4094	511	45.08	541	49.54	571	54.21	599	58.75	654	69.06	708	80.45

FAN 39" FC

Wheel Diameter: 39.25 inches Outlet Area: 15.19 square ft Tip Speed: 10.21xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	1974	192	4.62	221	5.82	248	7.01	275	8.35	326	11.52		
32000	2105	201	5.45	228	6.65	254	7.97	280	9.37	329	12.60	375	16.22
34000	2237	211	6.46	236	7.65	261	9.08	285	10.46	332	13.69	376	17.36
36000	2368	220	7.47	244	8.73	267	10.12	291	11.73	336	14.95	378	18.65
38000	2500	230	8.69	253	10.02	275	11.46	297	13.04	340	16.28	381	20.09
40000	2632	239	9.90	261	11.29	282	12.75	303	14.40	345	17.86	385	21.72
42000	2763	249	11.35	270	12.79	290	14.26	310	15.95	350	19.53	389	23.42
44000	2895	259	12.92	279	14.41	299	16.05	318	17.74	356	21.43	393	25.21
48000	3158	279	16.46	297	18.01	316	19.84	333	21.47	368	25.41	403	29.52
52000	3421	299	20.57	316	22.31	333	24.12	350	26.07	382	30.06	414	34.39
56000	3684	320	25.53	336	27.43	351	29.16	367	31.24	397	35.35	427	40.01
60000	3947	340	30.93	355	32.97	370	35.08	385	37.27	413	41.43	441	46.23
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
38000	2500	421	24.36	459	28.84								
40000	2632	422	25.80	460	30.56								
42000	2763	425	27.59	461	32.27	496	37.25						
44000	2895	429	29.60	463	34.21	497	39.24	530	44.53				
48000	3158	437	33.88	469	38.53	501	43.75	532	49.09				
52000	3421	446	38.85	477	43.61	507	48.81	536	54.25	594	66.24		
56000	3684	457	44.77	486	49.46	515	54.73	543	60.37	597	72.34	650	85.35
60000	3947	469	51.31	497	56.44	524	61.51	551	67.17	602	79.13	652	92.20

FAN 42" FC

Wheel Diameter: 42.25 inches Outlet Area: 18.31 square ft Tip Speed: 11.00xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
36000	1965	183	5.89	208	7.18	233	8.69	258	10.31	304	13.99	348	18.22
40000	2183	198	7.77	221	9.17	243	10.73	266	12.48	309	16.20	350	20.57
44000	2402	213	9.99	234	11.47	255	13.22	275	14.98	316	18.91	354	23.30
48000	2620	228	12.57	248	14.26	267	15.99	286	17.97	324	22.13	360	26.53
52000	2838	244	15.71	263	17.63	281	19.49	298	21.40	333	25.83	367	30.28
56000	3057	260	19.32	277	21.21	294	23.21	311	25.42	343	29.94	375	34.65
60000	3275	276	23.42	293	25.71	308	27.58	324	29.87	354	34.54	384	39.58
64000	3493	293	28.32	308	30.48	323	32.72	337	34.77	366	39.77	394	45.03
68000	3712	309	33.53	324	36.09	338	38.41	351	40.47	379	45.77	405	51.08
72000	3930	326	39.68	339	41.93	353	44.66	366	47.08	392	52.31	417	57.87
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
44000	2402	390	28.01	426	33.35								
48000	2620	394	31.41	428	36.87	460	42.41						
52000	2838	400	35.36	431	40.69	462	46.50	492	52.58				
56000	3057	406	39.57	436	45.09	465	50.95	494	57.27				
60000	3275	414	44.79	443	50.36	470	56.07	498	62.72	551	76.20		
64000	3493	422	50.39	450	56.08	477	62.15	503	68.59	553	82.09	603	97.28
68000	3712	431	56.61	458	62.62	484	68.69	509	75.10	557	88.88	605	104.31
72000	3930	442	63.87	467	69.93	492	76.18	516	82.49	563	96.72	608	111.96

FAN 48" FC

Wheel Diameter: 48.25 inches Outlet Area: 22.45 square ft Tip Speed: 12.57xRPM

		0.25" SP		0.50" SP		0.75" SP		1" SP		1.5" SP		2" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
48000	2138	162	8.03	184	9.82	206	11.91	227	13.96	267	18.85	305	24.41
52000	2316	172	9.92	193	11.88	213	14.03	232	16.08	270	20.98	306	26.68
56000	2494	183	12.26	202	14.19	220	16.27	238	18.54	275	23.72	308	29.22
60000	2673	193	14.68	211	16.77	228	18.91	245	21.35	279	26.43	312	32.35
64000	2851	203	17.39	220	19.60	237	22.06	253	24.58	285	29.94	316	35.65
68000	3029	214	20.68	230	23.00	246	25.52	261	28.05	291	33.64	321	39.55
72000	3207	225	24.33	240	26.73	255	29.29	269	31.78	298	37.83	326	43.73
76000	3385	235	28.02	250	30.82	264	33.38	278	36.17	305	42.18	332	48.55
80000	3563	246	32.45	260	35.27	274	38.22	287	40.93	313	47.17	339	54.02
84000	3742	257	37.30	271	40.53	283	43.00	296	46.05	321	52.46	345	59.16
88000	3920	268	42.59	281	45.78	293	48.61	306	52.05	329	58.06	353	65.52
92000	4098	279	48.35	292	51.97	303	54.65	315	57.96	338	64.58	361	72.19
96000	4276	291	55.16	302	58.08	314	61.71	325	64.84	347	71.55	369	79.19
100000	4454	302	61.96	313	65.26	324	68.68	335	72.20	356	78.96	377	86.55
104000	4633	313	69.27	324	72.98	334	76.12	345	80.05	365	86.82	386	95.04
		2.5" SP		3" SP		3.5" SP		4" SP		5" SP		6" SP	
CFM	OUTLET VEL.	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
60000	2673	343	38.75	373	45.56								
64000	2851	346	42.27	375	49.34	403	56.76						
68000	3029	350	46.23	377	53.15	404	60.70	431	69.00				
72000	3207	354	50.40	381	57.83	406	65.15	432	73.52				
76000	3385	359	55.30	385	62.67	409	70.05	434	78.61	482	96.48		
80000	3563	364	60.52	389	67.76	413	75.57	437	84.23	483	102.12		
84000	3742	370	66.51	394	73.73	418	81.91	440	89.90	484	107.82	528	127.95
88000	3920	376	72.71	399	80.03	422	88.00	444	96.36	487	114.83	529	134.72
92000	4098	383	79.68	405	87.21	427	95.10	449	103.81	490	121.86	531	142.35
96000	4276	390	86.85	411	94.62	433	103.24	454	111.70	494	129.79	533	149.95
100000	4454	398	94.95	418	102.95	439	111.70	459	120.00	499	138.84	536	158.37
104000	4633	405	102.65	425	111.49	445	120.41	465	129.45	503	147.46	540	167.83

FAN 14" DD

Wheel Diameter: 14.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1600	1637	0.42	1989	0.80	2336	1.28										
1800	1743	0.49	2072	0.90	2384	1.38	2689	1.94								
2200	1966	0.66	2281	1.14	2535	1.65	2791	2.22	3045	2.87	3293	3.56				
2600	2207	0.86	2495	1.42	2743	2.00	2956	2.60	3171	3.26	3388	3.98	3602	4.74	3812	5.55
3000	2459	1.10	2716	1.75	2957	2.41	3166	3.07	3352	3.76	3535	4.49	3723	5.28		
3400	2716	1.40	2951	2.13	3173	2.87	3380	3.61	3565	4.37	3731	5.14	3892	5.94		
3800	2976	1.77	3198	2.57	3399	3.40	3595	4.22	3779	5.05						
4200	3239	2.20	3450	3.06	3637	3.98	3817	4.89								
4600	3505	2.71	3706	3.64	3883	4.62										

FAN 18" DD

Wheel Diameter: 18.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4000	1368	1.05	1614	1.85	1829	2.71	2021	3.63								
4600	1495	1.30	1723	2.20	1925	3.15	2109	4.16	2276	5.20						
5200	1627	1.61	1840	2.60	2030	3.65	2205	4.74	2367	5.88	2516	7.05	2664	8.29		
5800	1763	1.97	1964	3.07	2141	4.19	2307	5.38	2463	6.61	2610	7.89	2745	9.17	2877	10.50
7000	2044	2.86	2222	4.17	2384	5.51	2532	6.87	2673	8.27	2807	9.71	***2937***	***11.20***	***3061***	***12.72***
8200	2334	4.04	2492	5.56	2640	7.11	2777	8.68	2905	10.25	***3028***	***11.86***	***3147***	***13.52***	***3262***	***15.21***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 24" DD

Wheel Diameter: 24.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	831	1.07	1047	2.13												
5600	877	1.23	1079	2.36	1258	3.63										
6200	926	1.41	1115	2.60	1286	3.96	1442	5.40								
7400	1031	1.83	1200	3.18	1354	4.67	1497	6.27	1632	7.96	1759	9.73				
8600	1140	2.35	1295	3.87	1435	5.49	1567	7.23	1691	9.06	1810	10.99	1924	13.00	2034	15.08
9800	1250	2.95	1399	4.68	1526	6.44	1648	8.33	1763	10.30	1874	12.37	1981	14.52	2084	16.74
11000	1364	3.67	1506	5.61	1626	7.55	1738	9.58	1845	11.69	1949	13.89	2049	16.18	2146	18.54
12200	1481	4.53	1615	6.66	1731	8.81	1835	10.99	1935	13.24	2032	15.58	2126	18.00	***2218***	***20.51***
14600	1720	6.71	1838	9.19	1947	11.77	2045	14.36	2134	16.93	***2219***	***19.55***	***2302***	***22.25***	***2384***	***25.03***

FAN 30" DD

Wheel Diameter: 30.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	702	1.73	872	3.40	1025	5.31										
9000	746	2.01	904	3.82	1047	5.81	1179	8.03								
10000	794	2.35	940	4.26	1074	6.37	1200	8.68	1317	11.17						
11000	842	2.70	980	4.74	1106	6.99	1225	9.40	1337	11.96	1443	14.70				
13000	941	3.56	1068	5.87	1181	8.36	1287	11.01	1390	13.83	1488	16.75	1582	19.82	1672	23.02
15000	1041	4.58	1164	7.24	1266	9.96	1363	12.85	1456	15.91	1546	19.09	1633	22.36	1718	25.77
17000	1144	5.82	1262	8.82	1359	11.83	1448	14.97	1533	18.23	1616	21.67	1696	25.20	1775	28.86
21000	1359	9.10	1461	12.70	1555	16.45	1636	20.16	1709	23.89	1781	27.79	***1851***	***31.80***	***1919***	***35.93***
25000	1582	13.67	1668	17.79	1753	22.16	***1832***	***26.61***	***1903***	***31.03***	***1968***	***35.45***	***2030***	***39.95***	***2090***	***44.53***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 33" DD

Wheel Diameter: 33.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9000	617	1.92	779	3.86														
11000	682	2.47	824	4.65	954	7.09	1073	9.77										
13000	754	3.15	881	5.57	998	8.27	1107	11.13	1211	14.24	1308	17.51						
15000	828	3.97	946	6.67	1052	9.59	1152	12.72	1247	15.99	1339	19.47	1426	23.11	1510	26.94		
17000	903	4.92	1016	7.93	1113	11.08	1205	14.45	1294	18.03	1379	21.71	1461	25.53	1541	29.57	1617	33.7
19000	979	6.04	1090	9.41	1180	12.81	1265	16.39	1347	20.18	1427	24.18	1504	28.25	1578	32.40	***1651***	***36.75***
23000	1137	8.86	1238	12.89	1324	16.94	1400	21.07	1471	25.28	1541	29.70	1609	34.29	***1675***	***39.00***	***1740***	***43.84***
27000	1302	12.66	1389	17.21	1472	21.99	1546	26.81	1611	31.57	***1673***	***36.45***	***1734***	***41.49***	***1794***	***46.70***	***1852***	***51.99***

FAN 36" DD

Wheel Diameter: 36.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
14000	615	3.12	741	5.79	852	8.67										
16400	676	3.92	791	6.92	893	10.15	987	13.51	1078	17.13						
18800	741	4.88	846	8.23	941	11.77	1029	15.53	1111	19.35	1191	23.40				
23600	880	7.40	967	11.40	1050	15.64	1128	20.01	1201	24.54	1271	29.26	1338	34.05	1403	38.93
28400	1026	10.93	1099	15.45	1171	20.39	1240	25.45	1307	30.67	1371	36.04	1431	41.44	***1490***	***47.06***
33200	1176	15.63	1239	20.71	1301	26.17	1363	32.00	1422	37.86	***1480***	***43.85***	***1537***	***50.01***	***1592***	***56.30***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 40" DD

Wheel Diameter: 40.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	540	3.50	657	6.59	762	9.97												
19000	595	4.44	702	7.95	797	11.74	885	15.72										
22000	654	5.56	752	9.51	840	13.71	921	18.13	998	22.72	1072	27.53						
25000	717	6.93	806	11.32	888	15.90	964	20.75	1035	25.75	1103	30.87	1169	36.19				
28000	782	8.56	863	13.35	940	18.41	1012	23.66	1078	29.01	1142	34.61	1204	40.35	1264	46.22	1322	52.19
34000	918	12.84	985	18.27	1051	24.19	1115	30.31	1176	36.56	1234	42.96	1290	49.59	***1343***	***56.24***	***1395***	***63.07***
40000	1057	18.56	1115	24.70	1172	31.33	1228	38.30	1283	45.48	***1336***	***52.72***	***1388***	***60.18***	***1437***	***67.63***	***1485***	***75.32***

FAN 44" DD

Wheel Diameter: 44.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
17400	461	3.68	574	7.17												
21000	507	4.69	610	8.70	700	12.97										
24600	558	5.92	652	10.42	735	15.24	812	20.30	886	25.69						
28200	612	7.37	697	12.37	775	17.69	846	23.24	914	29.07	978	34.98				
35400	727	11.20	798	17.20	865	23.49	929	30.06	989	36.88	1046	43.92	1101	51.13	1154	58.44
42600	848	16.57	907	23.31	966	30.73	1022	38.28	1077	46.14	1129	54.12	1179	62.36	***1226***	***70.57***
49800	972	23.71	1024	31.37	1074	39.50	1124	48.16	1173	57.06	***1220***	***65.99***	***1266***	***75.14***	***1311***	***84.56***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 49" DD

Wheel Diameter: 49.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	409	4.20	514	8.25												
24000	446	5.26	542	9.89	627	14.89										
28000	487	6.53	576	11.75	654	17.34	726	23.18								
32000	531	8.02	612	13.77	685	19.91	752	26.34	816	33.08						
36000	577	9.77	651	16.09	720	22.78	783	29.79	843	37.13	899	44.48	955	52.38		
44000	673	14.24	736	21.62	797	29.53	854	37.62	908	46.06	958	54.56	1007	63.42	1055	72.53
52000	774	20.34	828	28.62	881	37.63	932	46.90	981	56.35	1028	66.06	1073	76.03	***1116***	***86.13***
60000	878	28.34	925	37.53	971	47.38	1017	57.90	1061	68.50	***1104***	***79.29***	***1147***	***90.58***	***1187***	***101.71***

FAN 54" DD

Wheel Diameter: 54.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	407	6.61	493	12.38	569	18.60										
35000	445	8.23	524	14.67	594	21.64	659	28.97								
40000	486	10.15	558	17.28	624	24.99	684	33.03	740	41.21	796	50.15				
45000	528	12.35	595	20.31	656	28.56	713	37.37	766	46.40	817	55.73	866	65.30		
55000	618	18.20	674	27.39	727	37.07	779	47.31	827	57.74	872	68.37	916	79.44	959	90.82
65000	711	26.05	759	36.35	806	47.55	851	59.03	895	70.86	937	82.91	978	95.51	***1016***	***107.93***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 60" DD

Wheel Diameter: 60.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
37000	370	8.20	447	15.27	515	22.87										
43000	403	10.09	475	18.08	538	26.62	596	35.50								
49000	440	12.45	505	21.19	564	30.53	618	40.32	670	50.63	720	61.44				
55000	477	15.08	537	24.71	593	34.92	644	45.57	692	56.61	738	67.96	783	79.86		
67000	557	22.09	608	33.33	656	45.13	703	57.59	746	70.17	787	83.19	827	96.73	866	110.62
79000	640	31.51	683	43.96	726	57.66	767	71.67	807	86.09	845	100.75	882	116.03	***917***	***131.39***
91000	724	43.59	762	57.48	800	72.58	837	88.44	872	104.29	***908***	***121.07***	***942***	***137.78***	***975***	***154.85***

FAN 66" DD

Wheel Diameter: 66.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
45000	337	9.97	407	18.57	469	27.85												
53000	371	12.59	435	22.29	492	32.80	544	43.64										
61000	408	15.79	466	26.64	519	38.20	567	50.20	613	62.77	657	75.78						
69000	446	19.54	499	31.57	549	44.33	594	57.40	637	71.20	678	85.32	717	99.59	756	114.81		
77000	486	24.13	534	37.15	580	50.97	623	65.19	664	80.20	702	95.29	740	111.32	775	126.80	810	143.08
93000	568	35.82	608	50.55	648	66.76	686	83.28	723	100.34	759	118.17	792	135.79	***824***	***153.85***	***856***	***172.78***
109000	653	51.66	687	68.12	722	86.31	756	105.39	788	124.36	***821***	***144.53***	***852***	***164.54***	***882***	***184.95***	***911***	***205.76***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 73" DD

Wheel Diameter: 73.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
55000	305	12.23	368	22.72	424	34.06												
60000	320	13.76	381	25.06	434	37.07	484	49.94										
70000	353	17.40	408	30.02	457	43.43	503	57.78	546	72.49								
80000	387	21.63	437	35.69	484	50.77	526	66.27	566	82.49	604	99.02	641	116.27				
90000	424	27.03	469	42.42	512	58.71	552	75.63	589	93.01	625	111.25	660	130.06	693	148.77	726	168.56
110000	499	40.70	537	58.52	574	77.82	609	97.38	643	117.67	676	138.96	706	159.78	***736***	***181.75***	***765***	***203.99***
130000	577	59.46	609	79.38	641	101.11	672	123.77	702	146.75	732	170.68	***761***	***195.11***	***788***	***219.30***	***815***	***244.7***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 14" PF

Wheel Diameter: 14.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1600	1660	0.48	1983	0.88	2261	1.31												
1800	1780	0.57	2086	1.00	2351	1.47	2593	1.96										
2200	2030	0.79	2311	1.29	2553	1.83	2774	2.41	2977	2.99	3174	3.60						
2600	2292	1.08	2550	1.65	2776	2.26	2980	2.90	3170	3.57	3351	4.25	3521	4.95	3687	5.66	3858	6.42
3000	2561	1.44	2800	2.09	3011	2.77	3204	3.48	3383	4.22	3551	4.97	3713	5.75	3869	6.55		
3400	2835	1.89	3059	2.62	3257	3.38	3438	4.15	3608	4.95	3769	5.78						
3800	3112	2.43	3324	3.25	3510	4.08	3682	4.93	3844	5.80								
4200	3393	3.08	3593	3.99	3770	4.90												
4600	3676	3.84	3866	4.84														

FAN 18" PF

Wheel Diameter: 18.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4000	1436	1.18	1658	2.04	1852	2.89	2031	3.79	2200	4.75	2370	5.79				
4600	1588	1.51	1785	2.44	1969	3.45	2135	4.43	2292	5.46	2441	6.54	2587	7.68	2736	8.89
5200	1746	1.93	1922	2.91	2094	4.04	2252	5.17	2397	6.27	2538	7.42	2672	8.62	2802	9.87
5800	1905	2.42	2067	3.48	2223	4.66	2375	5.95	2515	7.21	2646	8.43	2773	9.70	2896	11.01
7000	2228	3.67	2375	4.94	2506	6.23	2636	7.64	2764	9.17	2887	10.73	***3003***	***12.24***	***3114***	***13.73***
8200	2557	5.33	2693	6.84	2812	8.32	2922	9.83	***3033***	***11.44***	***3144***	***13.18***	***3252***	***14.99***	***3358***	***16.82***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 24" PF

Wheel Diameter: 24.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	838	1.17	1041	2.25														
5600	891	1.36	1074	2.51														
6200	947	1.59	1116	2.81	1278	4.18												
7400	1064	2.11	1213	3.51	1352	5.00	1489	6.64	1623	8.39								
8600	1185	2.76	1324	4.36	1446	6.01	1566	7.77	1683	9.63	1799	11.61						
9800	1309	3.55	1440	5.37	1552	7.19	1659	9.10	1764	11.09	1867	13.17	1970	15.38	2072	17.68	2173	20.06
11000	1436	4.50	1558	6.52	1666	8.57	1764	10.65	1859	12.79	1952	15.00	2044	17.30	2136	19.7	***2228***	***22.22***
12200	1565	5.63	1680	7.86	1783	10.13	1876	12.40	1963	14.70	2049	17.09	2134	19.55	***2217***	***22.04***	***2300***	***24.64***
14600	1827	8.50	1930	11.16	2022	13.82	2109	16.55	***2189***	***19.25***	***2265***	***21.99***	***2337***	***24.73***	***2409***	***27.56***	***2481***	***30.47***

FAN 30" PF

Wheel Diameter: 30.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	712	1.90														
9000	763	2.27	903	4.06												
10000	817	2.70	945	4.57												
11000	870	3.17	992	5.18	1105	7.44										
13000	978	4.24	1094	6.65	1192	9.06	1288	11.75	1387	14.66						
15000	1089	5.55	1201	8.43	1291	11.12	1376	13.93	1459	17.00	1542	20.25				
17000	1203	7.15	1308	10.43	1397	13.59	1474	16.63	1550	19.86	1623	23.25	1696	26.87	1770	30.61
21000	1438	11.40	1529	15.42	1612	19.47	1687	23.44	1753	27.21	***1815***	***30.97***	***1876***	***34.87***	***1937***	***38.95***
25000	1677	17.22	1757	21.99	***1832***	***26.81***	***1902***	***31.63***	***1968***	***36.44***	***2027***	***41.02***	***2082***	***45.50***	***2135***	***50.00***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 33" PF

Wheel Diameter: 33.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9000	623	2.09												
11000	698	2.79	824	4.96										
13000	779	3.69	891	6.07	996	8.79								
15000	860	4.72	965	7.45	1059	10.33	1150	13.53						
17000	942	5.93	1045	9.13	1130	12.21	1212	15.55	1292	19.17				
19000	1026	7.35	1126	11.02	1207	14.45	1281	17.92	1355	21.74	1426	25.73	1500	29.97
23000	1200	11.01	1289	15.44	1368	19.84	1436	24.00	1499	28.16	1560	32.45	1620	36.96
27000	1378	15.87	1457	21.02	1531	26.28	1598	31.44	***1658***	***36.41***	***1712***	***41.18***	***1765***	***46.07***

FAN 36" PF

Wheel Diameter: 36.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
14000	646	3.60	749	6.23	849	9.16												
16400	719	4.67	813	7.67	899	10.85	985	14.32										
18800	793	5.96	883	9.37	960	12.87	1035	16.56	1109	20.47	1187	24.84						
23600	946	9.32	1029	13.61	1099	17.89	1161	22.22	1222	26.73	1281	31.31	1340	36.10	1400	41.17	1462	46.61
28400	1103	13.91	1178	19.05	1245	24.27	1304	29.43	1357	34.58	1408	39.86	1458	45.22	***1508***	***50.74***	***1557***	***56.35***
33200	1264	20.06	1332	26.05	1393	32.06	1450	38.16	***1502***	***44.22***	***1550***	***50.30***	***1594***	***56.29***	***1637***	***62.39***	***1680***	***68.65***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 40" PF

Wheel Diameter: 40.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	563	3.97	661	7.04	760	10.61												
19000	631	5.25	718	8.74	799	12.47	882	16.67										
22000	699	6.75	782	10.76	854	14.91	924	19.29	995	24.04								
25000	769	8.57	850	13.17	915	17.70	978	22.47	1039	27.38	1101	32.66	1166	38.48				
28000	841	10.76	918	15.91	981	20.95	1038	26.10	1094	31.44	1149	36.96	1204	42.73	1260	48.86	1318	55.46
34000	987	16.33	1056	22.51	1117	28.75	1171	34.96	1219	41.11	1265	47.36	1312	53.93	***1358***	***60.59***	***1403***	***67.34***
40000	1137	23.86	1199	31.08	1255	38.36	1307	45.73	***1354***	***53.01***	***1397***	***60.26***	***1437***	***67.48***	***1477***	***74.95***	***1516***	***82.46***

FAN 44" PF

Wheel Diameter: 44.50 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
17400	474	4.08	573	7.60														
21000	533	5.42	617	9.37	698	13.72												
24600	594	7.07	670	11.53	740	16.28	810	21.47										
28200	655	9.01	729	14.15	791	19.35	852	24.86	912	30.68	975	37.15						
35400	781	14.08	850	20.59	907	27.00	957	33.42	1007	40.21	1055	47.05	1103	54.20	1151	61.65	1201	69.69
42600	912	21.13	973	28.83	1028	36.67	1076	44.38	1120	52.19	1161	60.02	1202	68.11	***1242***	***76.23***	***1282***	***84.63***
49800	1045	30.46	1100	39.40	1151	48.54	1197	57.63	***1240***	***66.79***	***1279***	***75.86***	***1315***	***84.85***	***1350***	***93.97***	***1385***	***103.35***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 49" PF

Wheel Diameter: 49.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	418	4.61	513	8.78												
24000	466	6.00	546	10.60	625	15.82										
28000	516	7.69	588	12.86	655	18.38	724	24.63								
32000	567	9.70	635	15.51	695	21.57	753	27.94	813	35.00						
36000	618	12.02	685	18.64	739	25.17	792	32.08	844	39.33	897	47.14	952	55.69		
44000	724	18.00	785	26.02	837	34.03	882	41.99	926	50.31	969	58.78	1012	67.64	1054	76.67
52000	833	26.01	888	35.38	938	44.98	982	54.47	1021	63.85	1058	73.36	***1095***	***83.21***	***1132***	***93.31***
60000	944	36.40	994	47.16	1040	58.11	1082	69.06	***1121***	***80.07***	***1156***	***90.89***	***1189***	***101.76***	***1221***	***112.78***

FAN 54" PF

Wheel Diameter: 54.25 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	426	7.57	497	13.27	567	19.71										
35000	472	9.72	536	16.12	596	23.00	657	30.71								
40000	519	12.28	580	19.53	634	27.13	686	35.10	738	43.64						
45000	567	15.33	626	23.49	675	31.71	722	40.29	768	49.23	815	58.90	863	69.29		
55000	665	23.05	719	33.01	766	43.07	807	53.13	845	63.25	884	73.97	922	84.92	959	96.03
65000	765	33.32	815	45.18	859	57.05	899	69.01	934	80.72	967	92.56	***999***	***104.56***	***1032***	***117.15***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 60" PF

Wheel Diameter: 60.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
37000	387	9.36	451	16.39	514	24.33										
43000	428	11.97	486	19.85	540	28.30	594	37.58								
49000	470	15.09	525	23.95	573	33.14	620	42.88	668	53.57						
55000	512	18.69	566	28.74	610	38.73	653	49.33	694	60.12	736	71.78	780	84.65		
67000	599	27.92	648	40.05	691	52.40	728	64.65	763	77.15	798	90.12	832	103.31	866	117.03
79000	688	40.19	733	54.52	773	68.96	809	83.43	841	97.75	871	112.18	***901***	***127.16***	***930***	***142.06***
91000	779	56.15	819	72.33	857	89.12	891	105.71	***923***	***122.52***	***951***	***138.70***	***978***	***155.25***	***1004***	***171.96***

FAN 66" PF

Wheel Diameter: 66.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
45000	353	11.42	411	19.96	468	29.60												
53000	394	14.93	447	24.74	495	35.05	543	46.34										
61000	436	19.19	486	30.28	529	41.72	570	53.53	612	66.48	656	80.93						
69000	479	24.32	527	36.85	567	49.49	604	62.40	641	76.03	677	90.07	715	105.60				
77000	522	30.28	568	44.29	607	58.33	641	72.34	675	87.13	708	102.21	740	117.54	774	134.47	808	152.07
93000	611	45.70	652	62.42	689	79.46	722	96.50	751	113.24	779	130.42	807	148.19	***835***	***166.48***	***862***	***184.8***
109000	702	66.34	739	85.88	773	105.73	804	125.56	***833***	***145.59***	***859***	***165.25***	***884***	***185.33***	***907***	***204.86***	***931***	***225.59***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

FAN 73" PF

Wheel Diameter: 73.00 inches

	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
55000	319	13.96	371	24.31	423	36.17												
60000	338	16.06	387	27.14	434	39.28	483	53.29										
70000	376	20.87	422	33.59	463	46.94	503	61.14	544	76.79								
80000	415	26.70	460	41.40	497	56.17	532	71.35	567	87.50	602	104.59	639	123.62				
90000	455	33.72	498	50.26	533	66.50	565	83.17	597	100.71	628	118.68	659	137.50	691	157.74	724	179.48
110000	537	51.88	575	71.76	609	91.99	639	112.17	665	131.73	691	152.24	717	173.36	***743***	***195.24***	***768***	***217.09***
130000	620	76.15	654	99.40	686	123.49	714	146.97	***741***	***171.28***	***764***	***194.31***	***787***	***218.44***	***809***	***242.62***	***831***	***267.35***

Class I = Regular face to left of Class II

Class II = Regular face in shaded area

Class III = Italic face to right of Class II

Filter Standard Conversion/Classification Chart

Camfil Farr Product	Eurovent 4/9	EN 779 old and proposed new	Average Arrestance ASHRAE Standard 52.1-1992		Average Dust Spot Efficiency ASHRAE Standard 52.1-1992	Minimum Efficiency Reporting Value ASHRAE 52.2-1999
			Greater than or equal to	Less than	Greater than or equal to	
Type 44 504 panel	**EU1**	**G1**		**65%**		
Aeropleat®	**EU3**	**G3**	**80%**	**90%**	**20%**	**6**
30/30®	**EU4**	**G4**	**90%**		**25%**	**7**
Riga-Flo® XL Hi-Flo® 45% HP® 2A	**EU5**	**F5**	**96%**		**40%**	**9**
Riga-Flo® 15 Durafil™ 65% Aeropac® 65% Opti-Pac™ 65% Hi-Flo® 65% HP®15	**EU6**	**F6**	**97%**		**60%**	**11**
Riga-Flo® 100 Durafil™ 85% Aeropac® 85% Opti-Pac™ 85% Hi-Flo® 85% HP® 85	**EU7**	**F7**	**98%**		**80%**	**13**
Riga-Flo® 200 Durafil™ 95% Aeropac® 95% Opti-Pac™ 95% Hi-Flo® 95% HP® 200	**EU8**	**F8**	**99%**		**90%**	**14**
Micretain® Ultra-Pac™ Filtra 2000™ 95- DOP	**EU9**	**F9**	**99%**		**99%**	**16**

Filter Classes for HEPA/ULPA Filters (EN 1882)		
	Efficiency at the MPPS	
Filter Class	Overall Efficiency	Local Value (leakage)
H10	> 85 %	---
H11	> 95 %	---
H12	> 99.5 %	97.5
H13	> 99.95 %	99.75
H14	> 99.995 %	99.975
U15	> 99.9995 %	99.9975
U16	> 99.99995 %	99.99975
U17	> 99.999995	99.9999
Classification based on overall efficiency and leaks Leak is 5 times higher value that the overall penetration (except U17)		

APPLICATION GUIDELINES

MERV Std 52.2	Average ASHRAE Dust Spot Efficiency Std 52.1	Average ASHRAE Arrestance Std 52.1	Particle Size Ranges	Typical Applications	Typical Filter Type
1-4	<20%	60 to 80%	>10.0 µm	Residential/Minimum Light/Commercial Minimum/Equipment Protection	Permanent/Self Charging (passive) Washable/Metal, Foam/Synthetics Disposable Panels Fiberglass/Synthetics
5-8	<20% to 35%	80 to 95%	3.0 -10.0 µm	Industrial Workplaces Commercial Better/Residential Paint Booth/Finishing	Pleated Filters Extended Surface Filters Media Panel Filters
9-12	40 to 75%	>95 to 98%	1.0 – 3.0 µm	Superior/Residential Better/Industrial Workplaces Better/Commercial Buildings	Non-Supported/Bag Rigid Box Rigid Cell/Cartridge
13-16	80 to 95%	>98 to 99%	0.30 – 1.0 µm	Smoke Removal General Surgery Hospitals & Health Care Superior/Commercial Buildings	Rigid Cell/Cartridge Rigid Box Non-Supported/Bag
17-20[1]	99.97[2] 99.99[2] 99.999[2]	N/A	<=0.30 µm	Clean Rooms High Risk Surgery Hazardous Materials	HEPA ULPA

Note: This table is intended to be a general guide to filter use and does not address specific applications or individual filter performance in a given application. Refer to manufacturer test results for additional information.

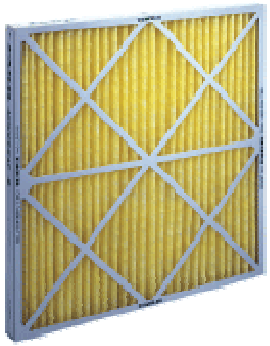
(1) Reserved for future classification
(2) DOP efficiency

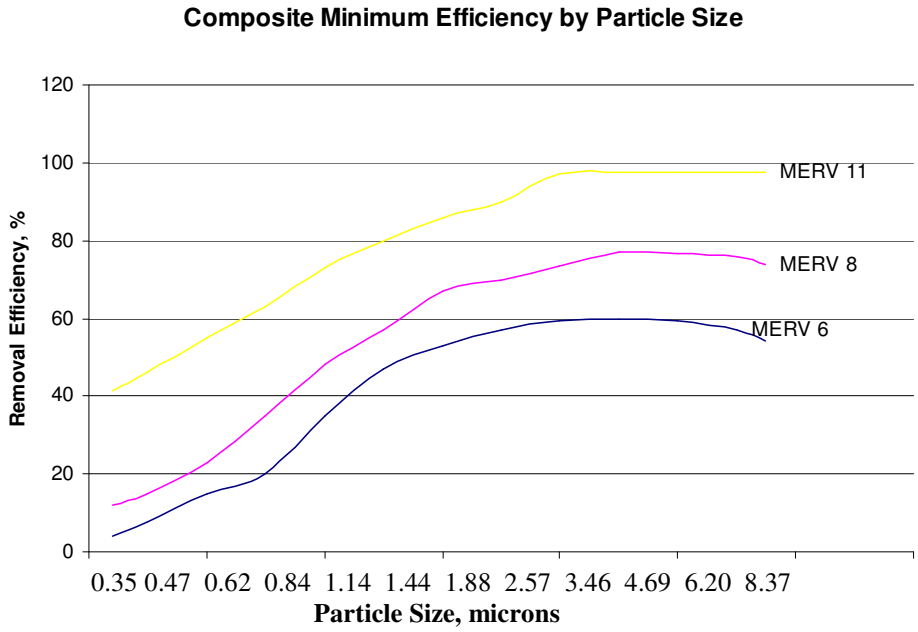
FILTER DATA

Filters are provided in air-conditioning systems to improve the quality of pre-conditioned air, to protect equipment components such as heating and cooling coils from particulate contamination and to assure that the conditioned air will meet design cleanliness conditions. Below is a list of some of the types of dry-media filters available with a brief description.

Pleated Panels with cardboard frame (disposable) – Standard & High Capacity

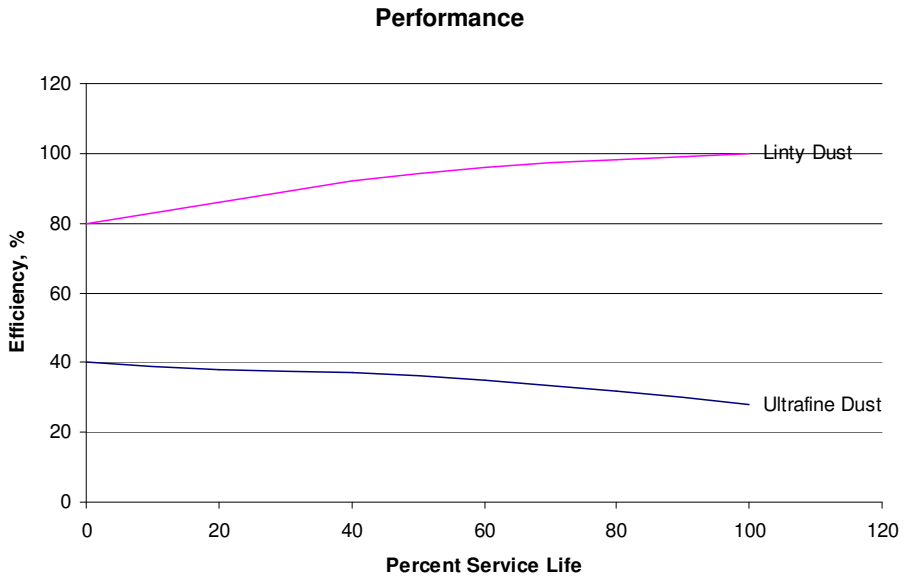
The filter media is composed of a high loft pleated synthetic material that is bonded to a welded wire media grid backing, treated for corrosion resistance, preventing media oscillation or filter pack failure as filter pressure drop increases. Applications include commercial buildings, educational facilities and specialty manufacturing. As a pre-filter these filters offer protection for the higher efficiency final filters required for today's high technology applications.





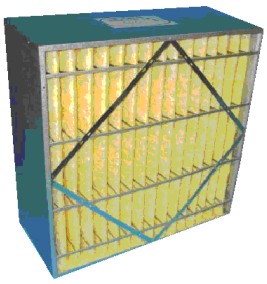
Metal Filters for Large Particles and Lint

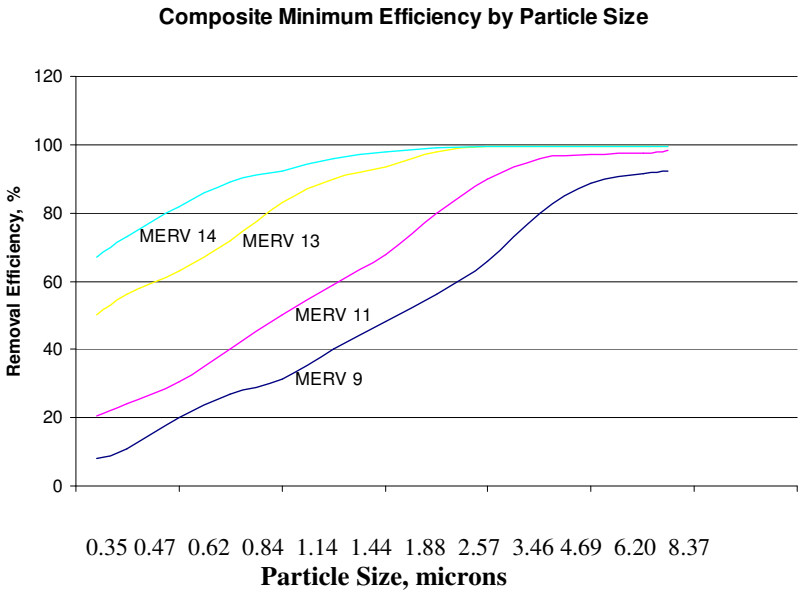
Panel filters are constructed of an electro-galvanized steel media mesh, assembled into alternating layers of corrugated and flat layers and enclosed in a 20-gauge galvanized steel frame. Filter are cleanable, low pressure drop, low or high velocity permanent panel filters for applications with high lint or large particle concentrations.



High-Lofted Supported Media Air Filter

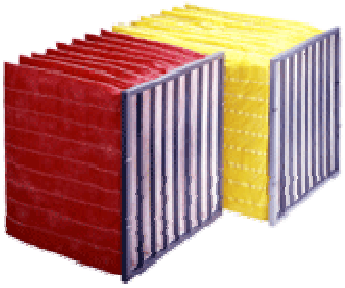
The materials of construction preclude contaminant amplification as all components are inert with respect to supporting the growth of captured bacteria or other viable contaminants. These filters are available in four efficiencies: high-lofted, depth-loading, microfine glass media for longer service life and uniform low resistance to airflow. Filtration efficiency is maintained throughout the life of the filter. They have a laminated media backing to maintain fiber blanket uniformity and preclude media migration. Includes a stiffened backing that is bonded to the media to support and maintain tapered radial pleats and prevent media oscillation during varying system airflows.



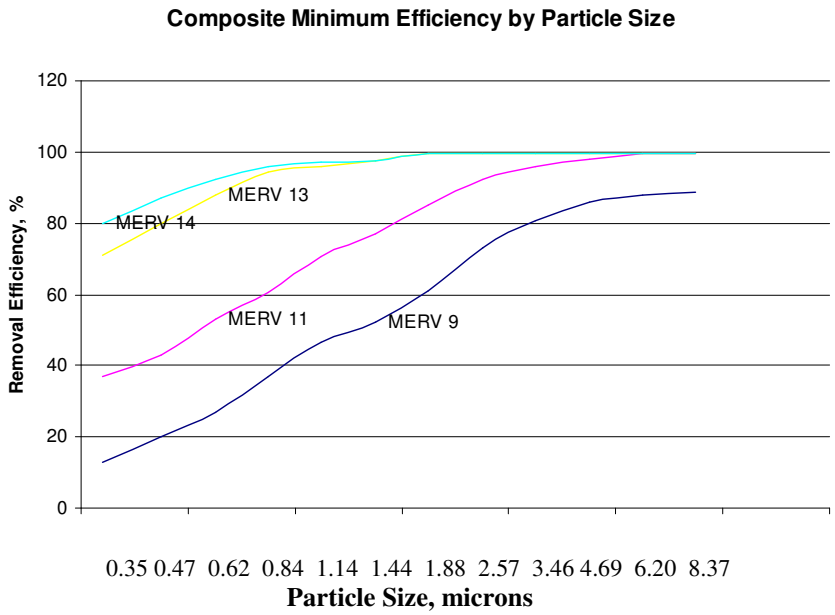


(High-Lofted Supported Media Air Filters Performance Chart)

Extended Surface Multi-Pocket Synthetic Air Filters



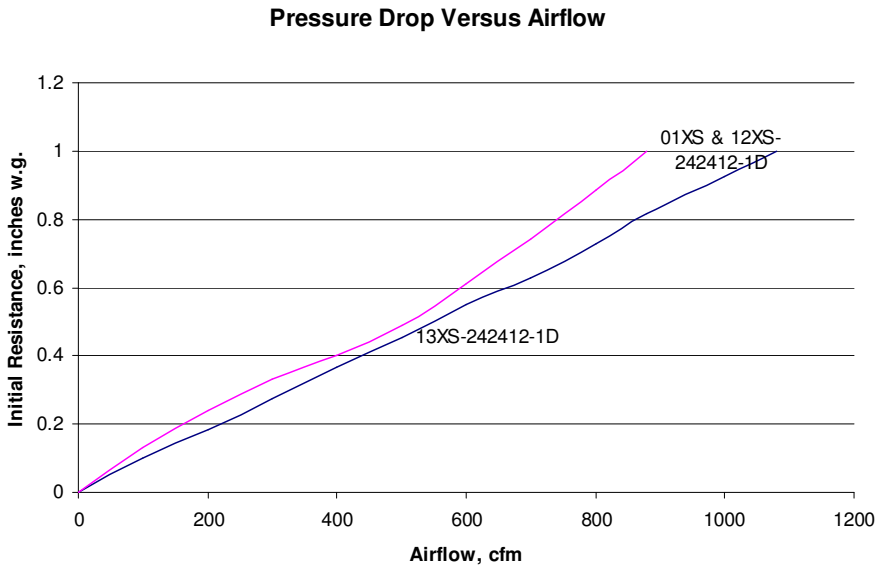
The extended surface multi-pocket synthetic air filters offers high efficiency filtration with a synthetic fiber material. Designed for use in air conditioning applications, it can remove contaminants such as fumes, smoke, bacteria, fungi and virus-bearing droplet nuclei. They features an optimized design of the pocket manufacture, controlled media spacing, allowing for the lowest possible resistance to air flow throughout the lifetime of the filter. Applications include commercial buildings, medical facilities and industrial manufacturing facilities.



(Extended Surface Multi-Pocket Synthetic Air Filters Performance Chart)

High Efficiency Particulate Filters

HEPA are manufactured from the highest quality components, under demanding quality control conditions, and they are certified to ensure performance in the most critical of applications. HEPA is available in efficiencies from 99.97% to 99.999% on 0.3 micron particles. Typical applications include medical facilities, pharmaceutical manufacturing, electronic component manufacturing, food and dairy processing facilities and many other locations where ultra-clean air is a requirement.



(High Efficiency Particulate Filters Performance Chart)

Static Pressure Losses (W.C.)

Hot Water and Steam Coils							
		Coil Face Velocity (ft/min)					
Rows	Fins/in.	300	350	400	450	500	600
1	8	0.03	0.04	0.05	0.06	0.08	0.11
2	8	0.06	0.08	0.10	0.12	0.14	0.20
4	8	0.11	0.14	0.18	0.22	0.27	0.36
1	12	0.06	0.08	0.09	0.11	0.13	0.17
2	12	0.11	0.14	0.17	0.20	0.24	0.31

Chilled Water and DX Coils							
		Coil Face Velocity (ft/min)					
Rows	Fins/in.	300	350	400	450	500	600
Wet							
4	8	0.13	0.17	0.21	0.25	0.30	0.41
6	8	0.19	0.24	0.30	0.37	0.44	0.60
8	8	0.25	0.33	0.41	0.50	0.60	0.82
4	14	0.26	0.32	0.39	0.46	0.53	0.68
6	14	0.39	0.48	0.58	0.68	0.79	1.00
8	14	0.51	0.63	0.76	0.90	1.04	1.34
Dry							
4	8	0.17	0.21	0.26	0.31	0.36	0.48
6	8	0.24	0.31	0.39	0.47	0.55	0.74
8	8	0.33	0.42	0.52	0.64	0.74	0.99
4	14	0.33	0.42	0.51	0.60	0.70	0.92
6	14	0.50	0.63	0.77	0.92	1.08	1.41
8	14	0.68	0.86	1.03	1.23	1.44	1.89

Note: The values presented on this page are generalized for the purpoes of summing the pressure drops through a unit. For exact values please contact manufacturers.

STANDARD FEATURES

CABINET

- Welded structural base frame primed with zinc rich primer
- Lifting lugs
- Heavy gauge color bond steel casing with rust-resistant grey two part epoxy
- One inch thick 1.5# density neoprene coated fiberglass. The insulation is glued and pinned.
- Out door units complete with sloped roof.

BLOWER/MOTOR

- AMCA rated DWDI centrifugal blower or SWSI plenum fan.
- Polished steel shaft with rust inhibitor.
- Maximum operating speed less than 75% of first critical speed
- Standard heavy-duty industrial bearings
- ODP motor, 1800 RPM, T frame, 1.15 service factor mounted on adjustable base
- Drives designed for 150% motor brake horsepower
- Adjustable V-belt drives used up to and including 5 HP; fixed drives on 7.5 HP and larger

CONTROLS ENCLOSURE

- High and Low airflow pressure switches
- Manual reset high limit
- Factory wired control panel with numbered terminal strip
- Motor starter with overloads
- Control circuit transformer, 120 volt
- Control panel service switch
- Circuit breaker
- Terminal connections for exhaust interlock
- Nationally recognized components, service parts

OPTIONAL FEATURES

WEATHERHOUSING
Control and manifold enclosure

INLET HOODS
Expanded metal screen inlet with optional 2" filters.

FILTER SECTION
V-bank filter section with side access suitable for 2" filters
Hinged access doors completely sealed with gasketing.

WINTER FILTER SECTION
Located on the discharge side of blower.

FILTERS
2" thick permanent, pleated and throwaway filters;
Various efficiency bag filters and HEPA filters complete with filter gauge and/or indicating light.

MOTORIZED INLET & DISCHARGE DAMPER
Parallel blade damper with a two-position spring return actuator and end switch.

ROOF CURB
Prefabricated galvanized roof curb 16" or 24" high; full perimeter available on most units.

BLOWERS
Air foil, and plug fans, double supply fans.

REHEAT
Electric, High Turndown indirect gas fired or hot water/steam coil reheat.

HINGED ACCESS DOORS
Door switches
Special access door gasketing
#310 ventlock fasteners

MUSHROOM HOOD
Air velocity through the inlet ranges between approximately 450 and 550 feet per minute at maximum air capacities listed.
Complete with internal screen for debris.

LOUVERED INLET
Sized for a maximum velocity of 500 FPM to ensure moisture does not enter the unit.

4 WAY DISCHARGE HEAD
The adjustable 4 way discharge head provides 4 equal quantities of air in the conditioned space.

HORIZONTAL DISCHARGE HEAD
180 deg. Vertical and horizontal adjustment with 360 deg. of free rotation.

INTERNAL VIBRATION ISOLATION
Blower and motor isolated on separated frame with R.I.S. or spring c/w canvas connector.

EXTERNAL VIBRATION ISOLATION
Floor mounted or suspended isolation.

SERVICE PLATFORM
Provides access to controls and gas train.

MOTORS
TEFC and high-efficiency, meeting EER and CSA standards and 2-speed.

DISCONNECT SWITCH
Weatherproof enclosure; non-fused or fused.

PACKAGED COOLING
DX Coil, Condenser, Compressor

GIDM TYPE
Indirect Gas Heat (4 - Pass Drum & Tube Heat Exchanger)

GIDMH TYPE
Indirect Gas Heat (4 - Pass Drum & Tube Heat Exchanger), w/High CFM.

BMA TYPE
Direct Gas Heat

BMAE TYPE
Electric Heat

DIDM TYPE
Indirect Gas Heat (4 - Pass Drum & Tube Heat Exchanger)

DIDMH TYPE
Indirect Gas Heat (4 - Pass Drum & Tube Heat Exchanger), w/High CFM.

MTI TYPE
Indirect Gas Heat (Multiple Tube Heat Exchanger)

HTDM TYPE
Indirect Gas Heat (2 - Pass Drum & Tube Heat Exchanger)

HEAT RECOVERY TYPE
Heat Pipe, Heat Core, Enthalpy Wheel, Run Around Glycol

HUMIDIFICATION TYPE
Electric Humidifier, Gas to Steam Humidifier

Additional Options

- *Auto low limit freeze protection control with bypass timer*
- *10 point electronic circuit analyzer with signal lights*
- *Exhaust Interlock Relay*
- *Proof of Closure Valve*
- *Inlet Air Controller (burner economizer)*
- *Ultra violet flame supervision*
- *Audible alarm*
- *Firestat*
- *7-day programmable timeclock*
- *Purge timer*
- *Delay exhaust start*
- *115 volt GFI service receptacle*
- *Marine service light with 100 watt bulb, guard, and lighted switch*
- *High density insulation*
- *2' thick and 4" thick insulation*
- *Motor and bearings out of airstream*
- *JIC wiring*
- *Extended grease lines*
- *Belt guards*
- *Checker plate floor*
- *Walk-in service corridors*
- *Special coatings*
- *Special construction: aluminum, stainless steel, heavier gauge*

TYPICAL SPECIFICATIONS

CASING

The unit exterior casing shall be heavy gauge G90 rated bonderized steel. Unit roof shall feature standing seam construction. The entire unit casing shall be insulated with 1-in. thick 1.5-lb. (2-in. thick 1.5-lb.) fiberglass insulation with hard neoprene backing in a sandwich wall fashion (22-gauge solid liner). The unit exterior shall be finished with industrial enamel (catalyzed epoxy) paint. An integral welded iron channel frame shall support the unit casing. The structural iron frame shall be sandblasted, primed and finished with industrial enamel (catalyzed epoxy) paint.

BLOWER/MOTOR SECTION

The fan section and motor assembly shall be constructed in accordance with the requirements of the Air Moving and Conditioning Association (AMCA). The assembly shall be designed to house the fan(s), bearings, motor, and v-belts, which shall be selected for at least 50% above the rated motor capacity. The fan(s) and motor shall be mounted on a welded unitary base made of angle iron frame. The frame shall be sandblasted, primed and finished with industrial enamel (catalyzed epoxy) paint. The unitary base shall be provided with seismic spring vibration isolation. The blower section shall have a hinged access door with Ventlock handles to allow easy maintenance of filters and belts. The NEMA T-Frame motor shall be mounted on an adjustable base located within the fan section. The blower wheel shall be statically and dynamically balanced, and mounted on a turned, ground and polished shaft with rigid bearing supports. The shaft shall be designed with a maximum operating speed not exceeding 75% of the first critical speed. The bearings shall be split taper lock ball bearing type L20 minimum life of 100,000 hours (L10 200 kHr).

Fan performance shall be based on tests conducted in accordance with AMCA Standard Test Code for Air moving Devices. (All fans shall have sharply rising pressure characteristic extending throughout the operating range and continuing to rise well beyond the efficiency peak to assure quiet and stable operation under all conditions. Horsepower characteristics shall be truly non-overloading and shall reach a peak in the normal selection area.) Fan manufacturer shall provide sound power ratings in the eight octave bands, which shall be based on AMCA Standard 300-67, test, setup number one. Sound power ratings shall be referenced 10-12 watts. A factory dynamic balance shall be made on all fans after their assembly. An IRD or PMC analyzer shall be used to measure velocity, and the final reading shall not exceed 0.1 inches per second. The exact level of vibration shall be recorded on the fan as proof of the final dynamic balance at the factory.

COOLING CONTROLS

Cooling control shall be achieved via a Honeywell T775 multi-stage sequencer. The sequencer shall be controlled with an analog signal provided by the discharge air thermostat. As the discharge air thermostat requires cooling the signal shall increase, thereby turning on the stages at specific set points. The set points shall be set with appropriate offset and differential to ensure accurate discharge temperature is maintained. The stages are to be sequenced without turning on and off of compressors to minimize unnecessary wear on the compressors. Upon sensing a call for cooling from the space, the compressors shall provide full cooling until the space sensor is satisfied, upon which time the cooling shall revert to discharge air control. A low discharge temperature set point with a large differential shall

be set to prevent the compressor from cycling on and off. The compressor will remain on low setting until cooling is disabled manually or the ambient temperature falls below the minimum set point.

ELECTRICAL CONTROL EQUIPMENT

Electrical assembly and components shall be in strict accordance with the latest provisions and requirements of the National Electric Code. Control cabinet shall be designed and constructed to ETL specifications. A safety disconnect switch shall be mounted on the unit. The controls shall be located in a weatherproof cabinet. Provisions for service padlocking shall be provided. The following items shall be located within the cabinet: fuses, starters, control relays, timing and holding relays, resistors and numbered terminal strips. All components shall be labeled and cross-referenced to control and field wiring diagrams. The control circuit shall be 24V, single phase. Wiring shall be neatly run in "PANDUIT" wiring duct. Low and/or line voltage thermostats shall be furnished shipped loose for installation by others. Unit shall be equipped with automatic low limit freeze protection with bypass timer.

DAMPERS & FILTER SECTION

The dampers are to be galvanized steel (aluminum airfoil low leak) type (with seals). The dampers shall be equipped with 2-position (modulating) actuators. The filters shall be 2" pleated throwaway type with minimum of 85% arrestance and 30% efficiency. Filter access shall be through a latched and gasketed access doors located on both sides of the unit. (Final filters shall be 4 or 12 inch high efficiency cartridge filters.)

REMOTE CONTROL PANELS

Remote NEMA 1(12) locking control panel shall be equipped with summer/off/winter switch and blower on, burner on, flame failure and loaded filter lights. (A remote adjustment potentiometer shall control damper positioning.) (An LCD display shall provide system temperature and set points.)

FLUID COILS

Fluid coils are intended for use with water, glycol, or other appropriate heat transfer fluids. Coils are to be designed to maximize performance under specified conditions with minimal air-side pressure drop.
All water coils designed with 1/2” or 5/8” tubes are to be ARI performance certified and shall bear the ARI symbol.
Tubes and return bends shall be constructed from seamless UNS C12200 copper conforming to ASTM B224 and ASTM E527. Properties shall be O50 light annealed with a maximum grain size of 0.040 mm.
Tubes are to mechanically expanded into fins (secondary surface) for maximum heat transfer. Materials are to be 3/8” diameter x (0.014, 0.022) wall thickness, 1/2” diameter x (0.016, 0.025) wall thickness, or 5/8” diameter x (0.020, 0.025, 0.035, 0.049) wall thickness.
Secondary surface (fins) shall be of the plate-fin design using aluminum or copper, with die-formed collars. Fin design to be flat, waffle, or sine-wave in a staggered tube pattern to meet performance requirements.
Collars will hold fin spacing at specified density, and cover the entire tube surface. Aluminum properties are to be Alloy 1100 per ASTM B209, with O (soft) temper; copper is to be Alloy 11000 per ASTM B152-06 with soft (anneal) temper. Fins are to be free of oils and oxidation.

Headers are to be constructed of seamless UNS C12200, Type L (drawn) copper material sized to match specified connection size. Type K (drawn) copper headers and Schedule 40 steel headers shall be offered as optional materials.
Die-formed copper end caps are brazed on the inside of the headers, unless spun-closed (for sizes up to 1-3/8”). 1/4” vents and drains are to be provided for all fluid coils.
Connection material shall be copper, or Schedule 40 steel or red brass pipe. The type of connection is to be sweat type, MPT or FPT, grooved, or flanged as required.
Coil casing material shall be of G90 galvanized steel, 16 gauge minimum. Heavier material, stainless steel, copper, or aluminum casing are to be provided as required.
Intermediate tube supports are to be provided on all coils 48” and longer fin length. Coil casing on top and bottom of coils are to have double-flange construction, allowing for vertical stacking of coils.
All coils are to be brazed with minimum 5% silver content (BCup-3) filler material to insure joint integrity. Low-fuming, flux-coated bronze braze-weld material is to be used for ferrous to non-ferrous joints.
Coils shall be tested at 550 psig using dry nitrogen, submerged under water. Dual-operator verification shall determine that all coils are leak-free.
Fluid coils shall be designed to withstand 300ºF maximum operating fluid temperature, and 250 psig maximum operating pressure.

STEAM COILS

Steam distributing coils (tube-within-a-tube design) should be used for applications where freeze protection is a concern, and entering air temperatures are below 40ºF. Supply steam pressure for steam distributing coils should be a minimum of 5 psig for proper operation and freeze protection.
Modulating control valves should be used with steam distributing coils. Non-distributing type coils should be used only with on-off control valves.
All steam coils are to be ARI performance certified and shall bear the ARI symbol.
Tubes and return bends shall be constructed from seamless UNS C12200 copper conforming to ASTM B224 and ASTM E527. Properties shall be O50 light annealed with a maximum grain size of 0.040 mm.
Tubes are to mechanically expanded into fins (secondary surface) for maximum heat transfer. Minimum wall thickness for steam coils shall be .025 for performance longevity.
Materials are to be 5/8” diameter x (0.025, 0.035, 0.049) wall thickness, or 1” diameter x (0.035, 0.049) wall thickness.
Secondary surface (fins) shall be of the plate-fin design using aluminum or copper, with die-formed collars. Fin design to be flat, waffle, or sine-wave in a staggered tube pattern to meet performance requirements.
Collars will hold fin spacing at specified density, and cover the entire tube surface. Aluminum properties are to be Alloy 1100 per ASTM B209, with O (soft) temper; copper is to be Alloy 11000 per ASTM B152-06 with soft (anneal) temper. Fins are to be free of oils and oxidation.
Headers are to be constructed of seamless UNS C12200, Type L (drawn) copper material sized to match specified connection size. Type K (drawn) copper headers and Schedule 40 steel headers shall be offered as optional materials.
Die-formed copper end caps are brazed on the inside of the headers, unless spun-closed (for sizes up to 1-3/8”).
Steam distributing coils shall utilize a header-within-a-header design to facilitate freeze protection.
Connection material shall be copper, or Schedule 40 steel or red brass pipe. The type of connection is to be sweat type, MPT or FPT, grooved, or flanged as required.

Connections shall be sized to accommodate supply steam and condensate loads. Steam distributing coil connection locations shall be such that steam is distributed adequately among all tubes, and that condensate is removed from all tubes to insure freeze protection.
Coil casing material shall be of G90 galvanized steel, 16 gauge minimum. Heavier material, stainless steel, copper, or aluminum casing are to be provided as required.
All tube sheet holes are to be oversized to allow for free thermal expansion and contraction of tubes during operation. Intermediate tube supports are to be provided on all coils 48" and longer fin length.
Coil casing on top and bottom of coils are to have double-flange construction, allowing for vertical stacking of coils.
All coils are to be brazed with minimum 5% silver content (BCup-3) filler material to insure joint integrity. Low-fume, flux-coated bronze braze-weld material is to be used for ferrous to non-ferrous joints.
Coils shall be tested at 550 psig using dry nitrogen, submerged under water. Dual-operator verification shall determine that all coils are leak-free.
Steam coils shall be designed to withstand 150 psig saturated steam supply pressures with appropriate wall thicknesses.

EVAPORATOR COILS

Evaporator coils are intended for use with a wide range of applications and refrigerant types. Coils are to be designed to maximize performance under specified conditions with minimal air-side pressure drop.
Coils shall be UL recognized as Refrigerant Containing Component. Coils to be used with refrigerant R-410A shall have undergone cycle testing, and shall be safety listed with 750 psig rating.
Tubes and return bends shall be constructed from seamless UNS C12200 copper conforming to ASTM B224 and ASTM E527. Properties shall be O50 light annealed with a maximum grain size of 0.040 mm.
Tubes are to mechanically expanded into fins (secondary surface) for maximum heat transfer. Materials are to be 3/8" diameter x (0.014, 0.022) wall thickness, 1/2" diameter x (0.016, 0.025) wall thickness, or 5/8" diameter x (0.020, 0.025, 0.035, 0.049) wall thickness.
Secondary surface (fins) shall be of the plate-fin design using aluminum or copper, with die-formed collars. Fin design to be flat, waffle, or sine-wave in a staggered tube pattern to meet performance requirements.
Collars will hold fin spacing at specified density, and cover the entire tube surface. Aluminum properties are to be Alloy 1100 per ASTM B209, with O (soft) temper; copper is to be Alloy 11000 per ASTM B152-06 with soft (anneal) temper. Fins are to be free of oils and oxidation.
Headers are to be constructed of seamless UNS C12200, Type L (drawn) copper material sized to match specified connection size. Type K (drawn) copper headers shall be offered as optional material.
Die-formed copper end caps are brazed on the inside of the headers, unless spun-closed (for sized up to 1-3/8").
Evaporator coils shall be designed with brass liquid distributors (as required), and copper sweat suction connections. Distributors shall be capped using soft-solder for ease of cap removal; suction connections shall be capped.
Coil casing material shall be of G90 galvanized steel, 16 gauge minimum. Heavier material, stainless steel, copper, or aluminum casing are to be provided as required.
Intermediate tube supports are to be provided on all coils 48" and longer fin length. Coil casing on top and bottom of coils are to have double-flange construction, allowing for vertical stacking of coils.
All coils are to be brazed with minimum 5% silver content (BCup-3) filler material to insure joint integrity.

Coils shall be tested at 550 psig using dry nitrogen, submerged under water. Dual-operator verification shall determine that all coils are leak-free.
Coils shall be shipped with nitrogen charge to verify leak-free integrity, and to prevent moisture migration into coil.
Coils shall be certified to withstand 750 psig working pressure.

CONDENSER COILS

Condenser coils are intended for use with a wide range of applications and refrigerant types. Coils are to be designed to maximize performance under specified conditions with minimal air-side pressure drop.
Coils shall be UL recognized as Refrigerant Containing Component. Coils to be used with refrigerant R-410A shall have undergone cycle testing, and shall be safety listed with 750 psig rating.
Tubes and return bends shall be constructed from seamless UNS C12200 copper conforming to ASTM B224 and ASTM E527. Properties shall be O50 light annealed with a maximum grain size of 0.040 mm.
Tubes are to mechanically expanded into fins (secondary surface) for maximum heat transfer. Materials are to be 3/8” diameter x (0.014, 0.022) wall thickness, 1/2” diameter x (0.016, 0.025) wall thickness, or 5/8” diameter x (0.020, 0.025, 0.035, 0.049) wall thickness.
Internally enhanced rifled or cross-hatched tubes can be offered as an option.
Secondary surface (fins) shall be of the plate-fin design using aluminum or copper, with die-formed collars. Fin design to be flat, waffle, or sine-wave in a staggered tube pattern to meet performance requirements.
Collars will hold fin spacing at specified density, and cover the entire tube surface. Aluminum properties are to be Alloy 1100 per ASTM B209, with O (soft) temper; copper is to be Alloy 11000 per ASTM B152-06 with soft (anneal) temper. Fins are to be free of oils and oxidation.
Headers are to be constructed of seamless UNS C12200, Type L (drawn) copper material sized to match specified connection size. Type K (drawn) copper headers shall be offered as optional material.
Die-formed copper end caps are brazed on the inside of the headers, unless spun-closed (for sized up to 1-3/8”).
Condenser coils shall be designed with copper sweat connections, and shall be shipped with caps on connections.
Coil casing material shall be of G90 galvanized steel, 16 gauge minimum. Heavier material, stainless steel, copper, or aluminum casing are to be provided as required.
Coils designed for hot-gas applications shall have oversized tube sheet holes for hot gas feeds to allow for free expansion and contraction of tubes during operation.
Intermediate tube supports are to be provided on all coils 48” and longer fin length. Coil casing on top and bottom of coils are to have double-flange construction, allowing for vertical stacking of coils.
All coils are to be brazed with minimum 5% silver content (BCup-3) filler material to insure joint integrity.
Coils shall be tested at 550 psig using dry nitrogen, submerged under water. Dual-operator verification shall determine that all coils are leak-free.
Coils shall be shipped with nitrogen charge to verify leak-free integrity, and to prevent moisture migration into coil.
Coils shall be certified to withstand 750 psig working pressure.

REFRIGERATION COMPRESSORS

Hermetic compressors- Compressors shall be set on resilient neoprene mounts and complete with line voltage break internal overload protection, internal pressure relief valve and crankcase heater. Each unit shall have a minimum of two compressors or single digital scroll compressor. Whereby a unit utilizing two compressors in tandem, the first stage compressor must be a digital scroll operating with a Emerson EC3/EC2 series stand-alone superheat controller with a built in synchronization control for the digital scroll. Unit will provide modulation on cooling. Multiple refrigeration circuits shall be separate from each other. Refrigeration circuits shall be complete with liquid line filter-driers. Service ports fitted with Schraeder fittings and combination sight glass moisture indicators. Units shall incorporate electronic expansion valves and VFD controlled condenser fans operating on a floating head design. Thermostatic expansion valves and hot gas bypass valves will not be accepted. Each system shall be factory run and adjusted prior to shipment. Controls shall include:

- Compressor motor contactors
- Overload protection control
- Cooling relays
- Ambient compressor lockout
- Dual pressure controls
- Anti-cycle timers

Packaged units shall operate down to 50 degrees Fahrenheit as standard. Minus 40 refrigeration systems are available as an option. Compressors shall be located on the side of the unit in a service enclosure complete with hinged access doors.

GIDM/GIDMH TYPE HEAT EXCHANGER & BURNER

The heat exchanger shall be of four pass design with a primary combustion chamber and multi-tube secondary. Internal turbulators or other flue restrictor to boost efficiency are unacceptable. The entire primary heat transfer surface shall be constructed of Type 409 Series stainless steel, and shall be cooled in its entirety by the air to be heated. The secondary heat transfer surface shall also be constructed from Type 409 Series stainless steel. The stainless steel tubes shall be continuously welded into the secondary front and rear header tube sheets to ensure an airtight seal. Mechanically swedging the tubes are unacceptable. All heat transfer surfaces, including headers and the front collector box, shall be inside the casing and in the airstream. The construction of the heat exchanger shall permit free, unrestricted lateral, vertical, and peripheral expansion during the heating and cooling cycle without damage or strain to any part. The heat exchanger shall be designed to prevent contamination of heated air with the product of combustion. A spring loaded pressure relief door with glass view port shall be provided. The entire heater casing shall be lined with a 22 gauge liner.

The heater shall have of a power type 409 stainless steel burner, with integral combustion air blower and motor; combustion air proving switch, removable pilot assembly and positive pilot combustion air supply. The combustion air damper shall be interlocked with the main gas valve to insure a proper air/gas mixture. A solid state programmable safeguard relay with UV Scanner and purge card shall continuously monitor main and pilot flame. The main and pilot valve train to the burner shall be completely factory pre-piped. This assembly shall be wired and include the following minimum components; main and automatic shut off valves and adequate unions and test ports for service. A 6,000 volt transformer shall accomplish ignition of pilot flame. The unit shall be suitable for natural gas and

designed and certified by ETL and C.G.A to provide full gas modulation. Depending on the burner selection, turndown from 100% to 70% of output are achievable.

BMA TYPE BURNER SECTION

Each unit shall be equipped with a wide range fully modulating direct-fired burner capable of 30:1 turndown. The burner shall have stainless steel combustion baffles, non-clogging gas ports, spark-ignition intermittent pilot and flame safeguard system. Burner combustion must be clean and odourless. Combustion efficiency must limit the products of combustion to a maximum of 5 ppm carbon monoxide and 0.5 ppm nitrogen dioxide. The burner profile is to be equipped with adjustable profile plates. A heat-treated glass observation port shall provide a full view of the flame. Hinged access doors are to be provided to allow easy maintenance and inspection for burner, igniter and flame rod.

MTI TYPE FURNACE SECTION

The furnace section shall be positioned downstream of the blower section to ensure it is operating in a positive pressure chamber. The furnace is to be constructed of minimum 16 gauge heavy duty 409 (optional 304) stainless steel tubes. The furnace shall include heavy duty inshot burners.
The furnace section will operate under a negative pressure as induced by the power venter. The power venter will be two speed to provide optimum combustion and efficiency levels on reduced capacities. The power venter shall come standard with a blocked flue switch, and the burner equipped with a flame roll out switch. A modulating electro-mechanical valve will reduce gas flow in response to the signal from the unit mounted PLC. The modulation will allow reduction of capacity down to 1/6 of high fire per furnace.
Indoor units shall be suitable for sidewall venting, and shall come with optional sealed combustion kit.

HTDM TYPE HEAT EXCHANGER

The heat exchanger shall be of two-pass design, made up of at least 16-gauge stainless steel drum and tubes. The primary and secondary heat transfer surfaces shall be constructed of Type 409 series stainless steel, with internal stainless steel high efficiency enhancing baffles. The stainless steel tubes shall be continuously welded into the secondary front and rear header tube sheets to ensure an airtight seal. Units shall be provided with multiple condensate drains. The heat exchanger section shall have an internal radiation shield to maintain a jacket loss of less than 2% of rated output. All heat transfer surfaces, including headers and the front collector box, shall be inside the casing and in the airstream. The construction of the heat exchanger shall permit free, unrestricted lateral, vertical, and peripheral expansion during the heating and cooling cycle without damage or strain to any part. The burner shall be constructed with at least 14-gauge stainless steel and with the air baffles being made up of 430 stainless steel to ensure high durability and life of the burner. The burner assembly shall be a blow through positive pressure type with an intermittent pilot ignition system. Flame supervision shall be with a solid state programmed flame relay complete with flame rod. The unit's burner motor and modulating gas valve must be electronically controlled to guarantee, to the customer, a highly efficient unit at all times and applications. The unit efficiency shall be a minimum of 80% through the entire operating range and shall be independently tested and verified by ETL. The main and pilot manifolds shall be completely factory pre-piped to the burner. This assembly shall be wired and include the following minimum components; main and pilot manual shut-off valves, main and pilot regulators, main and pilot automatic

shut off valves and adequate unions and test ports for unconstrained service. There must also be a means of collecting and disposal of condensate formed in the flue gas by means of a 409 stainless steel flue box with drain and heat exchanger drains. Drains shall be made of copper (stainless steel) tubing.

HEAT WHEEL

The energy recovery enthalpy wheel shall be ARI certified and carry the official ARI certification stamp. The wheel shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to the delamination or erosion of the desiccant material. Media shall be synthetic to provide corrosion resistance and resistance against attacks from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Coated aluminum is not acceptable. Face flatness of the wheel shall be maximized (+/- 0.032 in) in order to minimize wear on inner seal surfaces and to minimize cross leakage. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by airflow are unacceptable due to the possibility of channeling and performance degradation. The media shall be in accordance with NFPA or UL guidelines. The minimum acceptable performance shall be as specified in the drawing/submittals. The desiccant material shall be a 4A molecular sieve to minimize cross contamination. Silica gel and other pore size desiccants are not acceptable due to the possibility of cross contamination introduced by desiccant adsorption. The wheel frames shall consist of evenly spaced galvanized steel spokes, galvanized steel outer band and rigid center hub. The wheel shall allow for post fabrication wheel alignment. The wheel seals shall be a neoprene bulb seals or equivalent. Seals should be easily adjustable. Cassettes shall be fabricated of heavy duty reinforced galvanized steel. Cassettes shall have a built in adjustable purge section minimizing cross contamination of supply air. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged bearings. Drive systems shall consist of fractional horsepower AC drive motors with multi-link drive belts.

HUMIDIFIER

The tank and cover shall be 14-gauge stainless steel with Heli-arc welded seams. The burner assembly shall be AGA/CGA certified and tested. The humidifier shall be capable of modulating down to 10% of the maximum steam capacity. The gas train assembly complete with burner/mixing tube assembly, igniter, sight glass, flame rod electrode, gas manifold and gas valve. The heat exchanger shall be tubular stainless steel connected to a stainless steel flue box. The humidifier shall be capable of supporting tap, softened or DI/RO water. The unit shall contain the following features: water make-up valve control, auto drain/flush, end-of-season flush, low water cutoff, modulating steam control, aquastat freeze protection, surface skimmer, support legs, factory insulation, blocked flue safety, service access port and removable cleanout tray. A microprocessor-based controller shall be provided and be capable of both on/off and fully modulating (0-100%) control of humidifier outputs as well as control of all fill and drain functions. A keypad capable of either unit or remote mounting shall be provided as the controller. The keypad shall be capable of monitoring and/or controlling the following parameters: relative humidity set-point and actual space conditions, relative humidity set-point and actual duct conditions for variable air volume applications, relative humidity high limit set-point and actual conditions, total system demand in % of total humidifier capacity, total system output in lb./hr, auto drain/flush frequency

interval and duration, end-of-season drain status and system fault indicator. The unit shall be supplied with a stainless steel dispersion assembly complete with calibrated orifice tubelets. Provided assembly for connection between humidifier and dispersion tube assembly.

HEAT PIPE COIL

Heat pipes shall be constructed of 1" I.D. seamless, integrally finned aluminum tubing. Heat pipes shall be arranged in the heat pipe coil with a maximum of 2-1/8" on center on the face and 1-7/8" on center row to row. Heat pipe fin surface shall be integral to the heat pipe container wall and shall have a minimum of 0.017" mean fin thickness. Fins shall be tapered root to fin tip. Fin surface from the root to the fin tip shall have a minimum of 0.437" mean fin height. Heat pipes shall have a capillary wick structure integral to the heat pipe container wall. Heat pipes shall be of one piece construction. Two component heat pipes such as expanded tube to fin shall not be allowed. Heat pipe working fluids shall be R-134a or be selected on the basis of heat pipe operating temperature and compatibility with heat pipe container material. Heat pipe shall be individually processed, charged, hermetically sealed and factory tested. Heat pipe coils structural frame shall be fabricated from a minimum of 16 gauge galvanized steel. The heat pipe coil shall be supplied with a minimum of 2-inch wide flanges on all four sides both front and back. Intermediate supports shall be furnished as required. Heat pipe coils shall be provided with a partition to isolate the airstreams and prevent cross contamination. The partition shall be at the centre unless otherwise specified. The partition shall be fabricated from a minimum of 16 gauge galvanized steel and shall extend beyond the finned surface with 4-inch flanges. Both front and back are to be flush with the frame. End covers shall be provided to protect the heat pipe ends. End covers shall be fabricated from a minimum of 16 gauge galvanized steel. Additional specifications for other configurations available upon request.

Copeland Scroll Digital™ Compressors

High Efficiency Scrolls

Modulated Refrigeration Applications

Advantages of Copeland Scroll Digital™ Compressors

- Simple, Variable Modulation for Precise Temperature Control
- Highly Flexible Load Matching, from 10-100%
- Less Costly and More Reliable than Variable Speed
- Simple Control Methods
- Significantly Improved Efficiency Vs. Hot Gas Bypass and Other Methods of Modulation
- Linear Power Reduction Relative to Modulated Capacity
- Based Upon Field-Proven Copeland Scroll® Design

Copeland Scroll Digital Compressor Benefits

- Improved Load Matching Capability
- Reduced Compressor Cycling
- Reduced Power and Energy Consumption
- Decreased Electrical Load at Startup
- Can Be Applied to Multiple Evaporator Systems
- Efficient Modulation of Copeland Scrolls for High, Medium & Low Temperature Applications
- Low Temperature Model Equipped with Vapor Injection

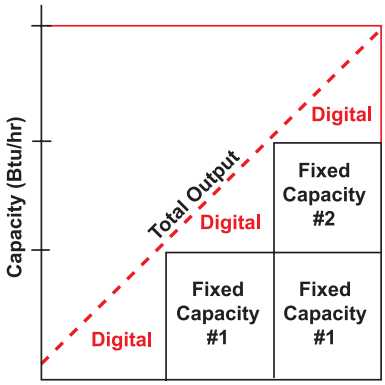
As the longtime leader in refrigeration compressor solutions, Emerson Climate Technologies, Inc. offers Copeland Scroll compressors with digital technology - an extraordinary new way to precisely match capacity and power consumption to the desired load of your food storage equipment.

Digital technology takes the proven Copeland Scroll compressor design one step further. For 15 years, the patented axial and radial compliance of the Copeland Scroll compressor have provided a decisive reliability advantage by allowing the scroll elements to mechanically separate under the most extreme circumstances.

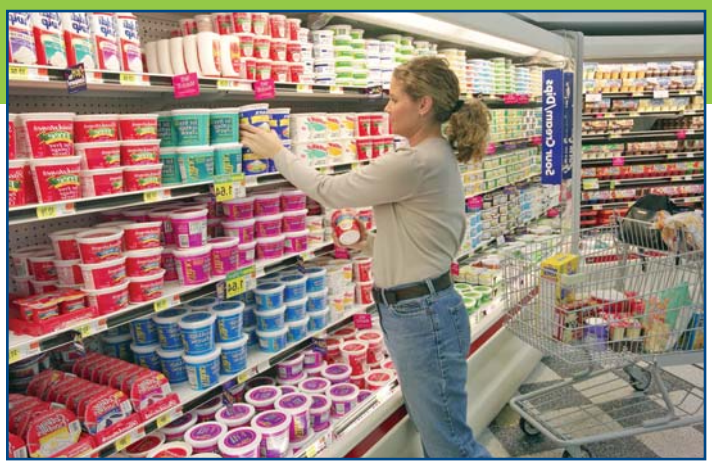
Now, digital technology actively manages axial compliance, achieving continuous capacity modulation from 10% to 100%. The result is precision temperature control, reduced compressor cycling, and lower energy consumption. For our customers, this means:

- Enhanced product integrity
- Longer lasting refrigeration equipment
- Lower energy bills

Digital Scroll™ compressors can be used as the lead compressor and paired with fixed capacity scrolls on a parallel rack, as shown below, to provide superior load matching and reduce compressor cycling.



EMERSON
Climate Technologies



A Superior Solution for Food Safety

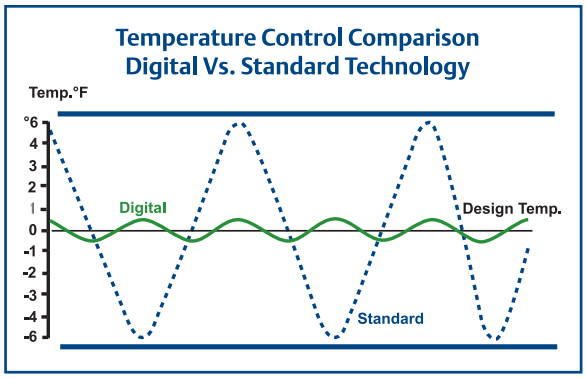
When we say "...precision temperature control...", we mean maintaining box temperatures within +/- 0.5 degrees F (see **Chart A**). This provides supermarkets and food service establishments with the security of knowing that their food is safe from harmful bacteria growth and other harmful micro-organisms.

A Superior Solution for Energy Savings

Traditional modulation technologies consume close to full-load energy no matter what the required capacity. Digital Scroll compressor technology reduces power consumption linearly as it modulates capacity resulting in optimum system performance and control, as shown in **Chart A**.

With our simple electronic controller, digital can be integrated into your store network enabling web-based communications and remote monitoring.

Chart A



Copeland Scroll Digital Model Summary

Model	Displacement (CFH)	Capacity (Btu/hr)	EER (Btu/w-hr)	Length (in)	Width (in)	Height (in)	Weight (lbs)
Medium Temp		@ 20/120					
ZBD30KCE	498	30,500	7.4	9.48	9.7	19.46	81
ZBD45KCE	727	44,300	7.0	9.48	9.7	19.46	88
Low Temp		@ -25/105					
ZFD18KVE	727	29,200	5.9	11.83	11.79	19.46	95

Capacity with R404A, 65°F Return Gas, 0°F Subcooling.

Copeland Scroll has set the standard for reliability and performance for more than 15 years. And today, it's just one more proven innovation from Emerson Climate Technologies, Inc. Visit emersonclimatecustomer.com or refer to AE21-1319 to learn more about Emerson's refrigeration solutions for system manufacturers.

2006ECT-171 (3/07)

EMERSON™
Climate Technologies

EMERSON. CONSIDER IT SOLVED.™

Honeywell

T775 Series 2000 Electronic Stand-Alone Controllers

SPECIFICATION DATA

DESCRIPTION

The T775 electronic stand-alone controllers are the next generation of commercial and agricultural controls capable of remote sensing of temperature and providing switched and/or proportional outputs to various types of loads.

IMPORTANT

The T775 is an operating control, not a limit or safety control. If used in applications requiring safety or limit controls, a separate safety or limit control device is required.

FEATURES

- **Easy-To-Use Graphical Interface** Operating the new T775 is easy and the intuitive programming will save you time on every job. Each model includes a keypad lockout.
- **NEMA 4X Enclosure Option** Certain models are offered with NEMA 4X enclosures to protect them from water and corrosion for installations like washdown areas, animal confinement areas, swimming pools and other similar locations.
- **Internal Time Clock Scheduler** The Setback and Disable Output options, controlled by the built-in scheduler or digital input, will help save energy during unoccupied times and give you more control of the equipment without needing to purchase an additional time clock. Run times can be displayed for the first 4 relay outputs.
- **Up To Two Independent Modulating Outputs** Each output can be individually configured for 0-10 Vdc, 2-10 Vdc, 4-20 mA or Series 90.
- **Modulating High Or Low Limit Control** To protect your equipment from freezing or overheating, models offering this feature give you the ability to adjust your control temperature at Sensor A to protect equipment at Sensor B. The control adjusts its modulating output to prevent exceeding the user-entered High or Low limit for Sensor B.
- **Optional Configurable Integral And Derivative Times** Standard on every device, this feature delivers pinpoint (PI or PID) control on modulating outputs set up by default to behave just like the previous T775 Series 1000, but now you can adjust reaction times and behavior, giving you more control. Anti-integral wind-up is standard.
- **Reset Models With Simplified Setup** Reset programming is easy. Simply enter the high and low control temperatures and the corresponding high and low outdoor temperatures. As your outside temperature gets colder, the setpoint temperature automatically adjusts to save energy.
- **Configurable Minimum Off Time** If needed, setting a minimum off time can protect equipment and reduce the need for a separate time delay device.
- **Sensor Calibration** Calibrate input sensors up to +/-10° F (+/-6° C) for temperature and up to +/-10% of range for other sensors (e.g. pressure, humidity) to compensate for resistance drops in longer sensor wire runs.
- **Special Models** Five T775 models are available for special applications:
  - **Universal Models (T775U2006 and T775U2016)** to control pressure, humidity, or any medium with an analog input
  - **Special Boiler Model (T775P)** for boiler control
  - **Special Staged Sequencing Model (T775L)** for sequence staging of relays with one or two setpoints
  - **Special Expansion Model (T775S)** for staging up to 12 relays with two setpoints

E4436

63-1318-03

SPECIFICATIONS

Power: 24, 120, or 240 Vac; 50/60 Hz
A separate earth ground is required for any power source.

Power Consumption:
- 8 VA maximum at 60 Hz
- 10 VA maximum at 50 Hz

Operating & Storage Temperature Ambient Rating:
- -40°F to 125°F (-40°C to 52°C) @ 50 Hz
- -40°F to 140°F (-40°C to 60°C) @ 60 Hz

Relative Humidity: 5% to 95% non-condensing

Dimensions: refer to Fig. 1 on page 4.
All T775 controllers are field-mountable in any orientation to either a panel or wall.

Digital Input (DI): 18 Vdc and 3.5 mA (for choosing external contact)

Digital Output (DO) Alarm (T775P only):
- Alternating Current (AC):
  — 30 Vac RMS; 1.5 A steady 3 A inrush P.F. 0.45 NC
  — 20 Vac RMS; 100 mA minimum load on NO and NC contacts
- Direct Current (DC): 1 mA at 100 mV DC minimum load

NOTE: In applications requiring a gold contact signal relay, an external signal relay or additional load resistor may be needed for the digital output.

Relay Contact Output Ratings (N.O. and N.C.):
- 1/2 hp; 9.8 AFL, 58.8 ALR @ 120 Vac
- 1/2 hp; 4.9 AFL, 29.4 ALR @ 240 Vac
- 125 VA pilot duty @ 120/240 Vac
- 10A @ 24 Vac (resistive)

Modulating Outputs:
- 0-10 Vdc; drive a minimum of 2,000 Ohms
- 2-10 Vdc; drive a minimum of 2,000 Ohms
- 4-20 mA; drive a maximum of 600 Ohms
- Electronic Series 90; requires 340 Ohm resistor (included) across terminals R and W
- Floating

Sensed Temperature Limits (displayed):
- Minimum -60°F (-51°C)
- Maximum 270°F (132°C)

High Setpoint Limit: An irreversible high limit setpoint can be configured to meet local code requirements.

Sensed Temperature Accuracy:
- T775: 1°F/C @ ambient room temperature of 77°F (25°C)
- 50021579-001 and T775-SENS-WR: ±0.42°F from -22°F to 248°F (+/-.24°C from -30°C to 120°C)

Setpoint Range: -40°F to 248°F (-40°C to 120°C)

Time Clock: Two settable time periods per day are standard on all models.

Volatile Memory: The date and time settings are retained for 24 hours after a power outage. After a power loss of more than 24 hours, the date and time settings may need to be reentered. All other settings are stored permanently.

Approvals: UL 60730-1 for US and Canada, CuL, CE, C-tick

COMPATIBLE COMPONENTS

Temperature Sensors[a]

The controller accepts 1,097 Ohms PTC at 77°F (25°C):
- 50021579-001 – Standard sensor (included with all models except NEMA 4X models)
- T775-SENS-STRAP – Strap on sensor with wiring box
- T775-SENS-WR – Water resistant with 5 foot leads (included with NEMA 4X models)
- T775-SENS-WT – Watertight with 6 foot lead
- T775-SENS-OAT – Outdoor air temperature sensor
- C7031D2003 – 5 inch immersion sensor with wiring box (use immersion well; P/N 50001774-001)
- C7031J2009 – 12 foot duct averaging sensor with wiring box
- C7046D1008 – 8 inch duct probe with mounting flange
- C7100D1001 – 12 inch fast response, duct averaging sensor with flange
- C7130B1009 – Room mount sensor

Humidity Sensors (T775U only)

The controller accepts 0-10 Vdc or 4-20 mA input with a range of 0-100%

H7625, H7635, and H7655 models (available in 2, 3, and 5% RH accuracy) can be used.

Differential Pressure Sensors (T775U only)

P7640A and PWT pressure transducer models with selectable pressure ranges can be used.

The controller accepts pressure sensors with a signal output of 0-10 Vdc or 4-20 mA for any output range within the following ranges (the minimum and maximum for the sensor output range can be adjusted within the following limits):
- -500 to 500 PSI
- -30.0 to 30.0 inches w.c.
- -3,000 to 3,000 Pa
- -3,000 to 3,000 kPa

Universal Sensors (T775U only)

The controller accepts 0-5 Vdc, 0-10 Vdc or 4-20 mA input for temperature, pressure, humidity, etc. They may be programmed in units of °F, °C, %, Pa, kPa, PSI, Inches W.C., PPM, or None (no units). CO_2 sensors (C7232 and C7632) are also compatible.

Actuators

For more information on compatible actuators or other Honeywell products, such as dampers and valves, go to www.customer.honeywell.com. From the home page select **Product Selection Tool** under **Products**.
- Spring return models: ML6425, ML7425, MS4105, MS4110, MS4120, MS7505, MS7510, MS7520, MS8105, MS8110, MS8120
- Non-spring return models: ML6161, ML6174, ML7161, ML7174, MN6105, MN6110, MN7505, MN7510

Accessories

- 107324A – Bulb Holder, duct insertion
- 107408 – Heat Conductive Compound, 4 ounce
- 50001774-001 – Immersion Well, stainless steel 304, 1/2 in. threading

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[a] See form 62-0265 – *Temperature Sensors for the T775 Series 2000 Stand-alone Controller*

Table 1. T775 Controller Configurations.

Controller Model [a]	Description	Replaces	Output Reset	SPDT Relay Outputs	Analog (Mod) Outputs[b]	DO[c]	Floating Outputs[d]	Sensor Inputs	Nbr of Sensors Included	Staged Loop Control	Addable T775S	Enclo-sure
T775 A/B/M/R Controller Configurations												
T775A2009	Standard	T775A1001	No	1	None	N/A	None	1	1	N/A	N/A	NEMA 1
T775B2016	Standard	N/A	No	2	None	N/A	1	2	1	N/A	N/A	NEMA 4X
T775B2024	Standard	T775C1009 T775D1008	No	4	None	N/A	2	2	1	N/A	N/A	NEMA 4X
T775B2032	Standard	T775A1019 T775B1000	No	2	None	N/A	1	2	1	N/A	N/A	NEMA 1
T775B2040	Standard	T775A1027 T775A1035 T775B1018 T775B1026 T775B1042	No	4	None	N/A	2	2	1	N/A	N/A	NEMA 1
T775M2006	Modulating	N/A	No	None	2	N/A	None	2	1	N/A	N/A	NEMA 1
T775M2014	Modulating	T775G1005 T775G1013 T775G1021 T775G1039	No	4	2	N/A	None	2 [e]	1	N/A	N/A	NEMA 4X
T775M2022	Modulating	N/A	No	2	2	N/A	None	2 [e]	1	N/A	N/A	NEMA 4X
T775M2030	Modulating	T775E1114 T775F1022 T775F1055 T775F1089	No	4	2	N/A	None	2 [e]	1	N/A	N/A	NEMA 1
T775M2048	Modulating	T775E1015 T775E1023 T775E1056 T775E1064 T775E1098	No	2	2	N/A	None	2 [e]	1	N/A	N/A	NEMA 1
T775R2001	Reset Option	N/A	Yes	4	None	N/A	2	2	2	N/A	N/A	NEMA 1
T775R2019	Reset Option	N/A	Yes	4	2	N/A	None	2	2	N/A	N/A	NEMA 1
T775R2027	Reset Option	T775J1043 T775J1050 T775J1068	Yes	2	2	N/A	None	2	2	N/A	N/A	NEMA 1
T775R2035	Reset Option	T775J1001 T775J1076	Yes	2	None	N/A	1	2	2	N/A	N/A	NEMA 1
T775R2043	Reset Option	T775J1019 T775J1027 T775J1035	Yes	None	2	N/A	None	2 [e]	2	N/A	N/A	NEMA 1
T775 L/P/U/S Special Application Controller Configurations												
T775L2007 [f]	Stage Sequencer with Reset	N/A	Yes	4 [g]	None	N/A	None	2	1	Yes	Yes	NEMA 1
T775P2003	Boiler Model with Reset [h]	N/A	Yes	4	None	1	None	3	3	Yes	Yes	NEMA 1
T775U2006	Universal Humidity, Pressure, Temperature, etc.	H775A1006 H775A1022 H775A1048 H775A1063 H775B1005 H775C1004 H775D1003 H775E1002	Yes	2	2	N/A	None	2 [i]	None	N/A	N/A	NEMA 1
T775U2016		N/A	Yes	2	2	N/A	None	2 [j]	None	N/A	N/A	NEMA 1
T775S2008	4-Relay Expan-sion Module [k]	N/A	N/A	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NEMA 1

[a] All models include a digital input for use with the disable or setback option.

[b] The modulating (analog) outputs are 4-20 mA, 0-10 Vdc, 2-10 Vdc, or Series 90 selectable.

[c] Digital Output alarm (low voltage) available only on the T775P model. The Digital Output alarm can be configured based on minimum, maximum, or differential temperature.

[d] Each floating output eliminates two SPDT relays.

[e] For the models noted above, Sensor B can support a high/low modulating limit for temperature control at Sensor A.

[f] The T775L model can be used to stage multiple relays from two independent heat or cool setpoints. The number of stages for each setpoint can be freely chosen, limited by the number of relays available (up to 12 using two T775S expansion modules). For example, programming could be (3 heat - 4 cool), (5 heat - 1 cool), etc. In addition to the two staged loops, an additional two relays can be available for independent on-off control.

[g] For the T775L model, the maximum number of non-sequenced relays is two (2) with each having its own setpoint and its own throttling range. These relays are available if they are not being used by the staged relay loops.

[h] The T775P model provides an optional Pump Output using the last SPDT relay output (4th, 8th, or 12th depending on configuration). Stages can be configured for either standard, first-on first-off, or equal run time.

[i] For the T775U2006 sensor inputs, Sensor A can be 0-5 Vdc, 0-10 Vdc, 4-20 mA, or a standard temperature input. Sensor B is a standard temperature sensor input only. Sensor B is used only for reset on the T775U2006.

j The T775U2016 can control Sensor A (universal) and Sensor B (temperature) independently, like other standard T775 controllers.

k Up to two T775S expansion modules can be used with the T775L and T775P models to provide a total of 8 or 12 stages.

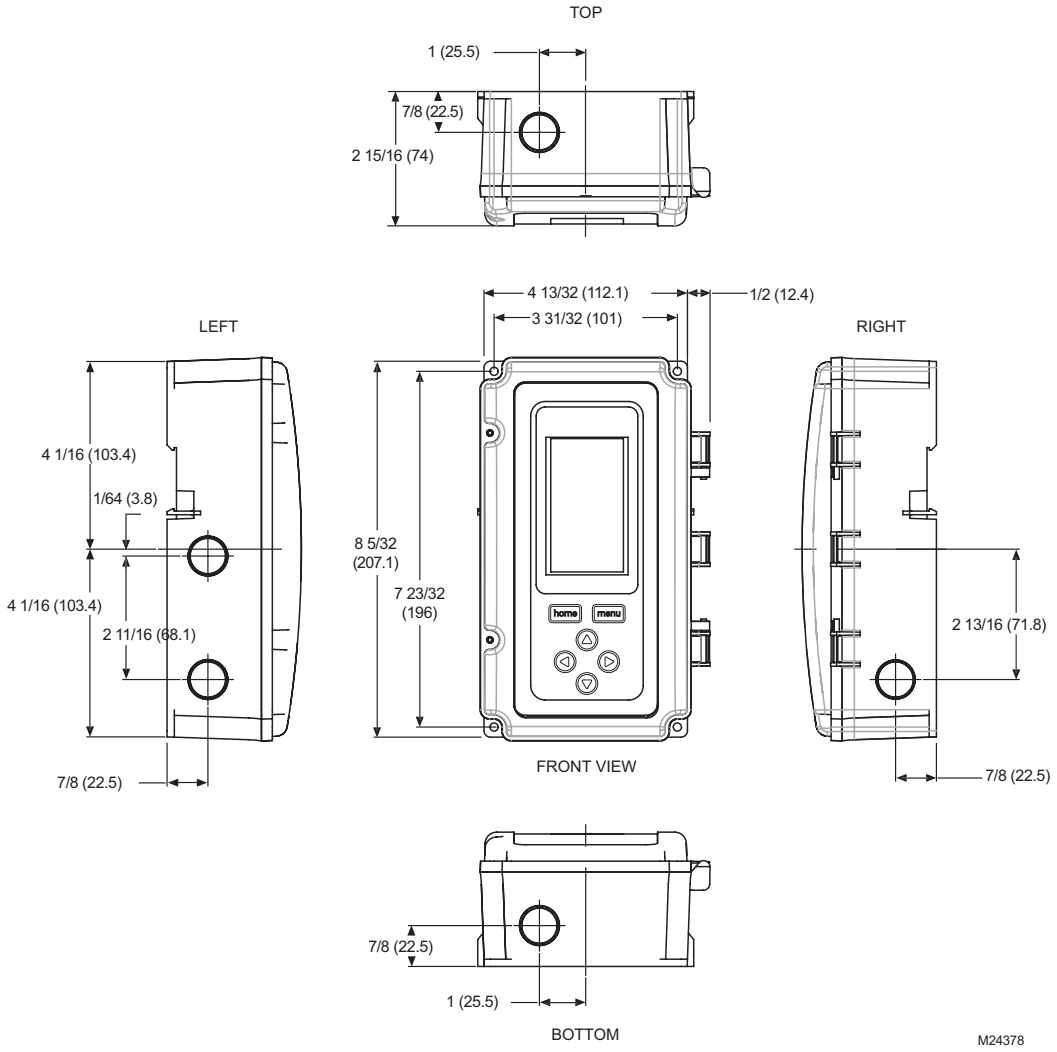

Fig. 1. T775 Dimensions in inches (mm).

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
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Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
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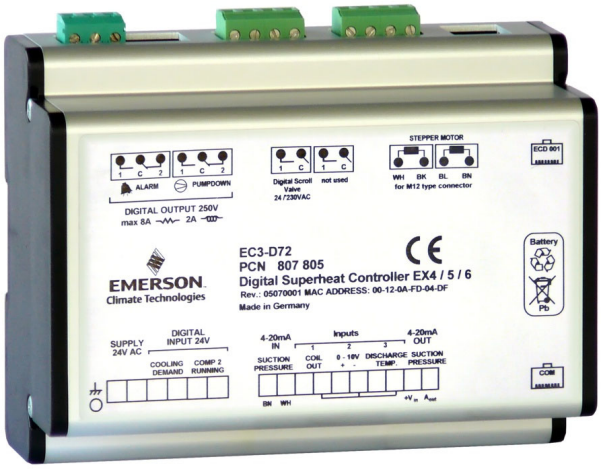
Honeywell

63-1318—03 M.S. Rev. 02-09

EC3-D72 / EC3-D73
Superheat & Digital Scroll Controller
Technical Data

The **EC3-D7x series** is a **stand-alone** universal **superheat controller with a built-in synchronization control for the Copeland Digital Scroll**. It is suitable for air conditioning, refrigeration and industrial applications such as chillers, industrial process cooling, rooftops, heat pumps, package unit, close control, cold room, food process and air driers. The EC3-D72 offers remote access with built-in TCP/IP Ethernet communications and WebServer functionality. Any standard Webbrowser (e.g.Microsoft Internet Explorer® 5.0 or higher or Mozilla Firefox) can be used for monitoring or parameter setting. The EC3-D73 is exactly the same in its functionality but has no external communications. It is only possible to program the parameters using the optional ECD-002 display unit.



EC3-D72/D73

Features EC3-D72

- Superheat control in conjunction with Alco Controls stepper motor driven Electrical Control Valves (EX4..EX6)
- Synchronization of the PWM solenoid valve used for variable capacity control of the Copeland Scroll Digital
- Limitation of evaporating pressure (MOP)
- Low and high superheat alarm
- Low pressure switch function/alarm
- Freeze protection function/alarm
- Pump down function
- Feed through of 4…20mA signal from the evaporator pressure sensor to analogue output. This may also be connected to pressure input of any other controller to avoid need for multiple pressure sensors.
- Monitoring of sensors and sensor wiring and detection of sensor and wiring failures
- Intelligent alarm management in order to protect the compressor i.e. fail safe operation
- Integral rechargeable battery to close the Electrical Control Valve in case of power loss
- Support of TCP/IP Ethernet technology with WebServer functionality allows monitoring and configuration of controllers through a standard WebBrowser (e.g. Internet Explorer® or Mozilla Firefox)
- Multiple language support
- Electrical connection via plug-in type screw terminal
- Aluminum housing for DIN rail mounting

Typical ordering package: refer to page 7 for details

Description	Type	PCN
Digital Superheat Controller with TCP/IP communication	EC3-D72	807 805
Terminal kit	K03-331	807 648
Temperature sensor	ECN-N60	804 497
Electrical Control Valve	EX4, EX5, EX6	*
Pressure sensor		
- for R22/R124/R134a/R404A/R407C/R507C	PT4-07M	802 332
- for R410A & intermediate pressure applications	PT4-18M	802 333
Plug and cable assembly for pressure sensor	PT4-M60	804 805

*For further details refer to: EX4, EX5, EX6 Electrical Control Valves datasheet EX48_35008.pdf

EC3-D72 / EC3-D73
Superheat & Digital Scroll Controller

EMERSON Climate Technologies

Application

The EC3-D7x series can be applied into a number of different superheat applications in conjunction with either a single Copeland Digital Scroll or a tamdem unit consisting of one fixed and one Copeland Digital Scroll:

- Superheat control of conventional evaporators such as shell and tube, plate heat exchanger, air coil etc.
- Superheat control of sub-coolers or economizers connected to suction pressure of compressor or intermediate pressure

Description of performance

EC3-D7x series controls the opening of electrical control valve according to desired superheat. As the Emerson Electrical Control Valves (ECV) are able to provide a better positive shut-off function than conventional solenoid valves, there will be no flow through Emerson ECV when the compressor(s) are not running. In the event of a cooling demand request from a third party controller and the Copeland Digital Scroll compressor starts-up, the EC3-D7x needs to be informed through a digital cooling demand input. In addition, upon receiving a capacity demand signal through the 0-10V input, the Digital Scroll will initially run at minimum capacity and will subsequently start to vary the capacity of the compressor. The EC3-D7x will start to control the refrigerant mass flow by precise positioning of the ECV under different operating conditions such as compressor start-up, start of second compressor, high head pressure, low head pressure, high load, low load and partial load operation.

EC3-D7x is capable of alarm handling and diagnostics. The alarm can be received via relay output, via TCP/IP network as well as optical LED/alarm code on ECD-002.

Algorithm

The superheat control algorithm is self-adapting so that it automatically adjusts itself to the characteristics of the evaporator at regular intervals. This guarantees optimal superheat control performance for different types of evaporators and even when the operating conditions of the evaporator change over time.

Superheat Control function

By receiving two measured values from Emerson pressure sensor PT4 and temperature sensor ECN-N60, the EC3-D7x calculates the actual superheat and compares to preset superheat. The EC3-D7x operates the Electrical Control Valve in order to keep superheat at desired setpoint under various operating conditions.

The superheat set point is adjustable in the range between 3K and 30K. If low superheat alarm function is disabled, it is possible to adjust the superheat set point below 3K down to 0.5K for special applications such as flooded evaporators.

MOP function

To avoid overload of the compressor motor, the MOP function of the EC3-D7x limits the evaporating pressure to a pre-determined value, which can be adjusted to match the safe operating envelope of the compressor. MOP setpoints are entered as saturation temperature values to match published safe operating data of compressor manufacturer and to avoid unnecessary manual conversions from temperature into pressure values. The MOP function may be totally disabled, when not needed.

Low superheat alarm

Liquid flooding may lead to serious damage of compressors and must be avoided. The built-in low superheat alarm function of the EC3-D7x detects low superheat conditions and deactivates the alarm relay. If the alarm relay is wired into the serial safety loop of the system controller, the compressor will be switched off when a low superheat alarm occurs and the ECV will close.

High superheat alarm

If this function is enabled, it detects longer lasting high superheat conditions (adjustable) and triggers the high superheat alarm and the ECV will close.

Digital input status (factory setting)

The digital input is the interface between EC3-D7x and system controller. The digital status is dependant on the operation of system's compressor/thermostat. The Copeland Digital Scroll should always be regarded as the base load; compressor 1.

System Operating condition	Digital Inputs	0-10V input from third party controller
Comp. 1 & Comp.2 in stop mode	"Cooling demand" open (0V) "Comp 2 Running" open (0V)	ECV remains closed irrespective of voltage input value
Comp. 1 in run & Comp.2 in stop mode)	"Cooling demand" closed (24V) / "Comp 2 Running" open (0V)	ECV active Input =0V: digital valve capacity at 10% default capacity. When the digital comp. is in by-pass the ECV will: Close when capacity is <70% Be inhibited when the capacity is >70%
Comp 1 & Comp. 2 in run mode	"Cooling demand" closed (24V) / "Comp 2 Running" closed (24V)	ECV active The ECV will always modulate even when the digital compressor is in by-pass mode.
Comp.1 in stop and Comp. 2 in run mode starts	"Cooling demand" open (0V) / "Comp 2 Running" closed (24V)	ECV remains closed irrespective of voltage input value

Shut-off function

When the cooling demand digital input is open (0V), the EC3-D7x will drive the electrical control valve to closed position. Due to the positive shut-off capabilities of the EX4/5/6 valves a separate liquid line solenoid valve is not required. The shut-off function is guaranteed in case of power loss due to built-in internal battery.

⚠ If this function is disabled, the user must ensure appropriate safety precautions are in place to protect the system against damage caused by a power failure. Refer to operating instructions

Analogue output (4-20mA signal) function

EC3-D72 requires the outlet pressure level of evaporator for superheat and MOP control. The output signal from the PT4 is used by EC3-D7x and again provided as 4 to 20mA signal (galvanized) for connection to any other third party controller, which can receive a 4 to 20 mA signal. Please see the wiring diagram for more details. If system controller does not have capability of using this signal, the terminal will not be wired to any other device.

Pump-down function

When the pump-down function is active, the electrical control valve will close in event of no demand i.e. the digital input is 0V (open), but the Digital Scroll compressor will keep running to perform a pump down of the refrigeration system until the pump-down threshold pressure (adjustable) is reached. If after a time delay (adjustable) the pump-down setpoint is not reached, the output pump-down relay trips to stop the compressor and an alarm is indicated. This relay must be wired into the Digital Scroll compressor control wiring.

Low pressure switch function/alarm

The use of low-pressure switch is very common for preventing of compressor running in event of refrigerant charge loss and alarming. When the low pressure function is active, a software routine detects excessively low pressure level (adjustable) and after a time delay (adjustable) output alarm relay trips and the ECV will close.

Freeze protection function/alarm

This feature permits the elimination of a separate freeze protection thermostat in a water chiller application. When the freeze protection function is activated, the evaporating temperature is constantly monitored and if it drops below the freeze protection threshold, the freeze protection alarm triggers the alarm relay and the ECV will close.

Safety / internal battery function

In event of power failure to the entire system, the stepper motor driven valve would not be able to move. Due to the differential pressure between condenser and evaporator, the refrigerant could continue to flow through the valve if the valve is open. The compressor must be protected after power recovery against wet running. EC3-X32 contains an internal rechargeable battery and smart battery charge control to automatically close the valve in case of power failure. Whilst the battery is maintenance free, the life expectancy will depend upon the working ambient; as the temperature increases the life expectancy reduces.

It is recommended to replace the battery annually to maintain the system in optimum operating condition.

⚠ If the output relays are not utilized, the user must ensure appropriate safety precautions are in place to protect the system against damage caused by a power failure

Alarm and maintenance functions

EC3-D7x provides several alarms to facilitate diagnosis as well as shut down of compressor/system if alarm relay is wired into the serial safety loop. Built-in diagnostics routines constantly monitor the battery health, sensors, the Electrical Control Valve and the associated wiring for open and short circuits. When such errors are detected, the controller goes into an alarm condition and closes the valve.

Additional to hardware errors also EC3-D7x will monitor the minimum operating superheat. If the superheat drops below 0.5K for continuous period of one minute, the low superheat alarm will occur. The low superheat alarm can be disabled for applications such as flooded evaporator, which lower operating superheat is required.

There are several other alarms such as low pressure alarm, freeze protection alarm and high superheat alarm if they are enabled.

In case of alarm, EC3-D7x will close the valve and the alarm relay will be deactivated. All alarms are automatically cleared after correction. Battery alarm, low superheat alarm, freeze protection alarm and low pressure alarm can be modified for manual reset.

Alarm relay function (factory setting)

Alarm relay contains a SPDT contact. If the relay is wired to system controller, it is possible to stop compressor/system. The alarm relay is activated during normal operation and deactivated during alarm conditions as well as supply power interruption.

Start-up configuration function

Built-in valve opening (%) at start-up for certain period of time helps the compressor's start-up and prevents erratic low pressure cut-out for the following cases:

- Operation of systems with air cooled condenser in low ambient temperatures
- Compressor start-up after long period standby time in low ambient environment
- Start-up of very large single stage compressor capacity

Emerson Pressure Sensor PT4 function

The pressure sensor measures the saturation pressure at the outlet of the evaporator. The output signal is 4 to 20 mA corresponding to a pressure range. Based on type of refrigerant and system, different types of pressure sensor are needed.

- PT4-07M for evaporators operating with R22/R124/R134a/R404A/R407C refrigerants
- PT4-18M for evaporators operating with R410A refrigerant
- PT4-30M for evaporators operating with R744

Every type of pressure sensor is calibrated in temperature range for the above specified applications. The feature set and performance of the PT4 Series is a perfect match for the EC3-D7x. Other pressure sensors are not released for use with EC3-D7x and when applied, may lead to poor performance.

Emerson temperature sensor ECN-N60 function

The temperature sensor measures the refrigerant temperature at the outlet of the evaporator. It is important to use only this dedicated temperature sensor because the ECN-N60 has the right performance such as desired time constant and tolerance compensation within the specific working range. The use of other temperature sensors is not recommended/released. The sensor is hermetically sealed for high reliability and long life. The sensor has metal housings for optimal thermal conductivity.

Setting and visualising Data via WebPages

The EC3-D72 has a TCP/IP Ethernet communication interface enabling the controller to be directly connected to a network or a PC via the standard Ethernet port. The EC3-D72 controller has embedded WebPages to enable the user to visualise the parameter lists using real text labels.

To view WebPages on the PC, a standard WebBrowser like Internet Explorer® or Mozilla Firefox and JRE Java Runtime Environment is needed. JRE can be downloaded at no charge from the Emerson website; www.emersonclimate.eu

List of adjustable parameters

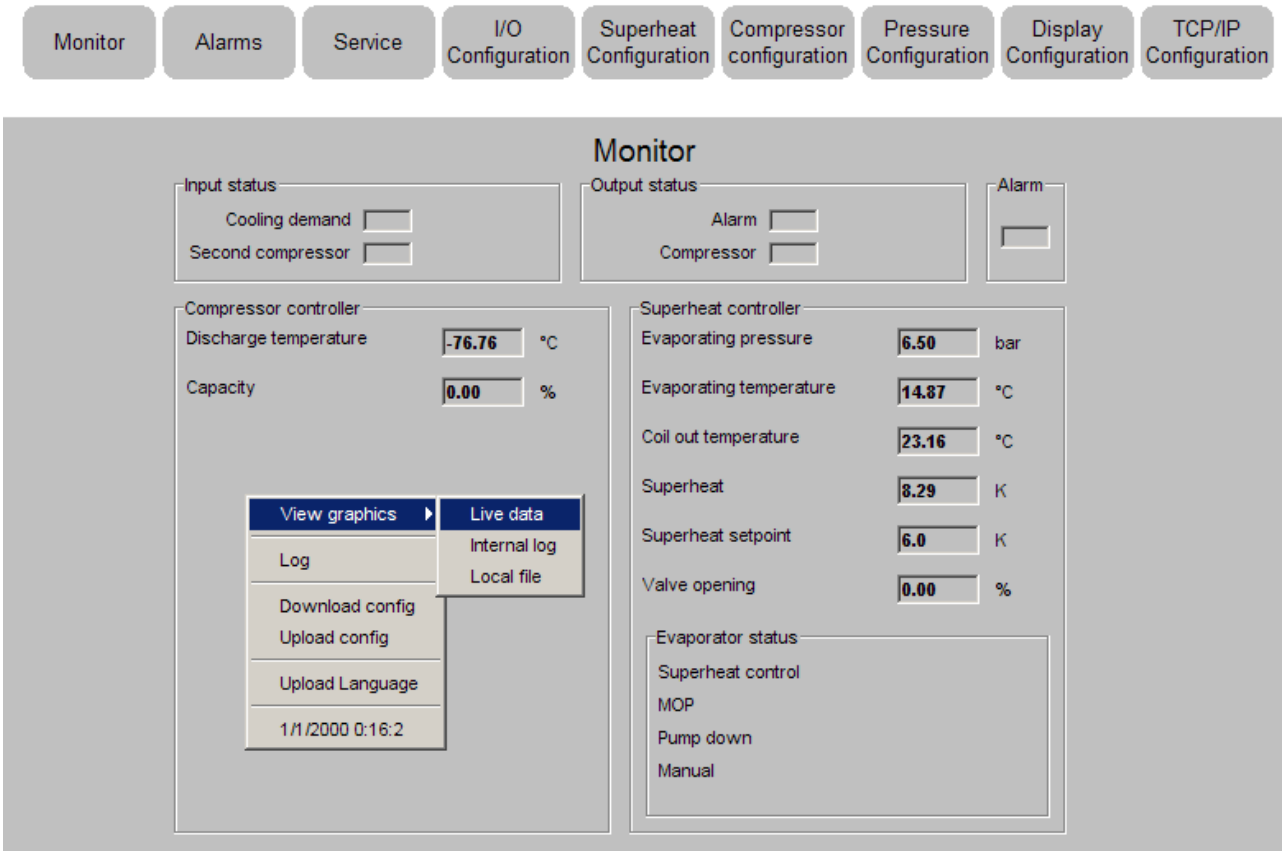
- Superheat set point and mode
- Low superheat function
- MOP function and set point
- Type of refrigerant and required pressure sensor
- Type of Electrical Control Valve
- Valve start opening and duration
- Unit conversion
- Value to display
- Battery error management
- Password
- User name (only via web page)
- Low pressure alarm: cut-out/cut-in and time delay
- Freeze protection alarm: cut-out/cut-in and time delay
- High superheat alarm: Cut-out and time delay
- Pump down cut-out and duration
- Manual control of valve (only via web page)
- TCP/IP configuration (only via web page)
- Others

WebServer function of the EC3-D72 with TCP/IP Ethernet networking capabilities

All relevant parameters and modes are visible on a single WebPage simultaneously. For even more details and for setup and maintenance a click on one of the screen tabs calls up a WebPage dedicated to specific task. The next page shows the homepage of an EC3-D72 with the monitoring WebPage of the controller.

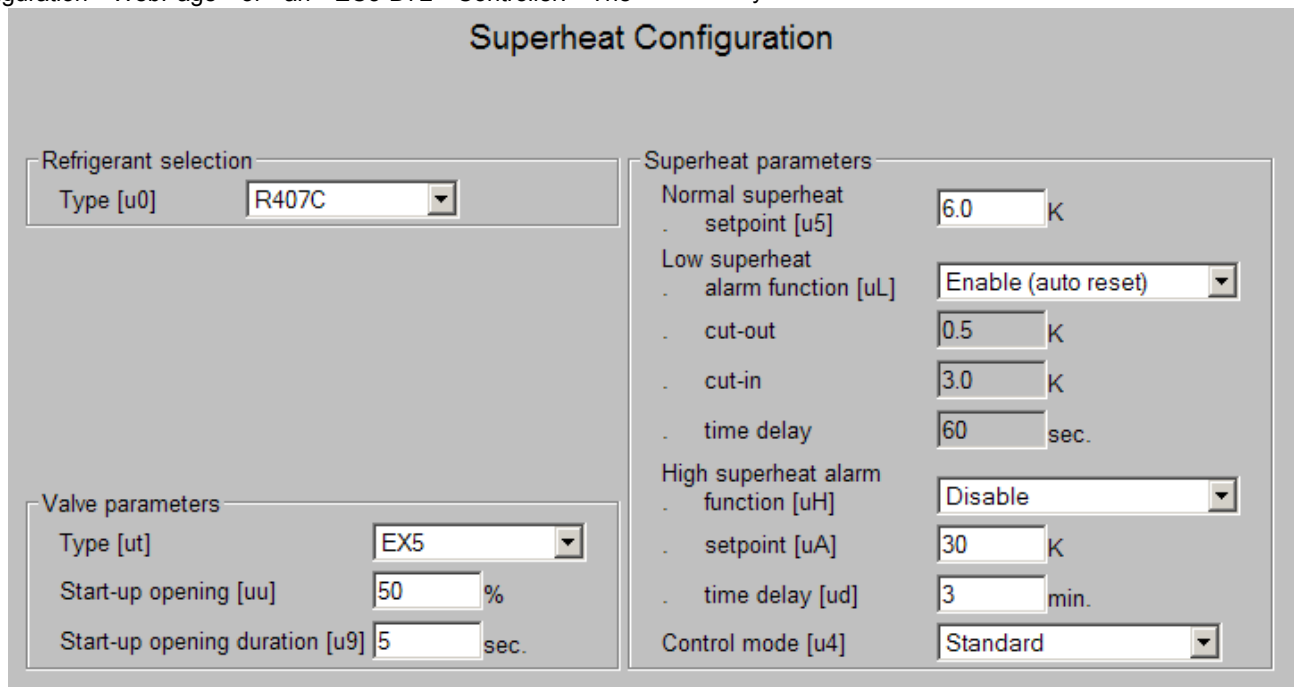
EC3-D72 features multi-language WebPages. Two languages are always available in the controller. English is the default language and is permanently stored. When delivered from the factory, the second language is German. Customers who desire to use an alternative second language can download language files for the most common European languages from the www.emersonclimate.eu website and upload one of them into the EC3-D72. This action will overwrite the German language with the customers' language choice.

Examples Webpages:



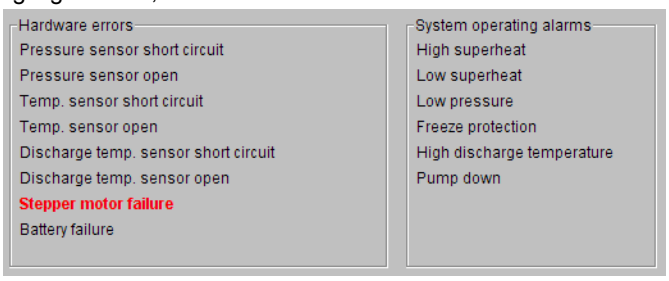
The top fields indicate the status of the controller. When alarms occur, they will be shown in red. The fields below show temperature and pressure of all sensors attached to the controller as well as the superheat setpoint, the measured superheat and the valve opening. The evaporator status field on the right hand side shows the operating modes. The active mode is shown in blue.

All WebPages, which allow the change of controller parameters are password protected. Below is the example for the superheat configuration WebPage of an EC3-D72 Controller. The setpoints for superheat, low and high super-heat alarms as well as the refrigerant and the Electrical Control Valve selected can be easily reviewed and modified if needed:



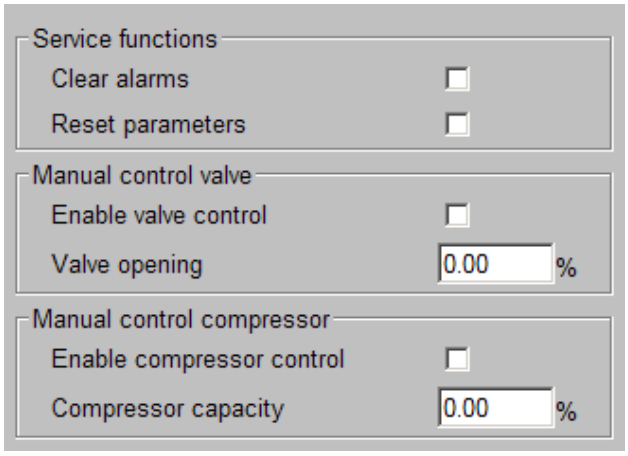
Alarms

The monitoring WebPage shows all alarms in text form. All possible alarm messages are visible, active alarms are highlighted red, see below:

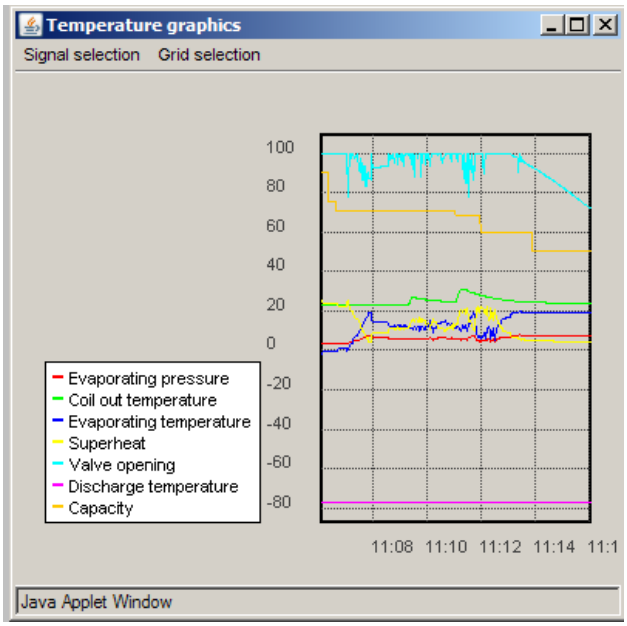


Service Functions

Particularly useful facilities are the service functions, which enable the engineer to manually control the system during commissioning. They include manual operation of the Electrical Control Valve, clearing alarms which require a manual reset and resetting the controller to factory default settings.



A rolling graph with superheat, evaporating pressure, evaporating temperature, valve opening and coil out temperature data over a period of approximately 10 minutes can be displayed:



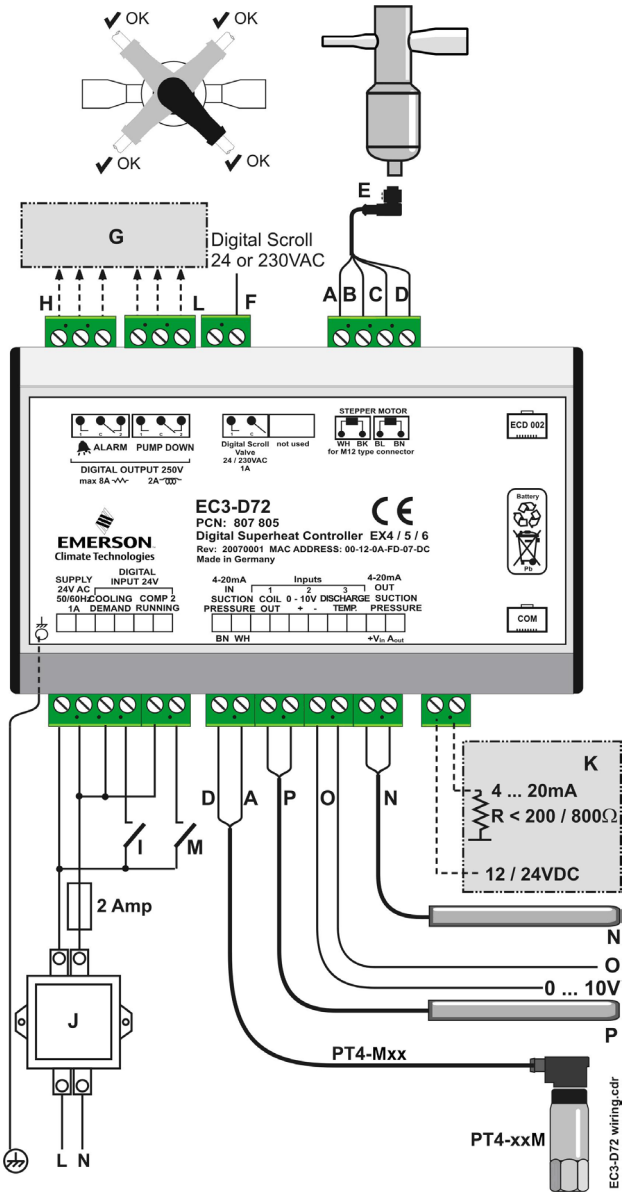
A logfile can be stored on the PC. The file format of the datalog is text with semicolon (;) separated fields. On the picture below is a sample log file from an EC3-D72 imported in Microsoft Excel®:

Microsoft Excel - EC3-D72 sample data.xls

	A	B	C	D	E	F	G	H
1	Time	Evaporating pressure	Coil out temperature	Evaporating temperature	Superheat	Valve opening	Discharge temperature	Capacity
2	23:52:56	5.39	19.49	9.84	9.64	52.75	-76.76	50.31
3	23:52:57	5.39	19.49	9.84	9.64	52.75	-76.76	50.31
4	23:52:58	5.50	19.49	10.40	9.09	48.24	-76.76	50.31
5	23:52:59	5.64	19.49	11.09	8.91	51.74	-76.76	50.31
6	23:53:00	5.85	19.49	12.02	7.46	45.66	-76.76	50.31
7	23:53:01	5.85	19.49	12.02	7.46	52.61	-76.76	50.31
8	23:53:02	5.66	19.49	11.06	8.42	57.14	-76.76	50.31
9	23:53:03	5.32	19.49	9.29	8.99	59.36	-76.76	50.31
10	23:53:04	5.12	19.49	8.53	10.92	57.40	-76.76	50.31

Wiring Diagram

Permanent



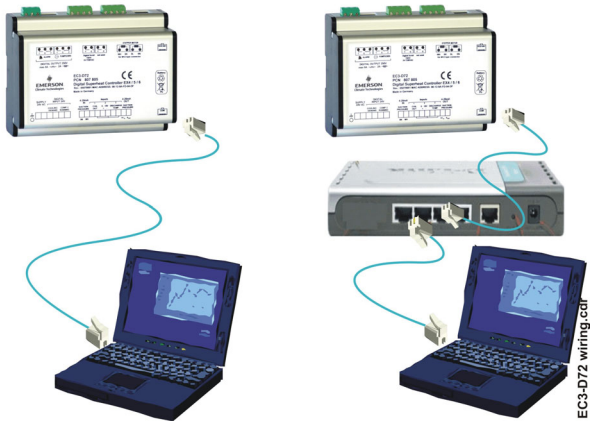
A: White wire **B**: Black wire **C**: Blue wire **D**: Brown wire

E: Plug cable assembly EX5-Nxx for connection to EX4/EX5/EX6

Optional ECD-002 display/keypad unit

The ECD-002 can be used as an option for service purposes for the EC3-D72 but is the only means of visualizing the parameters for the EC3-D73. ECD-002 may be connected or removed from EC3-D72 at any time. The display unit can be switched from K/bar/°C to R/psig/°F. Indicator LEDs show the status of valve opening, valve closing, demand and alarm.

Temporary for set-up, start-up and service



Direct connection via cross over cable **Connection via Router**

F: Output for Copeland Digital Scroll solenoid valve

G: Remote control panel, system controller

H: Alarm relay, dry contact. Relay coil is not energized at alarm condition or power off

⚠ The use of the relay is essential to protect the system in case of power failure if the communications interface or the ECD-002 are not utilized

I: Digital input 1: "Cooling demand"; Digital Scroll compressor is running: 0V/open = Stop; 24V/closed = Start)

J: Transformer Class II, 24VAC secondary / 25VA

K: Third party controller (can use the analog output signal from EC3)

Note: The internal resistor of third party controller must fulfill the following conditions:

R ≤ 200 Ω if the supply voltage is 12VDC

R ≤ 800 Ω if the supply voltage is 24VDC

L: Pump down relay, dry contact. Relay is energized during normal operation

M: Digital input 2: "Comp. 2 running";

0V/open = Comp2 stop; 24V/closed = Comp2 running.

N: Discharge Temp. Sensor

O: 0-10V Digital Scroll capacity demand signal from system controller

P: ECN-N60 Coil out sensor

EC3-D72 / EC3-D73
Superheat & Digital Scroll Controller

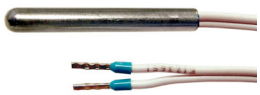
EMERSON Climate Technologies

Ordering

Description	Type	Part Code Nr.
Digital Superheat Controller with communication; **Complete kit for 7bar applications**	**EC3-D72**	**808 042**
Complete kit for 18bar applications	**EC3-D72**	**808 044**
Digital Superheat Controller without communication; **Complete kit for 7bar applications**	**EC3-D73**	**808 041**
Complete kit for 18bar applications	**EC3-D73**	**808 043**

Kit consists of: Controller, Terminal kit, Pressure transmitter inc. 6.0m cable, 6.0m Temp. sensor, 60VA transformer

Description		Type	Part Code Nr.
Digital Superheat Controller EC3-D72		EC3-D72	807 805
Digital Superheat Controller EC3-D73		EC3-D73	807 804
Terminal Kit for EC3-X32		K03-331	807 648
Pressure Sensors	-0.8…7bar	PT4-07M	802 332
	0…18bar	PT4-18M	802 333
Cable Assembly for PT4	1.5m cable length	PT4-M15	804 803
	3.0m cable length	PT4-M30	804 804
	6.0m cable length	PT4-M60	804 805
NTC Temperature sensors	3m cable length	ECN-N30	804 496
	6m cable length	ECN-N60	804 497
	12m cable length	ECN-N99	804 499
Display/keypad unit (opt.)		ECD-002	807 657
Connection cable EC3 to ECD-002	1,0 m	ECC-N10	807 860
	3,0 m	ECC-N30	807 861
	5,0 m	ECC-N50	807 862



ECT-323

Ordering, accessories, spare part

Transformer 230VAC Input, 24V output, Din rail mounting		Type	Part Code Nr.
For one set of controller and valve	25VA	ECT-323	804 424
For two sets of controllers and valves	60VA	ECT-623	804 421
Replacement battery kit			807 790

Suitable valves for connection to EC3-D7x series

Valve	Capacity range kW *	Refrigerant	Capacity regulation
EX4	2 ... 20	**R 22**	10 -100%
EX5	5 ... 50		
EX6	12 ... 120		
EX4	2 ... 21	**R 407C**	
EX5	5 ... 53		
EX6	13 ... 126		
EX4	2 ... 15	**R 134a**	
EX5	4 ... 39		
EX6	10 ... 93		
EX4	2 ... 14	**R 404A/ R507**	
EX5	4 ... 35		
EX6	9 ... 84		

Valve	Capacity range kW *	Refrigerant	Capacity regulation
EX4	3 ... 23	**R 410A**	10 - 100%
EX5	6 ... 58		
EX6	14 ... 140		
EX4	1 ... 11	**R 124**	
EX5	3 ... 28		
EX6	6 ... 67		
EX4	3 ... 33.5	**R 744**	
EX5	10 ... 102		
EX6	24 ... 244		

*) Nominal rating conditions:

Refrigerant	Evaporating temperature	Condensing temperature
R22, R134a, R404A, R507C, R407C, R410A	+4°C	+38°C
R744	-40°C	-10°C
R124	+20°C	+80°C

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Technical Data

EC3-D7x series

Supply voltage	24V AC ±10%, 50/60Hz, 1A
Digital input	24V AC ±10%, 50-60HZ 24V DC ±10%
Power consumption	25VA max. including connected ECV and display/keyboard
Internal battery charging time	Approximately 2 hours if battery is fully empty
Plug-in connector size	Removable screw version wire size 0.14 … 1.5mm^2
Ground connection	6.3mm spade earth connector
Applied directive EMC LVD RoHS	EN 61326, EN 50081, EN 61000-6-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11
Marking	CE
Protection class	IP 20
Vibration	4g, 10-1000Hz
Temperature storage operating	 -20 … +65°C 0 … +60°C 1….+25°C for optimum battery life
Humidity	0 … 80% r.h. non condensing
Weight	~ 800g
Mounting	DIN rail mounted

ECD-002 Display Unit

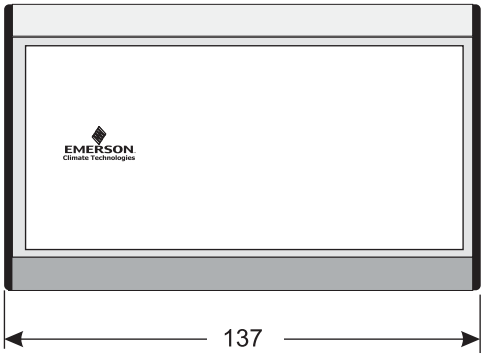
Supply	From EC3 Series Controller via connecting cable
LED indicators	Valve opening, valve closing, alarm, demand
Display LED	Numeric segmental display, 2½-digits, red, with automatic decimal point betw. ±19.9, switchable between °C and °F
Connecting cable	ECC-Nxx or standard CAT5 patch cord with RJ45 connectors
Protection class	IP 65 (front protection with gasket)
Humidity	0 … 80% r.h. non condensing
Temperature storage operating	 -20 … +65°C 0 … +60°C
Weight	~ 52g
Mounting	Panel mount (71 x 29 mm cutout)

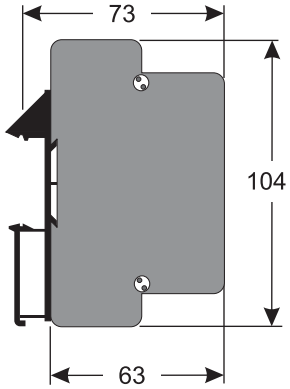
Input and Output, EC3-D7x series Controller

Description	Specification
Temperature input	ECN-Nxx: 10kΩ @ 25 °C, Range: -50 … 50 °C
Pressure sensor input	PT4-07M/18M/30M: 24VDC, 4 … 20mA
Analog input Digital Scroll capacity demand from system controller	0-10VDC with maximum load current 2mA. Absolute maximum voltages: -0.7V min / 10.7V max
Analog output (evaporating pressure fed-through signal) Deviation from input signal	4 20mA Requires 12 or 24 VDC ±8% max
Digital input Cooling demand Comp.2 running	 0/24 VAC/DC
Output relay Alarm/Pumpdown Digital Scroll solenoid Spare relay	SPDT contacts, AgCdO, Max. rating: Inductive 2Amp, Resistive 8 Amp @ 250V Solid state relay, Max rating 1Amp @ 240VAC with 1.6 voltage drop. Minimum switching current 22mA Maximum off state leakage current 1.5mA SPST: not used
Stepper motor output	For EX4 … EX6 Electrical Control Valves
Connection to ECD-002	RJ45
TCP/IP connection	RJ45

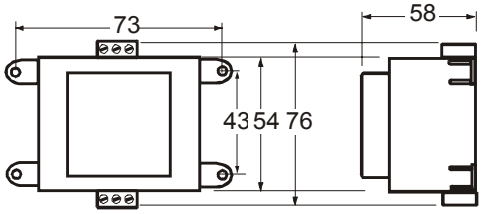
Physical Dimensions Drawings (mm)

EC3-D72 Controller

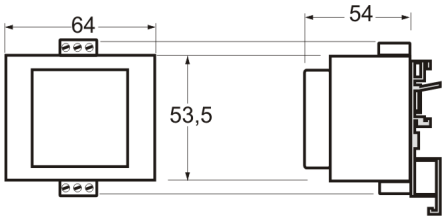




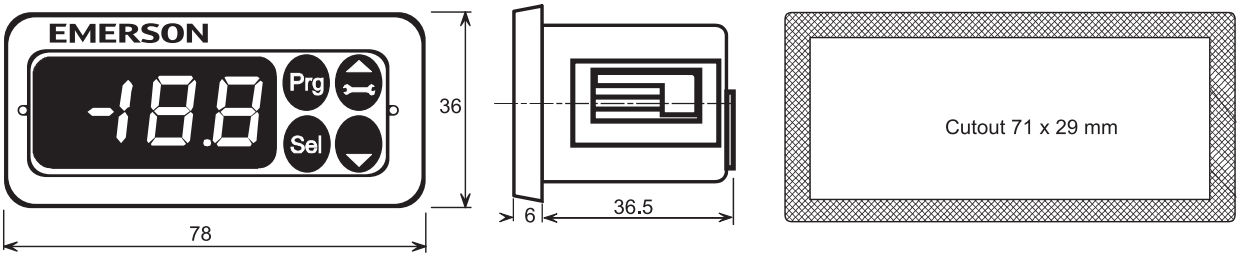
ECT-623 Transformer



ECT-323



ECD-002 Display Unit



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