AIRDEX CORPORATION

INTRODUCTION

This catalogue presents a line of standard Airdex Belt Drive Blowers in both the regular BC and compact BCT housing series. Data is presented so as to be most useful to the product design and application engineer.

All the following performance data has been developed from precise equipment and measuring instrumentation under the test conditions of AMCA Code, Bulletin 210 with outlet duct.

Competent engineering service together with our laboratory facilities are available to assist in your application requirements.

SUGGESTIONS FOR THE USE OF THIS PERFORMANCE DATA. The following data presents blower performance under standard test conditions. Blower performance in a unit must be determined by test. Often space for a blower is governed by unit design and air volume requirements by proposed unit ratings. The required external static pressure is usually known but internal and entering losses must be approximated. These losses – the pressure drop – cannot be calculated. They must be determined by test. While methods are available to measure such losses, they usually serve only academic interest. The Product Design Engineer knows that these losses are high, particularly in an era of compact equipment with increased output ratings. His experience and judgement will serve for preliminary blower selection using performance data. More often than not, he will be correct.

The blower performance graphs which follow show constant speed lines for the static pressure (S.P., inches W.G.) and volume (CFM) relationship. These lines are intersected by constant horsepower (broken) lines which indicate horsepower requirements for each set of air volume, static pressure and speed relationships. For safe motor selection, we suggest that these horsepower values, expressed in terms of commonly available motor sizes, be regarded as the top limits for motor size selection. Average drive losses are built in as part of the horsepower calculation.

To interpolate for changing conditions., system lines based on the fan laws are also shown on each graph. The individual blowers principal dimensions are also shown on the appropriate graph for each reference.

We call attention to the performance data arrangement – standard size housing blowers in one group and the compact housing series in another.

FURNACE BLOWER SELECTION TABLE

This table serves the Furnace Design Engineer by making it easy to determine the amount of air (CFM) required for various temperature rise conditions., the table shows the relationship between Temperature Rise, CFM, and Heat Output based on the following formula:

$$CFM = \frac{BTU/hr.}{1.08 \times Temp.\ Rise\ ^{\circ}F.}$$

When any two factors are known or assumed, the third may be obtained from the table. Note: Formula based on Standard Air.

EXAMPLE:
A furnace to be designed must deliver 100,000 BTU at an 80° Temperature Rise. How much air is required?

Find the 100,000 BTU line on the left margin and read over to its intersection with the 80° Temperature Rise Column.

ANSWER:
1160 CFM required.

REQUIRED CFM

BONNET OUTPUT B.T.U./HR.	TEMPERATURE RISE DEGREES FAHRENHEIT					
	50°F	60°F	70°F	80°F	90°F	100°F
40,000	740	620	530	460	410	370
60,000	1110	930	790	690	620	560
80,000	1480	1230	1060	930	820	740
100,000	1850	1540	1320	1160	1030	930
120,000	2220	1850	1590	1390	1230	1110
140,000	2590	2160	1850	1620	1440	1300
160,000	2960	2470	2120	1850	1650	1480
180,000	3330	2780	2380	2080	1850	1670
200,000	3700	3090	2650	2300	2060	1850
220,000	4070	3400	2910	2550	2260	2040
240,000	4440	3700	3170	2780	2470	2220
260,000	4810	4010	3440	3010	2670	2400
280,000	5190	4320	3700	3240	2880	2590
300,000	5560	4630	3970	3470	3090	2780

AIR CONDITIONER BLOWER SELECTION GRAPH

These graphs serve the Design Engineer by making it easy to determine the amount of air (CFM) required for various air conditioner sizes. The chart shows a relationship between temperature drop and air requirements (CFM). The chart is based on the formula:

$$CFM = \frac{\text{Load (tons)} \times 12{,}000 \times .75}{1.08 \times \text{Temp. Drop °F.}}$$

Note that the formula is based on Standard Air.

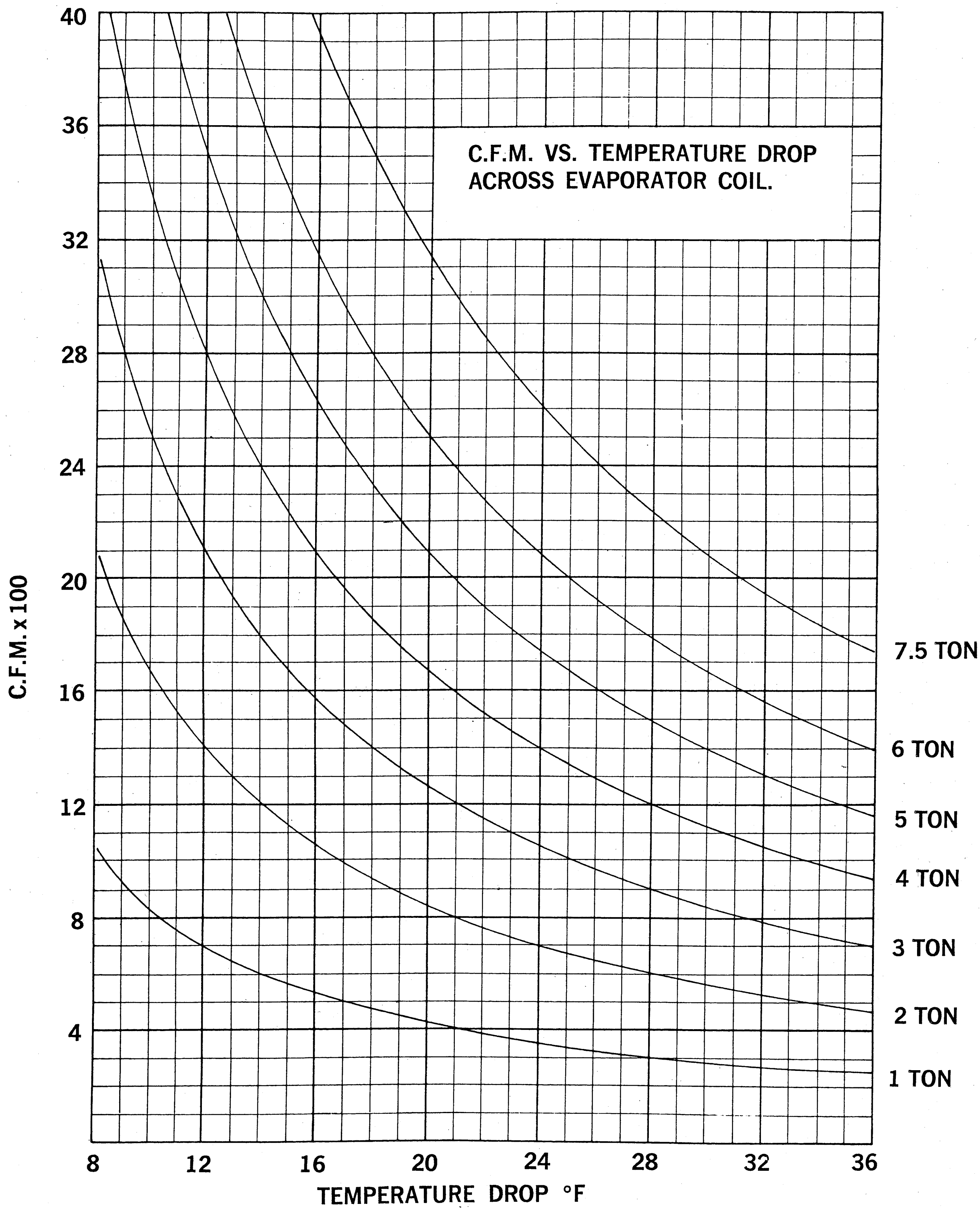
EXAMPLE:

Find CFM required for a 3 ton load with a 20° temperature drop across the evaporator coil.

On bottom scale find 20° drop and read up to where the vertical line intersects the 3 ton curve. Read left from this intersection to the CFM scale.

ANSWER:

1250 CFM required.



CRITICAL SPEED OF STEEL SHAFTS

The combined weight of a shaft and wheel can cause deflection that will create resonant vibration at certain speeds. This is not a problem when one wheel is applied with bearing centers spaced as indicated by the standard blowers listed in this manual. However, when bearing centers for a single wheel and shaft are greater than the standards shown in this manual, or when two or more wheels are mounted on a single shaft between bearings, critical speed calculations using the following formulae are recommended. Good practice suggests that the maximum speed should not exceed 75% of the critical speed.

Shaft Diameter	I	w
3/4	.0155	.125
1	.0492	.222
1 3/16	.0977	.314
1 7/16	.210	.460
1 5/8	.342	.587
1 11/16	.397	.633
1 15/16	.693	.835
2	.786	.890
2 3/16	1.120	1.065

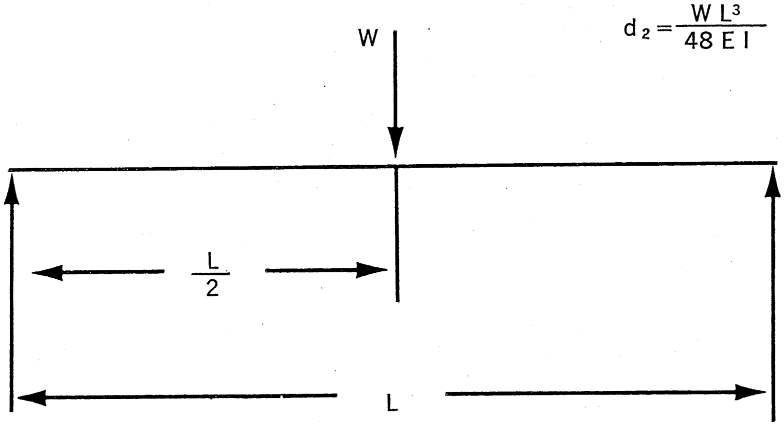
$$\text{Critical Speed RPM} = \frac{187.7}{\sqrt{d_t}}$$

d_t = Total maximum deflection.
d_1 = Deflection of shaft only.
d_2 = Deflection due to wheel weight.
w = Weight of 1 inch of shaft.
W = Weight of wheel.
I = Shaft moment of inertia.
L = Length of shaft, bearing center-to-center.
a = Length in inches.
E = Modulus of elasticity = 30,000,000.

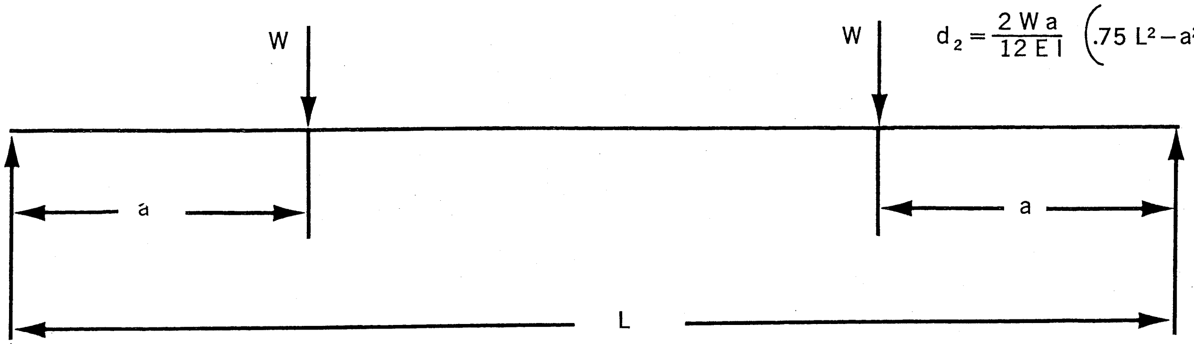
$$d_t = d_1 + d_2 \quad (1)$$

$$d_1 = \frac{5\,wL^4}{384\,E\,I} \quad (2)$$

$$d_2 = \frac{W\,L^3}{48\,E\,I} \quad (3a)$$

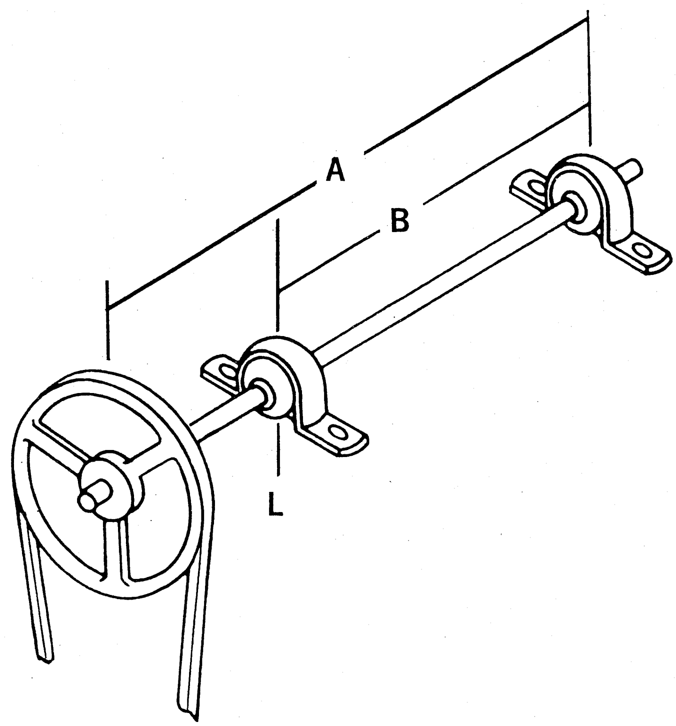


$$d_2 = \frac{2\,W\,a}{12\,E\,I}\left(.75\,L^2 - a^2\right) \quad (3b)$$



BEARING LOAD DATA

Blowers using ½ horsepower motors or less will require a small amount of belt tension and, therefore, standard bearings will not normally be overloaded. Larger motor sizes generally indicate greater speeds and belt tensions which may require bearing selection based on accepted design procedure. The bearing nearest the drive is critical.



A simplified formula to aid in bearing selection is;

$$L = \frac{200{,}000 \times HP \times A}{D \times RPM \times B}$$ in which . . .

L = Bearing load in pounds.
HP = Motor nameplate rating x service factor.
A = Length, in inches, from far bearing to belt.
D = Blower sheave pitch diameter in inches.
RPM = Blower RPM.
B = Bearing centers, in inches.

MAXIMUM RECOMMENDED BEARING LOAD RATINGS IN POUNDS AT 70°-90° AMBIENT TEMPERATURES

PLASTIC 'E' BEARINGS
(Operating range 30°F. to 110°F.)

DIAMETER	STYLE	400 RPM	600 RPM	800 RPM	1000 RPM	1200 RPM	1400 RPM	1600 RPM
¾″	Sintered	61	53	45	37	30	25	21
1″	Sintered	80	59	40	27	19	15	11

OIL-TYPE BEARINGS
(Lubricate every 1,000 hours.) (See lubrication table below.)

DIAMETER	STYLE	400 RPM	600 RPM	800 RPM	1000 RPM	1200 RPM	1400 RPM	1600 RPM
¾″	Sintered	83	70	64	57	47	40	35
1″	Sintered	96	81	71	62	55	49	40

BALL BEARINGS
(Operating range −20°F. to +160°F.)

Diameter	Load rating
¾″	250
1″	300
1³⁄₁₆″	300

LUBRICATION TABLE

Ambient Temp.	Oil
−30°F. to 0°F.	Low Temp. Oil
0°F. to 30°F.	SAE 10
40°F. to 70°F.	SAE 30
80°F. to 110°F.	SAE 50

HORSEPOWER TRANSMISSION

The horsepower transmission (Table I), below, is provided to determine the minimum shaft diameter recommended for a given application. This table is based on the following formula:

$$\text{Diameter} = \sqrt[3]{\frac{85\ (\text{Horsepower})}{(\text{Rotating Speed})}}$$

This assumes a maximum design stress of 5000 pounds per square inch.

Two maximum horsepower tables have been provided to aid in selection of the correct wheel hub-to-shaft connection. If no steel hub combination of the desired shaft size can be found to transmit the required horsepower, we recommend keywayed hubs and shaft.

TABLE I

KEYWAYED SHAFT TRANSMISSION MAXIMUM HORSEPOWER

SHAFT DIA.	RPM													
	100	200	300	400	500	600	700	800	900	1000	1200	1400	1600	1800	2000
3/4	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
1	1.1	2.3	3.5	4.7	5.9	7.0	8.2	9.4	10.6	11.8	14.1	16.5	18.8	21.0	23.5
1 3/16	2.0	3.9	5.9	7.9	10.0	11.8	13.8	15.8	17.7	19.7	23.6	27.6	31.5	35.5	39.4
1 7/16	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.4	34.9	41.9	48.9	55.9	62.9	69.9
1 11/16	5.7	11.3	17.0	22.6	28.3	33.9	39.6	45.2	50.9	56.5	67.8	79.1	90.4	101.8	113.1
1 15/16	7.3	14.5	21.8	29.1	36.4	43.6	50.9	58.2	65.4	72.7	87.3	101.8	116.4	130.9	145.5

MAXIMUM HORSEPOWER SHAFT DIAMETER

Belt Drive wheels with steel hubs are available with set screws only or keyways if required. Steel hubs 1 3/4" outside diameter and smaller have 5/16" set screws requiring 140 inch pounds setting torque. Steel hubs 2 3/4" outside diameter and larger have 3/8" diameter set screws requiring 290 inch pounds setting torque. Two set screws at 90° will transmit 1.7 times the torque a single set screw would transmit.

TABLE II

1 3/4 O.D. & SMALLER HUBS

RPM	1 S.S. per Hub				2 S.S. per Hub			
	5/8	3/4	1	1 3/16	5/8	3/4	1	1 3/16
100	.17	.20	.27	.32	.29	.35	.46	.55
200	.34	.41	.54	.65	.58	.69	.92	1.10
300	.51	.61	.82	.97	.87	1.04	1.39	1.65
400	.68	.82	1.09	1.29	1.15	1.39	1.85	2.20
500	.85	1.02	1.36	1.61	1.44	1.73	2.31	2.75
600	1.02	1.22	1.63	1.94	1.73	2.08	2.77	3.29
700	1.19	1.43	1.90	2.26	2.02	2.43	3.24	3.84
800	1.36	1.63	2.18	2.58	2.31	2.77	3.70	4.39
900	1.53	1.84	2.45	2.91	2.60	3.12	4.16	4.94
1000	1.70	2.04	2.72	3.23	2.89	3.47	4.62	5.49
1200	2.04	2.45	3.26	3.88	3.47	4.16	5.55	6.59
1400	2.38	2.85	3.81	4.52	4.05	4.85	6.47	7.69
1600	2.72	3.26	4.35	5.17	4.62	5.54	7.40	8.78
1800	3.07	3.67	4.90	5.81	5.20	6.24	8.32	9.88
2000	3.40	4.08	5.44	6.46	5.78	6.94	9.25	10.98

TABLE III

2 3/4 O.D. HUB & LARGER 2 S.S. @ 90° PER HUB

RPM	DIAMETER						
	1 3/16"	1 7/16"	1 11/16"	1 15/16"	2 3/16"	2 7/16"	2 11/16"
100	.8	1.0	1.2	1.4	1.6	1.7	1.9
200	1.7	2.1	2.4	2.8	3.1	3.5	3.9
300	2.5	3.1	3.6	4.2	4.7	5.2	5.8
400	3.4	4.1	4.8	5.6	6.3	7.0	7.7
500	4.2	5.2	6.0	7.0	7.9	8.8	9.7
600	5.1	6.2	7.3	8.3	9.4	10.5	11.6
700	6.0	7.2	8.4	9.7	11.0	12.2	13.5
800	6.8	8.3	9.7	11.1	12.6	14.0	15.5
900	7.7	9.3	10.9	12.5	14.1	15.8	17.4
1000	8.5	10.4	12.1	13.9	15.7	17.5	19.4
1200	10.2	12.4	14.5	16.7	18.8	21.0	23.2
1400	12.0	14.5	16.9	19.5	22.0	24.5	27.1
1600	13.7	16.6	19.4	22.2	25.1	28.0	31.0
1800	15.4	18.7	21.8	25.0	28.3	31.5	34.8
2000	17.1	20.7	24.2	27.8	31.4	35.0	38.7