CINCINNATI FAN

Selecting a Fan or Blower

PROPER SELECTION PROCEDURE

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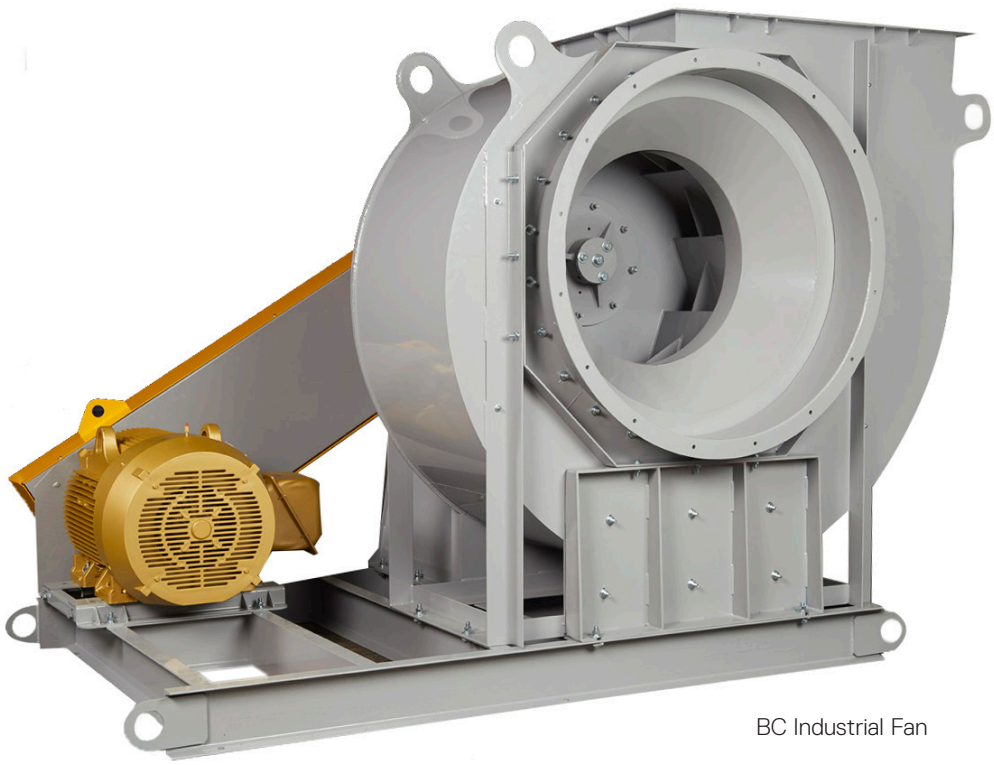
SPECIFIC INFORMATION REQUIRED WHEN MAKING A FAN OR BLOWER SELECTION



BC Industrial Fan

How To Properly Select a Fan or Blower	
Steps	**Explanation**
1–Choose fan type _____ Centrifugal blower _____ Axial flow fan	A centrifugal blower wheel draws air into the inlet of the blower housing through the wheel, and discharges it at 90° out through the discharge of the blower housing. An axial fan uses a **propeller** to draw the air into the fan and discharges the air in the same axial direction. A centrifugal blower housing has a "scroll" whereas a axial fan is an "in-line duct type" fan or a "wall" fan. **Do not use an axial flow fan to convey material.** There is a variation of axial flow duct fan that uses a blower wheel instead of a propeller. It is referred to as a Tubular Centrifugal fan and are not available at Cincinnati Fan.
2–Total airflow _____ ACFM	Airflow is rated in cubic feet of air per minute (**CFM**) or in metric equivalent, it is rated in cubic meters per hour (m^3/hr). To convert **m^3/hr** to **CFM** multiply m^3/hr x .58858 If conveying material, make there is enough CFM for the duct, pipe or hose size so the material will maintain the required velocity to carry it completely through the system and not settle in the duct, pipe or hose. **See step 2 on page 4.**
3–Static Pressure _____ inches SPWG	Static Pressure is the resistance to airflow (friction) caused by the air moving through a pipe, duct, hose, filter, hood slots, air control dampers or louvers. Static pressure is rated in inches of water gauge (**SPWG**) or in metric equivalent, it is rated in Pascals (**Pa**). This should include the pressure drop through all of the ductwork on the inlet and outlet of the fan or blower plus the pressure drop through any filters, control dampers, louvers and other system components that restrict airflow. 1 Pa = .004" SPWG Note-If the static pressure on the inlet side of a blower will exceed 15" SPWG, a correction for suction pressure (called Rarefication) should be made. See Static Pressure Corrections For Suction Pressure in step 3 on page 4.

Density, Altitude and Temperature Corrections	
4–Density _____ @ Standard Conditions	Standard air is based on a temperature of 70° F, 29.92" barometric pressure and .075 pounds per cubic foot. Density changes resulting from temperature and/or barometric pressure variations, such as higher altitudes, must be corrected to standard conditions before selecting a fan or blower based on standard performance data. If density is in kilograms per cubic meter (kg/m^3), make the following correction: 1 kg/m^3 = .0624 lb/ft^3. For Altitude and Temperature Correction Factors, see step 4 on page 5. Note-If you make the correction for density, you do not need to show the temperature and altitude in steps 5 and 6. If the fan or blower will be handling a gas or vapor with a density that is less or greater than standard air, contact our sales office for your area for fan sizing assistance.
5–Air Temperature _____ °F _____ °F to _____ °F	The temperature of the air going through the fan or blower will affect the performance of the fan or blower. Temperature should be shown in degrees Fahrenheit (F). Make the following correction for degrees Celsius (C): °F = 1.8 x °C + 32 If the air temperature will vary, what are the minimum and maximum temperatures in °F?
6–Altitude _____ feet above sea level	The altitude the fan or blower will be operating at will also affect the performance of the fan or blower. The altitude should be given in feet above sea level.

Special Conditions That May Affect a Fan or Blower Construction	
Steps	**Explanation**
7–Material Handling	Will you be conveying any material through the fan or blower or will it be clean air?
☐ Yes ☐ No	Clean air? (If Yes, move on to Step 8).
☐ Yes ☐ No	Dirty air? (A fan or blower with a Radial type wheel should be used) If dirty air, the four models below come with radial type wheels: **PB Series** cast aluminum blower **PBS Series** fabricated steel blower **SPB Series** die formed steel blower **RBE Series** radial blade exhaust blower
☐ G ☐ P	If dirty, is material granular (G) or powdery (P)? A shrouded Radial wheel can be used
☐ Yes ☐ No	If dirty, is material long and stringy like paper trim or fibers? Use only a non-shrouded Radial wheel
☐ Yes ☐ No	For any material will the material be wet or moist?
☐ Yes ☐ No	For any material will the material be dry?
_____ lb/cu ft	If conveying material, what is the weight of the material in pounds per cubic foot?
_____ lb/hr	If conveying material, how many pounds will be conveyed in pound per hour
8–Ambient Temperature	The ambient temperature is the temperature of the air outside the fan or blower. This can affect the operation of the motor and the fan bearings and/or belts for any belt driven fans or blowers.
_____ °F	
_____ °F to _____ °F	If the outside air temperature will vary, what are the minimum and maximum temperatures in degrees F?
9–Safety Conditions	Is there anything going through the fan or blower or outside the fan or blower that is explosive and/or flammable?
☐ Yes ☐ No	Will the airstream of the fan or blower be explosive or flammable?
☐ Yes ☐ No	Will the area outside the fan or blower be explosive or flammable?
Class _____	If Yes for either of the above, what Class and Groups of Explosive Proof (EXP) motor will be required?
Groups _____	
AMCA Type _____	If checked Yes for either of the above what AMCA Type spark resistant construction will be required (AMCA Type A, B or C)?

⚠ **Caution**—All fans and blowers shown have rotating parts and pinch points. Severe personal injury can result if operated without guards. Stay away from rotating equipment unless it is disconnected from its power source. Read all operating instructions prior to installing, inspecting, moving, performing maintenance or operating any fan or blower equipment.

STEP 2 Total Airflow (CFM):

Selecting the proper system airflow (CFM) can be very critical. If exhausting contaminated air such as engine exhaust fumes, not having enough CFM can lead to asphyxiation and even an explosion. If conveying material such as wood chips, too low a CFM will allow the chips to settle somewhere in the system thus clogging the duct, pipe or hose which leads to down time to disassemble the ducting to clean it out. Too much CFM can cause a blow out in the system. The correct CFM must take the material conveying velocity into consideration for the material to be moved to another location.

SCFM and ACFM (SCFM and ACFM are not interchangeable)

SCFM (Standard Cubic Feet per Minute) is the total CFM at standard density conditions. These CFM values typically are listed by fan manufacturers.

ACFM (Actual Cubic Feet per Minute) is the mass flow rate divided by the density of the air or gas being moved. Since fans and blowers handle the same volume of air at any density, the ACFM value should be used when selecting a fan or blower.

The total airflow (SCFM) should also meet or exceed the minimum CFM required by any regulating authorities for the application. This sometimes only requires meeting the minimum CFM as recommended by a "standards" organization.

If not sure how much CFM will be required for a specific application, contact the Cincinnati Fan sales engineer for your area for assistance.

STEP 3 Static Pressure (SP):

The **Total Static Pressure** must include the static pressure of the total airflow (CFM) moving through the entire system. This should include the static pressure of the CFM going through ducting, piping, hose, filters, hood slots, airflow control dampers and louvers. To select the correct static pressure through smooth wall pipe or duct you will need to refer to pages 11 and 12 in the: ***Cincinnati Fan Engineering Data catalog CF-ENG.***

It will show the friction loss per 100 feet of duct or pipe for the total CFM. Next, add the additional static pressure loss for any dampers, filters, etc. for the **Total Static Pressure**.

Static Pressure Correction For Suction Pressure:

When a large amount of static pressure is on the inlet of a blower, it requires additional suction to move the air because it is easier to blow air than to suck air. This is called Rarefication. If there is more than 15" SP on the blower inlet, correct for suction pressure per the chart below. If corrections for altitude and/or temperature are required, make them first and then correct for Rarefication.

Other Static Pressure Estimating Factors:

1 For flexible hose, use 2-3 times the pressure drop for smooth wall duct or pipe.

2 Each 90° elbow is equal to 10 feet of straight duct or pipe. Example: 25 feet of straight pipe + two 90° elbows = 145 feet of straight pipe.

The ***Cincinnati Fan Engineering Data*** catalog also provides very helpful recommendations for material conveying, air changes required for good ventilation, velocities for exhaust hoods, and guidelines for good duct installations.

Static Pressure Corrections for Suction Pressure

Based on standard air at 70°F, 29.92" Barometric Pressure, .075 lb per cubic feet density

Suction Pressure inches WG	Corrected Static Pressure	Suction Pressure inches WG	Corrected Static Pressure	Suction Pressure inches WG	Corrected Static Pressure	Suction Pressure inches WG	Corrected Static Pressure
16	16.6	33	35.9	50	57.0	67	79.7
17	17.7	34	37.1	51	57.9	68	82.3
18	18.8	35	38.5	52	60.0	69	83.5
19	20.1	36	39.5	53	61.2	70	84.7
20	21.1	37	40.8	54	62.3	71	85.9
21	22.2	38	41.9	55	63.5	72	87.1
22	23.3	39	43.0	56	64.6	73	88.3
23	24.3	40	44.4	57	65.8	74	91.0
24	25.5	41	45.9	58	68.0	75	92.3
25	26.8	42	46.8	59	69.1	76	93.5
26	27.8	43	48.1	60	70.3	77	94.7
27	28.9	44	49.3	61	71.5	78	95.9
28	30.1	45	50.3	62	72.7	79	98.8
29	31.6	46	51.9	63	75.0	80	100.0
30	32.4	47	53.4	64	76.2	81	101.2
31	33.7	48	54.4	65	77.4	82	102.6
32	34.7	49	55.7	66	78.5	83	104.3

1 With 45" of suction pressure on the blower inlet and no discharge pressure on the blower discharge, the total static pressure = 50.3" Total SPWG.

2. With 45" of suction pressure on the blower inlet and 12" of discharge pressure on the discharge, your total static pressure = 50.3"+12" = 62.3" Total SPWG.

3. With 0" of suction pressure on the blower inlet and 12" of discharge pressure on the blower discharge, the total static pressure = 12" Total SPWG. There is no correction required for discharge pressure.

STEP 4 Corrections For Altitude and Temperature:

Fan performance tables are developed using standard air which is 70°F, 29.92" barometric pressure (at sea level) and .075 lb per cubic foot. Density changes resulting from temperature and/or barometric pressure variations (at higher altitudes) must be corrected to standard conditions before selecting a fan or blower based on standard performance data. Temperature and/or altitude conversion factors are used in making the corrections to standard conditions.

Example:

Select a **Model PB**, cast aluminum pressure blower to deliver 1500 CFM at 7" SP at 250°F and at 6500 feet altitude.

Step 1 From the table below, the conversion factor for 250°F and 6500 ft altitude is **1.71**.

Step 2 The correct static pressure is: **1.71** x 7" SP = 11.97" SP at standard conditions. Round off to 12" SP.

Step 3 Referring to the **Model PB** blower engineering data catalog for 1500 CFM at 12" SP, a direct drive **PB-15A** with an 8" inlet and 16.5" x 4.625" BC wheel is selected. The bhp at standard conditions is 4.99.

Step 3 Next, correct the bhp for lighter air 4.99 ÷ 1.71 = 2.92 bhp at 250°F and 6500 ft. A 3 hp motor will suffice at 250°F and 6500 ft, but not at standard conditions. Special motor insulation may be required above 3500 ft altitude.

Note—If the blower is started at standard room temperature, the calculations for 6500 feet altitude will need to be run for both 70°F and at 250°F to determine the minimum hp motor needed at 70° F. Failure to complete both calculations could result in a non-warranty motor failure.

Safe Operating Speeds

When a blower or fan will be moving air at temperatures substantially above 70°F, the safe operating speed of the blower wheel or fan propeller must be taken into consideration. Most metals become characteristically weaker at higher temperatures. There are maximum operating temperatures listed in suppliers catalogs for various blowers and fan types. The wheel or propeller speeds shown are the maximum for that blower or fan construction.

Bearings

The weakest part of a fan or blower is the bearing system, whether in a pillow block design on belt-drive fans or located within the motor on direct-drive fans. Temperatures above the fans maximum operating range can break down the lubricant in the bearings and cause bearing failure. The location of the bearings on a fan or blower must be considered when moving high temperature air. Fans with bearings located in the air stream have lower temperature limitations. Fans or blowers with bearings outside the air stream have higher temperature limitations. Tube axial fans can handle higher temperatures when there is a bearing-belt tube installed in the air stream to isolate and protect the bearings. With the addition of a shaft cooler wheel (heat slinger), a blowers maximum temperature limit can be extended. The heat slinger absorbs heat from the blower shaft while circulating air over the inboard bearing to keep it cool.

Motors

Standard motors are typically rated up to 104°F (40°C) and up to 3300 feet altitude. As operating temperatures and/or altitudes are increased, special winding insulation and/or special high temperature bearing grease may be required. Consult a Cincinnati Fan sales engineer to ensure the motor you specify will operate correctly for your specific application.

Note—Temperatures below 15°F or above 250°F may require special ow temperature or high temperature grease

TEMPERATURE AND ALTITUDE CONVERSION FACTORS

Air Temperature °F	Altitude in Feet Above Sea Level																					
	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	10000	11000	12000
-50°	0.77	0.79	0.80	0.81	0.83	0.85	0.86	0.88	0.89	0.91	0.92	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.12	1.16	1.21
-25°	0.82	0.84	0.85	0.87	0.89	0.91	0.92	0.94	0.95	0.97	0.98	1.01	1.03	1.05	1.07	1.09	1.11	1.13	1.15	1.20	1.24	1.29
0°	0.87	0.89	0.91	0.92	0.94	0.96	0.98	0.99	1.01	1.03	1.05	1.06	1.09	1.10	1.13	1.15	1.17	1.19	1.22	1.26	1.31	1.37
40°	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.19	1.21	1.23	1.26	1.28	1.30	1.32	1.36	1.41	1.47
70°	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.25	1.27	1.30	1.32	1.35	1.37	1.40	1.45	1.51	1.57
80°	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.19	1.21	1.23	1.26	1.28	1.30	1.33	1.36	1.38	1.41	1.43	1.48	1.56	1.61
100°	1.06	1.08	1.10	1.12	1.14	1.16	1.19	1.21	1.23	1.25	1.28	1.30	1.33	1.35	1.38	1.41	1.43	1.46	1.48	1.54	1.60	1.66
120°	1.09	1.12	1.14	1.16	1.18	1.20	1.23	1.25	1.28	1.30	1.32	1.35	1.38	1.40	1.43	1.46	1.48	1.51	1.53	1.58	1.66	1.72
140°	1.13	1.15	1.18	1.20	1.22	1.25	1.27	1.29	1.32	1.34	1.37	1.40	1.42	1.45	1.48	1.51	1.54	1.57	1.58	1.65	1.72	1.78
160°	1.17	1.19	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.39	1.42	1.44	1.47	1.50	1.53	1.56	1.59	1.62	1.64	1.70	1.78	1.84
180°	1.21	1.23	1.26	1.28	1.30	1.33	1.36	1.38	1.41	1.43	1.46	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.75	1.84	1.90
200°	1.25	1.27	1.29	1.32	1.34	1.37	1.40	1.42	1.45	1.48	1.51	1.54	1.57	1.60	1.63	1.66	1.69	1.72	1.75	1.81	1.89	1.96
250°	1.34	1.36	1.39	1.42	1.45	1.47	1.50	1.53	1.56	1.59	1.62	1.65	1.68	1.71	1.74	1.78	1.82	1.85	1.88	1.94	2.02	2.10
300°	1.43	1.46	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.74	1.77	1.80	1.84	1.87	1.91	1.94	1.98	2.00	2.08	2.16	2.25
350°	1.53	1.56	1.59	1.62	1.65	1.68	1.72	1.75	1.78	1.81	1.85	1.88	1.92	1.96	2.00	2.04	2.07	2.11	2.14	2.22	2.31	2.40
400°	1.62	1.65	1.69	1.72	1.75	1.79	1.82	1.85	1.89	1.93	1.96	2.00	2.04	2.08	2.12	2.16	2.20	2.25	2.27	2.35	2.47	2.55
450°	1.72	1.75	1.79	1.82	1.86	1.89	1.93	1.96	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.29	2.33	2.38	2.41	2.50	2.61	2.70
500°	1.81	1.85	1.88	1.92	1.96	1.99	2.03	2.07	2.11	2.15	2.19	2.23	2.28	2.32	2.36	2.41	2.46	2.51	2.54	2.62	2.75	2.85
550°	1.91	1.94	1.98	2.02	2.06	2.10	2.14	2.18	2.22	2.26	2.30	2.35	2.40	2.44	2.49	2.54	2.58	2.63	2.68	2.77	2.90	3.00
600°	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.29	2.33	2.38	2.42	2.47	2.50	2.56	2.61	2.66	2.71	2.77	2.80	2.90	3.04	3.14
650°	2.10	2.14	2.18	2.22	2.26	2.31	2.35	2.40	2.44	2.49	2.54	2.58	2.63	2.68	2.74	2.79	2.84	2.90	2.94	3.04	3.19	3.30
700°	2.19	2.23	2.27	2.32	2.36	2.41	2.46	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.86	2.91	2.97	3.03	3.06	3.18	3.33	3.44
750°	2.28	2.33	2.37	2.42	2.47	2.51	2.56	2.61	2.66	2.71	2.76	2.81	2.87	2.92	2.98	3.04	3.10	3.16	3.19	3.31	3.47	3.59
800°	2.38	2.43	2.48	2.53	2.57	2.62	2.67	2.72	2.76	2.81	2.86	2.92	2.98	3.04	3.10	3.16	3.22	3.28	3.33	3.45	3.60	3.74

Selecting a Fan or Blower

INSTRUCTIONS

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