

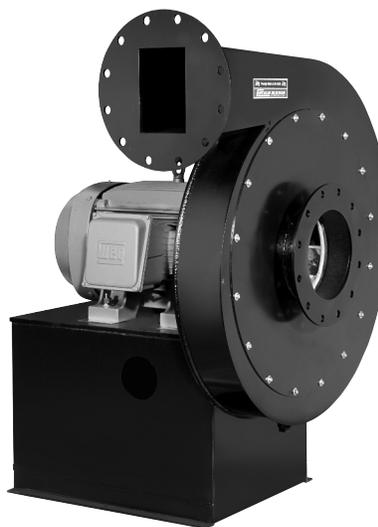
## SAFETY - INSTALLATION - OPERATING AND MAINTENANCE INSTRUCTIONS

# INDUSTRIAL CENTRIFUGAL FANS

This Manual is for the following Fans: D/10A and D/36A (SQA/SQB, SQAD/SQBD), Centrifugal Airfoil and "B" Wheel Fans; D/16A, D/39A (SQI), and D/52 Industrial Fans; D/51 Double Width, Single Width and Plenum Fans; D/53 Pressure Blowers; and D/64 PBI (Packaged Backward Inclined) Fans.



D/36A Centrifugal Fan



D/53 Pressure Blower



D/16A Industrial Fan



D/51 Double Width Fan



D/64 PBI Fan

### TO ORDER SPARE PARTS:

Spare or repair parts may be ordered from your nearest Chicago Sales Engineer by giving the part name, (Wheel, Motor, Bearing, etc.) and the FAN SERIAL NUMBER taken from the nameplate or the JOB ORDER drawings. If possible also give the bearing or shaft size and the fan class. Due to the small number of parts required, spare parts lists are neither necessary nor available. Use these instructions instead.

## RECEIVING:

Chicago Blower Corporation equipment is prepared for shipment in accordance with the Uniform Freight Classification. It is thoroughly inspected at the factory and, barring damage in transit, should be in good condition upon arrival.

When a carrier signs Chicago Blower Corporation's bill of lading, the **carrier accepts the responsibility** for any subsequent shortages or damage evident or concealed, and **any claim must be made against the carrier by the purchaser**. Evident shortage or **damage should be noted on the carrier's delivery document** before signature of acceptance. Inspection by the carrier of damage evident or concealed must be requested. After inspection, issue a purchase order for necessary parts or arrange for return of the equipment to Chicago Blower Corporation factory for repair.

Chicago Blower fans are shipped, skidded, and may be handled and moved using good rigging techniques, being careful to avoid concentrated stresses that distort any of the parts.

## STORAGE:

If the fan installation is to be delayed, store the unit in a dry, protected area. Protect the fan, especially fan and motor bearings, from moisture and vibration. Protect all machined surfaces such as shafts, couplings, and bushings. Rotate the wheel several revolutions every two weeks, stopping the wheel in a position other than its initial position. Keep the bearings fully greased by filling monthly with a grease compatible to that originally supplied. Contact Chicago Blower for extended storage instructions.

## SAFETY PRECAUTIONS:

The fan which you have purchased is a rotating piece of equipment and can become a source of danger to life or cause injury if not properly applied. The **maximum operating temperature** or **speed** for which this fan is designed **must not be exceeded**. These limits are given in our catalog or on Chicago Blower Corporation drawings.

Personnel who will operate this fan, or those who will perform maintenance thereon, **must be given this bulletin to read and warned of the potential hazards of this equipment**.

This pamphlet contains general recommendations, but specific requirements may apply to the individual installation. Such requirements are outlined in federal, state and local safety codes. Strict compliance with these codes, and strict adherence to these installation instructions are **the responsibility of the user**.

## INSTALLATION:

1. Good results **require a proper foundation**. Foundations should be level, rigid, and of sufficient mass for the equipment. Concrete is preferable. Its mass should be at least four times the fan weight. Adequately brace steel platforms in all directions. The minimum natural frequency of any part must be at least 50% higher than the fan running speed.
2. Shim the fan support points before tightening foundation bolts. Do not distort or twist the equipment. Duct connections should be smooth and straight. Elbows and other transitions should be located at least five wheel diameters from fan inlet and outlet (see AMCA Publication 201 for further details). **Flexible connections** should be used at inlet and discharge. The **fan should never support or restrain** any duct weight or force.
3. Make sure the power is locked "OFF".
4. Check wheel-to-inlet clearance (For D/36 and D/51 fans, refer to table at right) to make sure it has not shifted during shipment or handling. There should be approximately equal radial clearance all around. Rotate wheel by hand to check that it runs free.

5. If the wheel is striking, correct it by loosening the hub set screws and reposition the wheel on the shaft, or loosen the motor mounting bolts (for Arrangement 4 fans) and realign the wheel to the inlet so it does not hit. Position the wheel so that the set screw over the key is at the bottom. Torque the bottom set screw first and then the opposing set screw next. Torque all set screws per Torque Values chart. Turn wheel by hand to verify wheel to inlet cone clearance.

SET SCREW TORQUE VALUES

Bolt Size (In. Dia.)	Threads Per Inch	Steel Grade 2 Non-Plated (Inch-lbs.)
1/4	20	65.5
5/16	18	136.0
3/8	16	239.0
7/16	14	381.0
1/2	13	586.0
5/8	11	1163.0
3/4	10	2076.0

6. If the fan wheel is fastened with a taper-lock bushing and the wheel must be shifted, follow this procedure:

- a. Remove all bolts from the bushings.
- b. Insert two bolts in the threaded holes in the bushing. (Note that one bolt is left over and not used in the demounting.)
- c. Tighten bolts alternately until bushing is loosened in hub. If bushing does not loosen immediately, lightly tap hub while applying torque to the bolts.

To reinstall the taper-lock bushing in the wheel hub, insert the three mounting bolts through the unthreaded bushing holes into the hub. Alternately tighten the bolts. When tightening, the bolts should be turned down equally to the Initial Torque requirement given below. Then tighten the bolts progressively one-half turn per bolt to the Second Torque setting. Finally, the bolts should be tightened in small increments to the Final Torque settings.

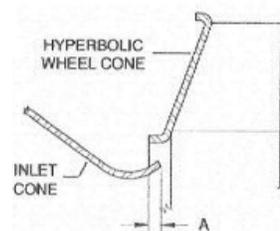
Size Bushing	Initial Torque*		Second Torque*		Final Torque*	
	Alum.	Steel	Alum.	Steel	Alum.	Steel
Q & R	57	120	108	240	228	348
P	36	84	72	132	132	192

\*Torque values shown are inch lbs. and apply when both components are either aluminum or steel. If either component is aluminum, use values for aluminum. Values for steel are for Grade 5 hardware.

Check bushing to verify type or refer to bushing box sent with the fan.

7. Check the motor wiring and fusing in accordance with the National Electrical Code and local requirements. Follow wiring diagram on the motor nameplates.
8. Chicago Blower requires that all appurtenances, including ductwork or stacks, which are attached to the fan inlet and/or outlet, be independently supported, unless prior approval has been obtained from Chicago Blower. Excess dead loads or wind loads can distort the fan housing causing misalignment and possible failure. Flexible connections are also necessary to prevent duct expansion or movement from adding loads to the fan.
9. Chicago Blower recommends the use of caulk or gasket when mounting appurtenances to the inlet or outlet flanges to minimize leakage.

WHEEL and INLET CONE OVERLAP VALUES  
DESIGNS 36 and 51



Fan Design D/36 Sizes	Fan Design D/51 Sizes	Overlap A (In.)
8 3/4	100	3/8
10	122	3/8
12 1/4	135	3/16
13 1/2	150	1/4
15	165	1/4
16 1/2	182	5/16
18 1/4	200	3/8
20	222	7/16
22 1/4	245	1/2
24 1/2	270	9/16
27	300	11/16
30	330	13/16
33	365	1
36 1/2	402	1 1/32
40 1/4	445	1 1/32
44 1/2	490	1 11/32

## BEARING LUBRICATION

AMBIENT CONDITIONS		OPERATING CONDITIONS		BEARING OPERATING TEMPERATURE (°F)		SUGGESTED GREASING INTERVAL**	USE THESE GREASES or EQUIVALENT
Dirt	Moisture	Load	Speed	Low	High		
Clean	Dry	Light to Medium	Slow to Medium	0	120	2 to 6 Months	High quality NLGI #1 or #2 multi-purpose bearing greases are generally satisfactory. Consultation with a reputable lubricant supplier is recommended.
				120	200	1 to 2 Months	
Moderate to Dirty	Dry	Light to Medium	Slow to Medium	0	120	1 to 4 Weeks	
				120	200	1 to 7 Days	
Extreme Dirt	Dry	Light to Medium	Slow to Medium	0	200	Daily - Flushing Out Dirt	
	High Humidity - Direct Water Splash*	Light to Heavy	Slow to Medium	32	200	1 to 4 Weeks - Grease at Shutdown	
		Heavy to Very Heavy	Slow	0	200	1 to 8 Weeks	Shell Oil Company, Gadus S2 V220
				- 20	120	1 to 8 Weeks	Mobil Oil Corporation, Mobiltemp 78
		Light	High Speed	100	200	1 to 8 Weeks	Amoco, Rykon No. 2 Texaco Inc., Premium RB 2
	Possible Frost	Light to Heavy	Slow to Medium	- 65	250	1 to 4 Weeks - Grease at Shutdown	Mobil Oil Corporation, Mobiltemp SHC32 Texaco Inc., 2346EP Low Temp Shell Oil Company, Aeroshell 7A
Clean to Moderate	Dry	Light to Medium	Slow to Medium	80	250	1 to 8 Weeks	Union Oil Company, Unoba EP2 Mobil Oil Corporation Mobiltemp 78
Clean to Dirty	Dry	Light	Slow	80	300	1 to 4 Weeks	Keystone Lubricants Company, No. 89 Dow Chemical Company, DC44

\* Additional bearing protection or special sealing may be required.

\*\* Suggested starting interval for maintenance program. Check grease condition for oiliness and dirt and adjust greasing frequency accordingly. Watch operating temperatures. Sudden rises may show need for grease or indicate over lubrication on higher speed applications.

Chicago Blower Corporation cannot be held responsible for performance of individual batches of grease. Changes in lubricant specifications, performance, and lubricant guarantees are the responsibility of the lubricant manufacturer.

## FAN BEARINGS:

1. Units are prelubricated with lithium base NLGI #2 grade grease, but make sure they have adequate grease. As a precaution, if equipment is to be built and left idle for any period of time prior to actual use, the units should be filled 100% full to provide maximum protection from corrosion, etc. The suggested relubrication schedule on the following page is a general guide.

The specific conditions on an application such as exact hours of operation, temperature, moisture, speed and dirt govern the required lubrication cycle. This can be determined by inspection of the flushed out lubricant during a trial period of operation. Add grease slowly. Use a sufficient volume to purge bearing seals of old lubricant. It is preferable to rotate bearings during relubrication where good safety practice permits.

**Inspect bearing installations at least every six months. Any unusual noise or vibration change should be immediately investigated.**

2. Bearing must be properly locked to the shaft. Check before operation. Make sure bearing locking collar is in position and set screws are tightened to the bearing manufacturer's recommended torque levels. See bearing manufacturer's instructions enclosed for details. The bearing set screws should be re-torqued after eight and twenty-four hours of operation.

### VERTICAL OPERATION:

If the fan is to operate with its shaft vertical, reset the bearings as follows

- With the shaft vertical, unlock the drive end bearing set screws and turn the shaft by hand. This allows the wheel end bearing to take the gravity load of the shaft and wheel.
- Re-lock the drive end bearing locking device and replace and torque set screws as required by the bearing manufacturer's instructions so that this bearing now takes only the belt pull.

## FANS WITH COUPLINGS:

On any completely assembled fan, where CBC has mounted the motor and coupling, it is required that the alignment be rechecked after the fan is set on its permanent foundation. It is not possible to hold alignment during shipment or when set on a different foundation. Coupling must be realigned and lubricated per manufacturer's instructions sent with the fan.

## V-BELT DRIVES:

- Alignment of the drives must be checked with a straightedge or string. Belt tension must be properly adjusted to assure good belt and bearing life. Sheave faces should be parallel and aligned within 1/16". **Use balanced sheaves.**
- With all belts in their proper grooves, adjust the centers to take up all slack and until the belts are fairly taut.
- It is normal on v-belt drives handling more than 20 HP to "squeal" on start-up. **Do not tighten belts too tight.** Normal belt tension can be determined by being able to depress belt, at mid-point a distance equal to one belt width, with normal finger pressure.
- After a few days of operation the belts will seat themselves in the sheave grooves and it may become necessary to readjust so that the drive again shows a slight "bow" in the slack side. The drive is now properly tensioned and should operate satisfactorily with only an occasional readjustment to compensate for belt and groove wear.

## OPERATION OF FAN:

After installing the fan per these instructions and the instructions of the manufacturers, make final safety checks to prevent injury to personnel or damage to the equipment. **Always block rotating parts to prevent windmilling while inspecting the fan.**

1. Lock power source in "OFF" position.
2. Check bearings for alignment and proper lubrication, with wheel and inside of the housing clean and free of debris.
3. Check wheel position for proper clearance and rotation. Unblock rotating parts and turn wheel by hand to insure that it rotates freely.
4. Check sheave set screws or bushings and wheel set screws for tightness. If fan is a HEAT FAN, check to see that the shaft cooling wheel bolts are tight. Check foundation bolts. Secure safety guards and access doors.
5. If fan is designed for low density (such as high temp), make sure overload of fan motor is avoided if fan is run with standard air.
6. Start fan and allow unit to reach full speed, then shut down. During this short period, check for rotation, excessive vibration, any unusual noise, or overheating of the motor. Check the motor amps drawn against the nameplate rating. A plate over the fan inlet will limit the horsepower drawn during a test run with limited ductwork.
7. After the trial run lock the power "OFF".
8. Recheck for tightness of hold-down bolts, wheel set screws and keys, and re-tighten if necessary. Recheck after eight and twenty four hours of operation.
9. The run-in period should be at least eight hours. Check bearings a minimum of once each hour during this period. Over-greasing may cause bearings to heat up. There need be no concern if the bare hand can be held on the bearings briefly. Bearings will vent extra grease and cool down after start-up. Recheck torque of all bearing set screws after eight and twenty four hours of operation to ensure levels are maintained per the bearing manufacturer's recommended levels.

### 10. Bearing Vibration Limits: Running fan(s) with high vibration could result in personal injury or property damage.

Vibration amplitudes shown are peak velocity, inches/sec and are measured in all three planes on bearing housings or the motor bearings if the fan wheel is mounted directly on the motor shaft; vertical, horizontal and axial. See Bearing Vibration Severity Chart.

Alarm values are a warning that vibration must be corrected at the **earliest possible moment (short term hours)**. **Long term operation, at or exceeding ALARM values, greatly reduces rotor and bearing life/hours and voids the Chicago Blower warranty.**

SHUT-DOWN limit signals hazardous operation and requires immediate repair. Operation at this limit voids the Chicago Blower warranty and could result in injury or property damage.

## BEARING VIBRATION SEVERITY CHART

Application	AMCA Fan Category	ISO 1940 Standard	ANSI/AMCA Standard 204-205 Vibration Limits (in/sec)			
		Balance Grade	Factory Tested	Field Startup	Field Alarm	Field Shutdown
Industrial Process, Power Generation	BV-3	G6.3	.15	.25	.40	.50
Petrochemical Process	BV-4	G2.5	.10	.16	.25	.40

### NOTES:

1. CBC Standard is BV-3 and a Balance Grade of G6.3
2. Balance Grade of G2.5 is available at additional cost.
3. Vibration Limits are for a fully assembled fan, rigidly mounted.
4. Factory tested values are peak velocity, filter in, at operating speed. All others are filter out.
5. Field vibration level of a fan is not solely dependent upon the balance grade. Installation factors and the mass and stiffness of the supporting system will influence the field vibration level. Therefore, field vibration is not the responsibility of the fan manufacturer.

**Warranty:** The warranty on Chicago Blower fans is our standard warranty. The warranty on the motor is that extended by the motor manufacturer.

## MAINTENANCE:

To insure long life and trouble-free service, frequently check all bearing lubrication. See the bearing manufacturer's instructions packed with the fan. Should excessive vibration develop, check the following possibilities:

1. Build-up of dirt or foreign material on the wheel.
2. Loose bolts on bearings, housings, foundation and drive.
- 3a. **If the fan is belt driven**  
V-belt drive improperly aligned. Belts must have proper tension, sheaves must be balanced.
- 3b. **If the fan is directly driven**  
Coupling may be improperly aligned.
4. Check wheel set screws or bushing cap screws.
5. Foreign matter may have entered fan causing damage to wheel, shaft or bearings.
6. Fan support improperly shimmed to foundation.
7. Vibration may be coming from a source other than the fan. Stop the fan and determine if the vibration still exists. Disconnect the driver from the fan and operate it by itself to determine if it produces vibration.
8. Improper clearance between the wheel and the inlet cone.

A preventive maintenance schedule is a necessity for extending fan life. Establish a lubrication schedule based on time periods suggested in lubrication instructions and by motor and bearing manufacturers.

After approximately one (1) month of operation, all base, hub, bearing, pedestal, etc. bolts should be checked.

Potentially damaging conditions are often signaled in advance by change in vibration and sound. A simple, regular audio-visual inspection of fan operation leads to correction of the condition before expensive damage occurs. Vibration levels should be checked by an approved technician using electronic balancing equipment.

If air handled by the fan contains corrosive, erosive or sticky materials, fan should be shut down regularly for inspection, cleaning and reconditioning of interior parts.

If the fan is to remain idle for an extended period, fill bearing with grease. Protect motor and exposed surfaces. Follow the motor manufacturer's recommendations for storage and rotate the shaft by hand several revolutions each month.

**Mechanical Integrity:** Certain operating conditions reduce the built-in strength in the fan impeller and may cause unsafe operation. It is the user's responsibility to inspect for these conditions as frequently as necessary and make corrections as required. Failure to comply with the following limits voids the Chicago Blower Corporation warranty.

**Maximum Safe Speed and Temperature:** Operation exceeding maximum safe RPM and temperature even for a short time causes over-stressing or fatigue cracking of the impeller resulting in unsafe condition. Maximum safe speed and maximum safe temperature are shown on fan.

**NOTE: For High Temperature Applications - fan should not be shut off until the airstream temperature is below 200°F.**