CHICAGO BLOWER CORPORATION

SAFETY - INSTALLATION - OPERATING AND MAINTENANCE INSTRUCTIONS

FAN KIT COMPONENTS

Design 62 – Design 41
Design 1900 Series PFD

- WHEELS
- INLET CONES
- HOUSINGS
- SHAFTS
- INLET VOLUME CONTROL DAMPER
- BEARINGS
- COOLING WHEELS

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 the purchaser must make any claim against the carrier. 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 replacement parts or arrange with the Chicago Blower Corporation service department for return of the equipment to the factory for repair.

HANDLING:

Chicago Blower components are shipped boxed or skidded and should be handled and moved using good rigging techniques, being careful to avoid concentrated forces that distort or bend any of the parts. Partial or disassembled units require special handling. All parts should be handled in a manner which protects the parts and their coating from damage.

If the shaft and wheel is shipped as an assembly it can be lifted using a hoist and a spreader with a sling around shaft at points nearest the wheel. Take special care not to scratch the shaft where the bearings or wheel will be mounted. Never lift the wheel/shaft assembly by the wheel. Always support the assembly by the shaft when lifting or storing. Do not support the shaft or wheel on the housing sides. Use only the key provided with the shaft and wheel.

Slings running through the blades and around the hub can lift wheels shipped separately. Never lift the wheel by blades of flanges alone. Always transport wheels by lifting. Do not roll the wheel as this can damage coatings and affect the balance of the wheel.

Bent shafting can be a source of vibration and bearing failure, so handle the shaft with care.

STORAGE:

If the fan kit installation is to be delayed, store the parts in a dry protected area. Protect the parts, especially the kit and motor bearings, from moisture and vibration. Protect all machined surfaces such as the bore of a wheel hub, bushings, shafts, and couplings. Keep the bearings fully greased by filling monthly with a grease compatible to that originally supplied. Contact Chicago Blower for extended storage instructions.

an ISO 9001 Company
CHICAGO BLOWER CORPORATION

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Bulletin IMI - FK 6/11

SAFETY PRECAUTIONS:

The fan kit, 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 these fan kits, or those who will perform maintenance thereon, must be given this manual to read and warned of the potential hazards of this equipment.

This bulletin contains general recommendations, but specific requirements may apply to given 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.

HOUSINGS:

Housing stiffeners or frame should provide rigidity and support to the housing. Housings are often supplied less stiffeners to provide flexibility for various installations. See Fan Kit Bulletins –SAF (single width), -DAF (double width), or –PFD as required for recommended bracing schedule. Additional support may also be required. Supports should not restrict air flow to the inlet or discharge of the fa

WHEEL DESIGN NOTE:

Many airfoil wheels supplied by Chicago Blower have weep holes supplied as standard. The weep holes are small diameter holes located on the top skin of the blade near the trailing edge or integrally formed into the blade. Weep holes are designed to allow condensation, which can accumulate within an airfoil blade when at rest, to be expelled when the wheel is running. When the wheel is running centrifugal forces of the rotating wheel force the condensation out the weep hole. Without the weep holes the condensation can adversely affect the balance integrity of the wheel. This condensation phenomenon typically occurs in applications where the system conditions i.e. temperature or density varies from that of the ambient surroundings. If high humidity is involved in your application contact Chicago Blower for recommendations.

BALANCE:

All Chicago Blower wheels are precision balanced at the factory to ISO 1940/ANSI S2.19 Quality Grade G6.3 or better; however, when a precision balanced wheel is installed onto a shaft, there are many other aspects to consider before the system will run with minimal vibration. Some of these include, but are not limited to, fit-up the wheel hub to the shaft, especially if bushings are used, residual imbalance of a motor, residual imbalance of the sheaves used for belt drive, soft foot on the motor caused by improper shimming of the fan bearings, alignment of the shaft coupling, and alignment of the fan bearings. With all of these items playing a part in the overall vibration of the assembly, it may seem daunting to commission a system with low vibration and minimal maintenance that will operate for years.

To minimize system vibration the wheel must be “phase balanced” to the rest of the components in the rotating system. What is phase balance? Phase balance is performing a touch up or trim balance to any component of the rotating system including the wheel. Depending on whether the wheel or other rotating component has one or two planes, phase balance can be carried out in either single plane or two plane mode. Also, a phase balance does not mean that the wheel itself is out of balance; rather, phase balance of an otherwise perfectly balanced wheel is usually easiest because it is typically the largest and heaviest rotating element of the system. It is easier to apply the correction weights to the outer diameter of the wheel to compensate for the imbalance of the rotating system. There are times where the imbalance of the system is minimal and no phase balance is required for smooth operation.

Once the wheel has been phase balanced to the rotating system, the wheel must be visually inspected periodically for any signs of wear or material build up that can cause imbalance. In material handling systems, even a small amount of material that has eroded or corroded the wheel can affect the balance of that wheel. If this were to happen, the wheel would have to be phase balanced to the rotating system again to correct the balance for the missing material. Eventually, eroded or corroded wheels will not be able to be rebalanced and will need to be replaced entirely to avoid total failure. In addition, rotating systems that handle clean air can also have eventual balance problems if not watched closely. Fine dirt and dust can build up on the wheel blades causing imbalance again. Occasionally, the wheel must be cleaned to restore the balance.

It is also recommended that vibration checks be conducted on the fan and motor bearings. Fans that have been tested for vibration with phase balanced wheels normally run smoothly at first and over time begin to show signs of increasing vibration levels. Steadily increasing vibration levels are indicators that the wheel or other rotating element has gone out of balance for the reasons stated above, or the bearings have begun to wear and will need to be replaced.

FAN KIT ASSEMBLY and INSTALLATION:

Fan Kit components are available separately or in virtually any combination including wheel, inlet cone, inlet volume control damper, housing, shaft, bearings and cooling wheel. Housings are to be mounted so the inlets are free from obstructions and should be centered within enclosures for double inlet fans. Bearing pedestals are to be installed so that the bearings can be shimmed for proper centerline height.

If mounting within an oven or enclosure, provide an opening in the wall for shaft to pass through. Additional space at wall may be required when installing a cooling wheel and cone. Installation of a cooler cone may also require the use of a cylindrical section to retain insulation and maintain proper depth of over wall.

1. Move components to the final mounting location. Be sure to follow the handling instructions given above.
2. Remove skid, crates, and packaging.
3. Move lower housing/supports to mounting location.
4. Level and shim if required. Do not distort or twist the equipment. Bolt into place.
5. If bearing support is separate from housing:
   a. Set bearing pedestal on bolts.
   b. Never distort bearing pedestal by forcing into position espcially if mounting to a non-level surface. Shim under pedestal as required.
   c. Check bearing centerline height. Adjust centerline height to match centerline of housing. High temperature applications may require the housing centerline to set lower when cold so that it will be centered when hot due to thermal expansion.
   d. Measure from housing to bearing pedestal to bring into square with housing.
   e. Bolt into position.
6. Shaft and wheel assembly
   a. Clean protective coating off shaft with solvent. Do not touch clean areas of shaft with hands. Perspiration or oils from hands can cause rust or pitting over time.
   b. Remove keys from shaft.
   c. Clean inside of bore. Bores may have paint overspray and dirt from shipment which must be removed prior to mounting the wheel and/or bushing. Make sure hub set screws or bushing mounting bolts are loosened as to not interfere when inserting shaft into bore.
7. Continue to 8, 9 or 10 based on arrangement.
8. Arrangements 1, 8 or 9
   a. Insert shaft into wheel from back side of wheel.
   b. Typically shaft should protrude out face of hub approximately 1-1/2". Put key into keyway and lightly tighten wheel set screws. Do not torque set screws at this time.
   c. Install bearings onto shaft. Do not tighten bearing set screws at

this time. The bearing housing should be perpendicular and the bearing base parallel to the axis of the shaft to prevent misalignment loads. Continue to Step 11.

d. Bolt bearings to pedestals. Shaft must be parallel with side of bearing pedestal.

9. Arrangement 3

a. Parts on DIDW unit are assembled in the following order as viewed from opposite drive side: Opposite inlet cone, bearing bar assembly and opposite bearing (housing side),wheel/shaft (housing side), drive inlet cone, drive side bearing bar assembly, drive bearing and sheaves. Mount bearing bar assembly to housing.

Center the wheel in inlet cones axially and maintain equal radial clearance between wheel and cones.

b. Parts on SISW are assembled in the following order as viewed from opposite drive side: Bearing bar assembly and opposite bearing (inlet housing side), wheel/shaft (drive housing side), inlet cone, drive side bearing bar assembly, drive bearing and sheaves. Mount bearing bar assembly to housing. Continue to step 11.

c. Bolt bearings to pedestals. Shaft must be parallel with side of bearing pedestal.

10. Arrangement 4

a. Mount and loosely bolt motor on pedestal or structure. Mount wheel on shaft loosely and install inlet cone. Continue to step 12.

11. After aligning and bolting to pedestal, tighten bearing set screws. Make sure bearing locking collar is in position and set screws are tightened to the bearing manufacturer's recommended torque levels indicated by the manufacturer, but recheck. If grease is required, use the grease recommended in bearing instruction manual.

12. Identify the wheel as a straight bore or a bushed bore. See Figure 1 showing both straight and bushed hub types. Position wheel on shaft to properly set the wheel to cone fit (see Figure 2, Wheel to Inlet Cone Overlap). A special non-standard gap may be required for high temperature applications; refer to factory for proper high-temp setting.

13. Tighten/torque all remaining hardware at this time.

14. Check the motor wiring and fusing in accordance with the National Electrical Code and local requirements. Follow wiring diagram on the motor nameplates or conduit boxes.

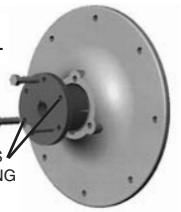
15. Check motor bearing lubrication. Motors were lubricated by the manufacturer, but recheck. If grease is required, use the grease recommended in the motor instruction manual.

Figure 1A

STRAIGHT BORE HUB DETAIL

Figure 1B

TAPER-LOCK BUSHING DETAIL



Straight Bore Assembly

Tighten all set screws over the keyway first, then tighten all set screws which are located 90° to 120° from the keyway. Torque all set screws per the chart.

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

Bushed Bore Assembly

Changing of the busing can adversely affect the balance of a wheel. If the bushing is changed for any reason be sure to recheck balance of the wheel prior to putting the unit back into service.

A. Assembly

Check bushing to verify type or refer to the bushing box shipped with the wheel.

To reinstall the taper-lock bushing in the wheel hub, clean bushing, hub and shaft of all oil, lacquer, grease or dirt. Orient bushing to align the match marks and insert the three mounting bolts through the unthreaded bushing holes into the hub. Alternately tighten the bolts. Do not use oil or other lubricants in bushing or hub.

When tightening, the bolts should be turned down equally to the Initial Torque requirement given below. Then tighten the bolts progressively to the Second Torque setting. Finally, the bolts should be tightened in small increments to the Final Torque settings below.

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.

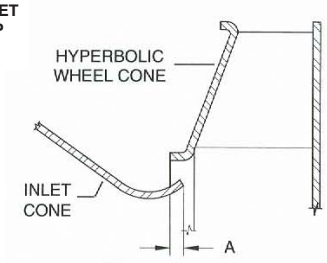
B. Disassembly

1. Match mark the bushing and the hub so they can be reinstalled in exactly the same relative position to insure the balance integrity of the wheel.
2. Remove all bolts from the bushing.
3. Insert two bolts in the threaded holes in the bushing. See bushing/wheel detail in Figure 2b. (Note that one bolt is left over and not used in demounting.)
4. Tighten bolts alternately until bushing is loosened in hub. If the bushing does not loosen immediately, lightly tap hub while applying torque to the bolts.
5. See Step A. above for assembly.

Figure 2

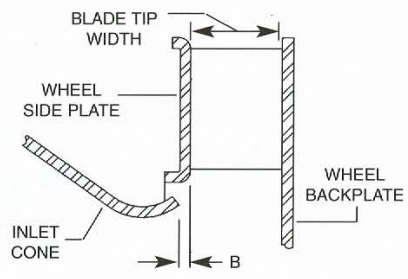
WHEEL and INLET CONE OVERLAP VALUES

DESIGNS 41 and 62



Fan Design D/62 Size	Fan Design D/41 Size	Overlap A (In.)
100	875	3/8
122	1000	3/8
135	1225	3/16
150	1350	1/4
165	1500	1/4
182	1650	5/16
200	1825	3/8
222	2000	7/16
245	2225	1/2
270	2450	9/16
300	2700	11/16
330	3000	13/16
365	3300	1
402	3650	1-1/32
445	4025	1-1/32
490	4450	1-11/32

DESIGN 1900 SERIES PFD



PFD Fan Size	Overlap B (In.)
2000	23/64
2214	25/64
2412	7/16
2700	35/64
3000	3/8
3300	11/32
3612	3/8
4014	3/8
4412	15/32

Add "B" to the measured blade tip width for proper set-up of inlet cone to inside of backplate.

FAN BEARINGS:

1. Lubricate fan bearings per instructions in packet attached to the fan. Use a premium quality NLG#1 or 2 grade multi-purpose grease, such as Shell Alvania Grease 2. Lubricate bearings immediately on receipt. Add enough grease to cause slight purge at seals. It is common for bearings to purge excessive grease during first 24 to 48 hours of operation. See bearing manufacturer's instructions enclosed for lubrication schedule.

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.

3. **Vertical Operation:** If the fan is to operate with its shaft vertical, reset the fan bearings as follows:

a. 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.

b. 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.

4. Do not use "high temp" greases. Many are not formulated for the high speeds associated with fan bearings.

HOUSINGS:

Housing stiffeners or frame should provide rigidity and support to the housing. Housings are often supplied less stiffeners to provide flexibility for various installations. See Fan Kit Bulletins –SAF (single width), -DAF (double width), or –PFD as required for recommended bracing schedule. Additional support may also be required. Supports should not restrict air flow to the inlet or discharge of the fan.

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 wheel set screws or bushing for tightness. If fan will see high temperatures, check to see that the shaft cooling wheel bolts are tight. Check foundation bolts. Secure safety guards and access doors.

5. 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.

6. After the trail run lock the power "OFF".

7. Recheck for tightness of hold-down bolts, wheel set screws andkeys, and retighten if necessary. Recheck after eight and twenty-four hours of operation.

8. The run-in period should be at least eight hours. Check bearings a minimum of once each hour during this period. Overgreasing 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 insure levels are maintained per the bearing manufacturer's recommended levels.

9. Take vibration readings at the bearings, or the motor bearings if the fan wheel is mounted directly on the motor shaft. Adhere to these limits. Velocity Limits in inches/second filter in – Normal: 0.15; Alarm: 0.22, Shutdown: 0.50.

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.

3. V-belt drives improperly aligned. Belts must have proper tension, sheaves must be balanced.

4. Check wheel set screws

5. Foreign matter may have entered fan causing damage to wheel, shaft or bearings.

6. Vibration may be coming from a source other than the fan. Stop the fan and determine if the vibration still exists. Disconnect driver from the fan and operate it by itself to determine if it produces vibration.

7. Proper clearance between the wheel and the inlet.

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 to 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 temperarture even for a short time causes overstressing or fatique cracking of the impeller, resulting in unsafe condition. Maximum safe speed and maximum safe temprature are shown on fan assembly drawings, catalogs or order acknowledgement.

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

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