

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Model CSB Centrifugal Single Width Blower

The single-width centrifugal blower is designed for supply, exhaust or return air installations. Performance capabilities range up to 17,000 cmh and up to 5.8 in. wg. of static pressure.

CSB fans are available in 8 sizes with wheel diameters ranging from 315 - 710 mm. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.



General Safety Information

Only qualified personnel should install this unit. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than the maximum cataloged fan RPM. Adjustments to fan speed with Variable Frequency Drives (VFD) may affect motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER

Always disconnect power before working on or near a unit. Lock and tag the disconnect switch or breaker to prevent accidental power up.

CAUTION

When servicing the unit, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Fans are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the fan to resist corrosion. Fans should never be lifted by the shaft, fan housing, motor, belt guard, windband or accessories.

Storage

- Rotate fan wheel monthly and purge bearings once every three months
- Energize fan motor once every three months
- Store belts flat to keep them from warping and stretching
- Store unit in a location which does not have vibration
- After storage period, purge grease before putting fan into service.

If storage of fan is in a humid, dusty or corrosive atmosphere, rotate the fan and purge the bearings once a month. Improper storage which results in damage to the fan will void the warranty.

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

INDOOR - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures

should be evenly maintained between 30° to 110°F (-1° to 43°C), wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to remove any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ inches (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

OUTDOOR - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant in motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing from Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Prior to assembly and installation of the unit and system components, inspect the fan assembly to make sure it is in working order.

1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel by hand and assure no parts are rubbing.
3. Ensure wheel backplate is equidistant from inlet cone ID on both sides (in case of double-wide wheel) for proper wheel centering.

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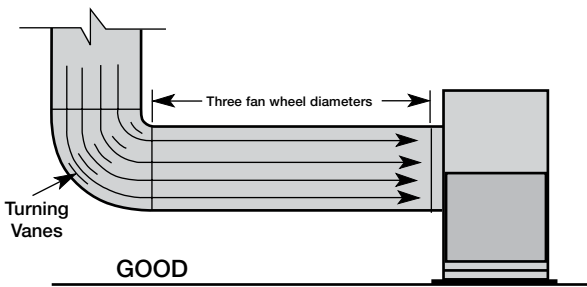
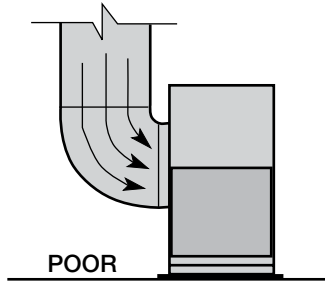
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System Set-Up

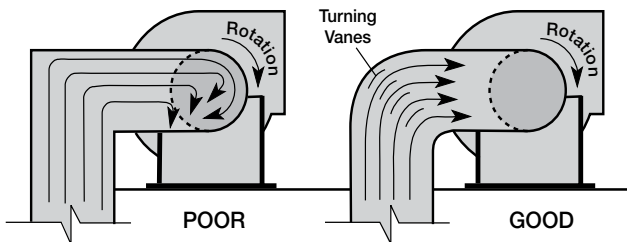
Installations with inlet or discharge configurations that deviate from this manual may result in reduced fan performance. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel, yielding large system losses, increased sound levels and structural failure of the fan wheel. Free turbulent flow in the discharge ductwork will also result in system effect losses. Refer to the following diagrams for the most efficient installation conditions.

Ducted Inlet Installations

Inlet Duct Turns - Installation of a duct turn or elbow too close to the fan inlet reduces fan performance because air is loaded unevenly into the fan wheel. To achieve full fan performance, there should be at least three fan wheel diameters between the turn or elbow and the fan inlet.



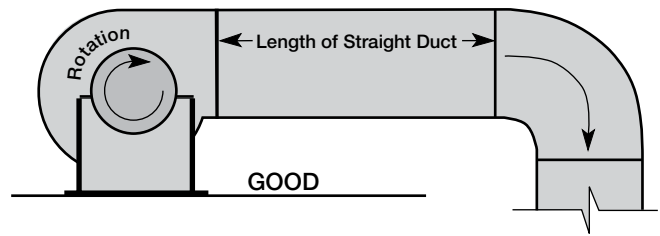
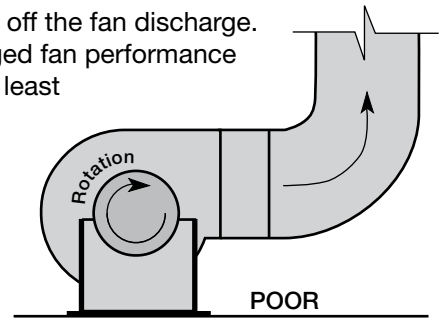
Inlet Spin - Inlet spin is a frequent cause of reduced fan performance. The change in fan performance is a function of the intensity of spin and not easily defined. The best solution is proper duct design and airflow patterns. Turning vanes reduce the effects of inlet spin.



Ducted Outlet Installations

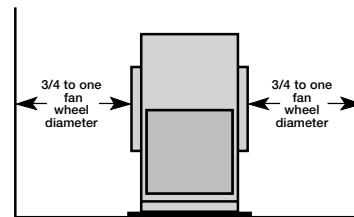
Discharge Duct Turns - Duct turns located near the fan discharge should always be in the direction of the fan rotation.

Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance there should be at least three equivalent duct diameters of straight ductwork between the fan discharge and any duct turns.

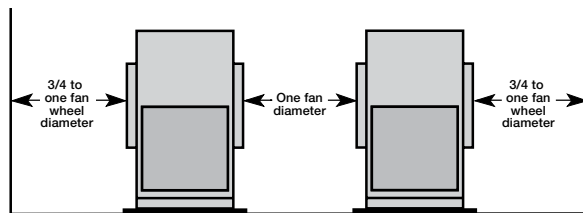


Non-Ducted Installations

Inlet Clearance - Installation of a fan with an open inlet too close to a wall or bulkhead will cause reduced fan performance. It is desirable to have a minimum of three-fourths of a wheel diameter between the fan inlet and the wall.

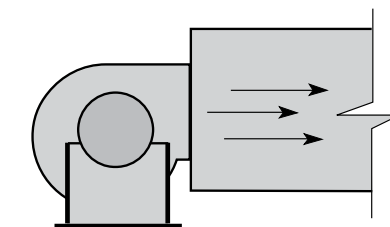


Single Fan Installation



Parallel Fan Installation

Free Discharge - Free or abrupt discharge into a plenum results in a reduction in fan performance. The effect of discharge static regain is not realized.

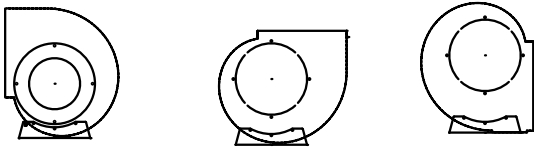


Installation

Move the fan to the desired location. Check and tighten fasteners throughout the unit and then fasten securely through mounting holes provided in the base angles. The unit must be set level (shimming may be necessary). Flexible duct connections and vibration isolators should be used where noise is a factor.

The motor voltage and ampere rating must be checked for compatibility with the electrical supply prior to final electrical connection. Supply wiring to the fan must be properly fused, and conform to local and national electrical codes.

Discharge Positions



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UB

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The discharge is factory set as specified by customer order, however, certain sizes can be rotated to other discharge positions in the field if necessary. If rotating the fan housing, accommodations may need to be made for the fan to drain properly. Removal of the housing bolts allows the discharge to be rotated to the clockwise positions above. For DB discharge position, a portion of the frame angle must be removed.

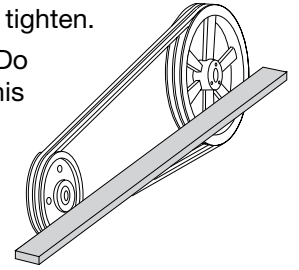
Fan rotation is always specified from the drive side of the housing.

Method for Centering Wheel

On belt drive units, centering can be accomplished by (a) loosening the inlet cone bolts to move the inlet cone or by (b) loosening the bearings in order to move the shaft. Wheel and inlet cone overlap can be adjusted by loosening the wheel hub set screws and moving the wheel to the desired position. Tighten all fasteners and set screws securely and realign drive pulleys after adjustment.

V-Belt Drive Installation

1. Remove the protective coating from the end of the fan shaft using mineral spirits or another similar solvent. Check to ensure that the shaft is free of nicks and burrs.
2. Slide sheaves on shafts. Do not drive sheaves on as this may result in bearing damage.
3. Align fan and motor sheaves with a straight edge or string and tighten.
4. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.
5. Adjust the tension until the belts appear snug. Run the unit for a few minutes and allow the belts to “set” properly.
6. With the fan off and disconnect locked out, adjust the belt tension by moving the motor pivot plate. When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.



Aligning Sheaves with a Straight Edge

Alignment of Pulleys and Belts

Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line as shown in Figure 1.

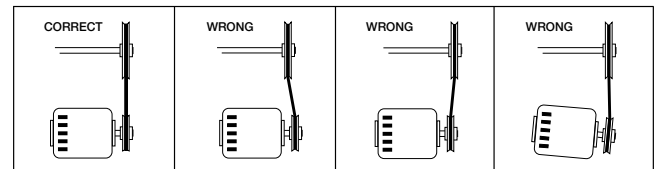


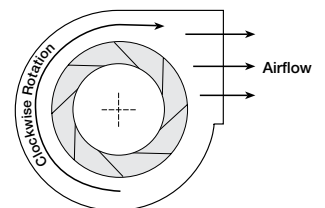
Figure 1

To avoid motor overheating and possible burnout, motor load amperes should always be checked and compared to nameplate rating when fan speed is increased.

Wheel Rotation

Rotation direction of the wheel is critical. Incorrect rotation will result in reduced air performance, increased motor loading and possible motor burnout.

Check wheel rotation by momentarily energizing the unit and noting if rotation is in the same direction as the airflow at the outlet and conforms to the rotation decal affixed to the unit.



Wheels as viewed from the drive side:

Centrifugal Backward Inclined

Unit Start-Up

WARNING

Disconnect and secure to the **OFF** position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

Visual Inspection of Equipment

The equipment type and arrangement should be verified as ordered at once when it arrives at the job site. When a discrepancy is found, the local representative must be notified immediately so that corrective action may be investigated, also verify electrical conformance to specifications. Unauthorized alterations and unauthorized backcharges will not be recognized by the fan manufacturer.

After the unit has been assembled, installed and all utilities have been hooked up, the unit is now ready for operation.

Check

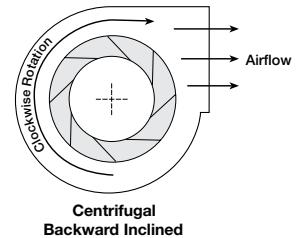
Before starting the unit, check the following:

1. Disconnect and lock-out all power switches to fan.
2. Check all fasteners, set screws and locking collars on the fan, bearings, drive, and accessories for tightness.
3. Rotate the fan wheel by hand and assure no parts are rubbing.
4. Check for bearing alignment and lubrication.
5. Check the V-belt drive for proper alignment and tension.
6. Check all guarding (if supplied) for being securely attached and not interfering with rotating parts.
7. Check operation of variable inlet vanes or discharge dampers (if supplied) for freedom of movement.
8. Check all electrical connections for proper attachment.
9. Check housing and ductwork, if accessible, for obstructions and foreign material that may damage the fan wheel.

Additional Steps for Initial Start-Up

1. Check for proper wheel rotation by momentarily energizing the fan. Access to view the wheel can be gained through the blower housing access panel.

One of the most frequently encountered problems are motors that are wired to rotate the wheel in the wrong direction. This is especially true with 3-phase installations where the motor will run in either direction, depending on how it has been wired. To reverse rotation of a 3-phase motor, interchange any two of the three electrical leads. Single phase motors can be reversed by changing internal connections as described on the motor label or wiring diagram.



2. Fans with multi-speed motors should be checked on low speed during initial start-up.
3. Check for unusual noise, vibration or overheating of bearings. Refer to the "Troubleshooting" section of this manual if a problem develops.
4. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature for the type of bearing used on this product.

Vibration

On start-up and during operation, the unit should operate smoothly with minimal vibration. It is possible that a higher degree of vibration may be experienced. Excessive vibration if left unchecked, can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed.

Common Sources of Vibration

1. Wheel Unbalance
2. Drive Pulley Misalignment
3. Incorrect Belt Tension
4. Bearing Misalignment
5. Mechanical Looseness
6. Faulty Belts
7. Drive Component Unbalance
8. Poor Inlet/Outlet Conditions
9. Foundation Stiffness

Many of these conditions can be discovered by careful observation. Refer to the troubleshooting section of this manual for corrective actions. If observation cannot locate the source of

vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done through the access panel located on the side of each fan's tubular housing. Any correction weights added to the wheel should be welded to either the wheel back (single-plane balance) or to the wheel back and wheel cone (two-plane balance).

Routine Maintenance and Operation

CAUTION

When performing any service to the fan, disconnect the electrical supply and secure fan impeller.

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of bearings and motor.
2. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.
3. Any dirt accumulation on the wheel or in the housing should be removed to prevent unbalance and possible damage.
4. Inspect fan impeller and housing looking for fatigue, corrosion, or wear.

Fan Operation

All fans should be run every thirty (30) days, or at least “bumped” every thirty days. It is preferred that each fan is run as this causes all electrical and mechanical components to get up to temperature, displacing any formed condensation, redistributes load on bearings, and redistributes grease in the bearings (motor and shaft bearings).

CAUTION

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult manufacturer to determine if the unit can operate safely at the new condition.

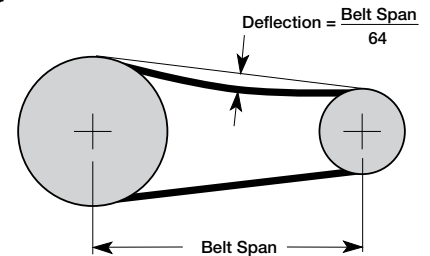
Belt Drive Maintenance

V-belt drives must be checked on a regular basis for wear, tension, alignment and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage and overheated sheaves. Either excessively loose or tight belts may cause fan vibration.

When replacing V-belts on multiple groove drives all belts should be changed to provide uniform drive loading. Use a set of matched belts whenever possible. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, ensure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. Belts are adjusted by raising or lowering the motor pivot plate. For initial tensioning, the proper belt deflection halfway between sheave centers is 1/64-inch for each inch of belt span.



For more information about measuring belt tension, refer to Greenheck's Product Application Guide, FA/127-11, Measuring Belt Tension, found online at www.greenheck.com in the library section.

Check belt tension two times during the first 24 hours of operation and periodically thereafter.

Bearing Lubrication Schedule

Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. See the recommended bearing lubrication schedule below.

Recommended Bearing Lubrication Schedule Relubrication Schedule in Months					
Standard Grease					
Fan RPM	Bearing Bore (mm)				
	20 - 25	30 - 35	40 - 45	50 - 55	60 - 65
To 250	12	12	12	12	12
500	12	12	11	10	8
750	12	9	8	7	6
1000	12	7	6	5	4
1250	12	6	5	4	
1500	12	5	4	3	
2000	12	3	3	2	
2500	12	2	2		
3000	12	2			
3500	12				
4000	12				
5000	12				
Replenishing Quantity (gms)	2.5	4.5	6	8	10.5

- Lubrication interval is based on 12 hour per day operation and maximum 80°C housing temperature. For 24 hour per day operation, the interval should be cut in half.
- Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated in chart for bore size.
- For conditions including high temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Factory recommends VT307 lubricant.

In addition to lubricating the bearings at specified intervals, adapter sleeves and locking collar should be checked for tightness. A bearing collar which has loosened will cause premature failure of the fan shaft. Fasteners attaching the bearings to the drive frame should also be checked.

Wheel and Fastener Maintenance

Wheels require very little attention when exhausting clean air, however, air heavily laden with grease or dirt will tend to accumulate on the wheel causing unbalance. Wheels exhausting dirty or grease-laden air require frequent cleaning to assure smooth and safe operation.

All fasteners, including set screws in the bearing collars, should be checked for tightness each time maintenance checks are performed.

A proper maintenance program will help preserve the performance and reliability designed into the fan.

Bearing Replacement

The intent of this procedure is to allow a field service technician to replace bearings with the fan remaining in place in its intended application. All work can be conducted by accessing the bearings by either removing a shaft guard, a weatherhood or working under a weatherhood (if applicable). This is dependent on the size of the unit. This procedure assumes the power source has been locked out prior to removing guards and covers, belts and pulleys have been loosened and removed properly and extended lubrication lines have been disconnected at the bearing. In some cases, it may be necessary to remove the fan inlet cone and wheel if the bearings cannot be removed due to corrosion or damage.

Bearing Removal

This procedure assumes proper safety measures have been taken.

- Read and follow all instructions carefully.
 - Disconnect and lockout power before installation and maintenance.
 - Driven sheaves and belts have already been removed.
 - **Arr. 3 fans (if applicable)** will need the inlet ducting removed to access the non-drive bearing removal.
 - Shaft black coating can be removed with a solvent similar to a brake/carburetor cleaner.
1. Scribe a line around the shaft by both bearings and around the bearing base to the bearing support or write down the measurement from the end of the shaft to the bearings. This will help in repositioning the new bearing and wheel cone overlap.
 2. Follow the bearing manufacturers' procedures for removal and installation.
 3. Before removing the bearing bolts, make sure the shaft is supported slightly. Remember to consider the wheel weight on the shaft. (Arr. 3 may need the wheel to be suspended through an access door on top of the fan.)
 4. Remove both bearings from the shaft and clean/remove any burrs using an emery cloth or file.
 5. Clean mounting surface of any dirt or grease.

Bearing Installation

1. Before installing, read bearing manufacturers' procedures. Before putting the new bearings on the shaft, you may need to break what is called swivel torque on the bearings (depending on style of bearing). This is done by holding the bearing housing securely and being able to move the inner bearing race around freely.
2. Apply light film of oil on shaft, then gently slide the new bearings onto the shaft.



Do not hammer bearing onto shaft!

3. Align bearings on shaft with the previous scribe marks that are on the shaft and lock bearing to shaft.
4. Put bolts into mounting surface and bearings. Do not tighten.
5. Remove blocks if shaft is supported. (Arr. 3 release the weight of the wheel onto the bearing.)
6. Set bearings on support with the scribed marks locating the bearings. Make sure bearings are square and level with the shaft.
7. Tighten bolts and torque bearing bolts, bearing set screws/locking collars as per bearing manufacturers' procedures.
8. Rotate shaft by hand to help allow the bearings to help set in. Also at this time, listen for any unusual noises such as wheel rubbing on cone and any bearing noise.
9. Connect extended lube lines in new bearings if needed.
10. Reinstall the drive sheaves and belts. Check the belt alignment.
11. Make sure to reinstall all guards and follow proper safety measures before starting up the fan.

Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray.

Greasing of motors is only intended when fittings are provided. Many motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the motor manufacturer's recommendations.

Consult fan manufacturer for instructions on the removal of replacement motors.

It is recommended to select VFD compatible motors for CSB fans and connect the motors through a VFD controller to avoid sudden torque on the impeller, and the belts ensuring soft start and safe operation.

Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see procedure). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance.
Low CFM	Fan	Check wheel for correct rotation.
	Duct System	Higher pressure than design. Filters need replacement.
High CFM	Fan	Decrease fan speed.
	Duct System	Resize ductwork. Access door, filters, dampers not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Remove obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
High Motor Amp Draw	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize ductwork. Check proper operation of isolation and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Bearing	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
Excessive Vibration	Belts	Adjust tightness of belts. Replacement belts should be a matched set.
	System Unbalance	Check alignment of shaft, motor and pulleys. Adjustable pitch pulleys with motors over 15 hp are especially prone to unbalance. Check wheel balance, rebalance if necessary.

* Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in motor failure. Do not exceed the maximum cataloged rpm of the fan.

Maintenance Log

Date _____ Time _____ AM/PM
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Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranty is found in the Model Specification located on greenheck.com.in within the product area tab and in the Technical Data Library.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

