

Installation, Operation and Maintenance Manual

Please read and save these instructions. 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 instructions could result in personal injury and/or property damage! Retain instructions for future reference.



Model TCF
Tubular Centrifugal Inline Fan



Models QEI and QEID
Mixed Flow Inline Fan

General Safety Information

Only qualified personnel should install this fan. 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.

DANGER

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

CAUTION

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

CAUTION

Precaution should be taken in explosive atmospheres.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
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 max cataloged fan rpm. Adjustments to fan speed significantly effects 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.

Receiving

Upon receiving the product check to make sure all items are accounted for by referencing the bill of lading to ensure all items were received. Inspect each crate for shipping damage before accepting delivery. Notify the carrier if any damage is noticed. The carrier will make notification on the delivery receipt acknowledging any damage to the product. All damage should be noted on all the copies of the bill of lading which is countersigned by the delivering carrier. A Carrier Inspection Report should be filled out by the carrier upon arrival and the Traffic Department. If damaged upon arrival, file claim with carrier. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

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

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. The following 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°F (-1°C) and 110°F (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 get rid of 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

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 that 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 that rain water will run off.

The use of a tarp to cover the unit will aid in keeping it clean and dry. Avoid using a black plastic tarp as it will promote condensation.

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 on motor. 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. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or 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 fully assembling and installing the fan and system components, inspect the fan assembly to make sure it is in working order.

1. Check all fasteners, set screws, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel by hand and assure no parts are rubbing. Access to the wheel is obtained through an access panel located on the side of the fan housing.
3. Ensure proper wheel settings for radial gap and alignment. See below.

Radial Gap, Overlap & Alignment

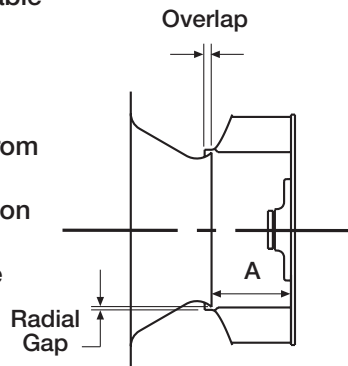
Efficient fan performance can be maintained by having the correct radial gap, overlap and alignment. These items should be checked before start-up and after the fan has been in operation for 24 hours.

TCF Radial Gap

Radial gap is adjusted by loosening the inlet cone bolts and centering the cone on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering wheel is acceptable as a secondary option.

TCF Overlap

Overlap is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The chart shows the proper distance between the wheel and the inlet cone.



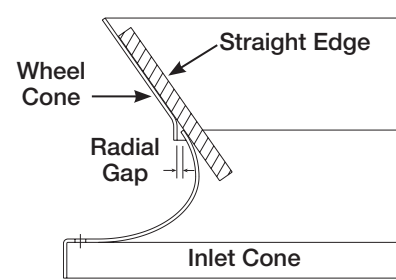
TCF Size	Dimension A (in.)	Dimension A (mm)
18	6 ³ / ₈ ± ¹ / ₈	86 ±3
20	7 ± ¹³ / ₁₆	178 ±5
22	7 ¹³ / ₁₆ ± ¹³ / ₁₆	198 ±5
24	8 ⁵ / ₈ ± ¹ / ₄	219 ±6
27	9 ⁷ / ₁₆ ± ¹ / ₄	240 ±6
30	10 ⁹ / ₁₆ ± ³ / ₈	268 ±10
33	11 ⁷ / ₁₆ ± ³ / ₈	291 ±10
36	12 ³ / ₄ ± ³ / ₈	324 ±10
40	14 ³ / ₁₆ ± ³ / ₈	360 ±10
44	15 ⁹ / ₁₆ ± ³ / ₈	395 ±10
49	17 ⁷ / ₈ ± ¹ / ₂	435 ±13
54	18 ¹³ / ₁₆ ± ¹ / ₂	478 ±13
60	20 ¹⁵ / ₁₆ ± ¹ / ₂	532 ±13
66	22 ⁷ / ₈ ± ¹ / ₂	581 ±13
73	25 ¹ / ₂ ± ¹ / ₂	648 ±13

QEI/QEID Radial Gap

Adjust inlet cone position such that the radial gap between the wheel cone and inlet cone is evenly distributed around the wheel.

QEI/QEID Alignment

If necessary, adjust wheel position by loosening the wheel hub from the fan shaft so that a straight edge held tight to the wheel cone just touches the inlet cone. Refer to drawing below.

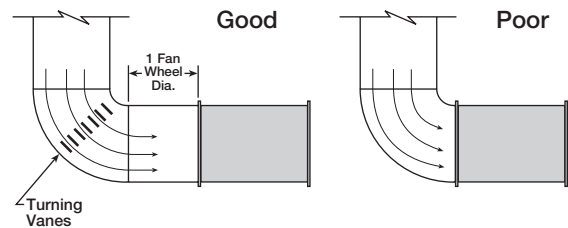


Installation

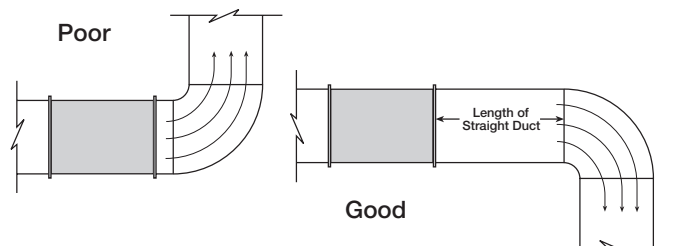
Installations with poor inlet or discharge configurations may result in reduced fan performance.

Ducted Installations

Inlet Duct Turns – Installation of a duct turn or elbow too close to the fan inlet reduces 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 and increased sound levels. To achieve full fan performance, there should be at least one fan wheel diameter between the turn or elbow and the fan inlet.



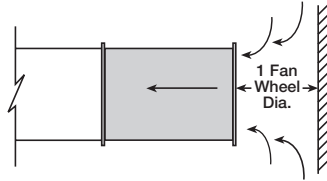
Discharge Duct Turns – Fan performance is reduced when duct turns are made immediately off the fan discharge. To achieve cataloged fan performance there should be at least three equivalent duct diameters of straight ductwork between the fan discharge and any duct turns.



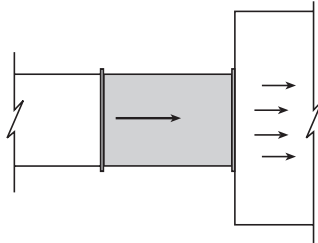
Non-Ducted Installation

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 one fan wheel diameter between the fan inlet and the wall.



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, and performance is reduced.

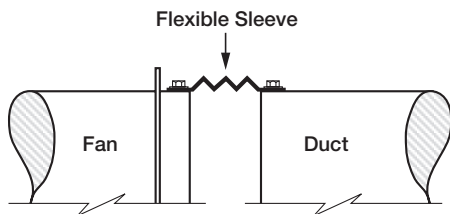


Duct Connections

It is highly recommended to use a flexible sleeve connection instead of a rigid duct connection. This will reduce vibration transmission through the ductwork.

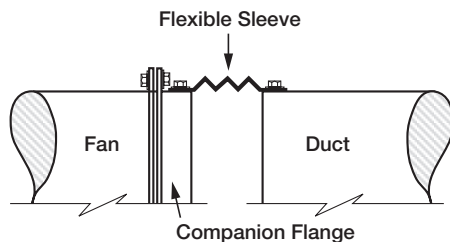
Slip-Fit End Connection (QEI/QEID)

Directly attach the flexible sleeve to the duct and fan. No additional parts are required.



Flanged End Connection (TCF/QEI/QEID)

Optional companion flanges are bolted to the fan to provide a slip-fit connection for a flexible sleeve.



Note: Flexible sleeve & attachment hardware not provided.

Unit Start-Up

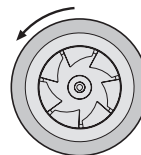
DANGER

High voltage electrical input is needed for this equipment. This work should be performed by a qualified electrician.

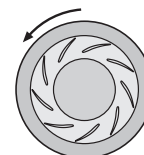
WARNING

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.

1. Disconnect and lock-out all power switches to fan.
2. Check all fasteners, set screws and locking collars on the fan, wheel, bearings, drive, motor base 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) to ensure that it is 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.
10. Check for proper wheel rotation by momentarily energizing the fan. Rotation should correspond to the rotation decal affixed to the unit (CCW rotation is correct as viewed from the fan inlet).



Mixed Flow



Centrifugal Airfoil

NOTE: One of the most frequently encountered problems with centrifugal fans is motors which are wired to run 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.

11. If the fan has inlet vanes, they should be partially closed to reduce power requirements.
12. Fans with multi-speed motors should be checked on low speed during initial start-up.
13. Ensure proper wheel location for radial gap, overlap and alignment (see Radial Gap, Overlap & Alignment section on page 3).
14. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature of the bearing.
15. Check for unusual noise, vibration or overheating of bearings. Refer to the Troubleshooting section of this manual if a problem develops.

Vibration

Excessive vibration is the most frequent problem experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure.

The most common sources of vibration are:

- Wheel unbalance
- Drive pulley misalignment
- Incorrect belt tension
- Bearing misalignment
- Mechanical looseness
- Faulty belts
- Drive component unbalance
- Poor inlet/outlet conditions
- 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 providing there is access to the fan wheel. 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).

Maintenance

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.

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. Variable inlet vanes should be checked for freedom of operation and wear.
3. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.

4. Any dirt accumulation on the wheel or in the housing should be removed to prevent unbalance and possible damage.
5. Isolation bases should be checked for freedom of movement and the bolts for tightness. Springs should be checked for breaks and fatigue. Rubber isolators should be checked for deterioration.
6. Inspect fan impeller and housing looking for fatigue, corrosion or wear.

WARNING

Changing the belts or drives can significantly increase the amp draw of the motor. If changes are made to the drives or belts, the amps must be checked to assure no overamping.

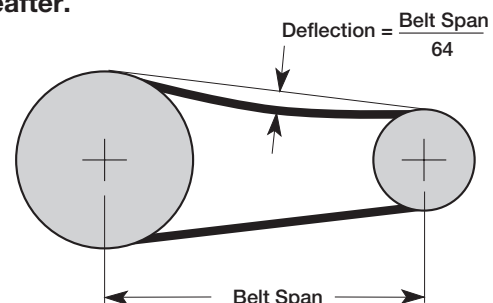
V-Belt Drives

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. 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.

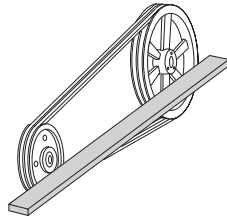
The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. Belts are adjusted by raising or lowering the motor pivot plate. For initial tensioning, the proper belt deflection half-way between sheave centers is 1/64 of the belt span. For example, if the belt span is 64 inches, the belt deflection should be 1 inch using moderate thumb pressure at mid-point of the drive. **Check belt tension two times during the first 24 hours of operation and periodically thereafter.**



V-Belt Replacement

The V-belt drive components, when supplied by Greenheck Fan Corporation, have been carefully selected for this unit's specific operating condition. Changing V-belt drive components could result in unsafe operating conditions which may cause personal injury or failure of fan components.

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 (refer to unit start-up section) and allow the belts to "set" properly.
6. With the fan off, adjust the belt tension by moving the motor pivot plate. (Belts are adjusted by raising or lowering 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

Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease build-up on the motor housing assists proper motor cooling.

CAUTION

Do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam, water or solvents.

Greasing of motor bearings is only required when fittings are provided. Many fractional motors are permanently lubricated and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.

Fan Bearing Lubrication

The bearings for Greenheck fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement and fan size. The instructions provided in this manual and those provided by the bearing manufacturer will minimize any bearing problems. Bearings are the most critical moving part of the fan. Therefore, special care is required when mounting them on the unit and maintaining them.

Refer to the following chart and the manufacturer's instructions for grease types and intervals for various operating conditions. Never mix greases made with different bases. This will cause a breakdown of the grease and possible failure of the bearing.

Recommended Fan Bearing Lubrication Schedule (in Months*)							
Fan RPM	Bearing Bore						
	1/2 - 1	1 1/8 - 1 1/2	1 5/8 - 1 7/8	1 15/16 - 2 1/16	2 7/16 - 3	3 3/16 - 3 1/2	3 15/16 - 4 1/2
To 250	6	6	6	6	6	5	4
500	6	6	6	5	4	3	3
750	6	5	4	3	3	2	2
1000	6	4	3	2	2	1	1
1250	5	3	2	1	1	0.5	0.5
1500	5	2	1	1	0.5	0.5	0.25
2000	5	1	1	0.5	0.25	0.25	0.25
2500	4	0.5	0.5	0.25	0.25	0.25	
3000	4	0.5	0.25	0.25	0.25		

*Suggested initial greasing interval is based on 12 hour per day operation and 150° F. maximum housing temperature. For continuous (24 hour) operation, decrease greasing interval by 50%.

- If possible, relubricate with grease while in operation without endangering personnel.
- For ball bearings (operating) relubricate until clean grease is seen purging at the seals. Be careful not to unseat the seal by over lubricating.
- For ball bearings (idle) add 1-2 shots of grease up to 2 in. bore sizes, and 4-5 shots of grease above 2 in. bore sizes with hand grease gun.
- For roller bearings, relubricate with 4 shots of grease up to 2 in. bore size, 8 shots for 2-5 in. bore size, and 16 shots above 5 in. bore size with hand grease gun.
- Adjust lubrication frequency based on condition of purged grease.
- A high quality lithium base grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used.

Mobilith SHC 220	Texaco Multifak AFB2
Mobilith AW2	Texaco Premium RB
Shell Alvania #2	Exxon Unirex N2

WARNING

Lubricate bearings prior to periods of extended shutdowns or storage and rotate shaft monthly to aid in preventing corrosion. If the fan is stored more than three months, the bearings should be purged with new grease prior to start-up.

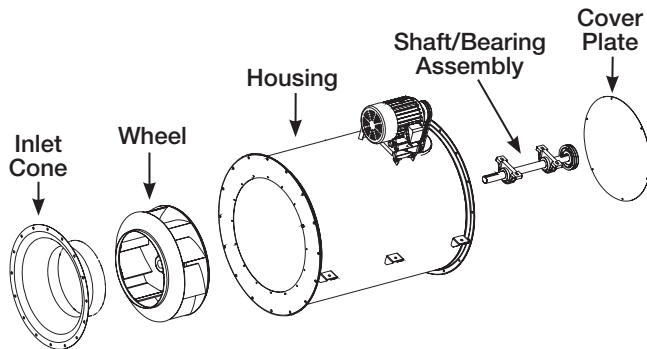
Fan Bearing Replacement

Replacement of bearings requires disassembly of internal components. For this procedure access must be available to both the inlet and outlet ends. The following procedure assumes belts have already been loosened and removed. (Belts are removed by adjusting the motor pivot plate).

Reinstall components in reverse order of removal. Reference the Radial Gap, Overlap & Alignment section to ensure proper wheel installation.

Model TCF

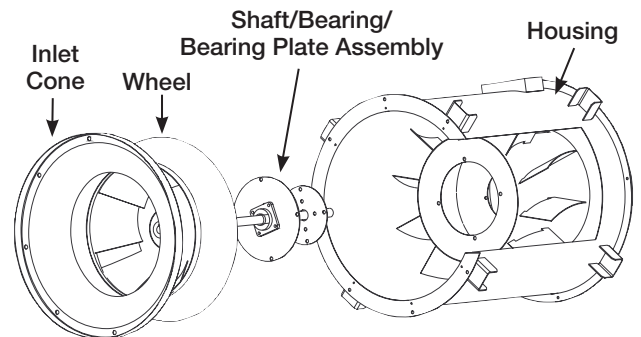
1. Remove cover plate from drive chamber (outlet side).
2. Unbolt and remove inlet cone (inlet side).
3. Loosen set screws at the wheel hub and remove wheel (inlet side).
4. Unbolt both sets of bearings from support bars (outlet side).
5. Remove shaft/bearing assembly (outlet side).
6. Replace bearings on drive shaft.



Model QEI

If the bearings cannot be removed from the shaft due to corrosion or damage, the bearing plates can be removed from the inner chamber. The shaft/bearing/bearing plates can be removed as a complete assembly from the fan inlet.

1. Unbolt and remove inlet cone (inlet side).
2. Loosen set screws at the wheel hub and remove wheel (inlet side).
3. Remove bolts from drive bearing plate (outlet side).
4. Remove bolts from wheel bearing plate (inlet side).
5. Pull shaft/bearing/bearing plate assembly out of the fan housing (inlet side).
6. Replace bearings on shaft/bearing/bearing plate assembly.



Troubleshooting

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 page 6). 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, rebalance in-place if necessary.
Volume Too Low	Fan	Check wheel for correct rotation. Increase fan speed.
	Duct System	See pages 3 and 4.
Volume Too High	Fan	Decrease fan speed.
	Duct System	Resize ductwork. Access door, filters, grilles not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.
Excessive Power Consumption High Horsepower	Fan	Check rotation of wheel.
	Duct System	Resize ductwork. Check proper operation of face 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.
Bearings Overheated	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 motors are especially prone to unbalance. Check wheel balance, rebalance if necessary.

Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

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

Greenheck Catalogs Model TCF and Models QEI/QEID provide additional information describing the equipment, fan performance, available accessories, and specification data.

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.



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