



# VERANTIS

Environmental Solutions Group

Installation &  
Maintenance  
Manual for  
Centrifugal  
and Axial Fans

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# INSTALLATION

## I. GENERAL

Verantis fans are known for their quality, efficient performance, and long life in corrosive environments. Each fan has been inspected and tested before being released for shipment. Proper care in the installation and operation of the fans will assure long and trouble free service.

These fans are manufactured of corrosion resistant fiberglass reinforced plastic (FRP). Care must be taken during handling and installation to prevent damage that may be caused from stress or shock.

## II. INSPECTION

All products are inspected prior to shipment but should be inspected immediately upon receipt and before any attempt is made to unload. First, visually inspect for any signs of damage. Using the following checklist, look for breakage and abrasion which should be very easy to recognize. Impact damage would appear as whitening of the surface or star shaped cracks or crazes. Such damage, if confined to the exterior may only be superficial.

Here is a check list to assist you:

1. Is the shipping media still intact? (Check for loose banding, or damage shipping crates.)
2. Is there any damage to the extremities of the fan? (Check the ends, tip and sides, and any protruding parts such as flanges and/or nozzles for evidence of damage.)

If any parts are found to be damaged, a claim should be filed immediately against the freight carrier. Do not put the fan into service until fully repaired.

## III. STORAGE

All fans should be stored in an area protected from the weather, free from potential damage by fork trucks or other vehicular traffic. If the fan is to be idle for more than 1 to 2 weeks, it is recommended that the impeller and motor be rotated several revolutions at least once a week for prevent bearing freeze up, and or avoid developing "flat spots" on fan and motor shafts.

## IV. HANDLING

Do not remove the fan from its shipping crate before moving it to the point of installation. **DO NOT** lift the fan by the housing, canopy/guards, shaft or motor. Lifting straps should be attached **only** to the structural steel base, or use clevis pins if the fan skid has "lifting holes" provided in all four corners of the skid. Lifting lugs, if provided on the fan housing are **only** to be used in lifting the "pie section" of the housing and **not** the entire fan.

## V. FAN BASE GROUT (For Centrifugal Fans)

To assure continued alignment, we recommend the use of a high strength, non-shrink epoxy grout that provides the desired mechanical properties for support of the fan. Such support ensures the proper transmission of static and dynamic loads to the equipment foundation.

## VI. FAN INSTALLATION

Particular care must be taken when installing the fan to assure that the fan base is not twisted or misaligned when anchoring to the foundation. Do not force the base into alignment. Use shims, if necessary, to assure proper alignment. A twisted or misaligned base will result in incorrect gaps between the fan inlet, impeller and housing. Operating the unit in that condition can cause the impeller to rub on the inlet and/or housing, resulting in damage to the unit.

Check all bolts at locations listed below to assure that none have loosened, and **before** starting the fan:

1. Fan back plate. (Centrifugal fans only.)
2. Access door (where applicable).
3. Motor base.
4. Fan base. (Centrifugal fans only.)
5. Bearing mounting bolts.
6. Set screws on bearing locking collar.

Before wiring the motor, rotate fan wheel by hand to check for free rotation and to assure that the impeller has not shifted such that it would be rubbing against the fan housing.

All ductwork and/or stack must be self-supporting and independent of the fan. The use of flexible sleeves is recommended to make connections to the fan inlet and discharge. These flexible sleeves help prevent the transmission of stresses onto the fan from the ductwork and/or stack. If flanges must be used, a soft sponge gasket should be installed between the flanges to avoid air or condensate leakage. In this case, the connecting ductwork must be properly aligned to avoid distorting the fan housing. Excessive pressure applied when bolting a flange connection may cause damage to the fan housing or flange.

All ductwork and/or stacks connected to Verantis fans must be independently supported. The fan inlet and outlet are **not intended nor designed** to support any connecting duct or stack.

Install all accessory equipment that is not already preassembled with the fan, such as belt and shaft guards or motor and drive canopy, vibration isolators.

Wire the motor in accordance with the wiring diagram that is supplied with the motor.

Check to be sure that the sheaves are properly aligned. See "Belts" under Maintenance section.

The drain line must be installed using either a U-trap arrangement or an equivalent method (drain leg is submerged in liquid). To obtain a proper seal, the leg length must be greater than the system pressure drop.

## VII. MOTOR INSTALLATION

**SAFETY WARNING:** High voltage and rotating parts of electrical machinery can cause serious or fatal injury. Its installation, operation and maintenance should be performed by qualified personnel only. Familiarization with NEMA MG2 "Safety Standard for Construction and Guide for Selection, Installation and Use of Fractional and Integral HP Motors and Generators", the National Electrical Code, and sound local practices is recommended.

For equipment covered by these instructions, it is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed to:

Avoid contact with energized circuits.

Disconnect all power sources before attempting work on the motor.

### Installation:

#### 1. Motor Types

- A. **Dripproof motors** are designed for installation in a well ventilated place where the atmosphere is reasonably free of dirt and moisture.
- B. **Totally enclosed fan cooled motors (TEFC)** are designed for installation where motor may be exposed to dirt, moisture and most outdoor conditions.
- C. **Severe-duty motors** are designed for installation in a highly corrosive or excessively moist atmosphere.
- D. **Explosion proof motors** have a U/L label which indicates manufacture to Underwriters' Laboratories standards for hazardous locations shown on the label.

#### 2. Power Supply and Connections

- A. **Nameplate** voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within 10% of nameplate value and frequency within 5% of the nameplate value. The combined variation of frequency and voltage must not exceed 10%.
- B. **Dual voltage** motors can be connected for the desired voltage by following instruction on nameplate of connection diagram.
- C. **Wiring** of motor and control, overload protection and grounding should be in accordance with National Electrical Code and local building codes.

- D. Remove drain plugs from the frame of enclosed motors used outdoors or in other high moisture areas.

# START-UP

## I. SAFETY CHECKLIST

INSPECT THE SYSTEM TO BE SURE THAT THERE IS NO DEBRIS LEFT IN THE DUCT.

BEFORE OPENING ACCESS DOOR, REMOVING GUARDS (IF APPLICABLE), AND/OR FAN HOUSING OR DUCTWORK, BE SURE THE MAIN ELECTRICAL DISCONNECT SWITCH IS LOCKED IN THE POWER "OFF" POSITION.

NEVER REMOVE BELT AND SHAFT GUARDS OR MOTOR AND DRIVE CANOPY UNLESS THE MAIN ELECTRICAL DISCONNECT SWITCH IS LOCKED IN THE POWER "OFF" POSITION.

NEVER ATTEMPT TO PERFORM ANY MAINTENANCE ON THE FAN UNLESS THE MAIN ELECTRICAL DISCONNECT SWITCH IS LOCKED IN THE POWER "OFF" POSITION.

DO NOT ATTEMPT TO REPLACE BELTS, SHEAVES, BEARINGS, SHAFT OR IMPELLER BEFORE BECOMING FAMILIAR WITH THE SPECIFIC PROCEDURES DETAILED IN THIS MANUAL.

BEFORE OPERATING FAN, MAKE CERTAIN THAT ALL SAFETY GUARDS ARE PROPERLY INSTALLED.

DO NOT RUN THE FAN AT SPEEDS GREATER THAN THE MAXIMUM RPM SHOWN ON THE FAN NAMEPLATE.

BEFORE OPERATING FAN, VISUALLY CHECK BELT TIGHTNESS (FIGURE 4) AND VERIFY THAT BEARINGS ARE LUBRICATED. ALL BEARINGS ARE GREASED AT THE FACTORY PRIOR TO SHIPMENT. **DO NOT** OVER GREASE THE BEARINGS AS HIGH BEARING TEMPERATURES AND POSSIBLE DAMAGE TO THE FAN AND/OR COMPONENTS MAY RESULT.

START THE FAN AND NOTE WHETHER THE BELTS SQUEAL OR SLIP. TO CORRECT, THE TENSION MUST BE ADJUSTED BY ADJUSTING THE CENTER DISTANCE. REFER TO "BELTS" UNDER THE MAINTENANCE SECTION ON HOW TO OBTAIN PROPER BELT TENSION.

CHECK FOR EXCESSIVE NOISE OR VIBRATION. (REFER TO "VIBRATION AND NOISE" UNDER "TROUBLE SHOOTING" BELOW.) IF THE NOISE AND/OR VIBRATION CONTINUE, CONTACT YOUR FACTORY REPRESENTATIVE OR THE FACTORY DIRECT. **DO NOT OPERATE THE FAN IF EXCESSIVE NOISE OR VIBRATION IS PRESENT.**

PRIOR TO SHIPMENT, ALL IMPELLERS ARE STATICALLY AND DYNAMICALLY BALANCED. FULLY ASSEMBLED FANS ARE DYNAMICALLY BALANCED AT THE FACTORY AND RUN TO MINIMIZE CONCERNS REGARDING FAULTY BEARINGS AND/OR VIBRATION.

**PRIOR TO STARTING FAN:**

1. Dry the motor windings if stored in a damp location. In drying, do not exceed 85°C (185°F).
2. Check rotation under no-load conditions. To reverse rotation:  
3 phase – interchange any two line leads  
2 phase – interchange line leads 1 and 3  
1 phase – follow connection nameplate or label on motor.
3. Operate under load for at least one hour. Then observe whether any unusual noise or heating has developed.
4. Check operating current against nameplate.
5. Check the motor with an ammeter and compare the current drawn by the motor with the amperes shown on the motor nameplate. Do not operate the fan with the motor overloaded as this may burn out the motor and void the motor manufacturer’s warranty.

**SAFE MOTOR OPERATION:**

Avoid contact with rotating parts and be sure that shaft key is fully captive before motor is energized.

Avoid contact with the start or run capacitors in single-phase motors until a safe discharge procedure has been followed.

Act with care and in accordance with prescribed procedures in handling, lifting, installing, operating and maintaining the equipment. Do not lift motor and fan using only motor lifting means. If eyebolts are used for lifting motors, they must be securely tightened, and the direction of the lift must not exceed a 15 degree angle with the shank of the eyebolt.

Do not use motors with automatic–reset thermal protection where unexpected starting of equipment might be hazardous to personnel. Provide proper safeguards for personnel against possible failure of motor–mounted brake, particularly on applications involving overhauling loads.

Safe maintenance practices and qualified personnel are imperative. Before initiating maintenance procedures, be sure that all power sources are disconnected from the machine and accessories to void electric shock and personal injury from rotating parts, If a high–potential insulation test is required, procedures and precautions outlined in NEMA Standards MG1 should be followed.

FAILURE TO PROPERLY GROUND MOTOR MAY CAUSE SERIOUS INJURY TO PERSONNEL. GROUNDING SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND CONSISTENT WITH THE SOUND LOCAL PRACTICE.

**II. GENERAL**

Before starting up the fan be sure that you have removed all debris from the inlet ductwork and fan housing and that there are no unsafe conditions existing.

Check the fan for proper rotation by momentarily starting the blower. The rotation should be as indicated by the arrow on the fan housing. If the arrow is missing, the rotation can be determined from the drive end. (See Figures 1 and 2 for centrifugal fans.) For axial fans, the impeller should rotate in a clockwise manner when viewed from the drive end.



**Clockwise  
Top Horizontal  
Figure 1**



**Counterclockwise  
Top Horizontal  
Figure 2**

Check the housing drain to assure proper drainage.

Check all bolts and belt tension after 1 hour. Refer to the maintenance section for periodic maintenance requirements. Make necessary adjustments.

### III.TROUBLE SHOOTING

#### CORRECTIVE ACTION

#### Capacity or Pressure Below Rating

1. Total resistance of system higher than anticipated.
2. Speed too low.
3. Dampers not properly adjusted.
4. Poor fan inlet or outlet conditions.
5. Air leaks in system.
6. Damaged impeller.
7. Incorrect direction of rotation.

- Open damper or speed up fan. Make sure you do not overload motor.
- See above.
- Reset.
- Contact Factory for assistance.
- Locate and seal.
- Replace impeller.
- Reverse motor leads.

#### Vibration and Noise

1. Misalignment of bearings, couplings, wheel or V-belt drive.
2. Unstable foundation.
3. Foreign material in fan causing unbalance.
4. Worn bearings.
5. Damaged wheel or motor.
6. Broken or loose bolts and set screws.
7. Bent Shaft.
8. Fan wheel or driver unbalanced.
9. Fan delivering more than rated capacity.
10. Speed too high or fan rotating in wrong direction.
11. Vibration transmitted to fan from some other source.

- Check Alignment.
- Shim/strengthen.
- Clean out.
- Replace bearings.
- Replace.
- Replace or Tighten.
- Replace shaft.
- Return to factory for rebalance.
- Increase system resistance.
- Change sheaves or reverse motor leads.
- Isolate fan with flex connectors and vibration isolators.

#### Overheated Bearings

1. Too much grease in ball bearings.
2. Poor alignment.
3. Damaged wheel or driver.
4. Bent shaft.
5. Dirt in bearings.
6. Excessive belt tension.

- Remove alimite fittings and run to reduce grease.
- Realign.
- Replace.
- Replace shaft.
- Replace.
- Loosen.

#### Overload on Driver

1. Speed too high.
2. Discharging over capacity due to existing system resistance being lower than original rating.
3. Specific gravity or density of gas above design value.
4. Packing too tight or defective on fans with stuffing box.
5. Wrong direction of rotation.
6. Shaft bent.
7. Poor alignment.
8. Wheel wedging or binding on inlet bell.
9. Bearings improperly lubricated.
10. Motor improperly wire.

- Slow down by sheave change.
- Increase resistance.
- Consult Factory.
- Loosen.
- Change motor leads.
- Replace.
- Realign.
- Align
- Consult bearing manufacturer.
- Consult motor manufacturer.

# MAINTENANCE

## I. SAFETY

BEFORE ANY MAINTENANCE IS PERFORMED ON THE FAN BE SURE THAT THE MAIN ELECTRICAL DISCONNECT SWITCH IS LOCKED IN THE POWER “OFF” POSITION.

## II. GENERAL

Maintenance inspections should be performed after a few hours, after one day, after one week, after two weeks, and at least once a month thereafter. All maintenance checks should include the following items as a minimum:

1. Check **and tighten if necessary**, bolts securing taper lock bushing to impeller hub after 1 hour operation, after 2, 4, 6, and 8 hours, and after one week of operation, then during monthly maintenance inspections.
2. Check V–belt tension.
3. Check bolt tightness – avoid excess tightening.
4. Check fan bearings for lubrication, wear and overheating.
5. Check bearings for excessive vibration.
6. Check impeller and housing for build–up of foreign parts and overheating.
7. Check condition of FRP.

## III. BEARINGS

Lubrication: Bearings are pre–lubricated at the factory so it is not necessary to add grease to new bearings. If the bearings have been stored of idle for a period of time, add a little fresh grease before running. There should be a little grease showing at the seals.

Improper lubrication will cause high bearing temperatures. Depending upon the size bearings and the speed, the bearings may be “warm to the touch” up to “too hot to touch for more than a few seconds”. High temperature in conjunction with excessive leakage of grease indicates too much grease. To overcome this condition, remove the grease fitting to allow the excess grease to escape. High temperature with no grease showing usually indicates too little grease. This latter condition is often accompanied by noisy bearings. A slight amount of grease showing at the seals indicates that the bearings are properly lubricated.

Mounting: Shaft must be straight and free from burrs.

Slide bearings on shaft with the locking collars toward the ends of the shaft. Place bearings in position and install bolts, snug.

Verify alignment. Tighten bolts. Shaft should slide freely end to end. Before tightening the locking collar, be sure shaft is centered properly.

Tighten the eccentric cam locking collar of the bearing at the impeller end. The locking collar design provides a positive lock of the wide inner ring bearing to the shaft. To tighten, turn the locking collar in the direction of the shaft rotation to the lock position, then tighten the collar set screw.

Tighten the sheave end bearing eccentric cam locking collar.

## IV. SHEAVES

Installation: Whether installing new belts or a completely new drive, worn bearings, bent shafts or other components, that might cause future problems should be replaced at this time. If installing belts only, check existing sheaves carefully for worn grooves or other damage. (Always use gloves or a rag for feeling in the sheave grooves to protect from cuts due to nicks or burrs.)

Worn grooves can be detected by feel, or by sight. Worn grooves can shorten belt life by as much as 50%, which in turn increases the cost of maintenance. Therefore, worn sheaves should also be replaced.

Rusty or dirty sheaves also impair a drive’s efficiency.

Clean existing sheaves thoroughly before installing a new set of belts. A safe cleaning fluid, such a methyl chloroform, is recommended.

Make sure the bore of the sheave and the tapered cone surface of the bushing are free of all foreign substances such as paint, dirt and lubricants.

### To Remove Sheaves

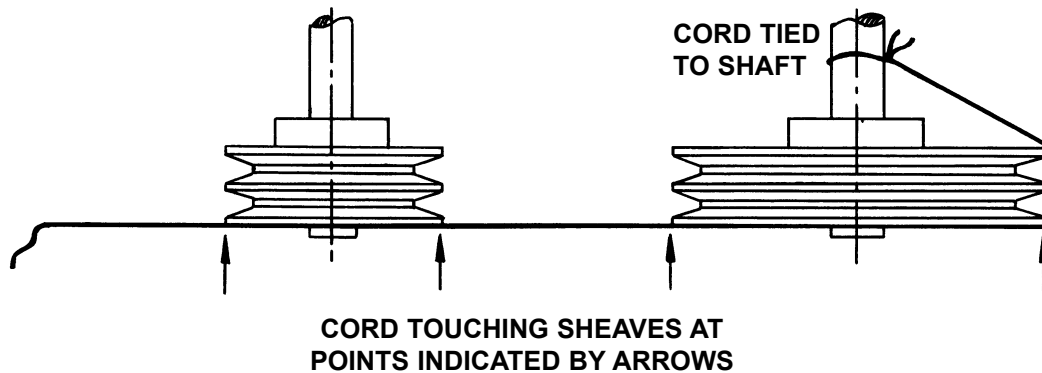
1. Loosen and remove cap screws.
2. Insert cap screws in tapped removal holes and progressively tighten each one until mating part is loose on bushing.
3. Remove mating part from bushing and, if necessary, bushing from shaft. If bushing won’t slip off shaft, wedge screwdriver blade in saw cut to overcome tightness.

When replacing sheaves, place bushing into sheave. Loosely insert the cap screws into this assembly. Do not lubricate the cap screw threads.

With key in keyseat of shaft, slide the sheave/bushing assembly to its desired position with cap screw heads to the outside. (A few small sheaves may have to be installed with the cap screws on the inside.) If the bushing is hard to slide onto the shaft, wedge a screwdriver blade into the saw cut to overcome the tightness. Align sheaves by sight, but do not tighten yet.

To check the alignment of the sheaves on the shafts, a straightedge or a piece of string can be used. If the sheaves are properly lined up, the string will touch them at the points indicated by the arrows in the accompa-

nying sketch (Figure 3). Rotating each sheave a half revolution will determine whether the sheave is wobbly or the drive shaft is bent. Correct any misalignment.



**FIGURE 3**

With sheaves aligned, tighten cap screws evenly and progressively

#### **Inspect Sheaves Often**

Keep all sheave grooves smooth and uniform. Burrs and rough spots along the sheave rim can damage belts. Dust, oil and other foreign matter can lead to pitting and rust, and should be avoided as much as possible.

A shiny groove bottom indicates that either the sheave, the belt or both are badly worn and the belt is bottoming in the groove.

Badly worn grooves cause one or more belts to ride lower than the rest of the belts and the effect is the same as with mis-matched belts. This is called "differential driving". The belts riding high in the grooves travel faster than the belts riding low. In a drive under proper tension, a sure sign of differential driving is when one or several belts on the tight side are slack.

### **V. BELTS**

#### **Belt Maintenance**

Dirt and grease reduce belt life. Belts should be wiped with a dry cloth occasionally to remove any build-up of foreign materials. If the belts have been splattered with

grease and/or oil, clean them with methyl chloroform or soap and water. Flammable cleaners such as gasoline are to be avoided as a matter of safety.

Under no circumstances is the use of belt dressing recommended on the V-belt. The remedial effect is only temporary. It is much better to keep the belts and grooves of the drive clean.

#### **Belt Replacement**

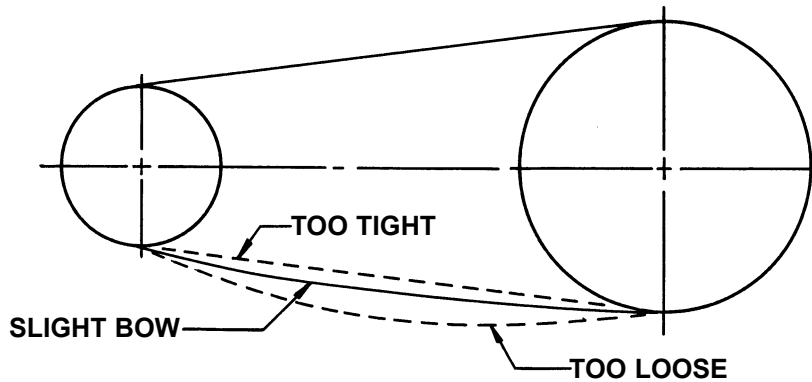
Shorten the center distance between the driven and driver sheave so the belt can be put on without the use of force.

**NOTE:** Never "roll" or "pry" the belts into the sheave grooves. This can damage the belt cords and lead to belt turnover, short life or actual breakage. Moreover, it is both difficult and unsafe to install belts this way.

While the belts are still loose on the drive, rotate the drive until all the slack is on one side. Then increase the center distance until the belts are snug. The drive is now ready for tensioning. Keep takeup rails, motor base or other means of center distance adjustment free of dirt, rust and grit. Lubricate adjusting screws and slide rails from time to time.

Start the drive and continue to adjust until the belts have only a slight bow on the slack side of the drive while operating under load. (See Figure 4).





**FIGURE 4**

## VI. MOTOR

### 1. Inspection:

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

### 2. Lubrication:

Ball bearing motors are adequately lubricated at the factory. Relubrication at intervals consistent with the type of service will provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

Motors having pipe plugs or grease fittings in bearing housings should be relubricated while warm and at stand-still. Replace one pipe plug on each end shield with  $\frac{1}{8}$ " pipe thread lubrication fitting. Remove the other plug for grease relief. Be sure fittings are clean and free from dirt. Using a low pressure grease gun, pump in the recommended grease until new grease appears at grease relief hole. After relubricating, allow motor to run for 10 minutes before replacing relief plugs.

Motors not having pipe plugs or grease fittings in bearing housing can be relubricated by removing end shields from motor, cleaning grease cavity and refilling the cavity with recommended grease. **CAUTION:** Bearings and grease must be kept free of dirt.

## VII. IMPELLER

Before attempting to replace an impeller, be sure that the main electrical disconnect switch is locked in the power "off" position.

Remove the fan from the system and proceed as outlined below.

### Centrifugal Fans

Measure the gap between the impeller and inlet cone. This is important to assure proper performance after reassembly.

Remove fan housing from base.

Mark the location of the taper lock on the shaft.

Remove cap screws from bushing/hub and place in threaded holes in the bushing. Tighten these cap screws by turning each part. Turn cap screws in succession until the impeller is forced off the bushing.

To assemble new impeller, reverse above procedure.

To center impeller to correct gap as measured above, it is necessary to be sure bushing is in exact location on shaft that it was before dis-assembly.

The impeller should be repaired only by a factory authorized repairman in our factory. This will assure that the repairs are correct and that the impeller is balanced.

### Axial Fans

For axial fans the following procedure applies:

For removable bearing assembly, see Section VIII.

If the fan does not have the removable bearing assembly proceed as follows:

Loosen set screws on locking collars on the bearings.

Mark shaft location with respect to bearings. Remove pulley from shaft (see "Sheave" section).

Slide impeller/shaft assembly out of fan.

To remove the impeller from the shaft, grind away the FRP that encapsulates the shaft at the rear of the impeller.

Cut away the flat FRP plate on the front of the impeller to expose the taper-lock bushing. Remove the taper lock as described in the centrifugal section above.

Assembly of the impeller and installation of the shaft and impeller is the reverse of the above. Care must be taken to overwrap with FRP the shaft and hub, plus encapsulate the access to the taperlock.

The impeller should be repaired only by a factory authorized repairman in our factory. This will assure that the repairs are correct and that the impeller is balanced.

## **VII. REMOVABLE BEARING ASSEMBLY (Optional on Axial Fans)**

### **Flange Type Bearings:**

1. Remove access door.
2. Unbolt front coverplate and rear flange bearing.
3. Remove pulley from shaft.
4. Pull out impeller, front cover plate, shaft and bearings.
5. Remove shaft from bearings.

### **Assemble New Flange Bearings:**

1. Clean up shaft, remove all setscrew burrs. Replace shaft if necessary.
2. Check front cover plate gasket and replace with  $\frac{1}{4}$ " thick foam neoprene gasket if necessary. (Do not use solid rubber gasket thicker than  $\frac{1}{16}$ " .)
3. Check shaft grease seal and renew if necessary.
4. Attach new bearing to coverplate, hand tight only.
5. Slide shaft through coverplate and assemble rear bearing.
6. Insert assembly into fan. Leave approximately  $\frac{1}{16}$ " gap between impeller and drive housing.
7. Align impeller and shaft with fan centerline and tighten bearing bolts.
8. Re-assemble pulley (see belt section).
9. Test run.

### **Pillow Block Bearings:**

1. Remove access door.
2. Unbolt front cover plate and bearing base at drive bearing bracket.

3. Pull out impeller, front cover plate, shaft, and bearing base with pillow blocks.
4. Remove bearing base from assembly.
5. Pull bearings from shaft.

### **Assemble New Pillow Block Bearings:**

1. Clean up shaft, remove all setscrew burrs. Replace shaft if necessary.
2. Check front cover plate gasket and replace with  $\frac{1}{4}$ " thick foam neoprene gasket if necessary. (Do not use solid rubber gasket thicker than  $\frac{1}{16}$ " .)
3. Check shaft grease seal and renew if necessary.
4. Assemble bearing plate to front cover plate.
5. Assemble front cover plate to drive housing and bearing plate to drive bearing bracket, tighten all nuts.
6. Assemble new pillow blocks to bearing base, install expansion bearing near front cover plate, install non-expansion bearing near drive bearing brake, tighten nuts hand tight only.
7. Assemble impeller with shaft, leaving approximately  $\frac{1}{4}$ " gap between impeller rim and drive housing.
8. Align impeller and shaft with fan centerline and tighten bearing bolts.
9. Assemble drive and test run.

## **IX. HOUSING**

Should the housing need to be repaired it is preferable to have an authorized repairman perform the work. This is essential when repairs are made that could affect the fit up between the impeller and the housing.