Introduction
This manual has been prepared to guide the users of Aerovent equipment in the proper installation, operation and maintenance procedures to insure maximum equipment life and trouble-free operation.

Receiving
Products leaving the assembly plant have been inspected and are in satisfactory operating condition. The carrier assumes full responsibility for material from the time it leaves the plant until it is delivered to the user. Therefore, material should be inspected for damage immediately so that any damage claims against the carrier can be made before acceptance of the shipment. No equipment is to be returned without an authorized returned goods tag.

Handling
All products must be handled with extreme care to avoid misalignment of rotating components. Never lift a unit assembly by using the shaft, drive sheaves, wheel or motor as a point of attachment. If it is apparent that slings will not clear a portion of the product being hoisted, a spreader should be used to avoid damage.

Initial Operation
All Aerovent fans are lubricated at the factory and have been given a run-in test before shipment. Read carefully all installation and maintenance manuals before following the startup check list.

Safety Precautions
Any piece of machinery should be treated with respect and not overconfidence. Overconfidence usually leads to carelessness and carelessness leads to injury. Following is a list of DO's and DO NOT's:

DO
1. Make sure the unit is stopped and electrical power is locked out before putting hands into the inlet or outlet openings or near the belt drive. A warning sign on the START SWITCH cautioning not to start is recommended when the unit is being serviced.
2. Follow maintenance instructions.

DO NOT
1. Put hands near or allow loose or hanging clothing to be near belts or sheaves while the unit is running.
2. Put hands into inlet or outlet while the unit is running. It is sometimes difficult to tell whether or not a fan is running . . . be sure it is not running and cannot be operated before any inspection.

Startup Checklist
1. Inspect the equipment for any shipping damage. Remove any foreign material such as tags or packing from any moving parts or from within the fan housing.
2. Compare the voltage, hertz, and phase stamped on the motor with the current characteristics of the line to which the motor is to be connected.
3. Lock out the power source at the disconnect switch.
4. Turn motor, drive, and propeller by hand to see that no misalignment has taken place in shipment. Check V-belt drive for proper alignment and belt tension.
5. Check all bolts, screws and fasteners and tighten if necessary. Make certain all set screws, locking collars and bearing mounting bolts are secure.
6. Secure and check clearance of access doors, belt guards and inlet and outlet guards.
7. If equipped with dampers, check for correct linkage operation. Make sure that the operator opens or closes these control devices to the proper positions.
8. Jog the fan electrically and note the rotation. Reverse two electrical leads, if necessary, to obtain proper rotation as marked with rotation arrow on fan. Do not allow the propeller to run backwards except momentarily.
9. Centrifugal Fans: Close dampers as required for adequate system resistance to prevent the motor from overloading.

CAUTION: With fans that use the forward-curve or radial type of wheel, it is possible to overload the motor if the fan is operated at a lower static pressure than that which the fan is rated. Check the catalog rating of the fan for proper speed and resistance.

10. Start the fan and observe its operation.
11. Take a motor amp reading and compare with the amp rating on the motor. (The actual running amps should not exceed motor nameplate amps x service factor, exceptions may be taken for air over motors.)

Fan Balance
Fan propellers are statically and dynamically balanced within acceptable tolerances at the factory. Damage in shipping and handling or poor installation of the unit may upset the unit balance. A propeller that is not properly balanced can lead to excessive vibration causing undue wear on the entire unit. It is recommended that after installation a vibration test be made on the fan by an experienced technician.

CAUTION: For units furnished less final drive compo-
ments at customer request, the addition of drive components in the field can create critical vibration modes. Aerovent strongly recommends a final unit balance procedure after all rotating components are installed. Failure to do so voids Aerovent's warranty.

All Aerovent fan assemblies are factory balanced to quality grade G6.3 (mm/sec, vel.) in accordance with ISO 1940-1973 standards. Selected values of fan RPM and corresponding total displacement (mils-peak to peak) and peak velocity (in./sec.) for quality grade G6.3 are charted below.

<table>
<thead>
<tr>
<th>Fan RPM</th>
<th>Total Displacement (Mils-Peak-To-Peak)</th>
<th>Peak Velocity (In./Sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3600</td>
<td>0.66</td>
<td>0.124</td>
</tr>
<tr>
<td>1800</td>
<td>1.32</td>
<td>0.124</td>
</tr>
<tr>
<td>1200</td>
<td>1.97</td>
<td>0.124</td>
</tr>
<tr>
<td>900</td>
<td>2.63</td>
<td>0.124</td>
</tr>
<tr>
<td>700</td>
<td>3.38</td>
<td>0.124</td>
</tr>
</tbody>
</table>

Vibration measurements, when possible, should be taken at each fan shaft bearing in two planes perpendicular to the axis of rotation (planes to have 90 degree interval), and one measurement parallel to the axis of rotation. On direct drive units, the perpendicular measurements will be taken at each end of the motor casing, taking care not to take measurements on the fan shroud on TEFC motors. The axial measurement can be taken on the motor foot or mounting base. In some cases, primarily on axial flow units, it will not be possible to take measurements at the bearings or motor. On these units, the measurements should be taken on the inner shell near the bearings. If this is not possible, then take the readings on the outer shell near the bearing locations.

If vibration is excessive, shut down the fan and determine the cause.

**Common Causes of Excessive Vibration**

1. Support structure not sufficiently rigid or level. Vibration amplified by resonance in ductwork or support structure.
2. V-belt drive misalignment. Belt tension is too tight or too loose.
4. Material accumulation on propeller.

**Motors**

Most integral horsepower totally-enclosed motors have drain plugs in the end bells for drainage of condensation. On all roof ventilators, the bottom or lower plug has been removed for continuous drainage.

All other style fans are shipped with the drain plugs installed. The user should remove the proper drain plug. For horizontally mounted units with the motor in the airstream, remove the downstream drain plug. For vertically mounted units, remove the bottom or lower drain plug.

With motors supplied by the user, drain plugs may not have been provided. Check with the motor manufacturer regarding drainage and condensation.

**Lubrication Instructions for Ball Bearing Motors**

Grease-lubricated bearings, as furnished, are adequate for a long period of operation without relubrication. A good maintenance schedule for regreasing will vary widely depending on motor size, speed and environment.

The table below suggests relubrication intervals for motors on normal, steady running, light duty indoor loads in relatively clean atmosphere at 40°F (105°F) ambient temperature or less. Fractional horsepower motors follow a schedule similar to that shown under frames 145T to 215T.

**Motor Lubrication Intervals**

<table>
<thead>
<tr>
<th>TYPE OF ENCLOSURE</th>
<th>INSULATION</th>
<th>FRAME SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>145T-215T</td>
</tr>
<tr>
<td>Open-IP</td>
<td>B</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>Enclosed-PC</td>
<td>E</td>
<td>18 mos.</td>
</tr>
<tr>
<td>Enclosed-PW</td>
<td>F</td>
<td>9 mos.</td>
</tr>
<tr>
<td>Free-PC</td>
<td>H</td>
<td>9 mos.</td>
</tr>
</tbody>
</table>

**Note:** For motors over 1800 RPM, use ½ of tabulated period. For heavy duty, dusty locations, use ½ of tabulated period. For severe-duty high vibration/shock, use ½ of tabulated period.

**VOLUME - REFERENCE TABLE**

<table>
<thead>
<tr>
<th>SHAFT DIAMETER (AT FACE OF BRACKET)</th>
<th>AMOUNT OF GREASE TO ADD</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; to 1½&quot;</td>
<td>1/8 cu. in. or 0.1 oz.</td>
</tr>
<tr>
<td>1⅛&quot; to 1⅜&quot;</td>
<td>1/4 cu. in. or 0.2 oz.</td>
</tr>
<tr>
<td>1½&quot; to 2½&quot;</td>
<td>3/4 cu. in. or 0.6 oz.</td>
</tr>
<tr>
<td>2½&quot; to 3½&quot;</td>
<td>2 cu. in. or 1.6 oz.</td>
</tr>
</tbody>
</table>

Motors with no provision for lubrication are equipped with sealed bearings and require no maintenance. Motors mounted in inaccessible locations are provided with extended grease lines to facilitate lubrication if provisions for lubrication are provided. The bearings are equipped with relief fittings to prevent over-lubrication. The grease lines are filled with lubricant at the factory.

**Procedure for Relubrication**

1. Stop motor.
2. Remove grease relief plugs in bearing housings.
3. Grease with hand gun until new grease appears at relief hole.
4. Run motor for ten (10) minutes before replacing relief plugs.

**CAUTION:** Do not over-lubricate. This is a major cause of bearing and motor failure. Make sure dirt and contaminants are not introduced when adding grease.

**Type of Grease**

Lubricate with the following greases or their equivalent:

- Amoco Rykon Premium #2
- Chevron BB-2 – Standard Oil or Calif.
- SRI-2 – Standard Oil Company
- Alvania #2 – Shell Oil Company
For motors lubricated with special greases, check lubrication tag on motor.

**Lubrication Instructions for Fan Ball Bearings**

Bearings and grease lines on belt driven fans are lubricated in assembly. When lubrication is required, add grease slowly while the shaft is rotating until grease comes rapidly out of the seal.

For extreme conditions, lubricate according to experience. For normal conditions, lubricate the bearings with Rykon Premium Grease No. 2 EP or an equivalent.

Bearings and grease lines on axial fans that are ordered for high moisture or above normal temperatures have been lubricated with a special lubricant, Plastilube #2. Lubricate at regular intervals with Plastilube #2 as indicated in the special lubrication chart listed below. Plastilube #2 is available from Sulfo, Inc. 1158 Erie Avenue, North Tonowanda, New York 14120.

**Special Lubrication Frequency For High Temperature and High Moisture**

<table>
<thead>
<tr>
<th>AIRSTREAM TEMPERATURE</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO 250°F</td>
<td>4500</td>
</tr>
<tr>
<td>TO 350°F</td>
<td>1500</td>
</tr>
<tr>
<td>TO 600°F</td>
<td>1000</td>
</tr>
<tr>
<td>WET ATMOSPHERE ROOM TEMPERATURE</td>
<td>1000 TO 1500</td>
</tr>
</tbody>
</table>

**Storage of Equipment**

**Fan Bearings**

Since bearings tend to “breathe” on equipment stored in areas with other than a constant temperature, moisture will condense internally. Therefore, it is necessary to keep the bearings completely full of grease and periodically rotated to make certain that all internal parts are coated with grease. Even a full bearing will eventually pick up moisture and, therefore, must be periodically purged with new grease.

Grease should be purged from the bearings to remove condensed moisture, and the fan wheel rotated by hand every thirty (30) days. This practice should be done more often if weather is severe or if there is a wide variation in temperature.

**CAUTION IN PURGING:** The fan should be rotated while greasing and high pressure pneumatic greasers should be avoided. See “Lubrication Instructions for Fan Ball Bearings.”

To rotate the fan, follow the procedure listed below:

The blade marked number 1 should be rotated to top center. The blade number and date should be recorded in a log book which is to be stored in a protective pouch attached to the fan. During storage, the fan propeller should be rotated by hand at least ten (10) revolutions every thirty (30) days to circulate the lubricant in the bearings in the motor or on the fan shaft. After the tenth revolution, stop with a blade at top center which is not the same one as is listed for the previous date in the log book.

Fans which are V-belt driven should be prepared for storage as follows:

Carefully remove the belts, coil them (without kinks) in matched sets and place them in a heavy carton. Mark the carton with fan identification and store the carton in a dry, well-ventilated area. Belts must not be left exposed to sunlight or subjected to storage ambient conditions exceeding 85°F, 70% relative humidity. Belts which show signs of deterioration should be replaced prior to startup. Before reinstalling belts, review the section on “Belt Tension.”

**NOTE:** Procedures for storage of Aerovent equipment as outlined above are intended as a general guide only. Storage conditions will vary depending on the location. Common sense and practical experience should determine to what extent the above procedures will be followed.

**Motors**

Motors must be stored under cover in a clean, dry, vibration-free location. Remove sufficient packaging material to allow circulation of air around the motor. Maintain the temperature of the windings a few degrees above that of the surrounding air to protect against condensation. If the motor is equipped with internal heaters, the heaters should be energized throughout the storage period to prevent this condensation. If the motor does not have internal heaters, this can be accomplished using any other safe, reliable method of heating. Measure and record the ambient air temperature and winding temperature monthly.

In the event that the motor is not equipped with internal heaters and space heating equipment is unavailable, wrap the motor as tightly as possible with heavy duty polyethylene. Enclose bags of desiccant (such as sil-
icagel) with the motor to minimize moisture problems. Check the desiccant regularly and replace it periodically as dictated by climate requirements.

To prevent rusting of bearing parts, the rotor must be rotated at regular intervals (30 days) to assure these parts are well covered with oil or grease.

Prior to energizing the motor, it is to be inspected and meggered by a motor manufacturer's field service engineer. The charges for this service to the customer will be in accordance with the manufacturer's published service rates in effect at the time of the inspection.

In addition, it is strongly recommended that the motor manufacturer be contacted for specific long-term storage instructions.

**Fan Bearing Replacement Procedure**

It is important to follow the assembly and alignment procedure when making an installation of replacement bearings. Inspect the shaft for wear at the bearing mounting positions. Shaft diameter should not be undersized more than commercial ground and polished tolerances. Excessive undersizing will result in rapid wear.

1. Place new bearings loosely on the shaft. Locking collars may be located on either end of the bearings for ease of installation. The illustration shows one locking collar on the drive end and one locating collar on the fan end which is typical for a tubaxial type fan. A typical SWSI centrifugal fan would have both collars mounted on the sheave side of the bearings. Drop the mounting bolts in place, snug them and adjust the position of the shaft with proper spacing at either end.

2. Center both ends of the shaft in the housing of tubaxial fans using the propeller as a guide. On centrifugal fans, the shaft is positioned 90° to the scroll side with the wheel inlet centered in the scroll inlet. Use the clearance in the mounting holes for horizontal adjustment and shims, if necessary, for vertical adjustment.

3. Tighten the bearings to the base plate and check the position of the shaft again. Before tightening the locking collars, be sure the shaft and bearings are in proper alignment. The shaft should slide freely end to end.

4. Tighten the eccentric cam locking collar of the bearing at the propeller/wheel 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 shaft rotation to the lock position, then tighten the collar set screw.) Repeat this procedure for the sheave end locking collar on DWDAI and open wheel centrifugals. For other fan types, proceed to Step 5.

5. Axial flow propellers and single inlet centrifugal wheels with back plates exert an air thrust toward the fan inlet. To help balance the bearing loading, we allow the fan end bearing (belt driven units) to carry the majority of this thrust loading while the sheave end bearing carries most of the radial load. (Direct coupled units would be just the opposite.) To accomplish this, grasp the sheave end of the shaft and pull or push on it toward the fan inlet. At the same time, tap the locking collar of the sheave end bearing (fan end on direct coupled units) in the opposite direction with a soft mallet.

6. The final step is to tighten the sheave end bearing eccentric cam locking collar while maintaining constant pressure on the shaft toward the fan inlet.

For special heavy duty bearings, a spring locking collar is used. The two knurled cup-point set screws extend through the inner ring of the bearing and lock firmly onto the shaft. Tighten the propeller end collar first, then take hold of the sheave end of the shaft, pull and then tighten the locking collar. The locking collar is tightened by using the two set screws mentioned above.

**Replacing Fan Belts**

Worn belts may be easily replaced without removing the fan from the system.

1. Loosen the motor hold-down bolts and move the motor toward the fan. (This is done by turning a jack screw which is a part of the motor base on models having larger motors.) The belt may be slipped off the motor sheave and then easily removed from the sheave on the propeller shaft.

2. Check the numbers on the belt and make the replacement with a belt having the same length and section.

3. Adjust the motor outward to tighten the belt (see instructions on belt tension, below) and tighten the motor hold-down bolts. Be sure that the motor is not cocked at an angle and that the end face of the motor sheave is parallel to the end face of the driven sheave.

**Belt Tension Procedure**

Belt tension is very important to the proper operation of a fan and to the service life of a V-belt drive. A new fan will be received with its belts properly adjusted; however, all V-belts stretch in the first few hours of operation. It is necessary to readjust the belt tension after eight hours of running. After 100 hours the belts should again be adjusted. Thereafter, periodic inspection is recommended so belts may be adjusted or replaced when necessary.

1. To adjust the belts, loosen the motor hold-down bolts. Tighten the belt using the motor base adjusting screw until the belt appears to be taut. You should be able to deflect the belt slightly by squeezing the two sides between thumb and forefinger and the belt should snap back into position when released.

2. Retighten the motor hold-down bolts and start the fan. If the belt screeches on startup it is too loose and should be tightened further.

3. Allow the fan to run for a while, stop the fan, and check the temperature of the sheave with your hand. If the sheave is too hot to touch, the belt is probably too tight.

Aerovent IM-100
V-belt drives on Aerovent fans are purposely sized to handle considerably more load than would be necessary for normal drive design. This is done to prolong the life of the drive and provide for minimum maintenance. Belts should be replaced when they have obviously become worn, even though they are still operating. A badly worn belt will also cause undue wear of the sheave. Replace belts when they show definite signs of wear; otherwise the sheaves will become worn to the point where they also must be replaced. Never put new belts on a badly worn sheave. This will reduce the capacity of the drive and cause excessive belt wear.

Most Aerovent fans are provided with an adjusting screw as a part of the motor base for easy setting of belt tension. However, small fans or fans using small horsepower motors may have only a slotted base plate. When the belt tension is adjusted by moving a motor on a slotted base, be sure to block the motor tightly and squarely before tightening the hold-down bolts, keeping the motor sheave in line with the belt. The motor sheave must be parallel to and in line with the fan sheave.

When you make replacement of belts on a multi-groove drive, be sure they are used in a matched set. If you are not sure the belts are matched, observe them in operation. The tight side should be perfectly straight and the belts should run smoothly and in line. The slack side should bow out and also be in line. If one of the belts extends out considerably farther than another, it is an indication that the belts are not matched and should be changed. If there is only a slight difference, the normal stretching in the first hours of operation will equalize the belt lengths and the belts will be well matched.

**Adjusting Variable Pitch Sheaves**

Many Aerovent belt driven fans are furnished with variable-pitch motor sheaves. Sheaves may be adjusted for lower fan speeds without concern of overloading motors. When adjusting sheaves to increase the fan speed, check the motor current to be sure the motor is not overloaded. Keep the motor current within the nameplate and service factor ratings.

The sheaves used are easily adjusted. They come in various styles, depending upon the size drive and motor shaft. They are all fitted with hollow head knurled point safety set screws.

The following steps should be taken to adjust the pitch diameter.

1. Release belt tension and remove the belt or belts from the sheave.
2. Loosen the set screw and remove the key holding the adjustable half of the groove (keys used on styles 2, 3, 5 and 6 only). With styles 3 and 6, it may be necessary to remove the sheave from the shaft to remove the key.
3. Rotate the adjustable half of the sheave out for a smaller pitch diameter (decreased speed) or in for a larger pitch diameter (increased speed). Each one-half turn will change the pitch diameter one-tenth of an inch. Adjust two-groove sheaves the same amount on each groove. 4L or A belts will operate satisfactorily with the sheave fully closed to a maximum of five full turns open. 5L or B belts will operate satisfactorily with the sheave one full turn open to a maximum of six full turns open. (This will insure full contact of the sheave in the groove.)
4. Replace the key and tighten the set screw to lock the sheave half in position.
5. Replace the belts and tighten to the proper tension. If an extreme amount of adjustment has been made, it may be necessary to replace belts with another length.

**V-Belt Drive Alignment**

Proper alignment and balance of the V-belt is as important as a well-balanced propeller. To insure smooth fan operation, the following should be checked:

1. The fan and motor sheaves must be in axial alignment. Shafts are parallel in both the vertical and horizontal planes (Figure 3).

2. The fan motor sheave must be in radial alignment. When sheaves are of equal width, align with a straightedge (Figure 4a). When sheaves are of unequal width, align the center of the sheaves (Figure 4b).
3. Sheaves must have no noticeable eccentricity.
4. Belts must have the proper tension. Belts either too loose or too tight cause vibration and excessive wear (Figure 5). See instructions for belt tension adjustment procedure.
5. After proper installation of drives, recheck the complete assembly for smoothness of operation.

Figure 4. Sheave Alignment

<table>
<thead>
<tr>
<th>4a</th>
<th>4b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straightedge Touching Sheaves At Arrows</td>
<td></td>
</tr>
</tbody>
</table>

3. Sheaves must have no noticeable eccentricity.
4. Belts must have the proper tension. Belts either too loose or too tight cause vibration and excessive wear (Figure 5). See instructions for belt tension adjustment procedure.
5. After proper installation of drives, recheck the complete assembly for smoothness of operation.

Figure 5. Proper Belt Tension

Slight Bow

Too Tight

Too Loose

**Flexible Couplings**

Direct-coupled fans, which are received factory assembled, on a common base plate, are accurately aligned before shipment. However, base plates are flexible to some extent and therefore must not be relied upon to maintain the factory alignment. Realignment is necessary after the fan has been leveled, grouted, and the foundation bolts tightened. Also, check the lubricant, where applicable, following the manufacturer's recommendations for the type and amount of lubricant.

For field installation, the coupling should be mounted as follows:
1. Remove dirt or rust from fan and motor shafts and coat with grease or oil for ease of mounting.
2. Check fan and fan shaft alignment, making sure that the bearings are secure. Mount the fan shaft coupling half flush to the end of the shaft and secure.
3. Mount the motor shaft coupling half flush to the end of the shaft and secure.
4. Move the motor into position, with the coupling faces separated by the coupling manufacturer's specified gap.
5. With a straightedge, tapered wedge, or a feeler gauge, check for parallel and angular alignment (Figure 6a).
6. Align the shafts until a straightedge appears to be parallel to the shafts. Repeat at three additional points at approximately 90° from each other (Figure 6b). Recheck the hub separation gap.
7. For more accurate alignment, use a dial indicator clamped on one hub. With the dial button resting on the other hub, rotate the hub on which the indicator is clamped and observe the indicator reading. Take readings at four locations, 90° apart. With correct alignment, the faces of the couplings should be parallel within 0.002".
8. Once proper alignment is assured, secure the motor, examine the alignment, complete the assembly, and lubricate the coupling (when required) before putting the unit into operation.

**Figure 6. Flexible Coupling Alignment**

Figure 6. Flexible Coupling Alignment

**Propeller/Wheel Alignment**

Fans, which are received factory assembled, have the propellers already aligned and in place before shipment. However, fans being flexible to some extent are sometimes subject to movement during shipment. To insure smooth operation and proper performance, the following propeller alignment should be checked before putting a fan into operation.

**Propeller Fan Alignment**

The fan shaft should be centered and parallel to the fan casing. Center by checking gap (B) between the propeller tip and the fan casing. Repeat at three additional points at approximately 90° from each other (Figure 7b). Parallelism can be observed by measuring the axial distance (A) from one blade to the end of the fan casing at four points at approximately 90° from each other (Figure 7a).

**Figure 7. Propeller Fan Alignment**

Do not confuse parallelism with blade track (axial deviation of one blade to another). Blade track can be checked by measuring the axial distance from one point on the fan casing to the same point on each blade as it passes by. (Some blades are mistracked for balancing.)

While checking the propeller alignment, it is good practice to check its rotation. Normally the fan rotation is marked by arrows on both the propeller and the fan casing. If omitted, obliterated, or misapplied, check for proper rotation as in Figure 8.

Aerovent IM-100
Centrifugal Fan Alignment

The fan shaft should be approximately centered in the clearance hole in the fan housing and perpendicular to the housing sides.

Adjust the clearance by moving the wheel axially on the shaft. The following table indicates the correct measurements for positioning the BI and BIA wheels. Proper positioning is important in attaining correct fan performance, particularly on the BI and BIA wheels.

Type BI & BIA (SWSI Units)

<table>
<thead>
<tr>
<th>SIZE</th>
<th>A</th>
<th>W*</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>4½/₃₄</td>
<td>4/₃₄</td>
</tr>
<tr>
<td>14</td>
<td>5/₃₄</td>
<td>5/₃₄</td>
</tr>
<tr>
<td>16</td>
<td>5½/₃₄</td>
<td>5½/₃₄</td>
</tr>
<tr>
<td>18</td>
<td>6½/₃₄</td>
<td>6½/₃₄</td>
</tr>
<tr>
<td>20</td>
<td>7½/₃₄</td>
<td>7½/₃₄</td>
</tr>
<tr>
<td>22</td>
<td>8½/₃₄</td>
<td>8½/₃₄</td>
</tr>
<tr>
<td>25</td>
<td>9½/₃₄</td>
<td>9½/₃₄</td>
</tr>
<tr>
<td>28</td>
<td>10½/₃₄</td>
<td>10½/₃₄</td>
</tr>
<tr>
<td>32</td>
<td>11½/₃₄</td>
<td>11½/₃₄</td>
</tr>
</tbody>
</table>

"A" dimension (inside edge of inlet cone to inside face of wheel backplate) must be held. This dimension is critical to fan performance. "A" dimension shown is based on 100% wheel width "W" and must be adjusted if the wheel furnished is other than 100% full width.

Type BW, OW, PB & HPB

These radial blade wheels do not require precise positioning to attain the correct performance. The important thing is to centrally locate these wheels axially within the housing to insure adequate running clearance and to maintain concentricity with the fan inlet.

Type AW

These wheels require a special inlet on the housing which must extend into the wheel inlet flange to perform properly. Other than maintaining a minimum ½" overlap, adequate running clearance and concentricity are all that is required.

Type FC

The forward-curved blower employs a shallow venturi in the housing to guide the air into the wheel. The depth of this venturi is approximately one-tenth the wheel diameter. Clearance between the wheel and venturi should be the smallest allowable and still maintain normal running clearance. This axial separation is approximately ½" and should be measured at four points approximately 90° apart.

Installation Instructions for Propellers Equipped with Browning Malleable Iron Split Taper Bushings

Many Aeroveit fans are furnished with split taper bushings for mounting the propeller to the shaft. When properly assembled, the bushings grip the hub with positive clamping action.

1. The bushing barrel and the bore of the propeller are tapered. This assures concentric mounting and a true running propeller.
2. Capscrews, when tightened, lock the bushing in the propeller. Use special plated capscrews threaded full length furnished by Aeroveit.
3. The bushing is split so that when the locking capscrews force the bushing into the tapered bore, the bushing grips the shaft with a positive clamping fit. This will withstand vibration and punishing loads without being loosened.
4. The propeller and bushing assembly is keyed to the shaft and held in place by compression. This gives added driving strength.

Before assembly, be sure that the shaft and keyway are clean and smooth. Check the key size with both the shaft and bushing keyways.

5. To assemble, put the capscrews through the clearance holes in the bushing and put the bushing loosely into the propeller. Do not press or drive. Start the capscrews by hand, turning them just enough to engage the threads in the tapped holes on the propeller. Do not use a wrench at this time. The bushing should be loose enough in the propeller to move slightly. Slide the propeller and bushing assembly onto the shaft, making allowance for end play of the shaft to prevent rubbing. Install the key into the keyway. Do not force the propeller and bushing onto the shaft. If it does not go on easily, check the shaft, bushing and key sizes once again.
Capscrew Torque Values

<table>
<thead>
<tr>
<th>BUSHING NO.</th>
<th>DIAMETER (IN)</th>
<th>LENGTH (IN.)</th>
<th>TORQUE FT. LBS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>¼-20</td>
<td>1/4</td>
<td>7½</td>
</tr>
<tr>
<td>P-1</td>
<td>¾-18</td>
<td>1½</td>
<td>13</td>
</tr>
<tr>
<td>P-2</td>
<td>½-18</td>
<td>1½</td>
<td>13</td>
</tr>
<tr>
<td>Q-2</td>
<td>¾-16</td>
<td>2½</td>
<td>24</td>
</tr>
<tr>
<td>R-2</td>
<td>½-16</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>

Tighten the capscrews progressively with a wrench. Do this evenly as in mounting an automobile wheel. Tighten each capscrew part of a turn successively until all are tight. These capscrews force the taper bushing into the hub which in turn compresses the bushing onto the shaft. This makes a positive clamping fit. The torque must not exceed that shown in the table above.

**WARNING:** Do not attempt to pull the bushing flange flush with the hub end. There should be a clearance which varies approximately 1/16" to 1/8" with the bushing size when tightened. (Note, this is not a locating dimension.)

Removing Propeller Assembly from Shaft (see Figure 9)

1. Remove all capscrews from the propeller and hub assembly.
2. Start capscrews into the threaded holes in the bushing flange.
3. Tighten each bolt successively part of a turn to force the propeller off the bushing. This forces the bushing loose from the propeller and releases the compression so that the entire assembly will slide from the shaft.
4. Pull the bushing off the shaft. If the assembly has been in place some time, it may be necessary to use a wheel puller to remove the bushing. Never use a wheel puller on the propeller.

**Typical Motor Current and Starter Size**

<table>
<thead>
<tr>
<th>HP</th>
<th>THREE PHASE</th>
<th>SINGLE PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>230V AMPS</td>
<td>460V AMPS</td>
</tr>
<tr>
<td>1/4</td>
<td>1.7</td>
<td>0.9</td>
</tr>
<tr>
<td>½</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1/2</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>3</td>
<td>3.5</td>
<td>1.8</td>
</tr>
<tr>
<td>1½</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>6.5</td>
<td>3.3</td>
</tr>
<tr>
<td>3</td>
<td>9.0</td>
<td>4.5</td>
</tr>
<tr>
<td>5</td>
<td>15.0</td>
<td>7.5</td>
</tr>
<tr>
<td>7½</td>
<td>22.0</td>
<td>11.0</td>
</tr>
<tr>
<td>10</td>
<td>27.0</td>
<td>14.0</td>
</tr>
<tr>
<td>15</td>
<td>40.0</td>
<td>20.0</td>
</tr>
<tr>
<td>20</td>
<td>52.0</td>
<td>20.0</td>
</tr>
<tr>
<td>25</td>
<td>64.0</td>
<td>30.0</td>
</tr>
</tbody>
</table>

For larger motor sizes, refer to National Electric Code.

---

**Figure 9. Removing Propeller Assembly**

Do not lubricate capscrews, bore, or bushing barrel.

---

**Aerovent**

A Twin City Fan Company

5089 Trenton Lane · Minneapolis, MN 55442-3238
Phone (763) 551-7500 · Fax (763) 551-7501 · www.aerovent.com
Model 53, 40C and SV40 Roof Ventilators

Installation
1. Check for possible damage in shipment to roof ventilator.
2. Assemble damper section, fan and curb base.
3. Caulk between flanges of damper section, fan section and curb base (see illustration).
4. Install assembled ventilator onto roof curb. Secure ventilator to curb with bolts (see illustration).
5. Check propeller for proper rotation.
6. Make certain dampers operate smoothly and are free from obstruction.

Detail of Mounting
Flat Type Curb Base on Existing Roof

Use Hydro Shield and heavy-duty glass membrane — Addex Corporation (or equal).
1. Set ventilator curb base in mastic.
2. Apply mastic over curb base flange.
3. Work membrane into mastic.
4. Trowel mastic over membrane and work in.

Field Procedure: Caulk ventilator at locations where indicated to prevent leakage.
Care and Maintenance

Good fan maintenance requires regular and systematic inspection of all fan parts. Severity of the application should determine frequency of inspection.

Regular fan maintenance should include the following:

1. Propeller — The propeller in an axial flow fan must be kept reasonably clean if it is to perform properly. Fans handling fresh air for ventilating purposes will seldom need cleaning. Fans exhausting process air should be cleaned as required. Dirt or chemical deposits will usually build up on a propeller evenly, and they present no problem to performance or operation until they become thick enough to break away in crust-like pieces. When this happens, the propeller may be thrown out of balance and the resulting vibration could be serious. The dirt or chemical deposits should be removed by solvent cleaning or scraping. If the propeller has been coated, be careful not to cut through this protective covering. If the propeller shows excessive wear, it should be replaced immediately. Refer to General Installation and Maintenance IM-100 for proper procedure in removing and replacing the propeller.

2. V-Belt Drive — Check V-belt drive for proper alignment and tension. See General Installation and Maintenance IM-101 for instructions.

3. Fan Bearings — Lubricate the bearings (if belt driven). Bearing lubrication instructions are detailed in IM-100.

4. Screws and Bolts — Check tightness of all screws and bolts throughout the ventilator assembly.

5. Dampers — Periodically check damper blades and remove accumulated dirt. Check bronze damper bearings for smooth operation.

Wiring — Disconnect Switch, Starter and Fan Motor

3-Pole Disconnect Switch/2 Speed Motor

Optional By Aerovent:
Disconnect switch mounted on unit. All wiring by electrical contractor.

6-Pole Disconnect Switch/2-Speed Motor

Optional By Aerovent:
Disconnect switch mounted on unit. Wiring from motor to disconnect. Other wiring by electrical contractor.

3-Pole Disconnect Switch/Single-Speed Motor

Optional By Aerovent:
Disconnect switch mounted on unit. Wiring from motor to disconnect.

Aerovent

A Twin City Fan Company

5959 Trenton Lane · Minneapolis, MN 55442-3238
Phone (763) 551-7500 · Fax (763) 551-7501 · www.aerovent.com
Recommended
SAFETY PRACTICES
For Users and Installers
of Industrial and Commercial Fans
AMCA Publication 410-96

FOREWORD

i. This publication has been prepared by the Air Movement Division of the Air Movement and Control Association International, Inc. (AMCA). The information contained in this publication has been derived from many sources. The suggestions made necessarily should be general in their meaning and cannot be applied literally to all specific situations or conditions.

ii. The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user. From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas which require some special attention include system design, layout and construction, fan performance specifications, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair. Specific safety requirements are mandated by federal, state, and local codes. Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans is published by AMCA for assistance. System designers, installers, maintainers, and users should consult and properly comply with all applicable codes and guidelines.

iii. The safety recommendations contained herein are intended to assist designers, installers, maintainers, or other users of air moving devices in the safe operation and use of the devices mentioned. These recommendations do not represent the only methods, procedures, or devices appropriate for the situations discussed. Caution should be used at all times when working in or around moving parts.

iv. AMCA disclaims any and all warranties, expressed or implied, regarding the products sold by the manufacturer with which this booklet has been provided. Further, AMCA recommends that competent personnel be consulted in deciding what is the preferred or recommended safety procedure in a particular instance where the guidelines contained in this booklet are unclear or in any way incomplete.

v. AMCA has offered the information within this booklet to assist in the safe operation, maintenance, and use of the products sold by members of AMCA. In so doing, AMCA does not assume any legal duties of the designer or manufacturer to instruct or warn about their product. AMCA expressly disclaims liability for any injury or damage arising out of the operation or use of the product or the guidelines contained herein.

vi. These recommended safety practices were adopted by the AMCA membership on April 28, 1996.

© 1996

1. INTRODUCTION

1.1 Fans and other air moving devices are made in a wide variety of types, sizes, and arrangements. This publication addresses the proper use and installation of industrial and commercial fans. It is not intended to address residential and consumer fans.

1.2 Various "size" factors are important when assessing potential for injury; some factors are: diameter of impeller (wheel, rotor, propeller), rotational inertia, voltage, and current.

1.3 This guide is intended to assist in the safe installation of air moving equipment and to warn operating and maintenance personnel of the commonly recognized hazards associated with this equipment.

1.4 Handling and installation should always be performed only by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury. In addition to following the manufacturer's installation instructions, care should be taken to ensure compliance with specific safety requirements mandated by federal, state, and local codes. Industry safety standards and practices published by AMCA and by other recognized agencies and associations should be consulted and followed wherever applicable.

2. PERSONNEL SAFETY ACCESSORIES

2.1 GENERAL

2.1.1 Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating procedures being employed. Proper protective safety devices; company safety standards; specific safety requirements mandated by federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be determined by the user, who should specify and obtain the appropriate devices from the fan manufacturer or others, and should not allow operation of the equipment without them. Examples of available devices include the following:

2.2 FAN GUARDS

2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be followed.
2.2.2 Roof-mounted fans and other fans which are not generally accessible may not require safety guards which might otherwise be appropriate. Where accessibility to these fans is occasional or infrequent, the expense of permanent guarding may be reduced through the use of lockout switches and suitable warnings. In such cases, maintenance personnel should engage the lockout switch before undertaking any maintenance or repairs. As is the case with other machinery involving moving parts, common sense and caution will preserve personal safety.

2.3 INLET AND OUTLET GUARDS

2.3.1 Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.

2.4 DRIVE GUARDS

2.4.1 Fans may be driven directly from the motor shaft or through a belt drive. Where the bearing assembly, rotating shaft, sheaves, or belts are exposed, a suitable guard may need to be provided. Some example guards are shown below.

2.4.2 Drive guards may be required for tubular centrifugal or axial fans to cover the exposed drive sheave and belts outside the fan housing.

2.4.3 A typical centrifugal fan drive guard may vary with the arrangement. Safety guards should be used when drive systems are accessible to personnel. In restricted areas, omission of the back cover may be acceptable.

2.4.4 Dampers and their linkage may operate suddenly without warning at high speeds. Dampers and their linkage contain pinch points which should be identified and guarded.

3. HIDDEN DANGERS

3.1 GENERAL

3.1.1 In addition to the obvious hazards associated with the moving parts of rotating machinery, fans present additional potential hazards that are not so obvious and should be considered by the system designer and user for safe operation.

3.2 SUCTION AND AIR PRESSURE

3.2.1 Fans operate by creating suction and air pressure which can be hazardous. Solid objects can be drawn into a fan’s inlet and then become dangerous projectiles when they are exhausted through the fan’s outlet. Solid objects can also cause fan failure or impeller failure due to imbalance or damage to the impeller blades. Personnel in close proximity to a fan inlet can be overcome by the suction, and drawn into the fan.

3.2.2 Whenever there is a possibility that solid objects can be drawn into a remote intake, the intake should be guarded at all times. Before a guard is removed, the fan should be disconnected and the power supply locked out.

3.2.3 Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

3.2.4 Access doors to a fan or duct system should never be opened while the fan is operating or coasting to a stop. On the downstream (or pressure) side of the system, releasing the door with the system in operation may result in an explosive opening. On the upstream (or suction) side, the inflow may be sufficient to draw in tools, clothing, and other materials. The power supply should always be locked out prior to accessing a fan or ductwork.

3.2.5 Fan design sometimes requires access doors to be supplied with internal components such as a plug to fill a hole in the fan casing. These doors can often be heavy and difficult to handle. Care should be exercised when opening, removing, and installing these components.

3.3 WINDMILLING

3.3.1 Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to “windmilling” which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

3.4 TEMPERATURE

3.4.1 Many fans, fan motors, and fan components run at temperatures that could burn someone who comes in contact with the hot areas, including discharged or leaking gases. If this potential hazard is present, steps should be taken so that personnel working near the fan are aware of the danger and can exercise caution.

3.5 FAN NOISE AND ENVIRONMENT

3.5.1 Some fans can generate sound that could be hazardous to exposed personnel. Sound pressure can be measured in the field, but obtaining accurate data is difficult. The environment in which the fan operates can impact the ability to obtain accurate fan sound readings. Consult the manufacturer for fan sound data. It is the responsibility of the system designer, installer, user, and maintainer to comply with specific safety requirements mandated by federal, state, and local codes; and to follow industry safety standards and practices published by AMCA and by other recognized agencies and associations, regarding personnel safety from exposure to fan noise associated with use and exposure to the equipment.

3.6 STROBOSCOPIC EFFECT

3.6.1 The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped. In these cases, irregular markings can be placed on the moving parts to prevent this type of effect. Personnel should be warned that the fan may be in motion even if it appears not to be.

3.7 SPECIAL PURPOSE FANS AND SYSTEMS

3.7.1 The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

4. POWER ISOLATION

4.1 Every fan should be installed with a suitable device allowing it to be completely disconnected or isolated from the power supply.

4.2 Many fans are started by remote switches or push-buttons,
by interlocks with other equipment, or by automatic controls. Before performing any maintenance, inspection, or other activity which will require removal of guards, ductwork, access doors, etc., or exposure of moving parts, the fan power supply should be locked out and the fan tagged out of service.

4.3 In some installations other equipment, such as gas burners, may be interlocked with the fan so that disconnecting the fan will automatically shut off the burner or other device. Maintenance on systems of this type should be performed only under the supervision of competent engineering personnel and in accordance with applicable codes and standards.

4.4 In cases where the fan is power driven by a source other than an electric motor, appropriate provisions should be made for the isolation or disengagement of the power supply.

5. START-UP CHECK LIST

5.1 GENERAL

5.1.1 Before putting any fan into initial operation, the manufacturer's instructions should be followed. Transportation, handling, and installation can cause fasteners to loosen, and cause misalignment of fan components. Carefully follow this check list when commissioning equipment.

5.1.2 Lock out the primary and all secondary power sources.

5.1.3 A complete inspection should be made of all of the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures might include the use of goggles, respirators, or other personal protective devices.

5.1.4 Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

5.1.5 Check and tighten all bolts, fasteners, and set screws as necessary.

5.1.6 Check the fan assembly and bearings for proper groundings to prevent static electricity discharge.

5.1.7 Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

5.1.8 Check bearings for recommended lubricant and lubrication amounts.

5.1.9 Spin the rotating assembly to determine whether it rotates freely, without hitting anything, and is not grossly out of balance.

5.1.10 Inspect impeller for proper rotation for the fan design.

5.1.11 Check alignment of drives and all other components.

5.1.12 Check the belt drive for proper sheave selection and installation and make sure the sheaves are not reversed (excessive speeds could develop).

5.1.13 Check for recommended belt tension.

5.1.14 Properly secure all safety guards.

5.1.15 Ensure that all appropriate warnings have been put in place.

5.1.16 Secure all access doors to the fan and ductwork.

5.1.17 Momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

5.1.18 Switch on the electrical supply and allow the fan to reach full speed. Check carefully for:

(1) Excessive vibration
(2) Unusual noise

(3) Proper belt alignment
(4) Proper lubrication
(5) Proper amperage, voltage, or power values.

(6) If any problem is indicated, SWITCH OFF IMMEDIATELY.

(7) Lock out the power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for the cause of the trouble, correct as necessary, and repeat check list procedure.

5.2 Even if the fan appears to be operating satisfactorily, shut down after a brief period, lock out the power supply, and recheck items 5.1.5 through 5.1.17 as the initial start-up has been loosened the bolts, fasteners, and set screws.

5.3 The fan may now be put into operation, but during the first eight hours of running, it should be closely observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

5.4 After eight hours of operation, the fan should be shut down and the power locked out. Check list items 5.1.5 through 5.1.17 should be inspected and adjusted, if necessary.

5.5 After twenty-four (24) hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

5.6 After commissioning and start-up, the fan should be operated and maintained in accordance with the manufacturer's and component manufacturer's recommendations. Some basic guidelines for WARNING SIGNS and ROUTINE MAINTENANCE are included in Sections 7 and 8 of this publication. These sections are meant as a supplement to other publications and are not intended to replace the manufacturer's instructions.

6. SPECIAL PURPOSE FANS

6.1 Most fans are designed to handle clean air at standard temperatures between 32°F and 120°F. These fans should not be placed in systems or used for other than their design intended use. Special Purpose Fans are designed for use in systems that may include extreme temperatures, explosive, toxic, or special gases, material handling, corrosive environments, or other special hazards which should be carefully considered. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be followed.

6.2 Where the system will handle explosive or flammable materials (i.e., dust, fumes, vapors or gases), fans of spark-resistant construction should be used.

6.3 Fans connected by ductwork or other piping may contain gases other than air which are hazardous. In these cases, procedures should be established to prevent exposure of personnel working on or near the fan, and by maintenance personnel who may need to enter the fan. Appropriate personal protective equipment as determined by the material safety data sheet, and system operators should be utilized. Appropriate environmental protective measures should also be taken.

6.4 Fan inlet boxes, housings, ductwork, and other system components which are large enough to permit entry should be considered confined spaces. System areas may also serve as low points where heavy gases, liquids, or other substances may accumulate and present explosive, fire, health, or suffocation hazards. Appropriate protective measures and safety practices should be observed when entering or working within these areas.

6.5 Material-handling fans are specially designed to allow the fan to handle a specific type of material without excessive accumulation of material on the fan impeller. Fans handling corrosive gases or erosive materials should be checked periodically. If loss of material is evident, the fan should be shut down, power supply locked out, and tagged out of service. The manufacturer or other qualified personnel should be consulted to determine if the fan is...
within safety limits for operation. To ensure satisfactory operation it is essential to observe the manufacturer's limitations concerning the type of material to be handled by the fan.

6.6 Fan ratings and maximum speed limits are typically based on the use of air at 70°F. At temperatures above the normal range (specified by the manufacturer), a reduction should be made in the maximum speed limit. Information on this reduction and on other precautions to be taken for high temperature applications should be obtained from the fan manufacturer. Personnel working near high temperature fans should be aware that coming in contact with the fan's housing, ductwork, or handled gases could result in serious burns. Where the danger of burns is not apparent, appropriate warnings should be posted. Appropriate protective apparel should be worn whenever working in close contact with heated housings or ductwork.

6.7 Corrosive contaminants can be formed when moisture combines with an active airborne chemical. Fans subjected to corrosive contaminants will corrode; however, suitable protective coatings or materials, if used in the fan construction, can delay corrosion. Protected fans should be regularly inspected to ensure that the protection remains effective. Personnel working in environments with airborne chemicals may require personal protective apparel equipment.

6.8 Where liquid can accumulate within the fan, provide for the installation of adequately sized drains.

6.9 In those applications where there is a potential for chemical build-up (such as grease, creosote, etc.), periodic cleaning and proper drainage are necessary to avoid a fire hazard.

7. WARNING SIGNS

7.1 GENERAL

7.1.1 A change in the operating characteristics of a fan may indicate the need for maintenance. Sudden changes may indicate severe problems or dangerous conditions developing. Investigate any changes in the operational characteristics or unusual symptoms of the fan. Refer to AMCA Publication 262, Troubleshooting, for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with questions concerning changes observed.

7.2 EXCESSIVE VIBRATION

7.2.1 Operational vibration levels are one of the best indicators of the condition of the blower. Careful observation and monitoring of vibration levels can detect a minor problem in the early stages of development when correction is less costly and easier. Recommended maximum vibration levels should be obtained from the equipment manufacturer.

7.2.2 If excessive vibration is observed, stop the fan and lock it out until the cause is corrected. Check for material build-up on the impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to catastrophic failure of the fan or its components. Excessive vibration can also be caused by looseness in the drive train, loose fasteners, misalignment or impeller damage. Contact the fan manufacturer or other qualified consultant to determine the maximum vibration level if it is not included in maintenance instructions.

7.3 NOISE

7.3.1 Changes to the sound level may indicate maintenance is needed. Some unusual noises often heard include: bearing noise indicating the bearings need lubricant or replacement; scraping or tucking noise indicating the rotating parts are hitting the stationary parts; squealing indicating the belt drive needs tensioning; repeated changing pitch of the blower indicating operation of the blower at too low a flow. If any of these noises or any other unusual noises are detected, their cause should be determined and corrective action taken as necessary.

7.4 HIGH MOTOR TEMPERATURES

7.4.1 Check that cooling air to the motor has not been diverted or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major change has occurred in the system.

7.5 HIGH BEARING TEMPERATURES

7.5.1 This condition is usually caused by improper lubrication; this can be either "over," "under," or "unsuitable" lubrication. In every case, if the cause of the trouble is not easily seen, experienced personnel should examine the equipment before it is put back in operation.

7.6 POOR PERFORMANCE

7.6.1 Too much flow or pressure or too little flow or pressure is often a symptom of a change in the operating system. A fan will typically operate at the same performance in a static system. Some typical causes include: operating of the fan backwards after maintenance procedures, filters dirty or not in place; change or blockage in the ductwork; change in speed of the fan (switching the sheaves); loss or failure of the impeller. All of these causes and many others will affect the flow and pressure produced by the fan.

8. ROUTINE MAINTENANCE

8.1 A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturer or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

8.2 The fan manufacturer's operating and maintenance recommendations, as well as the components manufacturer's instructions (such as motor, bearing, drives, etc.) should be strictly followed.

8.3 Maintenance should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Do not attempt any maintenance on a fan unless the fan power supply has been locked out and tagged out and the impeller has been secured.

8.4 When performing maintenance functions which include disassembly of the fan, careful consideration should be given to the size, weight, center of gravity, and lifting means of the fan components. It should also be noted that the outboard bearing on some fans such as arrangements 1, 8, 9, and 10 is often cap-loaded. Removal of the securing means may result in a sudden change in impeller position.

8.5 Historical data is often the best indicator for determining the operational condition of the fan. Maintenance logs which include relubrication, vibration levels, temperature levels, power requirements, inspections, and other pertinent records must be maintained and consulted as necessary when assessing the condition of the fan.

8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

8.7 The fan impeller should be specially checked for build-up of material or dirt which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

8.8 Periodic inspection of the rotating assembly should be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue. Where signs of deterioration are found, lock out and tag out the impeller until the unit has been inspected and approved by a qualified consultant.
IMPORTANT — Read Carefully

These instructions are provided to aid in the proper installation, operation and maintenance of Link-Belt Series B22400 and B22500 spherical roller bearing units. They should be carefully read and followed. Failure to do so may result in unsatisfactory service as well as serious personal injury or property damage.

CAUTION

The reliability built into all Link-Belt bearings can be realized in service only when they are correctly selected, properly installed, protected and maintained.

The correct selection of bearings or mounted units requires that the magnitude and nature of all loads, speeds, alignment, mounting, operating requirements and maintenance be adequately considered. The selection of suitable lubricant and design of housings, shafts, fasteners, seals and accessories as well as provisions for installation and maintenance must follow good engineering principles. Housing must be selected and installed with regard to the degree and direction of the forces that will occur. Housings should not be used unless designed for the specific application. For this reason, pillow blocks are best suited to withstand radial loads passing through the base. When heavy loads or shock loads are possible, it is important to mount a unit so that the line of force passes directly and equally through the base. If this is not possible, then an additional bearing must be provided. Support should be at points directly under the bearing.

The following general points of installation and operation are very important:

A. Cleanliness — Keep dirt, water and metal chips off all parts.

B. Careful Handling — Hammer blows or improper use of force can damage precision parts.

C. Shaft Fits — Bearings should have proper fits on the shafts to minimize fret wear. See installation instructions for shaft tolerances. When mounting bearings on a used or worn shaft, care must be taken to clean up the shaft journal and rebuild, as necessary, to the required tolerances. Never replace bearings on a shaft which is bent or has been damaged or softened by a torch.

D. Bolts — Housing mounting bolt tightness is important to prevent the housing from shifting, and to adequately support loads.

E. Setscrews — Setscrews must be properly torqued to prevent the shaft from slipping in the inner ring and to prevent loosening during operation.

F. Free Rotation and Alignment — Check for free rotation before machine start-up to assure that final alignment is proper.

G. Lubrication — Units must be adequately lubricated. A bearing not properly lubricated can rust, be destroyed and possibly cause damage to other components.

Installation

1. Check Shaft — Shafting must be clean, round, straight, free of burrs and nicks and of correct size. For the average installation with moderate loads and speeds, the shaft should measure as follows:

   **Shaft Diameter** | **Recommended Tolerance**
   ------------- | -------------
   1/4 to 1/2 in. | Nominal to minus 0005"
   1/2 to 3/4 in. | Nominal to minus 0010"
   3/4 to 1 in.  | Nominal to minus 0015"

   *Satisfactory performance may be obtained with increased shaft tolerances under some less severe conditions. Very difficult applications may require a tight interference fit of the bearing on the shaft. Consult Link-Belt Bearing Division for recommendations.*

2. Shaft Preparation — When frequent removal of bearings is anticipated, file flats on the shaft approximately 1/8" deep under the collar setscrew locations. This provides for easy removal, as bearings will clear the burrs caused by correctly tightened setscrews.

3. Lubricate Shaft & Bearing Bore — Coat the shaft and bearing bore with grease or oil to facilitate assembly.

4. Assemble on Shaft — It is necessary to top or press units on the shaft, use a hardwood block, soft steel bar or tube against the end of the inner ring. Do not strike or exert pressure on housing or seals.

5. Bolt Fixed or Locating Unit to Shaft — Bolt fixed unit securely to its support. Bolt grade selection is important on many applications depending on load and shock conditions. Use Grade 5 mounting bolts properly torque can be used. Grades over SAE 5 should not be used with cast iron housings.

6. Final Positioning — Establish final shaft position and secure locking collar of fixed unit to shaft. Tighten collar setscrews to the torque values given in Table 1.

7. Bolt Expansion or Other Unit to Support — If an expansion unit is used, position the cartridge in the housing to allow for adequate movement in the direction of expected expansion. Align and shim the housing as necessary to place the bearings in the approximate center of their housing alignment range. Bolt unit securely to support (reference step 5).

8. Finally Mounting — Rotate shaft slowly, under load if possible, for several revolutions to properly center the bearing elements with respect to the races. Securely tighten collar setscrews of remaining bearing, following the same procedure as outlined under step 6.

9. Check System for Freedom of Rotation — Any condition of strain, irregular rotational torque, abnormal sound or vibration may be due to improper alignment, improper location, bent shaft, distorted supports, etc. Installation should be rechecked and corrections made as required.

The use of stop bars welded to the support at each end of the units leaving about 1/4" space for ease of assembly is good practice. Wedge shims in 1/4" space after units are securely fastened. These bars assure proper location of the units and prevent shifting when loads are applied.

### Table 1 — Setscrew Tightening Torque

<table>
<thead>
<tr>
<th>Shaft Size (in.)</th>
<th>Seating Torque (in./lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 to 1/4</td>
<td>165</td>
</tr>
<tr>
<td>1/4 to 1/2</td>
<td>325</td>
</tr>
<tr>
<td>1/2 to 3/4</td>
<td>460</td>
</tr>
<tr>
<td>3/4 to 1</td>
<td>680</td>
</tr>
<tr>
<td>1 to 2</td>
<td>1350</td>
</tr>
</tbody>
</table>

*(1) Values can vary ± 2.5%*

**Note:** Satisfactory tightness can be obtained using a standard hex wrench (50-52 minimum RHN C) and tightening until a slight permanent twist is obtained in wrench for each screw.
**LUBRICATION**

Units are prefabricated, no additional lubricant is required for startup. As a precaution, if equipment is to be built and left idle for any period of time prior to actual use, the units should be季ed 100% to provide maximum protection from corrosion, etc. The suggested lubrication schedule under Table 2 is a general guide. The specific conditions on an application such as exact hours of operation, temperature, moisture, speed and dirt govern the required lubrication cycle. This can be determined by inspection of the flushed out lubricant during a trial period of operation. Add grease slowly. Use a sufficient volume of grease to purge the bearing seals of old lubricant. It is preferable to rotate bearings during relubrication where good safety practice permits. Inspection of bearing installations at least every six months is recommended. Any unusual noise or vibration change should be immediately investigated.

**TABLE 2 - Grease Lubrication**

<table>
<thead>
<tr>
<th>Ambient conditions</th>
<th>Operating conditions</th>
<th>Bearing temperature</th>
<th>Suggested greasing interval*</th>
<th>Use these greases or equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clean</strong></td>
<td>Dry</td>
<td>Light to medium</td>
<td>Slow to medium</td>
<td>0 to 120</td>
</tr>
<tr>
<td><strong>Moderate to Dirty</strong></td>
<td>Dry</td>
<td>Light to medium</td>
<td>Slow to medium</td>
<td>0 to 120</td>
</tr>
<tr>
<td><strong>Extreme Dirt</strong></td>
<td>Dry</td>
<td>Light to medium</td>
<td>Slow to medium</td>
<td>0 to 200</td>
</tr>
<tr>
<td><strong>High humidity Direct water splash</strong></td>
<td>Dry</td>
<td>Light to heavy</td>
<td>Slow to medium</td>
<td>32 to 200</td>
</tr>
<tr>
<td><strong>Heavy to very heavy</strong></td>
<td>Light</td>
<td>High speed</td>
<td>100 to 200</td>
<td>1 to 8 weeks</td>
</tr>
<tr>
<td><strong>Possible frost</strong></td>
<td>Dry</td>
<td>Light to heavy</td>
<td>Slow to medium</td>
<td>20 to 250</td>
</tr>
<tr>
<td><strong>Clean to moderate</strong></td>
<td>Dry</td>
<td>Light to medium</td>
<td>Slow to medium</td>
<td>80 to 250</td>
</tr>
<tr>
<td><strong>Clean to dirty</strong></td>
<td>Dry</td>
<td>Light to medium</td>
<td>Slow to medium</td>
<td>80 to 300</td>
</tr>
</tbody>
</table>

*Additional bearing protection or special sealing may be required. Consult Link-Belt Bearing Division.

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

---

**LIMITED WARRANTY - LIABILITY**

A. **IT IS EXPRESSLY AGREED THAT THE FOLLOWING WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION OR LIABILITY ON OUR PART OF ANY KIND OR NATURE WHATSOEVER.**

No representative of ours has any authority to waive, alter, vary or add to the terms herein without prior approval in writing, to our customer, signed by an officer of our company. It is expressly agreed that the entire warranty given to the customer is embodied in this writing, that this writing constitutes the final expression of the parties’ agreement with respect to warranties and that it is a complete and exclusive statement of the terms of the warranty.

We warrant to our customers that all Products manufactured by us will be free from defects in material and workmanship. If any Product is returned to us within one year from the date of shipment to the customer for a period of one year from the date of shipment, we shall be deemed waived. As to Products or parts thereof that are proven to have been defective at the time of shipment, and that were not damaged in shipment, the sole and exclusive remedy shall be repair or replacement of the defective parts or repayment of the proportionate purchase price for such Products or parts, at our option. Replacement parts shall be shipped free of charge to our customer. This warranty shall not apply to any Product which has been subject to misuse, misapplication, neglect (including but not limited to improper maintenance and storage).
NOTICE

A MEANS OF Disconnecting POWER TO THIS EQUIPMENT IS REQUIRED. AT THE PURCHASER'S OPTION, THIS UNIT IS NOT FURNISHED WITH A MOUNTED DISCONNECT SWITCH. IT IS THE INSTALLER'S/OWNER'S RESPONSIBILITY THAT A DISCONNECT MEANS BE INSTALLED, BEFORE OPERATION, THAT COMPLIES WITH THE LATEST NATIONAL ELECTRIC CODE (NEC), SECTIONS 440-14, 430-102, OR OTHER SECTIONS AND REQUIREMENTS BY THE LOCAL AUTHORITY HAVING JURISDICTION.

TCF Aerovent, Inc.

WARNING

PROTECTION OVER THE DRIVES ON THIS UNIT IS REQUIRED. AT THE PURCHASER'S OPTION, THIS UNIT WAS NOT PROVIDED WITH SAFETY GUARDS FOR DRIVE COMPONENTS. IT IS THE INSTALLER'S/OWNER'S RESPONSIBILITY THAT GUARDS BE INSTALLED THAT COMPLY WITH THE NECESSARY SAFETY LAWS, CODES, ETC. (OSHA 1910 SEC. 212 TO 219, ANSI 15.1, NFPA 91 SEC. 226, OR OTHER LOCAL REQUIRED CODES).

TCF Aerovent®