Twin City Fan & Blower

INSTALLATION, OPERATION & MAINTENANCE MANUAL

Heavy Duty Centrifugal Fans

ENGINEERING SUPPLEMENT

ES-995

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Introduction

This bulletin has been prepared to guide the users of heavy duty centrifugal fans in the proper installation, operation and maintenance procedures to insure maximum equipment life with trouble-free operation.

Since many fans of this type have custom features or components, please refer to the attached appendices for additional information. When manufacturers of components provide detailed installation and operation manuals, they will be provided. Because of the wide variety of equipment covered in this bulletin, the instructions given here are general in nature.

For safe installation, startup and operational life of this equipment, it is important that all involved with the equipment be well versed in proper fan safety practices and read this bulletin. Please review the safety section before beginning any work. It is the user's responsibility to make sure that all requirements of good safety practices and any applicable safety codes are strictly adhered to.

Shipping and Receiving

All Twin City Fan & Blower products are carefully constructed and inspected before shipment to insure the highest standards of quality and performance. Compare all components with the bill of lading or packing list to verify that the proper unit was received. Check each unit for any damage that may have occurred in transit. Any damage should be reported immediately to the carrier and the necessary damage report filed.

Handling

Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment. Maintain handling equipment to avoid serious personal injury.

Units shipped completely assembled may be lifted with slings and spreader bars. (Use well-padded chains, cables or nylon straps.) On most units, lifting lugs are fashioned to protect the fan and fan housing from damage. Never lift a fan by the inlet or discharge flange, shafting or drives, wheel or impeller, motor or motor base, or in any other manner that may bend or distort parts. Never lift with slings or timbers passed through the fan inlets.

Partial or disassembled units require special handling. All parts should be handled in a fashion which protects the coatings and parts from damage. Components should be handled such that forces are not concentrated to avoid bending or distortion.

The housing should be lifted using straps and spreaders. Do not distort housing or side plates when lifting.

Bearing pedestals should be lifted using straps or padded chains. Under no circumstance should an attached or separated bearing pedestal be lifted by the shaft, bearings, drives, motor or wheel.

The shaft and wheel assembly may be lifted using a hoist and a spreader with a sling around the shaft at points nearest the wheel. Use the spreader bar to ensure that the slings do not push against the sides of the wheel as this may distort the wheel. Take care not to scratch the shaft where the wheel or bearings will be mounted. Never lift or support the assembly by the wheel. Always support the assembly by the shaft when lifting or storing. Do not support the shaft or the wheel on the housing sides.

Wheels shipped separately can be lifted by slings running between the blades or around the hub. Never lift the wheel by blades or flanges. Always transport wheels by lifting. Do not roll the wheel as this can damage coatings and change the balance of the wheel.

Bent shafting is a source of vibration and bearing failure, so handle the shaft with care. Any scratches on the shaft may be removed with fine emery cloth or a stone.

Unit Storage

If fan installation is to be delayed, store the unit in an environmentally stable and protected area. Vibration should not exceed 2 mils at the storage site unless the fan is properly isolated from the vibration. The unit should be reasonably protected from any accidental impacts. Cover the fan to protect coatings and to prevent any foreign material or moisture from entering the inlet or discharge. Take care to protect the motor, drives and bearings.

Extended storage requires monthly inspections. Check for corrosion or damage to the unit and for debris within the fan.

Bearings tend to take on moisture if the atmosphere they are stored in is not at a constant temperature. To avoid corrosion, it is necessary to keep the bearings full of grease and to rotate them periodically. Even when full of grease, bearings will take on moisture, so it is necessary to purge the bearings with new grease to expel moisture every thirty days. It is recommended that the bearings be purged with grease while being rotated by hand. Do not use high pressure greasers as they may ruin the bearing seals.

The drives and belts should be removed if the fan is to be stored for a prolonged period. The drives should be labeled for service and stored in a dry place. Belts should be removed, coiled without kinks, placed in a heavy carton, and stored in a dry, well-ventilated place. To prevent belt deterioration storage conditions should not exceed 85°F and 70% humidity. If belts show signs of deterioration, they should be replaced prior to startup.

Motors should be stored in a clean, dry, vibration-free location. The packaging should be opened up enough to allow air circulation around the motor. The winding temperature should be kept slightly above that of the surroundings to prevent condensation. This can be accomplished by energizing the internal heaters, if the motor is so equipped, or by using space heaters. If it is impossible to heat the windings, the motor should be wrapped tightly with a waterproof material which also encloses several bags of desiccant. Replace the desiccant regularly to prevent moisture problems. The motor rotor should also be rotated regularly (monthly) to assure the bearing parts are well greased.

Foundations and Supporting Structures

The best means of floor mounting a fan is on a well-designed, flat, level concrete foundation. The foundation

should have a mass of at least three times that of the supported assembly. The foundation should extend 6" beyond the outer dimensions of the fan and driver; however, it should be no more than twice the area required for the equipment. If it is made larger, the mass should be increased accordingly to resist rocking modes of vibration. J or T type anchor bolts of sufficient size should be used and should be tied into the reinforcing bar for the the foundation. After the concrete is poured, a pipe sleeve with a diameter of 2 to 2½ times the anchor bolt diameter should be provided around the anchor bolt for final adjustment (see Figure 4). The mounting surface of the foundation should be smooth for good shim contact. When deciding the thickness of the foundation, approximately 1 to 1½" height should be allowed for shimming, grouting, levelling, washers, nuts, etc.

If a structural steel base or platform is to be used, the structure must be designed for the weight of the fan, live loads imposed by rotation of the rotor and driver, and any external live loads. The structure should be designed to ensure that no natural frequency will occur within 30% of the fan speed. This is especially true if the structure supports more than one fan.

Any ducting should have independent support. Do not use the fan to support ducting. The fan frame can be designed to carry some external loads. Consult the factory if this is a concern. Isolating the fan from ductwork with flex connections eliminates transmission of vibration. Fans handling hot gases require expansion joints at both the inlet and discharge to prevent excessive loads caused by thermal growth.

Fan Installation, Factory Assembled Units

Follow proper handling instructions as given earlier.

1. Move the fan to the final mounting position.
2. Remove skid, crates and packing materials carefully.
3. If vibration isolation is to be used, place isolation base on mounting bolts. Line up holes in fan base with bolts.
4. Place the fan on mounting structure. Carefully level the unit (checking the level on the shaft) on the foundation and shim as necessary using stainless steel shims on both sides of each anchor bolt.
5. Check the alignment of the bearings. Shim or reposition the bearings if necessary.
6. Check face alignment of sheaves on belt driven fans. Check tension of belts to see if it is sufficient. Sheaves on belt driven fans are often provided with taperlock bushings. When tightening bushing bolts, proceed in a progressive manner to avoid cocking the tapered surfaces between the bushing and the sheave.
7. Check alignment of factory mounted couplings, as they are subject to misalignment during shipment. Realign if necessary in accordance with the coupling manufacturer's directions which are included with the shipment. **NOTE:** Most couplings need lubrication.
8. Check the tightness of the wheel on the shaft. Check the tightness of foundation bolts, motor bolts, sheaves, and bearings. Make sure there is no rubbing or binding and that the wheel-inlet cone clearances and overlap are correct.
9. Check that bearings are fully lubricated and check the oil level in the static oil lube systems.
10. Install any accessories shipped loose from the factory.

Fan Installation – Disassembled Units With Split Housings

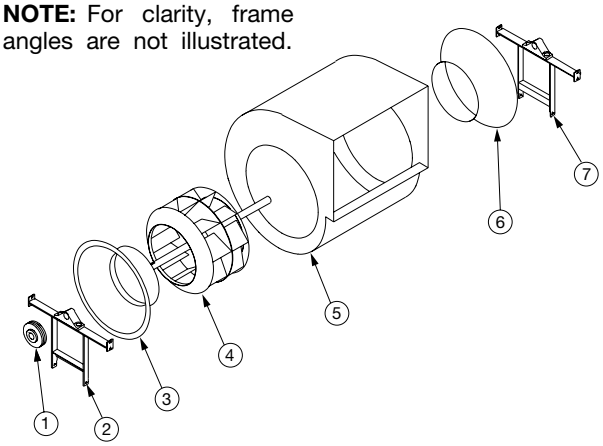
A unit is considered "disassembled" if any component required for proper operation is shipped or supplied separately or in pieces. Reference earlier instructions concerning proper handling of fan components.

All units where assembly of the fan housing or bearing pedestal or drive stand is required will have tags attached on adjacent parts. These tags are used to identify which components are joined together. Units which require extensive assembly may require additional instructions located in the appendix. Special instructions for some components and accessories are also in the appendix.

1. Move the lower half of the housing to its mounting location.
2. Remove skids, crates, and packing materials carefully.
3. If vibration isolation is to be used, place the vibration isolation base on mounting bolts. Line up holes in fan base with bolts.
4. Place the lower housing on the mounting structure. Carefully level the lower housing on the foundation and shim as necessary using stainless steel shims on both sides of each anchor bolt.
5. If the bearing pedestal(s) are separated they should be installed next.
   a. Move bearing pedestal(s) to mounting location.
   b. Put vibration base, if any, in place. Set pedestal(s) on bolt(s).
   c. Do not distort bearing pedestal by forcing it to align with a non-level foundation. Shim beneath the pedestal as necessary.
   d. Check the bearing centerline height. Adjust the height to match centerline height of the housing. High temperature units may require a lower housing centerline when cold so that it will be centered when hot.
   e. Bring the bearing pedestal into square with the housing using careful measurements or a large square.
   f. Bolt the pedestal into position.
6. If the wheel and shaft were shipped unassembled, you must now install the shaft in the wheel.
   a. First use solvent to clean the protective coating off the shaft. Check all surfaces for corrosion or nicks and clean if necessary with fine emery cloth or a stone. After thoroughly cleaning the shaft with solvent, do not touch it with bare hands as perspiration can cause rust or pitting over time.
   b. Remove keys from the shaft.
   c. Clean the inside of the wheel bore with solvent. Make sure the setscrews will not interfere when inserting the shaft into the wheel bore.
   d. Insert the shaft into the wheel from the back side of the wheel.
   e. When the shaft is flush with the wheel hub (Arr. 1, 9 and 8), put the key into the keyway and tighten the wheel setscrews.
   f. Check the assembly drawing to make sure that the wheel and shaft have been assembled correctly.

Figure 1. Exploded View of DWDI Fan Components

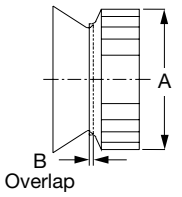
NOTE: For clarity, frame angles are not illustrated.



PART NO.	DESCRIPTION
1	DRIVEN SHEAVE
2	DRIVE SIDE BEARING STAND AND BEARING
3	DRIVE SIDE INLET FUNNEL
4	WHEEL AND SHAFT ASSEMBLY
5	HOUSING
6	INLET FUNNEL
7	OPPOSITE SIDE BEARING STAND AND BEARING

7. The rotor can now be installed in the housing. Slide the bearings on if they are solid pillow blocks or loosely mount the bottom halves if they are split. Inlet vanes and/or inlet funnels may need to be installed over the shaft before installing and bolting the bearings to their supports (Arr. 3 and 7). Refer to steps 8 and 9 below for order of assembly of components for double width and single width fans. The shaft should be cleaned and oiled where it will contact the bearings. Carefully lower the shaft assembly into the bearings. Use care when lowering the shaft onto the bearings so thrust bearings, collars, and liners are not damaged due to misalignment. The bearing housing should be parallel to the axis of the shaft to prevent loads caused by misalignment.
8. Arrangement 3 (split-housed) units (see Figure 1):
   a. Parts on a DWDI unit are assembled in the following order as viewed from opposite drive side: bearing bar assembly and opposite bearing, funnel (housing side), wheel (housing side), funnel, drive side bearing bar assembly, drive bearing and sheaves. Mount bearing bar assembly to housing. Center wheel in funnels.
   b. Assemble parts in above order on shaft.
   c. Proceed with connection of the shaft assembly to supports in step 7 above.
9. Parts on a SWSI unit are assembled in the following order as viewed from opposite drive side: bearing bar assembly and opposite bearing, funnel (housing side), wheel (housing side), drive side bearing bar assembly, drive bearing and sheaves. Mount bearing bar assembly to housing. See Figure 2 for wheel-funnel overlap.
   a. Assemble parts in above order on shaft.
   b. Proceed with connection of the shaft assembly to supports in step 7 above.
10. Install motor on the base if applicable. Carefully align shafts for drive installation.
11. Fans that have motors and drives mounted at the factory are trim balanced prior to shipment. This is not possible on units that are shipped without

Figure 2. Wheel Placement (Wheel Overlap)



NOTE: On Swingout construction, set overlap "B" at zero on all sizes.

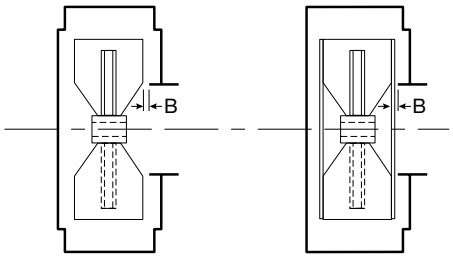
HIB & RTF

SIZE	A	B
180	20.50	0.31
200	22.50	0.34
220	25.00	0.38
240	27.50	0.44
270	30.38	0.47
300	33.50	0.50
330	37.00	0.56
360	41.00	0.63
400	45.25	0.69
450	50.00	0.75
490	55.13	0.81
540	61.00	0.91
600	67.50	1.00
660	74.25	1.13
730	82.00	1.22
800	90.75	1.34

BC, BCS, BAF SWSI & DWDI

SIZE	A	B
122	12.25	0.31
135	13.50	0.34
150	15.00	0.38
165	16.50	0.44
182	18.25	0.56
200	20.00	0.63
222	22.25	0.69
245	24.50	0.75
270	27.00	0.88
300	30.00	0.97
330	33.00	1.06
365	36.50	0.94
402	40.25	1.03
445	44.50	1.13
490	49.00	1.25
542	54.25	1.38
600	60.00	1.56
660	66.00	1.69
730	73.00	1.88
807	80.75	2.09
890	89.00	2.28

RBO & RBR



Class 22

SIZE	B
913	0.53
915	0.53
917	0.59
919	0.69
921	0.78
923	0.88
926	0.97
929	1.03
933	1.22
937	1.41
941	1.56
945	1.69
949	1.81
954	1.88
960	2.16

Class 32

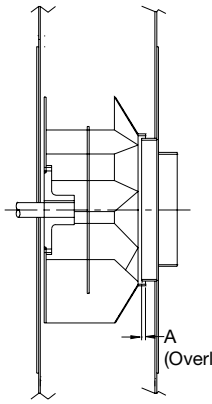
SIZE	B
913	0.53
915	0.53
917	0.59
919	0.69
921	0.78
923	0.88
926	0.72
929	0.78
933	0.97
937	1.12
941	1.28
945	1.41
949	1.53

Class 45

SIZE	B
913	0.53
915	0.53
917	0.59
919	0.69
921	0.78
923	0.88
926	0.72
929	1.78
933	0.97
937	1.12
941	1.31

NOTE: On sizes 905 through 911 the wheel is to be centered in the housing.

RBA



NOTE: For RBP and RBW center the wheel in the housing.

SIZE	A
907	0.25
909	0.38
911	0.47
913	0.53
915	0.59
917	0.69
919	0.00
921	0.00
923	0.00
926	0.00
929	0.00
933	0.00
937	0.00
941	0.00
945	0.00
949	0.00
954	0.00
960	0.00

motors and drives. The addition of drive components in the field can create unbalance forces. Twin City Fan & Blower recommends final balancing of the unit after the drive components are installed. Failure to do so voids the Twin City Fan & Blower warranty.

Bearing Installation

The following section gives some general instructions on bearing installation. If bearings are to be field installed, the specific installation manual for the bearings will be provided and should be followed carefully. Always make sure to check the assembly drawing or instructions for location of the fixed and expansion bearings. The positions of these bearings cannot be interchanged.

Sleeve Bearings

1. The bearings should be disassembled and cleaned with appropriate solvent, taking care not to interchange parts between bearings. Parts of one bearing are generally not interchangeable with parts from another bearing.
2. The lower bearing housing should be bolted loosely to the pedestal. The lower liner should then be placed in the housing.
3. Oil the lower liner per manufacturer's instructions and carefully sling the rotor assembly into place, being very careful not to damage the bearing liners.
4. Make sure to install the oil slinger rings in their correct location and peen the ring screws in place.
5. When handling the liners, be careful not to damage the surfaces, as they are babbitted and are fragile.
6. The housings are generally tapped with a number of ports. Be sure the oil level gauge, circulating oil supply and discharge, thermocouples, etc., are correctly connected.
7. Make sure that proper oil type and quantity is used.
8. Make sure that the thrust collar screws, liner screws, cap bolts, and plunger are torqued to manufacturer's specifications.

Split Roller Bearings

1. The bearings should be disassembled, taking care not to interchange parts between bearings. Parts of one bearing are generally not interchangeable with parts from another bearing.
2. The lower bearing housing should be bolted loosely to the pedestal and seals; bearing and adapter sleeve housing should be placed loosely on the shaft.
3. The rotor assembly with the seals and bearings should next be positioned over the housings and carefully placed into the lower housings.
4. The thrust locking ring should be installed in the bearing closest to the drive sheave.
5. When installing adapter sleeves, tighten for reduction in clearance per manufacturer's instructions.
6. Bend down a tab on the lockwasher after finishing adjustment.
7. Grease or oil according to manufacturer's instructions.
8. Install the bearing housing cap bolts and bearing mounting bolts. Tighten bearing housing cap bolts and bearing mounting bolts.

Solid Pillow Block

1. Slide shaft in bearing bore to proper location. **NOTE:** Shaft should slide easily if self-aligning feature of the shaft is within its limits. Sling the rotor assembly into place and loosely bolt the bearings in place.
2. When bearings are in place, torque the base bolts using values from Table 1 and tighten the collar setscrews to manufacturer's specification.
3. Grease or oil according to manufacturer's instructions.

Drive Mounting

Mount drives as follows:

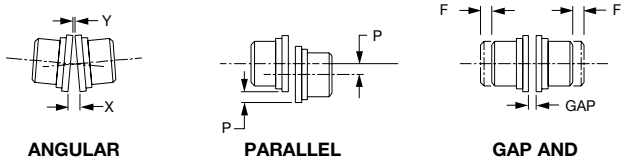
1. Slip (do not pound) proper sheave onto corresponding shaft. **CAUTION:** *Placing fan sheave on motor can overspeed wheel and cause structural failure.*
2. Align sheaves with straightedge extended along sheaves, just making contact in two places on outside perimeters of both sheaves. This "four-point" alignment may also be checked with a string tied to the shaft behind one of the sheaves. The string is then pulled taut over the faces of the sheaves to check the alignment at the four points at the outside perimeters. Each sheave should be rotated about one-half revolution during this check to look for excessive runout or a bent shaft.
3. Install and tighten the belts. Run the drive for a few minutes to seat the belts. When tightening the belts, slide the motor in to slip the belts on. Do not use a pry bar, as this may damage the belt cords. Tighten the belts to the proper tension. Ideal tension is just enough tension so that the belts do not slip under peak load. Many drives are provided with tensioning data which identifies the load to apply at the center of the span and the allowable deflection from this force. This may be checked visually (look for a slight bow on slack side), or listen for a squeal on start up, indicating that the belts are too loose. Recheck sheave alignment.
4. After initial installation of belts, recheck belt tension again after a few days to adjust belt tension. (New belts require a break-in period of operation.)

Flexible Couplings

These instructions are general for the installation of several types of flexible couplings and should not be used as a substitute for more specific manufacturer's instructions. The coupling manufacturer's installation data is available and will give specific dimensions for alignment limits, lubricants, etc.

Before preparing to mount the coupling, make sure that all bearings, inlet vanes, shaft seals, or other components have been installed on the shaft.

When mounting and keying the coupling halves to the shaft, follow supplied instructions for heating and shrink fitting. Set the coupling halves for the normal gap specified by the manufacturer. Coupling gap is illustrated below.



ANGULAR MISALIGNMENT | **PARALLEL MISALIGNMENT** | **GAP AND END FLOAT**

X-Y = ANGULAR MISALIGNMENT
P = PARALLEL OFFSET (MISALIGNMENT)
F = END FLOAT

The two types of misalignment are illustrated above. Typically angular alignment is checked with feeler gauges between the hub faces. When angular alignment has been adjusted to manufacturer's specification by shimming, if necessary, parallel alignment can be checked with a straightedge and feeler gauges on the hub halves' O.D. When shimming has brought parallel alignment

within specification, angular alignment and gap should again be checked, and adjustments made if necessary. A dial indicator may be used to more accurately take the measurements described above.

Special adjustments may need to be made for couplings used with some equipment. As an example, when used with motors of over 300 HP, couplings may require provisions for limiting end float. Larger drivers may grow in operation (due to heat expansion) requiring the driver side to be set slightly low when not operating. Refer to specific instruction manuals or assembly drawings.

Thoroughly clean the coupling halves after completion of alignment. Reassemble the coupling and tighten bolts, washers and locknuts. Lubricate per manufacturer's recommendations.

Motor Maintenance

The three basic rules of motor maintenance are:
1. Keep the motor clean.
2. Keep the motor dry.
3. Keep the motor properly lubricated.

Blow dust off periodically (with low pressure air) to prevent motor from overheating.

Some smaller motors are lubricated for life. Lubrication requirements are normally attached to the motor. Use the motor manufacturer's recommendations for relubrication. If this information is not available, the following schedule may be used. Motors less than 10 HP running about eight hours a day in a clean environment should be lubricated once every five years; motors 15 to 40 HP, every three years. For motors in dusty or dirty environments or running 24 hours a day: divide the service interval by 4. Do not over lubricate.

Drive Maintenance and Installation

V-belt drives need periodic inspection, retensioning, and occasional belt replacement. When inspecting drives, look for dirt buildup, burrs or obstructions that can cause premature belt or drive replacement. If burrs are found, use fine emery cloth or a stone to remove them. Be careful that dust does not enter the bearings.

Check sheaves for wear. Excessive slippage of belts on sheaves can cause wear and vibration. Replace worn sheaves with new ones. Carefully align sheaves to avoid premature sheave failure. If fraying or other wear is observed to be mostly on one side of the belts, the drives may be misaligned. Realign and reinstall belts. Tighten sheave bolts (or setscrews if appropriate).

When replacing belts, replace the entire set. Never use belt dressing on any belts.

Bearing Maintenance

Proper lubrication of the fan drive bearings helps assure maximum bearing life. All fans are equipped with decals indicating relubrication intervals for normal operating conditions. Figures 5, 6, and 7 illustrate the lubrication schedules for ball bearings, solid pillow block spherical roller bearings, and split pillow block spherical roller bearings, respectively. Note that all speeds shown do not apply to all shaft sizes in that group. Consult the factory if in doubt of maximum speed for a particular bearing. Note that every installation is different and the frequency of relubrication should be adjusted accordingly.

On high moisture applications the lubrication frequency may need to be doubled or tripled to adequately protect the bearings. Double the relubrication frequency on fans with vertical shafts.

Observation of the conditions of the grease expelled from the bearings at the time of relubrication is the best guide as to whether regreasing intervals and amount of grease added should be altered.

Greases are made with different bases. There are synthetic base greases, lithium base, sodium base, etc. Avoid mixing greases with different bases. They could be incompatible and result in rapid deterioration or breakdown of the grease. The lubrication sticker identifies a list of acceptable lubricants. All bearings are filled with a lithium-based grease before leaving the factory. When the fans are started, the bearings may discharge excess grease through the seals for a short period of time. Do not replace the initial discharge because leakage will cease when the excess grease has worked out. Sometimes the bearings have a tendency to run hotter during this period. This is no reason for alarm unless it lasts over 48 hours or gets very hot (over 200°F). When relubricating, use a sufficient amount of grease to purge the seals. Rotate bearings by hand during relubrication.

Wheel and Shaft Maintenance

Periodically inspect the shaft and wheel for dirt buildup, corrosion, and signs of excess stress or fatigue. Clean the components. If the wheel is removed for any reason, make sure that it is securely attached to the shaft before restarting the fan.

Structural Maintenance

All structural components or devices used to support or attach the fan to a structure should be checked at regular intervals. Vibration isolators, bolts, foundations, etc., are all subject to failure from corrosion, erosion, and other causes. Improper mounting can lead to poor operation characteristics or fan fatigue and failure. Check metallic components for corrosion, cracks, or other signs of stress. Concrete should be checked to insure the structural integrity of the foundation.

Duct Connections

The fan support structure is normally not designed to carry loads imposed by the weight of ducts, silencers, stacks, etc. Supporting these loads on the fan can cause housing distortion and may cause performance problems due to the relation of fan housing to wheel. Use of flexible connections is recommended when using vibration isolation or handling high temperature gases.

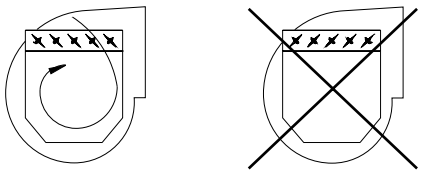
Optional Accessories

1. **Turning Gear —** A turning gear is sometimes used in high temperature applications where the fan is exposed to high temperature gases while not operating. The wheel and shaft can expand unevenly due to the temperature when sitting idle, which can cause vibration at startup and/or a permanent set to the rotor. The turning gear slowly turns the fan from the outboard side while it is not operating, providing for even thermal expansion. It starts automatically when the fan shuts down and disengages automatically when the fan starts up again. More specific information will be provided for each application.
2. **Shaft Seals —** The standard shaft seal is a ceramic fiber element retained with an aluminum retaining plate and clips. Other configurations of shaft seals are available for special applications, such as when it is necessary to keep the shaft seal as gas tight as possible. Shaft seal application manuals are provided in Engineering Supplement ES-595.
3. **Variable Inlet Vanes —** Variable inlet vanes are provided as assemblies internally in the inlet cone or

externally in a flanged cylinder. The vanes are used to control volume and save power in installations where different volumetric operating conditions are used. Installation manuals are provided in other engineering supplements for specific fan types. Variable inlet vanes may be provided with powered operators in which case the manufacturer's installation and operating manuals will be provided.

4. **Inlet Box and Inlet Box Dampers —** Inlet boxes may be provided to allow transition from a duct to the fan inlet. Inlet box dampers may also be provided for volumetric regulation similar to inlet vanes. Dampers are usually provided as a complete assembly and are installed with the damper axles parallel to the fan shaft. They should be installed to pre-spin the air in the direction of fan rotation. See Figure 3.

Figure 3. Orientation of Damper Blades As Related to Fan Rotation



5. **Outlet Dampers —** Outlet dampers are usually provided completely assembled like the inlet dampers. The damper is bolted to the fan discharge for volume control.
6. **Shaft Cooler —** Also referred to as "heat slingers" or "cooling wheels," these are small, radially bladed aluminum wheels that are split and bolted for installation between the inboard bearing and fan housing. The backplate usually is closest to the fan housing and the blades face the bearing. Specific instructions will be provided by application.
7. **Oil Circulating Systems —** Usually the following modifications will have to be made to the bearing if an oil circulating system is used.
   a. Four drain holes will be drilled in the bearing, two on each side of the bearing. Because of this, the bearing may be drained from either side. (Drain from both holes on one side of the bearing.)
   b. It is not necessary to drain the bearing.
   c. The bearing will be packed with grease to prevent corrosion until installed and started up. The drain holes will be plugged with plastic covers to make sure they are open. **The customer MUST REMOVE most of the grease using solvent and remove the plastic covers prior to starting the oil circulating system.**
   d. A wet sump will be added in case of circulating oil pump failure. Seals will be provided to accommodate the resultant splashing.
   e. The zerk on top of the bearing will be removed for that hole to be used as the oil inlet.

Grouting

Grouting is the final installation step. Check all shims before grouting to make sure that the fan is resting evenly on all points with anchor bolts secured to hold the shim. Use forms with sufficient space allowed for working the grout. The concrete foundation should be clean and well moistened before pouring grout. Use a commercial grade nonshrinking grout and be especially sure when pouring grout that the anchor bolt sleeves are filled. Refer to Figure 4 for a detail of a proper foundation, grout allowance and anchor bolt sleeves.

Fan Operation—Safety

For general safety practices for air moving equipment, see AMCA Bulletin 410. Twin City Fan & Blower offers many safety accessories. These safety devices include (but are not limited to) belt guards, shaft guards, inlet and discharge screens. The use and suitability of safety devices is the responsibility of the purchaser.

Facility related safety conditions include fans' accessibility and location. How easily can nonservice personnel access the unit? Is the fan in a hazardous duty environment? Was the unit ordered for this duty? Other concerns must also be addressed. All fans should be powered through switches which are easily accessible to service personnel from the fan. Every switch should have the ability to be "locked out" by the service person and the key to be retained by this person to prevent accidental powering of the fan while service is in process.

Operation Checklist

☐ Verify that proper safety precautions have been followed.
☐ Electrical power must be locked off.

Check fan mechanism components:
☐ Nuts, bolts, setscrews are tight.
☐ Mounting connections are properly made and tightened.
☐ Bearings are properly lubricated.
☐ Wheel, drives and fan surfaces are clean and tightened.
☐ Rotating assembly turns freely and does not rub.
☐ Drives on correct shafts, properly aligned, and properly tensioned.

Check fan electrical components:
☐ Motor is wired for proper supply voltage.
☐ Motor was properly sized for power of rotating assembly.
☐ Motor is properly grounded.
☐ All leads are properly insulated.

Trial "bump":
☐ Turn on power just long enough to start assembly rotating.
☐ Check rotation for agreement with rotation arrow.
☐ Listen for any unusual noise.

Run unit up to speed:
☐ Bearing temperatures are acceptable (<200°F) after one to two hours of operation.
☐ Check for excess levels of vibration. Filter in readings should be 0.15 inches per second or less.

After one week of operation:
☐ Check all nuts, bolts and setscrews and tighten if necessary.
☐ Readjust drive tension if necessary.

Troubleshooting Guidelines

Use current safety practices when investigating fan or system performance problems. General safe practices and performance troubleshooting guidelines can be found in AMCA Publications 410 and 202, respectively. Fan application and field measurement procedures can be found in AMCA Publications 201 and 203.

Below is a list of possible areas to check when air or sound values do not match expectations. Most fan problems can be pinpointed to one of these common causes.

Air Capacity Problems

1. Resistance of the system is not at design rating. If resistance is lower than expected, both airflow and horsepower may be up. If resistance is higher than anticipated, air volume will be down.
2. Fan speed is not at design speed.
3. Air density is not at the design value. Also check air performance measurement techniques/procedures.
4. Devices for air modulation are closed or plugged. Also check filters.
5. Wheel mounted improperly or is rotating in reverse.
6. Parts of the system or fan have been damaged or need cleaning.

Noise Problems

1. Air performance is incorrect and the fan is not at design point of operation. Fan is being forced to operate in an unstable flow region.
2. Bearing failure. Check bearings (lubrication).
3. Supply voltage high or inconsistent supply frequency. Adjustable frequency controllers can generate motor noise.
4. Objects which are installed in a high velocity air-stream can generate noise. This includes flow sensors, turning vanes, etc.
5. Poor fan inlet conditions.
6. Acoustics or sound measurement procedure incorrect.

Vibration Problems

1. Misalignment of drive components.
2. Poor foundation or mounting structure (resonances).
3. Foreign material attached to rotating components.
4. Damaged rotating components (bearings, shaft, fan, wheel, sheaves).
5. Broken, loose, or missing setscrews.
6. Loose bolts.
7. Vibration transmitted by another source.
8. Water accumulating in airfoil blades.
9. Fan is operating in stall or unstable flow region.

Motor Problems

1. Incorrect wiring.
2. Speed of fan too high.
3. Parts improperly installed; binding.
4. Bearings improperly lubricated.
5. WR^2 capability of motor too low for application.
6. Protection devices may be improperly sized.

Drive Problems

1. Belts improperly tensioned.
2. Drive alignment is poor.

Figure 4. Typical Foundation Section

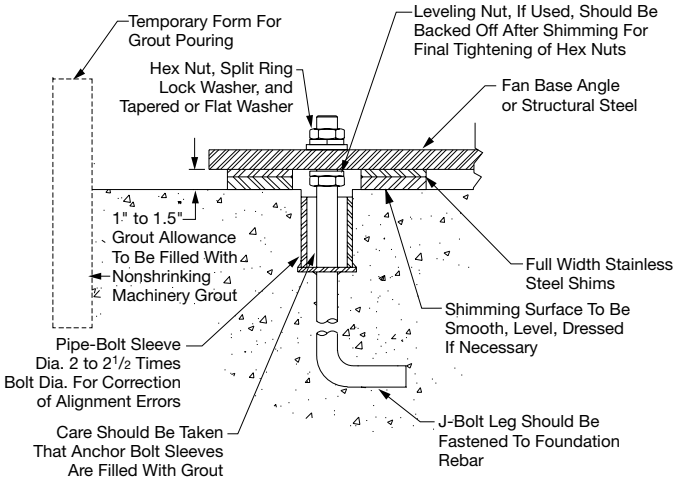


Table 1. Tightening Torque (Ft.-Lbs.)

SIZE	FASTENER			TAPER BUSHINGS		
				BROWNING SPLIT		QD
	GRADE 2	GRADE 5	GRADE 8	IN IRON	IN ALUM. HUB	FOR DRIVE
#10	—	—	—	—	—	--5
1/4-20	5.5	8	--12	7.9	7.5	--9
5/16-18	11	17	--25	16	13	-15
3/8-16	22	30	--45	29	24	-30
7/16-14	30	50	--70	—	—	—
1/2-13	55	75	-110	70	—	-60
9/16-12	—	—	—	—	—	-75
5/8-11	100	150	-200	—	—	135
3/4-10	170	270	-380	—	—	—
7/8-9	165	430-	-600	—	—	—
1-8	250	645	-900	—	—	—
1 1/4-7	500	1120	1500	—	—	—

Tolerance: +5%
For wheel setscrews use Grade 2 values.
The above torque values are for nonlubricated fasteners.
For bearing setscrews, use manufacturer's recommendations.

Figure 5. Safety & Lubrication Instructions for Fans with Ball Bearings

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See AMCA Publication 410 for recommended safety practices.
2. Before starting: Check all setscrews for tightness, and rotate wheel by hand to make sure it has not moved in transit.

RELUBRICATION SCHEDULE (MONTHS)*
BALL BEARING PILLOW BLOCKS

SHAFT DIA. (IN.)	SPEED (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1/2" – 1 11/16"	6	6	5	3	3	2	2	2	1
1 15/16" – 2 7/16"	6	5	4	2	2	1	1	1	1
2 11/16" – 2 15/16"	5	4	3	2	1	1	1		
3 7/16" – 3 15/16"	4	3	2	1	1	1			

*Suggested lubrication interval under ideal continuous operating conditions. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 or No. 3 multipurpose ball bearing grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SSU at 100°F. Some greases having these properties are:

   Shell - Alvania No. 2 — Mobil - Mobilith AW2
   Amoco - Rykon Premium 2 — Mobil - Mobilith SHC100

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Figure 6. Safety & Lubrication Instructions for Fans with Unit Roller Bearings

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See AMCA Publication 410 for recommended safety practices.
2. Before starting: Check all setscrews for tightness, and rotate wheel by hand to make sure it has not moved in transit.

RELUBRICATION SCHEDULE (MONTHS)*
SPHERICAL ROLLER BEARING – SOLID PILLOW BLOCKS

SHAFT DIA. (IN.)	SPEED (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1 3/16" – 1 7/16"	6	4	4	2	1	1	1	1	½
1 11/16" – 2 3/16"	4	2	1½	1	½	½	½	½	½
2 7/16" – 3 7/16"	3	1½	1	½	½	¼	¼		
3 15/16" – 4 15/16"	2½	1	½	¼					

*Suggested lubrication interval under ideal continuous operating conditions. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SSU at 100°F. Some greases having these properties are:

   Shell - Alvania No. 2 — Mobil - Mobilith AW2
   Amoco - Rykon Premium 2 — Mobil - Mobilith SHC100

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Figure 7. Safety & Lubrication Instructions for Fans with Split Roller Bearings

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See AMCA Publication 410 for recommended safety practices.
2. Before starting: Check all setscrews for tightness, and rotate wheel by hand to make sure it has not moved in transit.

RELUBRICATION SCHEDULE (MONTHS)*
SPHERICAL ROLLER BEARING – SPLIT PILLOW BLOCKS

SHAFT DIA. (IN.).	SPEED (RPM)									Grease Added Ea. Interval
	500	750	1000	1500	2000	2500	3000	3500	4000	
1 7/16" – 1 15/16"	6	4½	4	4	3½	2½	2½	1	1	0.50 oz.
2 13/16" – 2 11/16"	5	4½	4	2½	2½	1½	½	¼	¼	0.75 oz
2 15/16" – 3 15/16	4½	4	3½	2½	1½	1	½			2.00 oz
4 7/16" – 4 15/16"	4	4	2½	1	½					4.00 oz
5 7/16" – 5 15/16"	4	2½	1½	1						7.00 oz.

*Suggested lubrication interval under ideal continuous operating conditions. Remove bearing cap and observe condition of used grease after lubricating. Adjust lubrication frequency as needed. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required. Clean and repack bearings annually. Remove old grease, pack bearing full and fill housing reservoirs on both sides of bearing to bottom of shaft.

1. Lubricate with a multipurpose roller bearing NLGI No. 2 having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SSU at 100°F. Some greases having these properties are:

   Shell - Alvania No. 2 — Mobil - Mobilith AW2
   Amoco - Rykon Premium 2 — Mobil - Mobilith SHC100

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Static Oil Lubrication

1. Use only highest quality mineral oil with a minimum viscosity of 100 SSU at the oil's operating temperature. The oil's operating temperature is approximately 10° greater than the bearing housing's. SAE values having this viscosity at the following operating temperature are:

   150°F - SAE 20 — 160°F - SAE 30 — 180°F - SAE 40

2. Static oil level should be at the center of the lowermost roller. (Do not overfill.)
3. Complete lubrication change should be made annually.

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