

CENTRIFUGAL FAN INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Industrial
Air Technology Corp.



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1.0 GENERAL INFORMATION

Industrial Air Technology Industrial Fans and Blowers are designed for continuous duty in an industrial environment. They are engineered for predictable performance and trouble free operation. Each fan is thoroughly inspected and tested by trained factory personnel prior to shipping. When properly installed and maintained, your fan will be trouble free. It is the industries finest. This manual applies to all Industrial Air Technology fans. (Specially engineered fans for unique applications may require additional instructions, and will be included with the fan.) Read and adhere to the instructions in this manual. Retain the manual with the fan for future reference.

1.1 PERFORMANCE

Industrial Air Technology performance rating tables and curves were derived from tests made in accordance with AMCA Standard 210. The test procedure utilizes an open inlet and a straight outlet duct. Any installation with inlet or outlet configurations that deviate from this standard may result in fan performance different from the published data. Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel yielding large system losses and increased sound levels. Likewise, free discharge or turbulent flow in the outlet ductwork will result in system losses. Refer to AMCA Standard 201 for additional information regarding system effect factors and losses.

1.2 SAFETY

The responsibility for providing safety accessories for Industrial Air Technology supplied equipment is that of the systems integrator and user of the equipment. Industrial Air Technology sells its equipment with and without safety accessories, depending on the specific customer purchase order. Users and installers of this equipment should carefully read all accompanying literature provided with this equipment regarding safe operation.

1. Prior to any maintenance or service on the fan, be sure to follow proper lockout – tag out procedures.
2. Before operating the equipment, make sure all guards and access doors are securely in place. Never remove guards, screens, or access doors while equipment is in operation.
3. Where inlets and outlets are not ducted, screens are strongly recommended.
4. Do not operate equipment beyond speed or temperature limits. These limits are stated on the drawing provided with your fan.
5. All wiring should be done by a qualified electrician.
6. Some surfaces of the equipment can get hot during operation, particularly those in high temperature applications. Caution should be used prior to maintenance to insure those surfaces have cooled before beginning maintenance work.
7. Inspect the fan rotor on regular intervals. The fan rotor is subject to centrifugal force and stresses from vibration. Material impacting the fan rotor can damage and, or erode the material on the rotor. Carefully inspect the rotor for cracks, damage, and wear. Any Rotor that is damaged or shows signs of significant

wear should be replaced. Do not operate equipment with damaged rotors. Be sure to follow all lockout/tagout procedures during rotor inspection.

1.0 RECEIVING AND INSPECTION

All fans ship f.o.b. factory. Fans are prepared for shipment according to the uniform freight classification rules of the carriers. The equipment is carefully inspected and when possible tested before shipment and it is the responsibility of the carrier that it is in perfect condition upon arrival.

When the carrier accepts a shipment and signs the bill of lading, it becomes responsible for any subsequent shortages or damage, evident or concealed, and any claim must be made against the carrier.

Immediately upon receipt of a shipment, carefully inspect for damage and shortage. If any damage and/or shortage is detected or suspected, the carrier must be asked to conduct an inspection. The consignee's representative should not accept shipment without a notation on the delivery receipt indicating items not delivered or apparent extent of damage.

When a shipment is opened and damage found which was not evident externally ("concealed damage"), it is mandatory that the consignee request an immediate inspection by the carrier. Promptly file a claim against the final carrier. A transportation company will not consider a claim unless presented within nine months from the date of receipt of the equipment.

2.1 HANDLING

The fan should only be lifted by the base, mounting supports, or lifting eyes provided for on the fan assembly. Never lift a fan by the wheel, shaft, motor, motor bracket, housing inlet, outlet, or any fan part not designed for lifting. Lifting decisions must be left to trained personnel. Fork Lift/Crane capacity must be checked for lifting capacity. Fan wheels and housings which are furnished with special coverings such as rubber, phenolic enamels, or other protective coatings, should be handled with extreme care as many of these coatings are easily injured, and even a small chipped spot will break the continuity of the coating and destroy its value as a protective covering for the metal. If a wheel and shaft is shipped as an assembly, extreme care must be taken when handling this balanced component. Never lift the wheel/shaft assembly by one of the blades. Lift the assembly with a sling; around the shaft; and near the center of gravity.

2.2 STORAGE

Any fan stored for a period of time must be protected from dirt and moisture. Use of a tarp to cover the unit will aid in keeping it clean and dry. Do not use a black plastic tarp, as it will promote condensation.

For long term or outdoor storage, the bearings should be purged monthly with new grease to remove condensation. Rotate the fan wheel by hand at least once every two weeks to prevent the bearings from "setting" and in order to redistribute the grease on the bearing parts.

Motors that are idle should be stored according to the motor manufacturer's recommendations.

The fan must be isolated from any near-by vibration. High over all vibration levels in the fan storage area will prematurely damage the fan and motor bearings.

Before startup after extended storage time, purge the bearings with new grease to operating level according to the bearing manufacturer's specifications.

3.0 FAN FOUNDATIONS

Fans should be mounted on level, substantial foundations. Reinforced concrete provides an excellent foundation and is used in most installations, although substantial steel frame supports may also be used. The mass of the base must maintain the fan to driver alignment and absorb normal vibration. The overall dimensions of the concrete base should extend at least 6 inches (152 mm) beyond the base of the fan. The weight of the slab should be at least 5 times the fan/motor assembly weight. If the fan is to be installed on a steel structure, the structure must be adequately designed to support the static and dynamic loads. A fabricated steel base that does not have adequate stiffness can affect alignment of fan components. An implied twist to the fan base can cause the fan wheel to rub on the inlet, causing severe damage at start up as well as preloading bearings, causing premature failure and decreased bearing life. The steel structure must be designed so that its natural frequency does not coincide with the fan frequency.

3.1 INSTALLATION

Remove the skid, crate, and packing materials carefully.

Move the fan to the mounting location, leveling the fan with shims as necessary. Shimming must eliminate any "daylight" between the fan base plates and the foundation. This step is critical so that stresses from twisting are not induced into the bearing pedestal, which can damage bearings or shorten their life by preloading bearings. Anchor bolts must be provided at every foundation hole provided. Tighten the foundation bolts to the torque values shown in Chart A.

When grout is used, shim the fan at least 3/4 inch (19 mm) from the concrete base.

When an elevated or suspended structural steel platform is used, it must be of sufficient size and strength to support the unit static load and maintain permanent alignment of all components. The fan must always be supported along its entire length.

Install any accessories that were shipped loose from the factory.

3.2 DUCTING

The Inlet and Outlet ducts must be adequately supported. The fan is not designed to support the ductwork. Additional loads, applied to the fan from improperly supported ductwork, can cause distortion and a possible conflict with the rotating components. Flexible connections are recommended and are a must for high temperature fans.

Field installed Inlet Boxes, Discharge Stacks, Transitions, Silencers, etc, must be adequately supported.

3.3 FASTENER TORQUE VALUES

| CHART A | | | |
|-----------------------------------------------------------------------|----------------|---------|---------|
| FOUNDATION/BEARING & MOTOR HOLD DOWN BOLTS TORQUE VALUES FT/LBS (dry) | | | |
| FOUNDATION HOLE DIA | CAP SCREW SIZE | GRADE 5 | GRADE 8 |
| 7/16 | 3/8-16 | 36 | 44 |
| 9/16 | 1/2-13 | 80 | 98 |
| 11/16 | 5/8-11 | 165 | 210 |
| 13/16 | 3/4-10 | 285 | 335 |
| 17/16 | 7/8-9 | 430 | 500 |
| 1 1/8 | 1/8 | 650 | 760 |

| CHART B | | |
|-------------------------------------|-------|-------|
| WHEEL SET SCREW TORQUE VALUES (DRY) | | |
| Set Screw Size | Ft/lb | In/lb |
| 1/4 | 6.2 | 75 |
| 5/16 | 12 | 144 |
| 3/8 | 21 | 252 |
| 7/16 | 33 | 396 |
| 1/2 | 50 | 600 |
| 5/8 | 97 | 1164 |
| 3/4 | 168 | 2016 |
| 7/8 | 267 | 3204 |
| 1 | 400 | 4800 |

| CHART C | | |
|---------------------------------------|-------|-------|
| BEARING SET SCREW TORQUE VALUES (dry) | | |
| Set Screw Size | Ft/lb | In/lb |
| #10 | 3.3 | 40 |
| 1/4 | 7.5 | 90 |
| 5/16 | 15.4 | 185 |
| 3/8 | 27 | 325 |
| 7/16 | 38 | 460 |
| 1/2 | 57 | 680 |
| 5/8 | 112 | 1350 |
| 3/4 | 196 | 2350 |

| CHART D | | |
|----------------------------------------------|-------|-------|
| DODGE TAPER BUSHING BOLT TORQUE VALUES (dry) | | |
| Bushing Size | Ft/lb | In/lb |
| H | 7.5 | 90 |
| JA | 5 | 60 |
| SH/SDS/SD | 9 | 108 |
| SK | 15 | 180 |
| SF | 30 | 360 |
| E | 60 | 720 |
| F | 75 | 900 |
| J | 135 | - |
| M | 225 | - |
| N | 300 | - |
| P | 450 | - |
| W | 600 | - |
| S | 750 | - |

| CHART E | | |
|-------------------------------------------------|-------|-------|
| BROWNING TAPER BUSHING BOLT TORQUE VALUES (dry) | | |
| Bushing Size | Ft/lb | In/lb |
| G & H | 7.9 | 95 |
| P | 16 | 192 |
| Q&R | 29 | 348 |
| S | 70 | 840 |
| U | 140 | - |
| W | 250 | - |

4.0 START UP FACTORY ASSEMBLED UNITS

Precautions must be made prior to the startup of the fan even though it may have been previously test run at the factory.

All safety accessories must be installed before starting the fan. Never exceed the maximum RPM stated for the fan, accounting for speed de-rating factors due to temperature and materials of construction.

Check the alignment of the bearings. Check the alignment of the V-Belt drive. Check the alignment of the coupling.

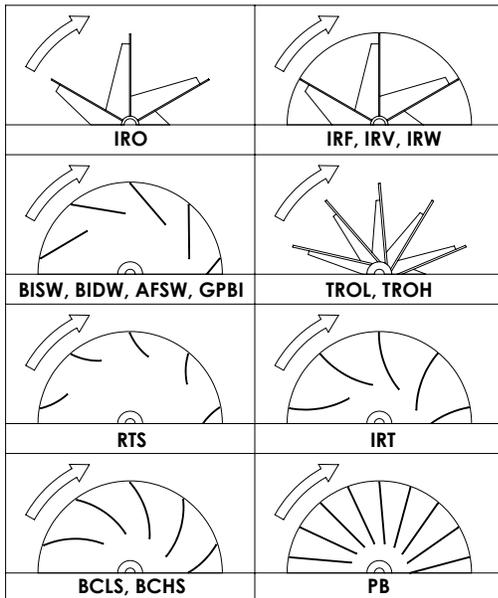
With the power off following proper lockout – tag out procedures, rotate the wheel by hand to ensure free movement of all components. Remove any construction debris from inside the inlet and outlet ducts. On open inlet fan installations, make sure the area adjacent to the fan inlet is “free and clear”. Objects can be sucked into the fan inlet causing major damage and bodily harm.

Check the motor electrical connections. The supplied voltage must match the motor voltage. A qualified electrician must be used. Improper connections are hazardous and can cause permanent damage to the motor. All wiring and fusing must be in accordance with the national electric code and local code requirements.

Check the fan foundation bolts for tightness. See chart A. Check the tightness of the wheel on the shaft. See charts B, D & E.

Check the bearing setscrew tightness. See chart C.

The area should be cleared of all unauthorized personnel. “Bump” the starter and check for proper wheel rotation.



If the ductwork has not been fully installed, the motor may overload, and cause damage if the fan is run at full speed. If startup of the fan is required before the ductwork is complete, block off the fan inlet with suitable material. This will eliminate the chance of overloading the motor.

Start the fan and bring it up to full speed, then shut the fan down. During the startup and coast down period the fan should be quiet. Listen for unusual noises, bearing sounds, metal-to-metal contact, etc. During the coast down period the fan may shake and vibrate at the lower rpm's. This is a common occurrence and is caused by resonant frequencies. This vibration must not occur at the fan operating frequency.

The fan should be restarted and run for approximately 1 hour. Periodically feel the bearings and motor. They should feel smooth. If unusual vibrations are felt, shut the fan down and refer to section 6.0 in this manual on Vibration. Vibration is a destructive force that must be eliminated.

If the fan is running smooth after 1 hour shut the fan down and re-check all fasteners for proper tightness.

The fan can now be put into service.

After 8 hours of operation and again after two weeks of operation, all fasteners and setscrews should be re-checked for proper torque values.

4.1 START UP PARTIALLY ASSEMBLED UNITS

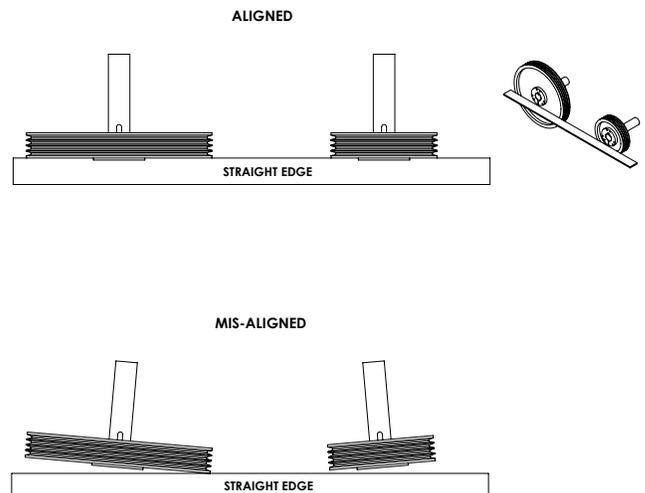
V-Belt Drive Installation

Remove all foreign material from the fan and motor shafts and coat the shafts with machine oil for easier mounting. Before beginning, follow all lockout – tag out procedures.

Mount sheaves on shafts after checking sheave bores and bushings for nicks or burrs. Avoid using force. If resistance is encountered, lightly polish the shaft with crocus cloth until the sheave slides on freely. Tighten the tapered bushing bolts sequentially so that equal torque is applied to each.

Adjust the motor on its base to a position closest to the fan shaft. Install belts by working each one over the sheave grooves until all are in position. Never pry the belts into place.

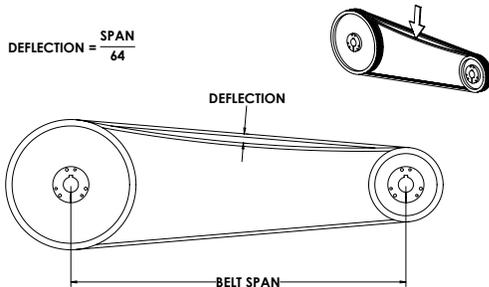
Adjust sheaves and the motor shaft angle so that the sheave faces are in the same plane. Confirm accuracy by placing a straightedge across the faces of the sheaves. Any gap between the edge and the sheave faces indicates misalignment.



Check the belt tension with a tensioning gage and adjust using the motor slide base.

For initial tensioning, the proper belt deflection half way between the sheave centers is 1/64 inch (0.4mm) for each inch of belt span.

For example, if the belt span is 64 inches (1625 mm), the belt deflection should be 1 inch (25.4 mm) using moderate thumb pressure at the mid-point of the belt span.



Caution: Excess tension shortens bearing life while insufficient tension shortens belt life and can reduce fan performance and may cause vibration. The lowest allowable tension is that which prevents slippage under full load. Belts may slip during startup, but the slipping should stop as soon as the fan reaches full speed. For more information on belt tensioning, consult the drive manufacturer.

Recheck the setscrews, rotate the drive by hand, checking for rubbing, and then complete the installation of the belt guard.

The belt tension should be rechecked 24 hours after startup and again after several days of operation and adjusted as necessary. Continue checking periodically until no further relaxing of the belts is detected.

Coupling Installation

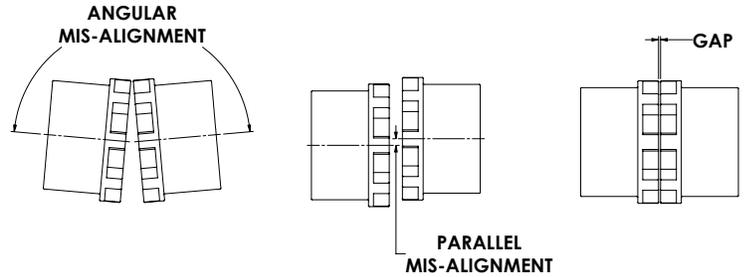
Remove all foreign material from the fan and motor shafts and coat with machine oil for easy mounting of the coupling halves

Mount the coupling halves on each shaft, setting the gap between the faces as specified by the mfr. Lightly polish the shafts with crocus cloth if necessary in order to avoid using excessive force.

Align the coupling to within the manufacturer's limits for parallel and angular misalignment (see figure 1).

Adjustments to change the shaft angle should be made by moving the motor and by the use of the foot shims to change the motor shaft height. Do not move the fan shaft or bearings in order to achieve better alignment.

Install the flexible coupling element and lubricate as necessary. Note that the coupling alignment should be



Checked after installation and prior to start up, regardless of who installed it.

After the unit has been field assembled go to section 4.0 for startup instructions.

5.0 MAINTENANCE

Caution: never attempt maintenance on a fan unless the electrical supply has been completely disconnected, and your company machine specific lockout/tagout procedures are followed. The rotating assembly should also be securely blocked to eliminate the potential for wheel rotation due to other means such as wind milling.

Fans must be regularly inspected, the frequency being determined by the severity of the application. Routine inspections should include the following checklist:

1. Check for wear, corrosion, and material build up on the fan wheel and/or housing and clean or replace as required.
2. Check the drive for proper alignment, tension, and lubrication as dictated by the drive type used.
3. Lubricate the bearings of the fan and motor. Never over lubricate.
4. Check for worn shaft seals and repair or replace as necessary.
5. Check all setscrews and bolts for tightness. Check isolation bases for freedom of movement, looking for broken or fatigued springs or deteriorated rubber elements.

Notes for high temperature fans: (air-stream temp > 300F).

1. Do not stop the fan while at temperature. Allow the process gas to reduce to near ambient before stopping the fan.
2. Never start the fan when hot in order to prevent damage to the rotor and/or shaft.
3. Never heat up the fan air-stream without the fan running

6.0 VIBRATION

All Industrial Air Technology wheels are factory dynamically balanced to at least quality grade G6.3 (mm/sec., vel) in accordance with ISO1940/1 standards.

Most fans are trim balanced at the factory; however some fans due to motor size are not able to be trim balanced at the factory. A certificate of vibration is included with the fan at shipment; if no certificate is included the fan was not trim balanced. In any case, all fans must be balanced on site upon installation and operation.

Type of product shipped:

Wheel Only:

See Notice 1, then use Chart F

Wheel Only 5000 Lbs. And heavier:

See Notice 4, then use Chart F.

Wheel/Shaft Assembly:

See Notice 2, then use Chart F.

Wheel/Shaft Assembly 5000 Lbs and heavier:

See Notice 4, then use Chart F.

Fan Assembly less driver:

See Notice 3, then use Chart F

Fan Assembly with driver:

Use Chart F

| Maximum Field Vibration Limits Chart F | | |
|----------------------------------------|---------------------|---------------|
| Fan | Total displacement | Peak Velocity |
| rpm | (Mils-Peak-to-Peak) | (In/Sec.) |
| 3600 | .7 | .1 |
| 1800 | 1.4 | .1 |
| 1200 | 2.0 | .1 |
| 900 | 2.6 | .1 |
| 700 | 3.4 | .1 |

Damage in shipment, rough handling, and improper installation of the unit will impact the factory balance. It is recommended that vibration readings be taken at start-up and recorded for future reference. The readings should be taken at each fan bearing in both the vertical and horizontal direction. On Arrangement 4 units the readings should be taken at the front and rear of the motor (near the motor bearing location) in both the vertical and horizontal directions.

After the fan is installed and field balanced at start up, the fan should be checked periodically to ensure the fan is staying within the balance specifications in Chart "F". How often a fan should be checked and rebalanced is dependent on a number of factors including, environmental conditions, soundness of installation, maintenance, etc. Any noticeable increase in vibration is cause for concern and should be addressed thru proper maintenance (see section 5.0 Maintenance) and potentially rebalancing. Any balancing to the fan must be done by qualified personnel. Improperly balanced equipment can cause severe damage to the equipment. If you need assistance contact IATC at 989-705-1768.

7.0 BEARINGS

Fan bearings must be maintained in order to provide reasonable service life. A maintenance schedule is provided with each fan as an addendum to this document. It will identify the initial lubrication performed on the fan bearings as well as the frequency and amount of lubricant to use in proper maintenance program. Bearings exposed to moisture, elevated temperatures, or a high level of dirt or other foreign contaminants may require more frequent lubrication than shown on the maintenance schedule.

Standard grease lubricated fan bearings should be maintained with high quality lithium based grease conforming to NLGI grade 2 consistency. Avoid mixing greases with different bases, as they may be incompatible and result in rapid deterioration of the lubricant and premature bearing failure.

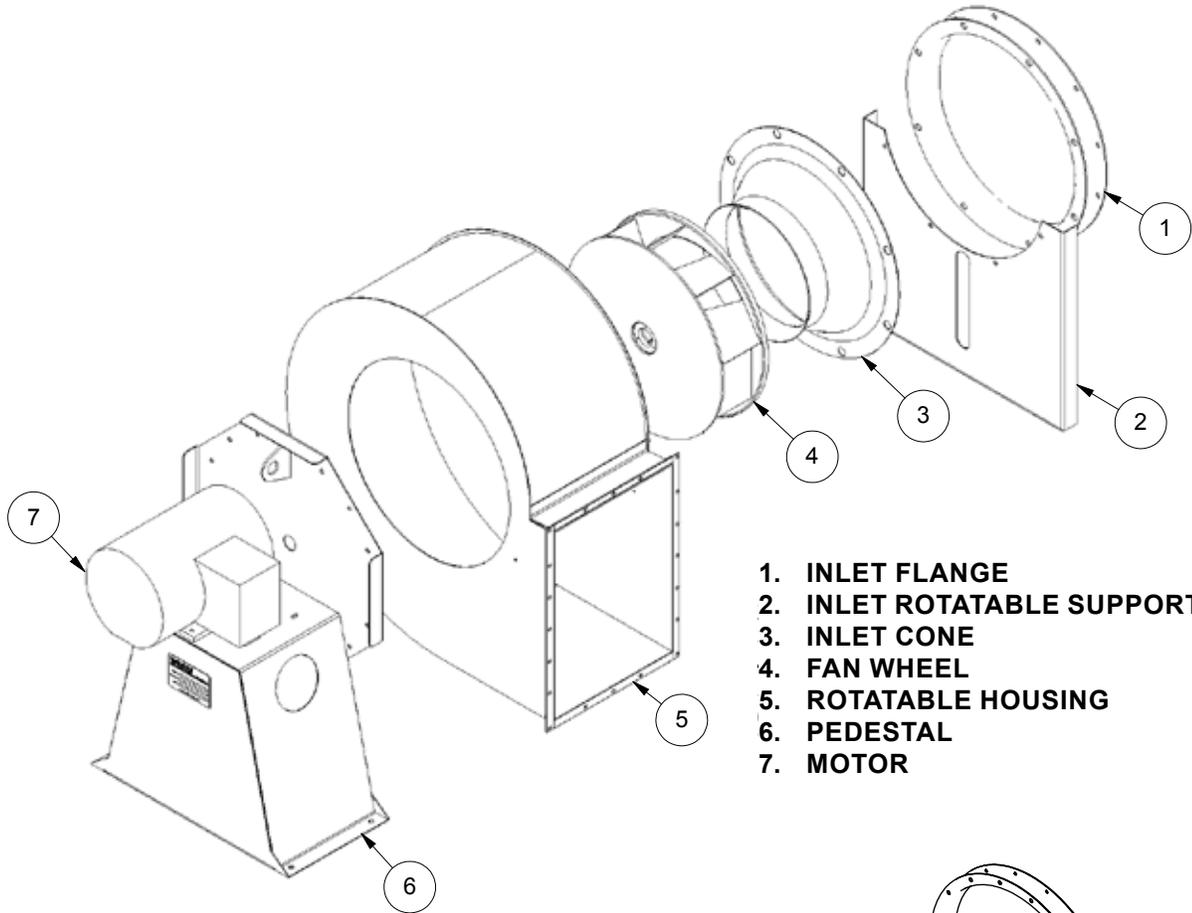
Fan bearings may initially run at elevated temperatures during the break-in period. Allow the fan to run for at least 12 hours, monitoring the bearing temperature periodically. If the surface temperature has not peaked within 12 hours of operation, or if the stabilized temperature exceeds 225F, stop the fan and contact Industrial Air Technology for assistance.

Add grease to the bearing while running the fan or rotating the shaft by hand. Do not over lubricate, as this will cause overheating of the bearings. Split top pillow block bearings with a large grease cavity should be cleaned and repacked approximately every eighth lubrication interval.

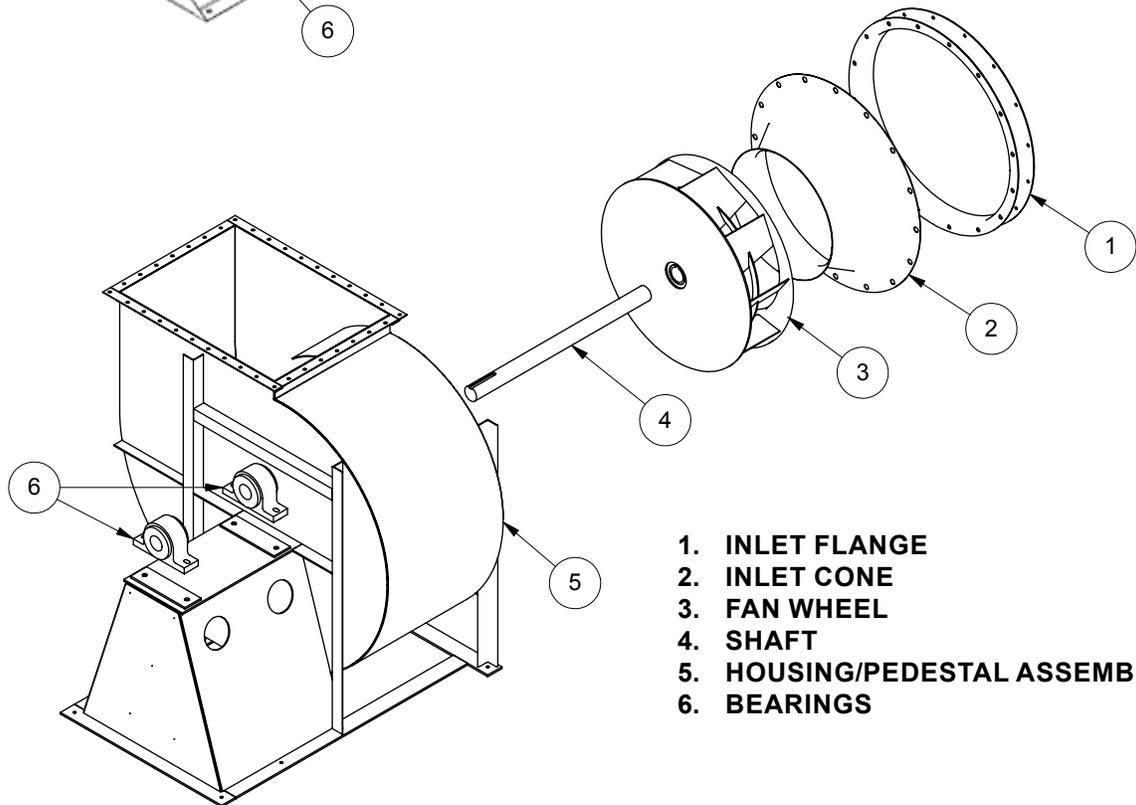
Motor bearings are supplied with factory-installed grease and are to be maintained according to the motor manufacturer's specifications.

8.0 SPARE PARTS

The recommended list of fan spare parts is as follows: wheel, set of bearings (2 per fan), shaft, and drive components (coupling, belts, sheaves, bushings). When ordering spare parts, please specify the following: the physical part name(s) (refer to below), the fan serial number, and the fan model number (refer to equipment tag). Contact your local sales representative for price and delivery.



1. INLET FLANGE
2. INLET ROTATABLE SUPPORT
3. INLET CONE
4. FAN WHEEL
5. ROTATABLE HOUSING
6. PEDESTAL
7. MOTOR



1. INLET FLANGE
2. INLET CONE
3. FAN WHEEL
4. SHAFT
5. HOUSING/PEDESTAL ASSEMBLY
6. BEARINGS

9.0 TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---------------------------|---------------------------------------------|-------------------------------------------------------------|
| Excessive vibration/noise | Accumulation of foreign material on wheel | Clean and rebalance as necessary |
| | Worn or corroded wheel | Replace |
| | Bent shaft | Replace |
| | Loose wheel, drive sheave or bearing | Tighten and align |
| | Imbalanced wheel, motor rotor or sheave | Balance |
| | Wheel, bearing or drive misalignment | Align |
| | Belts too loose or too tight | Tension properly |
| | Defective or worn bearings, belts coupling | Replace |
| | Loose fan mounting bolts | Tighten check torque values |
| | Inadequate or resonant foundation | Increase absorptive capacity, increase mass, add stiffeners |
| | Inadequately supported inlet or outlet duct | Add bracing |
| | Aerodynamic pulsation | Change point of operation via damper position etc. |
| | Excessive system pressure | Open damper |
| | Uneven wheel loading | Improve inlet conditions via turning vanes etc. |
| | Nearby sound reflecting surface | Install sound barrier |
| High BHP or CFM | Actual fan speed higher than design | Reduce speed |
| | Air density higher than design | Install larger motor, damper flow |
| | Wheel rotating wrong direction | Reverse direction |
| | Actual system resistance lower than design | Add system resistance via damper, etc |
| Low CFM | Actual fan speed lower than design | Increase speed |
| | Wheel rotating wrong direction | Reverse direction |
| | Actual system resistance higher than design | Decrease system resistance, via damper, duct change etc. |
| | Wheel not aligned properly to inlet | Align |
| | Uneven wheel air loading | Improve inlet or outlet condition via turning vanes etc. |
| | Poor outlet condition | Add stack, straight duct run before elbow etc. |

10.0 FIELD SERVICE

Field Service such as on site assembly supervision, startup assistance, trouble shooting, repair, or balancing can be provided and purchased thru qualified third party personnel. Industrial Air Technologies can assist you in aligning with these third parties. Contact IATC at 989-705-1768 for assistance.

11.0 LIMITED WARRANTY

The Seller warrants products of its own manufacture, against defects of material and workmanship under normal use and service for a period of eighteen (18) months from date of shipment or twelve (12) months from date of installation whichever occurs first. This warranty does not apply to any Industrial Air Technology products and parts which have failed as a result of faulty installation or abuse, or incorrect electrical connections or alterations, made by others, or use under abnormal operating conditions or misapplication of the products and parts. Expenses incurred by Purchaser in repairing or replacing any defective product will not be covered except where authorized in writing and signed by an officer of the Seller. Our obligation under the Warranty is limited to repairing or replacing (or allowing credit), at our option, without cost to the Purchaser, at our factory any part or parts thereof which shall, within such warranty period, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been defective. On equipment furnished by Seller, but manufactured by others, such as motors and bearings, Seller extends the same warranty as Seller receives from the manufacturer thereof. Seller assumes no responsibility for material returned to our plant without our written permission.

NOTE: exceeding Max. Design RPM; Max. Design Air Temperature; or a rate of air temperature rise exceeding 15F/min may void the Warranty.

