

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance instructions for the following corrosion resistant FRP fans:

- CNW
- DHK
- PVK
- PRVS
- AXCL

M.K. Plastics catalogs on the above corrosion resistant FRP fans, provides additional information describing the equipment, fan performance, available accessories, and specifications.

For additional safety information, refer to AMCA publication 410-96, *Safety Practices for Users and Installers of Industrial and Commercial Fans*.

For Information on special fan application requirements, contact M.K. Plastic's Corporate office at (514) 871-9999.

Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of the fan.

- Turn the wheel by hand to ensure it turns freely and does not bind.
- Inspect the dampers (if supplied) for free operation of all moving parts.
- Record on the *Delivery Receipt* any visible sign of damage.

WARNING

This unit has rotating parts. Safety precautions should be exercised at all times during installation, operation, and maintenance.
ALWAYS disconnect power prior to working on fan.

Handling

Lift the fan by the base or lifting lugs. **Never lift by the shaft, motor or housing.** See Fig. 1 – Fan Lifting Lug Details.

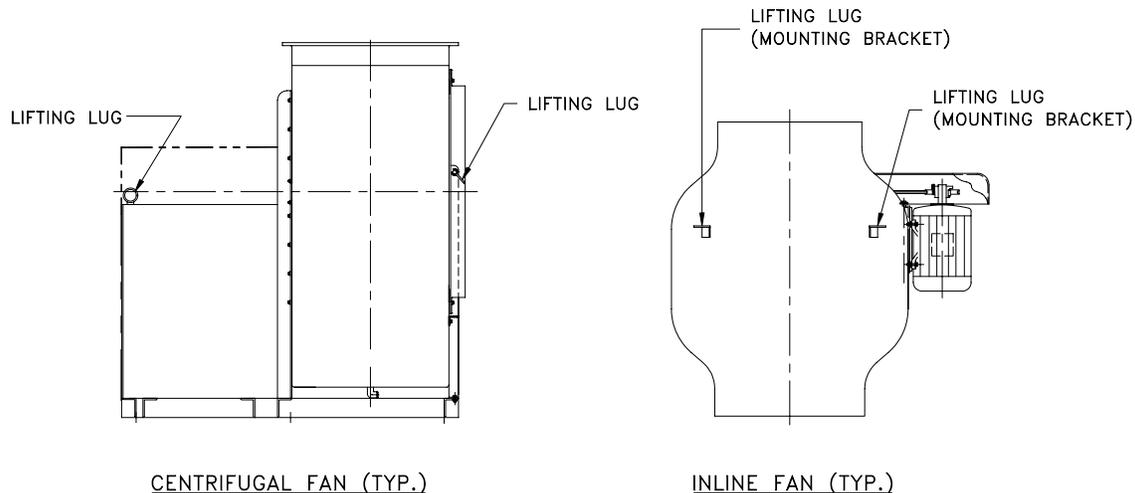


Fig. 1 – Fan Lifting Lug Details

Storage

If the fan is stored for any length of time prior to installation, completely coat the bearings with grease or moisture inhibiting oil (refer to Lubricants on page 8). Rotate the wheel several revolutions every three to five days to keep a coating of grease on all internal bearing parts.

Outdoor Storage

To maintain good working condition of the fan when it is stored outdoors, follow the additional instructions below.

1. Cover the inlet and outlet to prevent the accumulation of dirt and moisture in the housing.
2. Periodically rotate the wheel and operate dampers (if supplied).
3. Periodically inspect the unit to prevent damaging conditions.

Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.

Vibration Isolators

To prevent vibration and noise from being transferred to the building, vibration isolators are recommended. Isolators should be located between the fan system and the support structure. *M.K. Plastics* supplies three main types of isolators for FRP fans:

- Floor Mounted Spring Isolators
- Floor Mounted Rubber-In-Shear Isolators
- Hanging Spring Isolators (in-line fans)

In applications where seismic isolators are required, contact *M.K. Plastics* directly for further details.

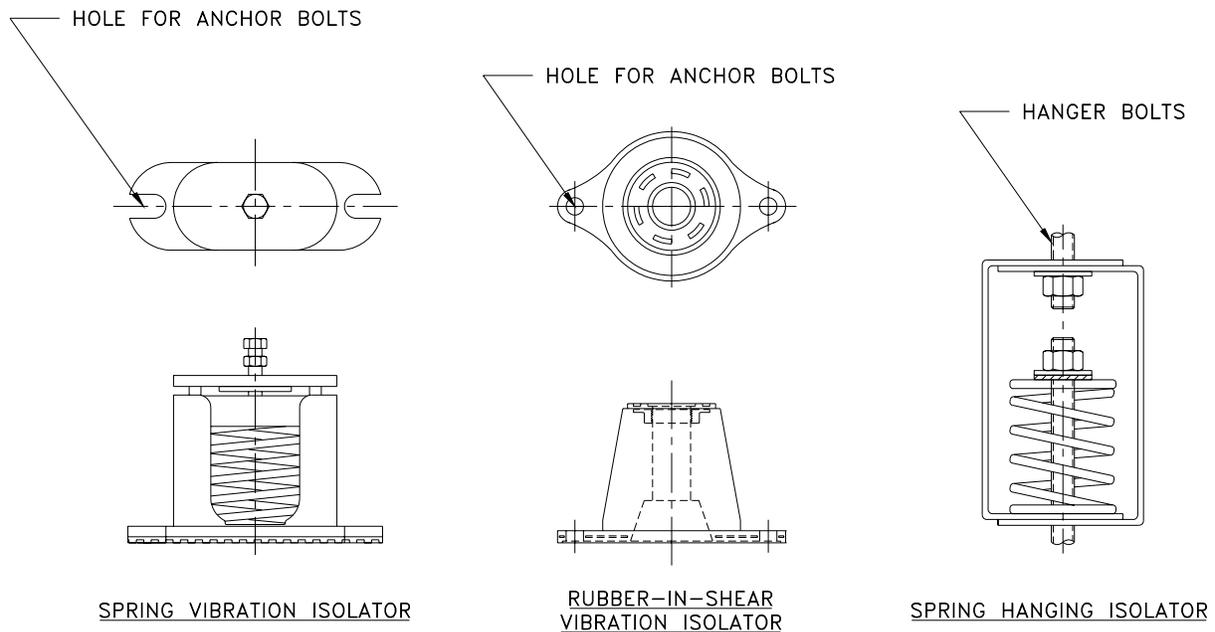


Fig. 2 – Floor Mounted Vibration Isolators – (Typical)

Floor Mounted Rubber-In-Shear Isolators

1. Mount fan on rail supports (if supplied).
2. Elevate fan to provide room to insert isolators between the fan base and supports and block in position.
3. Position isolators under fan and secure bolts.
4. Remove blocks and allow fan to rest on the isolators. Isolators must be installed on a level surface (leveling should not be required).
5. Secure isolators to mounting surface.

Floor Mounted Spring Vibration Isolators (Refer to Fig. 3)

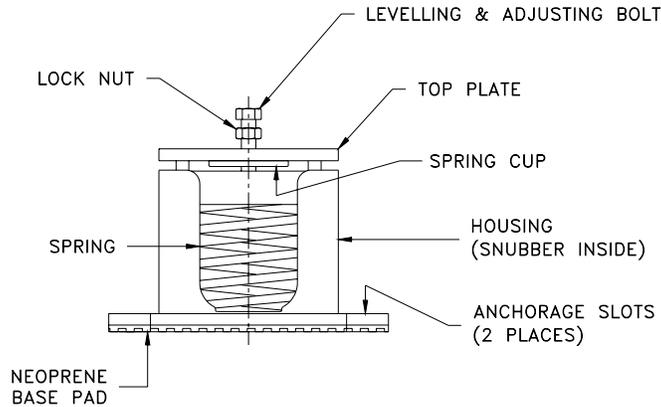


Fig. 3 – Spring Vibration Isolators (Assembly Detail - Typical)

1. Locate the isolators in their proper position under the fan. The equipment support should be flat and level. Shims, if required, should be full size.
2. Before the isolators are adjusted, the weight of the fan will cause the top plate to come to rest on the housing. The isolators should be adjusted to provide a minimum clearance of $\frac{1}{4}$ " between the top plate and the housing.
3. Install the adjusting and leveling bolts through the equipment mounting holes until the bolt comes into contact with the spring cup. Back off the lock nut and compress the springs by turning the adjusting bolt clockwise. Start at one isolator and make four turns on the adjusting bolt, move to the next isolator and make four turns, etc., until all isolators have been adjusted four turns. Repeat this procedure until a $\frac{1}{4}$ " clearance is obtained between top plate and housing.
4. Check the level of the fan. The fan may now be leveled by making small adjustments of individual isolators at the high and low points. The sleeves of the fan and isolation damper should be in line.
5. After the fan is level, visually check each isolator to make sure spring coils are not closed solid and there is sufficient clearance between the top plate and housing.

Spring Hanging Vibration Isolators (Refer to Fig. 4)

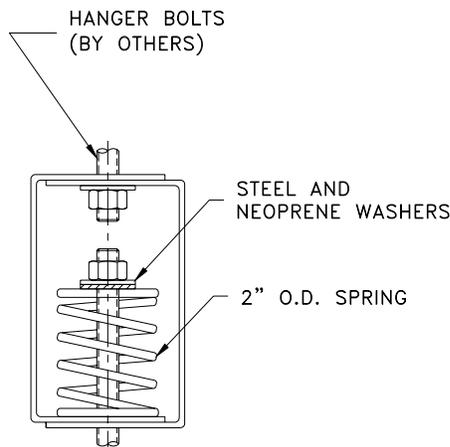


Fig. 4 – Spring Hanging Vibration Isolators (In-line fans - Typical)

1. Install the spring hanger as shown in Fig. 4.
2. Only after the fan is in it's final operating weight should the spring be adjusted. To adjust the spring, turn the nut directly above the spring cup clockwise. This will compress the spring.
3. When supporting the fan, not more than (3) complete turns should be made on the adjusting nut for each hanger at one time. Begin at one support point and progress around the fan compressing each spring in turn. This will tend to compress all springs uniformly and eliminate overloading of individual hangers.
4. Should any point be overloaded, turn the nut counterclockwise. This will unload the spring.
5. Check the level of the fan. The fan may now be leveled by making small adjustments of the individual isolators.
6. After the fan is level, visually check each isolator to make sure the spring coils are not closed solid.

Duct Installation

Efficient fan performance relies on the proper installation of inlet ducts (where factory inlet plenums are not provided). For duct inlets, allow at least 3 fan wheel diameters between duct turns or elbows and the fan inlet. See Fig. 5 below.

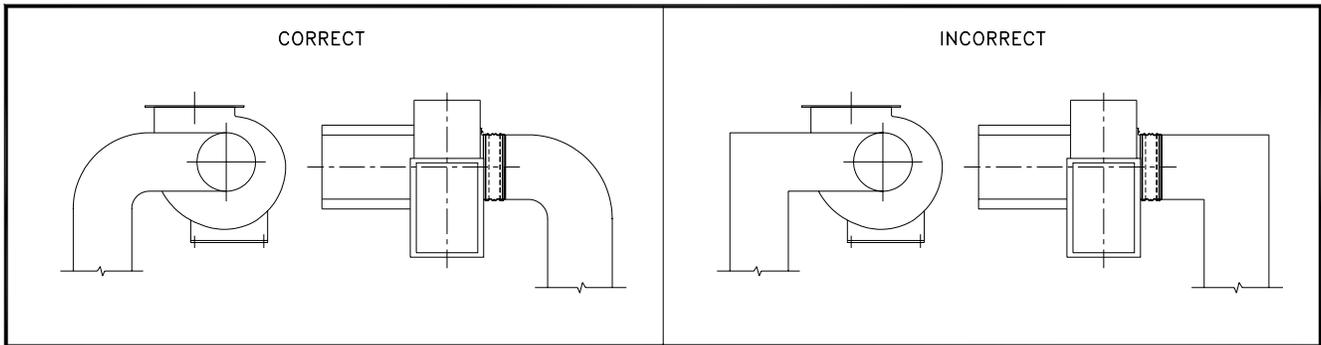


Fig. 5 – Inlet Duct Turns

Wheel-to-Inlet Clearance/Overlap

The correct wheel-to-inlet clearance/overlap is critical to proper fan performance. This clearance should be verified before initial start-up since rough handling during shipment could cause a shift in fan components. Refer to Fig. 6 - Wheel/Inlet Overlap for details.

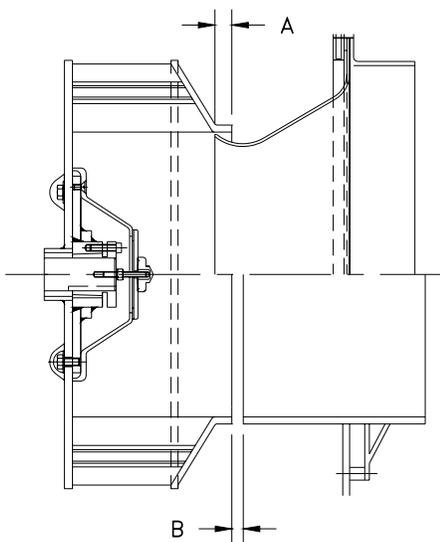


Fig. 6 – Wheel/Inlet Clearance/Overlap

DHK	AXCL	DIM A (in)
1225	1225	9/16"
1500	1500	5/8"
1825	1825	3/4"
2225	2225	15/16"
2450	2450	1-1/32"
2700	2700	1-1/16"
3000	3000	1-5/16"
3300	3300	1-11/32"
3650	3650	1-1/2"
4025	4025	1-5/8"
4450	4450	1-13/16"
4900	4900	2"
5425		2-1/8"
600		2-3/8"
6600		2-1/2"
7300		2-3/4"
PVK		DIM A (in)
500		1"
670		1-1/4"
CNW		DIM B(in)
160-200		1/8"
250-400		3/16"
PRVS		DIM B (in)
63-250		1/8"

Belt and Pulley Installation

Belt tension is determined by the sound the belts make when the fan is first started. Belts will produce a loud squeal, which dissipates after the fan is operating at full capacity. If the belt tension is too tight or too loose, lost efficiency and possible damage can occur. Do not change the pulley pitch diameter to change tension. This will result in a different fan speed than desired.

1. Loosen motor plate adjustment nuts on L-bolts and move motor plate in order that the belts can easily slip into the grooves on the pulleys. Never pry, roll, or force the belts over the rim of the pulley.
2. Slide the motor plate back until proper tension is reached. For proper tension a deflection of approximately $\frac{1}{4}$ " per foot of center distance should be obtained by firmly pressing the belt. Refer to Fig. 7.
3. Lock the motor plate adjustment nuts in place.
4. Ensure pulleys are properly aligned. Refer to Fig. 8

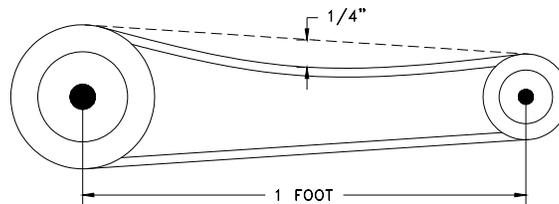


Fig. 7 – Belt & Pulley Tension

Pulley Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft, or by moving the entire motor along the motor mounting bracket. Fig. 8 illustrates correct and incorrect pulley alignment.

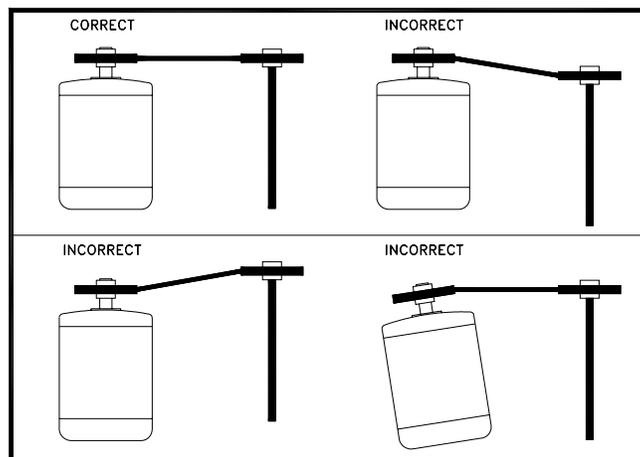


Fig. 8 – Pulley Alignment

A recommended method of inspecting the pulley alignment is shown in Fig. 9. With the shorter leg of a carpenter's square or other straight edge lying along the case of the motor, adjust the position of the motor pulley (or the motor) until the longer leg of the square is parallel to the belt.

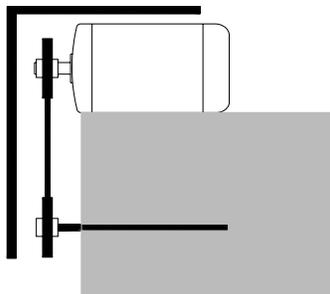


Fig. 9 – Pulley Alignment Method

Wiring Installation

All wiring should be in accordance with local ordinances and the National Electrical Code, NFPA 70. Ensure the power supply (voltage, frequency, and current carrying capacity of wires) are in accordance with the motor nameplate.

Lock off all power sources before unit is wired to power source.

Leave enough slack in the wiring to allow for motor movement when adjusting belt tension. Some fractional motors have to be removed in order to make the connection with the terminal box at the end of the motor. To remove the motor, remove bolts securing motor base to power assembly. Do not remove motor mounting bolts. The fans will have a hole provided at the base of the bearing pedestal to accommodate wiring.

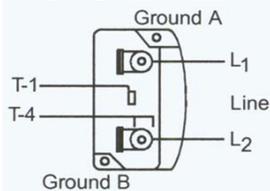
Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.

Follow the wiring diagram in the disconnect switch and the wiring diagram provided with the motor. Correctly label the circuit on the main power box and always identify a closed switch to promote safety (i.e. red tape over a closed switch).

Wiring Diagrams

Single Speed, Single Phase Motor



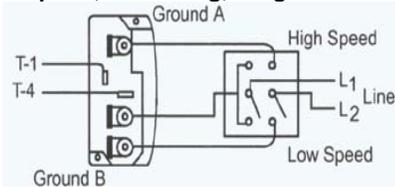
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

3 Phase, 9 Lead Motor



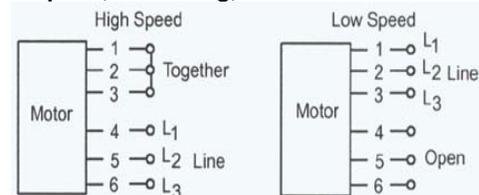
To reverse, interchange any 2 line leads.

2 Speed, 2 Winding, Single Phase Motor



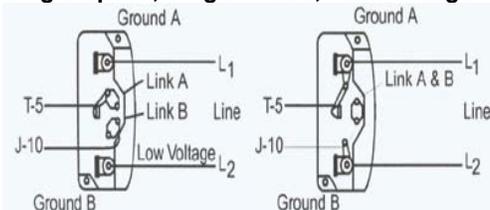
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

2 Speed, 1 Winding, 3 Phase Motor



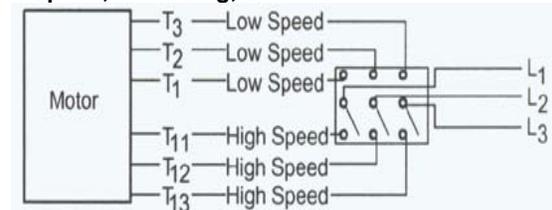
To reverse, interchange any 2 line leads. Motors require magnetic control.

Single Speed, Single Phase, Dual Voltage



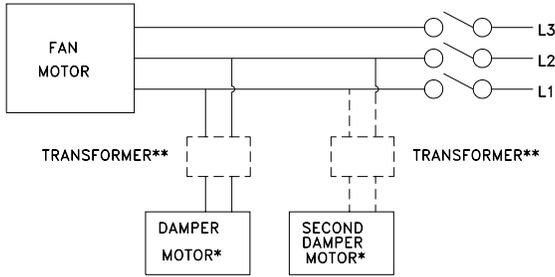
When ground is required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-5 and J-10 leads.

2 Speed, 2 Winding, 3 Phase



To reverse: High speed-interchange leads T11 & T12. Low speed-interchange leads T1 & T2. Both speeds-interchange any 2 line leads.

Typical Damper Motor Schematic



For 3 phase, damper motor voltage should be the same between L1 and L2. For single phase application, disregard L3. *Damper motors may be available in 115, 230 and 460 volt models. The damper motor nameplate voltage should be verified prior to connection. **A transformer may be provided in some installations to correct the damper motor voltage to the specified voltage.

Final Installation Steps

1. Inspect fasteners and setscrews, particularly fan mounting and bearing fasteners, and tighten according to the recommended torque shown in the table Recommended Torque for Setscrews/Bolts.
2. Inspect for correct voltage with voltmeter.
3. Ensure all accessories are installed.

Setscrews				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque (Inch-lbs)		Size	Wrench Torque Inch-lbs
		Min.	Max.		
No. 10	3/32"	28	33	3/8"-16	240
1/4"	1/8"	66	80	1/2"-13	600
5/16"	5/32"	126	156	5/8"-11	1200
3/8"	3/16"	228	275	3/4"-10	2100
7/16"	7/32"	348	384	7/8"-9	2040
1/2"	1/4"	504	600	1"-8	3000
5/8"	5/16"	1104	1200	1-1/8"-7	4200
3/4"	3/8"	1440	1800	1-1/4"-7	6000

Recommended Torque for Setscrews/Bolts (IN/LB)

Operation

Pre-Start Checks

1. Lock out all the primary and secondary power sources.
2. Ensure fasteners and setscrews, particularly those used for mounting the fan, are tightened.
3. Inspect belt tension and pulley alignment.
4. Inspect motor wiring.
5. Ensure belt touches only the pulleys.
6. Ensure fan and ductwork are clean and free of debris.
7. Inspect wheel-to-inlet clearance. The correct wheel-to-inlet clearance is critical to proper fan performance.
8. Close and secure all access doors.
9. Restore power to the fan.

Start Up

Turn the fan on. In variable speed units, set the fan to its lowest speed and inspect for the following:

1. Direction of rotation.
2. Excessive vibration.
3. Unusual noise.
4. Bearing noise.
5. Improper belt alignment or tension (listen for squealing).
6. Improper motor amperage or voltage.

If a problem is discovered, immediately shut the fan off. Lock out all electrical power and check for the cause of the trouble. See Troubleshooting.

Inspection

Inspection of the fan should be conducted in the first **30 minutes**, **8 hour** and **24 hour** intervals of satisfactory operation. During the inspections, stop the fan and inspect as per the *Conditions Chart*.

30 Minute Interval

Inspect bolts, setscrews, and motor mounting bolts. Adjust and tighten as necessary.

8 Hour Interval

Inspect belt alignment and tension. Adjust and tighten as necessary.

24 Hour Interval

Inspect belt tension, bolts, setscrews, and motor mounting bolts. Adjust and tighten as necessary.

Maintenance

Establish a schedule for inspecting all parts of the fan. The frequency of inspection depends on the operating conditions and location of the fan.

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air (airborne particles) should be inspected every three months, or sooner. Regular inspections are recommended for fans exhausting non-contaminated air.

It is recommended the following inspection be conducted twice per year.

- Inspect bolts and setscrews for tightness. Tighten as necessary. Worn setscrews should be replaced immediately.
- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. See Belt and Pulley Installation on page. 5.
- Bearings should be inspected as recommended in the conditions chart.

Conditions Chart

RPM	Temperature	Fan Status	Greasing Interval
100	Up to 120°F	Clean	6 to 12 months
500	Up to 150°F	Clean	2 to 6 months
1000	Up to 210°F	Clean	2 weeks to 2 months
1500	Over 210°F	Clean	Weekly
Any Speed	Up to 150°F	Dirty	1 week to 1 month
Any Speed	Over 150°F	Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Very Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Extreme Conditions	Daily to 2 weeks

- Inspect springs and rubber isolators for deterioration and replace as needed.
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling. Removing dirt from the wheel and housing prevents imbalance and damage.

Lubricants

M.K. Plastics uses petroleum lubricant in a lithium base. Other types should not be used unless the bearings and lines have been flushed clean. If another type of grease is used, it should be lithium-based grease conforming to NLGI grade 2 consistency.

A NLGI grade 2 grease is a light viscosity, low-torque, rust inhibiting lubricant that is water resistant. Its temperature range is from -30°F to +200°F and capable of intermittent highs of +250°F.

Motor Bearings

Motor bearings are pre-lubricated and sealed. Under normal conditions they will not require further maintenance for a period of 10 years. However, it is advisable to have your maintenance department remove and disassemble the motor, and lubricate the bearings after 3 years of operation in excessive heat and or in a contaminated air stream consisting of airborne particles.

Fan Bearings

Greasable fan bearings are lubricated through a grease fitting on the bearing and should be lubricated by the schedule, *Conditions Chart*.

For best results, lubricate the bearings while the fan is in operation. Pump grease in slowly until a slight bead forms around the bearing seals. Excessive grease can burst seals resulting in high operating temperatures, thus reducing bearing life.

In the event the bearing cannot be seen, use no more than three injections with a hand-operated grease gun.

Motor Service

Should the motor prove defective within one-year period, contact *M.K. Plastics* directly, or your nearest motor service representative.

Changing Shaft Speed

All belt driven fans with motors up to and including 5 hp (184T max.) are equipped with variable pitch motor pulleys. To change the fan speed, perform the following:

1. Loosen setscrews on driver (motor) pulley and remove key, if equipped.
2. Turn the pulley rim to open or close the groove facing. If the pulley has multiple grooves, all must be adjusted to the same width.
3. After adjustment, inspect for proper belt tension and alignment.

Speed Reduction

Open the pulley in order that the belt rides deeper in the groove (smaller pitch diameter).

Speed Increase

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained, which can be read on the motor nameplate.

Pulley & Belt Replacement

1. Remove pulleys from their respective shafts.
2. Clean the motor and fan shafts.
3. Clean bores of pulleys and coat the bores with heavy oil.
4. Remove grease, rust, or burns from the pulleys and shafts.
5. Remove burrs from the shaft by sanding.
6. Place fan pulley on the fan shaft and motor pulley on its shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.
7. Tighten in place.
8. Install belts on pulleys and align as described in the *Belt and Pulley Installation* section.

Bearing Replacement

The fan bearings are pillow block ball bearings or flange bearing assembly, depending on type of fan. An emery cloth or file may be needed to remove imperfections in the shaft left by the setscrews.

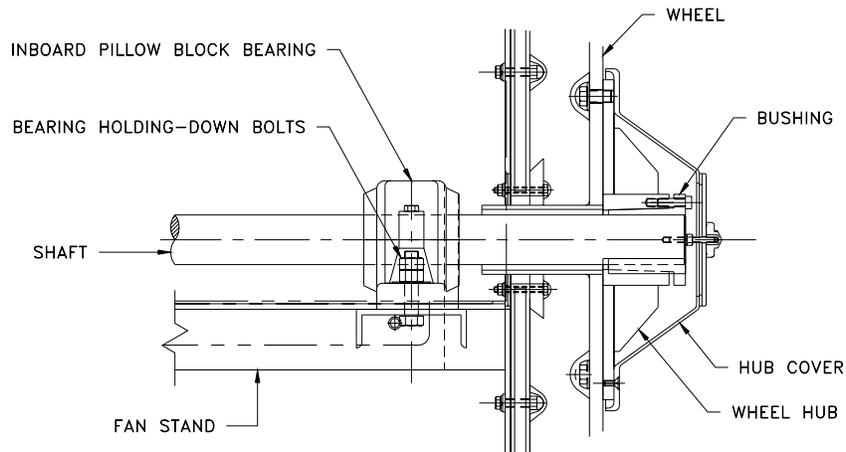


Fig. 10 – Bearing Assembly

NOTE: In applications where contact with the exhaust poses a serious contamination is a factor, the bearings can be removed with the wheel and inlet cone staying in place. In this case, the shaft must be held in place with suitable straps or bracings firmly secured around the bearing support frame. The shaft must be supported to restrict any lateral movement of both shaft and impeller. In this case, review but skip steps 2, 4, 6, & 14.

1. Mark the position on the shaft of both bearing races, setscrews, and the wheel and pulley.
2. Mark the location and orientation of the inlet cone. Note the clearance between the wheel and the inlet cone.
3. Remove the fan pulley.
4. Remove the inlet cone. Remove the wheel from the shaft – a 2-jaw puller may be needed.
5. Remove bearing hold-down bolts.
6. Remove shaft and bearings as one unit.
7. Remove anti-corrosion coating from the shaft with a suitable degreaser.
8. Remove the bearing from the shaft using a bearing puller. If a bearing puller is not available, tap on the bearing with a wood block and hammer to remove it.
9. Smooth and clean the shaft and bearing bore thoroughly.
10. Place the bearings into position making sure they are not on a worn section of the shaft. Tapping the inner ring face with a soft driver may be required. **Do not hammer on the housing.**

11. The outer ring of the bearing is spherical and swivels in the housing to compensate for misalignment. Secure hold down bolts, but **do not fully tighten**.
12. Align the setscrews on the bearings and tighten one setscrew on each bearing.
13. Rotate the shaft to allow the bearing outer rings to find their center of free movement.
14. Install the wheel on the shaft. Install the inlet cone in its original location. And adjust bearing position and inlet cone to center the wheel in the inlet cone.
15. Tighten the hold-down bolts to the proper torque.
16. Turn the shaft by hand. Resistance should be the same as it was before the hold-down bolts were fully tightened.
17. Tighten the bearing setscrews. Refer to the Torque chart.
18. Re-install the pulley and adjust the belt tension.
19. Test run and retighten all setscrews and hold-down bolts; trim balance as necessary (.0785 in/sec max.)

After 24 hours of operation, retighten the setscrews to the appropriate torque. Make sure the socket key or driver is in good condition with no rounded corners. The key should be fully engaged in the setscrew and held squarely to prevent rounding out of the setscrew socket when applying maximum torque.

Flange Bearing Replacement

Please refer to Fig. 11 for the following procedures. The fan bearings are housed inside the flange bearing assembly, which includes the shaft. It is easier and quicker to replace the entire assembly, rather than the bearings themselves.

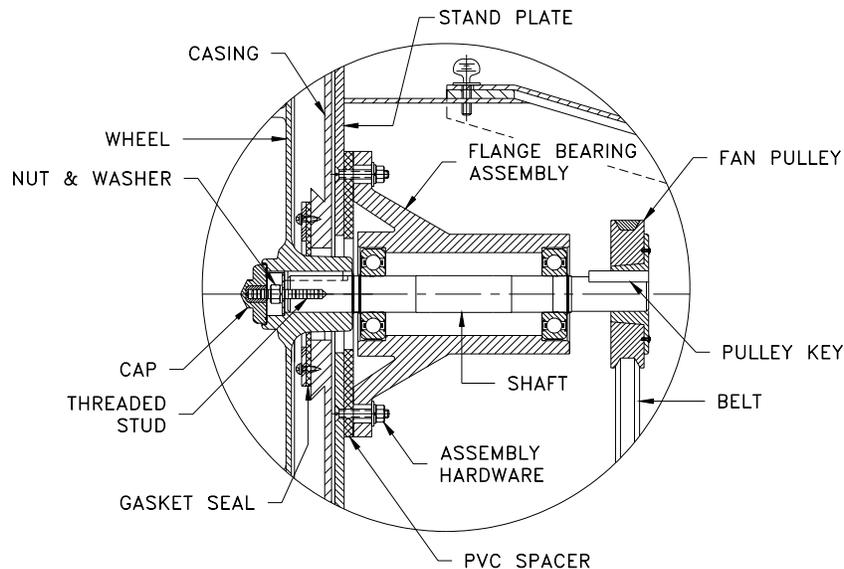


Fig. 11 – Flange Bearing Assembly

1. Remove the fan drive belt and pulley.
2. Remove by unscrewing the front protective cap, and then the nut, washers and threaded stud. Removal of the inlet collar on the front of the fan will give you better access.
3. Remove the wheel from the shaft – a 2-jaw puller may be needed.
4. Remove the assembly hardware that holds the entire assembly to the stand plate. The flange bearing assembly can now be removed, complete with the shaft.
5. Before replacing the assembly, make sure the shaft and keys are clean and smooth.
6. Re-attach the flange bearing assembly to the stand plate, but make sure the PVC spacer is in good condition. Replace if necessary.
7. Inspect and clean the bore of the wheel. Gently slide the wheel onto the shaft after inserting the key, and re-install the threaded stud, nut and washers to the shaft, and tighten. Make sure the wheel hub is sitting well against the snap ring on the shaft. Re-install the cap and tighten well.
8. Re-attach all the pulleys and adjust the belt tension.
9. Test run and retighten all screws and bolts if necessary.

Troubleshooting

Problem and Potential Cause
Low Capacity or Pressure <ul style="list-style-type: none">• Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or drive belt assembly.• Poor fan inlet conditions. There should be a straight clear duct at the inlet.• Improper wheel alignment.
Excessive Vibration and Noise <ul style="list-style-type: none">• Damaged or unbalanced wheel.• Belts too loose; worn or oily belts.• Speed too high.• Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or drive belt assembly.• Bearings need lubrication or replacement.• Fan surge or incorrect inlet condition.
Overheated Motor <ul style="list-style-type: none">• Motor improperly wired.• Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or drive belt assembly.• Cooling air diverted or blocked.• Improper inlet clearance.• Incorrect fan RPM.• Incorrect voltage.
Overheated Bearings <ul style="list-style-type: none">• Improper bearing lubrication.• Excessive belt tension.

Parts List

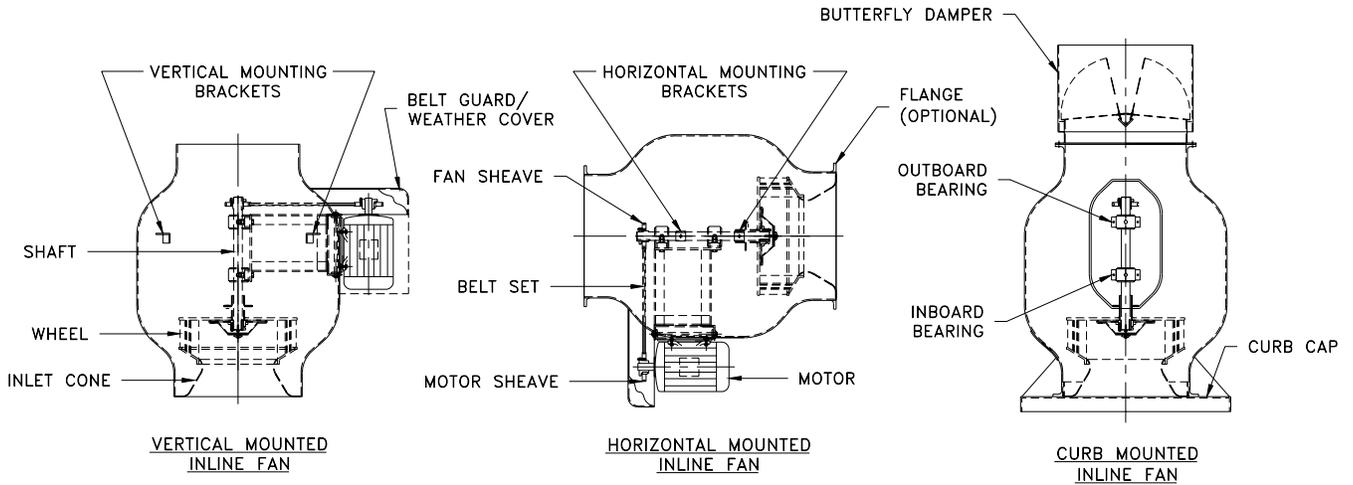


Fig. 12 – Inline Fans (typical)

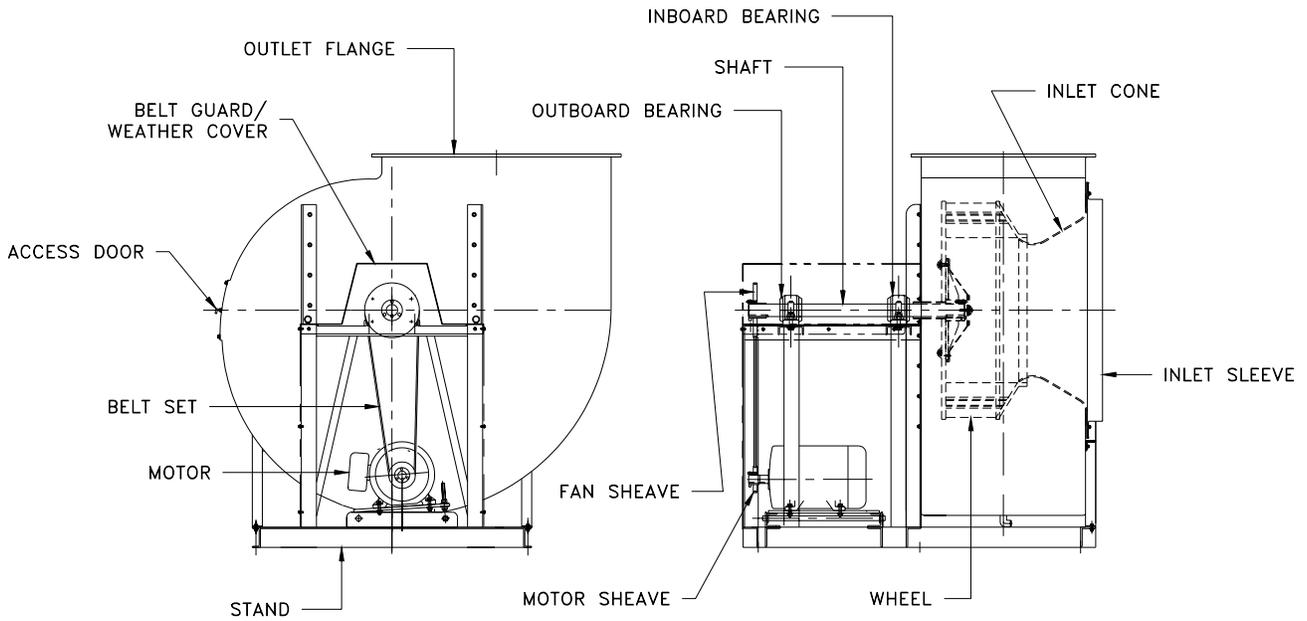


Fig. 13 – Centrifugal Fans (typical)