

# TUBE Axial Fans (RAVVAR Series)

## Installation, operation & Maintenance Manual Models: RAVVAR

### Introduction

The purpose of this manual is to provide instructions that complement good general practices when installing or operating fans manufactured by Ventech Systems Pvt. Ltd. It is the responsibility of the purchaser to provide qualified personnel experienced in the installation, operation, and maintenance of air moving equipment.

As always, follow good safety practices when installing, maintaining and operating your air moving equipment. A variety of safety devices is available. It is the user's responsibility to determine adequate safety measures and to obtain the required safety equipment.

### Shipping and Receiving

All Ventech Systems Pvt. Ltd products are carefully constructed and inspected before shipment to ensure the highest standards of quality and performance. Compare all components with the invoice 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 should be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment.



### CAUTION

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 provided for attaching chains. Lift the fan in a fashion that protects the fan and fan coating 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.

If fan installation is to be delayed, store the unit in a protected area. Protect the fan and motor bearings from moisture and vibration (or shock loading). For extended storage, wrap entire unit in plastic.

Extended storage requires monthly inspections. Check for corrosion or damage to the unit and for debris within the fan. Rotate the fan wheel a few revolutions. Stop the wheel in a position other than the initial position. Grease the bearings every month with a grease compatible with the grease supplied with the bearings.

### Foundations and Supporting Structures

Typical mounting arrangements are shown in Figures 4 and 5 on page 4. Floor mounted fans should be installed on a flat, level, rigid concrete foundation. They require the mass of the foundation to be at least three times that of the fan assembly. The plan area should be no more than twice that required by the equipment. Foundations with larger areas should have correspondingly larger mass. Anchor bolts should be "L" or "T" shaped with sufficient length for nuts, washers, shims, and threads for draw-down. Each bolt should be placed in a sleeve or pipe with a diameter larger than the bolt to allow for adjustment. When the mounting surface and the surface of the fan base do not match, shim or make allowance for grouting. Do not distort the fan when tightening the anchor bolts.

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Fans mounted to or within a structure should be placed as close as possible to a rigid member such as a wall or column. The structure must be designed for rotating equipment; static design for strength is not sufficient to insure proper operation. Supports for suspended fans must be cross-braced to prevent side sway. Structural resonance should be at least 20% from fan operating speed. Vibration isolators should be used where applicable.

Any ducting should have independent support; do not use the fan to support ducting. 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. Place vibration pads or isolation base on mounting bolts. Line up holes in fan base with bolts.
4. Place fan on mounting structure. Carefully level the unit using shims as required at all mounting hole locations. Bolt down the unit.
5. Any grout may now be used. Bolt the fan in position before applying grout. Do not depend upon grout to support rotating equipment.
6. Continue with Operations Checklist.

### General Motor Maintenance

The three basic rules of motor maintenance are: keep the motor clean, keep it dry, and keep it properly lubricated. Blow dust off periodically (with low pressure air) to prevent the motor from overheating. Some smaller motors are lubricated for life. 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 50 hp, every 3 years; and motors 50 to 150 hp, yearly. For motors in a dusty or dirty environment or running 24 hours a day, divide the service interval by 2. If the environment is very dirty or high temperatures exist, divide the service interval by 4. Lubrication requirements are normally attached to the motor. Do not overlubricate.

### Drive Maintenance

V-belt drives need periodic inspection 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. Inspect the belts for wear. If fraying or other wear is observed to be mostly on one side of the belts, the drives may be misaligned. Reinstall the drives according to the following instructions:

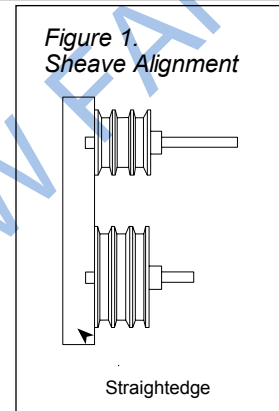
1. Slip (do not pound) the proper sheave onto its corresponding shaft.



### CAUTION

Reversing the sheaves (placing the fan sheave on the motor shaft) can overspeed the wheel and cause structural failure.

2. Align sheaves with a straightedge extended along the sheaves, just making contact on the outside perimeters of both sheaves. (See Figure 1.)
3. Tighten sheave bolts.
4. Adjust the motor position to obtain slack. Install and tighten belts. Use a matched set of belts. Using a pry will damage belts. Never use belt dressing on any belts.
5. Tighten belts to proper belt tension. Ideal tension is just enough so that the belts do not slip under peak load. Recheck sheave alignment.
6. New belts require a break-in period of operation so recheck the belt tension after a few days of operation.
7. When replacing belts replace the entire set and follow the procedure above.



### Drive Adjustment

On small fans, the belt tension is adjusted by loosening the four nuts on top of the motor plate and turning the four nuts underneath the motor plate to achieve the proper belt tension. Tighten the top four nuts to hold the motor plate in place. Care should be taken to maintain drive alignment as described above. Large fans use a pivoting motor mounting plate. Adjust the belt tension by loosening the two nuts and bolts on the pivoting side of the motor plate, and the nuts that hold the eyebolts to the motor plate on the other side. Turn the nuts on the eyebolts that are underneath the motor plate to achieve the proper belt tension and then tighten the top nuts and the pivot side nuts and bolts. When tightening the nuts that are on the eyebolts, take care to maintain proper drive alignment. Positioning the motor plate at too high of an angle may result in the belts rubbing against the belt tube inside the fan. The motor plate pivot bolt must be moved up or down to the next hole to keep the drives centered in the belt tube. The ideal motor plate position is perpendicular to the belt tube centerline.

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Figure 2. Ball Bearing Relubrication Schedule

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									
Speed (RPM)	500	1000	1500	2000	2500	3000	3500	4000	4500
<b>Shaft DIA</b>									
½" thru 1¼"	6	6	5	3	3	2	2	2	1
1½" thru 2¾"	6	5	4	2	2	1	1	1	1
2¼" thru 2½"	5	4	3	2	1	1	1		
3¼" thru 3½"	4	3	2	1	1	1			

\*Suggested initial greasing interval: Rotate bearings during relubrication where good safety practice 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. Some greases having these properties are:  
  
 Shell - Gadus S2 V100 2 Mobil - Mobilith AW2/Mobilith SHC100  
 Gulf - Gulfcrown No. 2 American - Rykon Premium 2
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Figure 3. Solid Pillow Block Spherical Roller Bearing Relubrication Schedule

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									
Speed (RPM)	500	1000	1500	2000	2500	3000	3500	4000	4500
<b>Shaft DIA</b>									
1¾" thru 1¾"	6	4	4	2	1	1	1	1	½
1½" thru 2¾"	4	2	1½	1	½	½	½	½	½
2¾" thru 3¼"	3	1½	1	½	½	¼	¼		
3½" thru 4½"	2½	1	½	¼					

\*Suggested initial greasing interval: Rotate bearings during relubrication where good safety practice 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 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 - Gadus S2 V100 2 Mobil - Mobilith AW2/Mobilith SHC100  
 Texaco - Premium RB2 American - Rykon Premium 2
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

## Bearing Lubrication

Proper lubrication of belt drive bearings helps assure maximum bearing life. However, conditions at every installation are different and the frequency of relubrication should be established accordingly. Figure 2 shows the relubrication schedule for ball bearings. Figure 3 shows the relubrication schedule for solid pillow block spherical roller bearings.

Lubrication intervals should be doubled on fans with vertical shafts.

On high moisture applications, the relubrication frequency may need to be doubled or tripled to adequately protect the bearings. Carefully replace the joint sealant under the bearing access cover whenever the bearings on high moisture fans are serviced.

Observation of the condition of the grease expelled from the bearings at the time of relubrication is the best guide as to whether regreasing intervals and the 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.

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. Bearings have a tendency to run hotter during this period and should not be a cause for alarm unless it lasts over 48 hours or gets very hot. When relubricating, use a sufficient amount of grease to purge the seals. Rotate bearings during relubrication where good safety practice permits.

## Propeller and Shaft Maintenance

The buildup of material on axial flow propellers can adversely affect fan performance. While fans that handle clean, fresh air seldom need cleaning, occasionally check fans used for industrial purposes for material buildup on the propeller. This material can come off in large chunks, throwing the propeller out of balance. Clean the propeller and, on vaneaxial fans, the turning vanes; when appropriate, apply new coatings.

If the propeller 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 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.

## Operation Checklist

Verify that proper safety precautions have been followed:

- Electrical power must be locked off.

Check fan mechanism components:

- Nuts, bolts and setscrews are tight.
- Mounting connections are properly made and tightened.
- Bearings are properly lubricated.
- Propeller, drive and fan surfaces are clean and free of debris.
- Rotating assembly turns freely and does not rub.
- Sheaves are on the correct shafts, properly aligned and properly tensioned.

Check fan electrical components:

- Motor is wired for proper supply voltage.
- Motor size is sufficient to power the 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 <180°F are acceptable after one to two hours of operation.

After one week of operation:

- Check all nuts, bolts and setscrews and tighten if necessary.
- Readjust drive tension if necessary.

Figure 4. Horizontal Mounting Arrangements

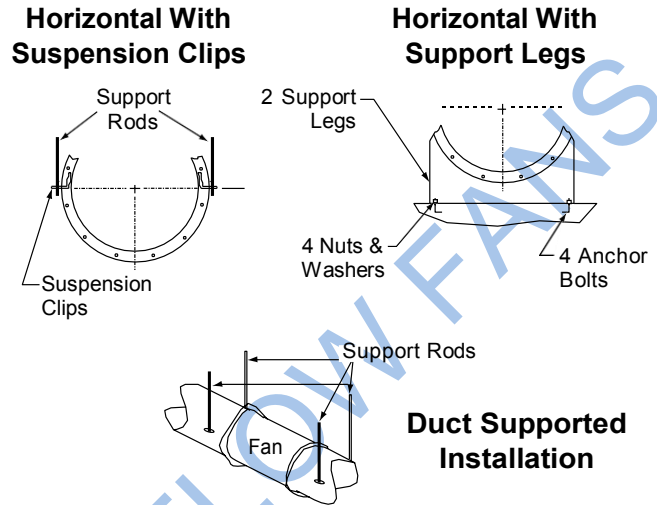
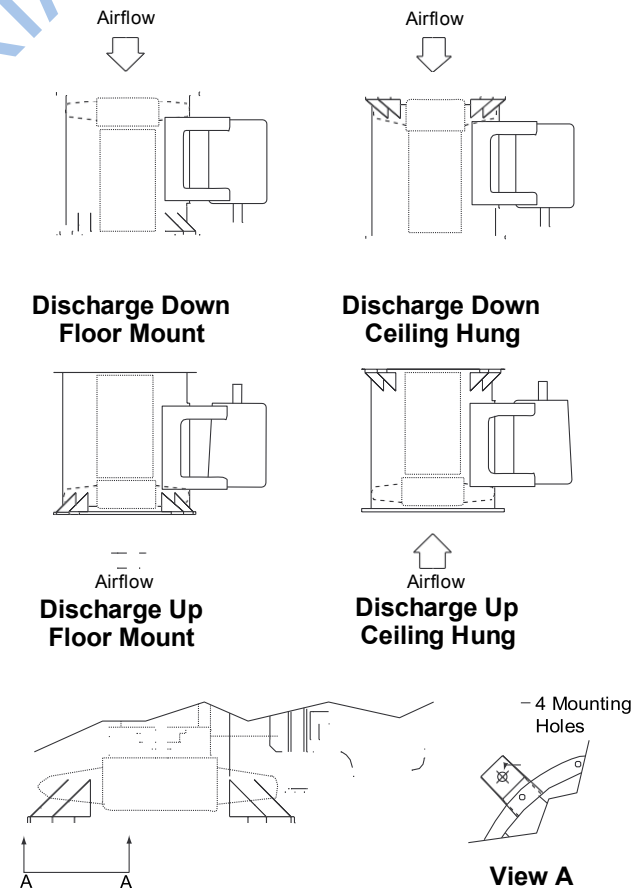


Figure 5. Vertical Mounting Arrangements



NOTE: Fan can be supported with anchor bolts, vibration isolators,

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or support rods.

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## Blade Adjustment on Adjustable Pitch Axial Fans

### Blade Angle Adjustment

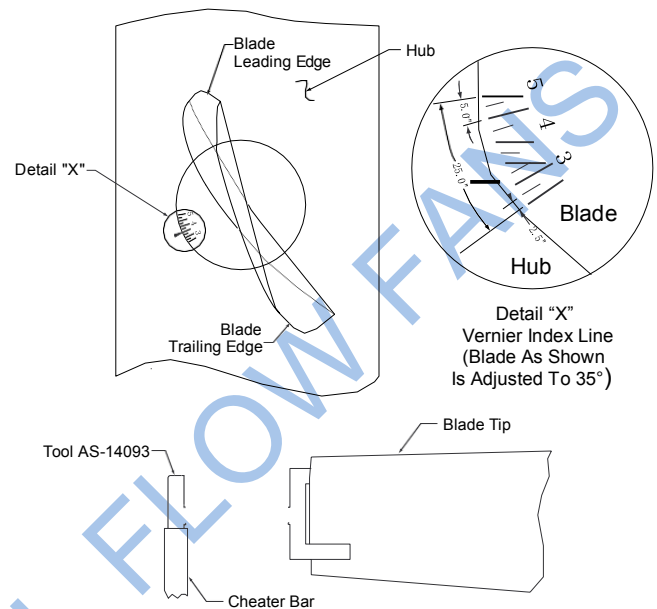
The blades are set at the factory to the blade angle that gives the performance specified on the order. This angle should be checked prior to start-up. The patented wheel construction uses friction and centrifugal force to hold the blades in place. No disassembly of the wheel is required to change the blade angles. If it is necessary to change the blade angle, the following procedure should be used:

1. Work safely. Make sure that proper safety precautions have been followed. Electrical power must be locked off.
2. The adjustment can be made through the inlet on open inlet fans. On fans with ducted inlets, open the wheel area access door.
3. Place adjustment tool around end of blade (see Figure 6, to the right). If necessary, apply "cheater bar" around the 1/4" diameter end for additional leverage.

The blades can be turned by hand on open inlet fans. If additional leverage is needed, place a wrench on the leading edge of the blade near the hub. Take care not to mar the surface of the blade.

4. **Prior to adjusting the blade angle, check the performance data to insure that the motor will not overload.**
5. Turn blade to desired angle. See Figure 6. There is an indicator mark on the hub. Align the Vernier index line on the blade with the indicator mark on the hub. The Vernier has the characters 3, 4, and 5 with gradation lines in between. (**Note:** Character 3 is 30°, 4 is 40°, 5 is 50°.) Each gradation is 2.5°. The blade is adjustable between 25° and 50°.
6. Friction and centrifugal force will hold the blade at the set angle. No additional adjustment is necessary.
7. **Adjust all blades to the same angle.**
8. Close the wheel area access door before operating the fan.

Figure 6.





## Troubleshooting

Problem	Cause	Corrective Action
<b>Excessive Noise</b>	Wheel rubbing (inlet)	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-belt drive	Tighten Sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see V-Belt Drives section). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
<b>Low Airflow</b>	Fan	Check wheel for correct rotation. Increase fan speed.*
	Duct system	See page 3.
	Air leakage in duct system	Check connections throughout.
	Ducting is undersized	Undersized ducting and fittings will increase system pressure and reduce flow accordingly. Unless changes can be made to the ducting a higher rated fan will need to be installed.
	Incorrect pitch angle (axial fans)	Check pitch angles against fan specification and correct as required.
	Wrong sized fan	Check against system requirements and replace as required.
	Dampers not adjusted correctly	Check position of all system dampers and correct as necessary.
	Turbulence in duct system	Install guide vanes to inlet side of axial fans to prevent air rotation. Install turning vanes in bends. Ensure transitions are designed with appropriate length and angle to prevent losses.
	Dirty filters	Remove filters and re-check performance, clean as required and reinstall.
	<b>High Airflow</b>	Fan
Duct system		Resize ductwork. Access door, filters, grilles not installed.
	Ducting is oversized	Oversized ducting and fittings will reduce system pressure and increase flow. Install dampers or speed control devices to fans to bring system back to correct balance
	Incorrect pitch angle (axial fans)	Check pitch angles against fan specification and correct as required
	Wrong sized fan	Oversized ducting and fittings will reduce system pressure and increase flow. Install dampers or speed control devices to fans to bring system back to correct balance.
<b>Static Pressure Wrong</b>	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
	Dirty filters	Filters need to be cleaned or replaced.
	Fan	Check rotation of wheel. Reduce fan speed.

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<b>High Horsepower</b>	Duct system	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
<b>Fan Doesn't Operate</b>	Electrical supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
<b>Overheated Shaft Bearing</b>	Lubrication	Check for excessive or insufficient grease in the bearings.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
<b>Excessive Vibration</b>	Belts	Adjust tightness of belts. Replacement belts should be a matched set.
	System unbalance	Check alignment of shaft, motor and pulleys. Adjustable pitch pulleys with motors over 15 hp are especially prone to unbalance. Check wheel balance, rebalance if necessary.
	Coupling misalignment	Check alignment between coupling, motor and fan shafts. Any adjustments should be made per coupling manufacturer's instructions. Shim only under motor.
<b>Wrong rotation direction</b>	Incorrect wiring	Check wiring against diagram in junction box or on fan datasheet and correct as necessary. For three phase fans, reverse any two supply cables.
<b>Humming sound from motor</b>	Incorrect electrical supply Electronic speed controller Incorrectly installed VSD speed controller	Check motor plate matches electrical supply. Replace with transformer type controller. Check installation of VSD against manufacturer's specifications.
	Overloaded motor Imbalanced phases in three phase supply	Ensure correct motor is fitted for the impeller size and/or pitch angle (axials). Check that supply phases are correct
<b>Fan rotates in alternating Directions</b>	Capacitor faulty or not correctly wired	Check wiring and replace if faulty.
<b>Excessive current draw</b>	Undersized motor for required duty Incorrect blade pitch angle (adjustable pitch axial fans) Impaired rotation of impeller Incorrect electrical supply Three phase motor operating with one phase disconnected Motor incorrectly wired for star or delta operation	Check motor plate and replace motor if required. Check and adjust pitch angles. Check for obstructions to impeller spinning freely. Check that supply matches motor plate. Check power supply or motor windings. Check motor plate and wiring diagram and correct as required.
<b>Overheating</b>	Frequent start ups	Check control system and adjust down number of starts per hour to eight or less. Clean motor.
	Dirty cooling fins on motor Blocked cooling vents on motor shrouds Cooling fan not fitted to motor out of airstream	Clear dirt and obstructions from cooling vents. Check fitment of cooling fan.

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	Motor incorrectly wired for star or delta operation	Check motor plate and wiring diagram and correct as required.
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## Maintenance Log

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## Warranty

Ventech Systems Pvt. Ltd. warrants this equipment to be free from defects in material and workmanship for a period of one year from the shipment date. Any units or parts which prove to be defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year.

*As a result of our commitment to continuous improvement, Ventech Systems Pvt. Ltd. reserves the right to change specifications without notice.*

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at [www.amca.org](http://www.amca.org).