

Throughout this manual, there are a number of HAZARD WARNINGS that must be read and adhered to in order to prevent possible personal injury and/or damage to equipment. Two signal words "WARNING" and "CAUTION" are used to indicate the severity of a hazard and are preceded by the safety alert symbol.

**⚠ WARNING**

Used when serious injury or death MAY result from misuse or failure to follow specific instructions.

**⚠ CAUTION**

Used when minor or moderate injury or product / equipment damage MAY result from misuse or failure to follow specific instructions.

**NOTICE**

Indicates information considered important, but not hazard-related.

It is the responsibility of all personnel involved in installation, operation and maintenance to fully understand the ⚠ Warning and ⚠ Caution procedures by which hazards are to be avoided.

## INTRODUCTION

This manual has been prepared to guide the users of TFE, QFE, QIFE and TVIFE Fume Exhaust Fans in the proper installation, operation and maintenance procedures to insure maximum equipment life with trouble-free operation.



TFE and QFE



QIFE



TVIFE

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**⚠ CAUTION**

**Fan systems include rotating components and electrical devices. Proper care must be taken during installation and maintenance of all fan system components to protect personnel. This includes, but is not limited to the use of protective enclosures, guards, locking devices to stop rotating parts and electrical disconnect lock-outs. Refer to applicable local codes to ensure compliance for all protective devices.**

**Fans create a suction at the inlet. Care should be taken around the inlet of the fan, whether it is in operation or not. Make sure the inlet area is clear prior to energizing the system. This includes all personnel and loose, foreign objects.**

## INSPECTION AND RECEIVING

All Twin City Fan 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.

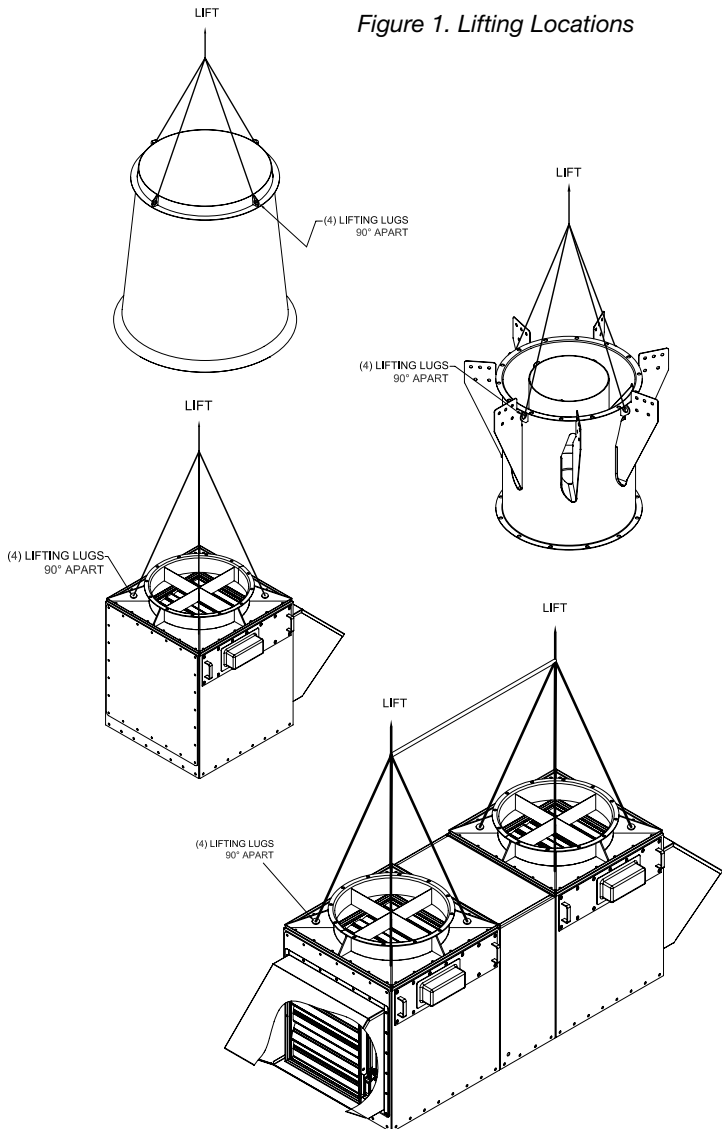
## HANDLING AND RIGGING

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.



Units shipped may be lifted with slings and spreader bars. Use well-padded chains, cables or nylon straps (see Figure 1). 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, motor or motor base, or in any other manner that may bend or distort parts.

Figure 1. Lifting Locations



Mixing plenum boxes configured for multiple fans mounted on a common unit are modular in design and may be broken down into smaller segments for ease of installation and handling.

## UNIT STORAGE

If fan installation is to be delayed, store the unit in an environmentally stable and protected area. During storage, the fan should not be subjected to vibration from external sources or bearing damage may occur. 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 in which they are stored 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.

Start-Up – When the unit is removed from storage, all fan bearing grease should be purged and replenished with fresh grease as per the lubrication decal. The motor should be measured to verify that the resistance is still at a satisfactory level compared to the value recorded prior to storage.

## INSTALLATION


### Pre-Installation Checklist

Prior to fully assembling and installing, inspect the fan and ancillary components to ensure it is in working order.

- Check all external and internal hardware on the fan, wheel, bearings, drive motor base and accessories for tightness.
- Rotate the fan wheel by hand and assure no parts are rubbing. Adjust components prior to installation as adjustments are easier while lower to grad.

- Check proper wheel clearances to be sure near tolerance. The wheel will need to be realigned after installation, therefore, clearances should be near tolerance.

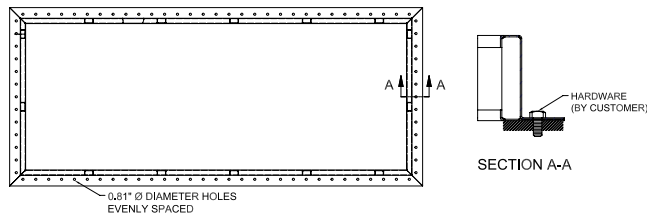
### Roof Curb Installation


CAUTION

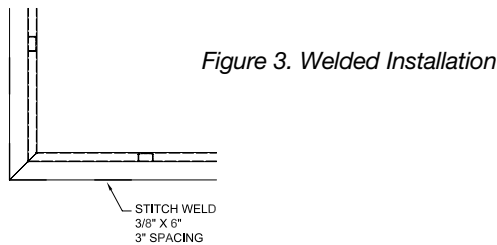
**Roof curbs should be square and level to ensure safe fan installation and proper sealing of gas stream to the fan.**

Roof curbs shall be installed and fully attached to structural support (by others) which is typically steel or concrete using 1/2" diameter bolts w/ 1-3/8" washers (by others).

Figure 2. Bolted Installation



For attachment to structural steel the curb can be continuously welded or stitch welded using 3/8" x 6" welds with a maximum of 3" spacing between welds. Welds should be evenly spaced along curb side and corners.



### Mixing Plenum Box Assembly and Installation

The modular plenum mixing boxes are designed to allow for easy installation and future expandability. Single mixing plenum boxes are fully assembled (less any dampers) to expedite installation. Depending on the size, multi-unit mixing boxes may or may not be assembled. When installing the mixing box(es), it is important to follow the guidelines for lifting and rigging on page 2.

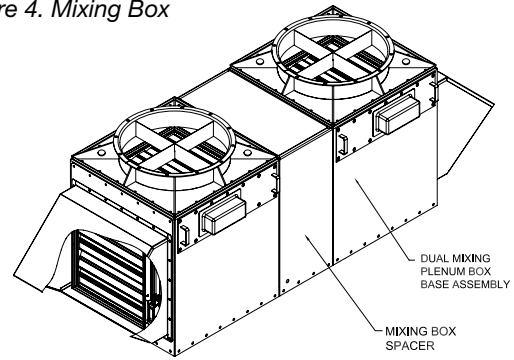
When a single-unit mixing plenum box is installed, prepare the roof curb or mounting structure. Lay gasket material on the top edge of the roof curb. Lift mixing box onto curb and square (level) mixing box.

Depending on the air intake (side or bottom), the mixing box must be oriented to allow for direct duct connection into the mixing plenum box. Match drill roof curb to mixing plenum box. Attach mixing plenum box to roof curb using 3/8" diameter, 3" length slotted, hex washer head type F machine screws, stainless steel (by others).

For multi-unit configurations, some assembly may be required. There are at least two different assemblies in a multi-unit configuration. There is the mixing plenum box assembly and the mixing box spacer. See Figure 4. There will be one less spacer than the quantity of mixing plenum boxes.

To assemble, space the mixing boxes a distance apart that is slightly more than the width of the spacer section. Utilize a gasket between the mixing box and the spacer section to provide a tight seal.

Figure 4. Mixing Box



Install 316 stainless steel bolts to attach the spacer and the mixing box. Repeat as necessary for each section.

When the multi-unit mixing plenum box is assembled, rig the mixing box system into place in accordance with Figure 1 to avoid any damage.

Install mixing plenum box assembly onto a prepared (gasket material on mating surface) roof curb or mounting structure. Lay Square (level) mixing box. Install lag bolts into the mixing plenum box to roof curb as indicated.

### Fan Installation with Curb Cap ONLY (No Mixing Plenum Box)

Securing the curb cap to the roof curb will be similar to attaching with a mixing box except the pre-drilled holes on the curb cap will be 13/16" diameter. Drill pilot holes on the roof curb using the curb cap as reference, then secure curb cap to the roof curb with 3/8" diameter, 3" length slotted, hex washer head type F machine screws, stainless steel (by others).

### Fan and Windband Installation

- Follow proper handling instructions as provided earlier.
- Identify each fan and component and match the equipment up with the supplied customer drawing(s).
- Move the fan to the final mounting location.
- Remove skid, crates and packing materials carefully.
- For fans mounted directly to roof curb (supplied with a curb cap), place the fan on properly installed roof curb. Fans mounted on a mixing plenum box (supplied with mixing plenum box transition) require the installation of the mixing plenum box prior to installing fan.
- Fans shipped as a single unit shall be broken down into several parts. Install each item individually in the following order:
  1. Fan and curb cap onto the installed roof curb  
-or-  
Fan and mixing plenum box transition onto installed mixing box.
  2. Stack extension, if in the scope of supply (TFE/QFE only)
  3. Windband

NOTICE

**When installing the components, lifting lugs shall be utilized for safe installation. Lifting lugs are designed for the weight of the component they are welded to and should not be used to lift assemblies.**

### Fan Housing Installation

1. Place supplied gasket around the perimeter of the mixing plenum box or roof curb.
2. Lower fan housing onto roof curb or mixing plenum box aligning the bolt holes on the two components. Allow for gasket to compress naturally prior to securing fan housing to the adjacent component.

3. Install 316 stainless steel hardware (provided) in all mounting holes. Use a commercially available anti-seizing compound formulated for 316 stainless steel to hardware. Carefully level the unit on the roof curb or mixing plenum box. Be careful not to force the fan to the mounting structure. This may cause misalignment which may unsafe operating conditions, cause vibration and premature failure.
4. Check the alignment of the bearings. Shim or reposition the bearings if necessary.
5. 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.
6. 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.

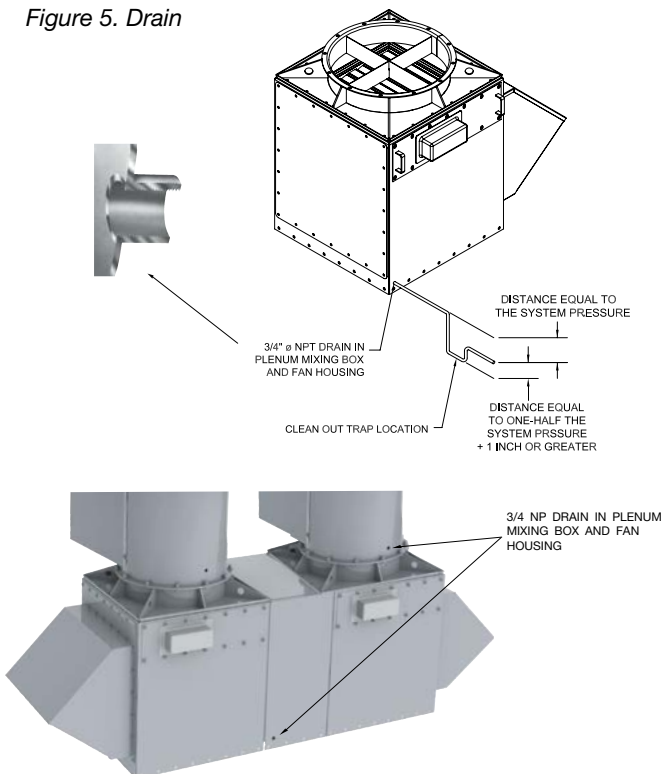
### Stack Extension (QFE/TFE) Installation

1. Place supplied gasket around the perimeter of the fan outlet.
2. Lower the stack extension onto the fan housing aligning the bolt holes on the two components. Allow for gasket to compress naturally prior to securing fan housing to the adjacent component.
3. Install 316 stainless steel hardware (provided) in all mounting holes. Use a commercially available anti-seizing compound formulated for 316 stainless steel to hardware.

### Windband Installation

1. Using the windband lifting lugs, raise the windband above the outlet of the fan assembly. Align the support brackets with the fan assembly discharge
2. Using caution not to swing the windband, insert the 316 stainless steel mounting hardware (provided) coated with anti-seize compound to join the two components.

Figure 5. Drain



### Drain Connection/Installation

Each section of the plenum mixing box as well as the fan housing contains a 3/4" NPT drain pipe for connecting to drainage system to ensure safe routing of any liquid that may form in the system. Due to the potential of hazardous chemical contamination, proper disposal of liquids is required (by customer). See Figure 5.

Note:

- A minimum of 1" of water must be placed in trap prior to start-up to create proper "lock" of system pressure.
- Drain should periodically be cleaned out for proper operation.

### Water Mitigation

Inline induced flow lab fans such as the QIFE and TVIFE require water mitigation upstream from the fan to manage water that may enter a fan that is not in operation. For a bottom intake mixing box application, care must be taken by the engineer to design ductwork with drains to mitigate any water that may enter through the fan. A side intake mixing box, which allows the water to collect and drain from the mixing box before entering the ductwork, would be another solution. Less concern is required for TFE and QFE products. The outlet damper on the TFE and QFE is designed to prevent rain entry.

All lab fan selections should have an outlet velocity of at least 3000 feet per minute at the nozzle per ANSI Z9.5. This will ensure that no rain enters the system when the fans are running.

Figure 6. Damper and Actuator Assembly

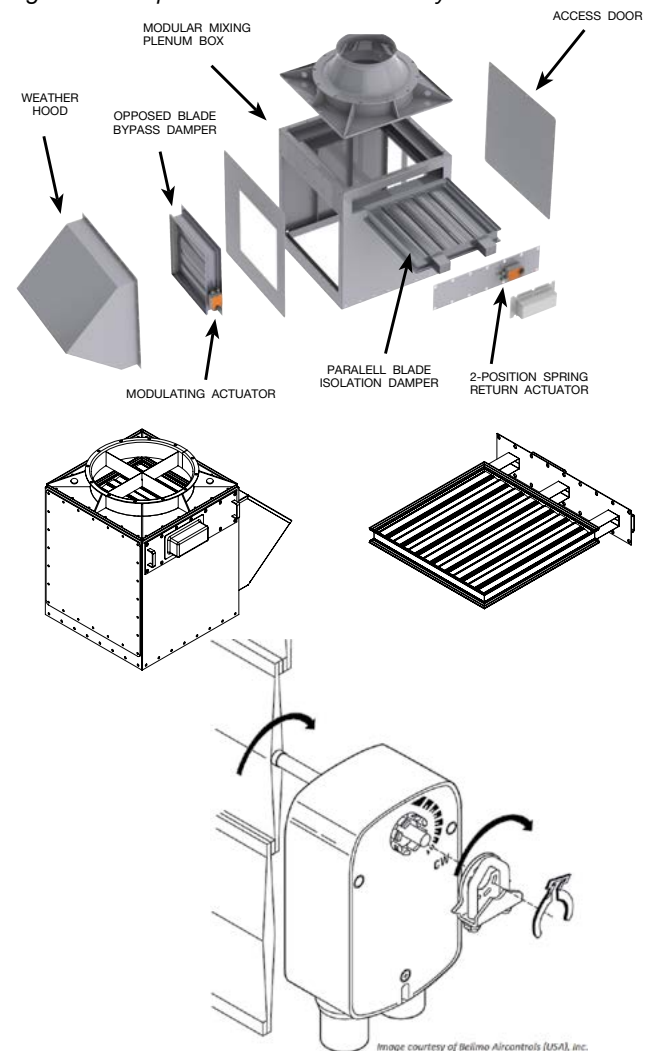


Image courtesy of Bellini Aircontrols (USA), Inc.



### Damper and Actuator Installation

Access to the Isolation Damper is obtained through opening the slide out door on the side of the plenum. Remove bolts from face of slide out door and remove damper/door assembly for inspection and maintenance. The 2-Position spring return actuator is attached to the damper shaft through the slide out door in a NEMA 4 enclosure and can be removed with the damper/door assembly. Wiring is completed through knockouts in NEMA 4 enclosure around the actuator.

Access to Bypass Damper and Modulating Actuator for removal is obtained by removing the weatherhood covering the damper. Damper is attached to plenum face with standard zip screws. An inspection door is available on the side of the weather cover for standard inspection and maintenance of the damper. Wiring for the modulating actuator is fed through the knockouts in the weatherhood.

### OPERATION CHECKLIST

WARNING

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

#### Check fan mechanism components:

- System connections are properly made and tightened.
- Bearings are properly lubricated.
- Wheel, drives and fan surfaces are clean and free of debris.
- Rotate the impeller by hand to verify it has not shifted in transit.
- Check fan/wheel overlap. (See Figure 7.)
- Drives on correct shafts (not reversed).
- Check position of guards to prevent rubbing.

#### Check fan electrical components:

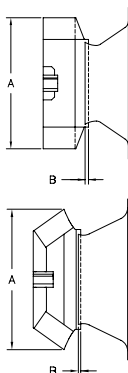
- Motor is wired for proper supply voltage.
- Motor was properly sized for power and rotational inertia of rotating assembly.
- Motor is properly grounded.
- All leads are properly insulated.

#### Trial “bump”:

- Turn on power just long enough to start assembly rotating.
- Check rotation for agreement with rotation arrow.
- Does the assembly make any unusual noise?
- Check drive alignment and tension. Does this meet with drive manufacturer’s recommendations?
- Correct any problems which may have been found. (Follow safety guidelines - shut power off.) Perform checklist again until unit is operating properly.
- Run unit up to speed.

Figure 7.

FAN SIZE	TFE		QFE, QIFE, TVIFE		
	A	B	A	B	
				MIN.	MAX.
90	-	-	12.25	0.25	0.38
122	12.25	0.31	15.00	0.31	0.44
135	-	-	16.50	0.38	0.50
150	15.00	0.38	18.25	0.44	0.56
182	18.25	0.56	20.00	0.50	0.63
200	20.00	0.63	22.25	0.56	0.69
222	22.25	0.69	24.50	0.63	0.75
245	24.50	0.75	27.00	0.69	0.88
270	27.00	0.88	30.00	0.75	0.97
300	30.00	0.97	33.00	0.88	1.06
330	33.00	1.06	36.50	0.75	0.94
365	36.50	0.94	40.25	0.81	1.03
402	40.25	1.03	44.50	0.88	1.13
445	44.50	1.13	49.00	1.00	1.25
490	49.00	1.25	54.25	1.13	1.38
542	54.25	1.38	60.00	1.25	1.56



### Verify fastener tightness. These may have loosened during shipment or installation.

- Setscrews attaching wheel hub to shaft.
- Setscrews in drive sheaves or coupling.
- Nuts on inlet funnel.
- Nuts and bolts holding motor.
- Nuts holding housing frame to base and base to ground.
- Nuts on accessories including shaft seal, access doors and pie-splits.
- Bolts in taper-lock bushings.
- Grease line connections.

After one week of operation, check all nuts, bolts and setscrews and tighten if necessary.

### FAN 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.

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. See curb installation section for detail on proper mounting procedures.

### 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.

### 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. However, 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.

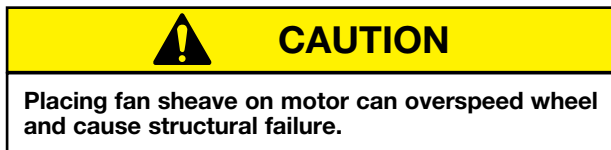
Greases are made with different bases. There are synthetic base greases, lithium base, sodium base, etc. Avoid mixing greases with different bases. They could be incompatible and result in rapid deterioration or

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. There 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.

## 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. 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) proper sheave onto corresponding shaft.



2. Align sheaves with straightedge extended along sheaves, just making contact in two places on outside perimeters of both sheaves.
3. Tighten sheave bolts (or setscrews if appropriate). Table 1 can be used to determine the amount of torque required.
4. Install a matched set of belts. Adjust the motor position to obtain slack, install and tighten belts. Using a pry bar will damage belts.
5. Tighten belts to proper belt tension. Ideal tension is just enough so that the belts do not slip under peak load. When using drive tensioning data supplied by V-belt drive manufacturers, new belts can be tensioned to a value 50% greater than for normal operation. This will reduce retensioning requirements after break-in. Recheck sheave alignment after tensioning.
6. After initial installation of belts, recheck belt tension again after a few days. (New belts require a break-in period of operation.)
7. When replacing belts, replace the entire set. After initial replacement and tensioning, recheck belt tension after a few days. (New belts require a break-in period of operation.) Never use belt dressing on any belts.
8. 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 motors and drives. The addition of drive components in the field can create unbalance forces. Twin City Fan recommends final balancing of the unit after the drive components are installed. Failure to do so may void the warranty.

## MOTOR CHANGE-OUT AND JIB CRANE

### Motor Change-Out Procedure (Direct Drive Fans)

Twin City Fan Model TVIFE is available with a portable jib crane option for use in removing the motor. The jib crane mounts directly to a fabricated base that is built into the mixing plenum box. When using a jib crane verify that it is not being used to lift loads that are greater than its design capacity.

#### To remove the motor:

Attach the jib crane to the mounting bracket on the mixing plenum box, verify that all attachments are properly tightened and that there are no cracks and no damage on the crane or mounting bracket.

Position the jib crane above the windband of the fan and rig the crane cable to the lifting brackets on the windband itself. Wind in cable until all lines are taught. Remove all bolts securing the windband to the fan assembly itself. Lift the windband off of the fan assembly and lower it to the roof top.



Position the jib crane above the fan housing and again rig the crane cable to the lifting brackets on the fan housing and tighten the cable. Remove all bolts holding the fan housing to mounting bracket on the mixing box or curb cap. Lift the fan housing and lower it to the roof top. Loosen and remove wheel from motor shaft. Loosen and remove bolts holding motor to fan housing and remove motor.

#### Install new motor:

Attach motor to fan housing, make sure all bolts are sufficiently tightened. Attach wheel to motor shaft and tighten. Using jib crane, lift wheel and housing assembly by mounting brackets back onto mixing box/curb cap. Carefully lower housing assembly onto box. Verify wheel and funnel are overlapping correctly. Bolt housing assembly to mixing plenum box/curb cap. Lift windband by lifting lugs and align with bolt holes on top of fan assembly. Bolt windband to fan assembly.

## 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.

## TROUBLESHOOTING PERFORMANCE PROBLEMS

The lists below indicate 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 system 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.

- Air density not at design values. Also check air performance measurement techniques/procedures.
- Devices for air modulation are closed or plugged. Also check filters.
- Wheel mounted improperly or is rotating in reverse.
- Parts of system or fan have been damaged or need cleaning.

**Noise Problems:**

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

**Vibration Problems:**

- Misalignment of drive components.
- Poor foundations or mounting structure (resonances).
- Foreign material attached to rotating components.
- Damaged rotating components (bearings, shaft, fan, wheel, sheaves).
- Broken, loose or missing setscrews.
- Loose bolts.
- Vibration transmitted by another source.
- Water accumulating in airfoil blades.
- Fan is operating in stall or unstable flow region.

NOTICE

**All fans manufactured by Twin City Fan are factory balanced prior to shipment. Installation variables, handling and movement of the fan during shipment may cause the rotating assembly to shift. Balance should be checked once the fan is installed. If a final trim balance is required, it is the end user's responsibility to bring the fan back to factory specifications. Final trim balancing is not the responsibility of Twin City Fan. Refer to Figure 8 for vibration guidelines.**

Figure 8. Vibration Guidelines, unfiltered

Condition	Fan Application Category	Rigidly Mounted mm/s (in./s)	Flexibly Mounted mm/s (in./s)
Start-up	BV-3	6.4 (0.25)	8.8 (0.35)
	BV-4	4.1 (0.16)	6.4 (0.25)
Alarm	BV-3	10.2 (0.40)	16.5 (0.65)
	BV-4	6.4 (0.25)	10.2 (0.40)
Shutdown	BV-3	12.7 (0.50)	17.8 (0.70)
	BV-4	10.2 (0.40)	15.2 (0.60)

Value shown are peak velocity, mm/s (inches/s), Filter out. Table taken from ANSI/AMCA Standard 204-05, Table 6.3. AMCA defines BV-3 for applications up to 400 HP; BV-4 for applications over 400 HP.

**Motor Problems:**

- Incorrect wiring.
- Speed of fan too high.
- Parts improperly installed - binding.
- Bearings improperly lubricated.
- WR<sup>2</sup> capability of motor too low for application.
- Protection devices may be improperly sized.

**Drive Problems:**

- Belts improperly tensioned.
- Drive alignment is poor.

**Bearing Problems:**

Generally speaking, Twin City Fan uses three types of bearings:

- Ball bearing with set screw lock.
- Spherical roller bearings with set screw lock.
- Spherical roller bearings with adapter lock/taper lock feature to attach them to the shaft.

**Ball bearings** – These are self-aligning bearings and should present no alignment problems with one exception: i.e., on Sealmaster bearings there is a pin beneath the grease fitting which prevents the bearings outer race from rotating. Should this pin jam, the bearing loses its alignment feature. Common failure causes are (1) set screws loosening and shaft turning within the bearing, and (2) crowned bearing supports. Loosen one bolt and measure the clearance between the pillow block and the support. Add shim to compensate.

**Spherical Roller Bearings with Set Screw Lock** – The self-aligning characteristic of these bearings are inherent in the spherical roller design. The closer that these bearings are to perfect alignment, the cooler they will operate.

Common failure causes are the same as with ball bearings, mainly set screws loosening and crowned bearing supports.

**Spherical Roller Bearings with Adapter Lock** – Again, the self-aligning feature is inherent in the spherical design. Good alignment results in a cooler operating bearing. The faster the bearing operates the more critical this becomes.

A common cause of failure is improper installation practice. Removing too much clearance from the bearing can result in preloading the bearing, resulting in premature failure; and removing not enough can result in the shaft rotating within the bearing. Properly tightened, this method of attaching a bearing to a shaft is second only to a press fit. Crowned bearing supports can also preload these bearings and should be checked by loosening one side of the bearing and checking for clearance.

**Lubrication** – The major cause of bearing failure is contamination of grease, insufficient grease, or incompatibility of grease. If a fan is to be stored for any length of time at the job site, the bearings immediately should be filled with grease while rotating the shaft and then the bearings should be regreased and rotated monthly. This will prevent moisture, which condenses within the bearing, from corroding the raceways. Most greases used on fan pillow blocks are lithium base. Use the greases shown on the bearing decal. Do not mix the bases without completely purging out the initial grease.

Initially, follow the lubrication instruction on the side of the fan. The frequency of lubrication should be adjusted depending on the condition of the old grease being purged. This is the responsibility of the user. If the grease is dirty, the lubrication frequency should be more often.

- Noise – If a bearing is increasing in noise intensity and/or vibration, it will probably result in failure.
- Temperature – If a bearing temperature begins to gradually rise, it will generally result in failure. A bearing can operate up to 200 degrees and operate satisfactorily if the temperature remains constant and

the bearing receives adequate lubrication. Remember that a roller bearing under the same load and speed will be somewhat more noisy and run warmer than a ball bearing. This is normal.

Rough handling and/or dropping a fan can result in brinelling the bearing. This appears as a clicking noise at first, then gradually worsens until failure.

When replacing a bearing, always align the bearings first, then bolt the pillow blocks to their support, rotate the shaft, fasten the bearings to it. If the bearing is fastened to the shaft first, tightening the pillow block bolts may bind the shaft and preload the bearings.

Figure 11. Safety & Lubrication Instructions for Fans with Spherical Roller Bearings with Split Pillow Block Housings

**WARNING**

- 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 installation manual for recommended safety practices.
- 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										Grease to be added at each interval
Shaft DIA	Speed (RPM)									
	500	750	1000	1500	2000	2500	3000	3500	4000	
1 <sup>7</sup> / <sub>16</sub> " thru 1 <sup>5</sup> / <sub>16</sub> " (35 - 50)	6	4 <sup>1</sup> / <sub>2</sub>	4	4	3 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	1	1	0.50 oz.
2 <sup>3</sup> / <sub>16</sub> " thru 2 <sup>3</sup> / <sub>16</sub> " (55 - 70)	5	4 <sup>1</sup> / <sub>2</sub>	4	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	1/4	1/4	0.75 oz.
2 <sup>5</sup> / <sub>16</sub> " thru 3 <sup>5</sup> / <sub>16</sub> " (75 - 100)	4 <sup>1</sup> / <sub>2</sub>	4	3 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>	1	1/2			2.00 oz.
4 <sup>7</sup> / <sub>16</sub> " thru 4 <sup>5</sup> / <sub>16</sub> " (110 - 135)	4	4	2 <sup>1</sup> / <sub>2</sub>	1	1/2					4.00 oz.
5 <sup>7</sup> / <sub>16</sub> " thru 6 <sup>5</sup> / <sub>16</sub> " (140 - 180)	4	2 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>							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. Use one-half of listed interval for vertical shaft applications or for 24 hour operation. 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 reservoir on both sides of bearings to bottom of shaft.

- Lubricate with a high quality NLGI No. 2 lithium-base grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SUS at 100°F (38°C). Some greases having these properties are:  
Shell - Gadus S2 V100 2                      Exxon - Ronex MP  
Mobil - Mobilith SHC100                      Mobil - Mobilith SHC220
- Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.
- Purge or remove old grease when changing lubrication brands or types.

**Static Oil Lubrication**

- Use only high quality mineral oil with a VG grade indicated on the customer submittal drawing.
- Static oil level should be at the center of the lower-most roller (Do not overfill.)
- Complete lubrication change should be made annually.

Figure 9. Safety & Lubrication Instructions for Fans with Ball Bearings

**WARNING**

- 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 installation manual for recommended safety practices.
- 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	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1/2" thru 1 <sup>1</sup> / <sub>16</sub> " (13 - 45)	6	6	5	3	3	2	2	2	1
1 <sup>1</sup> / <sub>16</sub> " thru 2 <sup>7</sup> / <sub>16</sub> " (50 - 60)	6	5	4	2	2	1	1	1	1
2 <sup>1</sup> / <sub>16</sub> " thru 2 <sup>5</sup> / <sub>16</sub> " (65 - 75)	5	4	3	2	1	1	1		
3 <sup>7</sup> / <sub>16</sub> " thru 3 <sup>5</sup> / <sub>16</sub> " (80 - 100)	4	3	2	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 conditions of purged grease. Use one-half of listed interval for vertical shaft applications or for 24 hour operation. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

- Lubricate with a high quality NLGI No. 2 lithium-base grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SUS at 100°F (38°C). Some greases having these properties are:  
Shell - Gadus S2 V100 2                      Exxon - Ronex MP  
Mobil - Mobilith SHC100                      Mobil - Mobilith SHC220
- Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

Figure 10. Safety & Lubrication Instructions for Fans with Unit Roller Bearings

**WARNING**

- 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 installation manual for recommended safety practices.
- 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	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1" thru 1 <sup>7</sup> / <sub>16</sub> " (25 - 35)	6	4	4	2	1	1	1	1	1/2
1 <sup>1</sup> / <sub>16</sub> " thru 2 <sup>3</sup> / <sub>16</sub> " (40 - 55)	4	2	1 <sup>1</sup> / <sub>2</sub>	1	1/2	1/2	1/2	1/2	1/2
2 <sup>7</sup> / <sub>16</sub> " thru 3 <sup>7</sup> / <sub>16</sub> " (60 - 85)	3	1 <sup>1</sup> / <sub>2</sub>	1	1/2	1/2	1/4	1/4		
3 <sup>5</sup> / <sub>16</sub> " thru 4 <sup>5</sup> / <sub>16</sub> " (90 - 125)	2 <sup>1</sup> / <sub>2</sub>	1	1/2	1/4					

\*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 conditions of purged grease. Use one-half of listed interval for vertical shaft applications or for 24 hour operation. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

- Lubricate with a high quality NLGI No. 2 lithium-base grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SUS at 100°F (38°C). Some greases having these properties are:  
Shell - Gadus S2 V100 2                      Exxon - Ronex MP  
Mobil - Mobilith SHC100                      Mobil - Mobilith SHC220
- Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.