

INLINE CENTRIFUGAL AND MIXED FLOW FANS

INSTALLATION, OPERATION & MAINTENANCE MANUAL



REVIEW AMCA PUBLICATION 410 PRIOR TO INSTALLATION

This manual has been prepared to guide the users of inline centrifugal and mixed flow fans in the proper installation, operation and maintenance procedures to ensure maximum equipment life with trouble-free operation. For safe installation, startup and operational life of this equipment, it is important that all involved with the equipment be well versed in proper fan safety practices and read this manual. It is the user's responsibility to make sure that all requirements of good safety practices and any applicable safety codes are strictly adhered to. Because of the wide variety of equipment covered in this manual, the instructions given here are general in nature. Additional product and engineering information is available at www.tcf.com.

SAFETY NOTICE

Refer to the safety section(s) in this manual prior to installing or servicing the fan. The most current version of this installation and maintenance manual can be found on our website at www.tcf.com/resources/im-manuals.

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FAN ARRANGEMENTS



ARRANGEMENT 3
Belt Driven

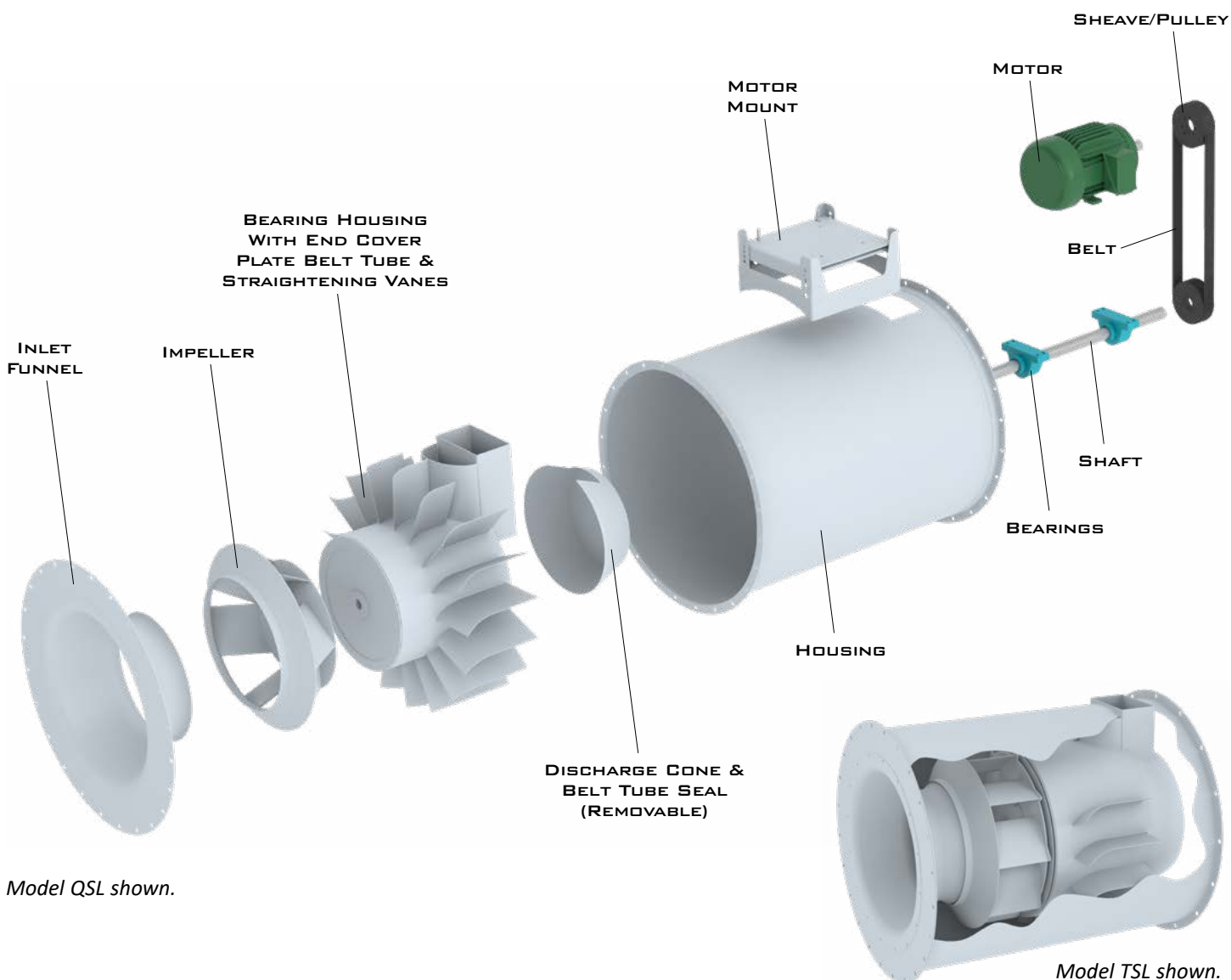


ARRANGEMENT 4
Direct Drive

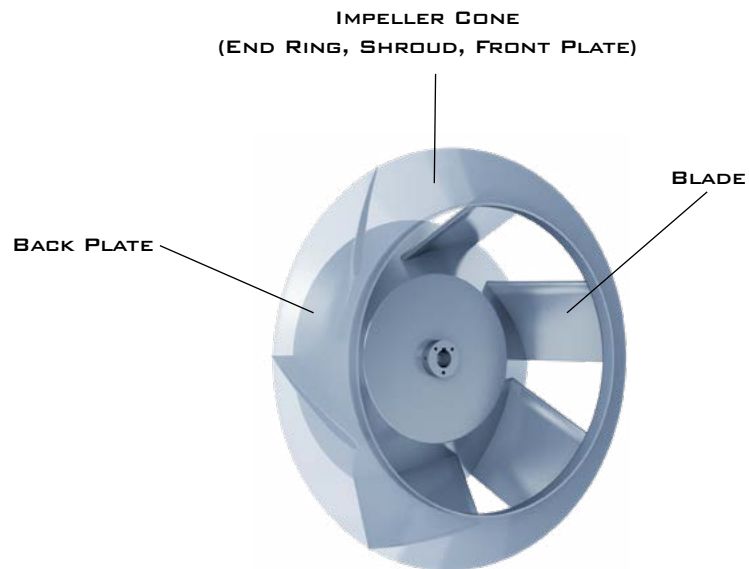


ARRANGEMENT 9
Belt Driven

EXPLODED VIEW



IMPELLER NOMENCLATURE



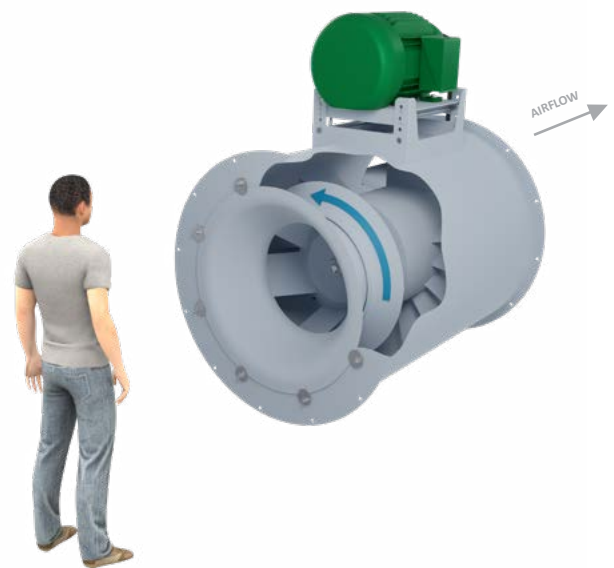
IMPELLER ROTATION

ROTATION VIEW FROM DRIVE SIDE

**CLOCKWISE (CW)
EXAMPLE SHOWN**



INLINE CENTRIFUGAL FANS



MIXED FLOW FANS

SAFETY & HAZARD WARNINGS

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

Facility related safety conditions include fans' accessibility and location. How easily can non-service personnel access the unit? Is the fan in a hazardous duty environment? Was the unit ordered for this duty? Other concerns must also be addressed. All fans should be powered through controls that are easily accessible to service personnel from the fan. Fan power must have the ability to be "locked out" by service personnel trained in lockout/tagout procedures per OSHA requirements (29CFR1910.147). When performing lockout, be aware of factors, such as building pressure and additional fans in the system that can influence unwanted fan rotation (wind milling). If you have any doubt about your ability to perform a task, seek a person qualified to do that task. Before any work is done on a fan, ensure that the fan is isolated from the electrical supply using a 'lockout/tagout system.'

Note: A stationary, non-rotating fan does not mean that the fan is isolated from the electrical supply or from other fans/dampers in the system that could cause the fan impeller to rotate. A non-rotating fan could be subject to controls or other circuit protection devices that may start the fan without notice.

The following safety precautions should be followed, where applicable:

- Do not attempt to slow a rotating impeller even when it is isolated from the electrical supply. Fan impellers have a high inertia and injury could result from an attempt to stop it. It is recommended that the impeller is isolated by closing off the inlet or outlet to prevent wind-driven rotation. If an impeller is chocked to prevent rotation, ensure that the chocks are removed prior to start up.
- Wear appropriate personal protective equipment. This may include protective clothing, eye protection, ear protection, respiratory equipment, hand and foot protection when installing or servicing the fan.
- Always use caution when entering a fan's air path. High velocity airflow can cause you to lose your balance.
- Motor, bearings and drives can be hot, and similarly if the fan is subject to processes that are hot, the fan housing could be hot.
- Fans are often used to move hazardous materials that could be dangerous. Always wear protective clothing and take precautions not to inhale dust/gases. If hazardous chemical vapors are present, respiratory equipment may be required.
- Sharp edges – wear protective gloves when handling, installing or servicing a fan.
- Fans can operate at high decibel sound levels. Wear proper ear protection to protect from excessive noise levels.
- Access doors – Do not open access doors when fan is in operation. The effects of suction and air pressure could result in injury.
- When working around pulleys and belts, keep hands away from pinch points. This pertains to when the fan is under or off power.

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. 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.



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.

SHIPPING & RECEIVING

All Twin City Fan & Blower products are carefully constructed and inspected before shipment to ensure 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. Damage should be noted on the bill of lading.

HANDLING

Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment. When using hoisting equipment, only qualified and trained personnel should operate the equipment.

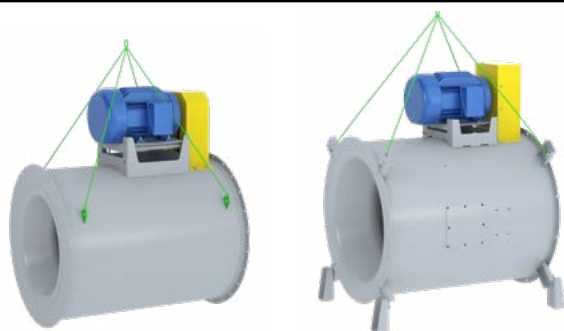
Units shipped completely assembled may be lifted with slings and spreader bars. (Use well-padded chains, cables or nylon straps, rated to lift the required weight.) On most units, lifting lugs are designed to protect the fan and fan housing from damage. Never lift a fan by the inlet or discharge flange,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

For fans provided without lifting lugs, use a forklift or pallet jack to handle the equipment. Consult a qualified person before lifting.



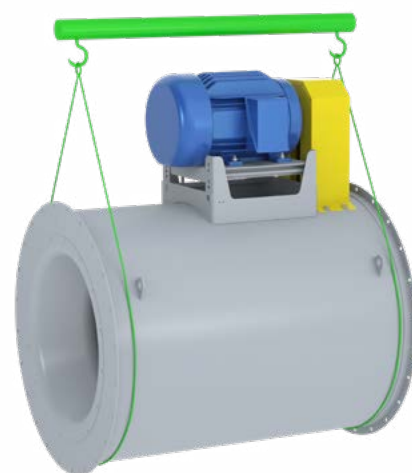
CAUTION

1. Maintain handling equipment to avoid serious personal injury and do not stand under the load.
2. If supplied, only use the provided lifting lugs to lift the equipment.
3. Ensure that the lifting equipment is rated for the capacity to be lifted.



Lifting lugs are provided on most units.

Lift completely assembled fans with straps and spreader bar, as shown



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

The housing should be lifted using suitably rated spreader bars and padded chains or straps. Do not distort housing or side plates when lifting.

The shaft and impeller assembly may be lifted using a hoist and a spreader with slings around the shaft at either side of the impeller. Use the spreader bar to ensure that the slings do not push against the sides of the impeller as this may distort the impeller. Take care not to damage the shaft where the impeller or bearings will be mounted. Never lift or support the assembly by the impeller. Always support the assembly by the shaft when lifting or storing (see the section regarding proper storage of equipment). Do not support the shaft or the impeller on the housing sides. See the Fan Installation section for additional details.

Impellers shipped separately can be lifted by slings running between the blades or through the hub. Never lift the impeller by a single blade or single point on the flange/shroud. Do not put a chain within the hub bore. Always transport impellers by lifting, do not roll the impeller as this can damage coatings and change the balance of the impeller.

Bent shafting is a source of vibration and bearing failure, so be sure to handle the shaft with care. If the shaft is bent, replace the shaft. Any scratches on the shaft may be repaired with fine emery cloth or a stone. Remove only the displaced metal that forms a high point at the edge of the scratch.



CAUTION

1. Bearing pedestals should be lifted using straps or padded chains. Under no circumstance should an attached or separated bearing pedestal be lifted by the shaft, bearings, drives, motor or impeller.
2. Note some rotor assemblies may have an off-center CoG and therefore a qualified person should be consulted before lifting.



UNIT STORAGE

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 bearings, motor, 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. Spherical roller bearings with split pillow block housings must be opened up and grease removed before start-up. Remove old/excess grease and regrease the bearing in accordance with the bearing manufacturer's instructions.

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 and 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 that 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. Shafts on motors equipped with shaft grounding rings must remain rust free. Failure to do so renders the grounding feature inoperative and may result in bearing failure under VFD operation. Consult the motor manufacturer for further detail on motor storage and start up after longer periods of storage. It may be necessary to regrease the bearings. If the fan's bearings or motor bearings have extended lubrication lines, it will be necessary to replace the grease by detaching from the motor/bearing and purging the line with new grease.





WARNING

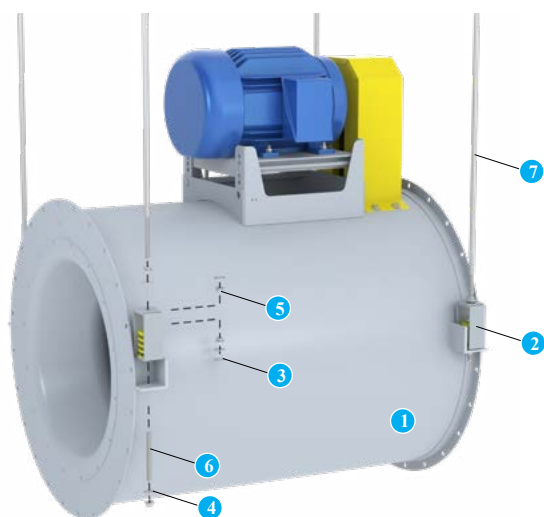
Refer to handling section prior to lifting equipment.

FOUNDATIONS & SUPPORTING STRUCTURES (REFER TO LIFTING/SAFETY SECTION)

The TSL Inline Centrifugal and QSL/QCLB Mixed Flow Fans can be mounted horizontally, vertically or at any angle if ordered accordingly. Mounting brackets are available to accept both floor mounted and hanging vibration isolation. Typical mounting arrangements are shown below.

When mounting to concrete, 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 diameter larger than the bolt to allow for adjustment. When the mounting surface and the surface of the fan base do not match, shim level. Do not distort the fan when tightening the anchor bolts.

A fan mounted to or within a structure should be placed as close as possible to a rigid member such as a wall or a column. The structure must be designed for rotating equipment. Static design for strength is not sufficient to ensure operation at low vibration levels. 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 may help block the transmission of vibration into a structure. Any ducting should have independent support; do not use the fan to support ducting. Flexible connections are required whenever the fan is supported on vibration isolators.



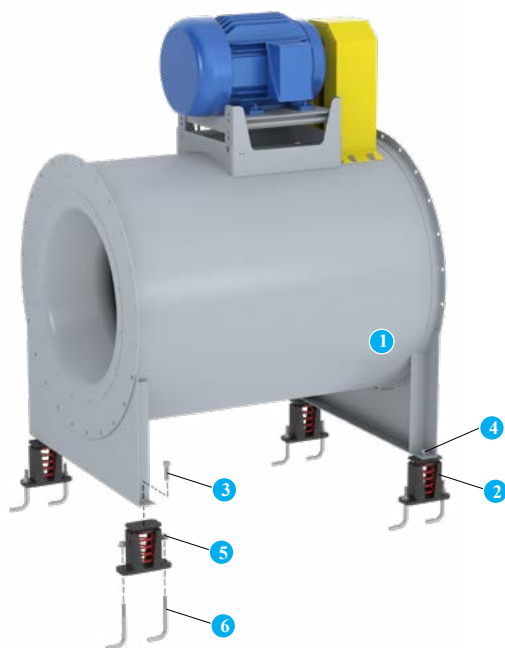
TYPICAL HORIZONTAL MOUNTING WITH VIBRATION HANGERS (CEILING HUNG)

ITEM	QTY.	DESCRIPTION
01	1	Fan
02	4	Spring Hanger*
03	4	Neoprene Washer
04	32	Steel Washer**
05	32	Hex Nut**
06	4	Threaded Rod
07	4	Hanger Rod**

NOTES:

*1. Spring hangers are optional accessories.

**2. Hanger rods, nuts and washers supplied by customer.



TYPICAL HORIZONTAL MOUNTING WITH VIBRATION ISOLATORS

ITEM	QTY.	DESCRIPTION
01	1	Fan
02	4	Vibration Isolator*
03	4	Adjusting & Leveling Bolt
04	4	Hex Nut**
05	8	Hex Nut**
06	8	Anchor Bolt**

NOTES:

*1. Vibration isolators are optional accessories.

**2. Anchor bolts and hardware supplied by customer.

FOUNDATIONS & SUPPORTING STRUCTURES (CONT.)

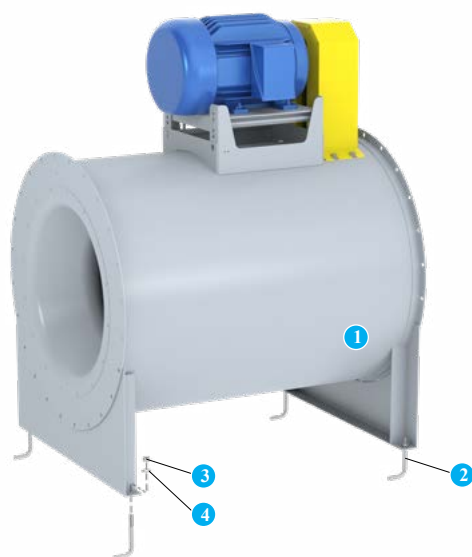


TYPICAL VERTICAL MOUNTING WITH VIBRATION HANGERS

ITEM	QTY.	DESCRIPTION
01	1	Fan
02	4	Spring Hanger*
03	4	Neoprene Washer
04	32	Steel Washer**
05	32	Hex Nut**
06	4	Threaded Rod
07	4	Hanger Rod**

NOTES:

- *1. Spring hangers are optional accessories.
 2. When spring hanger interferes with ductwork, add offset to threaded rod to provide clearance.
 **3. Hanger rods, nuts and washers supplied by customer.

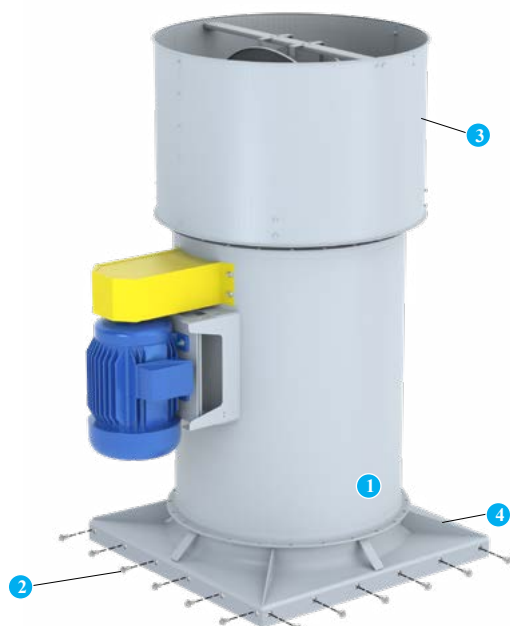


TYPICAL HORIZONTAL MOUNTING TO RIGID FOUNDATION

ITEM	QTY.	DESCRIPTION
01	1	Fan
02	4	Anchor Bolt*
03	8	Hex Nut**
04	8	Washer

NOTE:

- *1. Anchor bolts and hardware supplied by customer.



TYPICAL VERTICAL CURB MOUNTING

ITEM	QTY.	DESCRIPTION
01	1	Fan
02	See Note	Lag Bolt
03	1	Stack Cap (Optional)
04	1	Curb Cap (Optional)

NOTE:

1. Quantity and size of mounting lag bolts varies by fan size.

FAN INSTALLATION – FACTORY ASSEMBLED UNITS (REFER TO LIFTING/SAFETY SECTION)

All fan impellers are statically and dynamically balanced using state of the art equipment in the factory. Final trim balancing is performed on factory assembled fans, unless the specified electrical characteristics of the motor are outside the limits of the factory test equipment. If the motor and drives are supplied, the complete assembly is run tested and balanced. Infrequently, fans are supplied with unusual electrical characteristics and cannot be tested with the motor. In this situation the fans are run and balanced using a factory driver. Likewise, if motors and/or drives are not supplied, the fan is tested with the factory driver. Final balancing, at the buyer's expense, should be performed in the field after the motor and/or drives are installed. This service is available from TCF, otherwise this should be entrusted to a qualified technician.

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. Attach vibration isolators (if used) to appropriate mounting locations on fan. Locate fan in position using lifting instructions on page 5.
4. Place the fan on mounting structure. Carefully level the unit on the foundation and shim as necessary using stainless steel shims on both sides of each anchor bolt. Back off leveling nuts if used. Be careful not to force the fan to the mounting structure/foundation. This may cause the bearings to become misaligned or pinched causing vibration and premature failure.
5. Check the alignment of the bearings. Shim or reposition the bearings if necessary.
6. Check alignment of sheaves on belt driven fans.
7. Check tension of belts to see if it is sufficient. Sheaves on belt driven fans are often provided with taper lock bushings. When tightening bushing bolts, proceed in a progressive manner to avoid cocking the tapered surfaces between the bushing and the sheave. Torque per tables on the right.



**CLICK TO VIEW OUR
SHEAVE INSTALLATION VIDEO**

8. Check the tightness of the impeller 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 impeller-inlet cone clearances and overlap are correct.
9. Check that bearings are fully lubricated. For spherical roller bearings with split pillow block housings, the bottom half of the housings should be 1/3 full of grease. For oil lube bearings, the oil level should reach the midpoint of the bottom roller or ball.
10. Install any accessories shipped loose from the factory.



Carefully level the fan on the foundation

TIGHTENING TORQUE

SIZE	FASTENER - TIGHTENING TORQUE (Ft. Lbs.)		
	GRADE 2	GRADE 5	GRADE 8
#10	—	—	—
1/4-20	5.5	8	12
5/16-18	11	17	25
3/8-16	22	30	45
7/16-14	30	50	70
1/2-13	55	75	110
9/16-12	—	—	—
5/8-11	100	150	220
3/4-10	170	270	380
7/8-9	165	430	600
1-8	250	645	900
1 1/4-7	500	1120	1500

SIZE	TAPER BUSHINGS - TIGHTENING TORQUE (Ft. Lbs.)		
	SPLIT		QD
	IN IRON	IN ALUM. HUB	FOR DRIVE
#10	—	—	5
1/4-20	7.9	7.5	9
5/16-18	16	13	15
3/8-16	29	24	30
7/16-14	—	—	—
1/2-13	70	—	60
9/16-12	—	—	75
5/8-11	—	—	135
3/4-10	—	—	—
7/8-9	—	—	—
1-8	—	—	—
1 1/4-7	—	—	—

The above torque values are for nonlubricated fasteners and Browning Bushings. For bearing set screws, use manufacturer's recommendations. If other bushings are used, utilize bushing manufacturer's specifications.

Tolerance: +/- 5%

For impeller set screws use Grade 2 values.



BEARING INSTALLATION (REFER TO SAFETY SECTION)

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

Solid Pillow Block

1. Lightly lubricate the bearing bore and slide bearing into the proper position on the shaft. Sling the rotor assembly into place and loosely bolt the bearings in place.
2. When bearings are in place, shim appropriately and torque the base bolts using values from the Tightening Torque table on page 9. Tighten the collar set screws to manufacturer's specification. The set screws on both bearings should be aligned with one another. If the bearing has an adapter mount, hand tighten the locknut to establish the "zero" point. Next, tighten the number of turns per the instructions furnished with the bearing. Rotate by hand to be sure the bearings and shaft rotate freely.
3. Ensure the expansion bearing is centered within its housing. If bearings need to be forced onto the shaft then apply force on the inner race/collar only (does not apply to adapter mount.) If an expansion bearing has been supplied, it should not be bolted to the pedestal until the fixed bearing has been bolted and locked. After locking the expansion bearing to the shaft, position the pillow block to allow for axial expansion, approximately centered in the pillow block, then bolt to the pedestal.
4. Unless the user orders differently, bearings are lubricated in the factory with a lithium complex, NLGI grade 2 grease. **Refer to the bearing lubrication schedule on the next page.**



Solid Pillow Block Bearings

Spherical Roller Bearings with Split Pillow Block Housings

1. The bearings should be disassembled, taking care not to interchange parts between bearings. Tops of housings are not interchangeable with the bottom half pillow block from another bearing. Pins locate the top half of the housing to prevent it from being installed in the reverse.
2. The lower bearing housing should be bolted loosely to the pedestal and seals; bearing and adapter sleeve should be placed loosely on the shaft.
3. The rotor assembly with the seals and bearings should next be positioned over the housings and carefully placed into the lower housings.
4. The stabilizing ring, sometimes referred to as the "C" ring, is installed in the bearing closest to the drive sheave or coupling unless otherwise noted in the drawing. The bearing race should be centered in the expansion bearing. The exception may be on Arrangement 3 or 7 fans with a high operating temperature. Refer to the fan drawing for location. The "C" ring is not used in the expansion bearing.
5. When installing adapter sleeves, tighten for reduction in clearance per manufacturer's instructions.
6. Bend down a tab on the lockwasher after finishing adjustment. Some brands of bearings do not utilize a lockwasher. Instead you will find allen-head set screws in the locknut outside diameter. Tighten the set screw after reduction in clearance is attained.
7. Grease or oil according to manufacturer's instructions. Grease/lube will likely include the partial fill of the housing internal cavities.
8. Install the bearing housing cap bolts and bearing mounting bolts. Tighten bearing housing cap bolts and bearing mounting bolts. Torque to bearing manufacturer's instructions.



Split Pillow Block Bearings

SAFETY & BEARING LUBRICATION INSTRUCTIONS



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 set screws for tightness and rotate impeller by hand to make sure it has not moved in transit.

Fans with Unit Roller Bearings

Shaft DIA	Relubrication Schedule (Weeks)*								
	Spherical Roller Bearing - Solid Pillow Blocks								
	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1/2" thru 1 1/16" (13 - 35)	6	4	4	2	1	1	1	1	0.5
1 1/16" thru 2 3/16" (40 - 55)	4	2	1.5	1	0.5	0.5	0.5	0.5	0.5
2 3/16" thru 3 7/16" (60 - 85)	3	1.5	1	0.5	0.5	0.25	0.5	-	-
3 1/16" thru 4 15/16" (100 - 125)	2.5	1	0.5	0.25	-	-	-	-	-

*Suggested lubrication interval under continuous operation in adverse loading or with elevated temperatures. For operation less than 24 hours per day or under ideal conditions, lubrication frequency may be reduced. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 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 Mobil - Ronex MP
 Mobil - Mobilith SHC100 Mobil - Mobilith SHC220
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.
3. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Fans with Ball Bearings

Shaft DIA	Relubrication Schedule (Weeks)*								
	Ball Bearing Pillow Blocks								
	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1/2" thru 1 1/16" (13 - 45)	6	6	5	3	3	2	2	2	1
1 1/16" thru 2 7/16" (50 - 60)	6	5	4	2	2	1	1	1	1
2 1/16" thru 2 15/16" (65 - 75)	5	4	3	2	1	1	1	-	-
3 7/16" thru 3 15/16" (90 - 100)	4	3	2	1	1	-	-	-	-

*Suggested lubrication interval under continuous operation in adverse loading or with elevated temperatures. For operation less than 24 hours per day or under ideal conditions, lubrication frequency may be reduced. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 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 Mobil - Ronex MP
 Mobil - Mobilith SHC100 Mobil - Mobilith SHC220
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.
3. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Fans with Spherical Roller Bearings with Split Pillow Block Housings

Relubrication Schedule (Weeks)*										Grease to be added at each interval
Spherical Roller Bearing - Split Pillow Blocks										
Shaft DIA	Speed (RPM)									
	500	750	1000	1500	2000	2500	3000	3500	4000	
1 ⁷ / ₁₆ " thru 1 ¹⁵ / ₁₆ " (35 – 50)	6	4.5	4	4	3.5	2.5	2 ¹ / ₂	1	1	0.50 oz.
2 ³ / ₁₆ " thru 2 ¹³ / ₁₆ " (55 – 70)	5	4.5	4	2.5	2.5	1.5	0.5	0.25	0.25	0.75 oz.
2 ¹⁵ / ₁₆ " thru 3 ¹⁵ / ₁₆ " (75 – 100)	4.5	4	3.5	2.5	1.5	1	0.5	–	–	2.00 oz.
4 ⁷ / ₁₆ " thru 4 ¹⁵ / ₁₆ " (110 – 125)	4	4	2.5	1	0.5	–	–	–	–	4.00 oz.
5 ⁷ / ₁₆ " thru 6 ¹⁵ / ₁₆ " (140 – 180)	4	2.5	1.5	–	–	–	–	–	–	8.5 oz.

*Suggested lubrication interval under continuous operation in adverse loading or with elevated temperatures. For operation less than 24 hours per day or under ideal conditions, lubrication frequency may be reduced. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 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 Mobil - Ronex MP
 Mobil - Mobilith SHC100 Mobil - Mobilith SHC220
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.
3. Purge or remove old grease when changing lubrication brands or types.
4. Any lubrication requirements noted on the general assembly drawing supersede requirements found here.

Static Oil Lubrication

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

DRIVE MOUNTING

(REFER TO SAFETY SECTION)

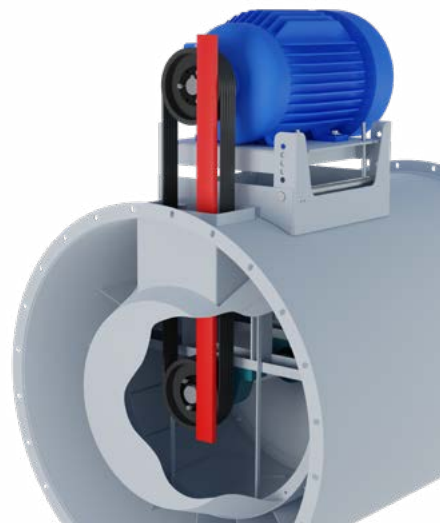
Mount drives as follows:

1. Slip (do not pound) proper sheave onto corresponding shaft. Most drives utilize tapered bushings. Draw the bushing up evenly tightening in steps. To minimize bearing loading, mount sheaves as close to bearings as possible. It is preferable to use alignment tools that align the grooves of the sheave.
2. Align sheaves with straightedge extended along sheaves, just making contact in two places on outside perimeters of both sheaves. This “four-point” alignment may also be checked with a string tied to the shaft behind one of the sheaves. The string is then pulled taut over the faces of the sheaves to check the alignment at the four points at the outside perimeters. Each sheave should be rotated about one-half revolution during this check to look for excessive runout or a bent shaft. Unless there is a bent shaft, runout can be corrected by adjustments to the bolt torque of the taper bushing.
3. Install and tighten the belts. Run the drive for a few minutes to seat the belts. When fitting the belts, adjust the motor position to fit on the belts. Do not use a pry bar, as this may damage the belt cords. Tighten the belts to the proper tension. Ideal tension is just enough tension so that the belts do not slip under peak load or acceleration. Many drives are provided with tensioning data, which identifies the load to apply at the center of the span and the allowable deflection from this force. A belt tension gauge is recommended for precise tensioning.
4. After initial installation of belts, recheck belt tension again after a few days of operation to adjust belt tension. (New belts require a break-in period of operation.)



WARNING

When working around belts and pulleys, keep hands away from pinch points.



CLICK TO VIEW OUR
SHEAVE INSTALLATION VIDEO



CAUTION

Placing fan sheave on motor can overspeed impeller and cause structural failure.

MOTOR SUPPORT ADJUSTMENT (REFER TO SAFETY SECTION)

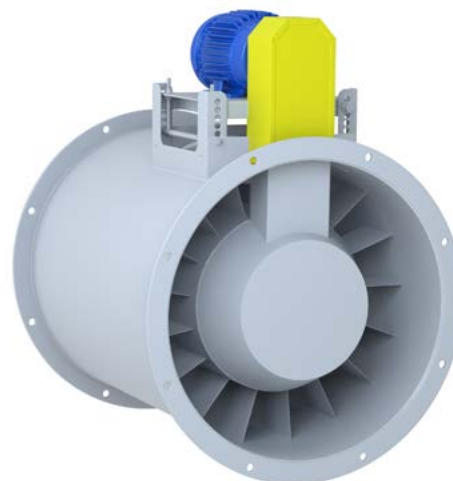
Two different types of motor mounts, post and saddle, are used on TSL Inline Centrifugal and QSL/QCLB Mixed Flow fans. The mount to use depends on the size of the fan and motor.

On the post type motor mount, the motor plate is supported on four threaded rods. Belt tension is adjusted by loosening the four nuts on top of the motor plate and raising the motor plate by adjusting the four nuts underneath it. The top nuts should then be tightened to hold the motor plate in place.

On the saddle type motor mount, the motor pivots on one side and adjustment of belt tension is achieved by loosening the nuts on top of the motor plate on the other side, then raising the motor plate by adjusting the nuts underneath the motor plate. The nuts on top of the motor plate should again be tightened to hold the motor plate in place. The saddle mount on QCLB Mixed Flow fans also incorporate a fastener to the motor plate flange that needs to be loosened prior to adjusting the motor plate. Several holes are provided on the pivot side and the pivot point can be raised for gross belt adjustment. If this adjustment is made, however, the motor plate should be as parallel as possible to the fan centerplane. Care should be taken to maintain drive alignment and proper belt tension.

MAINTENANCE (REFER TO SAFETY SECTION)

Develop a regular maintenance schedule according to your needs and the criticality of the fan. Periodic inspections, lubrication and observations of sound and vibration will help prolong the life of the fan. If changes are noted check bolt tightness, foundation integrity, cleanliness of the impeller and or motor, bearing lubrication and drive components. Always keep records of the maintenance that is performed.



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. Often motor lubricants are not the same as the fan bearings. If this information is not available, the Motor Lubrication Schedule may be used.

Shaft grounding rings are recommended for some VFD applications. If the motor is equipped with a shaft grounding ring a yearly inspection for wear and shaft corrosion is recommended. Replace the ring if it is making minimal contact with the shaft. If corrosion is present, treat the shaft with colloidal silver per the ring manufacturer's instructions.

MOTOR LUBRICATION SCHEDULE

Motors Less than 10 HP Running 8 Hrs/Day (clean environments)	Motors Between 15-40 HP (clean environments)	Motors Running 24/7 or if in dirty/dusty environments
Lube every 5 Years	Lube every 3 years	Divide the service interval by 4

Do not over lubricate.

DRIVE MAINTENANCE (REFER TO SAFETY SECTION)

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 failure. If burrs are found, use fine emery cloth or a stone to remove them. Be careful that dust does not enter the bearings.

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

When replacing belts, replace the entire set. Never use belt dressing on any belts, as it may cause belt wear.



WARNING

When working around belts and pulleys, keep hands away from pinch points.

FAN BEARING MAINTENANCE (REFER TO SAFETY SECTION)

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

Use 1/2 to 1/3 of the listed lubrication interval for high moisture applications. For vertical shaft mounts or dirty conditions use 1/2 the lubrication schedule.

Observation of the conditions of the grease expelled from unit ball or roller bearings at the time of relubrication is the best guide as to whether regreasing intervals and amount of grease added should be altered. Spherical roller bearings with split pillow block housings should not be lubricated until grease purges or overheating may result. Follow the lubrication interval and amount noted in the Bearing Installation section. Spherical roller bearings with split pillow block housings should be serviced once per year. Remove cap, clean out old grease and replace by filling the bottom half of the housing 1/3 full.

Greases are made with different bases. There are base greases, lithium base, sodium base, polyurea, 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 complex grease before leaving the factory. When the fans are started, the bearings may discharge excess grease through the labyrinth seals for a short period of time. Do not replace the initial discharge because leakage will cease when the excess grease has worked out. Sometimes the bearings have a tendency to run hotter during this period. This is no reason for alarm unless it lasts over 48 hours or temperatures exceed 200°F. When relubricating, use a sufficient amount of grease to purge the seals. Rotate bearings by hand during relubrication. If extended lubrication lines are fitted, lubricate the bearings while the fan is operating if it is safe to do so.

IMPELLER AND SHAFT MAINTENANCE (REFER TO SAFETY SECTION)

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

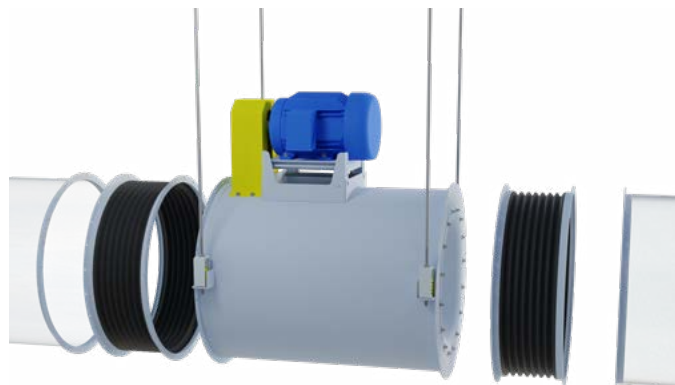
STRUCTURAL MAINTENANCE (REFER TO SAFETY SECTION)

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 ensure the structural integrity of the foundation.

DUCT CONNECTIONS

(REFER TO SAFETY SECTION)

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



*Ceiling Mounted Mixed Flow Fan
with Flexible Duct Connectors*

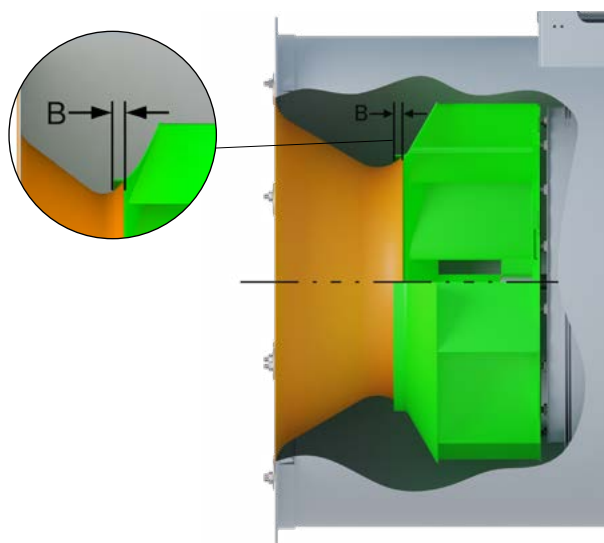
SERIAL NUMBER & FAN TYPE

The serial number and fan type can be found on our permanent nameplate of the fan.

TCF TWIN CITY FAN		TWIN CITY FAN & BLOWER MINNEAPOLIS, MN WWW.TCF.COM	
MODEL	QSL	SIZE	
SER. #	09-265399-1-1	CLASS	
VOLTS		HZ	
HP		PHASE	
TAG		ENCL.	
PARTS & SERVICE 500024210 888-444-4823 FIELDSERVICE@TCF.COM PARTS@TCF.COM			



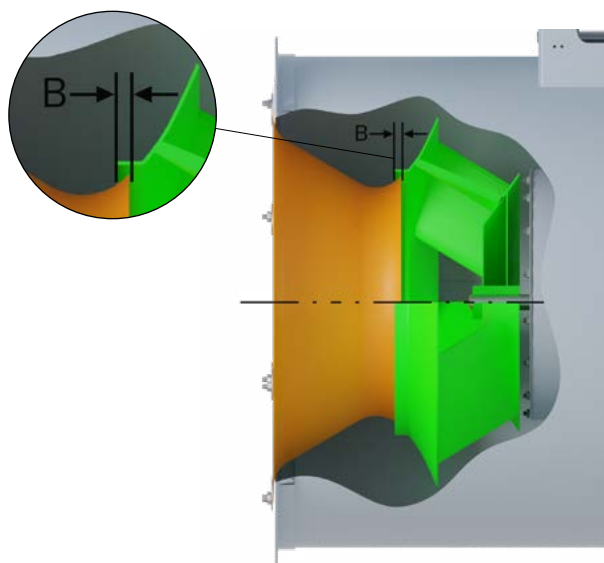
IMPELLER PLACEMENT



Model TSL

TSL Impeller Overlap																							
Size	90	105	122	135	150	165	182	200	222	245	270	300	330	365	402	445	490	542	600	660	730	807	890
A	10.50	10.50	12.25	13.50	15.00	16.50	18.25	20.00	22.25	24.50	27.00	30.00	33.00	36.50	40.25	44.50	49.00	54.25	60.00	66.00	73.00	80.75	89.00
B	0.28	0.28	0.31	0.34	0.38	0.44	0.56	0.63	0.69	0.75	0.88	0.97	1.06	0.94	1.03	1.13	1.25	1.38	1.56	1.69	1.88	2.09	2.28
C (CL 1)	3.02	4.02	4.69	5.31	5.86	6.36	7.36	8.00	8.89	9.86	10.91	11.89	13.31	14.72	16.23	17.92	19.64	21.70	24.08	26.42	29.19	32.30	35.66
C (CL 2)	3.02	4.02	4.72	5.31	5.86	6.36	7.42	8.06	8.95	9.86	10.91	11.89	13.31	14.72	16.23	17.92	19.64	21.70	24.08	26.42	29.19	32.30	35.66
C (CL 3)	3.02	4.02	—	5.31	—	6.36	7.48	8.13	9.08	9.92	10.97	12.14	13.38	14.78	16.30	17.98	19.70	21.83	24.14	26.48	29.25	32.36	35.70

Note: Use "B" dimension for positioning impeller.



Models QCLB and QSL

QCLB and QSL Impeller Overlap																
Size	90	122	135	150	165	182	200	222	245	270	300	330	365	402	445	490
A	12.25	15.00	16.50	18.25	20.00	22.25	24.50	27.00	30.00	33.00	36.50	40.25	44.50	49.00	54.25	60.00
B	0.31	0.38	0.44	0.56	0.63	0.69	0.75	0.88	0.97	1.06	0.94	1.03	1.13	1.25	1.38	1.56
C	4.20	5.13	5.64	6.19	6.75	7.56	8.31	9.13	10.19	11.19	12.38	13.63	15.13	16.63	18.38	20.25

Note: Use "B" dimension for positioning impeller.

TROUBLESHOOTING GUIDELINES

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

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

Air Capacity Problems

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

Noise Problems

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

Vibration Problems

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

Motor Problems

1. Incorrect wiring.
2. Speed of fan too high.
3. Parts improperly installed; binding.
4. Bearings improperly lubricated.
5. WR^2 capability of motor too low for application.
6. Protection devices may be improperly sized.
7. VFD compatible electrically? Effective shaft grounding?
8. Is cabling and grounding correct?

Drive Problems

1. Belts improperly tensioned.
2. Drive alignment is poor. Check belt or coupling.
3. Coupling lubrication.



NOTICE

Most fans manufactured by Twin City Fan & Blower are factory balanced prior to shipment. Certain high horsepower, large or unusual voltage fans, may not be run as an assembly due to power constraints, however the rotors have been dynamically balanced. 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 & Blower. Refer to the Vibration Guidelines table below.

VIBRATION GUIDELINES

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)

Values 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.





INSTALLATION/START-UP CHECKLIST

Become familiar with the equipment by looking at the fan assembly drawing for special instructions and accessories.

INITIAL FAN CHECK

- ☐ Inspect fan for damage
 - ☐ Check foundation, prepare for shims
 - ☐ Shim fan shaft level to 0.002"/ft
 - ☐ Are the bolts tight
 - ☐ Check to see if the fan is distorted by the foundation and/or ductwork
- Note: Applies to direct or isolation mount.*
- ☐ Check fan interior for debris and standing water

Fan Impeller

- ☐ Impeller clearance checked
- ☐ Impeller overlap checked
- ☐ Fasteners tight
- ☐ Impeller rotates freely

Springs (if equipped)

- ☐ Springs adjusted properly
- ☐ Flex joints allow movement
- ☐ Electrical conduit allows movement

Bearings

- ☐ Bearings aligned
 - ☐ Bearings greased
- Note: Rotate while greasing*
- ☐ Set screws tight (if equipped)

Lube Lines

- ☐ Lube lines been charged with grease prior to connecting to bearings

V-Belts (if equipped)

- ☐ V-belt drives aligned
- ☐ Sheaves retightened
- ☐ Belt tension correct
- ☐ Motor bolts retightened

Accessories

- ☐ Guards installed correctly, do not rub
- ☐ VIV/damper rotates freely (if equipped)
- ☐ Other accessories per drawing



WARNING

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

ELECTRICAL COMPONENTS

- ☐ Motor wired for proper voltage and starter
- ☐ Motor grounded
- ☐ Appropriate starter and heaters
- ☐ Leads are properly insulated
- ☐ Accessories wired per instructions supplied.

ENERGIZE

- ☐ Energize motor long enough to start assembly rotating, shut down
 - ☐ Verify direction of impeller rotation, rewire if necessary *Note: Refer to Impeller Rotation section*
 - ☐ Run the fan up to speed
 - ☐ Check for excess vibration and listen for unusual noise. Refer to the Vibration Guidelines table in the troubleshooting guidelines section for vibration limits
 - ☐ Proceed to grout
 - ☐ Bearing temperatures should stabilize after a few hours. Less than 200°F
- Note: Use sense of smell to identify possible electrical, belt issues.*

AFTER ONE WEEK

- ☐ Verify bolt tightness
- ☐ Verify belt tension and adjust as necessary

NOTICE

Always observe site specific and regulatory safety precautions.

SERIAL NUMBER: _____

COMPLETED BY: _____

DATE COMPLETED: _____



Model Number _____

Serial Number

[illegible]



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