

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.

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 bulletin has been prepared to guide the users of TSL Inline Centrifugal Fans and QSL Mixed Flow Fans in the proper installation, operation and maintenance procedures to insure maximum equipment life with trouble-free operation.

Shipping and Receiving

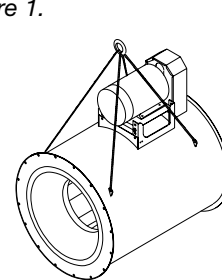
All Twin City Fan & Blower products are carefully constructed and inspected before shipment to insure the highest standards of quality and performance. Compare all components with the bill of lading or packing list to verify that the proper unit was received. Check each unit for any damage that may have occurred in transit. Any damage should be reported immediately to the carrier and the necessary damage report filed.

Handling

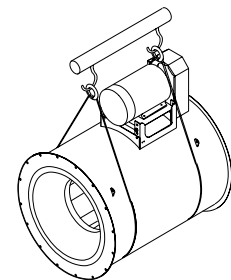
Handling of all air moving equipment should be conducted by trained personnel and be consistent with safe handling practices. Verify the lift capacity and operating condition of handling equipment.

collect, or use a desiccant. 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.

Figure 1.



Lifting With Lifting Lugs
(Standard)



Lifting With Straps &
Spreader Bar (Not Provided)



CAUTION

Maintain handling equipment to avoid serious personal injury and do not stand under the load.

Units shipped completely assembled 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.

If 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. Wrap loosely so air may circulate around the fan and moisture does not

Foundations and Supporting Structures

The TSL and QSL series can be mounted horizontally, vertically, or at any angle if ordered accordingly. Mounting brackets are available to accept both vibration isolating hangers or pads. Typical mounting arrangements are shown in Figures 2 through 8. Floor or wall mounted fans may be installed on a flat, rigid foundation.

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 insure 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.

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. Attach vibration isolators (if used) to appropriate mounting clips on fan. Locate fan in position using lifting instructions above.
4. Carefully level unit using shims (on rigid mounted fans) at mounting hole locations. Fans mounted with vibration isolators may be leveled by adjusting the hardware.
5. Continue with Operations Checklist.

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.

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 & Blower recommends final balancing of the unit after the drive components are installed. Failure to do so may void the warranty.

Table 1. Tightening Torque (Ft.-Lbs.)

SIZE	FASTENER			TAPER BUSHINGS		
	GRADE 2	GRADE 5	GRADE 8	BROWNING SPLIT		QD FOR DRIVE
				IN IRON	IN ALUM. HUB	
#10	—	—	—	—	—	5
1/4-20	5.5	8	12	7.9	7.5	9
5/16-18	11	17	25	16	13	15
3/8-16	22	30	45	29	24	30
7/16-14	30	50	70	—	—	—
1/2-13	55	75	110	70	—	60
9/16-12	—	—	—	—	—	75
5/8-11	100	150	220	—	—	135
3/4-10	170	270	380	—	—	—
7/8-9	165	430	600	—	—	—
1-8	250	645	900	—	—	—
1 1/4-7	500	1120	1500	—	—	—

Tolerance: +5%

For wheel setscrews use Grade 2 values. The above torque values are for nonlubricated fasteners.

Figure 2. 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 1/16" (13 - 45)	6	6	5	3	3	2	2	2	1
1 5/16" thru 2 7/16" (50 - 60)	6	5	4	2	2	1	1	1	1
2 1/16" thru 2 5/16" (65 - 75)	5	4	3	2	1	1	1		
3 7/16" thru 3 5/16" (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 Mobil - 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 3. 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 7/16" (25 - 35)	6	4	4	2	1	1	1	1	1/2
1 1/16" thru 2 3/16" (40 - 55)	4	2	1 1/2	1	1/2	1/2	1/2	1/2	1/2
2 7/16" thru 3 3/16" (60 - 85)	3	1 1/2	1	1/2	1/2	1/4	1/4		
3 9/16" thru 4 15/16" (90 - 125)	2 1/2	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 Mobil - 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 4. 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 1/16" thru 1 15/16" (35 - 50)	6	4 1/2	4	4	3 1/2	2 1/2	2 1/2	1	1		0.50 oz.
2 3/16" thru 2 13/16" (55 - 70)	5	4 1/2	4	2 1/2	2 1/2	1 1/2	1/2	1/4	1/4		0.75 oz.
2 15/16" thru 3 15/16" (75 - 100)	4 1/2	4	3 1/2	2 1/2	1 1/2	1	1/2				2.00 oz.
4 7/16" thru 4 15/16" (110 - 135)	4	4	2 1/2	1	1/2						4.00 oz.
5 7/16" thru 6 15/16" (140 - 180)	4	2 1/2	1 1/2								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 Mobil - 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.

Motor Support Adjustment

Two different types of motor mounts, post and saddle, are used on TSL Inline Centrifugal and QSL Mixed Flow fans. Which 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. 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.

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. See Figures 2, 3 and 4 for typical lubrication data. 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.

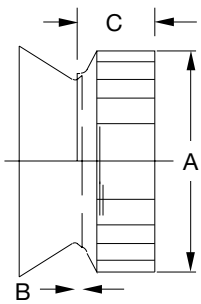
Wheel and Shaft Maintenance

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.

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 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.

Table 2. TSL Wheel-Funnel Overlap

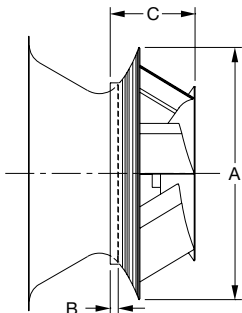


SIZE	122	150	182	200	222	245	270	300	330	365
A	12.25	15.00	18.25	20.00	22.25	24.50	27.00	30.00	33.00	36.50
B	0.31	0.38	0.56	0.63	0.69	0.75	0.88	0.97	1.06	0.94
C (CL 1)	4.69	5.86	7.36	8.00	8.89	9.86	10.91	11.89	13.31	14.72
C (CL 2)	4.72	5.86	7.42	8.06	8.95	9.86	10.91	11.89	13.31	14.72
C (CL 3)	—	—	7.48	8.13	9.08	9.92	10.97	12.14	13.38	14.78

SIZE	402	445	490	542	600	660	730	807	890
A	40.25	44.50	49.00	54.25	60.00	66.00	73.00	80.75	89.00
B	1.03	1.13	1.25	1.38	1.56	1.69	1.88	2.09	2.28
C (CL 1)	16.23	17.92	19.64	21.70	24.08	26.42	29.19	32.30	35.66
C (CL 2)	16.23	17.92	19.64	21.70	24.08	26.42	29.19	32.30	35.66
C (CL 3)	16.30	17.98	19.70	21.83	24.14	26.48	29.25	32.36	35.70

Note: Use "B" dimension for positioning wheel.

Table 3. QSL Wheel-Funnel Overlap



SIZE	150	165	182	200	222	245	270	300	330
A	18.25	20.00	22.25	24.50	27.00	30.00	33.00	36.50	40.25
B	0.56	0.63	0.69	0.75	0.88	0.97	1.06	0.94	1.03
C	6.19	6.75	7.56	8.31	9.13	10.19	11.19	12.38	13.63

SIZE	365	402	445	490	542	600	660	730
A	44.50	49.00	54.25	60.00	66.00	73.00	80.75	89.00
B	1.13	1.25	1.38	1.56	1.69	1.88	2.09	2.28
C	15.13	16.63	18.38	20.25	22.31	24.63	27.25	30.00

Note: Use "B" dimension for positioning wheel.

Operation Checklist

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

Check fan mechanism components:

- Nuts, bolts, setscrews are tight.
- Mounting connections are properly made and tightened.
- Bearings are properly lubricated.
- Wheel, drives and fan surfaces are clean and tightened.
- Rotating assembly turns freely and does not rub.
- Drives on correct shafts, properly aligned, and properly tensioned.

Check fan electrical components:

- Motor is wired for proper supply voltage.
- Motor was properly sized for power 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.
- Listen for any unusual noise.

Run unit up to speed:

- Bearing temperatures are acceptable (<200°F) after one to two hours of operation.
- Check for excess levels of vibration. Filter in readings should be 0.15 inches per second or less.

After one week of operation:

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

Figure 5. Typical Horizontal Mounting with Vibration Isolators

ITEM	QTY.	DESCRIPTION
01	1	TSL or QSL 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.

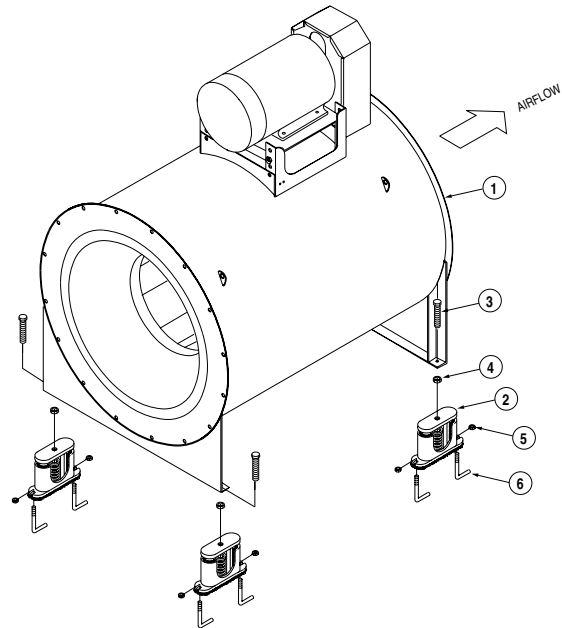


Figure 6. Typical Horizontal Mounting with Vibration Hangers (Ceiling Hung)

ITEM	QTY.	DESCRIPTION
01	1	TSL or QSL 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**

NOTE:

*1. Spring hangers are optional accessories.

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

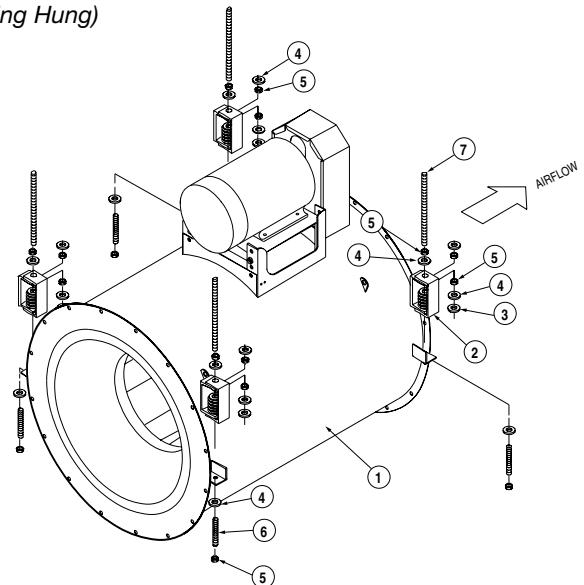
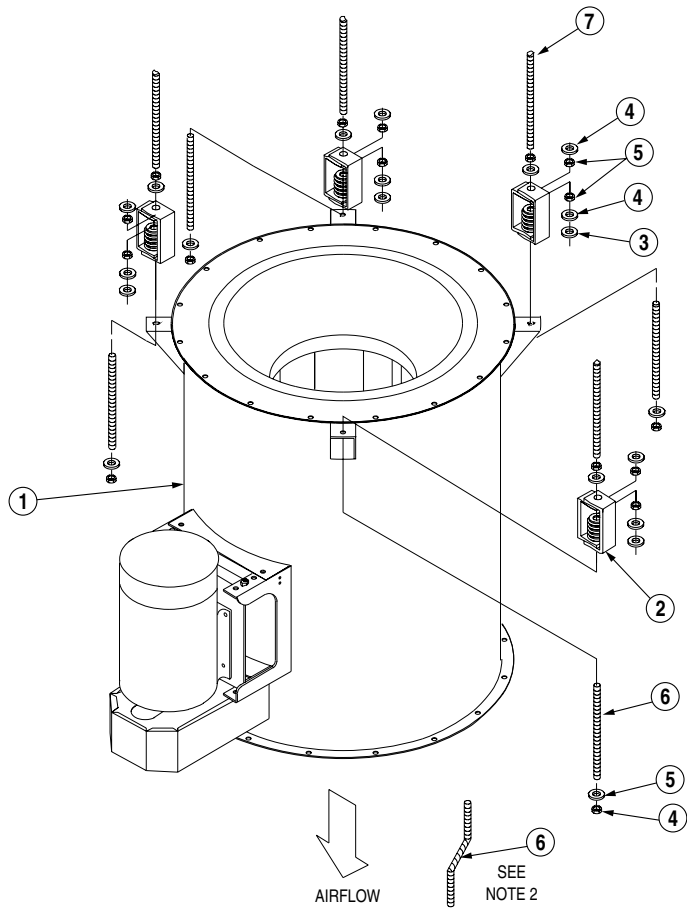


Figure 7. Typical Vertical Mounting with Vibration Hangers



ITEM	QTY.	DESCRIPTION
01	1	TSL or QSL 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.

Figure 8. Typical Horizontal Mounting to Rigid Foundation

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

NOTE:

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

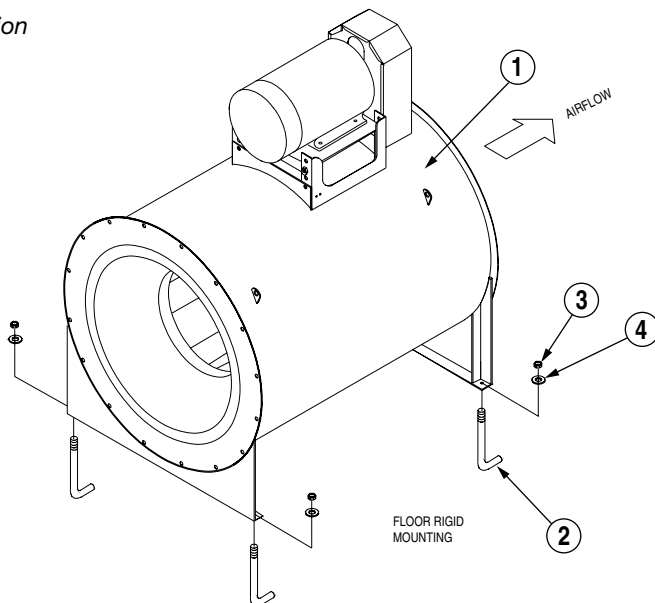


Figure 9. Cutaway View of TSL Assembly

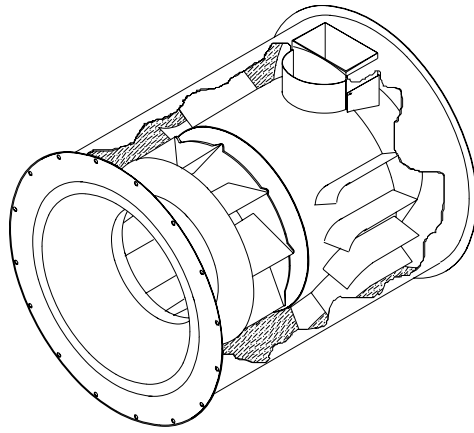
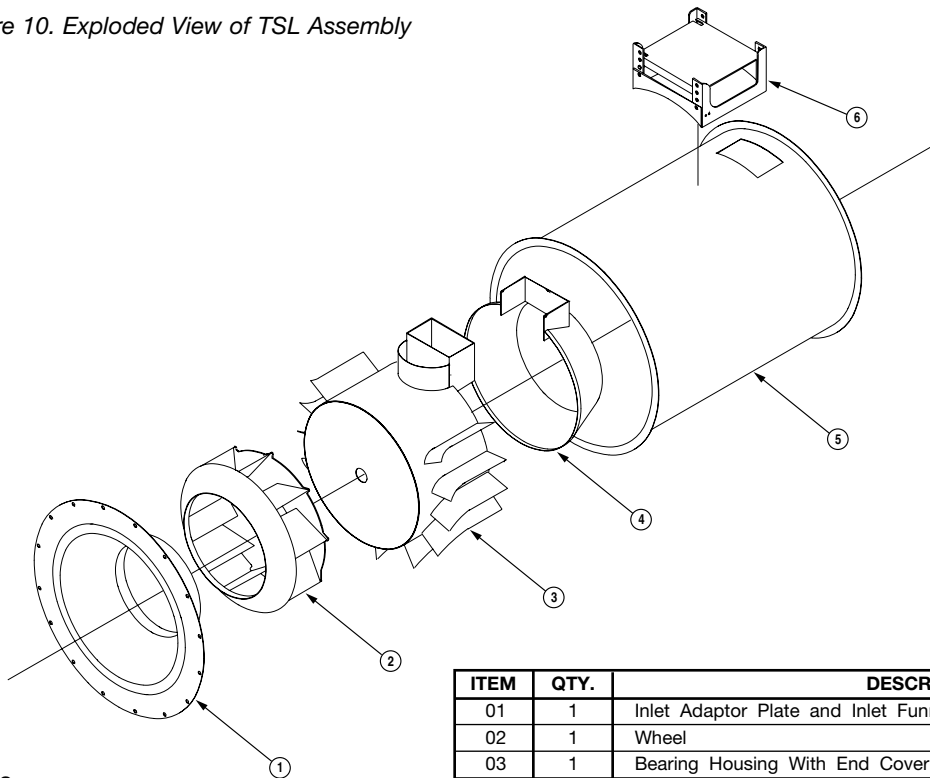


Figure 10. Exploded View of TSL Assembly



NOTES:

1. Shaft excluded from illustration.
2. Belts and driven sheave are accessible by removing discharge cone and belt tube seal.

ITEM	QTY.	DESCRIPTION
01	1	Inlet Adaptor Plate and Inlet Funnel
02	1	Wheel
03	1	Bearing Housing With End Cover Plate Belt Tube & Straightening Vanes
04	1	Discharge Cone & Belt Tube Seal (Removable)
05	1	Housing
06	1	Motor Mount (Saddle Type)

Figure 11. Cutaway View of QSL Assembly

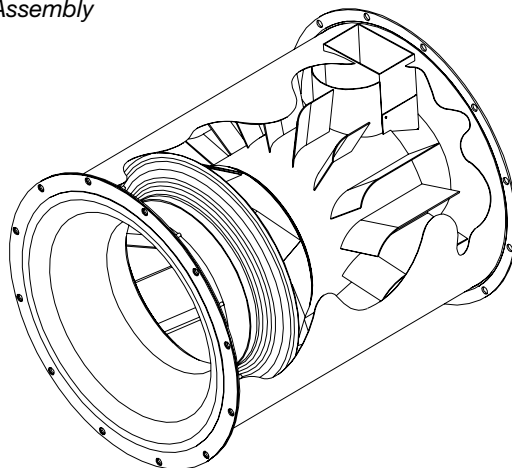
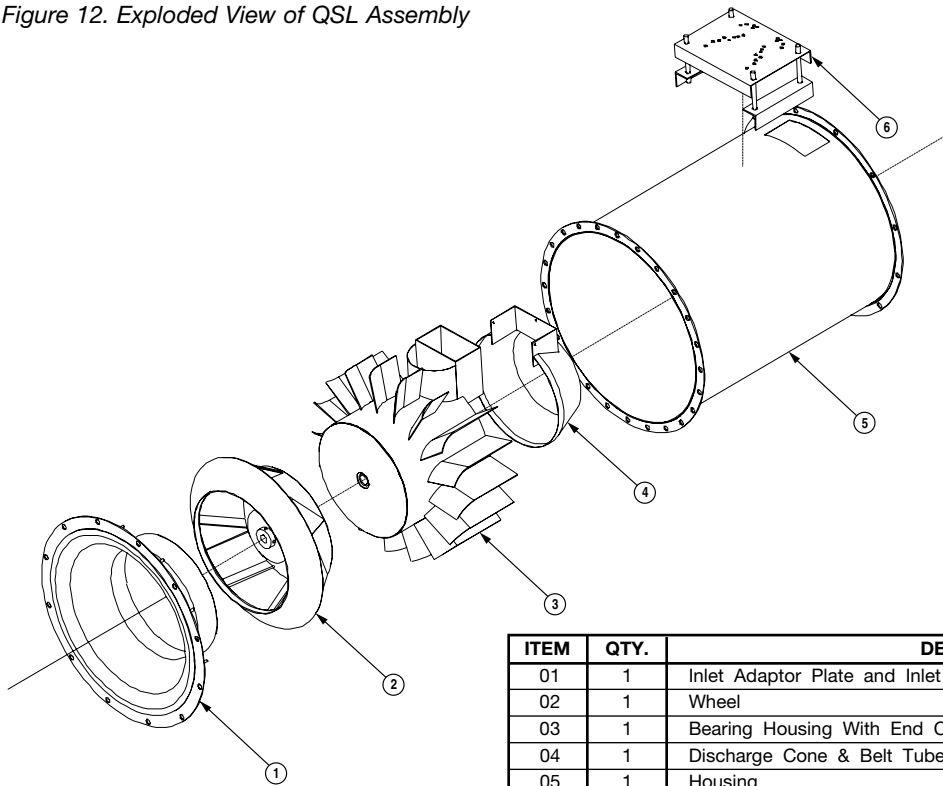


Figure 12. Exploded View of QSL Assembly

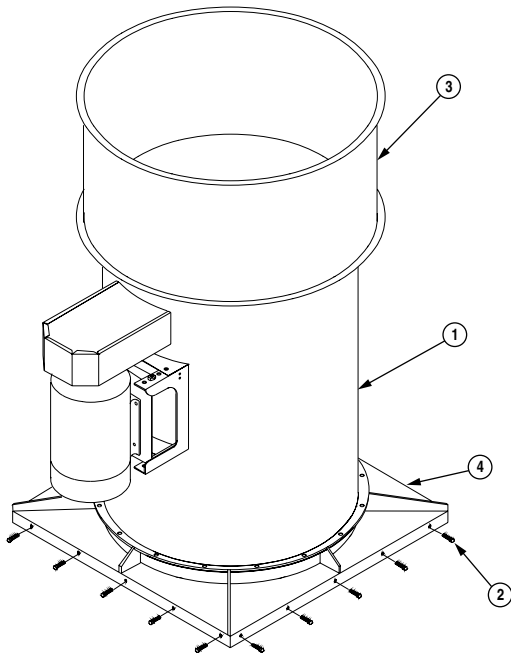


ITEM	QTY.	DESCRIPTION
01	1	Inlet Adaptor Plate and Inlet Funnel
02	1	Wheel
03	1	Bearing Housing With End Cover Plate Belt Tube & Straightening Vanes
04	1	Discharge Cone & Belt Tube Seal (Removable)
05	1	Housing
06	1	Motor Mount (Saddle Type)

NOTES:

1. Shaft excluded from illustration.
2. Belts and driven sheave are accessible by removing discharge cone and belt tube seal.

Figure 13. Typical Vertical Curb Mounting



ITEM	QTY.	DESCRIPTION
01	1	TSL or QSL Fan
02	See Note	Lag Bolt
03	1	Discharge Cap (Optional)
04	1	Curb Cap (Optional)

NOTE:

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



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