

MONOXIVENT[®]

Source Capture Systems

Operation and Maintenance Manual

Tubular Centrifugal Inline Fans

TCN



MONOXIVENT - SOURCE CAPTURE SYSTEMS

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INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance instructions for standard units of the *TCN-Inline Blowers*.

- TCN-B •TCNH-B
- TCN-D •TCNH-D

Carefully read this publication prior to any installation or maintenance procedure.

Monoxivent catalog, *TCN*, provides additional information describing the equipment, fan performance, available accessories, and specification data.

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

Receiving and Inspection

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

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

Handling

Lift the fan by foot brackets. Never lift by the shaft, motor, or housing.

WARNING

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

Storage

If the fan is stored for any length of time prior to installation, completely fill the bearings with grease or moisture-inhibiting oil. Refer to *Lubricants* on page 6. Also, store the fan in its original crate and protect it from dust, debris and the weather.

Outdoor Storage

To maintain good working condition of a TCN when it is stored outdoors, or on a construction site, follow the additional steps below.

- Cover the inlet and outlet, and belt tunnel opening to prevent the accumulation of dirt and moisture in the housing.
- Periodically rotate the wheel and operate dampers (if supplied) to keep a coating of grease on all internal bearing parts.
- Periodically inspect the unit to prevent damaging conditions.

Personal Safety

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

Installation

To prevent damage to the fan during shipping, motors 5 HP and larger, and extremely heavy motors (cast iron or severe duty) are shipped loose and must be field mounted by bolting the motor on the motor mounting plate in the existing mounting slots.



Note

Extreme vibration is a serious problem that may cause structural and mechanical failure. To help vibration and noise from being transferred to the building, isolators are recommended.

Isolation Installation

Floor Mounted Spring Isolators

- a. Mount fan and motor on unitary base (if supplied).
- b. Elevate fan (or isolation base) to operating height and insert blocks to hold in position.
- c. Position isolators under the fan and vertically align by inserting leveling bolt through mounting holes in the fan or the base. The isolator must be installed on a level surface.
- d. Adjust the isolators by turning the leveling nut counter clockwise several turns at a time alternately on each isolator until the fan weight is transferred onto the isolators and the fan raises uniformly off the blocks. Then remove the blocks.
- e. Turn lock nut onto leveling bolt and secure firmly in place against the top of the mounting flange or frame.
- f. Secure isolators to mounting surface.

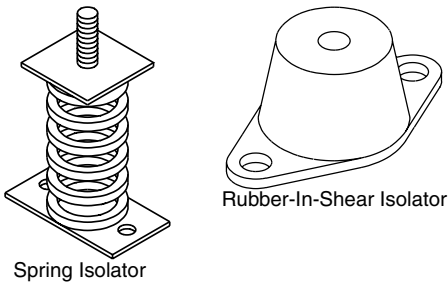


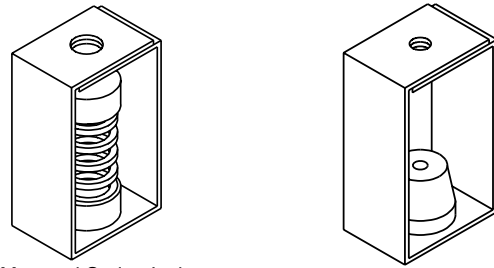
Figure 1 -Floor Mount Isolators

Floor Mounted Rubber-In-Shear (RIS) Isolators

- a. Mount fan and motor on a unitary isolation base (if supplied).
- b. Elevate fan to provide room to insert isolators between the fan and foundation and block in position.
- c. Position isolators under fan and secure bolts.
- d. Remove blocks and allow fan to rest on floor. Isolators must be installed on a level surface (leveling should not be required).
- e. Secure isolators to mounting surface.

Ceiling Mounted Spring and Rubber-in-Shear (RIS) Isolators

- a. Elevate fan to operating height and brace.
- b. Attach threaded rod to overhead support structure directly above each mounting hole. Rod should extend to within a few feet of fan.
- c. Attach isolator to end of threaded rod using a nut on each side of isolator bracket.
- d. Insert another section of threaded rod through the fan mounting hole and isolator.
- e. Attach two nuts to threaded rod in isolator.
- f. Place adjusting nut and locking nut on threaded rod near fan mounting bracket.
- g. Alternately rotate adjusting nut at each mounting location until the fan weight is uniformly transferred to the isolators. Remove bracing.



Ceiling Mounted Spring Isolator Rubber-In-Shear Ceiling Isolators

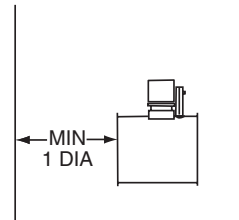
Figure 2 - Ceiling Mount Isolators

Duct Installation

Efficient fan performance relies on the proper installation of inlet and discharge ducts. Be sure your fan conforms to the guidelines below.

Non-Ducted Inlet Clearance

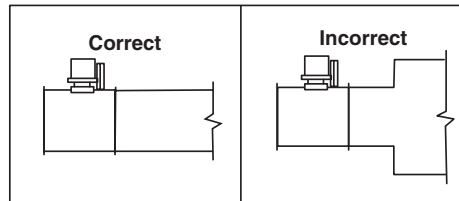
If your fan has an open inlet (no duct work), the fan must be placed 1 fan wheel diameter away from walls and bulkheads.



Non-ducted Inlet Clearance

Free Discharge

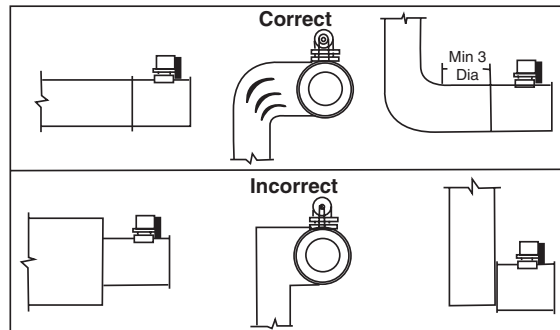
Avoid a free discharge into the plenum. This will result in lost efficiency because it doesn't allow for a static regain.



Free Discharge

Inlet Duct Turns

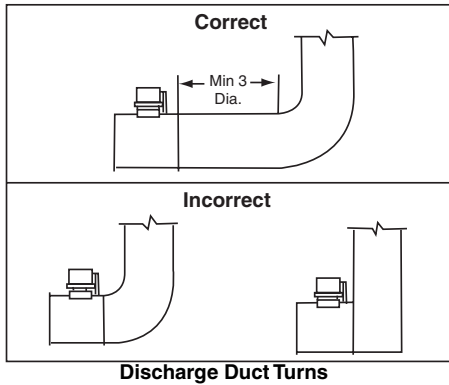
For ducted inlets, allow at least 3 fan wheel diameters between duct turns or elbows and the fan inlet.



Inlet Duct Turns

Discharge Duct Turns

Where possible, allow 3 duct diameters between duct turns or elbows and the fan outlet. Refer to the drawing at the top of page 3.



Wheel-to-Inlet Clearance

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

Adjust the overlap by loosening the wheel hub and moving the wheel along the shaft to obtain the correct value.

A uniform radial gap (space between the edge of the cone and the edge of the inlet) is obtained by loosening the inlet cone bolts and repositioning the inlet cone.

Size	Overlap
100	5/8"
120	
135	
150	
165	
180	3/4"
195	
210	
225	
245	
270	1"
300	
330	
365	
402	
445	1-1/4"
490	
540	
600	
660	
730	

Wheel/Inlet Overlap

Belt and Pulley Installation

Belt tension is determined by the sound the belts make when the fan is first started. Belts will produce a loud squeal which dissipates after the fan is operating at full capacity. If the belt tension is too tight or too loose, lost efficiency and possible damage can occur.

Do not change the pulley pitch diameter to change tension. This will result in a different fan speed.

- Loosen motor plate adjustment bolts and move motor plate in order that the belts can easily slip into the grooves on the pulleys. Never pry, roll, or force the belts over the rim of the pulley.
- Adjust the motor plate until proper tension is reached. For proper tension, a deflection of approximately 1/4" per foot of center distance should be obtained by firmly pressing the belt. Refer to Figure 3.

- Lock the motor plate adjustment nuts in place.
- Ensure pulleys are properly aligned. Refer to Figure 4.

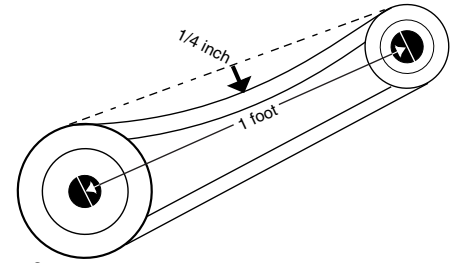


Figure 3

Pulley Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft or by moving the entire motor along the motor mounting bracket.

Figure 4 illustrates correct and incorrect pulley alignment. A recommended method of inspecting the pulley alignment is shown in Figure 5. With the shorter leg of a carpenter's square or other straight edge lying along the case of the motor, adjust the position of the motor pulley (or the motor until the longer leg of the square is parallel to the belt).

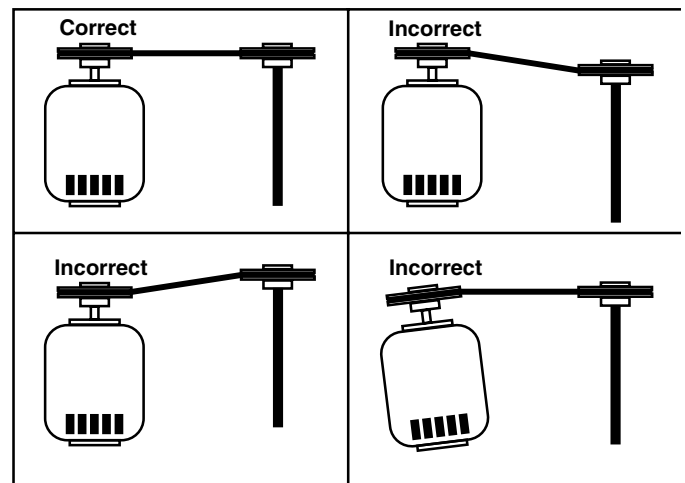


Figure 4

Wiring Installation

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

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

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

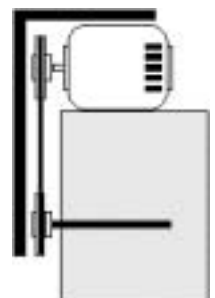
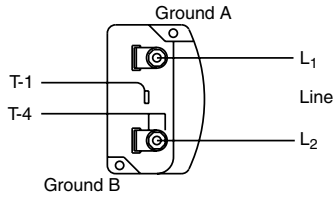


Figure 5

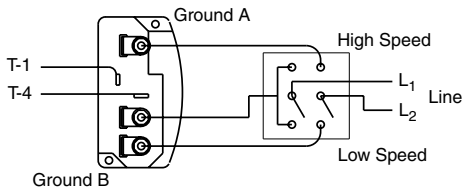
Wiring Diagrams

Single Speed, Single Phase Motor



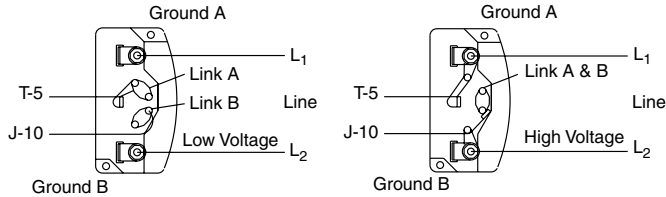
When ground is required, attach to ground A or B with no. 6 thread forming screw. To reverse, interchange T-1 and T-4.

2 Speed, 2 Winding, Single Phase Motor



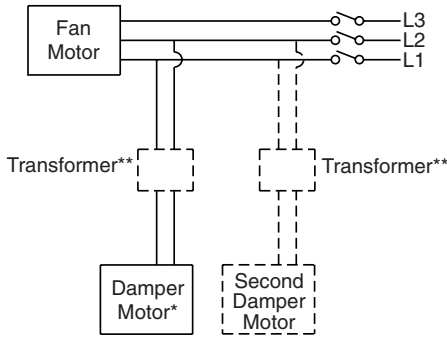
When ground required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

Single Speed, Single Phase, Dual Voltage



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

Typical Fan Motor/Damper Motor Schematic



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

Wiring Installation continued

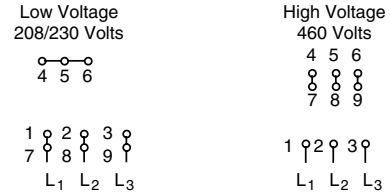
Personal Safety

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

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

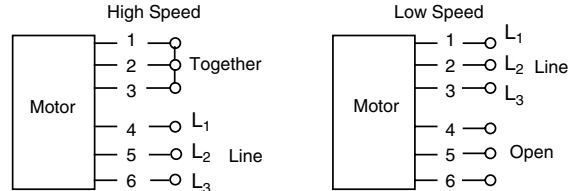
Wiring Diagrams

3 Phase, 9 Lead Motor



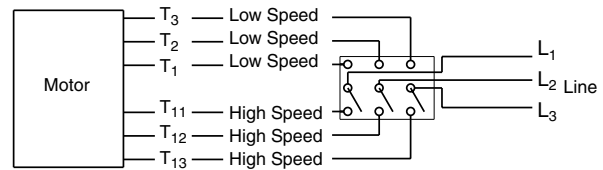
To reverse, interchange any 2 line leads.

2 Speed, 1 Winding, 3 Phase Motor



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

2 Speed, 2 Winding, 3 Phase



To reverse: High Speed-interchange leads T₁₁ and T₁₂. Low Speed-interchange leads T₁ and T₂. Both Speeds-interchange any 2 line leads.

Wheel Rotation

Test the fan to ensure the rotation of the wheel is the same as indicated by the arrow marked Rotation.

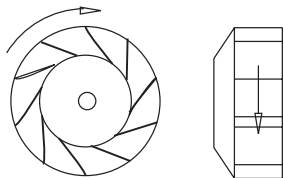
115 and 230 Single Phase Motors

Fan wheel rotation is set correctly at the factory. Changing the rotation of this type of motor should only be attempted by a qualified electrician.

208, 230, and 460, 3 Phase Motors

These motors are electrically reversible by switching two of the supply leads. For this reason, the rotation of the fan cannot be restricted to one direction at the factory. See Wiring Diagrams for specific information on reversing wheel direction.

Do not allow the fan to run in the wrong direction. This will overheat the motor and cause serious damage. For 3-phase motors, if the fan is running in the wrong direction, check the control switch. It is possible to interchange two leads at this location so that the fan is operating in the correct direction.



Tubular Centrifugal Inline

Final Installation Steps

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

Operation

Pre-Start Checks

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

Start Up

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

- Direction of rotation.
- Excessive vibration.
- Unusual noise.
- Bearing noise.
- Improper belt alignment or tension (listen for squealing).
- Improper motor amperage or voltage.

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

Inspection

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

30 Minute Interval

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

8 Hour Interval

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

24 Hour Interval

Inspect belt tension. Adjust and tighten as necessary.

Recommended Torque for Setscrews/Bolts (IN/LB)

Size	Key Hex Across Flats	Setscrews		Hold Down Bolts	
		Recommended Torque		Size	Wrench Torque
		Min.	Max.		
No.10	3/32"	28	33	3/8"-16	240
1/4"	1/8"	66	80	1/2"-13	600
5/16"	5/32"	126	156	5/8"-11	1200
3/8"	3/16"	228	275	3/4"-10	2100
7/16"	7/32"	29	348	7/8"-9	2040
1/2"	1/4"	42	504		
5/8"	5/16"	92	1104		
3/4"	3/8"	120	1440		

Maintenance

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

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air (airborne abrasives) should be inspected every three months.

Regular inspections are recommended for fans exhausting non-contaminated air.

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

- Inspect bolts and setscrews for tightness. Tighten as necessary.
- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. Refer to *Belt and Pulley Installation*, page 3.
- Bearings should be inspected as recommended in the *Conditions Chart*.
- Inspect variable inlet vanes for freedom of operation and excessive wear. The vane position should agree with the position of the control arm. As the variable inlet vanes close, the entering air should spin in the same direction as the wheel.
- Inspect springs and rubber isolators for deterioration and replace as needed.
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling. Removing dirt from the wheel and housing prevent imbalance and damage.

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

Lubricants

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

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

Motor Bearings

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

Fan Bearings

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

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

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

Motor Services

Should the motor prove defective within a one-year period, contact your local Monoxivent representative or your nearest authorized electric motor service representative.

Changing Shaft Speed

All belt driven fans with motors up to and including 5 HP are equipped with variable pitch pulleys. To change the fan speed, perform the following:

- Loosen setscrew on driver (motor) pulley and remove key, if equipped.
- Turn the pulley rim to open or close the groove facing.

If the pulley has multiple grooves, all must be adjusted to the same width.

- After adjustment, inspect for proper belt tension.

Speed Reduction

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

Speed Increase

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained.

Pulley and Belt Replacement

- Loosen and remove belts by lowering motor mounting plate with the four adjusting nuts.
- Remove pulleys from their respective shafts.
- Clean the motor and fan shafts.
- Clean bores of pulleys and coat the bores with heavy oil.
- Remove grease, rust, or burrs from the pulleys and shafts.
- Remove burrs from shaft by sanding.
- Place fan pulley on fan shaft and motor pulley on its shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.
- Tighten in place.
 - Install belts on pulleys and align as described in the *Belt and Pulley Installation* section.

Bearing Replacement

The fan bearings are pillow block ball bearings.

- Loosen and remove belts by lowering motor mounting plate with the four adjusting nuts.
- Remove the bearing cover by removing the four bolts around the perimeter of the bearing cover. *Do not remove fan sheave yet*.
- Remove inlet cone by removing attaching bolts/nuts around perimeter of the inlet plate.
- Remove wheel by loosening setscrews and sliding off shaft.
- Record the location of the fan sheave from end of shaft, and remove the sheave.
- Record the distance from the bearing to the end of the shaft.
- Loosen setscrews on bearings and remove shaft.
- Remove bearings and rubring and replace with new bearings.
 - Slide shaft through bearings until shaft protrudes the same amount as original shaft. Tighten setscrews.
 - Replace Rubring.
 - Replace fan sheave in original location.
 - Replace wheel but do not tighten yet.
- Replace inlet cone. Wheel may need to be moved to allow proper alignment. Care should be taken to insure that inlet cone is centered inside wheel before and after tightening attaching bolts.
- Slide wheel on shaft to achieve proper wheel/inlet overlap. Refer to *Wheel-to-Inlet Clearance* on page 3.
- Replace and tighten belts.
- Test run the fan.

- q. Re-tighten setscrews on bearings, sheave, and wheel. Recheck belt tension and adjust as needed.
- r. Replace bearing cover.

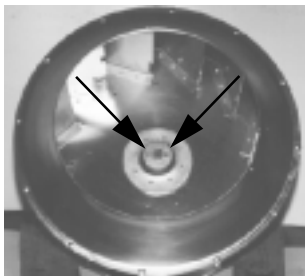
Wheel Replacement for TCN & TCNH

TCN

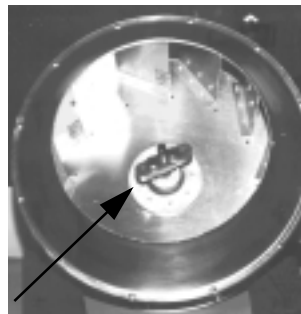
- a. Drill two 1/4" diameter holes, 180 ° apart centered approximately between the shaft and the outside diameter of the hub, 3/8" to 1/2" in depth.
- b. Tap 1/4" holes to 5/16" thread with a 5/16" hole tap. Do not drill or tap greater than recommended.
- c. Screw the puller arms to the full depth of the threads into the tapped holes. Align center of the puller with the center of the shaft. Ensure all setscrews in the hub, normally two, are fully removed.
- d. Slowly remove wheel from the shaft.

Recommended Puller

Lisle No. 45000 Sterling Wheel Puller. This puller is available at most automotive parts retail outlets.



Above - Drilled hole placement.
Right - Wheel puller.



TCNH

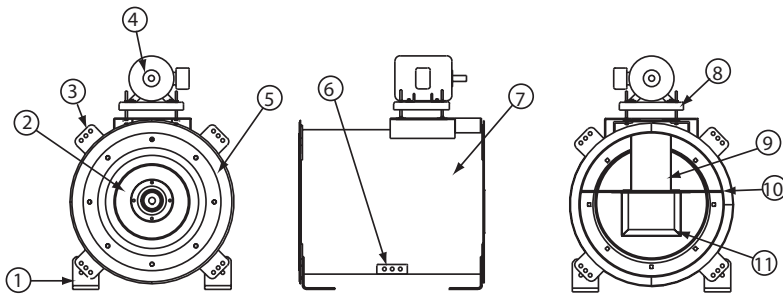
The TCNH wheel has a pre-machined shoulder in the hub for the use of most 2 and 3 jaw mechanical puller.

- a. Align center of the puller with the center of the shaft.
- b. Ensure all setscrews in the hub, normally two, are fully removed.
- c. Slowly remove wheel from the shaft.

Troubleshooting

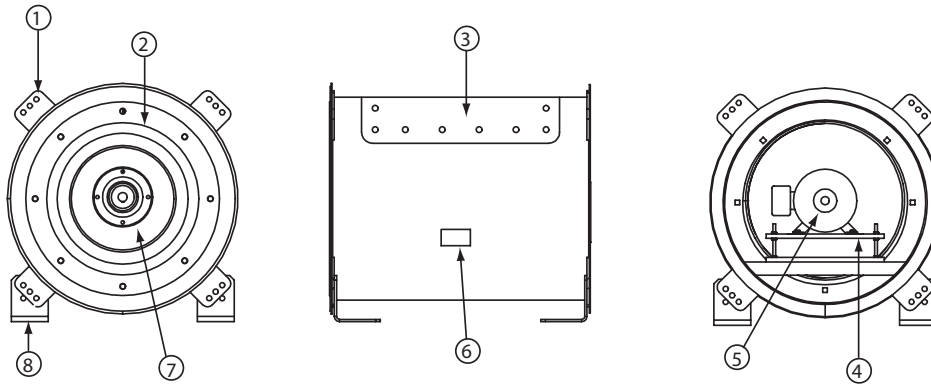
Problem and Potential Cause
Low Capacity or Pressure <ul style="list-style-type: none"> •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Poor fan inlet conditions. There should be a straight clear duct at the inlet. •Improper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

TCN-B/TCNH-B Parts List



Item No.	Description
1	Foot
2	Wheel
3	Foot Bracket
4	Motor
5	Inlet Cone
6	Inspection Door
7	Outer Housing
8	Motor Plate
9	Belt Tunnel
10	Bearing Plate
11	Bearing Cover
Not Shown	Rub Ring

TCN-D/TCNH-D Parts List



Item No.	Discription
1	Foot Bracket
2	Inlet Cone
3	Access Door
4	Motor Plate
5	TEFC Motor
6	Field Wiring Compartment
7	Wheel
8	Foot

MONOXIVENT

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