OPERATION AND MAINTENANCE MANUAL

Mechanical equipment example

Prepared October 21, 2026

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Taco Vertical Multistage O&M Manual 17-21
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Assembly notes

Read these notes and check the original files before you submit this manual.

01 This package combines supplied PDFs. Check the equipment, technical content, signatures and required records against the job specifications before submission. Fast Closeouts does not certify completeness or acceptance.

02 No supplied file is labeled Warranties. Check whether the job requires these records. This label check does not establish that required content is missing.

03 No supplied file is labeled Startup and TAB reports. Check whether the job requires these records. This label check does not establish that required content is missing.

04 Source 01 (Greenheck CUE-CUBE O&M Manual.pdf) contains PDF links or active controls. Safe internal links and web/email links are retained. Unsupported actions and unresolved destinations are excluded; the unchanged original remains in the ZIP.

TAB 01

O&M manuals

Greenheck CUE-CUBE O&M Manual	Pages 5-16
Taco Vertical Multistage O&M Manual	Pages 17-21

The pages in this tab are copies of the supplied documents, in the order selected. Section labels do not confirm suitability or approval.

GREENHECK
Building Value in Air.

Document 471560
Model CUE Direct Drive
Model CUBE Belt Drive
Upblast Centrifugal Roof Exhaust

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Direct Drive Upblast Centrifugal Exhaust Fan



These fans are specifically designed for roof and wall mounted applications. The maximum continuous operating temperature for fan sizes 099-300 is 400°F *(204°C)* and for fan sizes 060-095 is 130°F *(54°C)*. Direct drive fans are available with nominal wheel diameters ranging from 9 to 30 inches *(229 to 762 mm)* (060-300 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed metal nameplate containing the model number and individual serial number.

Belt Drive Upblast Centrifugal Exhaust Fan

These fans are specifically designed for roof and wall mounted applications. The maximum continuous operating temperature is 400°F *(204°C)*. Belt drive fans are available with nominal wheel diameters ranging from 10 to 48 inches *(254 to 1219 mm*) (099-480 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed metal nameplate containing the model number and individual serial number.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity is present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

IMPORTANT

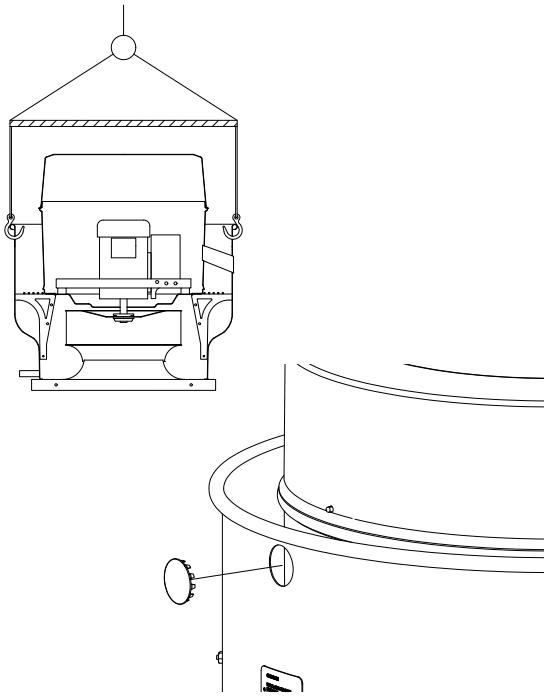
Do not lift by the fan hood. Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the venturi of fan. Fans with special coatings or paints must be protected in handling to prevent damage.

Handling

Direct and Belt Drive Units

Up through size 240, if provided, use the lifting points See Figure 1. For sizes 300 and larger, or if the lifting points are not provided, use the horizontal supports.

Figure 1



When lifting a unit onto the roof, use either the four lifting points on the drive frame or the two lifting points on the bearing plate if present, see Figure 2 for lifting points. Access to the drive frame is accomplished by push-pin toolless fasteners or removing the screws pointed out in Figure 3. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

Figure 2

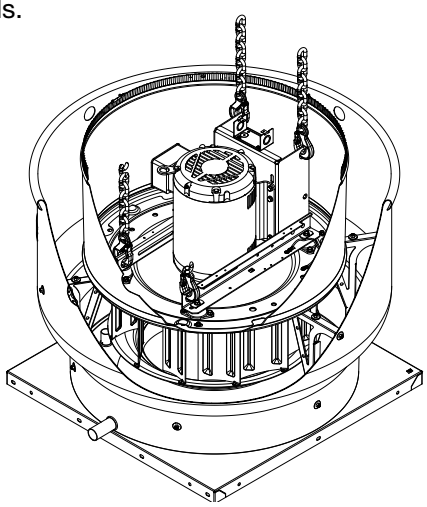
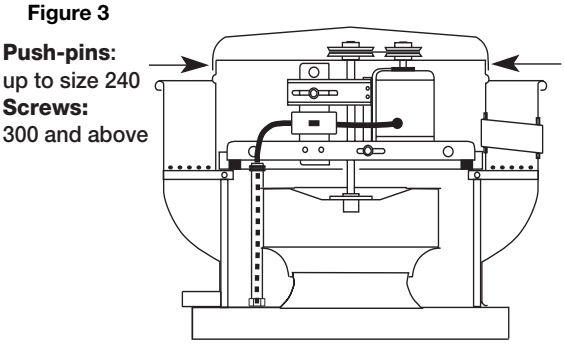


Figure 3



When the Direct and/or Belt Drive unit is on the roof, move fan to desired location using lifting points and fasten securely through mounting holes in base. Shims may be necessary depending upon roofing material thickness.

The motor amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. For Direct and/or Belt Drive installations, the electrical supply should be routed through the conduit chase located between the curb cap and the bottom of the motor compartment or through the breather tube. Wiring must conform to local and national codes.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)* (wide temperature swings may cause condensation and "sweating" of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts, allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to get rid of any moisture buildup. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3-1/2 inches *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant in motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

IMPORTANT

Installation, troubleshooting and parts replacement are to be performed only by qualified personnel. Consult and follow all applicable national, state and local codes. They will supersede this document.

Dimensional Data

Direct Drive

Model Size	Standard Curb Cap	Damper	Roof/Wall Opening	Wall Opening with a curb	**Approx. Weight
060, 070	17 *(432)*	8 *(203)*	13½ *(343)*	17 *(432)*	29 *(13)*
080, 090, 095	19 *(483)*	10 *(254)*	15½ *(393)*	19 *(483)*	40 *(18)*
099, 100, 101*, 120, 121*, 130, 131*	19 *(483)*	12 *(305)*	15½ *(393)*	19 *(483)*	67 *(30)*
140, 141*, 160, 161*	22 *(559)*	16 *(406)*	18½ *(470)*	22 *(559)*	90 *(41)*
180, 200, 200HP	30 *(762)*	24 *(610)*	26½ *(673)*	30 *(762)*	142 *(64)*
240, 240HP	34 *(864)*	24 *(610)*	30½ *(775)*	N/A	175 *(79)*
300, 300HP	40 *(1016)*	34 *(864)*	36½ *(927)*	N/A	313 *(142)*

Belt Drive

Model Size	Standard Curb Cap	Shaft Bearings	Damper	Roof/Wall Opening	Wall Opening with a curb	**Approx. Weight
099, 100, 101*, 100HP, 101HP*, 120, 121*, 130, 131*	19 *(483)*	¾ *(19)*	12 *(305)*	15½ *(393)*	19 *(483)*	66 *(30)*
140, 141*, 140HP, 141HP*, 160, 161*, 160HP, 161HP*	22 *(559)*	¾ *(19)*	16 *(406)*	18½ *(470)*	22 *(559)*	87 *(39)*
160XP, 161XP*	22 *(559)*	1 *(25)*	16 *(406)*	18½ *(470)*	22 *(559)*	87 *(39)*
180	30 *(762)*	¾ *(19)*	24 *(610)*	26½ *(673)*	30 *(762)*	126 *(57)*
180HP	30 *(762)*	1 *(25)*	24 *(610)*	26½ *(673)*	30 *(762)*	126 *(57)*
200	30 *(762)*	¾ *(19)*	24 *(610)*	26½ *(673)*	30 *(762)*	142 *(64)*
200HP	30 *(762)*	1 *(25)*	24 *(610)*	26½ *(673)*	30 *(762)*	142 *(64)*
220, 220HP, 240, 240HP, 240XP	34 *(864)*	1 *(25)*	24 *(610)*	30½ *(775)*	34 *(864)*	175 *(79)*
300, 300HP, 300XP	40 *(1016)*	1 *(25)*	34 *(864)*	36½ *(927)*	40 *(1016)*	313 *(142)*
360, 360HP, 360XP	46 *(1168)*	1¼ *(32)*	40 *(1016)*	42½ *(1080)*	N/A	440 *(200)*
420	52 *(1321)*	1¼ *(32)*	46 *(1168)*	48½ *(1232)*	N/A	578 *(262)*
480	58 *(1473)*	1½ *(38)*	52 *(1321)*	54½ *(1384)*	N/A	675 *(306)*

- All dimensions are in inches *(millimeters)*.
- * Previous size, no physical product change with new size
- ** Approximate weight shown in lbs. *(kg.)* is the largest cataloged open drip proof motor.
- "Curb Cap" is the inside dimension of the curb cap
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.
- Roof/wall opening is a square dimension

Installation

General Ventilation Installation

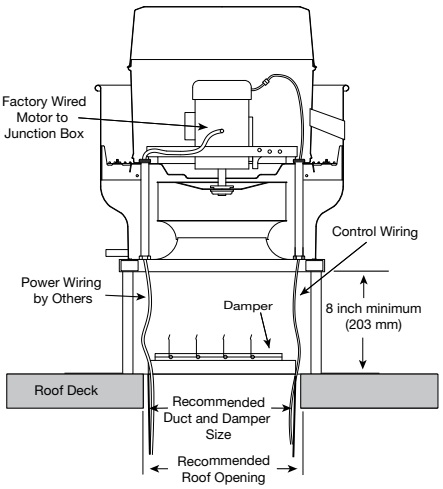


Figure 4 - Typical Roof Mounting Installation

1. On the roof surface, cut an appropriately sized hole and follow manufacturer's instructions on curb installation. Caulk and flash the curb to ensure a water tight seal.
2. If unit is equipped with a backdraft damper, it should be installed now.
3. To access the motor compartment for sizes smaller than 300, press two adjacent push-pin toolless fasteners simultaneously and pull the motor cover away. For sizes 300 and above, remove the screws.

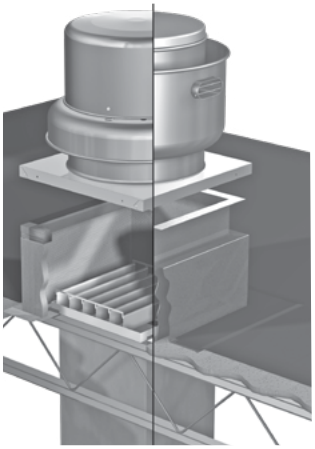


Figure 5 - Roof Curb Installation

4a. On **belt drive** fans, use the lifting points or lifting lugs on the drive frame or bearing plate to lift and place the unit on top of roof curb. Refer to Figure 1 and 2, page 2.

4b. On **direct drive** fans, lift and place the unit on top of roof curb using the lifting points or hooks under the horizontal supports. Refer to Figure 1 and 2, page 2.

5. Secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners. Shims may be required depending upon curb installation and roofing material.
6. Verify power line wiring is de-energized before connecting fan motor to power source.
7. For commercial kitchen and UL Listed emergency smoke control applications, the electrical supply must enter the motor compartment through the breather tube. For other non-flammable applications, the electrical supply can be routed through the conduit chase between the curb cap and the bottom of the motor compartment.
8. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover. Check the power source for compatibility with the requirements of your equipment.
9. Check fan wheel for free rotation, recenter if necessary. Check setscrew(s) for tightness.
10. Check all fasteners for tightness.
11. Mount and wire safety disconnect switch under motor cover. Wire control switches at ground level, refer to Figure 6.
12. Replace motor cover.

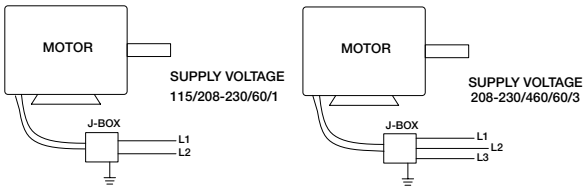


Figure 6 - Typical Wiring Diagram

Vari-Green® Wiring

For Vari-Green wiring refer to the Vari-Green Motor and Controls Installation, Operation and Maintenance Manual for complete wiring and operation instructions.

Sidewall Mounting Installation

1a. **Curb**: Cut an appropriate sized hole in the wall for either through wall (recommended) or exterior face mount and follow the manufacturer's instructions on curb installation.

1b. **Wall bracket**: Cut an appropriate sized hole in the wall for exterior face mounting. If unit is equipped with a backdraft damper, it should be installed in the ductwork/wall opening now.

2. Mount the curb or wall bracket to the wall with a minimum of eight 3/8 inch fasteners around the flange. Caulk and flash the curb or wall bracket to ensure a watertight seal.
3. **Curb only**: If unit is equipped with a backdraft damper, it should be installed now.
4. Lift the fan into place. Do NOT support the unit by the hoodband during installation.

5a. **Curb**: Orient fan so the grease trough is downward and secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners.

5b. **Wall bracket**: Orient fan so the grease trough is downward and secure fan to bracket using the fasteners provided.

6. Follow steps 6 through 12 of General Ventilation Installation instructions on page 4.

   NOTE: If using any type of hinging, your fan must be a minimum of 8 inches away from the wall.

   NOTE: Do not install your fan more than 12 inches away from the wall.

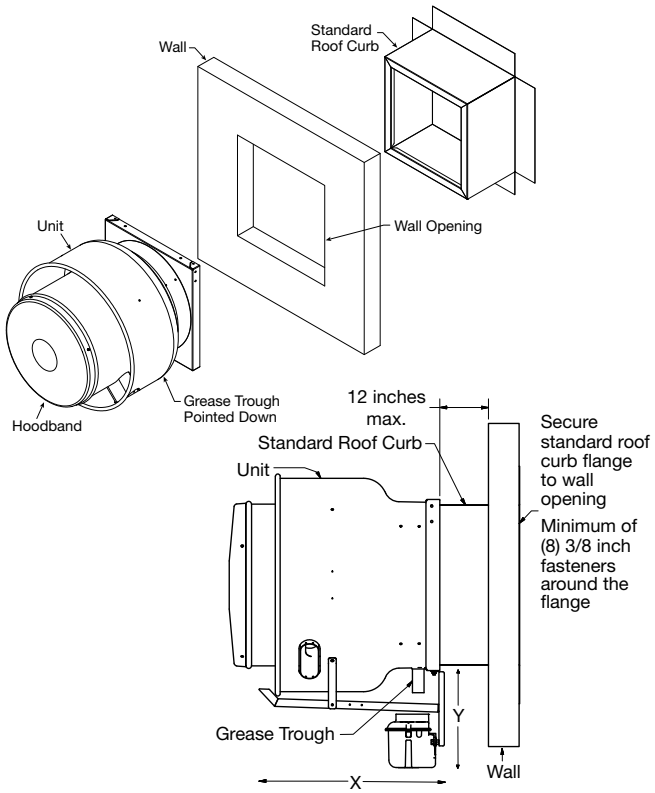


Figure 7 - Typical Sidewall Mounting Installation (Through Wall)

Grease Pan Kit Dimensions		
Fan Size	X (in.)	Y (in.)
99-130	21.5	13.5
140-160	23.5	13.3
180-200	29.5	17.5
220-240	32.5	18.5
300	33.0	19.5

Commercial Kitchen Installation

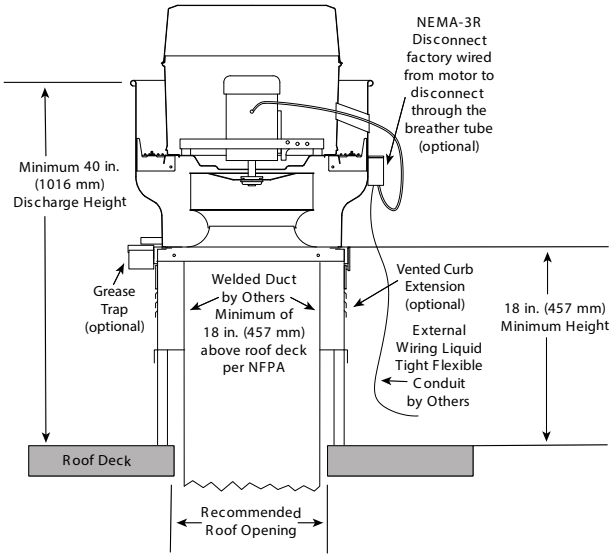


Figure 8 Typical Roof Mounting Installation

Commercial kitchen installations must comply with NFPA 96. Check local and national codes for these installations and consult local code authorities for other specific requirements.

1. On the roof surface, cut an appropriately sized hole and follow manufacturer's instructions on curb installation. Caulk and flash the curb to ensure a watertight seal.
2. If unit/curb is equipped with a backdraft damper. DO NOT install it.

Perform steps 3 - 12 of General Ventilation Installation.

IMPORTANT
The size of the duct must be equal to or larger than the inlet opening of the fan.
To comply with NFPA 96, the fan discharge must be a minimum of 40 in. *(1016 mm)* above the roof surface and a minimum of 10 ft. *(3048 mm)* from any building air intake.
Per NFPA 96, ductwork to an upblast discharge exhaust fan must be constructed of and supported by carbon steel not less than No. 6 MSG *(1.52 mm)* or stainless steel not less than No. 18 MSG *(1.21 mm)* in thickness. Duct must also extend a minimum of 18 in. *(457 mm)* above the roof surface.
Ensure that a minimum of 500 ft/min of air velocity through the duct is maintained per NFPA 96, clause 8.2.1.1, 2014 edition and UL 705 Supplement SC, Issue #7, clause 6.2, October 14, 2013.
The following accessories may be required by NFPA 96 depending upon installation: Grease Trap, Hinge Kit or Hinged Base, Clean-Out Port, and Vented Curb.
Minimum duct velocities must be maintained in kitchen exhaust applications. If a speed controller is used, ensure compliance with all applicable codes.

Grease Trap Installation

The polypropylene grease trap is designed to collect grease residue and avoid drainage onto roof surface. Follow all local codes, as well as the National Fire Protection Agency (NFPA) where applicable.

NFPA 96: Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 1 gal. *(3.8L)*

Document 476370 or 481936 (for sidewall mount)-

Grease Trap Installation, Operation and Maintenance Manual for parts list and specific installation instructions.

Grease Trap Maintenance

Regular inspection of grease trap is recommended. Depending on the amount of grease discharged through the fan, the grease trap should be cleaned regularly to ensure proper operation.

- Check grease absorber (if included) every month. Replace grease absorber after every cleaning and/ or as needed between cleanings.
- Replacement grease absorbers (P/N 476084) can be ordered from your local representative.

Hinge Installation

NFPA 96: Upblast exhaust fans shall be supplied with a hinge.

Refer to listed Installation, Operation and Maintenance Manuals for parts list and specific installation instructions:

Document 481937 - Sidewall Mount Hinge Kit
Document 481366 - Bracket Hinge Kit
Document 462865/462866 - Hinge Kit

UL Listed Emergency Smoke Control Installation

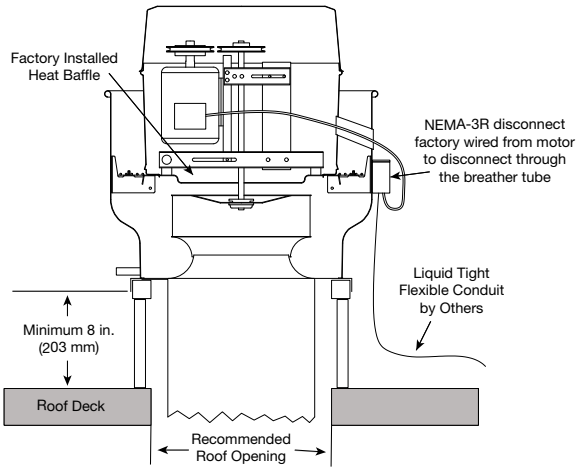


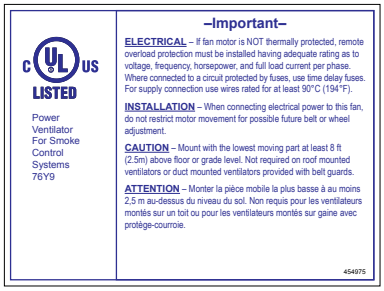
Figure 9 - Typical Roof Mounting Installation

Electrical Connection

For **belt drive** units in emergency smoke removal installations, the motor's amperage and voltage rating must be checked for compatibility to the supply voltage prior to final electrical connection. Also, the motor itself cannot have thermal overload protection.

The electrical supply must enter the motor compartment through the breather tube and the disconnect must be mounted outside the fan's motor compartment. Emergency smoke removal fans may also require an isolated power supply so that if power is cut to the building in the event of a fire, the fan will continue to operate.

Check the local and national electrical codes for emergency smoke removal fans. Consult local code authorities for your specific requirements.



Representation of UL Listed Power Ventilator for Smoke Control Systems label

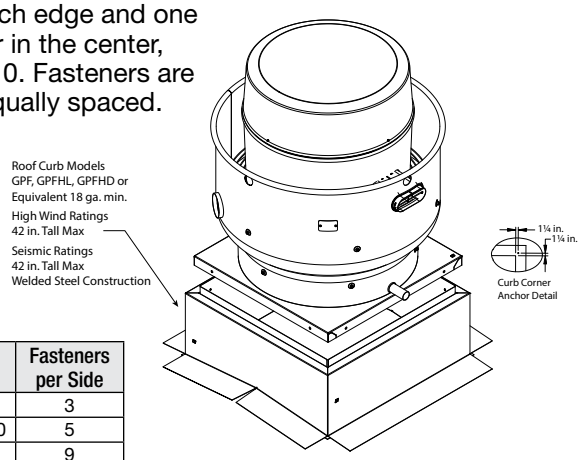
Mounting for Severe Duty Installation

IMPORTANT

Only qualified installers should perform this work. Manufacturer assumes no liability for damages resulting from installation.

Installation instructions for seismic ratings are only recommendations. Final design must be determined by Structural Engineer of Record (SEOR) including requirements for curb construction, mounting of unit to curb and mounting of curb to structure.

Fan to Curb Mounting: 5/16 inch *(7.9 mm)* self-drilling fasteners are to be installed on each side of fan with one fastener 4 inches *(102 mm)* from each edge and one fastener in the center, Figure 10. Fasteners are to be equally spaced.



Fan Size	Fasteners per Side
≤ 160	3
180 to 240	5
≥ 300	9

Figure 10 - Fan to Curb Mounting

Optional Hinged Base Mounting: For installations that include the optional hinged base accessory, the fan must be secured to the hinged base and curb using the correct number of fasteners as shown in the "Fan to Curb Mounting" section. All fasteners must be installed through the curb cap of the fan, the hinged base, and the curb. All fasteners must be reinstalled after each time the fan is hinged open, see Figure 11.

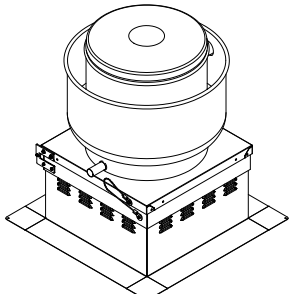


Figure 11 - Fasteners

Curb to Deck Mounting: Fasteners need to be located on all four sides of the curb, Figures 12a and 12b.

Figure 12a

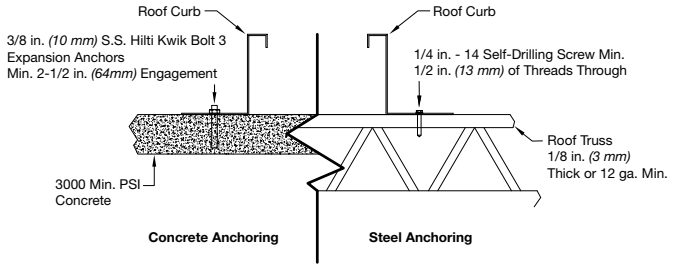
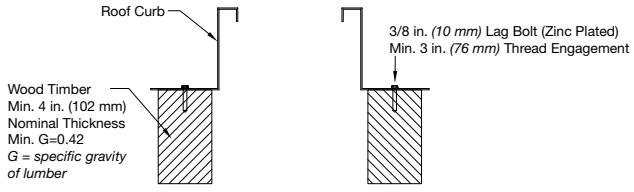


Figure 12b



Timber Anchoring

	High Wind Ratings				Seismic Ratings		
			Fasteners			Fasteners	
	Fan Size	Curb Cap Size inches *(millimeters)*	Per Side	Total	Fan Size	Per Side	Total
Steel	≤ 160	17x17 to 26x26 *(432x432 to 660x660 mm)*	3	12	060-240	2	8
	> 160	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	4	16	300-360	3	12
					420-480	5	20
Concrete	≤ 160	17x17 to 26x26 *(432x432 to 660x660 mm)*	3	12	060-240	2	8
	> 160	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	3	12	300-360	3	12
					420-480	5	20
Wood	≤ 160	17x17 to 26x26 *(432x432 to 660x660 mm)*	3	12	060-240	2	8
	> 160	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	4	16	300-360	3	12
					420-480	5	20

All dimensions are in inches *(millimeters)*.

Pre-Starting Checks

1. Check all fasteners and setscrews for tightness. The wheel should rotate freely and be aligned as shown in Figure 13.

Model Type		Model Size	G - Overlap inch *(mm)*	H - Gap inch *(mm)*
Direct	Belt			
X	–	060-095	–	3/32 *(2)*
X	X	099-240	1/4 *(6)*	–
X	X	300	1/2 *(13)*	–
–	X	360-480	3/4 *(19)*	–

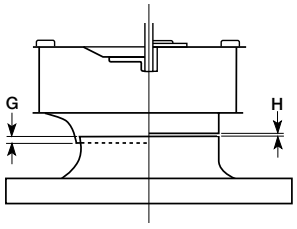


Figure 13
Wheel Overlap and Gap Dimension

2. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment and realignment may be necessary.

   Centering the wheel can be accomplished by loosening the bolts on the support pan and moving support pan until wheel is properly aligned. For units with drive frame mounting, loosen the bolts holding the drive frame to the vibration isolators and reposition the drive frame if additional movement is needed for wheel alignment.

   Wheel and inlet cone overlap can be adjusted by loosening the setscrews in the wheel hub and moving the wheel to the desired position. For direct and belt drive models with wheel hubs and shaft pulleys utilizing tapered bushing interface, reference page 9 for tapered bushing removal and move the wheel to the desired position.

3. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Figure 14 and correspond to the rotation decal on the unit. If wheel rotation is incorrect, reverse two of the wiring leads or check motor wiring for single phase. Fan RPM should be checked and verified with a tachometer.

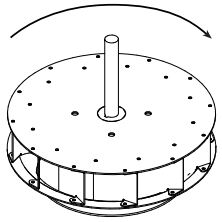


Figure 14

WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible motor burnout.

AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

Belt Drive Pre-Starting Belt Tension Checks

4. Always loosen tension enough to install belts without stretching. Do not force belt(s) *see* Figure 15. Forcing belts will break the cords and cause belt failure.

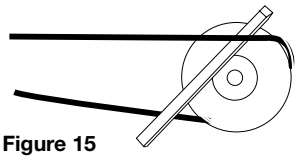


Figure 15

5. For units with two groove pulleys, adjust so the tension is equal in both belts.
6. If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss, see Figure 16.

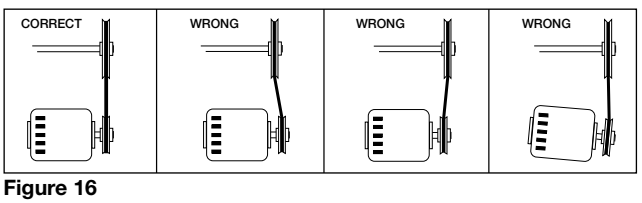


Figure 16

7. Belt tension can be adjusted by loosening four fasteners on the drive frame, see Figure 17. The motor plate slides on the slotted adjusting arms and drive frame angles in the same manner.

   Four (4) fasteners in total.

   Identical fasteners on opposing side must also be loosened.

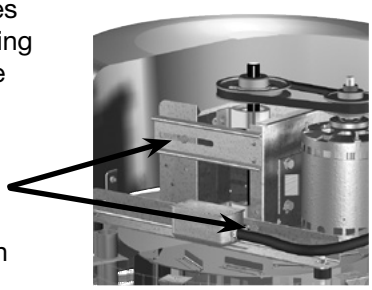


Figure 17

8a. **Sizes 099-160:** Belts should be tensioned just enough to prevent slippage at full load. Belts should have a slight bow on the slack side while running at full load; see Figure 18a.

8b. **Sizes 180-480:** Belt tension should be adjusted to allow 1/64 in. *(0.397 mm)* of deflection per inch of belt span. For example, a 15 in. *(381 mm)* belt span should have 15/64 in. *(5.95 mm)* (or about 1/4 in. *(6 mm)*) of deflection with moderate thumb pressure at mid-point between pulleys, see Figure 18b.

Figure 18a

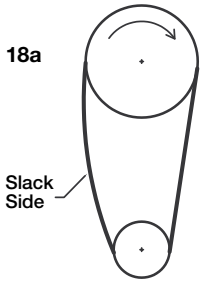
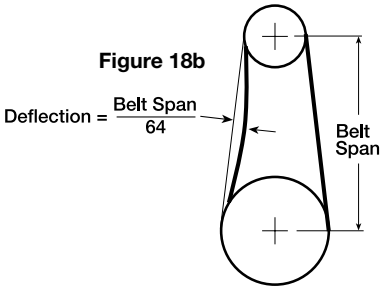


Figure 18b



9. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor pulley.
10. Any increase in speed represents a substantial increase in the horsepower required by the unit.
11. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

IMPORTANT
Over tightening belts will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

Operation

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in the wheel hub (or the tapered bushing and pulleys if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, reference Figure 14.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

IMPORTANT
Adjust (tighten) belt tension after the first 24-48 hours of operation.

Inspection

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval: Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval: Check all internal components. On belt drive unit only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance

DANGER
Disconnect and secure to the “off” position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.
WARNING
This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).
DANGER
Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l’alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.
AVERTISSEMENT
L’appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).
IMPORTANT
Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. Where motor temperatures do not exceed 104ºF *(40ºC)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

- When installing fans for restaurant exhaust applications follow NFPA 96 for cleaning fans.
- Grease containers must be emptied at regular intervals to prevent overflow.

A proper maintenance program will help these units deliver years of dependable service.

Powerpack Replacement

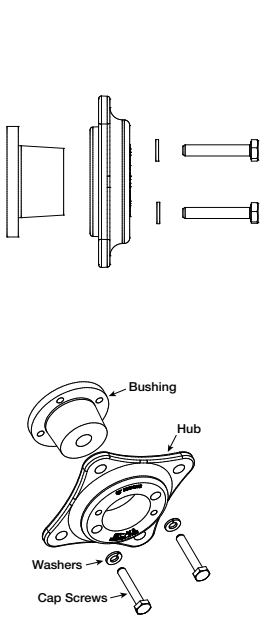
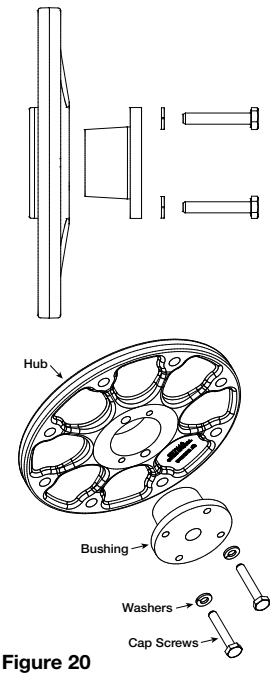
1. Ensure power is turned off to the fan.
2. Remove hood to gain access to motor compartment by pushing in two adjacent snap buttons and lifting.
3. Disconnect motor wiring and controls wiring (if present).
4. Remove the 4 or 6 screws which secure the powerpack in place.
5. Carefully lift out the powerpack while keeping the powerpack assembly centered to the housing so the wheel doesn't catch on the hoodband.
6. Set down the powerpack somewhere that won't be damaged by the metal components.
7. Pick up new powerpack and place into housing in the same orientation as the previous one.
   a. Be mindful of the conduit tube(s) coming through the hoodband, they should align with rounded clearance features in the powerpack.
8. If possible, spin the wheel by hand to check for wheel rub. If rubbing occurs, adjust powerpack accordingly until it stops.
9. Re-install the screws removed in step 4.
10. Reconnect any wiring that was disconnected in step 1 and restore power.
11. Turn on power to the fan. If no issues are detected, re-install the hood.

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible set ups for the tapered bushing, both have the same procedure, but orientation of the hub varies.

Tapered Bushing Removal (click for video):

1. If present, loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws which fasten the bushing to the hub as shown in the section views and examples of Figures 19-22.
3. **Standard Mounting:** Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting: Install the two socket head cap screws into the visibly threaded holes of the bushing flange.
4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Standard Mounting	Reverse Mounting
	
Figure 19	**Figure 20**
	
Figure 21 Standard Bushing Orientation	**Figure 22** Reverse Bushing Orientation

Bushing Installation

1. Clean all surfaces of hub and bushing to remove any oil or residue present and do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles, the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting:** Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting: Slide the wheel and hub assembly onto the fan shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and to a torque of 10 ft-lbs.

Belt and Bearing Maintenance

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen tensioning device enough to allow removal of the belt by hand.
4. Once installed, adjust belts as shown in "Pre-Starting Checks."
5. To ensure tightness, check pulley setscrews. Proper keys must be in keyways.
6. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys.
7. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All non-relubricating bearings on belt drive fans are factory lubricated and require no further lubrication under normal use (between -20º to 180ºF *(-29º to 82ºC)* in a relatively clean environment).
8. On belt drive fans, the standard cast pillow block bearings are factory lubricated and are provided with external grease fittings. Annual lubrication is recommended, or more frequently if needed, see Table 1. Do not over-grease. Use only one or two shots of lubricant with a hand gun. Maximum hand gun rating is 40 psi. Rotate bearings during lubrication where good safety practice permits. Caution should be employed to prevent over packing or contamination.
9. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent over packing or contamination.
10. Grease fittings should be wiped clean. The unit should be in operation while lubricating bearings. Extreme care should be used around moving parts.
11. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used (see Table 2).
12. During the first few months of operation, check bearing set screws periodically to ensure tightness.
13. If unit is to be left idle for an extended period, remove belts and store in a cool, dry place to avoid premature belt failure.

Recommended Bearing Lubrication Frequency in Months

NOTE

If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed in Table 2 may be used.

Table 1: Suggested Fan Bearing Lubrication Intervals

Interval (months)	Type of Service
1 to 3	Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.
3 to 6	12 to 24 hours per day, heavy duty, or if moisture is present
6 to 12	8 to 16 hours per day in clean, relatively dry atmosphere
12 to 18	Infrequent operation or light duty in clean atmosphere

Table 2: Grease Manufacturers

Manufacturer	Grease (NLGI #2)
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

NOTE

For replacement, the windband, vertical supports, drain trough and curb cap/venturi come as one complete assembly.

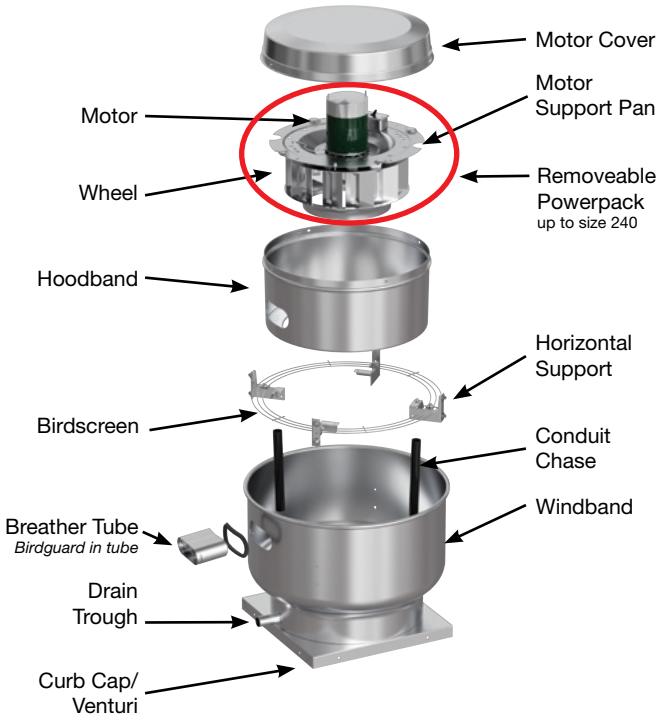
CAUTION

A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing mark for the fans approved usage.

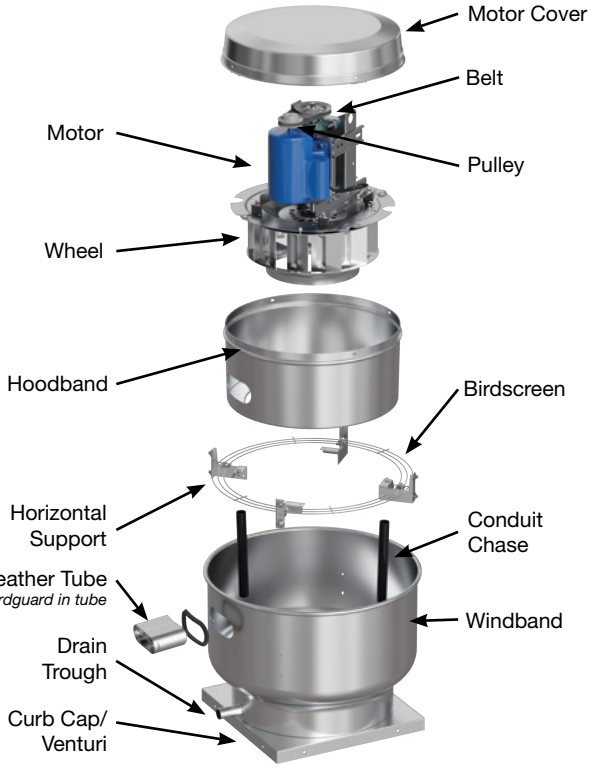
CAUTION

La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Direct Drive

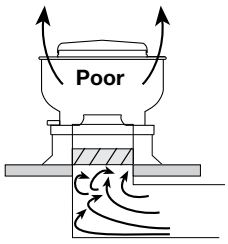


Belt Drive

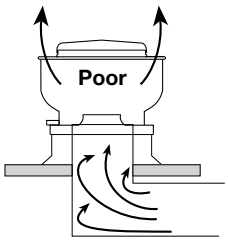


Fan Inlet Connections

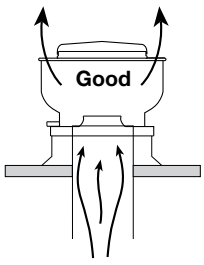
In order to ensure proper fan performance, caution must be exercised in fan placement and connection to the ventilation system. Obstructions, transitions, poorly designed elbows, improperly selected dampers, etc, can cause reduced performance, excessive noise and increased mechanical stress. For performance to be as published, the system must provide uniform and stable airflow into the fan.



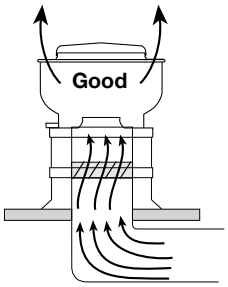
Dampers must open fully. Use motorized dampers in low airflow applications to reduce losses.



Avoid sharp turns or entrance conditions which cause uneven flow. Use turning vanes in elbows to reduce adverse effects.



Provide uniform airflow at fan inlet to ensure optimum performance.



Provide uniform airflow at fan inlet and through the damper to ensure optimum performance. Curb cap should be three wheel diameters from the radius. Use turning vanes in duct when possible.

Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel rubbing inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-belt drive	Tighten pulleys on motor/fan shaft. Adjust belt tension. Align pulleys properly, see page 7, Figures 15 and 16. Replace worn belts or pulleys.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Belts too tight or too loose	Adjust tension, see page 8, Figures 18a and 18b.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see page 7, Figure 13.
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks", pages 7 and 8.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Fan base not securely anchored	Secure properly.
	Motor hood loose and rattling	Tighten fasteners to secure the motor hood.
	Defective or loose motor bearings	Replace motor with same frame size, RPM-HP
High horsepower	Fan	Check rotation of wheel, see page 7, Figure 14. Reduce fan speed.
	Duct system	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan does not operate	Electrical supply	Check fuses/circuit breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys or belts.
	Motor	Ensure motor is correct horsepower and not tripping overload protector.
Motor overloads or overheats	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
	Belt slippage	Adjust tension or replace bad belts, see pages 7 and 8.
	Over/Under line voltage	Contact power company.
	Incorrect wheel rotation	Check motor wiring, see page 4, Figure 6. Confirm wheel rotation, see page 7, Figure 14.
	Wheel RPM too high	Check drives or slow down fan by opening variable pitch pulley on motor shaft.
	Undersized motor	Check motor ratings with catalog speed and air capacity chart.
	Motor wired incorrectly	Check motor wiring to wiring diagram located on fan motor.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown see page 7, Figure 14.
	Excessive dirt buildup on wheels	Clean wheel, see page 9.
	Improper wheel alignment	Center wheel on inlet, see "Pre-Starting Checks".
	Dampers closed	Inspect and repair.
	Blocked duct/clogged filter	Clean or replace.
	Belt slippage	Replace and adjust tension.
	Speed too slow	Check for correct drives.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Centrifugal Upblast and Sidewall Exhaust catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

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

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302-398

Vertical Multi-Stage Pump

Installation, Operation & Maintenance Manual

SUPERSEDES: NEW

EFFECTIVE: May 1, 2024

SAFETY REQUIREMENTS

This equipment should be installed and serviced by technically qualified personnel who are familiar with the correct selection and use of appropriate tools, equipment, and procedures. Failure to comply with national and local electrical and plumbing codes and within FPS recommendations may result in electrical shock or fire hazard, unsatisfactory performance, or equipment failure.

Know the product's application, limitations, and potential hazards. Read and follow instructions carefully to avoid injury and property damage. Do not disassemble or repair unit unless described in this manual.

Failure to follow installation or operation procedures and all applicable codes may result in the following hazards:

DANGER: Risk of death, personal injury, or property damage due to explosion, fire, or electric shock.

- **Do not use to pump flammable, combustible, or explosive fluids such as gasoline, fuel oil, kerosene, etc.**
- **Do not use in explosive atmospheres or hazardous locations as classified by the NEC, ANSI/NFPA70.**
- **Do not handle a pump or pump motor with wet hands or when standing on a wet or damp surface, or in water.**

WARNING: Risk of severe injury or death.

- **To reduce risk of electrical shock, disconnect power before working on or around the system. More than one disconnect switch may be required to de-energize the equipment before servicing.**
- **Check local electrical and building codes before installation. The installation must be in accordance with their regulations as well as the most recent National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).**
- **Wire pump system for correct voltage.**
- **Ensure that the system is properly grounded all the way to the service entrance panel.**
- **Use only labeled tie down points to secure unit for transportation. Failure to use labeled tie down points could lead to equipment damage and/or allow unit to come loose during transit and cause injury or death.**
- **This pump has not been investigated for use in swimming pool or marine areas.**
- **Employ a licensed electrician.**

CAUTION: Risk of bodily injury, electric shock, or equipment damage.

- **This equipment must not be used by children or persons with reduced physical, sensory or mental abilities, or lacking in experience and expertise, unless supervised or instructed. Children may not use the equipment, nor may they play with the unit or in the immediate vicinity.**
- **Equipment can start automatically. Lockout-Tagout before servicing equipment.**
- **Do not let the unit freeze. Freezing may cause cracking or distortion that may destroy the unit.**
- **For use with maximum 248 °F (120 °C) water. Must be installed by experienced professionals only.**
- **The pump has been evaluated for use with water only. Pump should only be used with liquids compatible with pump component materials. If the pump is used with liquids incompatible with the pump components, the liquid can cause failure to the electrical insulation system resulting in electrical shock.**
- **Pump may become hot during operation.**
- **Pumps can develop very high pressure in some situations.**
- **Check that lifting equipment complies with all safety rules, and is suitable to support the weight of the pump.**
- **Operation of this equipment requires detailed installation and operation instructions provided in this manual for use with this product. Read entire manual before starting installation and operation. End User should receive and retain manual for future use.**
- **Keep safety labels clean and in good condition.**

NOTICE: Risk of damage to pump or other equipment.

- **Periodically inspect pump and system components. Regularly check piping for weakness or wear, making certain that all connections are secure.**
- **Schedule and perform routine maintenance as required and in accordance with the Maintenance section of this manual.**
- **If the pump package is dropped, impacted, or otherwise mishandled, malfunction can occur.**

PRODUCT INFORMATION

The Vertical Multi-Stage booster pump is available in 1-95 m3/h options with all 316 stainless steel hydraulics for superior durability, efficiency, and performance. A small footprint, premium motor, and rugged components ensure this booster pump is capable of a long operating life to provide water pumping solutions in nearly any tough application.

The Vertical Multi-Stage pump is designed for professional use applications involving clean water or similar liquids, characterized by the following:

- a density of 1030 kg/m3
- no more than 50 g/m3 sand content
- 2 cPs maximum viscosity
- suspended solids no larger than 2 mm maximum

The application's room temperature should not exceed 104 °F (40 °C) up to 1000 m altitude. The electrical supply voltage must not deviate more than 6% from the motor rating.

Item	NEMA 56	NEMA 182/184	NEMA 213/215	NEMA 254/256	NEMA 284/286	NEMA 324/326 & 364/365
Coupling attachment hardware	10.5±1 Nm	24±2 Nm	24±2 Nm	50±3 Nm	50±3 Nm	50±3 Nm
Filling Plug w/ Needle Pin	30±2 Nm	30±2 Nm	30±2 Nm	30±2 Nm	30±2 Nm	30±2 Nm
Filling Plug Needle Pin	10±1 Nm	10±1 Nm	10±1 Nm	10±1 Nm	10±1 Nm	10±1 Nm
Filling Plug w/out Needle Pin	-	20±2 Nm	20±Nm	20±Nm	20±Nm	20±Nm
Motor Attachment Screw	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm
Coupling Guard Screws	5±1 Nm	5±1 Nm	5±1 Nm	5±1 Nm	5±1 Nm	5±1 Nm
Cartridge Seal	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm	40±2 Nm
Cartridge Seal Set Screws	3 +1/-0 Nm	3 +1/-0 Nm	3 +1/-0 Nm	3 +1/-0 Nm	3 +1/-0 Nm	3 +1/-0 Nm
Motor Flange Screw	-	16±1 Nm	16±1 Nm	40±2 Nm	40±2 Nm	75±5 Nm
Motor Bracket Screws, T30-T95 only	-	40±3 Nm	40±3 Nm	40±3 Nm	40±3 Nm	40±3 Nm
Bolt Fastener	50±5 Nm	50±5 Nm	50±5 Nm	50±5 Nm	-	-
Tie Bolt Fastener	-	100±5 Nm	100±5 Nm	100±5 Nm	100±5 Nm	100±5 Nm
Drain and Priming Cap, T01/T03/T06/T10 & T15/T20	30±2 Nm	30±2 Nm	30±2 Nm	30±2 Nm	-	-
Drain and Priming Cap, T30-T95 only	-	20±2 Nm	20±2 Nm	20±2 Nm	20±2 Nm	20±2 Nm

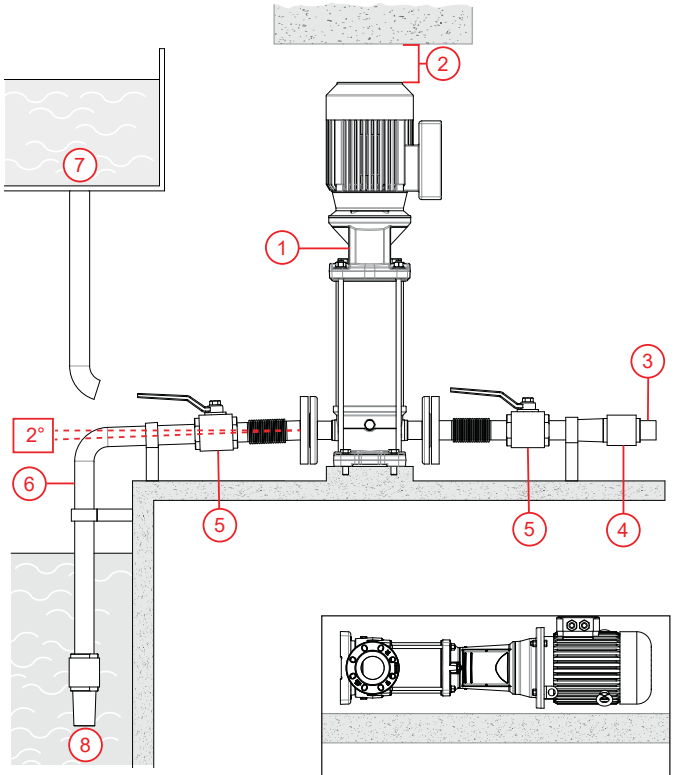
INSTALLATION

Surface pump applications must always take into account NPSH (Net Positive Suction Head), maximum pressure, minimum rated capacity, and other product specifications. Consult the product catalog at www.TacoComfort.com.

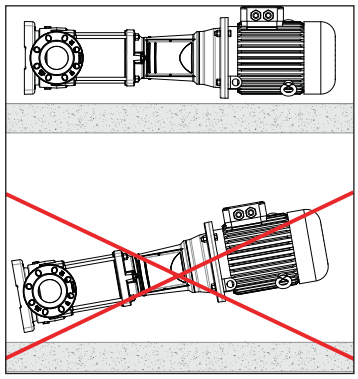
IMPORTANT: Refer to the motor manufacturer for motor hazards, installation, operation, and maintenance.

TYPICAL INSTALLATION

IMPORTANT: Always install the pump-motor vertically with the motor above the pump, except in a properly-supported horizontal installation.



1. Vertical Multi-Stage Pump
2. 4-inch (10.2 cm) clearance minimum
3. Discharge line
4. Check valve
5. Gate valve
6. Suction line
7. Flooded suction installation
8. Suction lift installation



PUMP LOCATION

CAUTION: Risk of bodily injury or damage to pump or other equipment.

- **Check that lifting equipment complies with all safety rules, and is suitable to support the weight of the pump.**

IMPORTANT: If high pressure units are installed, the high pressure pump must be placed second in the flow path.

- Install the pump in a clean, dry, and ventilated location shielded from direct sun and precipitation.
- Provide adequate room for future servicing, protection from freezing temperatures, flooding, and equipment drainage.
- Bolt unit down evenly on a good foundation, preferably concrete, to prevent unnecessary stresses from pump movement.
- Install as close as possible to water source to minimize suction piping length.

PIPING INSTRUCTIONS

NOTICE: Risk of damage to pump or other equipment.

- **Properly support all suction and discharge piping to avoid strain on the pump.**

- Ensure piping matches the pump inlet and outlet connection sizes.
- Calculate the maximum distance allowable between the pump and water source, and pipe accordingly.
- For long runs, increase connections by one pipe size.
- The use of pipe thread sealant is recommended.
- Use flexible hoses or expansion joints.
- Avoid the use of unions on the suction line if possible.
- Do not over-tighten piping connections.
- Include a gate valve and check valve in the discharge line.

Suction Line

- Set up piping in suction lift applications to rise vertically, or in a continual slope of 2° or greater, from the water source.
- Ensure there are no high spots that cannot be evacuated of air during the priming process.
- All suction line connections must be airtight.
- Include a gate valve.

OPERATION

WARNING: Risk of severe injury or death by electrical shock, high temperatures, or pressurized fluids.

- **To minimize risk of electrical shock, disconnect power before working on or around the system.**
- **Do not continuously run pump against closed discharge. Release all system pressure before working on any component.**

NOTICE: Risk of damage to pump or other equipment.

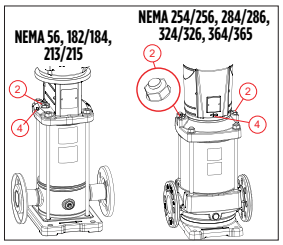
- **Do not let the unit run dry (without liquid). It is designed to be cooled by pumping fluid. The seal may be damaged and the motor may fail if the pump is allowed to run dry.**

Priming the Pump

NOTE: it may be necessary to remove the coupling cover guards during priming. Refer to “Maintenance” on page 3.

Flooded Suction Installation

1. Ensure the discharge line gate valve is closed.
2. Loosen the needle pin on the filling plug.
3. Open the inlet discharge gate valve.
4. Allow water to enter until it comes out the filling plug.
5. Tighten the needle pin on the filling plug.
   - Refer to “Torque Specifications” on page 2.



Suction Lift Installation

NOTE: Ensure the suction gate valve remains open.

1. Close the discharge gate valve.
2. Remove the filling plug(s).
3. Fill the pump and suction line with water.
4. Rotate motor shaft to let air in casing escape, following the pump rotation arrow.
5. Refill the pump and suction line with water.
6. Reattach the filling plug(s).
   - Refer to “Torque Specifications” on page 2.

Starting the Pump

1. Check pump rotation.
   - If direction is wrong, interchange any two of three wires either at the motor or starter.
2. Close all system outlets.
3. Slightly open one system outlet to allow excess air to bleed out of the system.
4. Start the pump.
5. Gradually open the discharge valve halfway.
   - Several starting attempts may be necessary to expel all air from the pump and suction lines.
   - After initial start-up, pump operation ought to be smooth and quiet.
   - If water is not delivered within seconds, stop the motor and prime again. Refer to “Priming the Pump” on page 3.
6. Once the pump is fully functioning, completely open the discharge valve and system outlets.

MAINTENANCE

WARNING: Risk of severe injury or death by electrical shock, high temperatures, or pressurized fluids.

- **To minimize risk of electrical shock, disconnect power before working on or around the system.**
- **Do not continuously run pump against closed discharge. Release all system pressure before working on any component.**

NOTICE: Risk of damage to pump or other equipment.

- **Do not let the unit run dry (without liquid). It is designed to be cooled by pumping fluid. The seal may be damaged and the motor may fail if the pump is allowed to run dry.**
- **Drain the pump, water tanks, and all piping exposed to freezing temperatures.**

NOTE: For replacement parts, visit www.TacoComfort.com.

Draining the Pump

NOTE: To remove all liquid, completely disassemble the pump.

1. Close the suction and discharge gate valves.
2. Release pump pressure.
3. Partially unscrew the needle pin on the filling plug.
4. Completely remove the drain and priming cap.
5. Allow the water to drain.
6. Fully tighten the drain and priming cap and the needle pin on the filling plug.
   - Refer to “Torque Specifications” on page 3.

Periodic Service

NOTICE: Risk of damage to pump or other equipment.

- **Periodic service of the pump should only be done by certified or licensed professionals. Inspect the pump system condition and operation after the first 500 hours of work and every month after - more frequently in heavy use applications.**

NOTE: Check guards and safety devices daily for proper operation.

1. Observe the unit during normal operation to notice any odd noises, vibrations, loose or rubbing parts, etc.
   - Service immediately if any unusual noise, leaks, or vibrations develop.
2. Disconnect power.
3. Check the power cords and electrical outlet/control panel for damage or corrosion.
   - If the pump cord is damaged, replace pump.
   - If the electrical outlet/control panel is damaged or corroded, employ a licensed electrician to replace the affected parts.
4. Check for seal wear indicators.
   - Remove a cover guard.
   - Inspect the shaft passage for any liquid leaks.

Disassembly

1. Unscrew the coupling guard screws and remove the coupling guards.
2. Loosen the set screws of the cartridge seal a quarter-turn.
3. Unscrew and remove the coupling attachment hardware.
   - For NEMA 56 - NEMA 213/215, set aside the extractable half of the coupling.
   - For NEMA 254/256 - NEMA 364 - 365, set aside the two halves of the coupling.
4. Remove the pin from the pump shaft.

NOTE: To remove the cartridge seal without removing the motor, omits steps 6-8.

5. Unscrew and remove the motor attachment screws.
6. Remove the motor.
7. Loosen any motor flange screws and remove the thrust bearing.

NOTE: NEMA 56 builds do not have motor flange screws.

8. Unscrew and remove the cartridge seal.

Reassembly

NOTE: Refer to “Torque Specifications” on page 2.

Cartridge Seal & Thrust Bearing Reassembly

NOTE: If a cartridge seal for NEMA 254-365 motors was replaced without disassembling the motor, omit 4-6.

1. Lubricate the shaft and threads with cleaning alcohol.
   - Wipe away any residues.
2. Insert new cartridge seal and tighten to the appropriate torque.
3. Tighten the set screws of the cartridge seal.
4. Apply white-knight anti-seize to the face of the thrust bearing flange.
5. Align the flange with the threaded holes of the coupling housing.
6. Tighten any motor flange screws.

NOTE: NEMA 56 assemblies do not have motor flange screws.

Motor and Coupling Reassembly

NEMA 56 - NEMA 213/215

1. Grease the entire motor shaft’s surface.
2. Position the motor on the pump thrust bearing assembly.
3. Install the motor attachment screws.
4. Insert the coupling pin into the extractable half of the coupling.
5. Install the pin and extractable piece of the coupling.
6. Tighten the coupling hardware to the appropriate torque, keeping the two coupling halves symmetrical.
7. Ensure the impeller spins freely, spinning it by hand and listening for interference.
8. Assemble the coupling cover guards.

NEMA 254/256 - NEMA 364/365

NOTE: If a cartridge seal for NEMA 254-365 motors was replaced without disassembling the motor, omit steps 1-3.

1. Grease the entire motor shaft’s surface.
2. Position the motor on the pump thrust bearing assembly.
3. Install the motor attachment screws.
4. Insert the pin into the pump shaft.
5. Engage one half of the coupling to the motor shaft’s shoulder.

IMPORTANT: The coupling must remain in position once released.

6. Arrange the second coupling half to the motor shaft.
7. Tighten the coupling attachment screws to the appropriate torque, keeping the two coupling parts symmetrical.
8. Ensure the impeller spins freely, spinning it by hand and listening for interference.
9. Assemble the coupling cover guards.

TROUBLESHOOTING

Problem	Probable Causes	Corrective Action
Motor fails to start or not running	Motor thermal protector tripped	Correct cause for high amperage, such as low voltage or excessive pumping.
	Open circuit breaker or blown fuse	Check electric wiring and motor for short circuits and correct.
	Impeller binding	Remove pump case and check for debris.
	Motor improperly wired	Check complete suction line and all fittings for air leaks and verify foot valve has adequate submergence.
	Defective motor	Take to an authorized motor shop for repair or replacement.
Little or no discharge	Pump is not primed: air or gases in pumpage	Check suction line and foot valve for leaks. Make sure that water level has not dropped to uncover suction inlet. Prime pump.
	Discharge or suction plugged or valve closed	Clear obstructions from suction and discharge lines.
	Incorrect rotation (3 Phase only)	Interchange any two of three wires either at the motor or starter.
	Low voltage or phase loss	Correct incoming power to match motor nameplate requirements.
	Impeller worn or plugged	Clean or replace impeller.
	System head too high	Reduce system head (back-pressure on pump) or resize pump.
	Excessive suction lift or losses, or NPSHA too low for the pump	Locate pump closer to the water source, increase pipe size or resize pump.
Low pump capacity or pressure	Valves in suction or discharge lines partially closed	Open valves to reduce possible restrictions.
	Suction or discharge line partially plugged	Clear obstructions from discharge line.
	Wrong pump rotation	Correct to proper rotation.
Excessive power consumption	Impeller binding	Remove pump case and check for debris.
	Discharge head too low creating excessive flow rate	Close down discharge valve to increase pressure and throttle back flow rate.
	Fluid viscosity: specific gravity too high	Modify fluid properties or resize pump.
Excessive noise and vibration	Impeller binding	Remove pump case and check for debris.
	Pump is not primed: air or gases in pumpage	Check complete suction line and all fittings for air leaks and verify foot valve has adequate submergence.
	Discharge or suction plugged or valve closed	Clear obstructions from suction and discharge lines.
	Impeller worn or plugged	Clean or replace impeller.

LIMITED WARRANTY STATEMENT

Taco, Inc. (Taco) will repair or replace without charge (at the company's option) any product or part which is proven defective under normal use within one (1) year from the date of start-up or one (1) year and six (6) months from date of shipment (whichever occurs first).

Motors provided on commercial pumps are not covered by this warranty, and are warranted by the motor manufacturer. For complete details on motor warranty returns, the purchaser should contact the motor manufacturer's local service repair center or contact the motor manufacturer directly.

Seals provided on commercial pumps are not covered by this warranty.

In order to obtain service under this warranty, it is the responsibility of the purchaser to promptly notify the local Taco stocking distributor or Taco in writing and promptly deliver the subject product or part, delivery prepaid, to the stocking distributor. For assistance on warranty returns, the purchaser may either contact the local Taco stocking distributor or Taco. If the subject product or part contains no defect as covered in this warranty, the purchaser will be billed for parts and labor charges in effect at time of factory examination and repair.

Any Taco product or part not installed or operated in conformity with Taco instructions or which has been subject to accident, disaster, neglect, misuse, misapplication, inadequate operating environment, repair, attempted repair, modification or alteration, or other abuse, will not be covered by this warranty.

Taco products are not intended for use to support fire suppression systems, life support systems, critical care applications, commercial aviation, nuclear facilities or any other applications where product failure could lead to injury to person, loss of life, or catastrophic property damage and should not be sold for such purposes.

If in doubt as to whether a particular substance is suitable for use with a Taco product or part, or for any application restrictions, consult the applicable Taco instruction sheets or contact Taco at 401-942-8000.

Taco reserves the right to provide replacement products and parts which are substantially similar in design and functionally equivalent to the defective product or part. Taco reserves the right to make changes in details of design, construction, or arrangement of materials of its products without notification.

TACO OFFERS THIS WARRANTY IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ANY WARRANTY IMPLIED BY LAW INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESS WARRANTY SET FORTH IN THE FIRST PARAGRAPH ABOVE.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR STATUTORY, OR ANY OTHER WARRANTY OBLIGATION ON THE PART OF TACO.

TACO WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS OR ANY INCIDENTAL COSTS OF REMOVING OR REPLACING DEFECTIVE PRODUCTS.

This warranty gives the purchaser specific rights, and the purchaser may have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or on the exclusion of incidental or consequential damages, so these limitations or exclusions may not apply to you.

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