

M-D Pneumatics™

PD PLUS®

Rotary Positive Displacement Blower

Series 17/46 - Lip-Labyrinth (Air Service)

Series 57/81 - Single Envelope Gastight

Series 64/67 - Double Envelope Gastight

(obsolete 16/47 series also included in this manual)

Models	4006	5507	5514
	4009	5509	5516
	4012	5511	5518
		5520	

INSTALLATION OPERATION MAINTENANCE REPAIR MANUAL



2014 1011 ORIGINAL LANGUAGE - ENGLISH



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1. INTRODUCTION

CONGRATULATIONS on your purchase of a new **PD PLUS™ Rotary Positive Displacement Blower** from **Tuthill Vacuum & Blower Systems**. Please examine the blower for shipping damage, and if any damage is found, report it immediately to the carrier. If the blower is to be installed at a later date make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If blower is stored outdoors be sure to protect it from weather and corrosion.

PD PLUS blowers are built to exacting standards and if properly installed and maintained will provide many years of reliable service. We urge you to take time to read and follow every step of these instructions when installing and maintaining your blower. We have tried to make these instructions as straightforward as possible. We realize getting any new piece of equipment up and running in as little time as possible is imperative to production.



NOTE

Record the blower model and serial numbers of your machine in the OPERATING DATA form on the inside back cover of this manual. You will save time and expense by including this reference identification on any replacement part orders, or if you require service or application assistance.

1.1 APPLICABLE DOCUMENTATION

The applicable documents associated with this manual are:

- 2006/42/CE – Machinery Directive
- EN 1012-1:1996 - Compressors and vacuum pumps - Safety Requirements - Part 1: Compressors

1.2 SCOPE OF MANUAL

The scope of this manual and the Declaration of Incorporation includes the bare shaft rotary positive displacement blower.

2. CONVENTIONS AND DATA PLATE

2.1 GRAPHIC CONVENTIONS IN THIS MANUAL

This manual is the result of a risk assessment according to the applicable documents referenced in section 1.1. The following are hazard levels are referenced within this manual:

DANGER

Indicates an immediate hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates that a physical injury or damage to health or property, if not avoided, could occur.

CAUTION






Indicates that a potential hazard may occur which, if not avoided, could result in minor or moderate injury.



NOTE
Indicates a statement of information which, if not avoided, could cause damage to the product.

CAUTION
Read manual before operation or bodily harm may result. Attention should be given to the safety related sections of this manual.

2.2 DATA PLATE

MODEL NUMBER	SERIAL NUMBER	MAWP	YEAR
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
		Tuthill Vacuum & Blower Systems 4840 West Kearney Street Springfield, Missouri USA 65803	
MAX RPM		<input type="text"/>	
READ INSTRUCTION MANUAL BEFORE OPERATION OR BODILY HARM MAY RESULT			
 WARNING Keep body & clothing away from machine openings.	 WARNING Do not operate without guards in place.	 CAUTION Hearing protection required.	 CAUTION Do not touch hot surfaces.
http://www.tuthill.com		(800) 825-6937	
		Made in the USA	

General Operation and Symbols on Data Plate - The following information is contained on the data plate:



WARNING
Keep body & clothing away from machine.
During operation, keep body and clothing away from inlet and outlet of the blower.



WARNING
Do not operate without guards in place.



CAUTION
Hearing protection is required while the blower is in operation. Noise levels may reach as high as 81 dBA.



CAUTION
Do not touch hot surfaces.
The upper limit of the blower operation is 400° F (205° C). Do not touch the blower while it is in operation and assure blower is cool when not in operation.

MODEL NUMBER: This identifies the specific model of the blower.

SERIAL NUMBER: Each blower has a unique serial number. This number is to be used with any service issues and with any contact with the manufacturer.

YEAR: This states the year that the blower was manufactured.

MAWP: This states the maximum allowable working pressure (MAWP) of the blower casing. This is NOT the allowable maximum pressure differential. When determining the pressure differential, the inlet pressure shall be taken into account to assure that the MAWP is not exceeded.

The standard MAWP is per Table 2. The MAWP shall not be exceeded unless specific factory testing of the pressure containing components of the blower has been performed.

Contact the factory for testing and documentation if this pressure is to be exceeded.

3. LIFTING



WARNING

The blower must be handled using an appropriate device such as a fork truck or appropriate lifting device. See Table 1 for approximate weights. Care should be taken to assure blower does not over-turn during handling and installation.

4. DESCRIPTION



NOTE

Refer to specific data sheets for flow capacities and vacuum capacities.



NOTE

Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

Tuthill Vacuum & Blower Systems model 4000 and 5500 Series rotary lobe blowers are positive displacement type units, whose pumping capacity is determined by size, operating speed, and differential pressure conditions. Blowers employ rotors rotating in opposite directions within a housing closed at the ends by end plates.

Effective sealing of the inlet to the discharge is accomplished through the use of very small operating clearances. The resulting absence of moving contact eliminates the need for any internal lubrication.

Clearances between the rotors during rotation are maintained by a pair of accurately machined helical timing gears, mounted on the two shafts extended outside the air chamber. The intermeshing rotary lobes are designed to rotate and trap air or gas between each rotor and the housing. As the rotor lobes rotate past the edge of the suction port, the trapped air or gas is essentially at suction pressure and temperature. Since the blower is a constant volume device, the trapped air remains at suction pressure until the leading rotor lobe opens into the discharge port. The close clearances between the rotors inhibit back slippage of the trapped volume from between the rotors and the trapped volume is forced into the discharge piping. Compression occurs not internal to the blower, but by the amount of restriction, either downstream of the blower discharge port, or upstream of the blower inlet port.

Figure 1 illustrates that the air moves not between the rotors but between the rotors and the side of the housing. Also, the machine is bi-directional, meaning that the direction of rotation of the blower can make either side the inlet or discharge. See also the *Flow Direction by Rotation* section below.

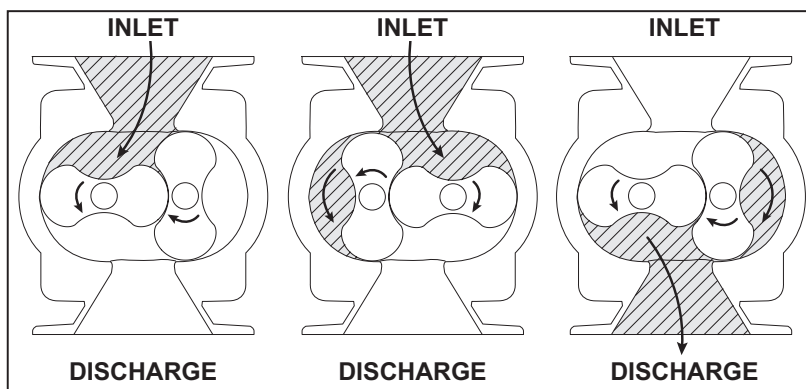


Figure 1 - Illustration of general operation principle

No attempt should ever be made to control capacity by means of a throttle valve in the intake or discharge piping. This will increase the power load on the drive system, increase operating temperatures, and can overload and/or seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, then an adequate vacuum relief valve must be installed near the blower. A pressure type relief valve in the discharge line near the blower is also strongly recommended for protection against cutoff or blocking in this line. Check valves should also be used on every blower when more than one blower is connected to a discharge line. This is for both safety and operating conditions.

When a belt drive is employed, blower speed, if necessary, can usually be adjusted to obtain desired capacity by changing the diameter of one or both sheaves, or by using a vari-speed motor pulley. In a direct coupled arrangement, a variable speed motor or transmission is required, or excess air or gas may be blown off through a manually controlled unloading valve and silencer. Gas units can use bypasses, but some applications may require additional cooling. If there is a large volume of high pressure air or gas downstream of the blower, a check valve in the piping downstream of the blower will protect the blower from overspeeding in a backward direction upon shutdown.

Consult your Tuthill Vacuum & Blower Systems sales professional if questions arise.

4.1 FLOW BY DIRECTION



WARNING

Refer to diagrams in this manual for proper rotation and orientation in inlet and discharge.

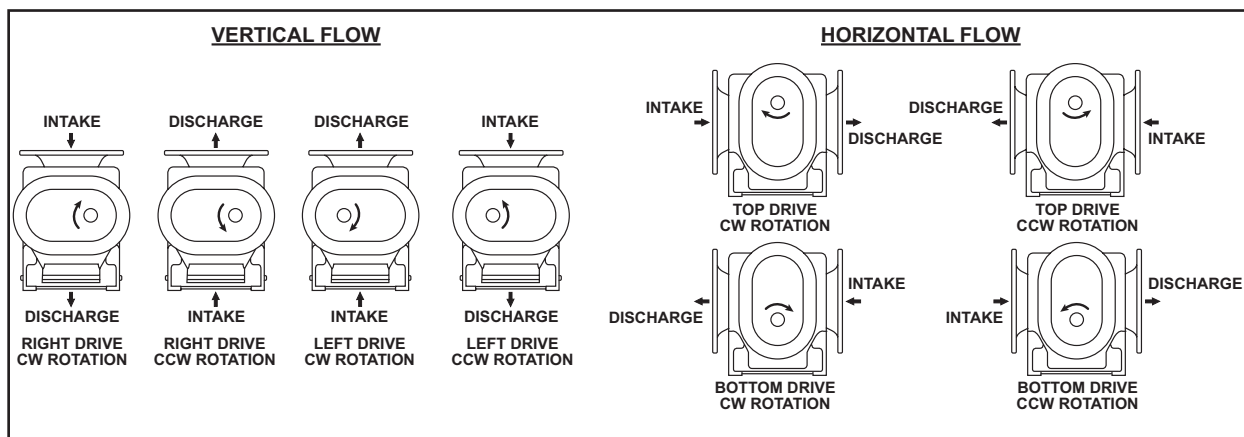


Figure 2 - Flow Direction by Rotation

4.2 SPECIFICATIONS

TABLE 1 — SPECIFICATIONS

MODEL	APPROXIMATE OIL CAPACITY FLUID OUNCES / LITERS				APPROXIMATE WEIGHT LBS. / KG		
	VERTICAL FLOW 46/81/67		HORIZONTAL FLOW 17/57/64		17/46	57/81	64/67
	GEAR (DRIVE) END	BACK END	GEAR (DRIVE) END	BACK END			
4006	24 / 0.70	24 / .070	14 / 0.42	14 / 0.42	170 / 77	180 / 82	185 / 84
4009					200 / 91	210 / 96	215 / 84
4012					225 / 182	235 / 107	240 / 109
5507	57 / 1.7	57 / 1.7	32 / 0.95	32 / 0.95	400 / 182	415 / 189	420 / 191
5509					420 / 191	435 / 197	440 / 220
5511					460 / 209	475 / 216	480 / 218
5514					500 / 227	515 / 234	520 / 236
5516					540 / 245	555 / 252	560 / 255
5518					580 / 264	595 / 270	600 / 273
5520					610 / 277	625 / 284	630 / 286

TABLE 2 — MAXIMUM OPERATING LIMITS

MODEL	MAXIMUM RPM	MAXIMUM PRESSURE DIFFERENTIAL psi / mbar	MAXIMUM VACUUM in. Hg / mbar	MAXIMUM TEMPERATURE RISE °F / °C	MAWP psi / bar
4006	3600	15 / 1035	15 / 508	300 / 167	100 / 6.9
4009		18 / 1241*	17 / 575	360 / 200*	
4012		15 / 1035	15 / 508	300 / 167*	
5507	3600	18 / 1241*	17 / 575	360 / 200*	
5509		18 / 1241*	17 / 575	360 / 200*	
5511		17 / 1172	17 / 575	360 / 200*	
5514		13 / 896	15 / 508	300 / 167	
5516		12 / 827	15 / 508	260 / 144	
5518		10 / 690	15 / 508	200 / 111	
5520		8 / 551	12 / 406	180 / 100	

* High pressure option



WARNING

The maximum pressure differential is based on the difference between the inlet pressure and the outlet pressure. The maximum pressure differential shall not be exceeded. Exceeding the maximum pressure differential will cause serious damage to the equipment and could cause bodily injury.



WARNING

The maximum allowable working pressure (MAWP) is based on the absolute pressure of the blower housing and is NOT the maximum allowable pressure differential. Exceeding the MAWP will cause serious damage to the equipment and could cause bodily injury.

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation. Maximum limits for pressure, temperature and speed are specified here for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any one of these limits.



5. INSTALLATION

5.1 GENERAL



NOTE

Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown within the *Assembly Clearances* table, will not have the operating limits specified here. Contact your Tuthill Vacuum & Blower Systems sales representative for specific information.

NOTE

Special attention must be paid when a blower has a higher than standard ambient suction temperature. Special recommendations for operating parameters and/or additional cooling may be recommended. Consult the factory or local representative for appropriate information.

DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.

DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.

WARNING

The bare shaft blower can generate excessive noise. Methods to reduce the noise levels by installing inlet and outlet silencers will be required. Even with inlet and outlet silencers, hearing protection will be required.

WARNING

Customers are warned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards in the installation and operation of this equipment in the system or facility.

WARNING

The standard MAWP is per Table 2. The MAWP shall not be exceeded unless specific factory testing of the pressure containing components of the blower has been performed.

WARNING

Table 2 states the maximum operating speed in RPM (rotations per minute) and maximum temperature. Do not exceed these limits. The installation of the blower shall take these critical operating parameters into account and adequate control features implemented.

WARNING

Upon completion of the installation, and before applying power, rotate the drive shaft by hand. It must move freely. If it does not, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment or any other cause of binding. If blower is removed and still does not move freely, check inside the blower housing for foreign material.



NOTE

Remove the protective covers from the shaft and inspect for damage.

Carefully check to ensure that no transit damage has been sustained. If damage has occurred from shipment a claim must be filed with the carrier immediately; preserve the shipping container for inspection by the carrier.



NOTE

In the event that your unit sustains damage while being shipped to your facility, do not return it to the factory without first obtaining shipping instructions from us.

Protective covers and plugs should not be removed until the connection is being made. Mount the blower on a flat, level surface. We recommend a baseplate that is a rigid, solidly supported, and structurally sound. Shim under the legs where necessary so that each leg of the blower supports an equal share of the blower weight. This is necessary to prevent eventual twisting of the blower. Make sure feet rest evenly on the mounting surface before fastening down. Twisting or cramping the blower in mounting will cause rotor contact and binding during operation, resulting in a condition called “soft foot”. (See the *Soft Foot* section of this manual for further details and preventative measures.)

A unit that is factory mounted on a base, should not require the above adjustments. However, since the assembly can become twisted in shipping or installation, checking for soft foot should be done after installation of the base. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. The base should be mounted on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly. (Also refer to the *Foundation* section.)

Transmission of small operating vibrations to a support structure may be objectionable in some cases. Use of vibration isolators or vibration absorbing materials can be effective in overcoming this problem. To avoid casing distortion, the treatment used should be applied under the common motor/blower base or mounting plate, rather than directly under the feet alone.

Piping should be accurately squared with the blower and supported independently. Stress imparted from incorrectly aligned piping or mounting will create problems with bearing and seal life, possibly leading to premature internal contact. The blower should sit stress free and evenly on its supporting surface. Care should be taken to evenly tighten the mounting bolts to not impart undue stress into the blower. Stress can be checked in a free state with feeler stock or verified on a previously installed blower with the aid of a dial indicator. Less than .002" (.05 mm) spring or gap should be found.

Use only clean new pipe and make certain it is free of scale, cuttings, weld beads, dirt, or any other foreign material. To guard against damage to the blower, insure that an inlet filter is used. Make provisions to clean the filter of collected debris after a few hours of operation and periodically thereafter. (See the *Piping Connections* section for additional details.)

Figure 3 shows a typical complete installation of blower and accessories. Note the absence

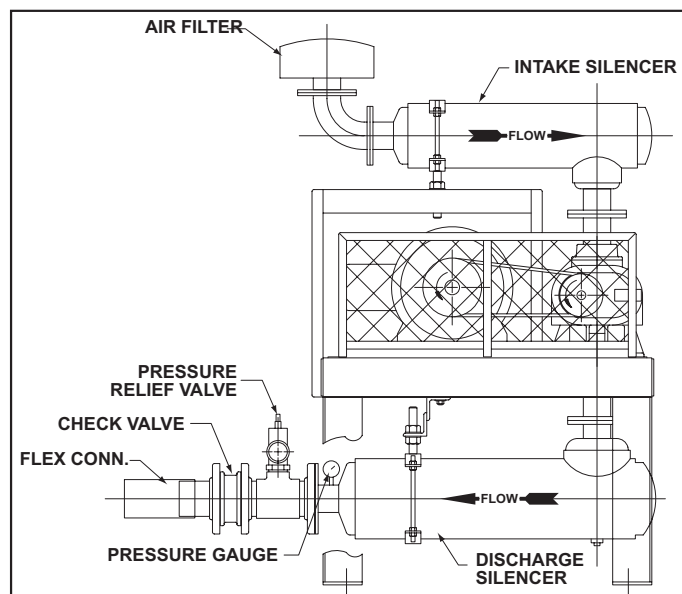


Figure 3 - Typical Blower Installation

of throttle or shut-off valves in either discharge or intake piping. If it is possible for air flow to be cut off in either of these lines, make provisions to add a pressure and/or vacuum relief valve. In some installations, it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. Weight of accessories and piping must be kept to a minimum to prevent blower casing distortion. Weights in excess of 10% of blower weight should be supported independently of blower and connected with a flexible hose or connectors. (The approximate weight of your unit is included within the *Specifications* table.)

A blower may be driven by direct-coupling to the driver or by V-belt drive, to obtain other speeds within approved range. (See the *Motor Drives* section for more information.)

Blowers from Tuthill Vacuum & Blower Systems are internally and externally treated after factory assembly and testing to protect against rusting in normal atmospheric conditions prior to installation. The maximum period of internal protection is considered to be up to 6 months under average conditions, provided closing plugs and seals are not removed. Protection against chemical or salt water atmosphere is not provided. Avoid opening the blower until ready to begin installation, as protection will be quickly lost due to evaporation. (For recommended preparations for long term storage (longer than 6 months), please see the *Long Term Storage* section in this manual.)

5.1.1 LOCATION

Install your blower in a room or outdoor area that supplies adequate space and lighting for routine maintenance. Indoor installation areas should be well ventilated and kept as cool as possible, because operating the unit at elevated temperatures can result in nuisance overload or temperature shutdowns. An unprotected outdoor installation is only satisfactory when correct lubrication for expected temperatures is provided, as per the *Recommended Lubricants* section in this manual.

5.1.2 BLOWER AIR INTAKE

To minimize maintenance, supply your blower with the cleanest air possible. It is important that the air does not contain any flammable or toxic gases, as the blower will concentrate these gases. This could result in damage to the unit and surrounding property, lead to personal injury or death. Do not block or restrict the opening or the blower and/or motor may overheat and fail.

Do not use blowers on explosive or hazardous gases. Each size blower has limits on pressure differential, running speed, and discharge temperature. These limits must not be exceeded. Consult Table 2 for details pertaining to the allowable performance criteria.

If it is necessary to take air from a remote source, such as in a vacuum application, the piping should be at least the same diameter of the blower inlet. For distances greater than 20 feet (6 m) the pipe diameter should be enlarged to reduce inlet restriction. Excessive restriction will reduce the efficiency of the blower and elevate its discharge temperature. The piping used should also be corrosion resistant, and free of scale and dirt. The inlet should be covered to keep out precipitation, insects, and small animals. Vacuum kits are available.

5.1.3 SOFT FOOT

Soft foot is a condition in which one of the blower feet does not sit flat on the base. Usually, this is due to irregularities in the surface to which the blower is mounted. When you tighten the bolt on the foot, the blower will distort slightly, but enough to cause problems with bearing and seal life, and premature internal contact between the rotors and the housing.

1. Place blower on base.
2. Check each foot for gaps between foot and base (soft foot), shim as necessary to fill gap within .002" (.05 mm). Below are shown the two most common types of soft foot conditions. If either type is present, and measures more than .003" (.076 mm), the blower may fail prematurely.
3. Tighten all bolts.
4. Mount a dial indicator on base contacting one foot at 12 o'clock position.
5. Loosen bolt on that foot. Observe indicator travel and add shims as needed to reduce "spring" to less than .002" (.05 mm). Repeat steps 4 and 5 on remaining feet.

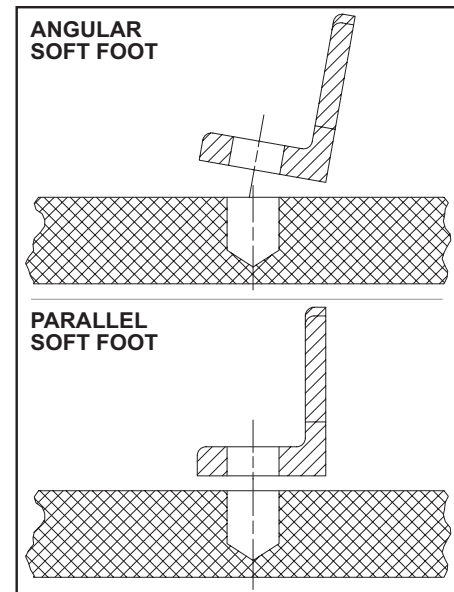


Figure 4 - Illustrations of Soft Foot

5.2 SAFETY

Tuthill Vacuum & Blower Systems recommends the use of relief valves to protect against excessive pressure or vacuum conditions. These valves should be tested at initial start-up to be sure they are properly adjusted to relieve at or below the maximum pressure differential rating of the blower.



DANGER

It is the responsibility of the installer to assure that proper guarding is in place and compliant with all applicable regulatory requirements.



DANGER

Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. The blower should never be run with the inlet or discharge piping removed. If it becomes necessary to inspect the rotating parts of the blower or to change V-belts, be absolutely sure that all power to the motor controls has been shut off, the motor controls are locked out, and properly tagged before proceeding.



DANGER

Assure that properly sized vacuum breaks/relief valves are used on the inlet side of the blower. Also assure that properly sized pressure relief valves are used on the outlet of the blower. The sizing shall be such to assure that the proper flow can be achieved without exceeding the rated vacuum and pressure ratings.



DANGER

Blower housing and associated piping or accessories may become hot enough to cause major skin burns on contact.



WARNING

Use lock out/tag out procedures to disable the electrical energy source before any service or work is done on the blower.



WARNING

Avoid extended exposure in close proximity to machinery with high intensity noise levels. Wear adequate ear protection.



NOTE

Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.

5.3 LUBRICATION

Every blower from Tuthill Vacuum & Blower Systems is factory tested, oil drained and shipped dry to its installation point. Both independent oil reservoirs must be filled to the proper level before operation. Oil reservoirs are under vacuum.

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil reservoir formed in the gear end plate and cover. Shaft bearings at the drive end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill oil sumps as shown below within the *Filling Procedure* section.

Add oil to the blower in the quantity shown within the *Specifications* Table. The oil level must be maintained within the notched area of the sight glass. See Figure 5. Lower drive units have “bull’s eye” type oil level gauges. Maintain oil levels at the center of the glass.



WARNING

Never attempt to change or add lubrication while the blower is running. Failure to heed this warning could result in damage to the equipment or personal injury. Oil must be checked when the blower is NOT running.



WARNING

Properly dispose of the spent lubricants. Refer to the manufacturer of the lubricant and any regulations to assure proper and safe disposal.



WARNING

Do not start the blower until you are sure oil has been put in the gear housing and rear cover. Operation of the blower without proper lubrication will cause the blower to fail and void the warranty.



NOTE

Assure oil is compatible with copper/yellow metals (if equipped with cooling coils).



NOTE

Refer to Table 1 for oil capacities.

5.3.1 FILLING PROCEDURE

See Figure 5. Recommended lubricants are shown on page 35.

1. Remove fill plugs or breathers from both gear end and drive end plates.
2. SLOWLY pour oil through fill until oil appears in the oil sight glass. Bring oil level to center of sight glass.
3. Verify oil level is at proper level in BOTH gear end and drive end sight glasses.
4. Replace fill plugs or breathers that were removed in step 1.

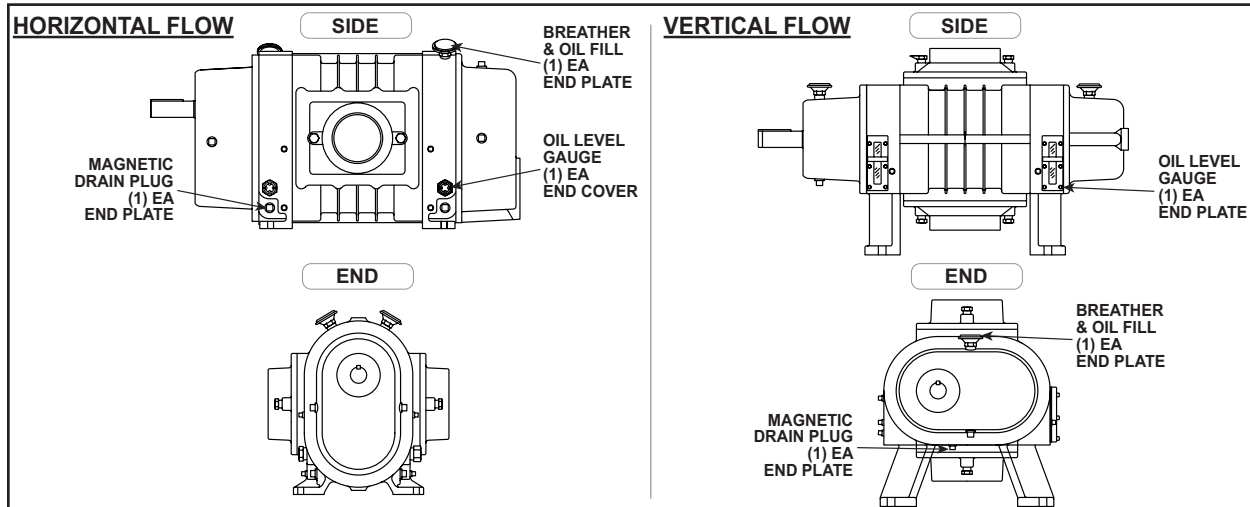


Figure 5 - Oil Fill, Drain Connections and Oil Level Gauges

5.3.2 FREQUENTLY ASKED QUESTIONS REGARDING LUBRICATION

What is the functional detriment if the “wrong oil” is used?

The lubricant is selected based on bearing and gear speed, and operating temperature. Too light of a lubricant increases wear by not separating the sliding surfaces and it will not remove the heat adequately. If the lubricant is too thick, the drag in the bearings is increased causing them to run hotter. Since it is thicker, it will not flow as readily into the gears and it will reduce the available backlash. Lubricants at our conditions are incompressible.

What is the functional detriment if the oil is not serviced?

If the lubricant is not serviced at the proper interval the shearing action in the bearing and the gears will begin to take their toll and the lubricant will thicken, making matters worse. The unit will run hotter and the wear on running surfaces will increase. Generally, the lubricant will appear dirtier, this is actually material rubbed off the unit's components. The discoloration comes from overheating the additive package. An indicator of the breakdown of a lubricant is the increase in the TAN (Total Acid Number), and a change in the base viscosity of ten percent.

Several things are happening as the lubricant goes through the unit. First, it is absorbing frictional energy in the form of heat. This heat has to be dissipated through either surface contact with cooler materials, or in a rest volume of lubricant. While reducing the friction, the lubricant is also going through a shearing process and the molecular structure is broken down.

The result is that the lubricant will begin to thicken because of the shorter molecular chains and the drop out of additive packages. The thickened lubricant will cause more drag, increasing the friction and heat, and further degrading the lubricant.

Operation of the blower (environment, run time, speed, and pressure) has a direct effect on duty cycles. Our published cycles are based on worst-case conditions.

5.3.3 HAZARDS ASSOCIATED WITH BREAKDOWN OR IGNITION OF LUBRICATION



DANGER

There is a risk associated with the lubrication media breaking down and resulting in a hazardous fluid or vapor. There may also be a hazard associated with the ignition of the lubrication media. Refer to the lubrication manufacture's applicable instruction for safety precautions.

5.4 PIPING CONNECTIONS



WARNING

Pipe loading on the blower should be negligible as pipe loading can cause distortion of the blower. Use proper supports and pipe hangers to assure that there is no loading.



NOTE

Remove the protective covers from the inlet and outlet ports and inspect for dirt and foreign material.

Inlet and outlet connections on all blowers are large enough to handle maximum volume with minimum friction loss. Maintain same diameter piping. Silencers must not be supported by the blower. Stress loads and bending moments must be avoided.

Be certain all piping is clean internally before connecting to the blower. We recommend placing a 16-mesh wire screen backed with hardware cloth at or near the inlet connections for the first 50 hours of use until the system is clean. Make provisions to clean the screen after a few hours of operation and completely discard it once the system is clean, as it will eventually deteriorate and small pieces going into the blower can cause serious damage. A horizontal or vertical air flow piping configuration is easily achieved by rearranging the mounting feet position.

HAZARDS ASSOCIATED WITH HAZARDOUS PROCESS FLUIDS



DANGER

It shall be the responsibility of the installer to ensure that piping is adequate, sealing between pipe joints is adequate for the process fluids and proper process and pressure protection devices are in place. It is also the responsibility of the installer to assure that process gasses are not vented in a manner that would be hazardous.

Refer to the manufacturer of the process media to assure that proper safety precautions are in place.

5.4.1 BLOCKAGE OR RESTRICTION



WARNING

Damage to the blower could occur if there is blockage in the inlet or outlet ports or piping. Care should be taken when installing the blower to assure that there are no foreign objects or restrictions in the ports or piping.

5.5 COOLING COILS (OPTIONAL)



CAUTION

If the blower is to be located outdoors or in a building where the temperature surrounding the blower or the water supply and return piping can fall below 35°F (2°C), then care must be taken to ensure that the water (or other cooling liquid) does not freeze and cause damage. Cooling coils must be drained of liquid during downtime unless a recirculating unit using a glycol mixture has been installed.

NOTE

Water cooled endplates are discontinued. Consult factory for connection details.

NOTE

Units are never shipped from the manufacturer with liquid in the end plates or cooling coils.

Blowers supplied with cooling coils are identified by the letter located in the tenth position of the complete blower model number.

Blowers supplied with cooling coils can also be identified by the hose that connects the top of the gear (drive) end cover to the bottom of the free (non-drive) end cover. See Figures 5 and 6 for details. Tuthill Vacuum & Blower Systems recommends water cooling for blowers in applications where the blower operates with discharge temperatures of 250° F (120° C) for periods of 4 hours or greater per day. The use of water cooling reduces oil temperature and improves oil viscosity for better lubrication. Generally, a water flow of 0.5-1.0 GPM (1.9-3.8 L/min) is sufficient to maintain oil temperatures of 150° F (65° C) or below. Do not allow water pressure to exceed 75 PSIG (510 kPa g).

5.6 COOLING WATER CONNECTIONS AND SPECIFICATIONS — COOLING COILS (OPTIONAL)

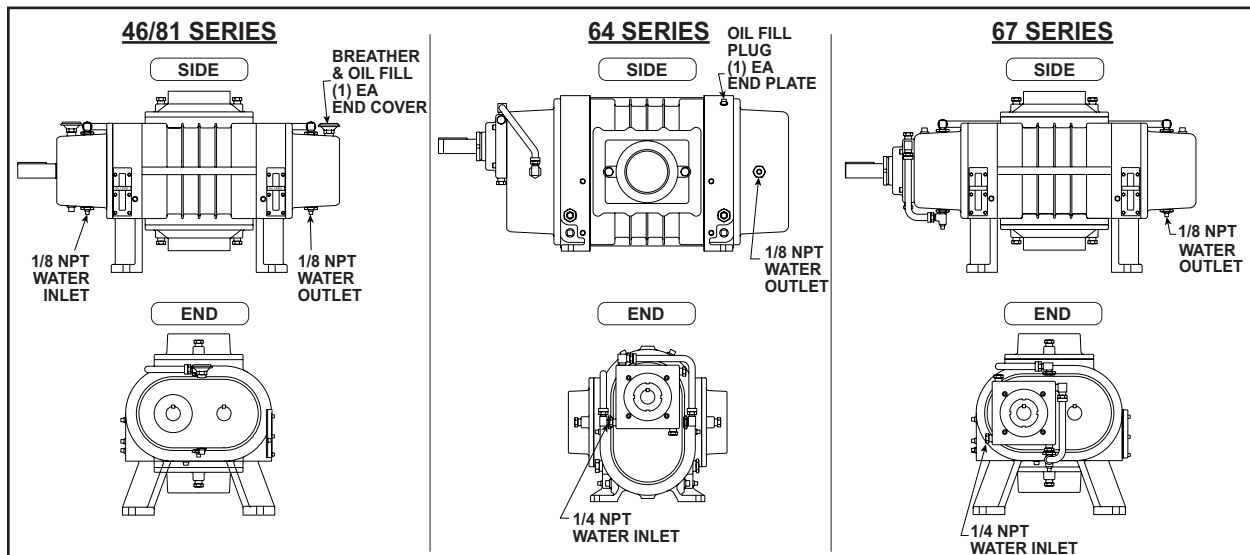


Figure 6 - Water Cooling Connections



WARNING

The cooling water pressure shall not exceed 75 psig (5.17 bar g)

Proper gap between coupling halves must be established according to coupling manufacturers instructions with the motor armature. This will minimize the change for end thrust on the blower shaft. All direct coupled base mounted units must be re-aligned and greased after field installation.

5.7 MOTOR DRIVES

Two drive connections commonly used are direct drive and V-belt drive.

5.7.1 DIRECT COUPLED

When installing the motor directly to the blower, align shafts to coupling in accordance with the coupling manufacturer's instructions. Blowers shipped with motor directly coupled and mounted on a common base have been aligned prior to shipment and normally no further alignment is necessary. However, alignment should be checked and adjustments made if necessary prior to starting the unit.

Coupling halves must correctly fit the blower and drive shafts so that only light tapping is required to install each half. The two shafts must be accurately aligned, A direct coupled blower and motor must be aligned with the two shafts not having more than .005" (13 mm) T.I.R. (Total Indicator Reading). Face must be aligned within .002"(.05 mm) .

Proper gap between coupling halves must be established according to coupling manufacturers instructions with the motor armature. This will minimize the change for end thrust on the blower shaft. All direct coupled base mounted units must be re-aligned and greased after field installation.

5.7.2 V-BELTS

If the motor and blower are V-belt connected, the sheaves on both motor and blower shafts, should be as close to the shaft bearings as possible. Blower Sheave is not more than 1/4" (6.5 mm) from the blower drive end cover. The drive sheave is as close to the driver bearing as possible. Care should be taken when installing sheaves on the blower and motor shafts. The face of the should be accurately in line to minimize belt wear.

Adjust the belt tension to the manufactures specifications using a belt tension tester. New belts should be checked for proper tension after 24 hours of run time. When manufacturer data is not available industry guidelines are 1/64 inch deflection for each inch of span at 8 to 10 pounds of force in the center of the belt.

Insufficient tensioning is often indicated by slipping (squealing) at start up. Belt dressing should not be used on V-belts. Sheaves and V-belts should remain free of oil and grease. Tension should be removed from belts if the drive is to be inactive for an extended period of time. For more specific information consult the drive manufacturer. In a v-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted as close to the bearing housing as possible to minimize bearing loads.

A tight or driving fit will force the drive shaft out of its normal position and cause internal damage. A loose fit will result in shaft damage or breaking. The motor sheave must also fit correctly and be properly aligned with the blower sheave.

Adjust motor position on its sliding base so that belt tension is in accordance with drive manufacturer's instructions. Avoid excessive belt tension at all times. Recheck tension after the first ten hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

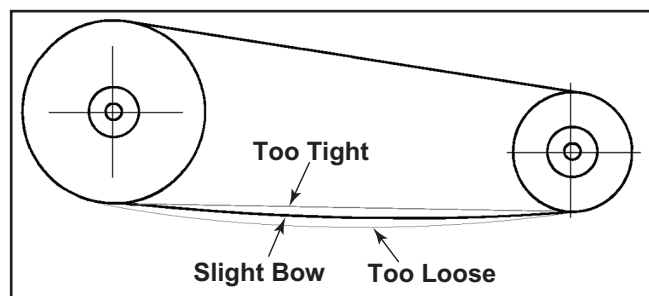


Figure 7 - General appearance of a V-Belt drive

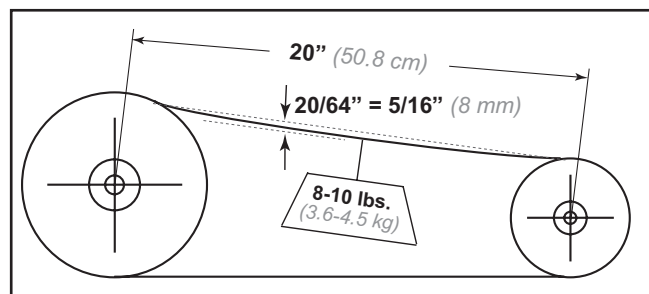


Figure 8 - Setting of proper tension for a V-Belt drive

Check blower after installation and before applying power by rotating the drive shaft by hand. If it does not rotate freely, look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment. Check blower at this time to insure oil was added to the reservoirs.

5.7.3 SETTING V-BELT TENSION

Proper belt tension is essential to long blower life. The following diagrams and procedures are provided to aid in field adjusting V-belts (when blower is so equipped) for maximum performance. A visual inspection of the V-belt drive should yield the appearance shown in Figure 7.

Factors outside the control of the belt tensioning system used on an individual blower package assembly may contribute to decreased belt life, such as environmental factors, and quality of the belts installed. This can cause wear of the belts beyond the ability of the tensioning system to compensate.

As such, it is recommended to check belt tension monthly and make any manual adjustments found necessary.

1. Turn off and lock out power.
2. Remove the fasteners from the belt guard (if equipped)
3. Remove the belt guard.
4. Check and adjust the belt tension as necessary. It should be 1/64" deflection per inch of span (0.157 mm) deflection per centimeter of span) between sheaves, with 8-10 lbs. (3.6-4.5 kg) force applied at center point of the top section of belt.
5. Install the belt guard, making sure that all drive components are free of contact with the guard.
6. Install belt guard fasteners removed in step 2.
7. Unlock the power and start your blower.
8. Resume normal operation.

5.7.4 V-BELT TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	SOLUTION
Belts slip (sidewalls glazed)	Not enough tension	Replace belts; apply proper tension
Drive squeals	Shock load	Apply proper tension
	Not enough arc of contact	Increase center distance
	Heavy starting load	Increase belt tension
Belt(s) turned over	Broken cord caused by prying on sheave	Replace set of belts and install correctly
	Overloaded drive	Redesign drive
	Impulse loads	Apply proper tension
	Misalignment of sheave and shaft	Realign drive
	Worn sheave grooves	Replace sheaves
	Excessive belt vibration	Check drive design Check equipment for solid mounting Consider use of banded belts
Mismatched belts	New belts installed with old belts	Replace belts in matched sets only
Breakage of belt(s)	Shock loads	Apply proper tension; recheck drive
	Heavy starting loads	Apply proper tension; recheck drive Use compensator starting
	Belt pried over sheaves	Replace set of belts correctly
	Foreign objects in drives	Provide drive guard
Rapid belt wear	Sheave grooves worn	Replace sheaves
	Sheave diameter too small	Redesign drive
	Mismatched belts	Replace with matched belts
	Drive overloaded	Redesign drive
	Belt slips	Increase tension
	Sheaves misaligned	Align sheaves
	Oil or heat condition	Eliminate oil. Ventilate drive.

5.8 SPECIAL INSTRUCTIONS FOR BLOWERS WITH EXTERNAL LUBRICATION SYSTEMS

Blowers furnished with external lube systems are designated with a special series number after the model number; for example, 4009-84. On older units, it will appear before the model number. There are four variations manufactured:

- 85 - Lip Seal/Vertical Flow (46)*
- 84 - Mechanical Seal
Single Envelope Gastight /
Vertical Flow (81)*
- 18 - Lip Seal/Horizontal Flow (17)*
- 54 - Mechanical Seal
Single Envelope Gastight /
Horizontal Flow (57)*

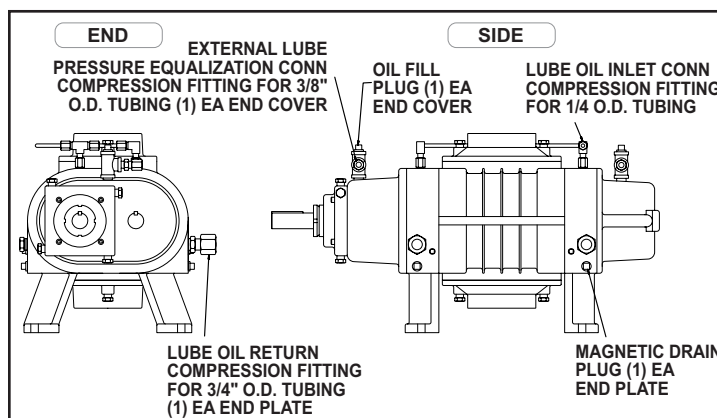


Figure 9 - External Lube Oil Connections

* Use this corresponding number when following the repair procedure. The blowers are the same except for the end plates which have different drillings for lubrication purposes.



CAUTION

Field conversions cannot be made on 46 and 81 series without replacing end plates. Consult factory before making any conversions.

1. The external lube tank is equipped with an oil filter which has a replaceable element. The part number for the element is 91999-1.
2. Each tank has an oil pressure relief valve which is set at the factory at 12 - 15 PSIG (80 - 100 kPa g) and normally requires no adjustment. If an adjustment becomes necessary, remove the cap and adjust the screw. Clockwise will increase pressure, and counterclockwise will reduce pressure.
3. Oil tank should be on a level surface with return connections of tank below the blower return connections at approximately 2 inches drop per foot (16.5 cm drop per meter). Each end of blower shall have separate return hose lines (3/4" [19 mm] I.D. minimum) not over six feet from farthest blower.
4. The oil supply hose and connections must be kept free of dirt and foreign material during installation to prevent clogging of blower oil supply restrictors (.055" [1.40 mm] diameter).
5. Make sure motor pump wiring connection is for correct rotation as indicated by arrow on motor.
6. Tanks equipped with heat exchangers should have water flow direction counter to oil flow. Required water flow rate is approximately 0.25 - 1.0 GPM (0.95 - 3.8 L/min) depending upon blower operating condition (oil sump temperature should not exceed 250° F [120° C] maximum).



CAUTION

Fill both ends of blower with oil to proper level, then operate oil supply system, and be sure oil is returning from both blower return hoses prior to starting blower.

5.9 MOTOR AND ELECTRICAL CONNECTIONS



WARNING

The motor and connections shall be protected to assure that product and environmental condensation does not come in contact with the electrical connections.



NOTE

It is the responsibility of the installer to assure that the motor is in compliance with the latest edition of IEC 60204-1 and all electrical connections performed per IEC 60204-1, this includes over current protection.

Wire the motor and other electrical devices such as solenoid valves and temperature switch to the proper voltage and amperage as indicated on the nameplate of each component being wired. Turn the blower by hand after wiring is completed to determine that there are no obstructions and if the blower turns freely; then momentarily start the blower to check the direction of rotation. Figure 2 shows direction of air flow in relation to rotor rotation. The air flow direction can be reversed by reversing the appropriate motor leads.

6. OPERATION

6.1 GENERAL



DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.



WARNING

Do not operate without guards in place.



WARNING

Maximum operating speed: Table 2 states the maximum operating speed in RPM (rotations per minute), the maximum pressure differential, maximum vacuum and maximum temperature rise. Do not exceed these limits.

Before starting the blower for the first time under power, recheck the installation thoroughly to reduce the likelihood of troubles. Use the following check list as a guide, but also consider any other special conditions in your installation.

1. Be certain no bolts, rags, or dirt have been left in blower.
2. Be certain that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by an inlet filter. This also applies to indoor use.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. Be certain the proper volume of oil is in the oil reservoir chambers.
5. Be certain the driving motor is properly lubricated, and that it is connected through suitable electrical overload devices.
6. With electrical power off and locked out to prevent accidental starting, rotate blower shaft several times by hand to make sure blower is rotating freely. Unevenness or tight spots is an indication of a problem that should be corrected before progressing.
7. Check motor rotation by momentarily pushing the start button and check flow direction of the blower. Reverse the motor connections if flow is in the wrong direction.

Initial operation should be carried out under “no load” conditions by opening all valves and venting the discharge to atmosphere, if possible. Then start motor briefly, listen for unusual noises, and check that the blower coasts freely to a stop. If no problem appears, repeat this check, and let the motor run a little longer. If any questions exist, investigate before proceeding further.

Assuming all tests are satisfactory, the blower will now be ready for continuous full load operation. During the first several days, make periodic checks to determine that all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove inlet filter. Also, recheck leveling, coupling alignment or belt tension, and mounting bolts for tightness.

6.2 START-UP CHECKLIST

We recommend that these startup procedures be followed in sequence and checked off (☒) in the boxes provided in any of the following cases:

- During initial installation
- After maintenance work has been performed
- After any shutdown period
- After blower has been moved to a new location

DATES CHECKED:

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Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Refer to the *Lubrication* section. Please see *Recommended Lubricants* for information on acceptable lubricants for your product.

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Check V-belt drive for proper belt alignment and tension.

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Carefully turn the rotors by hand to be certain they do not bind.



WARNING

Disconnect power. Make certain power is off and locked out before touching any rotating element of the blower, motor, or drive components.

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“Bump” the unit with the motor to check rotation (counter-clockwise [CCW] when facing shaft) and to be certain it turns freely and smoothly.

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Start the unit and operate it for 30 minutes at no load. During this time, feel the cylinder for hot spots. If minor hot spots occur, refer to the *Troubleshooting* chart.

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Apply the load and observe the operation of the unit for one hour.

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If minor malfunctions occur, discontinue operation and refer to the *Troubleshooting* chart.

6.3 OPERATING

The upper temperature limit for blower operation is 400° F (205° C) measured in the exhaust gas stream with a low mass thermocouple. When this temperature limit switch is installed, as the temperature exceeds the predetermined temperature, the blower motor will stop and cannot be restarted until the temperature drops below the trip setting of the temperature switch.



DANGER

The blower is not intended to be used with explosive products or in explosive environments. The blower is not intended to be used in applications that include hazardous and toxic gases. Consult the factory for support.



WARNING

Physical harm may occur if human body parts are in contact or exposed to the process vacuum. Assure that all connections are protected from human contact.



WARNING

If rated vacuum or pressure levels are exceeded, process fluids will migrate to other parts of the blower and system.



CAUTION

Do not touch hot surfaces.

The upper limit of the blower operation is 400° F (205° C). Do not touch the blower while it is in operation and assure blower is cool when not in operation.



CAUTION

Use of a thermowell insulates the thermocouple. Invalid and delayed readings will result. This can result in ineffective protection devices.



NOTE

The upper temperature limits are not intended for continuous operation. Consult with factory for detailed information assistance.

6.4 STOPPING



CAUTION

Do not stop the blower if there are high outlet pressures in the outlet piping. Unload the outlet piping prior to shutting down the blower.

Stop the blower by turning off the motor. Isolate the blower from the vacuum system and vent the blower to atmosphere. Turn off the cooling water, if water cooled. Stop the backing pump. Refer to component instruction manual.

6.5 METHANE GAS APPLICATIONS

Instructions for injecting fuel oil, kerosene, and lube oil into blowers sludged by methane digester (sewage) gas: Some sewage gases will adhere to the rotors in a gas blower. If enough sludge from the gas being pumped builds up on the rotors, it destroys the clearances between the rotors. The build-up can cause the blower to clatter and eventually freeze up when the rotors no longer have clearance to turn. This can be easily prevented by periodically flushing the blower with a mixture of 75% kerosene or fuel oil and 25% lubricating oil. The kerosene or fuel oil dissolves the sludge buildup and the lubricating oil coats the rotors to slow the build-up. The mixture should be injected on the inlet side through a valve set to feed a gallon of mixture in 15-20 minutes. On units regularly flushed, once a week is sufficient. If the unit is dirty, it should be flushed daily until the hard build-up is removed then put on a weekly cycle. In very dirty gas installations, the cycle must be varied to meet the demand.

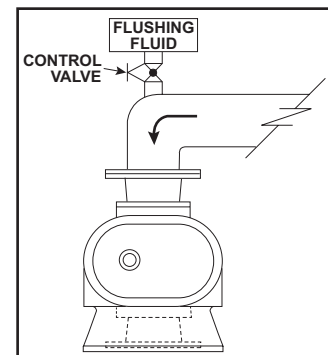


Figure 10 - Flushing Diagram

6.6 WATER INJECTED BLOWERS

Water injected into the inlet of a blower operating on vacuum service will cool the blower. The water absorbs the heat of compression as it passes through the unit along with the air/gas being compressed. A blower cooled in this manner can operate safely at higher vacuums or higher inlet temperatures than a normally uncooled unit.

The amount of water required depends on the inlet air/gas temperature, inlet vacuum, water temperature, and the maximum discharge temperature desired. Check with the factory or sales representative for additional guidance.

6.6.1 OPERATION

1. Check oil level in sight glass of blower and assure all fittings are tight.
2. Check the water injection system to assure water is available.
3. Operate the blower dry for a few minutes at no load to check correct rotation and smooth operation.
4. Turn water on and adjust flow as recommended for the individual blower. Assure water discharges freely from the outlet piping.
5. Apply vacuum and observe operation at the desired inlet condition.

6.6.2 SHUTDOWN

1. The blower can be shutdown for brief periods by relieving the inlet vacuum, shutting the water off, and then stopping the unit.
2. Rusting during a slightly longer shutdown period can be avoided by operating the blower under a partial vacuum without the water injection, allowing the blower to heat within safe limits. The heat will tend to drive off residual moisture.
3. For extended shutdown, oil may be injected into the inlet of the heated blower just prior to shutting the blower down. The oil will provide a protective coating on the internals. Insure that the water is completely shut off after shutdown.
4. Special coatings or platings are available to minimize rusting or corrosion in applications where units can remain wet.

Vertical flow units with two-lobed, plugged rotors should always be used. Always orient system such that the blower intake is at the top and discharge at the bottom.



CAUTION

Water injection can cause lime build-up on rotors. Check water supply for hardness. The use of water softeners, other chemicals, or distilled water may be necessary to prevent or remove this build-up. However, due to the wide variations in mineral content, pH, and chemical content of water that can be injected, Tuthill Vacuum & Blower Systems cannot be responsible for damage which may result should this build-up occur. Units should be inspected regularly to determine any problems.



NOTE

For liquid injection other than water, consult the factory.

6.7 RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When high humidity or moisture is present in an air piping system, condensation of water can occur after the blower is shut down and the blower begins to cool. This creates an environment favorable to corrosion of the iron internal surfaces, or in cold weather, the formation of ice. Either of these conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure outlined below minimizes the risk of moisture condensation, corrosion and freezing.



NOTE

Care must be taken so as not to overload or overheat the blower during this procedure.

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air. Operate the blower under a slight load allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.

2. For carpet cleaning applications, after the work is completed, simply allow the blower to run a few (3-5) minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.
3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just prior to shutdown. (*3-in-One and WD-40 are registered trademarks of WD-40 Company.*) The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, exercise care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, most likely to the point that repair would be required.
4. If the blower is being taken out of commission for an extended period of time, please also refer to the “Long Term Storage” section of this manual.

7. MAINTENANCE

7.1 GENERAL

Regular inspection of your blower and its installation, along with complete checks on operating conditions will pay dividends in added life and usefulness. Also, service the drive per manufacturer’s instructions and lubricate the coupling or check belt drive tension. By use of thermometers and gauges, make sure that blower operating temperature and pressure remain within allowed limits.



DANGER

The blower and parts may contain hazardous media. Assure that pump and parts are evacuated of hazardous media prior to servicing.



CAUTION

The electrical service must be isolated and de-energized prior to maintenance. Apply appropriate procedures to assure electrical supply is de-energized and cannot be inadvertently energized during maintenance.

Assure piping and product is isolated prior to maintenance of blower. Apply appropriate procedures to assure piping and product is isolated and that inadvertent opening of valves cannot occur during maintenance.



CAUTION

During routine maintenance, inspect and assure that guards are in place and secure.

Particular attention should be paid to lubrication of timing gears and bearings in accordance with comments under the *Lubrication* section.

When a blower is taken out of service, it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgment based on existing conditions as well as length of down time. Under atmospheric conditions producing rapid corrosion, the blower should be protected immediately. Refer to the *Long Term Storage* section for more details.

7.2 REGULAR MAINTENANCE

A good maintenance program will add years of service to your blower.

A newly installed blower should be checked frequently during the first month of operation, especially lubrication. With blower at rest, check oil level in both the gear (drive) end and free (non-drive) end of the blower and add oil as needed. Complete oil changes are recommended every 1000-1200 operating hours, or more frequently depending on the type of oil and operating temperature. Also change the oil more frequently if pumping corrosive vapors or where excessive operating temperatures are encountered. The following is recommended as a minimum maintenance program.

DAILY	WEEKLY	MONTHLY
1. Check and maintain oil level, and add oil as necessary. 2. Check for unusual noise or vibration (See <i>Troubleshooting</i>)	1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage. 2. Check relief valve to assure it is operating properly.	1. Inspect the entire system for leaks. 2. Inspect condition of oil and change if necessary. 3. Check drive belt tension and tighten if necessary.



NOTE

Oil levels should be checked every 24 hours of operation.

Proper oil drain schedules require oil be changed before the contaminant load becomes so great that the lubricating function of the oil is impaired or heavy disposition of suspended contaminants occurs. To check the condition of the oil, drain a sampling into a clean container and check for the presence of water or solids. Slight discoloration of the oil should not necessitate an oil change.

7.3 SPARE PARTS

Should adjustments or replacement eventually be needed, these can often be performed locally as described in this book after obtaining required parts. Personnel should have a good background of mechanical experience and be thoroughly familiar with the procedures outlined in this manual. Major repairs not covered in this book should be referred to the nearest Tuthill Vacuum & Blower Systems service representative.

When ordering parts, give all blower nameplate information, as well as the item number and parts description as per the parts lists and assembly drawings for your particular model. Repair kits are available for all models. These kits contain all of the seals, bearings, O-rings, locks, and special retaining screws necessary for an overhaul. For your convenience when ordering parts, we suggest you complete the *Operating Data Form* included on the inside, back cover of this manual.

In developing a stock of spare parts, consider the following:

- The degree of importance in maintaining the blower in a “ready” condition
- The time lag in parts procurement
- Cost
- Shelf life (seals and O-rings)

Contact Tuthill Vacuum & Blower Systems Service Department for any assistance in selecting spare parts. Telephone: (417) 865-8715 — Toll Free (48 contiguous states): (800) 825-6937 — Fax: (417) 865-2950

7.4 FACTORY SERVICE & REPAIR

With proper care, Tuthill Vacuum & Blower Systems blowers will give years of reliable service. The parts are machined to very close tolerances and require special tools by mechanics who are skilled at this work. Should major repairs become necessary, contact the factory for the authorized service location nearest you. Units which are still under warranty must be returned to the factory, freight prepaid, for service.

Tuthill Vacuum & Blower Systems
ATTN: Inside Service Manager
4840 West Kearney Street
Springfield, MO 65803-8702



NOTE
Current regulations require Material Safety Data Sheet to be completed and forwarded to Tuthill Corporation on any unit being returned for any reason which has been handling or involved with hazardous gases or materials. This is for the protection of the employees of Tuthill Corporation who are required to perform service on this equipment. Failure to do so will result in service delays.



NOTE
When returning a blower to the factory for repair, under warranty, please note the factory will not accept any unit that arrives without authorization. Contact the Service Department for return authorization.

7.5 LONG TERM STORAGE

Any time the blower will be stored for an extended period of time, you should take make sure that it is protected from corrosion by following these steps:

1. Spray the interior (lobes, housing and end plates) with rust preventative. This should be repeated as conditions dictate and at least on a yearly basis.
2. Fill both end covers completely full of oil.
3. Firmly attach a very prominent tag stating that the end covers are full of oil and must be drained and refilled to proper levels prior to startup.
4. Apply a rust preventative grease to the drive shaft.
5. Spray all exposed surfaces, including the inlet and discharge flanges, with rust preventative.
6. Seal inlet, discharge and vent openings. It is not recommended that the unit be set in place, piped to the system, and allowed to remain idle for a prolonged amount of time. If any component is left open to the atmosphere, the rust preventative will escape and lose its effectiveness.
7. During storage, ensure that the blower does not experience excessive vibration.
8. Attach a desiccant bag to either of the covers to prevent condensation from occurring inside the blower. Make sure any desiccant bag (or bags) is so attached to the covers that they will be removed before startup of the blower.
9. Store the blower in an air conditioned and heated building if at all possible. At least insure as dry conditions as possible.
10. If possible, rotate the drive shaft by hand at least monthly in order to prevent seals from setting in one position.

8. MODEL 4000 AND 5500 DISASSEMBLY AND REASSEMBLY

8.1 DISASSEMBLY OF BLOWER



WARNING

Before performing any repair or replacement, disconnect and lock out power.

With proper maintenance and lubrication, normal life expectancy for gears, bearings, and seals can be achieved. However, over a period of time these parts must be repaired or replaced to maintain the efficiency of your blower. This section is written in a way that will allow you to completely disassemble your blower. The inspection of certain repairable or replaceable parts is referred to at the point of disassembly where these parts are exposed. If at any point of inspection, repair or replacement is deemed necessary, appropriate instruction will be given to achieve these repair or replacement is deemed necessary, appropriate instruction will be given to achieve these repairs or replacements.

Remove the oil drain plugs [18] in the bottom of the end covers [Items 5 & 10] and drain the oil. Take out eight cap screws [16] and remove the gear cover. It may be necessary to tap the sides with a mallet or wooden block to break the seal joint.

Gears are not exposed for visual inspection. Items in brackets [] are referenced to item numbers shown in the *Parts Lists and Assembly Drawings* section beginning on page 27 for each particular blower model and series.

- Broken Teeth
- Chipped Teeth
- Uneven Wear
- Excessive Wear
- Any Other Abnormalities

1. Insure that all oil is drained from unit and remove port fittings [38].
2. Remove spanner lock nut [83], dust water [82], screws [93] and seal adapter housing [91]. Tap out seal [76] and discard O-rings [92, 140]. Remove spacers [77 & 74], and discard O-ring [75]. New Style only 64/67 series.
3. Remove cap screws [26] from gear end cover.
4. Remove gear end cover [6] using beveled chisel and hammer, unless jackscrew holes have been provided.
5. Remove snap ring [47] from drive shaft.
6. Using gear pullers, remove drive shaft bearing [50].
7. Remove drive shaft [45].
8. Remove gear locknuts [35] and locks [36].
9. Align timing marks, see Fig. 11 on timing gears [8].
10. Rotate drive gear in a clockwise rotation approximately 4 or 5 teeth and mark this location, see Figure 12. This gear position is necessary so rotors will clear and not jam. Do not allow the reference marks to change location while the driven gear is being removed.
11. Using gear pullers, pull driven gear first.
12. After removal of the driven gear, continue with pulling the drive gear.
13. Remove gear end bearing retainer rings [14], exposing bearings.
14. Remove cap screws [26] and free end cover [7], exposing oil slinger assembly.

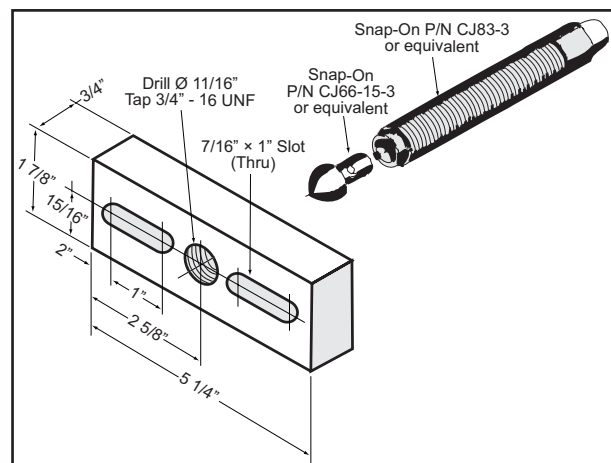


Figure 11 - Illustration of Bar Puller

See drawing on page 35 for further details.

15. Remove flat head socket screw [69] from oil slinger and gently pry oil slinger [21] from shaft. (On some models.)
16. Remove flat head socket screw [29] and washer [25] from opposite rotor.
17. Use bar pullers (see Fig. 10) and attach to free end plate bores. Using bar pullers, pull free end plate [4] from rotor shafts. (Note: The use of two bar pullers is recommended.)
18. Attach bar puller to gear end plate bore and push out rotors [1], one at a time.
19. Using rubber mallet, tap end plate from housing [3].
20. Using a soft metal punch and a mallet, tap out bearings from end plate bores.
21. Using bevel chisel, remove seals (#12 on lip seal units and #54 on mechanical seal units) from end plate bores.
22. Series 17/46, 57/81, 64/67 units have labyrinth seals [51] installed. If necessary, remove labyrinth seals [51] with a beveled chisel and hammer.
23. Inspect all parts for wear and serviceability.

8.2 ASSEMBLY OF BLOWER

The assembly procedure is generally the same for all series, but where there are differences, notations are made.

Gaskets are never used between rotor housing and end plates. Gaskets are used on 16/47 and 17/46 series between end covers and end plates to seal oil leakage. Dowel pins are used to locate end plates, housing, and drive end cover in proper location relative to each other. Be sure they are in place.

It is recommended that the gear end rotor shaft bearings be purchased from Tuthill Vacuum & Blower Systems, as they are specially ground to locate the rotors with correct end clearance relative to the gear end plate.

8.2.1 PREPARATION OF END PLATES FOR ASSEMBLY



NOTE

Make sure all parts are clean and free of any nicks or burrs caused by disassembly. Lip seal units will require all sleeves or seal journals to be polished to remove any nicks or scratches. Failure to polish seal journals will result in seal leakage or damage. Refer to page 36 for information and dimensions on seal pressing tools as well as other assembly tools required. For 16/47 series, skip step 1 and proceed to step 2.

1. 17/46, 57/81, 64/67 series blowers require labyrinth seals. Position labyrinth seals [51] with slots pointing up and press one seal into each end plate bore.
2. 16/47, 17/46 series blowers utilize lip seals [12]. As means of sealing, apply a smooth coating of Permatex #2 or silicone sealer to the O.D. edge of the seal shell. Press lip seal [12] into each end plate bore, making sure the seal "lip" is facing up, or toward the oil. Apply grease to lip seals only.
3. 57/81, 64/67 series blowers require mechanical seals [54]. Apply smooth coating of silicone to the O.D. of the seal shell as above. Position mechanical seal with the carbon face up and press the seal [54] into each end plate bore, and into end plate bores. Wipe carbon with soft tissue and acetone or similar cleaner, make sure seal is fully seated and shell is not deformed. Insure carbon is not scarred or cracked. Mating rings will be seated later in the assembly procedure.

8.2.2 GEAR END ASSEMBLY

4. Stand rotors [1] on free end in arbor press. Both keyways must be in line and point to the right. Two-lobe rotors include two keyways on each shaft. When positioning the rotors, two keyways (one on each rotor) should point in the same direction, to the right.

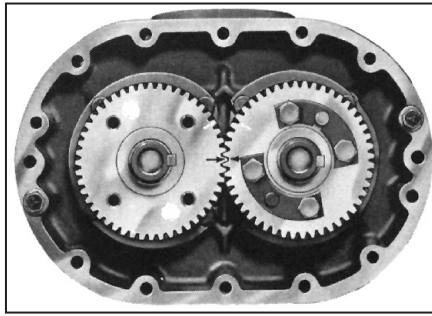


Figure 12 - Keyways in line and timing marks matched

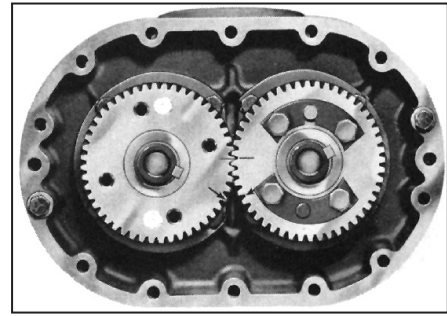


Figure 13 - Timing marks advanced 3 teeth (Reference marks aligned)

5. Place gear end plate [4] with seals installed on rotor shafts. Make sure threads on rotor shafts do not damage seals.
6. 57/81, 64/67 series blowers must have mating rings [54] installed. Make sure surface is clean, and gently place a few drops of clean oil on seal face for lubrication. Install mating ring (lapped surface) against carbon face.
7. Lightly coat rotor shaft with anti-seize compound or equivalent.
8. Using flush ground bearings on gear end only, press bearings [9] onto rotor shafts.



CAUTION

These bearings have flush ground faces and should be installed with manufacturer numbers up (toward gear). If no numbers appear on either side, look for a black dot (acid mark) the inner race. Install with dot up. Do not use bearings that have not been flush ground to within a .001" (.025 mm) tolerance.

9. Install oil retainer [15] (4000 models only).
10. Install bearing retainer ring [14] and lock plates [61] on all series blowers. Bolts are item [62].
11. Check clearance between gear end plate and rotor lobe ends. Correct clearances are shown in the *Assembly Clearances* table on page 34.



NOTE

Position of timing marks is for removing or installing driven gear. To remove the drive gear, advance three teeth in the opposite direction.

12. Stand rotors [1] on arbor press with gear end shafts up and both keyways facing to the right. The drive rotor should be on the left.
13. Install the gear end plate [4], making sure the feet are facing in the right direction, over the rotor shafts and coming to rest on top of the rotor lobes. Be careful not to damage seals.
14. On 57/81/64/67 series, check lapped surface of seal mating ring to be sure it is perfectly clean. Use soft tissue and cleaning agent (acetone) if necessary. Place a few drops of lubricating oil on its surface and install on shaft with lapped surface coming to rest on top of carbon. Gently press with fingers to insure compression is taking place and ring is not hung up for any reason.
15. Lubricate shafts and press the double row ball bearings [9] on rotor shafts and into end plate bores. Secure with retainer rings [14] and screws [30].



NOTE

These bearings have been flush ground at the factory. The inner race will have a black dot etched on the surface. This dot must be up and visible when bearings are installed.

16. Check clearance between the face of the end plate and the rotor lobes. See exploded view for correct gear and clearances. If clearances are not within specifications, recheck parts to find cause of improper clearances before proceeding.
17. Install spacer [17] (.260" [6.60 mm] thickness) and oil slinger [20] on the other shaft.



NOTE

Oil slinger and its spacer should always be mounted on either shaft for vertical flow units.

18. Install timing shim in same location as found in disassembly. This does not necessarily insure the unit will be in proper time. Adjustments can be made later in the assembly process.
19. Insert gear keys [24] into the rotor shaft keyways. Loose fits are not acceptable.
20. Lubricate shafts and install driver gear (right hand helix) on drive rotor (left side). To install driven gear, align reference marks as shown in Figure 12 on page 29. Install driven gear carefully to avoid mashing any teeth when engaging opposite gear.
21. Install washers [25] and flat head allen screws [29].
22. Remove assembly from press and stand on work table with gears down. Place blocks under end plate to prevent assembly from falling over. Drive gear should remain on left side.
23. On 57/81/64/67 series, use an RTV silicone type sealer. Place a small bead around periphery of the end plate and encircling each bolt hole.
24. Install rotor housing [3] and secure with four screws evenly spaced.
25. Check clearances between end of lobes and housing using a flat bar and feeler gauges or a depth micrometer. Refer to exploded view for free end clearances.

8.2.3 FREE END ASSEMBLY

26. On 57/81/64/67 series put sealer on free end plate. (Same as step 15 above).
27. Install free end plate and secure with 4 screws.
28. On 57/81/64/67 series, repeat instructions given in step 7.
29. Install bearing spacers [123] (.025" [.06 mm] thickness) on each shaft (57/81/64/67 series only). Lubricate shafts and tap on bearings [10]. Install spacers [67] on 57/81/64/67 series only.
30. Install oil retainer rings [14] with button head screws [30].
31. Install oil slinger [21] on lower rotor, (either shaft on vertical flow units) spacer [57] on opposite shaft, washers [25], and screws [29].

8.2.4 ADJUSTING ROTOR INTERLOBE CLEARANCE

32. Lay the unit down with the drive gear on the left. Using feeler gauges take interlobe readings and record on each side of housing as indicated in Figure 14. By removing or adding shim behind the helical gear, it rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes. Changing the shim thickness .006" (.16 mm) will change the rotor lobe clearance .003" (.08 mm) or one-half the amount.

EXAMPLE: Referring to Figure 14, check the clearance at AA (left hand reading) and BB (right hand reading). If AA reading is .003" (.08 mm) and BB reading is .009" (.24 mm), by removing .006" (.16 mm) of shim, the readings will change one-half the amount removed or .003" (.08 mm). AA should then read .006" (.16 mm) and BB should read .006" (.16 mm). The final reading should be within .002" (.05 mm) of each other.

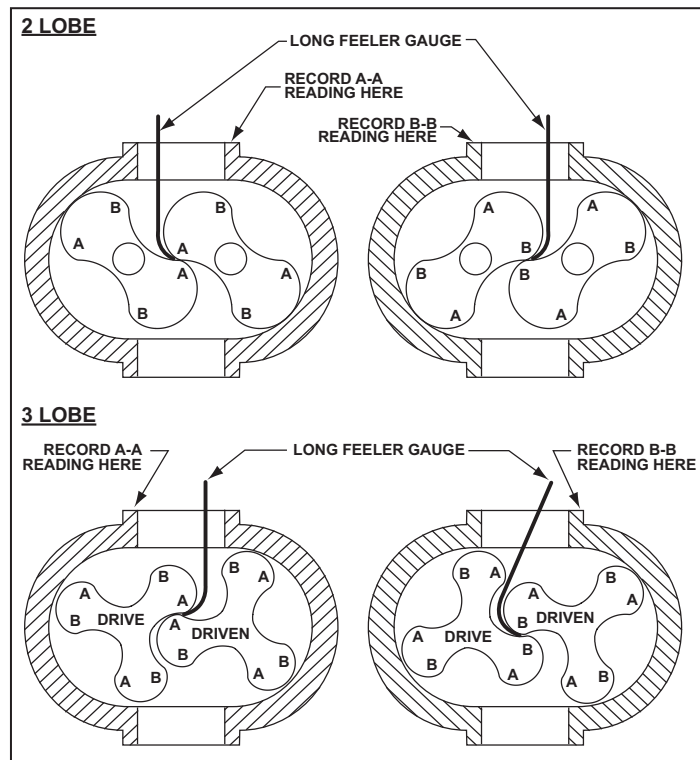


Figure 14 - Checking Rotor Interlobe Clearance

To determine the amount of shim to add or remove, subtract the small figure from the larger. If the right side reading is higher than the left side, remove shim. If the right side reading is lower, add shim.

33. Install drive shaft [45] and secure with Allen screws [66]. Check drive shaft runout at seal journal. Do not exceed .002" (.05 mm) T.I.R. Install lockwire [49].
34. Install bearing [9 or 50] on drive shaft and secure with retaining ring [47]. (Item 47 not required on 64/67 series.) Shield side of bearing must face outward (64/67 series only).



NOTE

To continue assembly for series 64/67, see "Special Instructions - 64/67 Series" following this section.

35. Remove temporary cap screws from each end plate and install cover gasket [28] and gear end cover [6]. Make sure dowel pins [22] are in place. Sealer is not required on factory supplied gaskets. Secure with cap screws [26A] and washers [27].
36. Coat O.D. of drive shaft seal [13] with sealer and grease I.D. Install carefully over keyway and tap into cover.
37. Install free end cover [7], with gasket [28] and secure with cap screws [26B] and washers [27].
38. Install port fittings [38], gaskets [39], and secure with cap screws and washers [40 & 41].

8.3 SPECIAL INSTRUCTIONS - 64/67 SERIES

Continue assembly:

- A. Prepare cover (6). Place flange side down, install first of two snap rings (78) into innermost groove. Press in first of 2 ea. Mechanical seals (54A) lightly silicone outer case of seal. Press seal with carbon side down until seated against the snap ring . Careful not to distort snap ring.
- B. Install second snap ring (78) into outer groove. Place mating ring from 1st seal into cover with lap surface up. Press second mechanical seal (54) in, carbon side groove down until seated against outer snap ring. Carbon will seal against mating ring when cover is installed on drive shaft.

8.3.1 DRIVE SHAFT ASSEMBLY

- A. Install one thin spacer (74) onto drive shaft so it is next to bearing with groove out. Install one o-ring (75) to seat in the groove of the spacer. Lightly oil face of mating ring, install onto shaft with lapped surface out. Install large spacer (77) with groove side facing mating ring. Install thin spacer (74) with groove out, install o-ring (75) so it will seat into groove.
- B. Remove temporary hold down bolts, place bead of silicone around periphery of the end plate (4) encircling each bolt. Install gear end cover and tighten bolts. Install large spacer (77) with groove out, install free end spacer, install dust cover (82) and lock nut. Install pipe plug (85) into bottom nose piece in cover (6) silicone plug.
- C. Fill with oil until oil can be seen in the middle hole, install pipe plug (85). Continue to fill to proper level. Wait 2 minutes before installing the last pipe plug (85) to make sure proper oil level is maintained.

9. TROUBLESHOOTING

Although Tuthill Vacuum & Blower Systems blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The chart below lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil	Gear housing not tightened properly.	Tighten gear housing bolts.
	Lip seal failure.	Disassemble and replace lip seal.
	Insufficient sealant.	Remove gear housing and replace sealant. See the <i>Disassembly</i> section.
	Loose drain plug.	Tighten drain plug.
Excessive bearing or gear wear	Improper lubrication.	Correct oil level. Replace dirty oil. See the <i>Lubrication</i> section.
	Excessive belt tension.	Check belt manufacturer's specifications for tension and adjust accordingly.
	Coupling misalignment.	Check carefully, realign if necessary.
Lack of volume	Slipping belts.	Check belt manufacturer's specifications for tension and adjust accordingly.
	Worn lobe clearances.	Check for proper clearances. See the <i>Assembly Clearances</i> section.
	Speed too low.	Increase blower speed within limits.
	Obstruction in piping.	Check system to assure an open flow path.
Knocking	Unit out of time.	Re-time.
	Distortion due to improper mounting or pipe strains.	Check mounting alignment and relieve pipe strains.
	Excessive pressure differential.	Reduce to manufacturer's recommended pressure. Examine relief valve and reset if necessary.
	Worn gears.	Replace timing gears. See the <i>Disassembly</i> section.
Excessive blower temperature	Too much or too little oil in gear reservoir.	Check oil level. See the <i>Lubrication</i> section.
	Too low operating speed.	Increase blower speed within limits.
	Clogged filter or silencer.	Remove cause of obstruction.
	Excessive pressure differential.	Reduce pressure differential across the blower.
	Elevated inlet temperature.	Reduce inlet temperature.
	Worn lobe clearances.	Check for proper clearances. See the <i>Assembly Clearances</i> section.
Rotor end or tip drag	Insufficient assembled clearances.	Correct clearances. See the <i>Assembly Clearances</i> section.
	Case or frame distortion.	Check mounting and pipe strain.
	Excessive operating pressure.	Reduce pressure differential.
	Excessive operating temperature.	Reduce pressure differential or reduce inlet temperature.
Vibration	Belt or coupling misalignment.	Check carefully, realign if necessary.
	Lobes rubbing.	Check cylinder for hot spots, then check for lobe contact at these points. Correct clearances. See the <i>Assembly Clearances</i> section.
	Worn bearings or gears.	Check condition of gears and bearings; replace if necessary.
	Unbalanced or rubbing lobes.	Possible buildup on casing or lobes, or inside lobes. Remove buildup and restore clearances.
	Driver or blower loose.	Check mounting and tighten if necessary.
	Piping resonance.	Check pipe supports, check resonance of nearby equipment, check foundation.

10. ASSEMBLY CLEARANCES

Values shown in inches and *millimeters*.

MODEL	LOBES TO END PLATES		LOBE TO HOUSING	INTERLOBE
	GEAR END	FREE END	TIP-PORT	
4006	.004 - .007 .10 - .18	.006 - .011 .15 - .28	.008 - .011 .20 - .28	CENTER TIMED
4009	.004 - .007 .10 - .18	.008 - .012 .20 - .30	.008 - .011 .20 - .28	
4012	.004 - .007 .10 - .18	.010 - .014 .25 - .36	.008 - .011 .20 - .28	
4014	.004 - .007 .10 - .18	.012 - .016 .30 - .41	.008 - .011 .20 - .28	
5507	.005 - .007 .13 - .18	.009 - .013 .23 - .33	.012 - .014 .30 - .36	CENTER TIMED
5509	.005 - .007 .13 - .18	.010 - .014 .25 - .36	.012 - .014 .30 - .36	
5511	.005 - .007 .13 - .18	.012 - .016 .30 - .41	.012 - .014 .30 - .36	
5514	.005 - .007 .13 - .18	.014 - .018 .36 - .46	.012 - .014 .30 - .36	
5516	.005 - .007 .13 - .18	.016 - .020 .41 - .51	.012 - .014 .30 - .36	
5518	.005 - .007 .13 - .18	.018 - .023 .46 - .58	.012 - .014 .30 - .36	
5520	.005 - .007 .13 - .18	.020 - .025 .51 - .64	.012 - .014 .30 - .36	

11. TORQUE CHART

Data shown represents “wet” torque values, in foot-pounds (ft.-lbs) and *Newton-meters (N-m)*.

PART DESCRIPTION	TORQUE
CAP SCREW 10-32UNF	4 5
CAP SCREW 1/4"-20UNC GR5	8 10
CAP SCREW 5/16"-18UNC GR5	15 20
CAP SCREW 3/8"-16UNC GR5	33 45
CAP SCREW 1/2"13UNC GR5	78 106
CAP SCREW 5/8"14UNC GR5	123 167
CAP SCREW 3/4"-10UNC GR5	260 350
GEAR NUT TORQUE 4000	310 417
GEAR NUT TORQUE 5500	900 1211

12. RECOMMENDED LUBRICANTS

RECOMMENDED MINERAL BASED LUBRICANTS				
AMBIENT TEMPERATURE	SHELL	CITGO	CHEVRON	EXXONMOBIL
0° to 32° F (-18° to 0° C)	TELLUS® S2 M 68 (ISO 68)	A/W 68 (ISO 68)	RANDO HD 68 (ISO 68)	DTE HEAVY MEDIUM (ISO 68)
32° to 90° F (0° to 32° C)	TELLUS® S2 M 100 (ISO 100)	A/W 100 (ISO 100)	RANDO HD 100 (ISO 100)	DTE HEAVY (ISO 100)
90° to 120° F* (32° to 50° C)	—	A/W 150 (ISO 150)	RANDO HD 150 (ISO 150)	DTE EXTRA HEAVY (ISO 150)

RECOMMENDED SYNTHETIC BASED LUBRICANTS**			
AMBIENT TEMPERATURE	TUTHILL	EXXONMOBIL	SHELL
0° to 32° F (-18° to 0° C)	PneuLube™ (ISO 100)	SHC 626 (ISO 68)	MORLINA® S4 B 68 (ISO 68)
32° to 90° F (0° to 32° C)		SHC 627 (ISO 100)	MORLINA® S4 B 100 (ISO 100)
90° to 120° F* (32° to 50° C)		SHC 629 (ISO 150)	MORLINA® S4 B 150 (ISO 150)

RECOMMENDED MINERAL BASED, FOOD GRADE LUBRICANTS		
AMBIENT TEMPERATURE	Lubricant meeting U.S. FDA regulation 21 CFR 178.3570 governing petroleum products which may have incidental contact with food, and USDA H1 requirements	Lubricant meeting U.S. FDA regulations 21 CFR 172.878 and 178.3620(a) for direct and indirect food contact
0° to 32° F (-18° to 0° C)	CITGO CLARION® A/W 68 (ISO 68)	CITGO CLARION® 350 FOOD GRADE (ISO 68)
32° to 90° F (0° to 32° C)	CITGO CLARION® A/W 100 (ISO 100)	CONSULT FACTORY
90° to 120° F* (32° to 50° C)	CONSULT FACTORY	CONSULT FACTORY

RECOMMENDED SYNTHETIC BASED, FOOD GRADE LUBRICANTS		
AMBIENT TEMPERATURE	Lubricant meeting U.S. FDA regulation 21 CFR 178.3570 governing petroleum products which may have incidental contact with food, and USDA H1 requirements	Lubricant meeting U.S. FDA regulations 21 CFR 172.878 and 178.3620(a) for direct and indirect food contact
0° to 32° F (-18° to 0° C)	PneuLube™ FG (ISO 100)	CONSULT FACTORY
32° to 90° F (0° to 32° C)		
90° to 120° F* (32° to 50° C)		

RECOMMENDED LUBRICANTS FOR M-D VACUUM BOOSTERS (90/91, 92/93, 96, 31/33 AND 35/37 SERIES)	
REQUIREMENTS	
<ul style="list-style-type: none"> • Suitable for high vacuum service • 100 cSt @ 40° C • Vapor pressure of 1 micron or less @ 70° F (21° C) • Straight mineral (no additives) or PAO synthetic oil 	

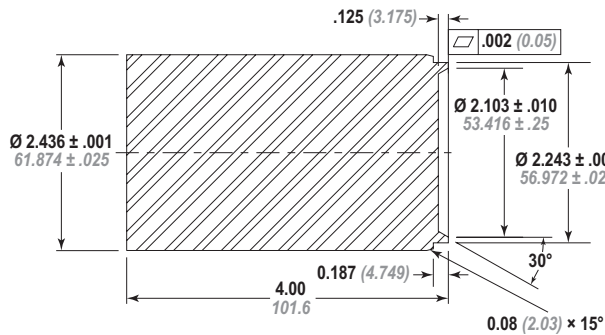
RECOMMENDED GREASE FOR COMPETITOR® PLUS BLOWERS:	
TUTHILL	CITGO
Tuthill PneuLube™ NLGI #2 premium grade, petroleum base lithium grease.	For food grade requirements: Use Citgo Clarion® Food Grade HTEP grease, NLGI No. 2 grade. It meets all requirements of FDA Regulation 21 CFR 178.3570 (the former USDA H-1 approval requirements) for lubricants having incidental contact with food.

* For higher ambient temperatures, please consult the factory.

** Blowers used in oxygen-enriched service should use only Castrol Brayco 1726 Plus non-flammable, PFPE synthetic lubricant. Blowers used in hydrogen service should use only PneuLube synthetic oil. Tuthill Vacuum & Blower Systems cannot accept responsibility for damage to seals, O-rings and gaskets caused by use of synthetic lubricants not recommended by Tuthill Vacuum and Blower Systems.

13. SPECIAL TOOL DRAWINGS

FIGURE 15 —
4000 MECHANICAL SEAL TOOL (T11549)

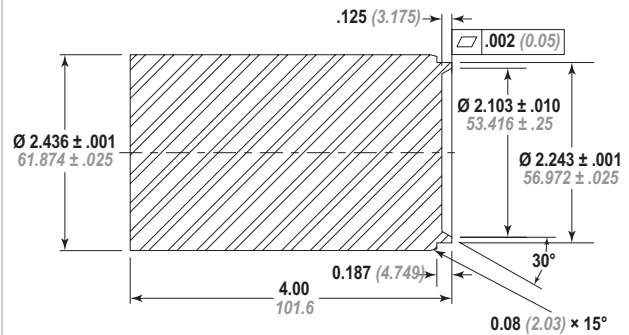


MATL P/N: CR1215RO-0250 x 4.25 (88.9) LG
MATL: COLD ROLLED STEEL BAR
Ø 2.50 (63.5) OD x 4.25 (107.95) LG

TOLERANCES

.XX = ± .01 (± .03)
.XXX = ± .005 (± .05)
CHAMFERS = ± 2°

FIGURE 16 —
4000 MECHANICAL SEAL TOOL (T11549)

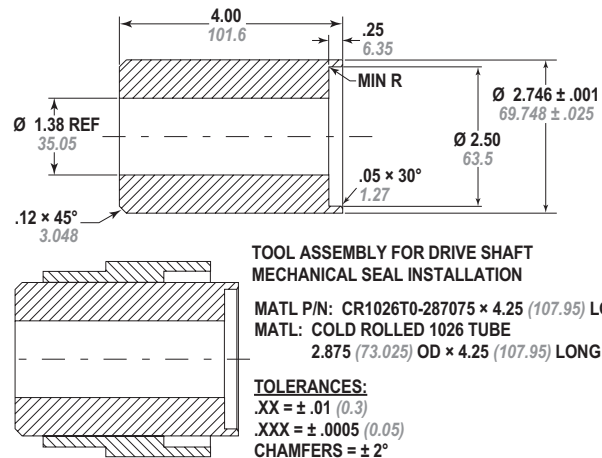


MATL P/N: CR1215RO-0250 x 4.25 (88.9) LG
MATL: COLD ROLLED STEEL BAR
Ø 2.50 (63.5) OD x 4.25 (107.95) LG

TOLERANCES

.XX = ± .01 (± .03)
.XXX = ± .005 (± .05)
CHAMFERS = ± 2°

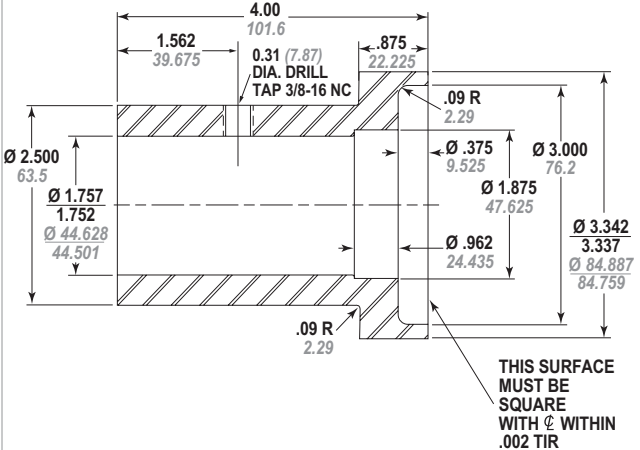
FIGURE 17 —
4000/5500 SEAL PRESSING TOOL (T11449-1)



TOOL ASSEMBLY FOR DRIVE SHAFT
MECHANICAL SEAL INSTALLATION
MATL P/N: CR1026T0-287075 x 4.25 (107.95) LG
MATL: COLD ROLLED 1026 TUBE
2.875 (73.025) OD x 4.25 (107.95) LONG

TOLERANCES:
.XX = ± .01 (0.3)
.XXX = ± .0005 (0.05)
CHAMFERS = ± 2°

FIGURE 18 —
4000/5500 PRESSING TOOL FOR MECHANICAL SEALS



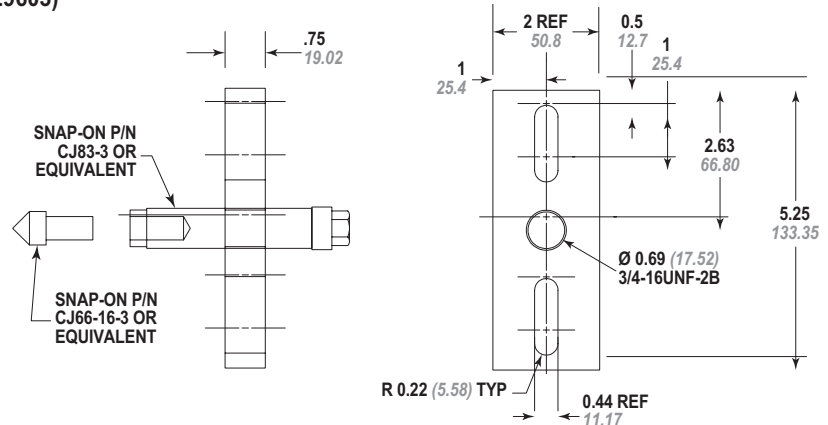
THIS SURFACE
MUST BE
SQUARE
WITH Ø WITHIN
.002 TIR

FIGURE 19 —
4000 AND 5500 GEAR AND EP TOOL (T29603)

MATL P/N: CR1018B0-200075 x 5.5 (139.7) LG
MATL: COLD ROLLED 1018 BAR
2.75 (69.85) x 5.5 (139.7) LONG

TOLERANCES

FRACTIONAL = ± .0005 (± 0.0127)
CHAMFERS = ± 2°



NOTE: All dimensions are shown in Inches and millimeters.

PARTS LIST FOR MODEL 4000 SERIES - 17/46

ITEM NO.	PART DESCRIPTION	17 / 46 QTY
1	ROTOR	2
3	HOUSING	1
4	END PLATE	2
6	DRIVE END COVER	1
7	FREE END COVER	1
8	TIMING GEAR SET	1
9	BEARING, DRIVE END	2
10	BEARING, FREE END	2
12	LIP SEAL	4
13	LIP SEAL	1
14	RETAINER	2
15	OIL RETAINER RING	4
21	OIL SLINGER	1
22	DOWEL PIN	6
23	DRIVE SHAFT KEY	1
24	GEAR KEY	2
25	ROTOR SHAFT WASHER	1
26	CAP SCREW, HEX HD	28
27	LOCK WASHER	28
28	GASKET	2
29	CAP SCREW	1
30	CAP SCREW	4
31	MAGNETIC PIPE PLUG	2
35	LOCK NUT	2
36	WASHER	2
37	BREATHER	2
38	PORT FITTING	2
39	PORT FITTING GASKET	2
40	CAP SCREW	28
41	LOCK WASHER	28
42	NAMEPLATE	1
45	DRIVE SHAFT	1
47	RETAINING RING	1
50	BEARING	1
51	LAB SEAL	4
61	BEARING LOCK PLATE	4
62	CAP SCREW	8
65	LOCK PLATE	2
66	CAP SCREW	4
68	DOWEL PIN	1
69	CAP SCREW	1
70	OIL GAUGE	2 / —
85	PIPE PLUG	4 / 6
98	PIPE PLUG	— / 4
121	PIPE PLUG	6 / 2
123	BEARING SPACER	2
129	SPACER	4
174	PIPE PLUG	2 / —
234	OIL LEVEL TAG	— / 2
241	CAP SCREW	— / 12
242	SIGHT GAUGE FRAME	— / 2
243	SIGHT GAUGE PLASTIC WINDOW	— / 2
244	WINDOW GASKET	— / 2
245	FRAME GASKET	— / 2

Parts kits are available (P/N 27306), consult factory.
Quantities shown are maximum values; quantities may vary between blower

PARTS LIST FOR MODEL 4000 SERIES - 57/81

ITEM NO.	PART DESCRIPTION	57 / 81 QTY
1	ROTOR	2
3	HOUSING	1
4	END PLATE	2
6	DRIVE END COVER	1
7	FREE END COVER	1
8	TIMING GEAR SET	1
9	BEARING, DRIVE END	2
10	BEARING, FREE END	2
13	LIP SEAL	1
14	RETAINER	2
15	OIL RETAINER RING	4
21	OIL SLINGER	1
22	DOWEL PIN	6
23	DRIVE SHAFT KEY	1
24	GEAR KEY	2
25	ROTOR SHAFT WASHER	1
26	CAP SCREW, HEX HD	28
27	LOCK WASHER	28
28	GASKET	2
29	CAP SCREW	1
30	CAP SCREW	4
31	MAGNETIC PIPE PLUG	2
35	LOCK NUT	2
36	WASHER	2
37	BREATHER	2
38	PORT FITTING	2
40	CAP SCREW	28
41	LOCK WASHER	28
42	NAMEPLATE	1
45	DRIVE SHAFT	1
47	RETAINING RING	1
50	BEARING	1
51	LAB SEAL	4
54	MECHANICAL SEAL	4
61	BEARING LOCK PLATE	4
62	CAP SCREW	8
65	LOCK PLATE	2
66	CAP SCREW	4
68	DOWEL PIN	1
69	CAP SCREW	1
70	OIL GAUGE	2 / 6
85	PIPE PLUG	4 / 8
98	PIPE PLUG	8 / 2
121	PIPE PLUG	6 / 2
123	BEARING SPACER	2 / —
174	PIPE PLUG	2 / —
234	OIL LEVEL TAG	— / 2
241	CAP SCREW	— / 12
242	SIGHT GAUGE FRAME	— / 2
243	SIGHT GAUGE PLASTIC WINDOW	— / 2
244	WINDOW GASKET	— / 2
245	FRAME GASKET	— / 2

NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES; QUANTITIES MAY VARY BETWEEN BLOWER

PARTS KITS ARE AVAILABLE. AS FOLLOWS:

MODEL 4000 SERIES - 57/81 — P/N 27307

PARTS LIST FOR MODEL 4000 SERIES - 64/67

ITEM NO.	PART DESCRIPTION	64 / 67 QTY	ITEM NO.	PART DESCRIPTION	64 / 67 QTY
1	ROTOR	2	68	DOWEL PIN	1
3	HOUSING	1	69	CAP SCREW	1
4	END PLATE	2	70	OIL GAUGE	2
6	DRIVE END COVER	1	74	SPACER	2
7	FREE END COVER	1	75	O-RING, VITON	2
8	TIMING GEAR SET	1	76	MECHANICAL SEAL	1
9	BEARING, DRIVE END	2	77	DRIVE SHAFT FACE SEAL SLEEVE	2
10	BEARING, FREE END	2	78	RETAINING RING	2
14	RETAINER	2	82	WASHER	1
15	OIL RETAINER RING	4	83	LOCK NUT	1
21	OIL SLINGER	1	85	PIPE PLUG	7 / 8
22	DOWEL PIN	6	86	SHIM	1
23	DRIVE SHAFT KEY	1	87	SLEEVE	1
24	GEAR KEY	2	88	O-RING, VITON	1
25	ROTOR SHAFT WASHER	1	89	SPACER	1
26	CAP SCREW, HEX HD	28	90	SET SCREW	2
27	LOCK WASHER	28	91	DRIVE SHAFT ADAPTOR SEAL	1
29	CAP SCREW	1	92	O-RING, VITON	1
30	CAP SCREW	4	93	CAP SCREW	4
31	MAGNETIC PIPE PLUG	2 / 3	98	PIPE PLUG	8
35	LOCK NUT	2	108	MAGNETIC PIPE PLUG	1 / —
36	WASHER	2	121	PIPE PLUG	7 / 3
38	PORT FITTING	2	123	BEARING SPACER	2
40	CAP SCREW	28	140	O-RING, VITON	1
41	LOCK WASHER	28 / 8	174	PIPE PLUG	2 / —
42	NAMEPLATE	1	234	OIL LEVEL TAG	— / 2
45	DRIVE SHAFT	1	241	CAP SCREW	— / 12
50	BEARING	1	242	SIGHT GAUGE FRAME	— / 2
51	LAB SEAL	4	243	SIGHT GAUGE PLASTIC WINDOW	— / 2
54	MECHANICAL SEAL	6	244	WINDOW GASKET	— / 2
61	BEARING LOCK PLATE	4	245	FRAME GASKET	— / 2
62	CAP SCREW	8	NOTES: • QUANTITIES SHOWN ARE MAXIMUM VALUES; QUANTITIES MAY VARY BETWEEN BLOWER PARTS KITS ARE AVAILABLE, AS FOLLOWS: MODEL 4000 SERIES - 64/67 — P/N 27308		
65	LOCK PLATE	2			
66	CAP SCREW	4			

PARTS LIST FOR MODEL 5500 SERIES - 17/46

ITEM NO.	PART DESCRIPTION	17 / 46 QTY
1	ROTOR	2
3	HOUSING	1
4	END PLATE	2
6	DRIVE END COVER	1
7	FREE END COVER	1
8	TIMING GEAR SET	1
9	BEARING, DRIVE END	2
10	BEARING, FREE END	2
12	LIP SEAL	4
13	LIP SEAL	1
14	RETAINER	2
21	OIL SLINGER	1
22	DOWEL PIN	6
23	DRIVE SHAFT KEY	1
24	GEAR KEY	2
25	ROTOR SHAFT WASHER	1
26	CAP SCREW, HEX HD	28
27	LOCK WASHER	56
28	GASKET	2
29	CAP SCREW	1
30	CAP SCREW	6
31	MAGNETIC PIPE PLUG	2
35	LOCK NUT	2
36	WASHER	2
37	BREATHER	2
38	PORT FITTING	2
39	PORT FITTING GASKET	2
40	CAP SCREW	28
42	NAMEPLATE	1
45	DRIVE SHAFT	1
46	RING ADAPTOR	1
47	RETAINING RING	1
50	BEARING	1
51	LAB SEAL	4
57	BEARING SPACER	1
61	BEARING LOCK PLATE	6
62	CAP SCREW	12
65	LOCK PLATE	2
66	CAP SCREW	4
68	DOWEL PIN	1
69	CAP SCREW	1
70	OIL GAUGE	2 / —
85	PIPE PLUG	6 / 4
98	PIPE PLUG	— / 4
121	PIPE PLUG	2 / —
123	BEARING SPACER	4 / 2
129	SPACER	7 / 4
174	PIPE PLUG	— / 5
234	OIL LEVEL TAG	— / 2
241	CAP SCREW	— / 12
242	SIGHT GAUGE FRAME	— / 2
243	SIGHT GAUGE PLASTIC WINDOW	— / 2
244	WINDOW GASKET	— / 2
245	FRAME GASKET	— / 2
NOTES: • QUANTITIES SHOWN ARE MAXIMUM VALUES; QUANTITIES MAY VARY BETWEEN BLOWER PARTS KITS ARE AVAILABLE, AS FOLLOWS: MODEL 5500 SERIES - 17/46 — P/N 27315		

PARTS LIST FOR MODEL 5500 SERIES - 57/81

ITEM NO.	PART DESCRIPTION	57 / 81 QTY
1	ROTOR	2
3	HOUSING	1
4	END PLATE	2
6	DRIVE END COVER	1
7	FREE END COVER	1
8	TIMING GEAR SET	1
9	BEARING, DRIVE END	2
10	BEARING, FREE END	2
13	LIP SEAL	1
14	RETAINER	4 / 2
21	OIL SLINGER	1
22	DOWEL PIN	6
23	DRIVE SHAFT KEY	1
24	GEAR KEY	2
25	ROTOR SHAFT WASHER	1
26	CAP SCREW, HEX HD	28
27	LOCK WASHER	56
28	GASKET	2
29	CAP SCREW	1
30	CAP SCREW	6
31	MAGNETIC PIPE PLUG	2
35	LOCK NUT	2
36	WASHER	2
37	BREATHER	2
38	PORT FITTING	2
40	CAP SCREW	28
42	NAMEPLATE	1
45	DRIVE SHAFT	1
46	ADAPTOR RING	1
47	RETAINING RING	1
50	BEARING	1
51	LAB SEAL	4
54	MECHANICAL SEAL	4
57	BEARING SPACER	1
61	BEARING LOCK PLATE	6
62	CAP SCREW	12
65	LOCK PLATE	2
66	CAP SCREW	4
68	DOWEL PIN	1
69	CAP SCREW	1
70	OIL GAUGE	2 / —
85	PIPE PLUG	10 / 8
98	PIPE PLUG	— / 4
123	BEARING SPACER	2 / 2
174	PIPE PLUG	7 / 5
234	OIL LEVEL TAG	— / 2
241	CAP SCREW	— / 12
242	SIGHT GAUGE FRAME	— / 2
243	SIGHT GAUGE PLASTIC WINDOW	— / 2
244	WINDOW GASKET	— / 2
245	FRAME GASKET	— / 2

NOTES:

- QUANTITIES SHOWN ARE MAXIMUM VALUES; QUANTITIES MAY VARY BETWEEN BLOWER

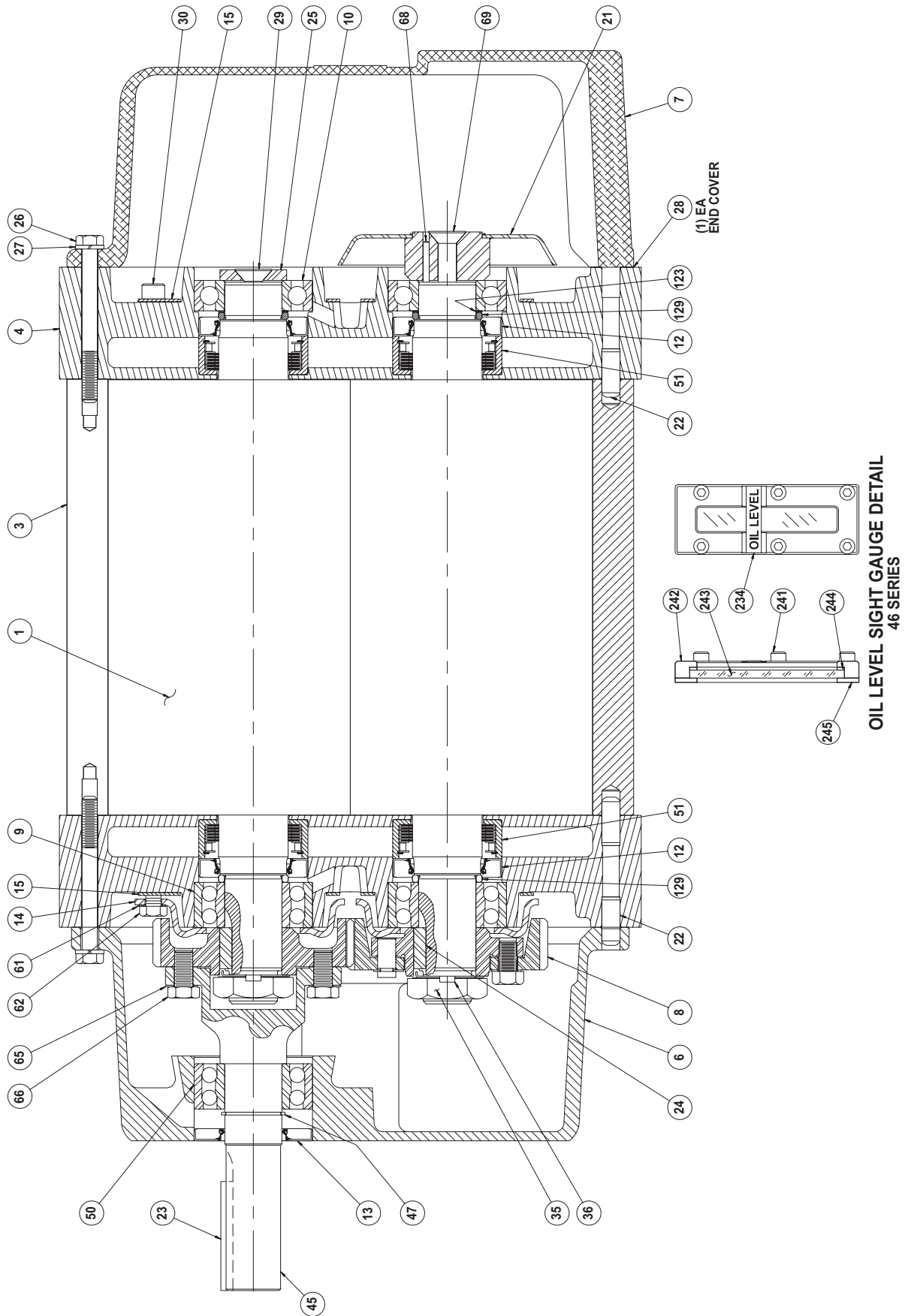
PARTS KITS ARE AVAILABLE, AS FOLLOWS:

MODEL 5500 SERIES - 57/81 — P/N 27317

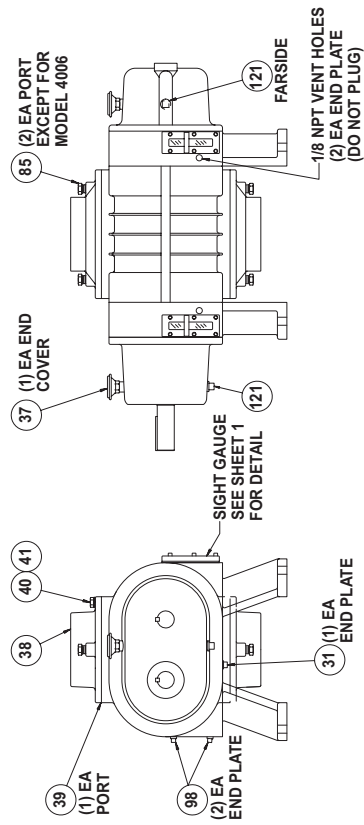
PARTS LIST FOR MODEL 5500 SERIES - 64/67

ITEM NO.	PART DESCRIPTION	64 / 67 QTY	ITEM NO.	PART DESCRIPTION	64 / 67 QTY
1	ROTOR	2	68	DOWEL PIN	1
3	HOUSING	1	69	CAP SCREW	1
4	END PLATE	2	70	OIL GAUGE	2 / —
6	DRIVE END COVER	1	74	SPACER	1
7	FREE END COVER	1	75	O-RING, VITON	1
8	TIMING GEAR SET	1	77	DRIVE SHAFT FACE SEAL SLEEVE	1
9	BEARING, DRIVE END	2	80	WASHER	1 / —
10	BEARING, FREE END	2	82	WASHER	1
14	RETAINER	2	83	LOCK NUT	1
20	G.E. OIL SLINGER	1 / —	85	PIPE PLUG	14 / 10
21	OIL SLINGER	1	86	SHIM	6
22	DOWEL PIN	6	86	SHIM	2
23	DRIVE SHAFT KEY	1	86	SHIM	4
24	GEAR KEY	2	91	DRIVE SHAFT ADAPTOR SEAL	1
25	ROTOR SHAFT WASHER	1	92	O-RING, VITON	1
26	CAP SCREW, HEX HD	28	93	CAP SCREW	4
29	CAP SCREW	1	98	PIPE PLUG	— / 4
30	CAP SCREW	6	123	BEARING SPACER	2
31	MAGNETIC PIPE PLUG	2	136	LOCK WASHER	1 / —
35	LOCK NUT	2	140	O-RING, VITON	8 / 1
36	WASHER	2	174	PIPE PLUG	8 / 8
38	PORT FITTING	2	224	OIL RETAINER PLATE	4 / 1
40	CAP SCREW	29 / 28	225	CAP SCREW	4
42	NAMEPLATE	1	234	OIL LEVEL TAG	2
45	DRIVE SHAFT	1	241	CAP SCREW	12
50	BEARING	1	242	SIGHT GAUGE FRAME	2
51	LAB SEAL	4	243	SIGHT GAUGE PLASTIC WINDOW	2
54	MECHANICAL SEAL	5	244	WINDOW GASKET	2
57	BEARING SPACER	1	245	FRAME GASKET	2
61	BEARING LOCK PLATE	6	255	ROLL PIN	2 / —
62	CAP SCREW	12			
65	LOCK PLATE	2	Parts kits are available (P/N 27318), consult factory. Quantities shown are maximum values; quantities may vary between blower		
66	CAP SCREW	4			

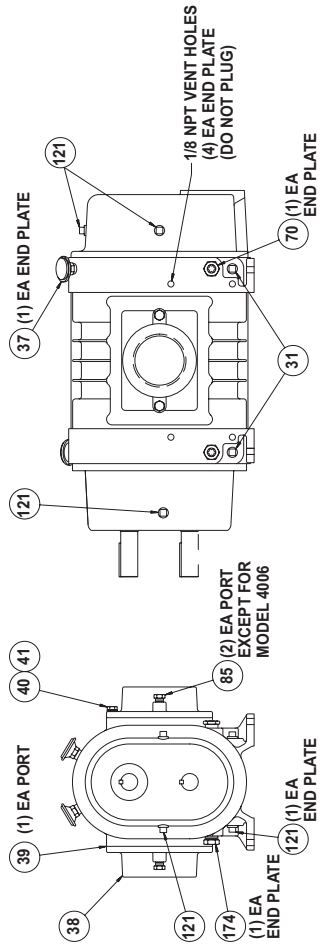
ASSEMBLY DRAWINGS FOR MODEL 4000 - 17-18-46-85 — CUTAWAY VIEW



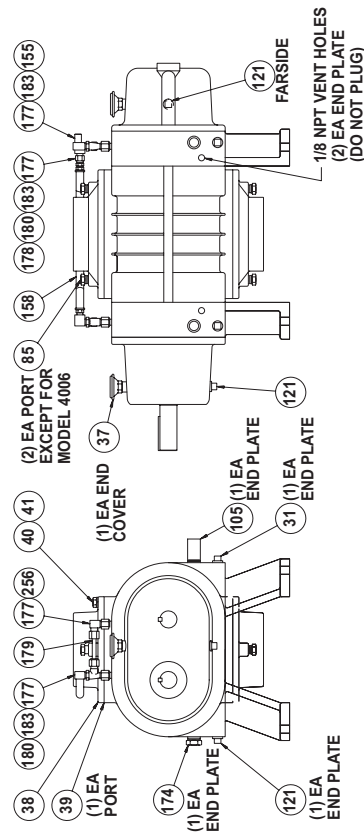
ASSEMBLY DRAWINGS FOR MODEL 4000 - 17-18-46-85 — SIDE AND END VIEWS



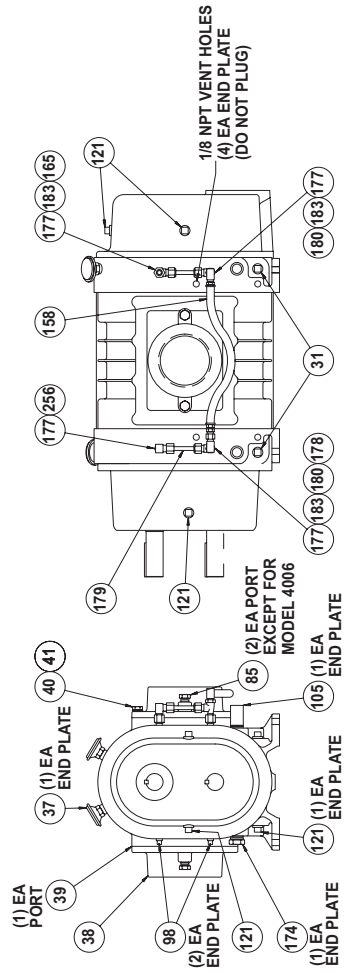
46 SERIES



17 SERIES

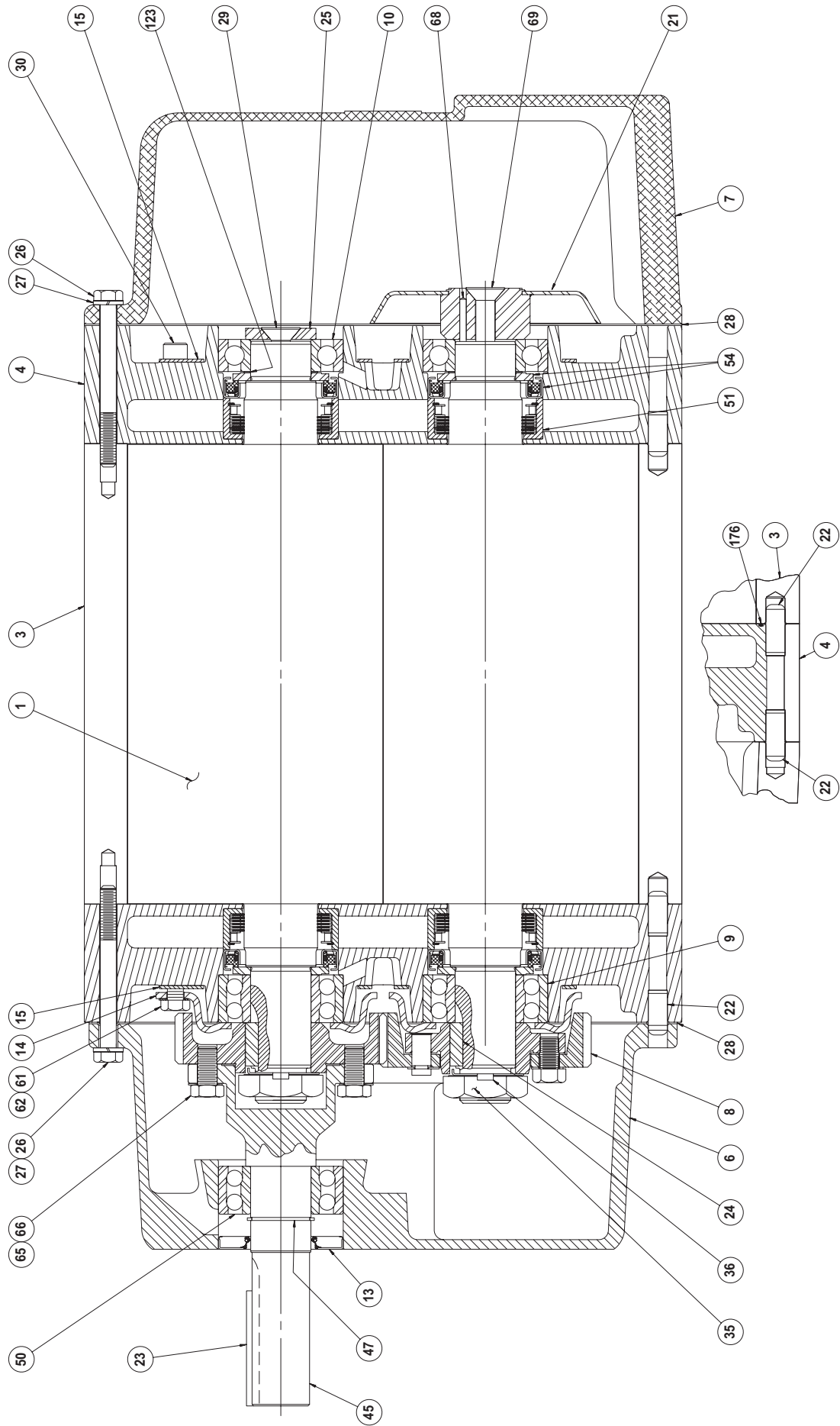


85 SERIES



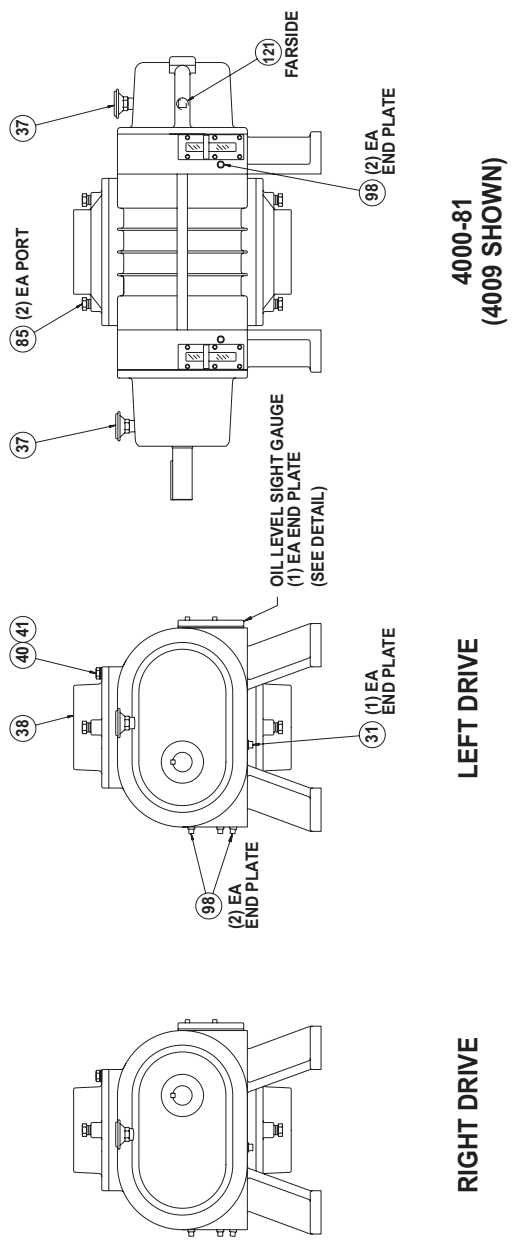
18 SERIES

ASSEMBLY DRAWINGS FOR MODEL 4000 - 54-57-81-84 — CUTAWAY VIEW

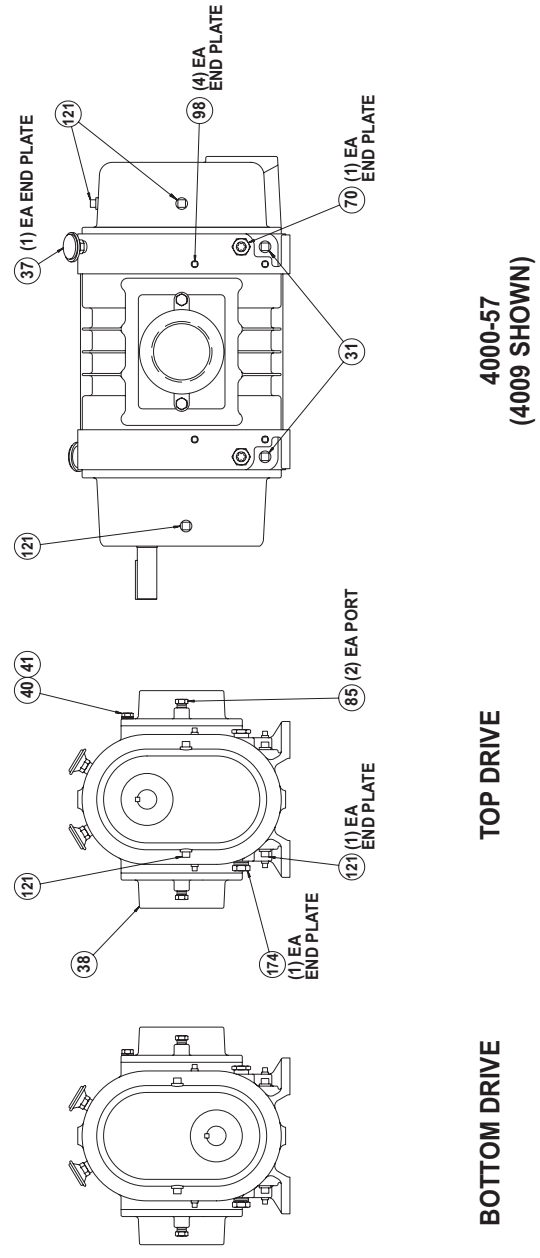


O-RING OPTION
O-RING BETWEEN END PLATE & HOUSING
BOTH END PLATES

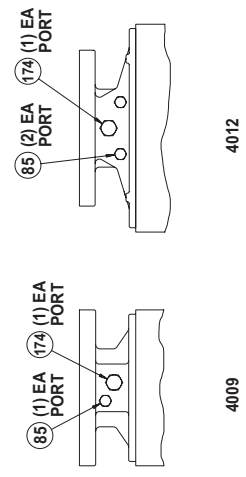
ASSEMBLY DRAWINGS FOR MODEL 4000 - 54-57-81-84 — SIDE AND END VIEWS



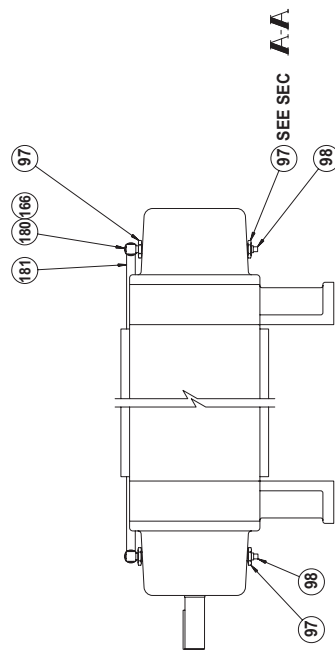
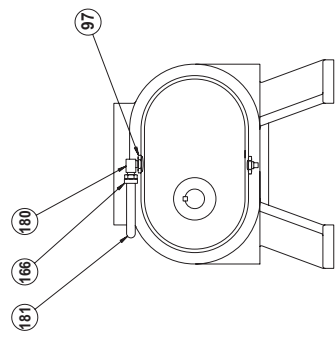
OIL LEVEL SIGHT GAUGE DETAIL



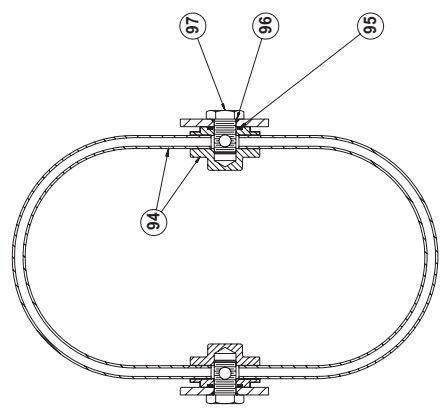
OPTIONAL FLANGED PORT FITTING DETAIL



ASSEMBLY DRAWINGS FOR MODEL 4000 - 54-57-81-84 (COOLING COIL OPTION) — SIDE AND END VIEWS

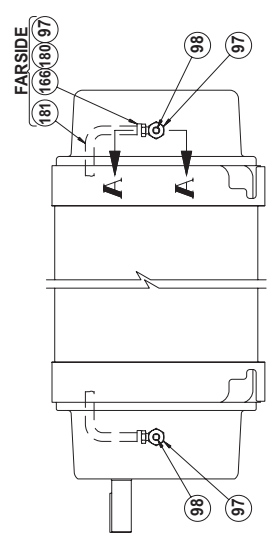
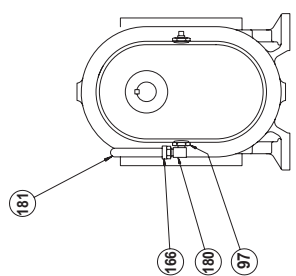


VERTICAL FLOW



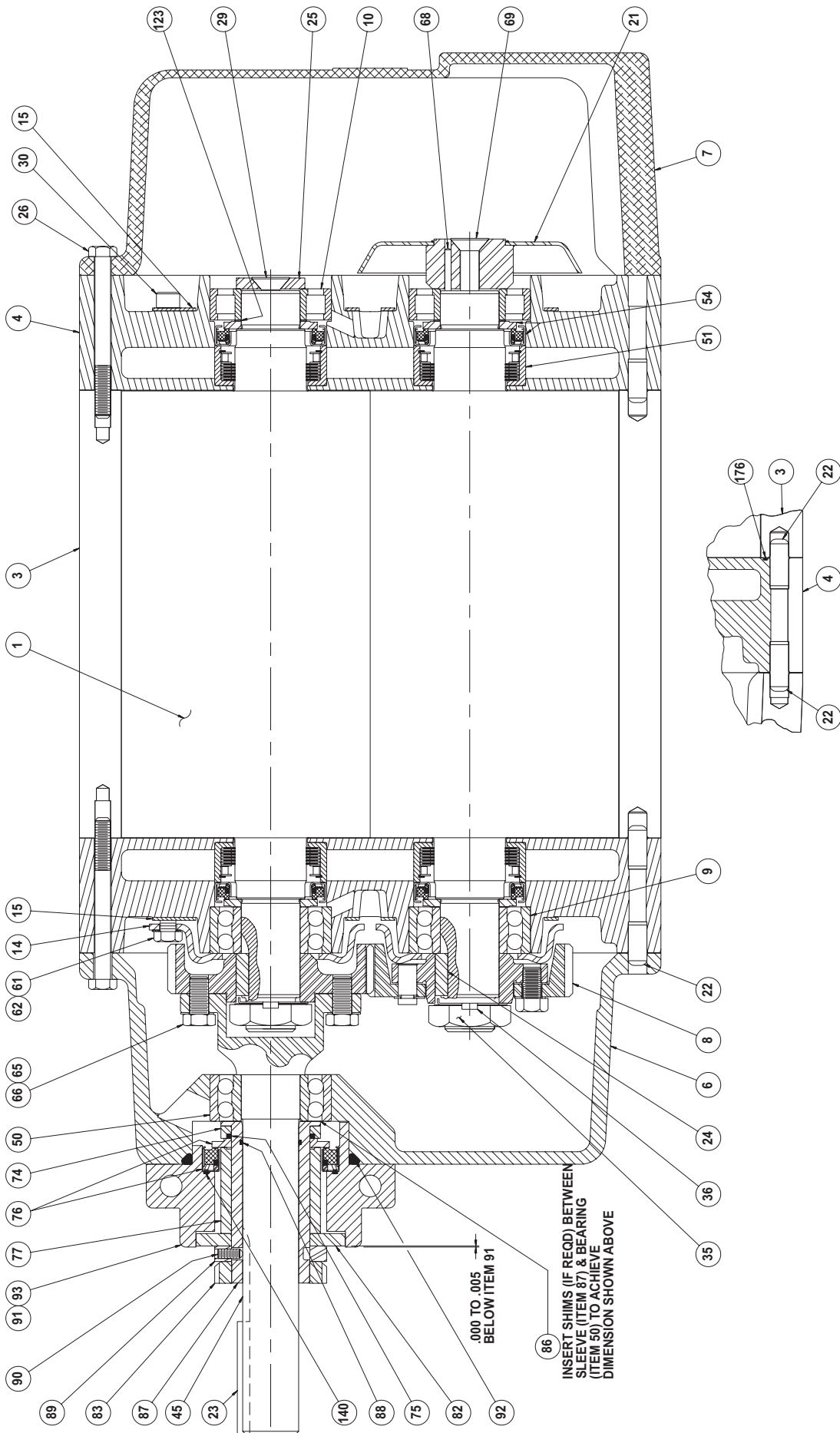
SEC **A-A**
COOLING COIL DETAIL
(TYP BOTH ENDS)
SCALE: NONE

COOLING COIL OPTION



HORIZONTAL FLOW

ASSEMBLY DRAWINGS FOR MODEL 4000 - 64-67-68 — CUTAWAY VIEW



O-RING OPTION
O-RING BETWEEN END PLATE & HOUSING
BOTH END PLATES

Technical drawings of the 4000-67 and 4009 SHOWN pumps, showing front, left drive, and right drive views with callouts for various components.

FRONT VIEW:

- (121) FARSIDE
- (121)
- (12)
- (2) EA PORT
- (85)
- (38)
- (40)
- (121)
- (2) EA END PLATE
- (98)

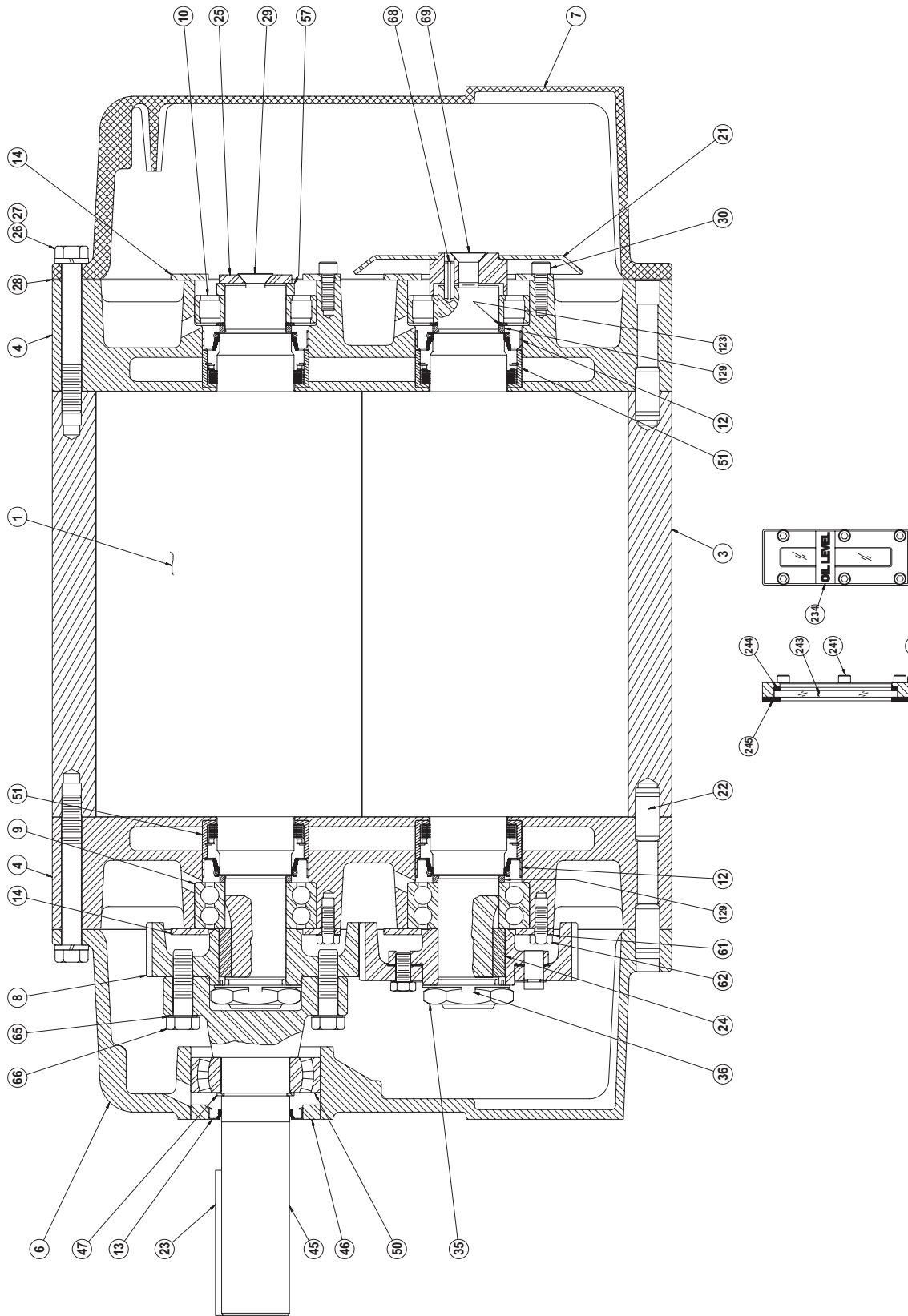
LEFT DRIVE:

- (85)
- (2) EA END PLATE
- (98)
- (31) (1) EA END PLATE
- OIL LEVEL SIGHT GAUGE (1) EA END PLATE (SEE DETAIL)

RIGHT DRIVE:

[illegible]

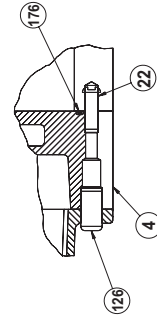
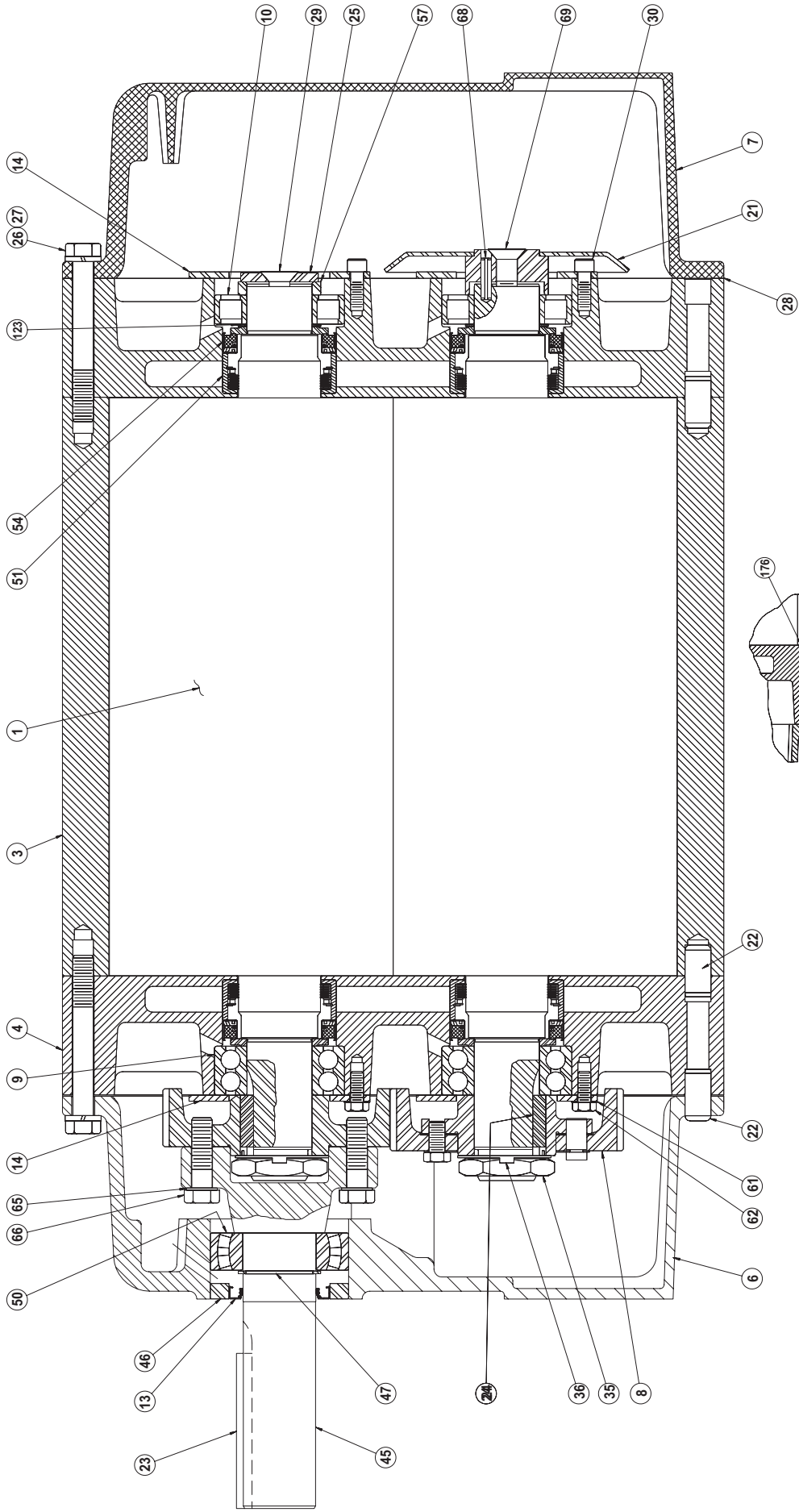
ASSEMBLY DRAWINGS FOR MODEL 5500 - 17-18-46-85 — CUTAWAY VIEW



5511 MODEL SHOWN

OIL LEVEL SIGHT GAUGE DETAIL
17/46 SERIES

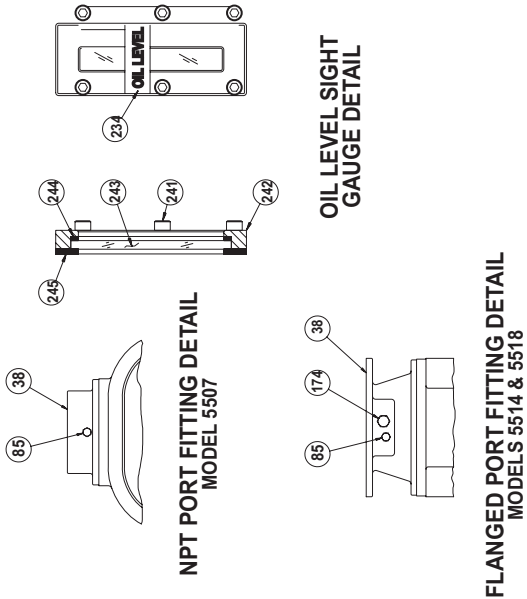
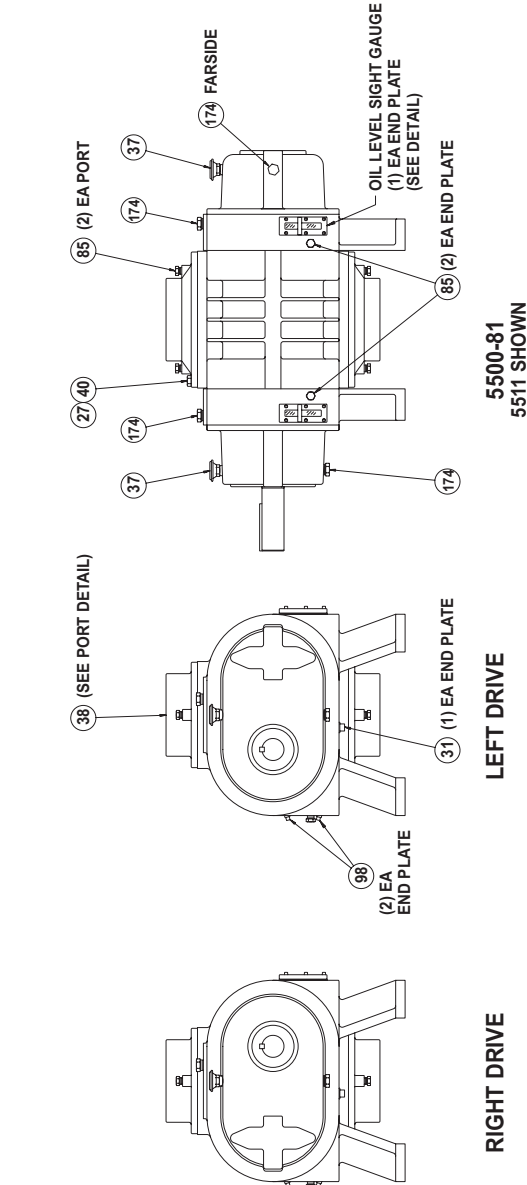
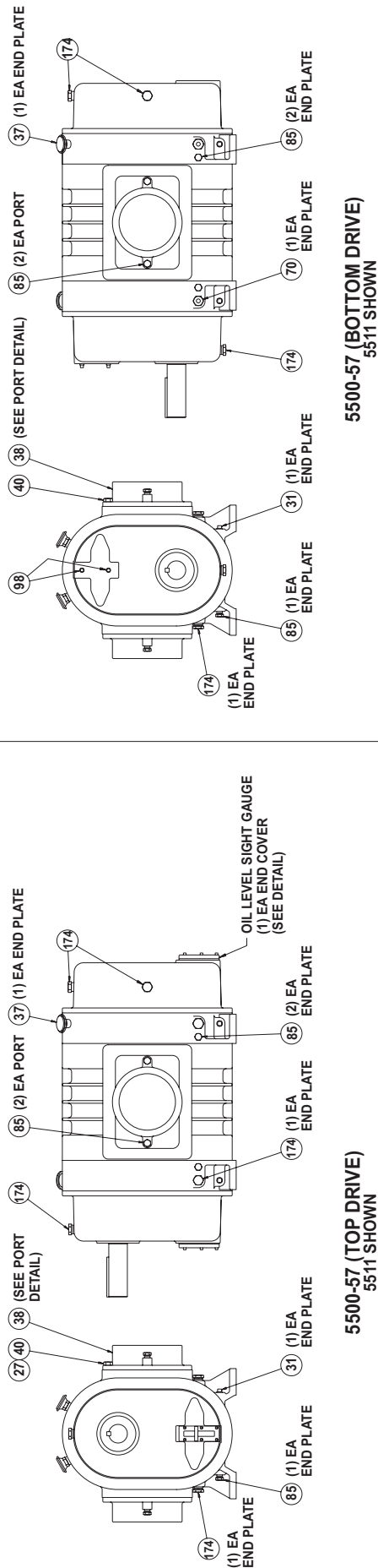
ASSEMBLY DRAWINGS FOR MODEL 5500 - 54-57-81-84 — CUTAWAY VIEW



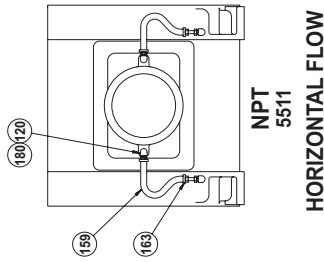
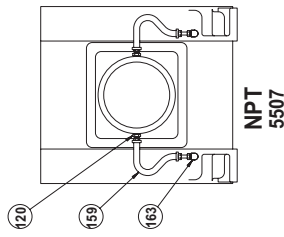
O-RING SEALING ARRANGEMENT OPTION (R)
TYP FOR BOTH END PLATES
SCALE: 1/2

5514 SHOWN

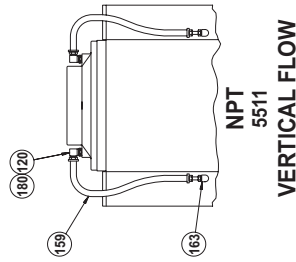
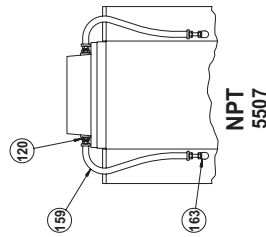
ASSEMBLY DRAWINGS FOR MODEL 5500 - 54-57-81-84 — SIDE AND END VIEWS



ASSEMBLY DRAWINGS FOR MODEL 5500 - 54-57-81-84 (COOLING COIL OPTION) — SIDE AND END VIEWS



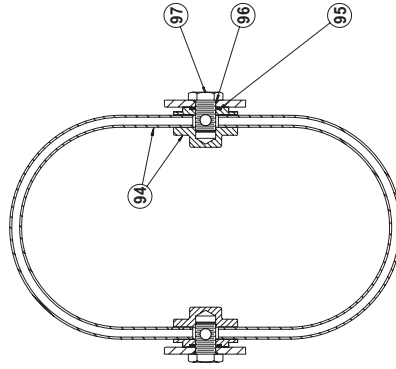
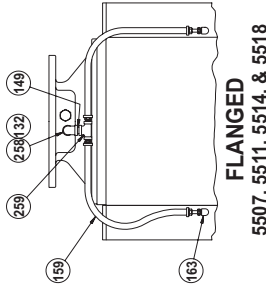
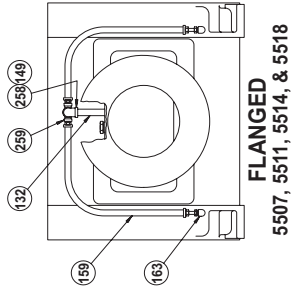
HORIZONTAL FLOW



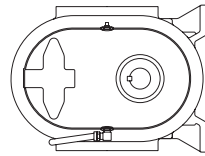
VERTICAL FLOW

VENTING DETAIL

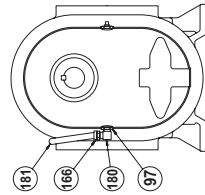
VENT TO INLET PORT
RIGHT SIDE & TOP INLET SHOWN
(SEE FACTORY FOR FLOW DIRECTION)



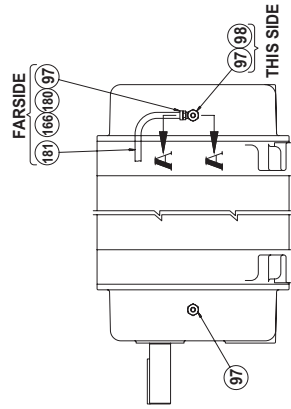
SEC **AA**
COOLING COIL DETAIL
SCALE: 1/2



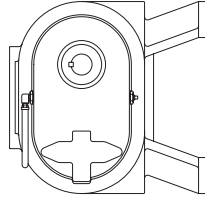
BOTTOM DRIVE



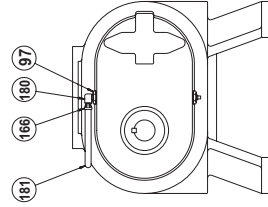
TOP DRIVE



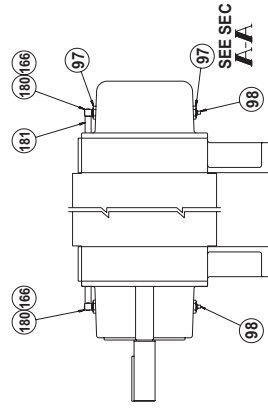
HORIZONTAL FLOW



RIGHT DRIVE

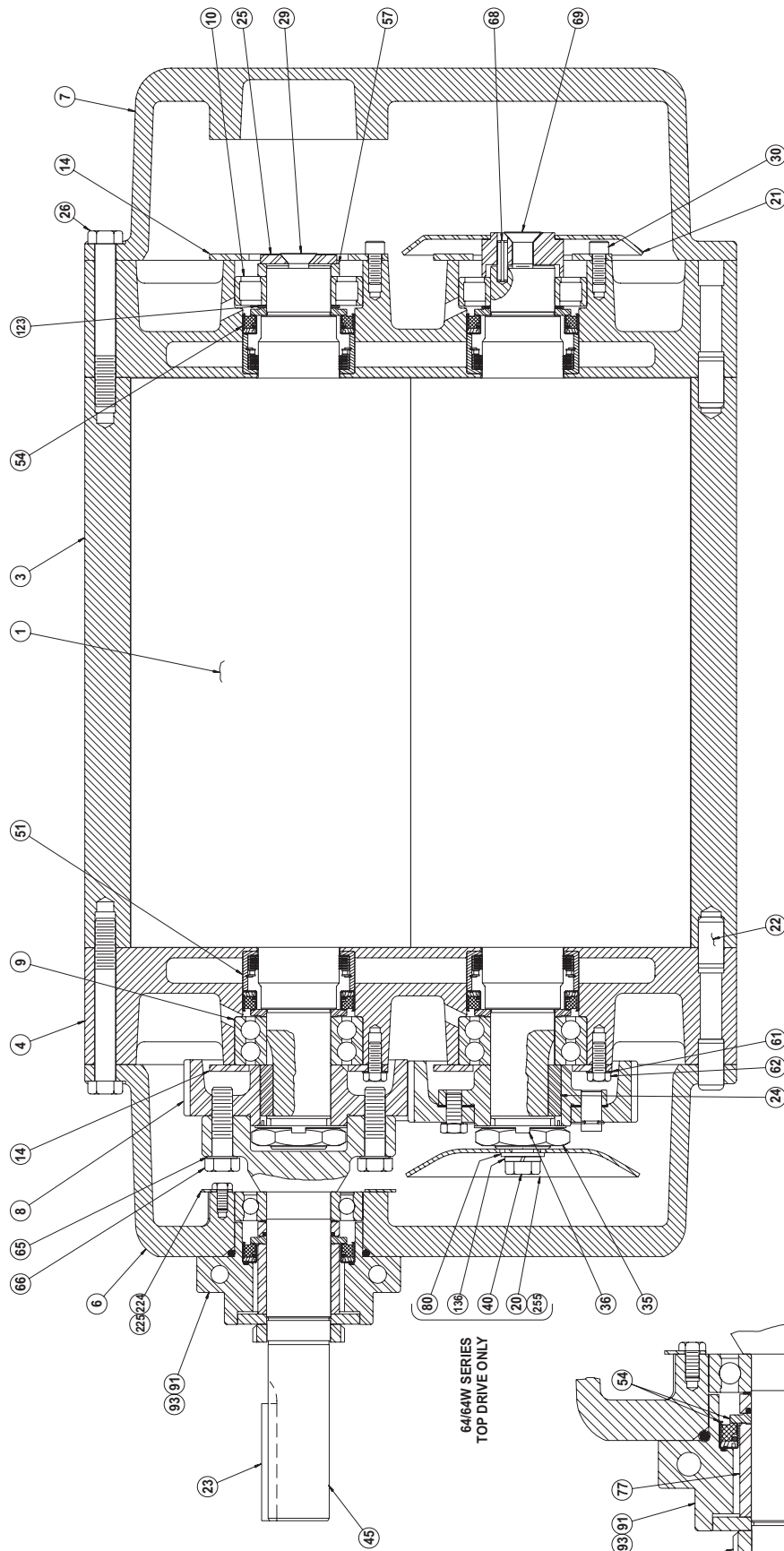


LEFT DRIVE

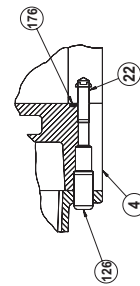
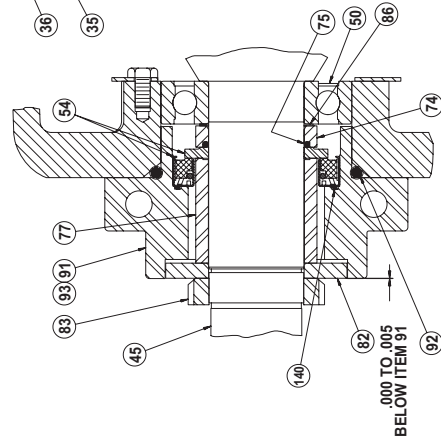


VERTICAL FLOW

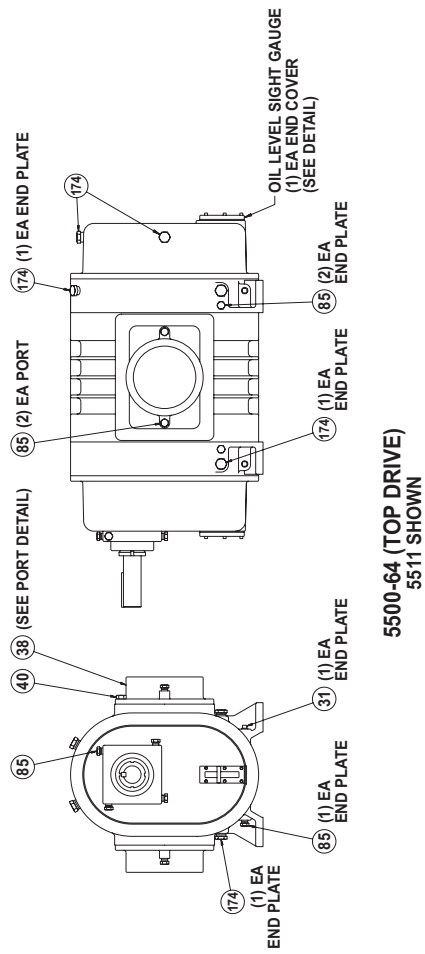
ASSEMBLY DRAWINGS FOR MODEL 5500 - 64-67-68 — CUTAWAY VIEW



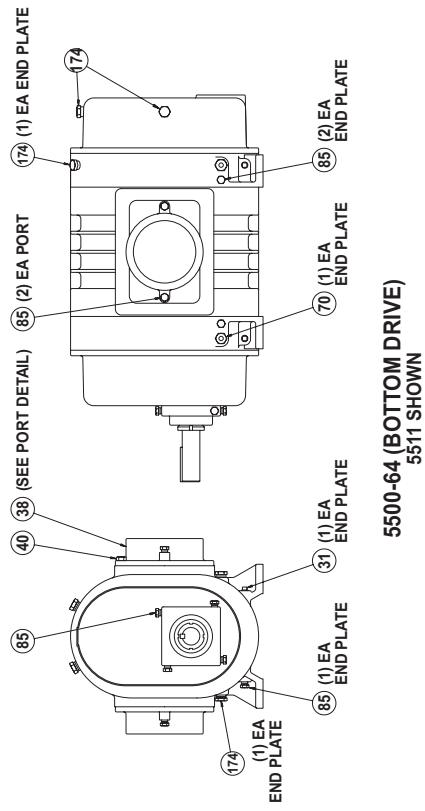
64/64W SERIES
TOP DRIVE ONLY



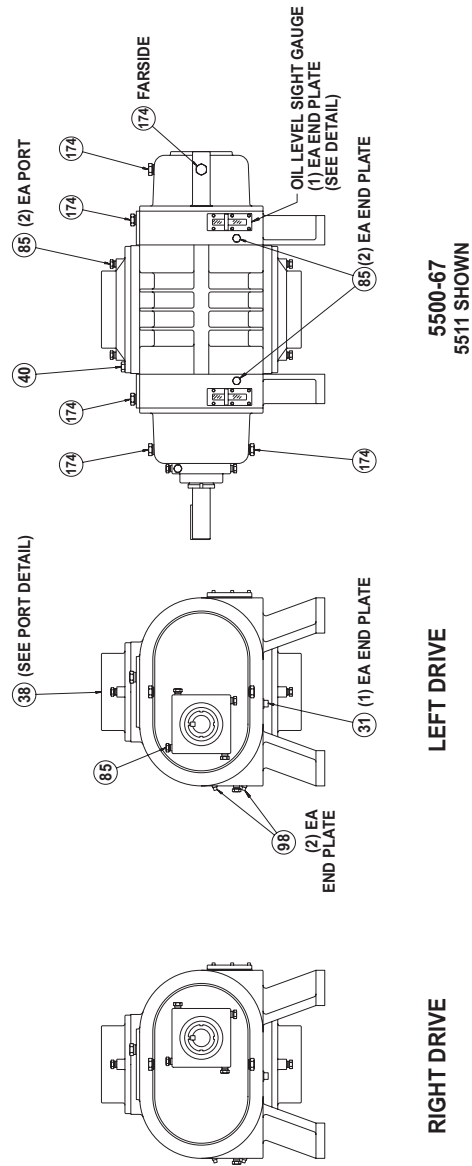
5514 MODEL SHOWN



5500-64 (TOP DRIVE)
5511 SHOWN

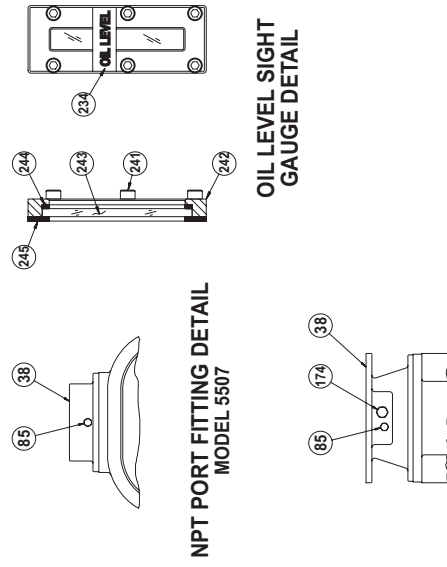


5500-64 (BOTTOM DRIVE)
5511 SHOWN



RIGHT DRIVE

LEFT DRIVE



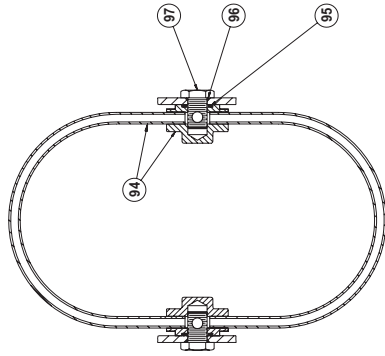
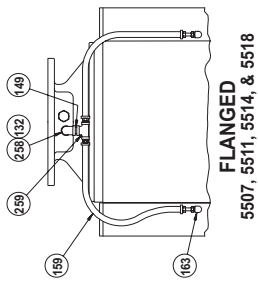
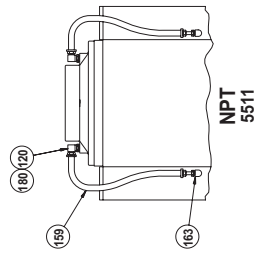
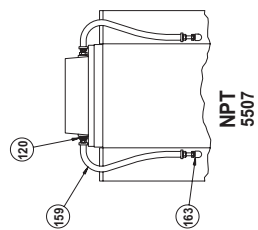
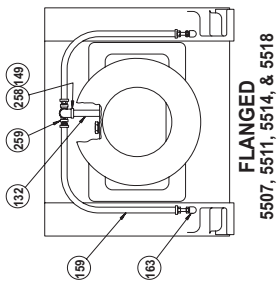
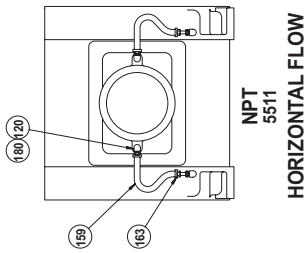
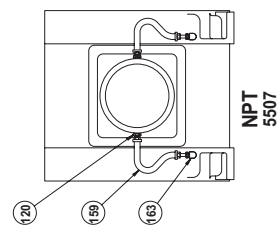
NPT PORT FITTING DETAIL
MODEL 5507

**OIL LEVEL SIGHT
GAUGE DETAIL**

FLANGED PORT FITTING DETAIL

MODELS 5514 & 5518

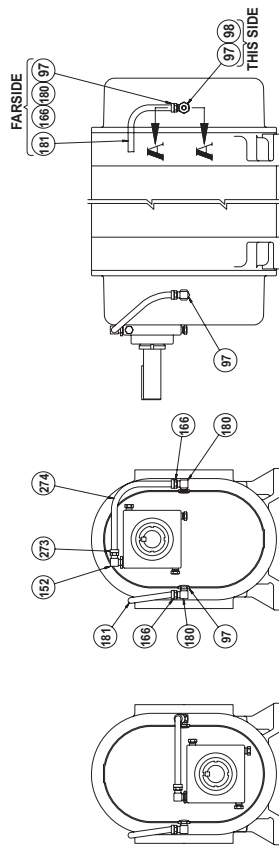
ASSEMBLY DRAWINGS FOR MODEL 5500 - 64-67-68 (COOLING COIL OPTION) — SIDE AND END VIEWS



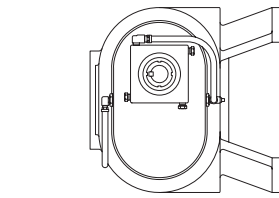
SEC **A-A**
COOLING COIL DETAIL
SCALE: 1/2



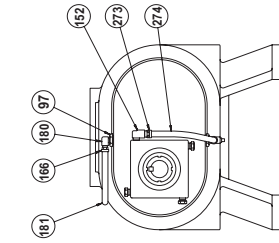
VENT TO INLET PORT
RIGHT SIDE & TOP INLET SHOWN
(SEE FACTORY FOR FLOW DIRECTION)



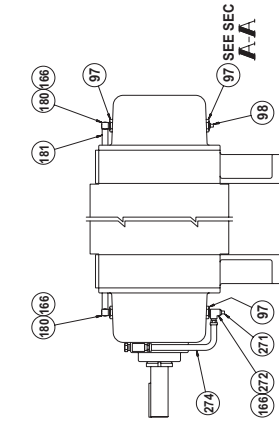
BOTTOM DRIVE



RIGHT DRIVE



LEFT DRIVE



VERTICAL FLOW

NOTES:

NOTES:

NOTES:



DECLARATION OF INCORPORATION

Herewith we declare that the items detailed below are in conformity with the provisions of the Machinery Directive 2006/42/EC.

Information on the items detailed are compiled per the Machinery Directive 2006/42/EC, Annex VII, part A and are the responsibility of the person listed below.

The items detailed below must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the relevant directive(s).

Other directives and standards that apply to this Declaration of Incorporation:

EN 1012-1:1996 - Compressors and vacuum pumps - Safety requirements -
Part 2: Vacuum pumps

The scope of the Declaration of Incorporation is for bare shaft Rotary Positive Displacement (PD Plus®) Blowers

Models 4000, 5500

17/46 – Lip-Labyrinth (Air Service)

57/81 – Single Envelope Gastight

64/67 – Double Envelope Gastight

The person authorized to compile the technical file is Xavier Lambert, Tuthill Corporation, Parc Industriel Wavre Nord-Avenue Vesale 30, B-1300 Wavre Belgium.

Ron Rinke
Director of Engineering, TVBS – Blower Systems



Tuthill Vacuum & Blower Systems
4840 West Kearney Street
P.O. Box 2877
Springfield, MO USA 65801-0877

WARRANTY – BLOWER PRODUCTS

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the Seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

PRODUCT TYPE	TYPE OF APPLICATION	
	ATMOSPHERIC AIR OR PROCESS AIR WITHOUT LIQUIDS PRESENT	PROCESS GASES OTHER THAN AIR, OR ANY LIQUID INJECTED APPLICATION
New (Qx™ models only)	30 months from date of shipment, or 24 months after initial startup date, whichever occurs first.	Consult Factory
New (all other models)	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair	12 months from date of shipment, or remaining warranty period, whichever is greater	12 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

OPERATING DATA

It is to the user's advantage to have the requested data filled in below and available in the event a problem should develop in the blower or the system. This information is also helpful when ordering spare parts.

Model No.	_____	V-Belt Size	_____	Length	_____
Serial No.	_____	Type of Lubrication	_____		
Startup Date	_____	_____			
Pump RPM	_____	Operating Vacuum	_____		
Pump Sheave Diameter	_____	Any other Special Accessories Supplied or in use:			
Motor Sheave Diameter	_____				
Motor RPM	_____	HP	_____		

NOTES:

IMPORTANT

All blowers manufactured by Tuthill Vacuum & Blower Systems are date coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return the product registration card below, or you can visit our product registration web page at:

<http://www.tuthillvacuumblower.com/index.cfm/contact-us/product-registration/>

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All blowers manufactured by Tuthill Vacuum & Blower Systems are date coded at time of shipment. In order to assure you of the full benefits of the product warranty, please complete, tear out and return this product registration card.

Company _____

Location _____

City	State/Province	ZIP/Postal Code	Country
------	----------------	-----------------	---------

Telephone _____

E-mail _____

Model _____

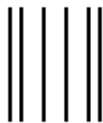
Serial Number _____

Date of Purchase _____

Date of Startup _____

PLEASE CHECK ONE

Pneumatic Conveying	<input type="checkbox"/>
Food	<input type="checkbox"/>
Vacuum	<input type="checkbox"/>
Paper	<input type="checkbox"/>
Food/Meat Packing	<input type="checkbox"/>
Wastewater	<input type="checkbox"/>
Gas/Petrochemical	<input type="checkbox"/>
Other	<input type="checkbox"/>



BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 2912 SPRINGFIELD MO

POSTAGE WILL BE PAID BY ADDRESSEE

ATTN. CUSTOMER SERVICE
TUTHILL VACUUM & BLOWER SYSTEMS
PO BOX 2877
SPRINGFIELD MO 65890-2150

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

