

WARNING: Do Not Operate Before Reading Manual

PD Plus OPERATOR'S MANUAL

Models

7010	7021
7013	7026
7017	

Horizontal Air Flow

Vertical Air Flow

Horizontal Flow, Single Envelope Gastight

Vertical Flow, Single Envelope Gastight

Horizontal Flow, Double Envelope Gastight

Vertical Flow, Double Envelope Gastight



Disclaimer Statement:

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INTRODUCTION

CONGRATULATIONS on the 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. Read and follow every step of these instructions when installing and maintaining your blower.

NOTE: Record the blower model and serial numbers of the machine in the **OPERATING DATA** form on the inside back cover of this manual. Use this identification on any replacement part orders, or if service or application assistance is required.

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

SCOPE OF MANUAL

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

02

CONVENTIONS AND DATA PLATE

GRAPHIC CONVENTIONS IN THIS MANUAL

This manual is the result of a risk assessment according to the applicable documents referenced in **“Applicable Documentation” on page 1**. The following hazard levels are referenced within this manual:

DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation that can cause damage to the engine, personal property, and/or the environment or cause the equipment to operate improperly.

NOTE: Indicates a procedure, practice, or condition that should be followed in order for the equipment to function in the manner intended.

CAUTION



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

DATA PLATE






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


Figure 1-1 – General Operation and Symbols on Data Plate


The following information is contained on the data plate:

WARNING

Keep body and 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 exceed 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:	The specific model of the blower
SERIAL NUMBER:	Unique to each blower
YEAR:	Year of manufacture
MAWP:	Maximum Allowable Working Pressure The standard MAWP is per Table 4-3 – Maximum Operating Limits on page 9 . The MAWP shall not be exceeded.



WARNING

The blower must be handled using an appropriate device such as a fork truck or appropriate lifting device. See *Table 4-1* and *Table 4-2 on page 8* for approximate weights. Care should be taken to assure blower does not over-turn during handling and installation.

04

DESCRIPTION

NOTICE

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

NOTE: See *Figure 4-2 on page 7* for proper rotation and orientation in inlet and discharge.

Tuthill Vacuum & Blower Systems model 7000 rotary lobe blowers are positive displacement type blowers, 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.

The inlet to the discharge is sealed with operating clearances that are very small. Internal lubrication is not needed, as there is no moving contact.

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 4-1 illustrates the air movement within the machine. 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 *Figure 4-2 on page 7*.

Never attempt 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, will 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, install an adequate vacuum relief valve near the blower. A pressure-type relief valve in the discharge line near the blower is also recommended for protection against cutoff or blocking in this line. Use check valves on each blower when more than one blower is connected to a discharge line.

When a belt drive is used, blower speed, it is possible to adjust blower speed to obtain the desired capacity by changing the diameter of one or both sheaves, or by using a variable-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 a Tuthill Vacuum & Blower Systems sales professional if questions arise.

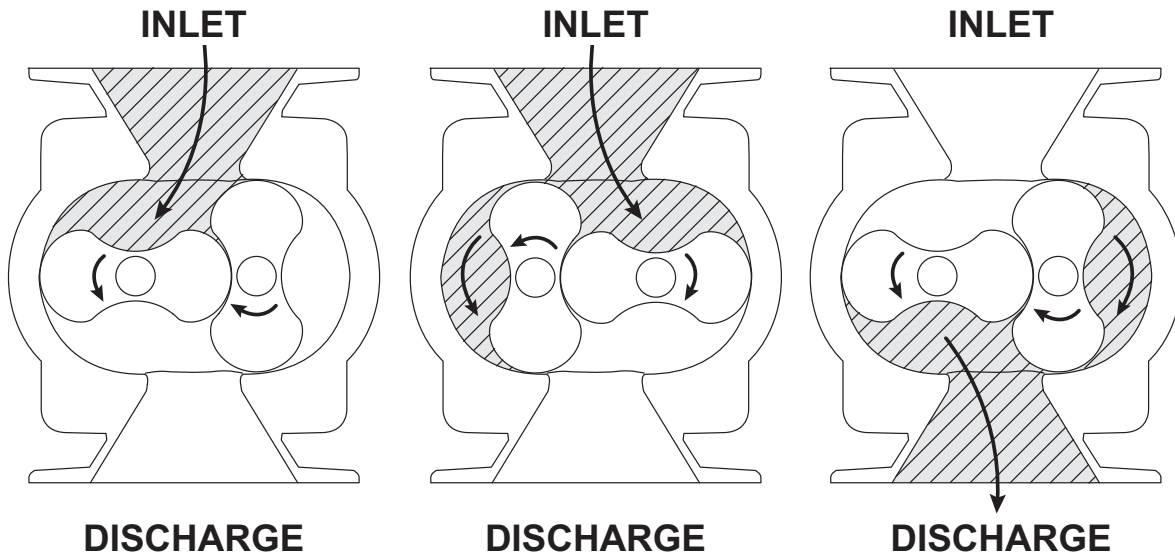


Figure 4-1 – General Operation Principle

FLOW BY DIRECTION

⚠ WARNING

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

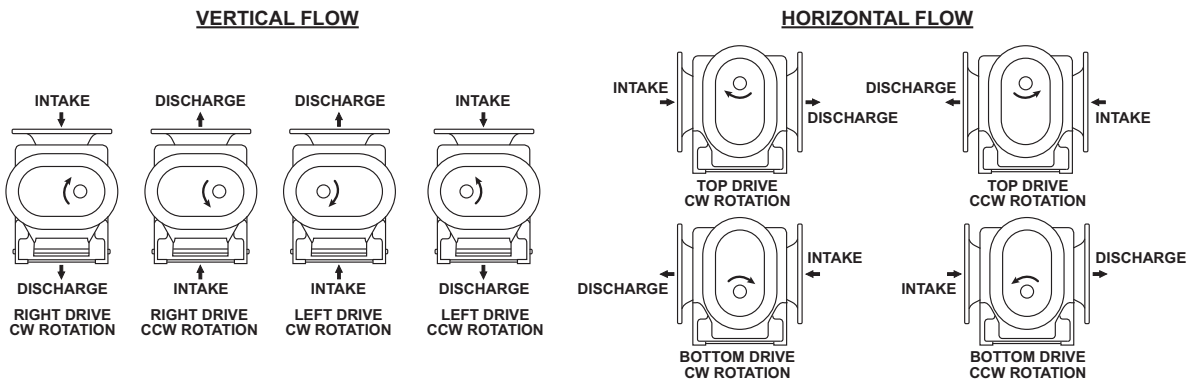


Figure 4-2 – Flow Direction by Rotation

SPECIFICATIONS

MODEL	APPROXIMATE OIL CAPACITY		PORT SIZE	MAXIMUM RPM	APPROXIMATE WEIGHT	
	VERTICAL FLOW	HORIZONTAL FLOW			VERTICAL FLOW	HORIZONTAL FLOW
7010	8.0 qt (7.5 L)	5.0 qt (4.75 L)	6 in. (150 mm)	3,000	–	1,120 lb (510 kg)
7013	8.0 qt (7.5 L)	5.0 qt (4.75 L)	8 in. (200 mm)	3,000	1,255 lb (570 kg)	–
7017	8.0 qt (7.5 L)	5.0 qt (4.75 L)	10 in. (250 mm)	3,000	–	1,390 lb (635 kg)
7021	8.0 qt (7.5 L)	5.0 qt (4.75 L)	12 in. (300 mm)	3,000	1,530 lb (695 kg)	1,530 lb (695 kg)
7026	8.0 qt (7.5 L)	5.0 qt (4.75 L)	12 in. (300 mm)	3,000	1,695 lb (770 kg)	1,695 lb (770 kg)

Table 4-1 – Specifications (Sump Oil Lubrication)

MODEL	APPROXIMATE OIL CAPACITY		PORT SIZE	MAXIMUM RPM	APPROXIMATE WEIGHT	
	VERTICAL FLOW	HORIZONTAL FLOW			VERTICAL FLOW	HORIZONTAL FLOW
7010	15qt (14.2 L)	12 qt (11.4 L)	6 in. (150 mm)	3,000	–	1,120 lb (510 kg)
7013	15qt (14.2 L)	12 qt (11.4 L)	8 in. (200 mm)	3,000	1,255 lb (570 kg)	–
7017	15qt (14.2 L)	12 qt (11.4 L)	10 in. (250 mm)	3,000	–	1,390 lb (635 kg)
7021	15qt (14.2 L)	12 qt (11.4 L)	12 in. (300 mm)	3,000	1,530 lb (695 kg)	1,530 lb (695 kg)
7026	15qt (14.2 L)	12 qt (11.4 L)	12 in. (300 mm)	3,000	1,695 lb (770 kg)	1,695 lb (770 kg)

Table 4-2 – Specifications (Integral Lubrication)

MODEL	MAXIMUM RPM	MAXIMUM PRESSURE DIFFERENTIAL	MAXIMUM VACUUM	MAXIMUM TEMPERATURE RISE	MAWP
7010	3,000	18 psi (1,241 mbar)	17 inch-Hg (575 mbar)	300°F (166°C)	100 psi (6.9 bar)
7013	3,000	18 psi (1,241 mbar)	17 inch-Hg (575 mbar)	300°F (166°C)	
7017	3,000	15 psi (1,034 mbar)	15 inch-Hg (507 mbar)	300°F (166°C)	
7021	3,000	15 psi (1,034 mbar)	15 inch-Hg (507 mbar)	280°F (156°C)	
7026	3,000	12 psi (827 mbar)	15 inch-Hg (507 mbar)	220°F (122°C)	

Table 4-3 – Maximum Operating Limits

 **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.

Maximum limits for pressure, temperature, and speed are specified in **Table 4-3 on page 9** for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any of these limits.

 **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.

NOTICE

*Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown in **Assembly Clearances on page 39**, will not have the operating limits specified here. Contact your Tuthill Vacuum & Blower Systems sales representative for specific information.*

NOTICE

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.

05

INSTALLATION

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.

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 4-3*. The MAWP shall not be exceeded unless specific factory testing of the pressure containing components of the blower has been performed.

WARNING

Table 4-3 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.

NOTICE

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, file a claim with the carrier immediately. Preserve the shipping container for inspection by the carrier.

NOTICE

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.

Do not remove protective covers and plugs until the connection is being made. Mount the blower on a flat, level surface. Use a baseplate that is 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 twisting of the blower. Make sure the feet rest evenly on the mounting surface before fastening down. Twisting or cramping the blower during mounting will cause rotor contact and binding during operation, resulting in a condition called "soft foot." **See Soft Foot on page 13** for further details and preventative measures.

A blower that is factory-mounted on a base should not require such adjustments. However, since the assembly can become twisted in shipping or installation, check for soft foot after installing the

base. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. Mount the base on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly. See also **Foundation on page 12**.

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 transmission. To avoid casing distortion, apply the treatment under the common motor/blower base or mounting plate rather than directly under the feet alone.

Make sure piping is 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. Take care to evenly tighten the mounting bolts to avoid imparting 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. Spring or gap should be found less than 0.002 in. (0.05 mm).

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, make sure that an inlet filter is used. Clean the filter of collected debris after 3 hours of operation and periodically thereafter. **See Piping Connections on page 18** for additional details.

Figure 5-1 shows a typical complete installation of blower and accessories. Note the absence of throttle or shut-off valves in both discharge and intake piping. If it is possible for airflow to be cut off in either line, 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. Keep the weight of accessories and piping to a minimum to prevent blower casing distortion. If the weight exceeds 10% of blower weight, support the components independently of the blower and connect them with a flexible hose or connectors. The approximate weights of the blowers are listed in **Table 4-1** and **Table 4-2 on page 8**.

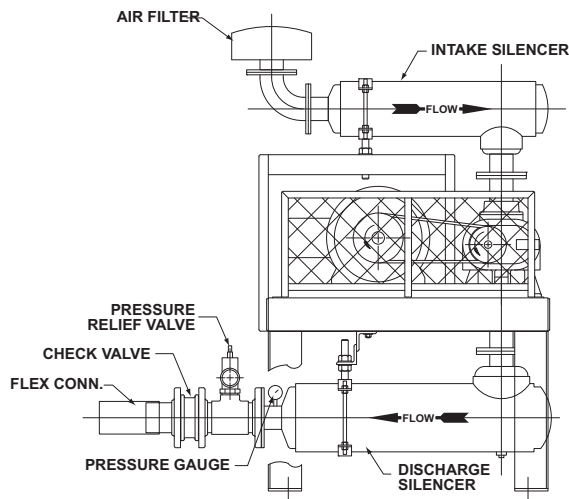


Figure 5-1 – Typical Blower Installation

A blower may be driven by direct-coupling to the driver or by V-belt drive for the purpose of obtaining other speeds within the approved range. **See Motor Drives on page 20** 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), **see Long-Term Storage on page 30**.

Location

Install the blower in a room or outdoor area that supplies adequate space and lighting for routine maintenance. Make sure that indoor installation areas are well ventilated and kept as cool as possible, because operating the blower at elevated temperatures can result in nuisance overload or temperature shutdowns. An unprotected outdoor installation is satisfactory only when correct lubrication for expected temperatures is provided. **See Recommended Lubricants on page 41**.

Foundation

The blower does not need a special foundation. However, it does require a solid, level floor and adequate frame support. Bolt the blower system to the floor, and seal any cracks.

Blower Air Intake

To minimize maintenance, supply the blower with the cleanest air possible. The air must not contain any flammable or toxic gases, as the blower will concentrate these gases. This could result in damage to the blower and surrounding property and lead to personal injury or death. Do not block or restrict the opening of the blower and/or motor, as they could overheat and fail.

Do not use blowers on explosive or hazardous gases. Do not exceed the limits described in **Table 4-3**. Each size blower has limits on performance criteria such as pressure differential, running speed, and discharge temperature.

If it is necessary to take air from a remote source, such as in a vacuum application, make sure the diameter of the piping is at least equal to the diameter of the blower inlet. For distances greater than 20 ft (6 m), enlarge the pipe diameter 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. Keep the inlet covered to keep out foreign objects and rain. Vacuum kits are available.

Soft Foot

Soft foot is a condition in which one of the blower feet does not sit flat on the base. Soft foot is usually due to irregularities in the surface to which the blower is mounted. When the bolt on the foot gets tightened, a slight distortion occurs that can affect bearing and seal life as well as cause premature internal contact between the rotors and the housing.

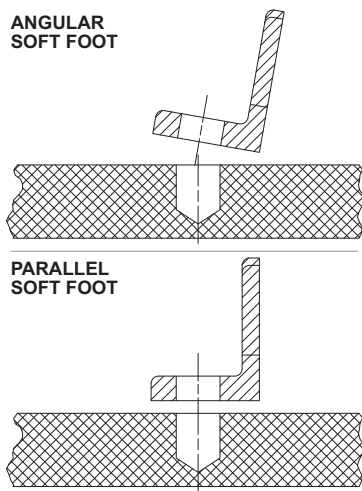


Figure 5-2 – Illustrations of Soft Foot

1. Place the blower on the base.
2. Check each foot for gaps between the foot and base (soft foot). Shim as necessary to fill gap within 0.002 in. (0.05 mm).
Figure 5-2 shows the two most common types of soft foot conditions. If either type is present at a measurement of more than 0.003 in. (0.076 mm), the blower may fail prematurely.
3. Tighten all bolts.
4. Mount a dial indicator on the base contacting one foot at 12 o'clock position.
5. Loosen the bolt on that foot. Observe indicator travel and add shims as needed to reduce "spring" to less than 0.002 in. (0.05 mm). Repeat steps 4 and 5 on the remaining feet.

SAFETY



Tuthill Vacuum & Blower Systems recommends the use of relief valves to protect against excessive pressure or vacuum conditions. Test these valves 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.

LUBRICATION

Every booster from Tuthill Vacuum & Blower Systems is factory-tested, oil-drained, and shipped dry to its installation point. Fill both independent oil reservoirs 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 the oil sumps as described in *Filling Procedure on page 15*.

Add oil to the blower in the quantity listed in *Table 4-2 on page 8*. Make sure oil level is maintained within the notched area of the sight glass. See *Figure 5-3* and *Figure 5-4*. Lower drive blowers 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.

NOTICE

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

NOTICE

See Table 4-1 and Table 4-2 for oil capacities.

Filling Procedure

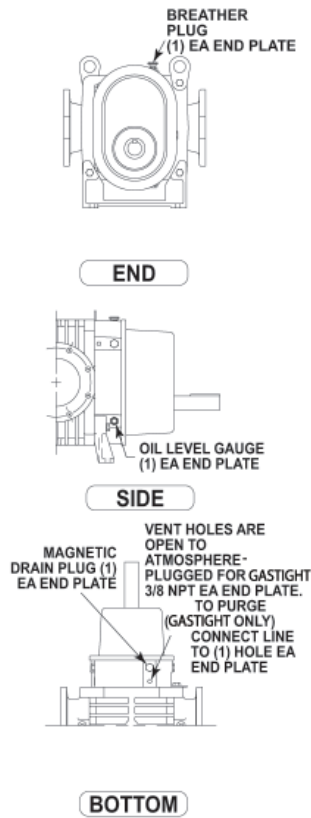
See Figure 5-3 and Figure 5-4.

See Recommended Lubricants on page 41 for suggested lubricants.

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

SPLASH LUBRICATION

HORIZONTAL FLOW



VERTICAL FLOW

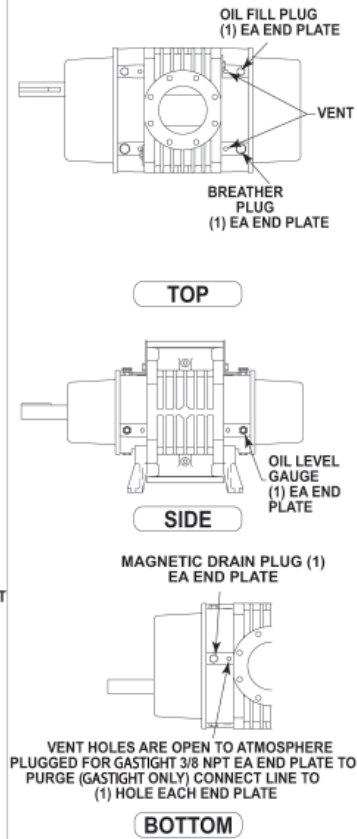


Figure 5-3 – Locations of Oil Fill, Drain, and Level Gauge on Blowers with Splash Lubrication

INTEGRAL LUBRICATION

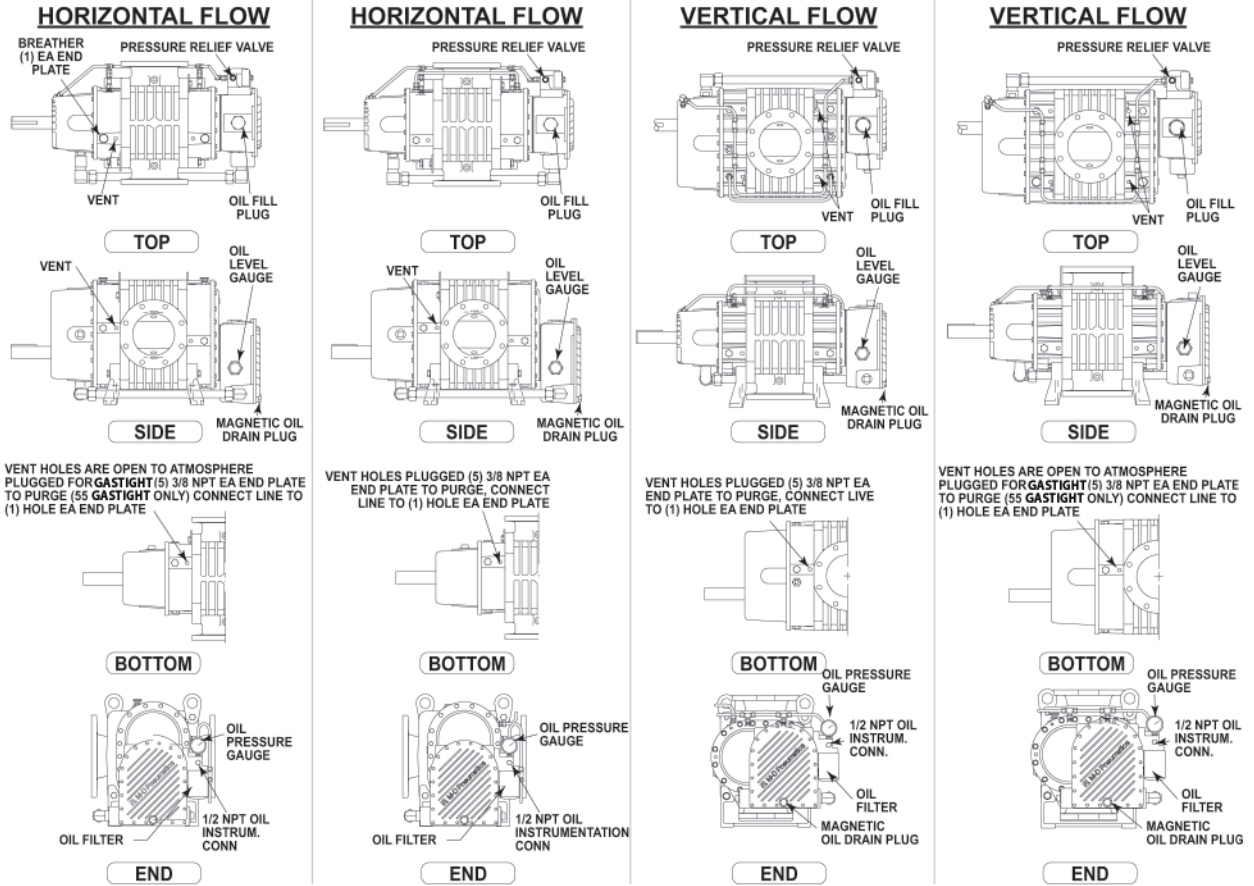


Figure 5-4 – Locations of Oil Fill, Drain, Level Gauges, and Cooling Connections on Blowers with Integral Lubrication

Frequently Asked Questions Regarding Lubrication

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

The lubricant is selected based on bearing speed, gear speed, and operating temperature. If the lubricant is too light, it 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. Thicker lubricant 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 its toll and the lubricant will thicken. The blower will run hotter and the wear on moving parts will increase. The lubricant will generally appear dirtier, caused by material rubbing off the components. The lubricant will discolor because of overheating. An indicator of the breakdown of a lubricant is the increase in the TAN (Total Acid Number), and a change of 10 percent in the base viscosity.

Several things are happening as the lubricant goes through the blower. 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. The published cycles are based on worst-case conditions.

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 manufacturer’s applicable instruction for safety precautions.

Lubrication (Splash)

NOTICE

For connecting water, remove only the 1" NPT plugs with the 5/8" allen heads. Use of any other connection for water will cause serious damage to unit.

Before starting the blower, fill the oil reservoirs as follows:

1. Remove the fill plugs or breathers from the gear (drive) end and free (non-drive) end plates.
2. Pour oil through the fill hole until oil appears in the sight glass. Slowly bring the oil level up to the center of the glass. Repeat for both end plates. Fill each oil sump independently.
3. Re-seal the plugs and reinstall them in them end plates.

Check the oil levels frequently. The blower must be shut down to properly check oil levels.

Lubrication (Integral Pressure)

Before starting the blower, fill the oil reservoirs as follows:

1. Remove the oil fill plug.
2. Pour oil through the fill hole until oil appears in the sight glass.

NOTE: The front and back oil reservoirs are connected. However, it may take a few minutes for the oil to travel to the front of the blower.

3. Bring the oil level up to the center of the sight glass.

NOTE: Again, allow time for the oil level to equalize between the front and back of the blower.

4. Reinstall the fill plug.

Oil Filter on Integral Lube Blowers

Change the oil filter element at every oil change.

The oil filters (P/N 70248) are available from Tuthill Vacuum and Blower Systems in Springfield, Missouri, or from any authorized distributor or service center.

Integral Lube Oil Pressure Adjustment

The oil pressure on each blower has been preset at the factory during the load testing. The oil pressure should not require adjustment once the blower is installed and in operation. However, in rare cases, some adjustment may be needed due to speed and oil temperature.

Once the blower reaches operating temperature, the oil pressure can be adjusted to the proper range. The oil pressure should be set to 15 psig (103 kPa).

To adjust the blower to the proper oil pressure:

1. Remove the hex cap (*see Figure 5-5*).



Figure 5-5 – Oil Pressure Adjustment Hex Cap

2. Loosen the lock nut.
3. Turn the set screw clockwise to increase the pressure or counterclockwise to decrease the pressure.
4. Tighten the lock nut and replace the cap.
5. Read the oil pressure. Repeat the process to re-adjust the pressure if necessary.

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.

NOTICE


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. Do not support silencers by the blower. Avoid stress loads and bending moments.

Be certain all piping is clean internally before connecting to the blower. Place 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. Clean the screen after

3 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 airflow 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.

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.

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.

NOTICE

Water cooled end plates are discontinued. Consult factory for connection details.

NOTICE

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

Blowers supplied with cooling coils can be identified by the letter located in the 13th position of the complete blower model number.

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 more per day. Water cooling reduces oil temperature and improves oil viscosity for better lubrication. A water flow of 0.5 – 1.0 GPM (1.9 – 3.8 L/min) is generally sufficient to maintain oil temperatures of 150°F (65°C) or below. Do not allow water pressure to exceed 75 psig (510 kPa g).

COOLING WATER CONNECTIONS AND SPECIFICATIONS — COOLING COILS (OPTIONAL)

WARNING

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

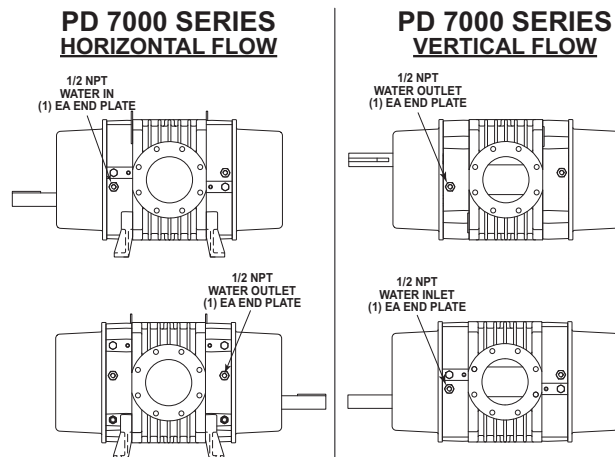


Figure 5-6 – Cooling Connections on Blowers with Cooling Coils Option

MOTOR DRIVES

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

Direct Coupled

When installing the motor directly to the blower, align the shafts to the coupling according to the coupling manufacturer's instructions. Blowers shipped with motor directly coupled and mounted on a common base have been aligned prior to shipment. Further alignment is normally necessary, but be sure to check the alignment and make adjustments if necessary prior to starting the blower.

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 0.005 in. (13 mm) Total Indicator Reading (T.I.R.). Make sure the face is aligned within 0.002 in. (0.05 mm).

Establish proper gap between coupling halves according to the coupling manufacturer's instructions with the motor armature. Proper gap will minimize the chance for end thrust on the blower shaft. Re-align and grease all direct-coupled base-mounted blowers after field installation.

V-Belts

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

Adjust the belt tension to the to the manufacturer's specifications using a belt tension tester. Check new belts for proper tension after 24 hours of run time. When manufacturer data is not available, industry guidelines are 1/64 in. deflection for each inch of span (0.157 mm per centimeter of span) at 8 – 10 lb (3.6 – 4.5 kg) of force in the center of the belt.

Insufficient tensioning is often indicated by slipping (squealing) at start-up. Do not use belt dressing on V-belts. Keep sheaves and V-belts free of oil and grease. Remove tension 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. Make sure the motor sheave fits correctly and is properly aligned with the blower sheave.

Adjust the motor position on its sliding base so that belt tension is in accordance with the drive manufacturer's instructions. Always avoid excessive belt tension. Recheck tension after the first 10 hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

Check blower after installation and before applying power by rotating the drive shaft by hand.

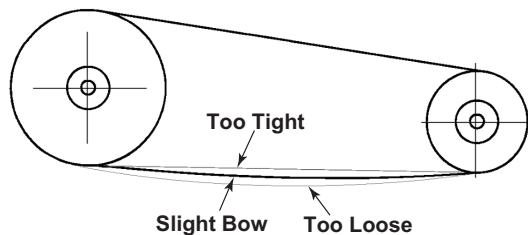


Figure 5-7 – General appearance of a V-belt drive

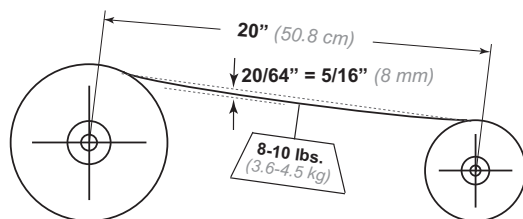


Figure 5-8 – Setting of proper tension for a V-belt drive

Check the blower after installation and before applying power by rotating the drive shaft by hand.

If the drive shaft does not rotate freely:

- Look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment.
- Check the blower to make sure oil was added to the reservoirs.

Setting V-Belt Tension

Proper belt tension is essential to long blower life. **Figure 5-7**, **Figure 5-8**, and the following procedure are provided to aid in field-adjusting V-belts (when the blower is so equipped) for maximum performance. A visual inspection of the V-belt drive should yield the appearance shown in **Figure 5-7**.

Factors outside the control of the belt tensioning system used on an individual blower package assembly, such as environmental factors and quality of the belts installed, may contribute to decreased belt life. Such factors 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. Tension should be 1/64 in. deflection per inch of span (0.157 mm deflection per centimeter of span) between sheaves, with 8 – 10 lb (3.6 – 4.5 kg) force applied at the center point of the top section of the belt.
5. Install the belt guard, making sure that all drive components are free of contact with the guard.
6. Install the belt guard fasteners that were removed in step 2.
7. Unlock the power and start the blower.
8. Resume normal operation.

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.

NOTICE

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 are performed per IEC 60204-1. This includes overcurrent 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 the component being wired. Turn the blower by hand after wiring is completed to determine that there are no obstructions and that the blower turns freely. Then, momentarily start the blower to check the direction of rotation. **Figure 4-2 on page 7** shows direction of airflow in relation to rotor rotation. The airflow direction can be reversed by reversing the appropriate motor leads.

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 4-3* 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 difficulties. Use the following checklist 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 the blower shaft several times by hand to make sure blower is rotating freely. Unevenness or tight spots are indicators of a condition that should be corrected before progressing.
7. Check motor rotation by momentarily pushing the START button and then checking the flow direction of the blower. Reverse the motor connections if flow is in the wrong direction.

Carry out initial operation 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 make sure the blower coasts freely to a stop. If no problem appears, repeat this check and let the motor run slightly longer. If any questions exist, investigate before proceeding.

Assuming all tests are satisfactory, the blower will now be ready for continuous full-load operation. During the first several days, check periodically to make sure 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 the inlet filter. Also, recheck leveling, coupling alignment or belt tension, and mounting bolts for tightness.

START-UP CHECKLIST

It is recommended that these start-up procedures be followed in sequence and checked off () in the boxes provided in any of the following cases.

<ul style="list-style-type: none"> • During initial installation • After any shutdown period 	<ul style="list-style-type: none"> • After maintenance work has been performed • After blower has been moved to a new location
DATES CHECKED:	<input type="text"/> <input type="text"/> <input type="text"/>
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check the unit for proper lubrication. Proper oil level is critical. See Lubrication on page 14. See Recommended Lubricants on page 41 for information on acceptable lubricants for the product.
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check the V-belt drive for proper belt alignment and tension.
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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.

<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	“Bump” (an intermittent start, then turned off immediately) the unit with the motor to check rotation (counterclockwise when facing the shaft) and to be certain it turns freely and smoothly.
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	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, see Troubleshooting on page 37.
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Apply the load and observe the operation of the unit for 1 hour.
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	If minor malfunctions occur, discontinue operation and see Troubleshooting on page 37.

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. 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.

NOTICE

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

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 the blower is water cooled. Stop the backing pump. See the component instruction manual.

METHANE GAS APPLICATIONS

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 build-up, and the lubricating oil coats the rotors to slow the build-up.

Inject the mixture on the inlet side through a valve set to feed 1 gal (3.8 L) of mixture in 15 – 20 minutes. On blowers that are regularly flushed, flushing once a week is sufficient. If the blower is dirty, flush it daily until the hard build-up is removed and then move to a weekly cycle. In very dirty gas installations, vary the cycle to meet the demand.

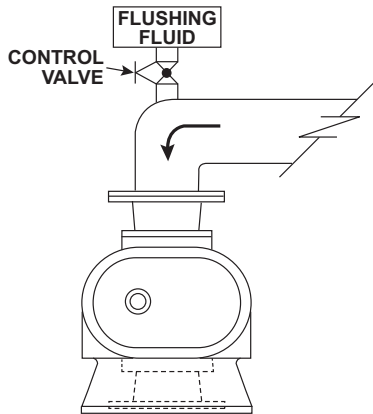


Figure 1-1 – Flushing

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 blower along with the air/gas being compressed. A blower cooled in this manner can operate safely at higher vacuums or higher inlet temperatures than an uncooled blower.

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

Operation

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

Shutdown

It is possible to shut down the blower for brief periods by relieving the inlet vacuum, shutting off the water, and then stopping the blower.

To avoid rusting during a slightly longer shutdown period, operate 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.

For extended shutdown, oil may be injected into the inlet of the heated blower just prior to shutting down the blower. The oil will provide a protective coating on the internal components. Make sure the water is completely shut off after shutdown.

Special coatings or platings are available to minimize rusting or corrosion in applications where blowers can remain wet.

Always use vertical-flow blowers with two-lobed, plugged rotors. Always orient system with the blower intake 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.

NOTICE

For liquid injection other than water, consult the factory.

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

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

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

NOTICE

Care must be taken 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 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 before 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, take care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, likely to a degree where repair would be required.
4. If the blower is being taken out of commission for an extended period of time, **see Long-Term Storage on page 30.**

07

MAINTENANCE

GENERAL

Regular inspection of the blower and its installation, along with complete checks on operating conditions, will pay dividends in added life and usefulness. Also, service the drive per the manufacturer's instructions and lubricate the coupling or check the belt drive tension. Use thermometers and gauges to 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.

Pay special attention to lubrication of timing gears and bearings according to the information in ***Lubrication on page 14.***

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 downtime. Under atmospheric conditions producing rapid corrosion, protect the blower immediately. ***See Long-Term Storage on page 30.***

REGULAR MAINTENANCE

A well-designed maintenance program will add years of service to the blower.

Check a newly installed blower frequently during the first month of operation, especially lubrication. With blower at rest, check the 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 1,000 – 1,200 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
<ol style="list-style-type: none"> 1. Check and maintain oil level, and add oil as necessary. 2. Check for unusual noise or vibration (See Troubleshooting on page 37). 	<ol style="list-style-type: none"> 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 the relief valve to make sure it is operating properly. 	<ol style="list-style-type: none"> 1. Inspect the entire system for leaks. 2. Inspect the condition of the oil and change if necessary. 3. Check drive belt tension and tighten if necessary.

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.

SPARE PARTS

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

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

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

- 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)

FACTORY SERVICE AND REPAIR

With proper care, Tuthill Vacuum & Blower Systems blowers will give years of reliable service. The parts are machined to close tolerances and require special tools by mechanics who are skilled at this work. Blowers that are still under warranty must be returned to the factory, freight prepaid, for service. Contact a customer service representative for information on how to return the blower for warranty evaluation.

NOTICE

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.

NOTICE

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 Customer Service for return authorization.

10. If possible, rotate the drive shaft by hand at least monthly in order to prevent seals from setting in one position.

LONG-TERM STORAGE

Any time the blower will be stored for an extended period of time, make sure it is protected from corrosion by following this procedure:

1. Spray the interior (lobes, housing, and end plates) with rust preventative. Repeated as conditions dictate and at least on a yearly basis.
2. Fill both end covers completely full of oil.
3. Firmly attach a prominent tag stating that the end covers are full of oil and must be drained and refilled to proper levels before start-up.
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 blower 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 one 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 possible. If air conditioned and heated storage is not possible, make conditions as dry as possible.

DISASSEMBLY AND REASSEMBLY

DISASSEMBLY OF BLOWER

WARNING

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

CAUTION

Remove all hazardous material and dispose of properly. Clean the unit before starting disassembly.

1. Remove the blower from the installation. Drain lubricant from both ends by removing the magnetic drain plugs. Mark the end plates, covers, and housing so they can be reassembled in their original configuration.
On blowers with drive shaft lip seals only: Skip step 2. Proceed to step 3.
2. **On integral and drive shaft mechanical face seal blowers only:** Remove three socket-head screws and dust plate using a 1/8 in. hex-head (Allen) wrench. Using the same wrench, loosen three set screws and remove the seal retainer.
3. Remove four socket-head screws (requires 5/32 in. hex-head [Allen] wrench). Place two of the screws in the tapped jacking holes, and remove the seal housing. Tap out the seal and discard the O-rings.
4. Remove the gear cover cap screws and gear cover by placing two of the screws in the tapped jacking holes provided on the cover flange. Support the cover with the lift straps or other suitable means while removing it. The jackscrews provide the force necessary to break the seal between the cover and end plate.
5. Temporarily secure the end plate to the housing with two screws and some flat washers.
On blowers with drive shaft lip seals only: Skip step 6. Proceed to step 7.
6. **On integral and drive shaft mechanical face seal blowers:** Remove the mating ring of the mechanical seal.
7. Remove four nylok screws from the drive shaft. A light tap with a mallet will break it loose from the drive gear. Remove the inner bearing race with a gear puller or press.
8. Bend back the lock tabs and remove the cap screws, lock washers and dowel pins.
9. Position the timing gears so both timing marks are matched. **See Figure 8-1.** Rotate the drive gear clockwise approximately three teeth, and mark a matching reference line on each gear (as shown in **Figure 8-2**). This gear position is necessary so the rotors will clear and not jam. Using a gear puller with a live center or a gear puller with a centering adapter large enough so it will not jam into the threaded hole, pull the driven gear while keeping the matched reference line marks aligned. Use a slight rocking motion to make sure the rotors have not jammed. Should jamming occur, release pressure and tap the gear back on until it rotates freely. Pull the mating gear.

NOTICE

Never attempt to pull the gear when rotors are jammed. Rotor keyway damage will result.

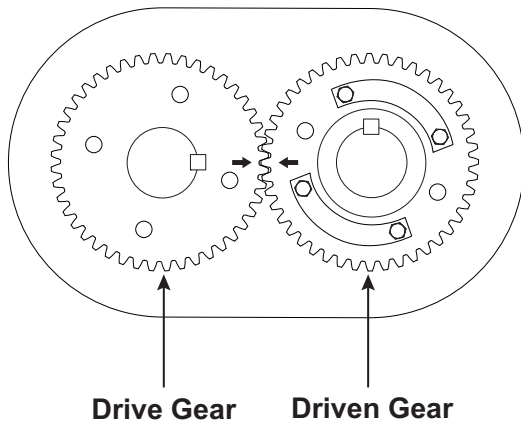


Figure 8-1 – Timing marks matched

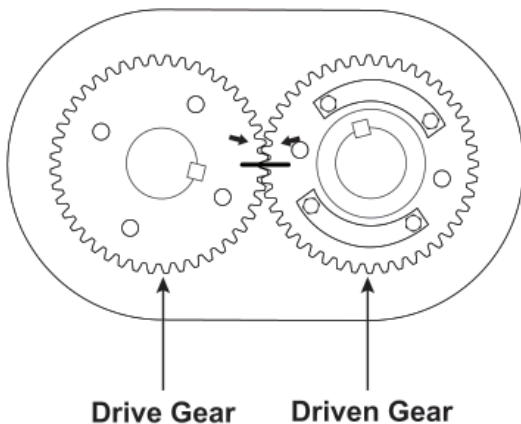


Figure 8-2 – Timing marks advanced 3 teeth (reference marks aligned)

10. Repeat the procedure used in step 4 to remove the free end cover. Remove the rotor shaft screws as was done in step 6. Remove the oil slinger. Remove cap screws and oil retainer rings. Place the 1/2 in. eye bolt into the holes provided for lifting:

- At the top of the end plate on horizontal flow series blowers
- At both sides of the end plate on vertical flow series blowers

11. Make up four pieces of threaded rod 1/2"-13 UNC approximately 9 in. (23 cm) long with double nuts or a single welded nut to turn rods. On the opposite ends, remove about 1/2 in. of threads as this end will mushroom slightly when jacking the end plate. This will prevent the threads from jamming when the rods are being removed. Run in equally to remove the end plate. Tap out the roller bearings. Note that each bearing on this end has two identical spacers, one on each side of bearing. Tap out the seals. Also remove the labyrinth seals, as they should be replaced with each overhaul. On process mechanical face seal series blowers, discard the O-ring and keep the O-ring spacers for reassembly.

12. Remove the cap screws and bearing retainer rings from the drive end of the blower. Remove the rotors. To remove the rotors from the end plate will require either a two-jaw gear puller with jaws inserted in the oil feed slots of the bearing bore, or a bar-type puller using the tapped holes around the bearing bore.

CAUTION

If rotors are side by side, position the lobes vertically when removing. If they are one on top of the other, remove top rotor first in a vertical position. Then position bottom rotor vertically and remove.

13. Support the end plate with the eyebolts and lift strap. Remove the temporary cap screws, and tap the end plate from the housing. Remove the bearings and seals.

14. Clean and inspect the parts for damage and wear. Replace all O-rings, seals, and bearings at each overhaul.

NOTE: If end plates, housing or end covers are not being reassembled in their original position or some new parts are being used, it will be necessary to clean all paint or rust build-up from the mating surfaces to ensure a good seal. Failure to do so could result in excessive end clearances and air or oil leaks.

ASSEMBLY OF 7000 BLOWER

The assembly procedure is generally the same for all series, but notations are made where there are differences. Dowel pins are used to locate end plates, housing, and end covers in their proper locations relative to each other. Be sure the dowel pins are in place. Use an O-ring lubricant on all O-rings.

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.

NOTICE

*Make sure all parts are clean and free of any nicks or burrs caused by disassembly. Lip-seal blowers 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. See **Special Tool Drawings on page 43** for information and dimensions on seal pressing tools as well as other assembly tools required.*

NOTICE

When rebuilding the model 7000 blowers and depending on the series designation, it may be necessary to reseal the joints between the rotor housing, end plates, and end covers. The following sealant is recommended and available for purchase from Tuthill Vacuum & Blower Systems: Loctite 5699.

Preparation of End Plates for Assembly

1. Press the labyrinth seals into the seal bores with the lips toward the oil side.

NOTE: For lip-seal blowers, put a light coat of silicon in the seal bore of the end plate. Install the lip seal open side facing up.

Mechanical Seal Blowers

2. Install O-ring spacers with the grooves up. Install O-rings, making sure they are fully seated in their grooves. Apply a thin coat of sealant to the O.D. of the seal, and press into seal bore. Make sure the seals are fully seated without deforming. Clean the seal carbon with soft tissue and a cleaning agent such as acetone.

Gear End Assembly

3. Place the free end plate on a suitable blocking with the rotor side up. Stand the rotors into each bore with the gear end shafts up and keyways facing in the direction shown in **Figure 8-3**.

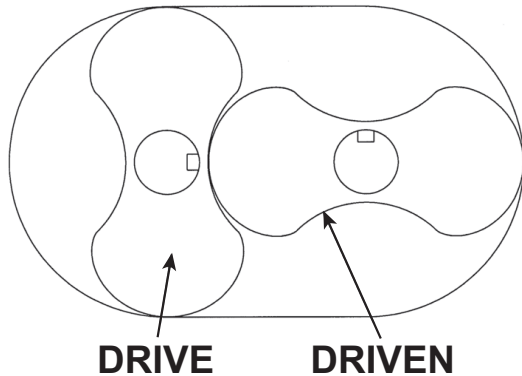


Figure 8-3 – Keyways

4. Install the gear end plate over the rotor shafts and coming to rest on top of the rotor lobes, being careful not to damage the seals. Recheck the location of the oil sight glass in relation to the drive rotor before proceeding with the assembly.
Lab seals series only: Skip step 5. Proceed to step 6.
5. **Mechanical face seal series only:** Inspect the lapped surface of the seal mating ring to be sure it is perfectly clean. Use a soft tissue and cleaning agent if necessary. Place a few drops of lubricating oil on its surface and lubricate the O-ring. Install on the rotor shaft with the lapped surface down. The slot must line up with the pin in the rotor shaft. Gently press with fingers to ensure compression is taking place and the mating ring is not hung up for any reason. The top of the mating ring should sit flush with the rotor shoulder when fully seated.

CAUTION

Gear end 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) on the inner race. Install with dot up (toward gear). Do not use bearings that have not been flush ground to within a .001" (.025 mm) tolerance.

6. Coat the rotor shafts with an anti-seize lubricant and press the bearings on the shafts. The bearing manufacturer numbers and/or an acid dot (inner race) should be up or toward the gears. Use the tool shown in **Figure 13-4** along with a length of 3/4"-10 x 6 in. threaded rod, washer, and nut. Tuthill recommends the use of a hydraulic ram with a hollow center, in which case the threaded rod will have to be made longer. Install the bearing retainer plates and secure with cap screws.
 7. Check the clearance between the face of the end plate and rotor lobes. **See Assembly Clearances on page 39** for the correct gear end clearances. If clearances are not within specifications, recheck the parts to find the cause of the improper clearances before proceeding. Install the keys in the rotor shaft keyways.
 8. Lubricate the shafts and keys, and press the drive gear (right-hand helix) on the drive rotor. To install the driven gear, align the reference marks as shown in **Figure 8-5**. Tap the gear with a mallet to start, and then press the gear until seated.
- NOTE: All timing gears must be used in sets as they are matched and serially numbered.**
9. Install the roll pins, washers, lock tabs, and shaft bolts. Bend over the lock tabs.
- NOTE: These bolts are structural bolts, not standard cap screws. Therefore they have a larger body diameter and this centers the washers and slinger. Do not replace with standard cap screws.**
10. Remove the gear end assembly from the free end plate, and turn over so the gears are facing down on some wood blocking on each side for support.
 11. **Mechanical face seal series:** Place a small bead of sealant around the periphery of the housing bores but inside the bolt pattern. Encircle the dowel pins. Install the rotor housing and temporarily secure it to the end plate with two cap screws and some flat washers. Check the clearances between the end of the lobes and housing using a flat bar and feeler gauges or a depth micrometer. See the exploded view for free end clearances.

12. **Mechanical face seal series:** Put sealant on the rotor housing, in the same manner as described in step 11.

All series: Install the free end plate and secure in the same manner as described in step 11.

13. **Mechanical face seal series:** Install the seal mating rings as was done in step 4.

As needed: Install one bearing spacer on each shaft. This is normally not required. Lubricate the shafts and install roller bearings with the inner race flange outward. **See Figure 8-4.**

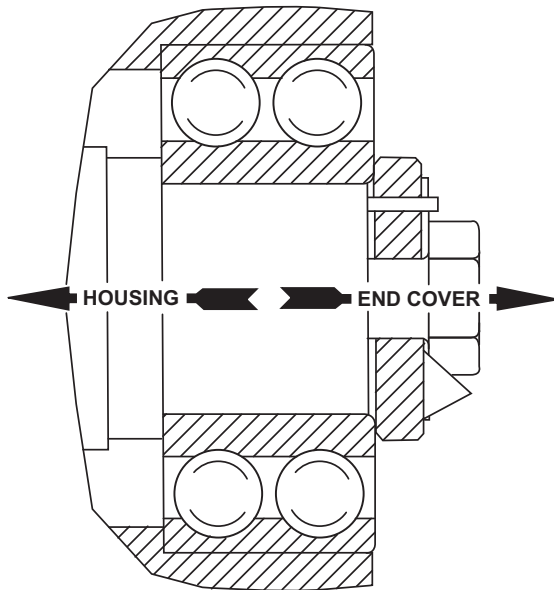


Figure 8-4 – Roller bearings

14. Install the oil retainer rings and cap screws. Install the roll pin, washers, oil slinger (on the drive rotor), lock tabs, and bolts. Bend over the tabs.

15. Install the mounting feet with the machined surface against the housing, and secure with the lock washers and cap screws. Install the lifting lugs with the cap screws.

Adjusting Rotor Interlobe Clearance

16. The driven gear is made of two pieces. The outer gear shell is fastened to the inner hub with four cap screws and located with two dowel pins. A laminated shim, made up of 0.003 in. (0.076 mm) laminations, separates the hub and the shell. By removing or adding shim laminations, the gear shell is moved axially relative to the inner hub. Being a 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.

EXAMPLE: **See Figure 8-4.** Check the clearance at AA (right-hand reading) and BB (left-hand reading). If AA reading is 0.017 in. (0.43 mm) and BB reading is 0.004 in. (0.10 mm), by removing 0.026 in. (0.66 mm) of shim, the AA reading should then read 0.011 in. (0.28 mm) and the BB reading should read 0.010 in. (0.25 mm).

To determine the amount of shim to add or remove, subtract the smaller figure from the larger and multiply the result by 2.0. If the right side reading is higher than the left side, remove shim. If the right side reading is lower, add shim. The final readings should be within 0.002 in. (0.05 mm) of each other. When removing the gear shell from the driven gear, it is not necessary to remove the gear lock bolt.

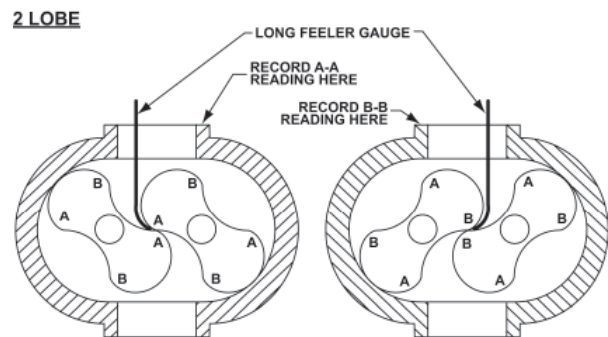


Figure 8-5 – Checking Rotor Interlobe Clearance

17. Install the inner race of the drive shaft roller bearing onto the drive shaft. The flange side must be inboard. **See *Special Tool Drawings on page 43***. Install the outer race with the rollers into the cover bore flush with the inside boss. Install the oil slingers back-to-back on the drive shaft flange. Make sure both mating surfaces are clean and free of burrs, and then mount the drive shaft to the gear and secure with nylok cap screws. Check the drive shaft runout at the seal journal. Do not exceed 0.003 in. (0.08 mm) T.I.R.
18. Remove the temporary cap screws from the gear end of the housing, and place a bead of silicone around the periphery of the end plate. Encircle the dowel pins. Install the cover and cap screws. Tuthill recommends using two 1/2"-13 threaded rods as guide screws.

Drive Shaft Seal Assembly

19. **On blowers with drive shaft lip seal:** Press the drive shaft lip seal into the seal housing. This is a double-lip seal; pack with grease. Install the O-ring and assemble to the cover with hex cap screws.
On blowers with integral drive shaft mechanical face seal:
 - a. Install the O-ring into the seal housing, and press in the stator portion of the mechanical seal. **See *Special Tool Drawings on page 43***. Clean the face of the carbon and mating ring with soft tissue and acetone. Install the O-ring.
 - b. Lubricate the O-ring in the I.D. of the mating ring and carefully slide onto the drive shaft with the slot up and seat against the shoulder. Do not use any tools. The lapped surface should be facing outward.
 - c. With the set screws in place, install the mating ring retainer while aligning the pin with the slot in the mating ring. Secure to the shaft with the set screws.
 - d. Install the nose piece lip seal adapter into the cover bore and secure with four hex-head screws.
20. Install the free end cover using the same process as used for the gear end.

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 following chart 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 Disassembly of Blower on page 31.
	Loose drain plug	Tighten drain plug.
Excessive bearing or gear wear	Improper lubrication	Correct oil level. Replace dirty oil. See Lubrication on page 14.
	Excessive belt tension	Check belt manufacturer's specifications for tension and adjust accordingly.
	Coupling misalignment	Check carefully. Re-align 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 Assembly Clearances on page 39.
	Speed too low	Increase blower speed within limits.
	Obstruction in piping	Check system to ensure an open flow path.
Knocking	Blower 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 Disassembly of Blower on page 31.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Excessive blower temperature	Too much or too little oil in gear reservoir	Check oil level. See Lubrication on page 14.
	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 Assembly Clearances on page 39.
Rotor end or tip drag	Insufficient assembled clearances	Correct clearances. See Assembly Clearances on page 39.
	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. Re-align if necessary.
	Lobes rubbing	Check cylinder for hot spots, and then check for lobe contact at these points. Correct clearances. See Assembly Clearances on page 39.
	Worn bearings or gears	Check condition of gears and bearings. Replace if necessary.
	Unbalanced or rubbing lobes	Possible build-up on casing or lobes, or inside lobes. Remove build-up and restore clearances.
	Driver or blower loose	Check mounting and tighten if necessary.
	Piping resonance	Check pipe supports, check resonance of nearby equipment, and check foundation.

ASSEMBLY CLEARANCES

MODEL	GEAR END	FREE END	INTERLOBE	TIP-DOWEL	TIP-PORT
7010	0.006 – 0.009 in. (0.15 – 0.23 mm)	0.013 – 0.019 in. (0.33 – 0.48 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)
7013	0.006 – 0.009 in. (0.15 – 0.23 mm)	0.016 – 0.022 in. (0.41 – 0.56 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)
7017	0.006 – 0.009 in. (0.15 – 0.23 mm)	0.021 – 0.027 in. (0.53 – 0.69 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)
7021	0.006 – 0.009 in. (0.15 – 0.23 mm)	0.026 – 0.032 in. (0.68 – 0.81 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)
7026	0.006 – 0.009 in. (0.15 – 0.23 mm)	0.031 – 0.037 in. (0.79 – 0.94 mm)	0.010 – 0.014 in. (0.25 – 0.36 mm)	0.008 – 0.012 in. (0.20 – 0.30 mm)	0.015 – 0.019 in. (0.38 – 0.48 mm)

11

TORQUE CHART

Data shown represents “wet” torque values.

PART DESCRIPTION	TORQUE
CAP SCREW 10-32UNF	3 ft-lb (4 N-m)
CAP SCREW 1/4"-20UNC GR5	6 ft-lb (8 N-m)
CAP SCREW 5/16"-18UNC GR5	13 ft-lb (17 N-m)
CAP SCREW 3/8"-16UNC GR5	23 ft-lb (31 N-m)
CAP SCREW 1/2"-13UNC GR5	57 ft-lb (77 N-m)
CAP SCREW 5/8"-14UNC GR5	113 ft-lb (153 N-m)
CAP SCREW 3/4"-10UNC GR5	200 ft-lb (271 N-m)

RECOMMENDED LUBRICANTS

RECOMMENDED LUBRICANTS FOR ROTARY BLOWERS AND VACUUM BOOSTERS

RECOMMENDED SYNTHETIC BASED LUBRICANTS FOR BLOWERS				
AMBIENT TEMPERATURE	TUTHILL	VISCOSITY GRADE	ISO 100	ISO 150
0° to 32°F (-18° to 0°C)	PneuLube™ (ISO 100)	Specific Gravity 16° C (62° F)	0.859	0.865
32° to 90°F (0° to 32°C)		Viscosity 40° C (104° F)	91.8 cSt	142.7 cSt
		Viscosity 100° C (212° F)	13.1 cSt	18.0 cSt
90° to 120°F* (32° to 50°C)		Viscosity Index	142	140
		Pour Point	-51° C (-60° F)	-51° C (-60° F)
		Flash Point	246° C (475° F)	246° C (475° F)
		Copper Corrosion Rating	1A	1A
RECOMMENDED SYNTHETIC BASED, FOOD GRADE LUBRICANTS FOR BLOWERS				
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				
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 Lubricants

RECOMMENDED GREASE FOR CP BLOWERS:	
TUTHILL	
Tuthill PneuLube™ NLGI #2 premium grade, petroleum base lithium grease.	Food Grade HTEP grease, NLGI No. 2 grade. Must meet 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.	
RECOMMENDED OIL FOR OXYGEN-ENRICHED SERVICE	
Blowers used in oxygen-enriched service should use only 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	

SPECIAL TOOL DRAWINGS

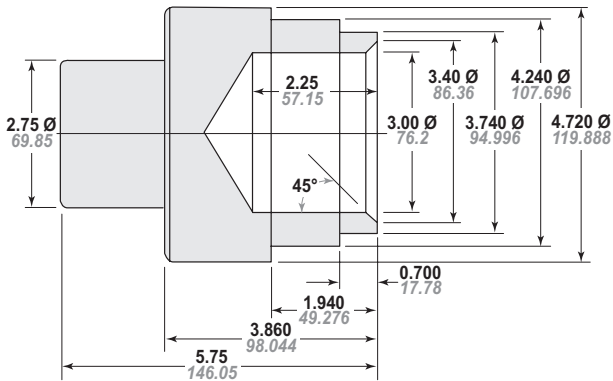


Figure 13-1 – Lab Seal Pressing Tool

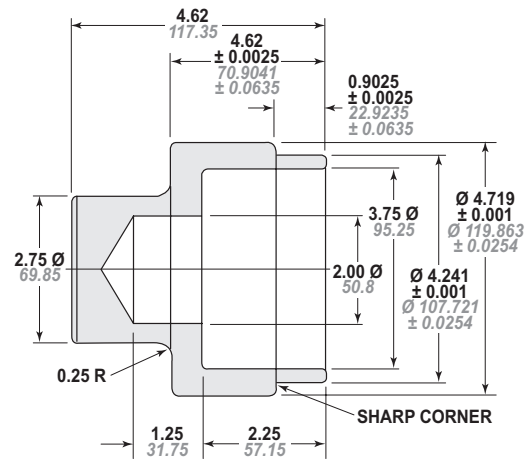


Figure 13-3 – Mechanical and Lip Seal Tool

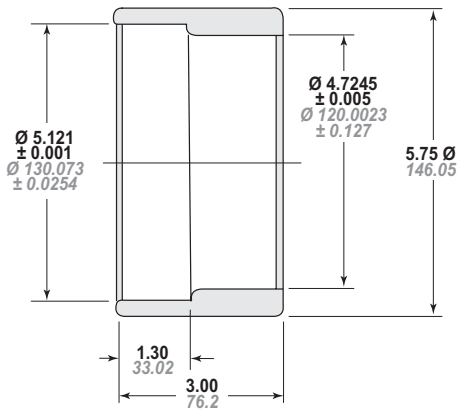


Figure 13-2 – Seal Installation Tool

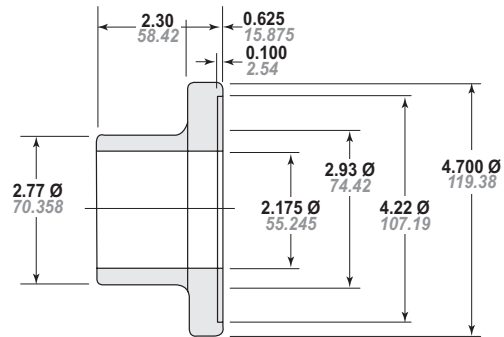
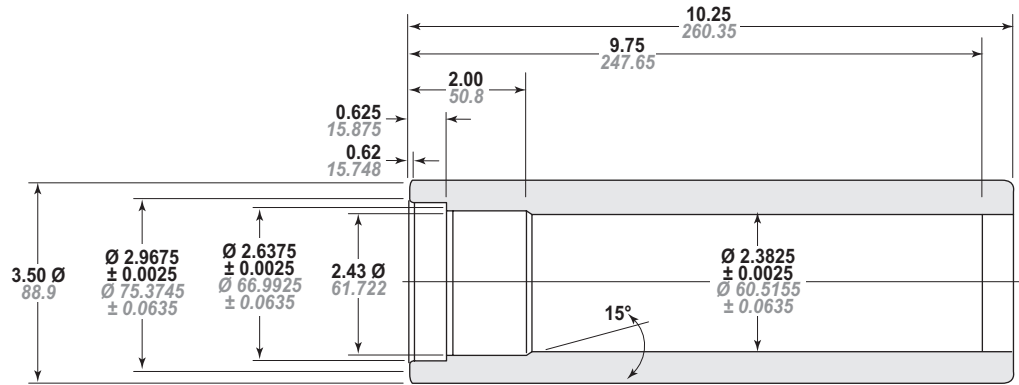


Figure 13-4 – Bearing Pressing Tool

**NOTE:**

All dimensions are shown
in Inches and *millimeters*.

TOLERANCES (Unless otherwise noted)

.XX = ± 0.01 .XXX = ± 0.003
.XX = ± 0.254 .XXX = ± 0.0762

MATERIAL:

MILD STEEL

Figure 13-5 – Drive Shaft Bearing Inner Race Pressing Tool

NOTE: All dimensions are shown in inches and millimeters.

PARTS LIST

Parts List for Model 7000 Series – Lip/Lap Seals

ITEM NO.	PART DESCRIPTION	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, Viton	4
13	Lip Seal, Viton	1
14	Retainer	2
15	Retainer	2
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	4
26	Cap Screw	36
29	Bolt	4
30	Cap Screw	16
31	Magnetic Pipe Plug	2
37	Breather	2
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
59	Rotor Locking Tab	4
66	Cap Screw	4
68	Dowel Pin	4
70	Sight Gauge Window	2
80	Lock Washer	4
85	Pipe Plug	14

ITEM NO.	PART DESCRIPTION	QTY
91	Nose Piece Lip Seal	1
92	O-Ring, Viton	1
93	Cap Screw	4
100	Straight Thread Adapter	2
109	Plug	12 / 0
195	Lifting Lug	2
196	Cap Screw	2
199	O-Ring, Viton	2
304	Mounting Foot	2
307	Cap Screw	4
339	Plug	4
395	Oil Slinger	2

NOTES:

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

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Parts List for Model 7000 Series – Single Mechanical Seals

ITEM NO.	PART DESCRIPTION	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, Viton	1
14	Retainer	2
15	Retainer	2
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	4
26	Cap Screw	36
29	Bolt	4
30	Cap Screw	16
31	Magnetic Pipe Plug	2
37	Breather	2
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
54	Mechanical Seal	4
59	Rotor Locking Tab	4
66	Cap Screw	4
68	Dowel Pin	4
70	Sight Gauge Window	2
74	Sealing Ring	4
75	O-ring, Viton	4
80	Lock Washer	4
85	Pipe Plug	14

ITEM NO.	PART DESCRIPTION	QTY
91	Nose Piece Lip Seal Adapter	1
92	O-Ring, Viton	1
93	Cap Screw	4
100	Straight Thread Adapter	2
109	Plug	4 / –
121	Plug	10 / –
195	Lifting Lug	2
196	Cap Screw	2
199	O-Ring, Viton	2
300	Roll Pin	4
304	Mounting Foot	2
307	Cap Screw	4
339	Plug	4
395	Oil Slinger	2

NOTES:

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

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Parts List for Model 7000 Series – Double Mechanical Seals

ITEM NO.	PART DESCRIPTION	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, Viton	1
14	Retainer	2
15	Retainer	2
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	4
26	Cap Screw	36
29	Bolt	4
30	Cap Screw	16
31	Magnetic Pipe Plug	2
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
54	Mechanical Seal	5
59	Rotor Locking Tab	4
66	Cap Screw	4
68	Dowel Pin	4
70	Sight Gauge Window	2
74	Sealing Ring	4
75	O-ring, Viton	5
80	Lock Washer	4
85	Pipe Plug	14
89	Mechanical Seal Lock Ring	1

ITEM NO.	PART DESCRIPTION	QTY
90	Set Screw	3
91	Nose Piece Lip Seal Adapter	1
92	O-Ring, Viton	1
93	Cap Screw	4
98	Plug	4
109	Plug	12 / –
121	Plug	10 / –
195	Lifting Lug	2
196	Cap Screw	2
199	O-Ring, Viton	2
300	Roll Pin	5
304	Mounting Foot	2
307	Cap Screw	4
339	Plug	6
395	Oil Slinger	2

NOTES:

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

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Parts List for Model 7000 Series – Internal Lube Lip/Lab Seals

ITEM NO.	PART DESCRIPTION	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	1
10	Bearing	1
12	Lip Seal, Viton	4
13	Lip Seal, Viton	1
14	Retainer	3
15	Retainer	1
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	1
26	Cap Screw	36
29	Bolt	3
30	Cap Screw	16
31	Magnetic Pipe Plug	1
37	Breather	2
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
57	Rotor Spacer	1
59	Rotor Locking Tab	3
66	Cap Screw	4
67	Bearing Spacer	1
68	Dowel Pin	3
69	Cap Screw	4
80	Lock Washer	4

ITEM NO.	PART DESCRIPTION	QTY
91	Nose Piece Lip Seal Adapter	1
92	O-Ring, Viton	1
93	Cap Screw	4
100	Adapter	2
101	St Elbow	1
102	Pipe Tube	1
106	Pipe Coupling	1
109	Pipe Plug	14
110	Cap Screw	3
121	Pipe Plug	4 / 8
122	Set Screw	2
124	Oil Filter, Spin On	1
125	Pump Mounting Bracket	1 / 4
135	Union, Tee, Tube	4
136	Lock Washer	4
144	Oil Pump	1
147	Tube, Al	1 / -
155	Tube Elbow	2
161	Tube, Al	2 / -
162	Tube, Al	1 / -
163	Tube Elbow	1
165	Tube Connector	1
172	Reducing Bushing	1
174	Pipe Plug	1
179	Tube, Al	1 / -
187	Tube	1
188	Tube Elbow, Union	4 / 2
195	Lifting Lug	2
196	Cap Screw	2
212	Cap Screw	2
226	Flat Washer	2
235	Male Tube Adapter	5
236	Tube, Al	2 / -
262	Gauge, 30 Hg - 30 PIS, Liquid Filled	1

Parts List for Model 7000 Series – Internal Lube Lip/Lab Seals (continued)

ITEM NO.	PART DESCRIPTION	QTY
265	Bypass Relief Valve	1
270	Oil Filter Adapter	1
271	Pipe Plug	2
294	Male Tube Adapter	1
302	O-Ring, Viton	2
304	Mounting Foot	2
306	Sleeve	1
307	Cap Screw	4
322	Cap Screw	4
325	O-Ring, Viton	1
329	Plug	1
336	Orifice Fitting	5
337	Key	2
339	Plug	8
349	Pipe	1
350	Cap Screw	36
351	Pipe	4
354	Reducer Bushing	5
360	Oil Filter Threaded Tube	1
369	Tube	1
395	Oil Slinger	2
446	Oil Pump Cover	1
449	Rotor Sprocket Adapter	1
450A	Chain, Roller	1
450B	Chain Link Connector, No. 35	1
451	Sprocket, No. 35	1
452	Sprocket, No. 35	1
458	Pump Housing	1
459	Oil Gauge, Bullseye	1
479	Tube, Al	- / 1

NOTES:

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

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Parts List for Model 7000 Series – Internal Lube Single Mechanical Seals

ITEM NO.	PART DESCRIPTION	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	1
10	Bearing	1
13	Lip Seal, Viton	1
14	Retainer	3
15	Retainer	1
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	3
26	Cap Screw	36
29	Bolt	3
30	Cap Screw	16
31	Magnetic Pipe Plug	1
37	Breather	2
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
54	Mechanical Seal	4
57	Rotor Spacer	1
59	Rotor Locking Tab	3
66	Cap Screw	4
67	Bearing Spacer	1
68	Dowel Pin	3
69	Cap Screw	4
74	Sealing Ring	4

ITEM NO.	PART DESCRIPTION	QTY
75	O-Ring, Viton	4
80	Lock Washer	4
91	Nose Piece Lip Seal Adapter	1
92	O-Ring, Viton	1
93	Cap Screw	4
100	Adapter	2
101	St Elbow	1
102	Pipe Tube	1
106	Pipe Coupling	1
109	Pipe Plug	14
110	Cap Screw	3
121	Pipe Plug	10
122	Set Screw	2
124	Oil Filter, Spin On	1
125	Pump Mounting Bracket	1
135	Union, Tee, Tube	4
136	Lock Washer	4
144	Oil Pump	1
155	Tube Elbow	2
163	Tube Elbow	2
172	Reducing Bushing	1
174	Pipe Plug	1
187	Tube	1
188	Tube Elbow, Union	2
195	Lifting Lug	2
196	Cap Screw	2
212	Cap Screw	2
226	Flat Washer	2
235	Male Tube Adapter	5
262	Gauge, 30 Hg - 30 PIS, Liquid Filled	1
265	Bypass Relief Valve	1
270	Oil Filter Adapter	1
271	Pipe Plug	2

Parts List for Model 7000 Series – Internal Lube Single Mechanical Seals (continued)

ITEM NO.	PART DESCRIPTION	QTY
294	Male Tube Adapter	1
300	Roll Pin	4
302	O-Ring, Viton	2
304	Mounting Foot	2
306	Sleeve	1
307	Cap Screw	4
322	Cap Screw	4
325	O-Ring, Viton	1
329	Plug	1
336	Orifice Fitting	5
337	Key	2
339	Plug	8
349	Pipe	1
350	Cap Screw	36
351	Pipe	4
354	Reducer Bushing	5
360	Oil Filter Threaded Tube	1
369	Tube	1
395	Oil Slinger	2
446	Oil Pump Cover	1
449	Rotor Sprocket Adapter	1
450A	Chain, Roller	1
450B	Chain Link Connector, No. 35	1
451	Sprocket, No. 35	1
452	Sprocket, No. 35	1
458	Pump Housing	1
459	Oil Gauge, Bullseye	1
479	Tube, Al	1

NOTES:

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

PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

Parts List for Model 7000 Series – Internal Lube Double Mechanical Seals

ITEM NO.	PART DESCRIPTION	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	1
10	Bearing	1
13	Lip Seal, Viton	1
14	Retainer	3
15	Retainer	1
20	Oil Slinger	1
22	Dowel Pin	8
23	Drive Shaft Key	1
24	Gear Key	2
25	Rotor Shaft Washer	3
26	Cap Screw	36
29	Bolt	3
30	Cap Screw	16
31	Magnetic Pipe Plug	1
42	Nameplate	1
45	Drive Shaft	1
50	Bearing	1
51	Lab Seal	4
54	Mechanical Seal	5
57	Rotor Spacer	1
59	Rotor Locking Tab	3
66	Cap Screw	4
67	Bearing Spacer	1
68	Dowel Pin	3
69	Cap Screw	4
74	Sealing Ring	4
75	O-Ring, Viton	5

ITEM NO.	PART DESCRIPTION	QTY
80	Lock Washer	4
89	Mechanical Seal Lock Ring	1
90	Set Screw	3
91	Nose Piece Lip Seal Adapter	1
92	O-Ring, Viton	1
93	Cap Screw	4
101	St Elbow	1
102	Pipe Tube	1
106	Pipe Coupling	1
109	Pipe Plug	14 / 12
110	Cap Screw	3
121	Pipe Plug	4 / 10
122	Set Screw	2
124	Oil Filter, Spin On	1
125	Pump Mounting Bracket	1
135	Union, Tee, Tube	4
136	Lock Washer	4
144	Oil Pump	1
147	Tube, Al	1 / –
155	Tube Elbow	2
161	Tube, Al	2 / –
162	Tube, Al	1 / –
163	Tube Elbow	1
165	Tube Connector	1
172	Reducing Bushing	1
174	Pipe Plug	1
178	Tube Adapter	2
179	Tube, Al	1 / –
187	Tube	1
188	Tube Elbow, Union	4 / 2
195	Lifting Lug	2
196	Cap Screw	2
212	Cap Screw	2
226	Flat Washer	2

Parts List for Model 7000 Series – Internal Lube Double Mechanical Seals (continued)

ITEM NO.	PART DESCRIPTION	QTY
235	Male Tube Adapter	5
236	Tube, Al	2 / –
262	Gauge, 30 Hg - 30 PIS, Liquid Filled	1
265	Bypass Relief Valve	1
270	Oil Filter Adapter	1
271	Pipe Plug	2
294	Male Tube Adapter	1
300	Roll Pin	5
302	O-Ring, Viton	2
304	Mounting Foot	2
306	Sleeve	1
307	Cap Screw	4
322	Cap Screw	4
325	O-Ring, Viton	1
329	Plug	1
336	Orifice Fitting	5
337	Key	2
339	Plug	8
349	Pipe	1
350	Cap Screw	36
351	Pipe	4
354	Reducer Bushing	5
355	Tube, Al	1 / –
360	Oil Filter Threaded Tube	1
369	Tube	1
395	Oil Slinger	2
446	Oil Pump Cover	1
449	Rotor Sprocket Adapter	1
450A	Chain, Roller	1
450B	Chain Link Connector, No. 35	1
451	Sprocket, No. 35	1
452	Sprocket, No. 35	1

ITEM NO.	PART DESCRIPTION	QTY
458	Pump Housing	1
459	Oil Gauge, Bullseye	1
479	Tube, Al	– / 1

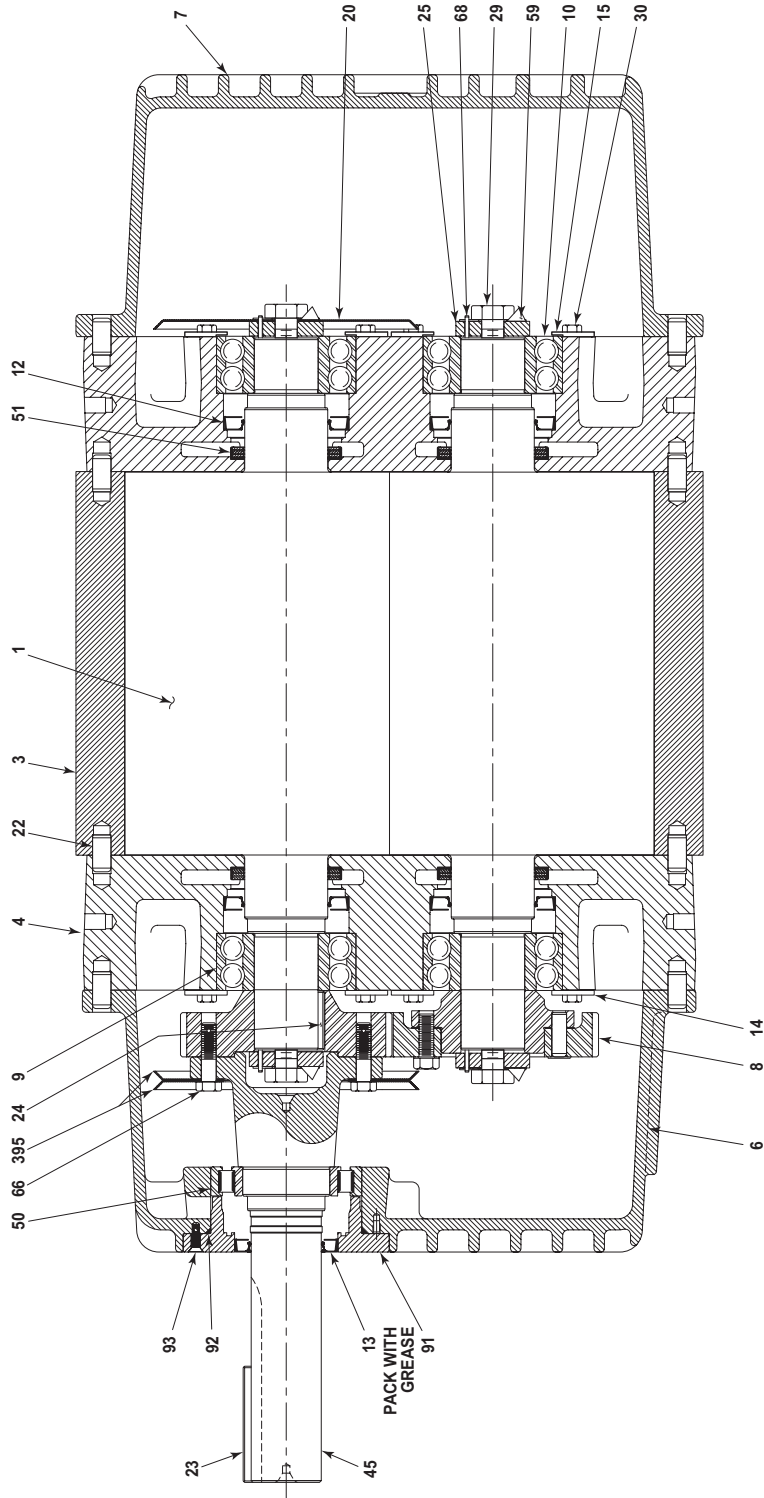
NOTES:

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PARTS KITS ARE AVAILABLE. CONSULT AUTHORIZED REPRESENTATIVE FOR PART NUMBERS.

ASSEMBLY DRAWINGS

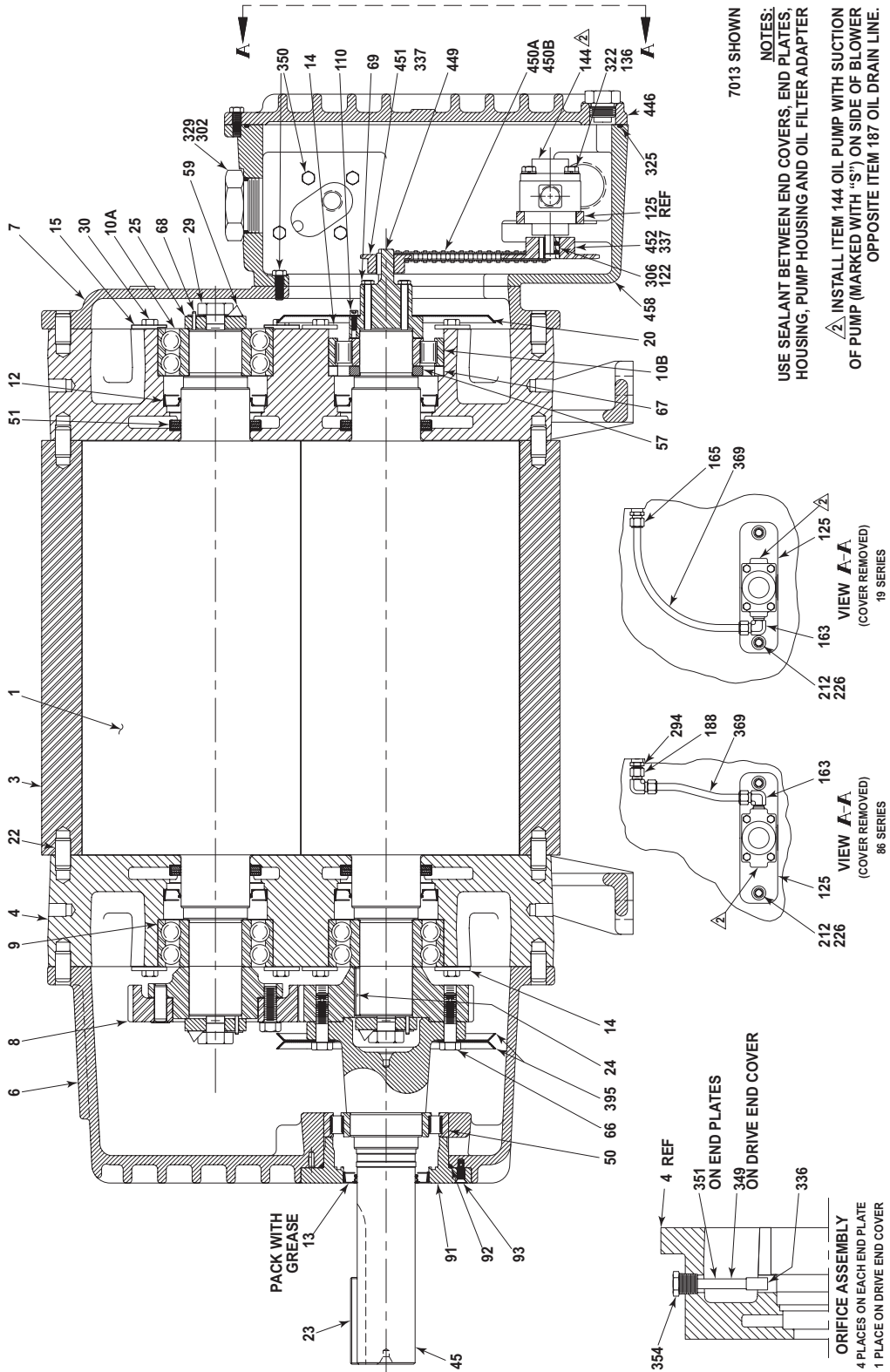
Model 7000 – Lip/Lab Seals – Cutaway View



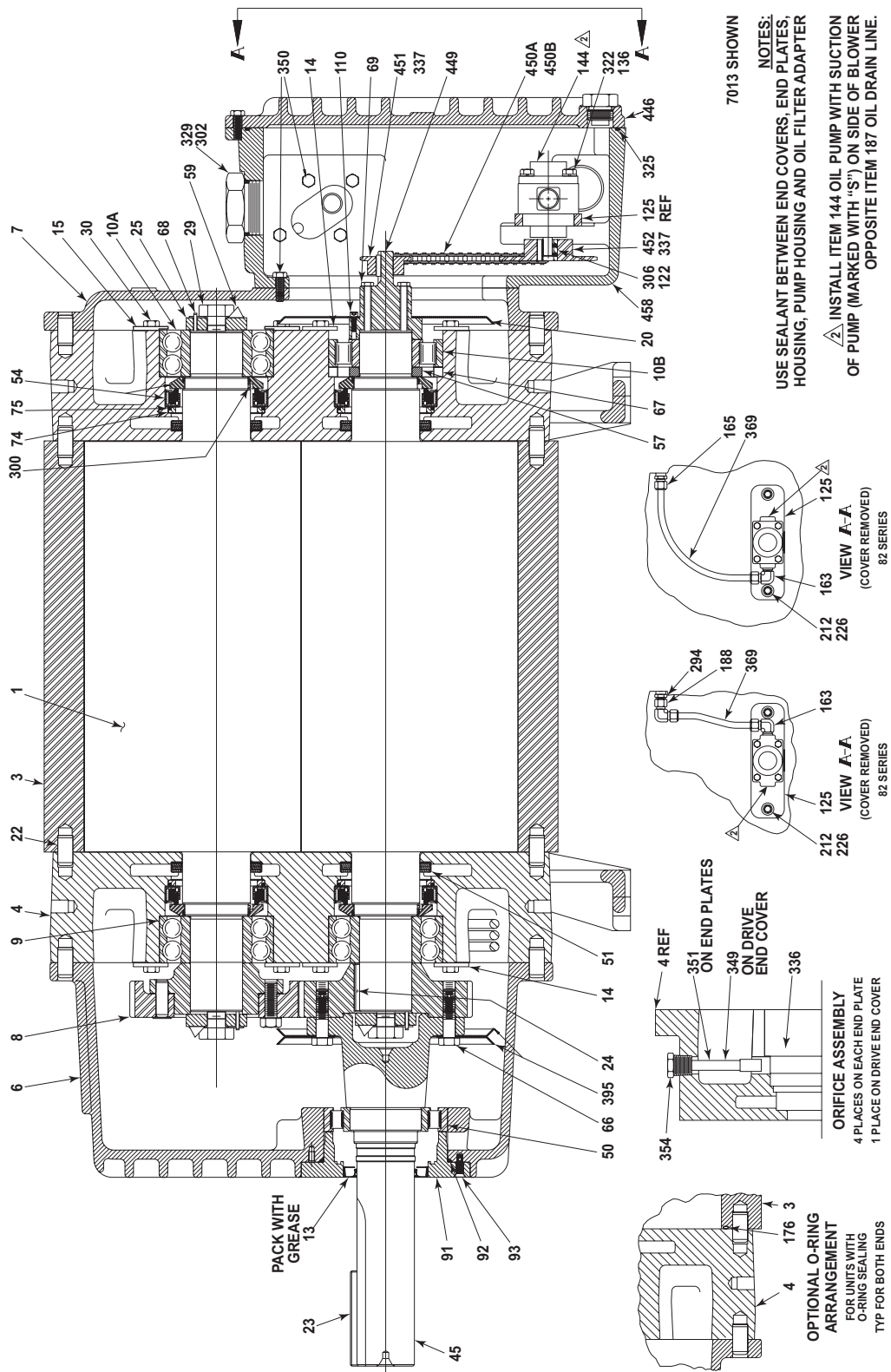
7013 SHOWN

NOTE: USE SEALANT BETWEEN
END COVERS, END PLATES & HOUSING

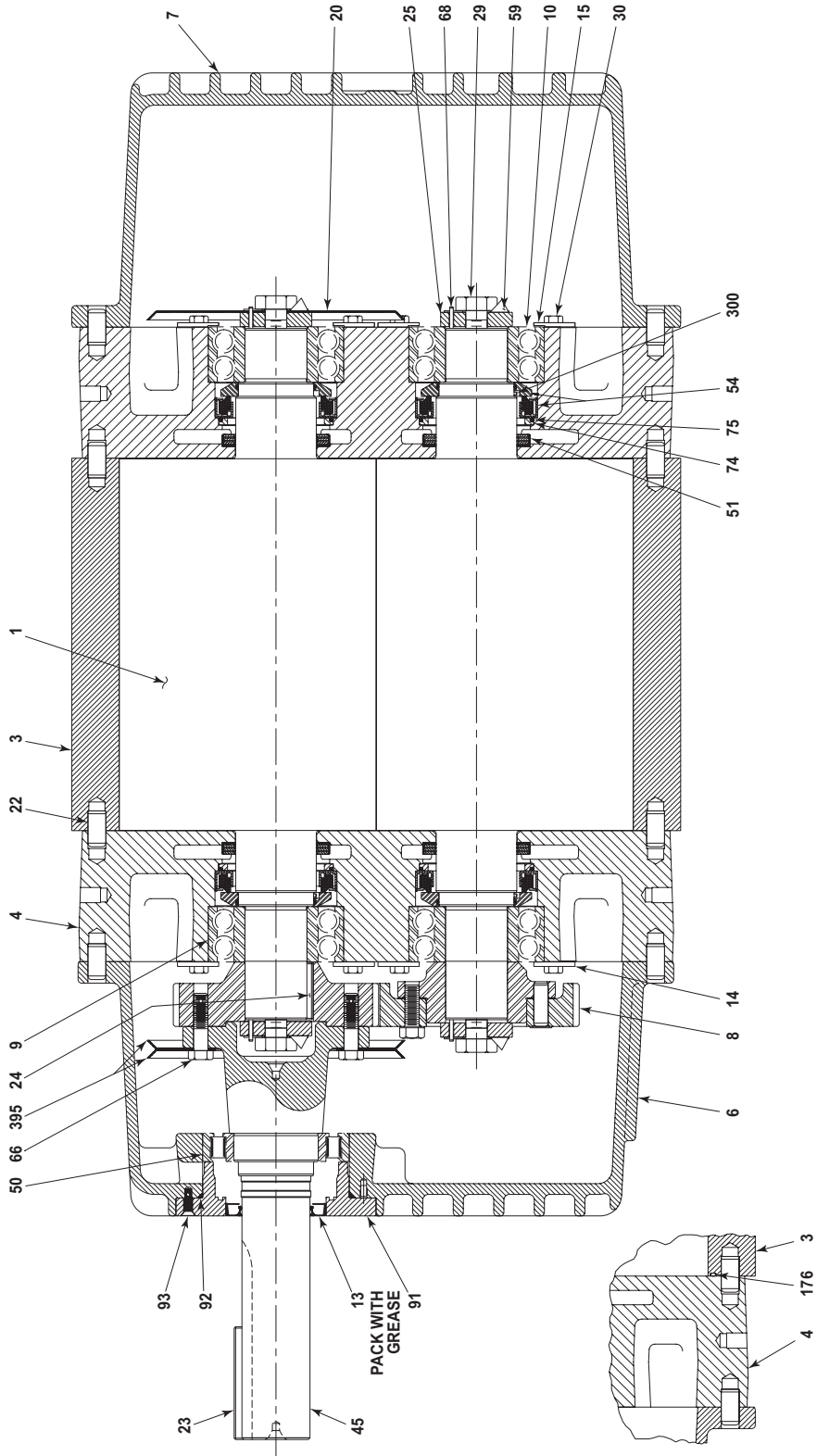
Model 7000 – Internal Lube Lip/Lab Seals – Cutaway View



Model 7000 – Single Envelope Gastight – Cutaway View



Model 7000 – Single Envelope Gastight – Cutaway View

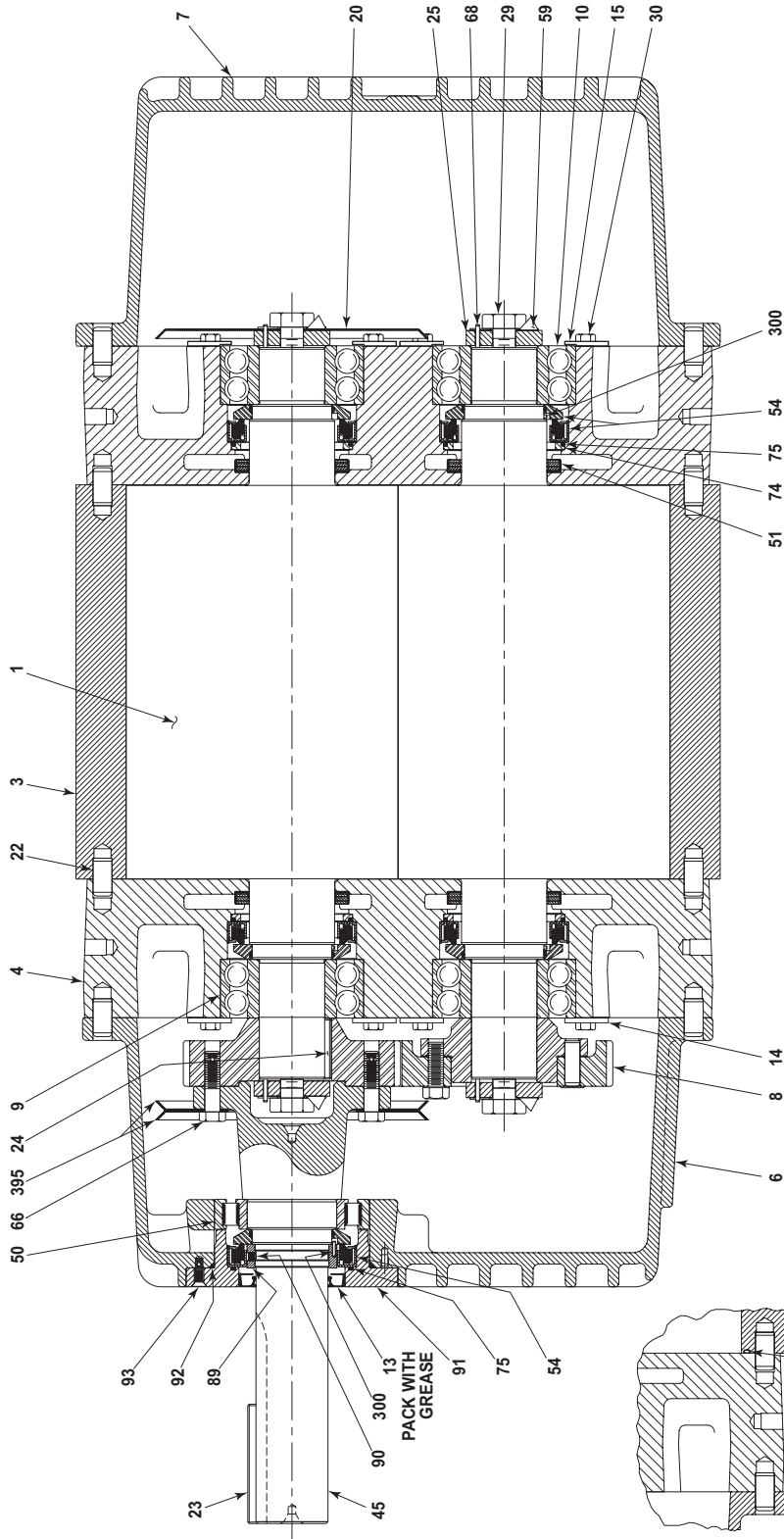


7013 SHOWN

NOTE: USE SEALANT BETWEEN
END COVERS, END PLATES & HOUSING

OPTIONAL O-RING
ARRANGEMENT
FOR UNITS WITH
O-RING SEALING
TYP FOR BOTH ENDS

Model 7000 – Double Mechanical Seals – Cutaway View

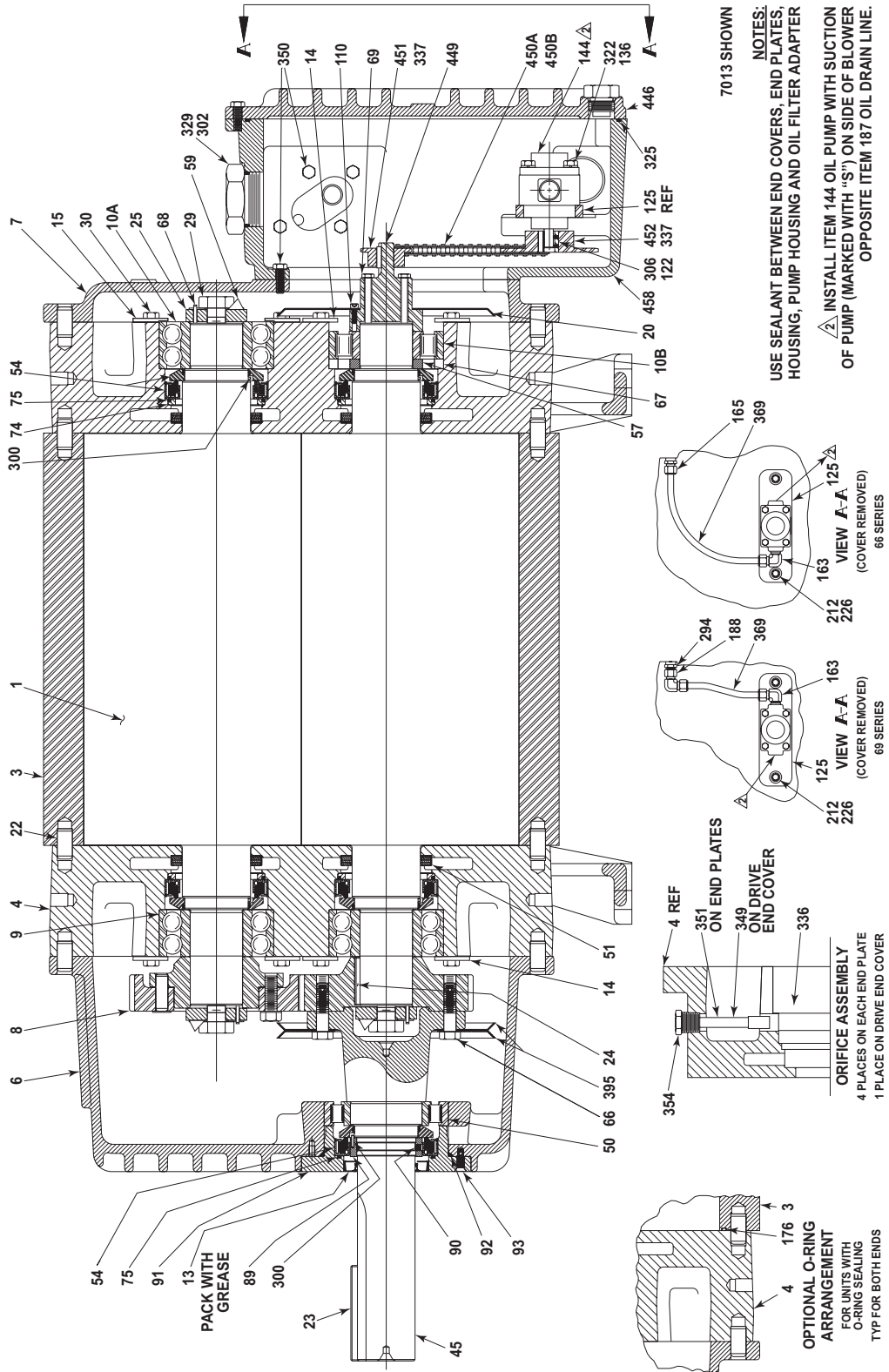


7013 SHOWN

NOTE: USE SEALANT BETWEEN END COVERS, END PLATES & HOUSING

OPTIONAL O-RING ARRANGEMENT FOR UNITS WITH O-RING SEALING TYP FOR BOTH ENDS

Model 7000 – Internal Lube Double Mechanical Seals – Cutaway View





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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 1: Compressors

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

Models
3200, 4000, 5500, 7000, 9000, 1200

David Schardt
Vice President of Engineering
Tuthill Vacuum & Blower Systems



WHEN WE COME ALIVE

THE WORLD COMES ALONG

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 <i>(Qx™ models only)</i>	30 months from date of shipment, or 24 months after initial startup date, whichever occurs first.	Consult Factory
New <i>(all other models)</i>	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 FORM / PRODUCT REGISTRATION

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	_____		
Start-up 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, or register online at tuthillvacuumblower.com.



**For Service & Repair, Technical
Support, or Product Sales contact:**

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