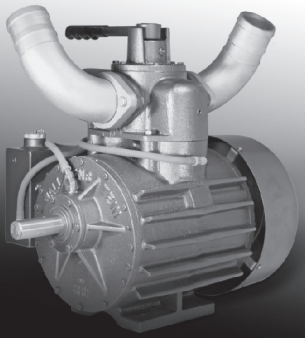
SIMPLY BETTER

vallenstein

vacuum . pumps

Owner's Manual

Environmental Vacuum Equipment



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wallenstein
vacuum . pumps

The "SIMPLY BETTER" choice for tanker and truck mount vacuum, Wallenstein Vacuum Pumps are oil lubricated rotary vane air pumps producing rough vacuum or high volume low pressure air in both continuous duty and intermittent cycle.

Wally Pumps are engineered for simplicity and ease of use.

Because of widespread success in environmental vacuum applications we have adopted the "SIMPLY BETTER" logo to distinguish Wally Pumps from more complicated designs.

At Elmira Machine Industries we have designed the "SIMPLY BETTER" WALLY VACUUM PUMP to bring you years of trouble free service, as it has to thousands of our pump users.

This manual contains instructions for working with Wallenstein Vacuum Pumps, to ensure problem free operation.

Wallenstein Vacuum Pumps are distributed through certified Original Equipment Manufacturers. Because equipment designs can vary between manufacturers, please contact your manufacturer or distributor for service, parts, or clarification on any issue relating to your vacuum pump use.

ATTENTION

Installation, operation and maintenance must follow the instructions in this manual. Workers should be experienced and qualified, and have the proper training.

NEVER operate a pump without knowing proper procedures.

READ this manual, and any manuals provided by your vacuum tank equipment manufacturer.

USE COMMON SENSE! Most accidents can be prevented by paying care and attention to the job at hand.

BE SAFE

Follow a safety program that includes proper clothing and personal protective items, proper procedures for emergencies, first aid, fire prevention, jobsite rules, and communication.

PUMP SAFETY

Before starting, learn the equipment controls, and how to read gauges. Learn the function and settings of relief valves. Know how to perform emergency shut down of the machine. Keep equipment clean and check daily for items that need attention.

This list identifies common hazards encountered with **any** vacuum pump operation.

1. **Rotating Parts:** Keep hands clear of moving parts such as the pump drive line or belts. Never work on a pump with the engine or power take off running.

2. **Vacuum Hazard:** Keep vacuum source away from face and body. Vacuum concentrated on the body through a hose end can cause serious injury or death.

3. **Hot Surfaces:** Pump exhaust can be very hot. Avoid contact with pump exhaust port and oil catch muffler.

4. **Heavy Parts:** Be sensible about lifting and use hoists for heavy loads.

5. **Fire Prevention:** Use non-flammable solvents for cleaning if possible. Follow directions when refuelling engine drive pumps.

6. **Modifications:** Unauthorized alterations or additions can affect the safe operation of the pump. Always use original manufacturers vanes and parts. Pumps that are altered may cause serious equipment damage and severe operator or bystander injury.

7. **Onsite Location:** Level and secure equipment to prevent movement.

8. **Exhaust Fumes:** Ensure your work area is properly ventilated, or remove exhaust with a pipe extension.

REMEMBER: ***SAFETY IS UP TO YOU***
YOU* CAN *PREVENT INJURY

NOTE: **Wallenstein Vacuum Pumps are bench tested prior to packaging and shipment. Each pump is lubricated and all ports are plugged prior to crating.**

Storage

If a vacuum pump is to be stored for any length of time it should be given extra lubrication. Approximately six ounces of oil should be added through one of the ports. Rotate pump by hand to uniformly disperse the oil throughout the interior surface.

Cleanliness of Piping Connections

Since a vacuum pump is always connected to a system, care must be taken to ensure that the new system is clean and free of debris that could be pulled into the vacuum pump the first time that the pump is turned on.

On new installations always flush lines and traps prior to initial start-up. The most common forms of contamination on new installations are welding splatter, sand from sandblasting operations, misplaced nuts and bolts and steel shavings from threaded pipes. Proper vacuum pump installation calls for the use of flanges where possible. A final filter screen will protect the pump on prestart-up. Always leave ports covered during installation, and remove covers before startup.

Rotation . . . . . Page 34 – Model Code Reference

Check rotation of drive prior to start up. Wallenstein pumps are produced in both clockwise and counterclockwise versions. The letters "R" in the model number indicate Right Hand (clockwise) rotation when viewing the pump from the drive end. If there is no letter "R" this indicates counterclockwise rotation. Directional arrows can be found on the pump body and stamped into the drive end of the pump shaft.

Accessories Check . . . . . Page 8-13 – Initial Startup

Accessories should be checked prior to start up; fill lubricator with oil, inspect and test cooling systems, check rotation of electric fans, check cooling liquid levels and coolant pump function. Relief valves and gauges must be operational. Filters should be present. Oil reclamation devices and mufflers should be inspected.

Many vacuum pump problems can be avoided by careful attention to initial start-up in a new vacuum system. These procedures also apply if a new vacuum pump is being installed on an older system.

Important factors to consider when operating a vacuum pump:

1 Air Filtration . . . . . Page 30 – Safeties, Page 15 – Flushing

☑ ***Always operate a clean pump.***

When dirt or moisture gets in a pump it can damage vanes and rotor.

2 Lubrication . . . . . Pages 9-12, 16 – Lubrication

☑ ***Never let pump run out of oil.***

Oil lubricates the vanes, bearings, and internal surfaces.

3 RPM . . . . . Page 8 – RPM

☑ ***Never overspeed vacuum pump.***

Operate within the recommended RPM range.

4 Drive . . . . . Pages 24-29 – Drive Options

☑ ***Make sure drive is vibration free.***

Improper drive can result in bearing failure and vane chatter.

5 Cooling . . . . . Pages 22, 23 – Cooling

☑ ***Keep cooling systems clean.***

Vacuum pumps rely on air or liquid cooling.

6 Connections . . . . . Pages 30, 31 – Components

☑ ***Ensure system is air tight***

Airtight connections will ensure rapid pumping and minimize duty cycle, for longer service life.

NOTE: On the initial startup of a vacuum pump it is important to check operating parameters including **rotation, speed, lube, and relief valve settings.** *For instructions follow the **Initial Startup** procedures on pages 8-13.*

While determining the RPM settings, leave a tank valve open for free air flow. On equipment with a variable RPM such as truck mount PTO (power take off) drive, **it is important to always engage and disengage the PTO at low RPM (idle speed)**. With the truck engine at an idle, depress clutch, engage PTO, and then slowly release clutch. Next, increase the throttle until the pump is up to speed according to plan. Finally check the pump speed with an RPM meter. On trucks with automatic transmissions, engage hot shift at an idle prior to increasing RPM to desired pump speed. **PUMP RPM WILL NOT ALWAYS BE THE SAME AS DIESEL ENGINE RPM ON TRUCK'S TACHOMETER.** This is because the PTO is often a different ratio than the engine speed. Other ratios are often a factor with hydraulic drive. Once pump speed is known, label the dash for the MAXIMUM engine RPM allowable. Reduce engine speed to idle prior to turning pump off. On trucks with manual transmissions it is a best practices procedure use the clutch when disengaging the PTO.

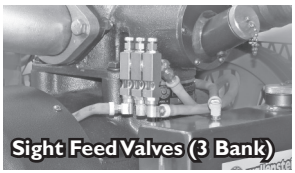
Setting changes to the Powertrain Control Module (**PCM**) are generally required when installing transmission PTO drives. For example, PTO's can automatically increase to correct RPM operating speed when turned on, or can also be installed so that pump RPM can be adjusted by using the cruise control settings.

Gasoline engine driven vacuum pumps are often supplied without a clutch. **For gasoline engine drive or for hydraulic drive, start and stop the pump in a similar manner, at slow speed.**

SERIES OR MODEL	MAXIMUM RPM	RECOMMENDED RPM	MINIMUM RPM
150	**1750**	**1000 to 1500**	**400**
200, 300, 400 550, 750, 1500	**1200**	**750 to 950**	**540**
1050, 1600, 2100	**1100**	**600 to 900**	**400**

Provided for reference only. If unsure of best RPM please consult your Distributor

The table shows maximum RPM for the different series of Wallenstein Pumps. In most applications, pumps will have been sized to achieve pumping speed and vacuum recovery at rotational speeds below maximum. These pumps utilize centrifugal force for vane action. At very low speeds the vanes will chatter because the centrifugal force is too low. The minimum RPM is slightly faster than this point. In the mid vacuum range (15" to 22" Hg) all Wallenstein pumps operate continuously at maximum RPM.


Sight Feed Valves (3 Bank)

Sight Feed Valve oil lubrication uses vacuum or pressure to draw oil into the oil entry points. This air pressure can be generated from the vacuum pump, or from the PTO air supply.

MODEL CODE **O**


Mechanical Piston Pump

Mechanical Piston Pump oil lubrication is driven by the vacuum pump shaft rotation. A piston mechanism pumps oil through the delivery lines.

MODEL CODE **P**

GUIDE: **Heavy** (Red tint) or **Light** (Blue tint) Wallenstein Vacuum Pump Oil is recommended and available from pump distributors. Equivalent premium **R&O 68** or **32** weight non-detergent, non-paraffin, petroleum based oil with a wide range of operating temperatures may also be used.

Pump Duty Cycle	**Heavy Duty Pumping**	**Moderate Duty Pumping**	**Light Duty Pumping**
Pump Application	Industrial Service	Septic Service	Sanitation Service
Pump Size - Series	Large - 1050, 1500, 1600, 2100	Medium - 400, 550, 750	Small - 150, 200, 300
Hot Climates Summer Months	ISO 68 (Red)	ISO 68 (Red)	ISO 32 (Blue)
Cold Climates Winter Months	ISO 32 (Blue)	ISO 32 (Blue)	ISO 32 (Blue)

Oil Flow Rate Settings At Each Oil Entry Point

Drops per minute can be observed in the sight feed valve glass as they form on the needle. Piston lubricators have transparent feed and delivery lines for visual flow confirmation. The rates suggested here should be adjusted based on operating conditions including the vacuum pump duty cycle, climate, and oil weight.

SERIES OR MODEL	TO 15" HG		15" TO 22" HG OR FOR PRESSURE		22" HG TO MAX WITH ICS		22" HG TO MAX WITHOUT ICS
	DROPS PER MINUTE	OUNCES PER HOUR	DROPS PER MINUTE	OUNCES PER HOUR	DROPS PER MINUTE	OUNCES PER HOUR	
150	**4**	**0.25**	**8**	**0.5**	**-**	**-**	**FLOOD**
200, 300, 400	**6**	**0.5**	**12**	**0.75**	**45**	**3**	
550, 750	**12**	**0.75**	**24**	**1.75**	**45**	**3**	
1050	**15**	**1**	**30**	**2**	**45**	**3**	
1500	**25**	**1.75**	**50**	**3.25**	**60**	**4**	
1600, 2100	**30**	**2**	**60**	**4**	**60**	**4**	

Number of Oil Entry Points (OEP)

Vacuum Pump lubrication systems are identified by the number of oil entry points. Oil passes through the endplate bearings and then disperses over the rotor, lubricating the vanes, rotor, and housing. Systems with three or more oil entry points also deliver oil directly to the pump housing and vane tip.

SIGHT FEED VALVE LUBRICATION

2	3	4	5	6
151	403	1054	1504LN	1604
202	403LN			1604LN
302	553			2106
402	753			2106LN
	753LN			

MECHANICAL LUBRICATOR

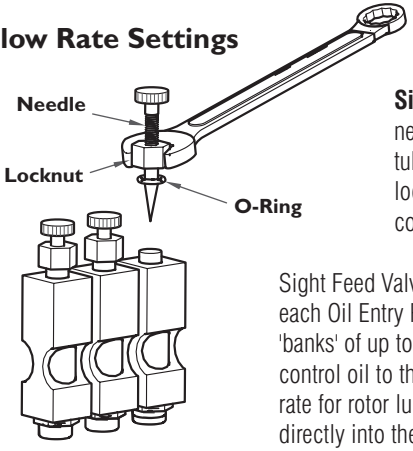
2	4	6
151	403*	1504LN
202	403LN*	1604
302	553	1604LN
402	753	2106
403*	753LN	2106LN
403LN*	1054	
	1054LN	

*403: 2 or 4 OEP's

Startup | ***Sight Feed Valve***

Flow Rate Settings

MODEL CODE O



Sight Feed Valves feature an adjustable needle to control oil flow, and a sight tube for visual inspection. Tightening the locknut secures the needle setting by compressing the o-ring.

Sight Feed Valve oil systems consist of one valve per each Oil Entry Point (O.E.P.), and are configured in 'banks' of up to six valves. The left and right valve control oil to the bearings, and are set at a higher flow rate for rotor lubrication. The middle valve(s) feed directly into the vacuum pump housing.

1. **Start pump and run until operating pressure or vacuum is reached.**
2. **Loosen locknut with wrench to allow needle to be adjusted by turning freely.**
3. **Open valve to increase flow by turning needle counterclockwise.**
4. **Close valve to decrease flow by turning needle clockwise.**
5. **Adjust flow until the desired drip rate is observed.** *(See table page 9)*
6. **Tighten locknut with wrench while holding needle to prevent setting changes.**

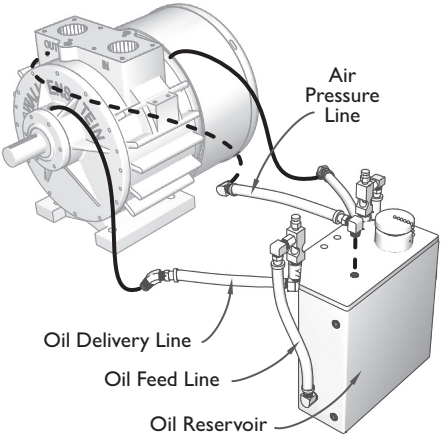
Vacuum/Pressure Sight Feed Valves

MODEL CODE O

Uses the air pressure differential at the pump's endplate. This pressure is roughly half of system pressure. If the pump is operating at **22" Hg** there will be roughly **11" Hg** at the endplate.

Lubricating oil is simply drawn through the sight feed valves and then into the pump by vacuum.

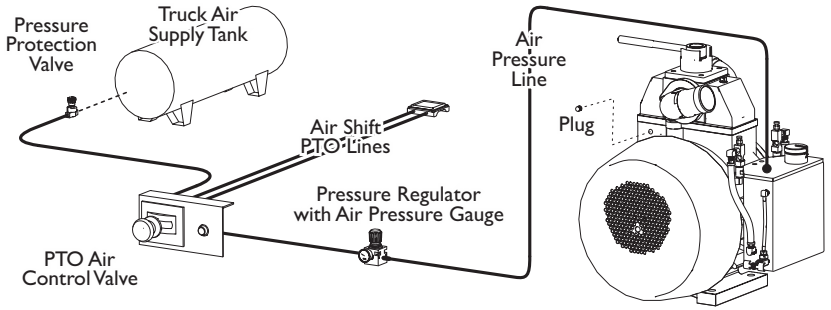
On pressure cycle the oil tank is pressurized from the pressure side of the pump. This forces oil into the pump at the entry points.



Air Pressure Sight Feed Valves

MODEL CODE O

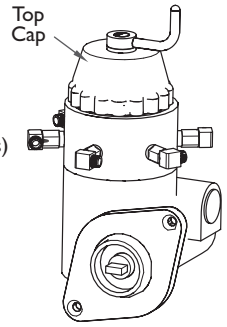
The chassis air supply can be used to achieve automatic lubrication with no moving parts. The best place to do this is the air shift PTO. Install a mini pressure regulator and gauge in the line to reduce the pressure to approximately 10-12 PSI. When the PTO is engaged, air is diverted to the oil tank to pressurize the oil tank and force lubricating oil into the pump, When the PTO is disengaged, this air is released and the oil flow stops. Install a 1/8" pipe plug *(Part #PF.12SPP)* on the vacuum pump housing after converting to truck chassis air supply.



Mechanical Lubricator

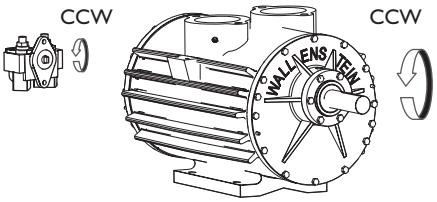
MODEL CODE **P**

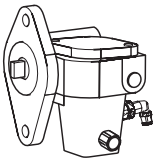
The mechanical oil pump is an automatic oiler that meters an exact amount of oil to the vacuum pump with each shaft revolution. Once set properly, the oil pump does not require further adjustments. Never allow the oil tank to run dry. Refill oil tank in time, using clean new oil.



Rotation

Lubricating pumps must be the same rotation as the vacuum pump. Clockwise or counterclockwise models are used, based upon the vacuum pump shaft rotation.





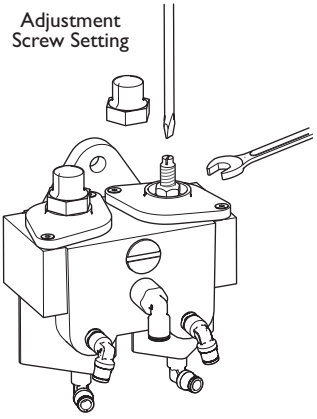
Flow Rate Settings (Piston Pump)

Oil flow rate is factory preset, but may be adjusted if required. **Rate may be reduced by clockwise rotation of the adjustment screws.**

1) Remove brass cover nut to expose adjustment screw and locking nut *(2-4 OEP),* or remove top cap *(6 OEP)*.

2) *(2-4 OEP only)* Back off the locking nut with a wrench, to allow adjustment screw to turn freely.

Using a flat screwdriver, turn each setting screw to adjust flow rate. Turn the screws only a quarter turn adjustment at a time, **CW** to reduce oil flow, **CCW** to increase oil flow.

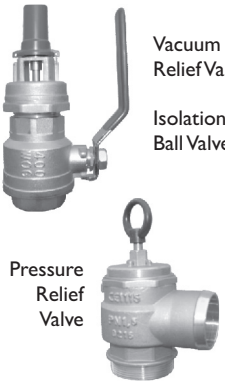


Four OEP Lubricator

3) Once the correct flow rate is observed, lock the adjustment screw in place by tightening the locking nut *(2-4 OEP only)*, and replace the top cover.

NOTE: Mechanical Lubricators require periodic inspection. Follow greasing maintenance instructions on page 16 to prevent lubrication failure.

NOTE: Relief Valves must be set and tested on initial startup.



Many vacuum systems are equipped with a vacuum relief valve and every pressure system must have a pressure relief valve. These valves are usually spring loaded devices that are adjusted by setting the spring tension. Always set relief valves with pump at maximum RPM, following the valve manufacturer's instructions.

These valves limit the vacuum or pressure level of the pump and system. The higher the vacuum or pressure setting, the harder the system will work and the hotter the pump will run. It is normal practice to set these devices at the lowest level that allows the work to be done in a satisfactory manner. For example a vacuum tank may have a routine discharge through a 6" hose. In this case the pressure relief valve could be set as low as 7 PSI since it would not normally require more pressure than this to offload. Wallenstein Pumps are positive displacement air pumps and they can produce high pressure differentials. Always make sure a pressure relief valve is set below the design pressure of the tank. Use multiple relief valves on larger pumps.

If a new Wallenstein vacuum pump is installed on an old vacuum tank, be sure to inspect tank and make necessary repairs to preclude the possibility of tank collapse. A vacuum relief valve can be installed to reduce this risk.

Startup | ***Trial Run***

Now that we have completed the settings for RPM, Lubrication and Relief Valves, the vacuum pump is ready for a trial run.

A trial run is the first time a vacuum system is put into actual service. It is best to have experienced personnel on hand for the trial run. Time the loading operation to make sure it is satisfactory. See example chart (next page) that can be used to record times and vertical lift height results for future reference. Check lubrication rates, RPM, and relief valve settings. Inspect drive, and test vacuum system components. Check airflow and check for air leaks in the system. Make final adjustments as necessary.

Once these final adjustments have been made, a vacuum system is ready to go into routine service. Be sure to follow maintenance instructions. (Next Section)

NOTE: This chart is an example that can be included with equipment records.

Keep a record of Pumpdown (evacuating air), and Loading (filling tank) times for pumps and tanks as a reference point for monitoring variations in operating results.

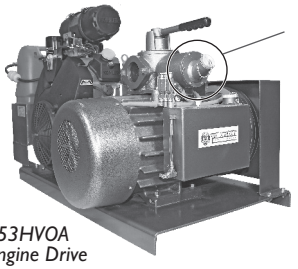
Operator: _____ Date: _____

Truck: _____ Truck RPM: _____

Notes: _____

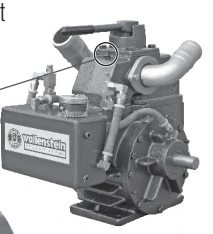
Elapsed Time	*Vacuum "Hg*	*Tank Level*	Elapsed Time	*Vacuum "Hg*	*Tank Level*	Elapsed Time	*Vacuum "Hg*	*Tank Level*
0	0	0	**5.5**			**11**		
0.5			**6**			**11.5**		
1			**6.5**			**12**		
1.5			**7**			**12.5**		
2			**7.5**			**13**		
2.5			**8**			**13.5**		
3			**8.5**			**14**		
3.5			**9**			**14.5**		
4			**9.5**			**15**		
4.5			**10**			**15.5**		
5			**10.5**			**16**		

Flushing combats contaminants that are often pulled through a vacuum pump during operation. Some materials create an abrasive mixture which leads to excessive wear. Your filtration system and the material being handled will determine flushing frequency. Pumping water in a dust free environment requires infrequent flushing even if the system has no filters. Situations where dust is present or where the vacuum system filters can't remove all the foreign matter will require frequent flushing, daily or after each job.

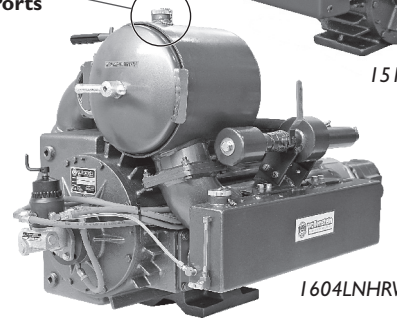


753HVOA
Engine Drive

Flush Ports



151HVO

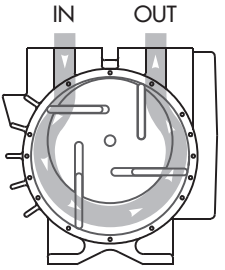


1604LNHRVPi

A flush port should be located in the vacuum system ahead of the vacuum pump. On some models this port is provided in the manifold or on the pump's vacuum to pressure change over valve. Regular flushing is important to protect from internal rust build up. Vacuum pumps benefit when foreign material is flushed and a clean slippery film is left in place.

Routine Flushing for Extended Vane and Pump Life

Use a 50:50 blend of vacuum pump oil and diesel fuel. Slowly add one cup to flush port while rotating pump at low RPM in the vacuum mode. Drain oil catch muffler.



Cleaning Fluid Travel Path

Never operate a pump that has been fouled by foreign matter. If freezing is suspected always rotate pump by hand to verify, and completely unthaw prior to operation.

Lubricator Flushing

Vacuum pump **oil reservoirs** should be checked for moisture build up and drained as required. Reservoir and oil lines should be flushed clean on a regular basis. Flush **mechanical lubricators** (2, 4, 6 OEP) with kerosene yearly, or prior to operation if not used for several months. Residues may solidify causing lubrication failure. As with service for all machinery, **never** add oil to the reservoir while machine is in operation.

Mechanical Piston Pump

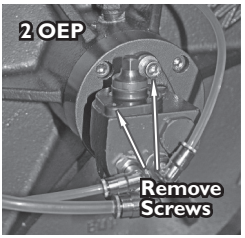
MODEL CODE **P**

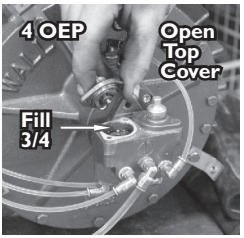
The top section of the mechanical piston pump must be filled with lubricant, and must never be run dry. Remove the cover at least every 6 months. Inspect lubricant level and replenish if needed.

Piston Pump	Recommended Lubricant
2 OEP 4 OEP	Mobilgrease XHP 005
	Mobilux EP004 NLGI-00
	ConocoPhillips Unoba EP00
6 OEP	White Lithium Grease

2 & 4 OEP

Use a 1/4" hex driver to first remove cap socket screw, then a 2.5mm hex driver for smaller top cover screws. Fill top section to 3/4 full, then replace top cover.





6 OEP

Remove the top cover and fill with lubricant

Unscrew top cover, with handle attached. Completely pack the top section with white lithium grease, making sure to completely cover all parts with the grease.

Hand priming of the 6-OEP (oil entry point) lubricating pump is needed when no oil is present in the delivery lines. To prime, push down on handle and turn clockwise.

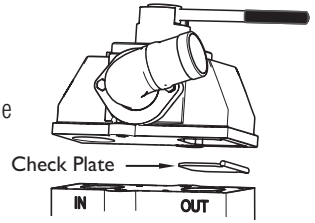
Vacuum / Pressure Top Valve

MODEL CODE **V**

A changeover valve to allow both vacuum or pressure operation is installed on pumps with a letter **V** in the model name. These 4-way valves allow reversing the vacuum pump air flow, thereby pressurizing the vacuum tank for discharging.

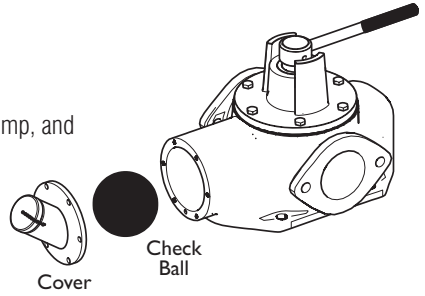
NOTE: Keep valves properly greased by periodically pumping a small amount into the grease fittings located on vacuum / pressure top valves.

Model 80 Valve *(2")*



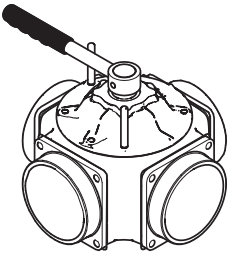
A **Check Plate** prevents backspin of the pump when the system is shutdown with vacuum or pressure in the tank. The check plate is on the exhaust side of the pump (marked OUT on housing). If backspin is observed, the check plate should be inspected for damage, and replaced if necessary. To access the check plate, use a 1/2" wrench to remove the two hex cap screws, then lift the top valve off of pump head. Use gasket #1000-386 and hi-temp silicone sealant when bolting the cover back into place.

Model 200, 300 Valve *(3")*



A **Check Ball** prevents backspin of the pump, and should be inspected in the event that backspin is observed. Using a screwdriver, remove screws and cover plate from side of the valve body. Inspect the check ball for roundness, softness (should be hard), or grooves. Clean any residue or replace with a new ball. Use a new gasket #1000-128 and hi-temp silicone sealant when screwing the cover back into place.

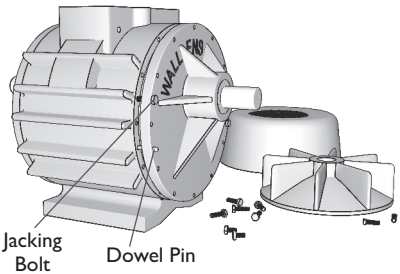
Model 350, 450, 650 Valve *(3", 4", 6")*



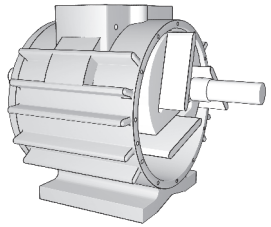
If the valve handle does not turn freely, and grease has already been applied, it may be necessary to adjust the spool height. This can be done by adjusting the spool lift bolt on the bottom of the valve. With a 3/8" wrench, loosen locknut, then turn spool lift bolt clockwise to raise spool. Tighten locknut to prevent spool from moving.

Vane inspection is part of regular maintenance. Vanes are self adjusting and they should be checked periodically and replaced If required. When vanes wear too far they can cause the pump to jam. Access the vanes through the non drive end. Because of the end plate and roller bearing design, this can be done without disturbing the bearing fit.

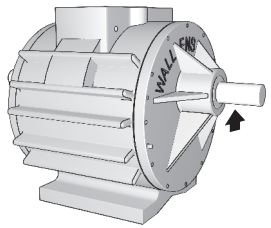
Internal inspection requires removal of the fan and shroud *(air cooled pumps)*. Disconnect the oil line and remove all endplate bolts. Insert the two longer bolts into the threaded holes, use the bolts to jack the endplate from the housing. Tighten jacking bolts equally.



Now the entire pump interior is visible for a thorough inspection. Make note of the cleanliness and condition of the pump housing. Clean if required. Remove vanes and measure to determine if replacement is necessary. Inspect vanes for flatness and straighten if they appear warped. Lightly lubricate vanes and insert into slots making sure they slide freely.



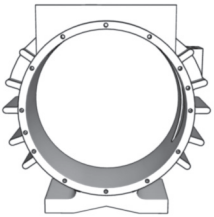
Slide the endplate back into place being careful to 'walk' the oil seal onto the rotor shaft without disturbing the oil seal spring. Turn in the bolts on each side of dowel pins until the endplate rests against the housing. Exert slight upward pressure on rotor shaft and tap the dowel pins lightly before final tightening of bolts. This ensures that the endplate is back in it's original position.



SERIES OR MODEL	151 (H / HR)	200, 300, 400 550, 750, 1500 (H / HR)	1050, 1600, 2100 (HR)	W6i	M	MM	W
New Vane Width	2-1/2"	4-5/8"	3-1/2"	3-1/2"	3-7/8"	3-7/8"	2-9/16"
Change Width	2"	3-5/8"	3"	2-3/4"	3-3/8"	2-7/8"	2-1/4"

The three major castings in the vacuum pump are the housing, the rotor, and the end plates. On liquid waste models there are also the castings that make up the vacuum/pressure valve.

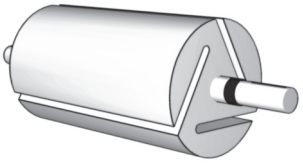
Housing



The pump housing is the cylinder on which the vanes travel. Wallenstein Vacuum Pump housings are honed to a micro-inch finish. This eliminates a wear in period and reduces noise and friction by providing a smooth surface for the vane tip. If a housing shows wear it should be honed to restore performance and increase vane life.

Sometimes damage is severe enough that a boring operation is required prior to honing. In general, a cylinder bore can only be enlarged to the point where the bolt holes interfere.

Rotor



Inspect rotor by turning between centers. Use a dial indicator to determine bearing concentricity. Use emery cloth on outside of rotor to polish. Sometimes a fine skin may be removed from the outside diameter and the non drive end. Rotor slots should be cleaned and all edges should be sanded smooth to remove sharp edges. Always flush rotor with cleaning solution prior to use.

Endplates

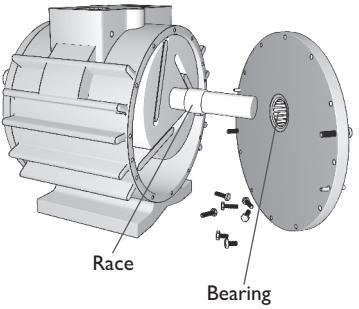
Endplates are precision machined to contain the bearings. If the **non-drive** (rear) endplate shows wear it can be cleaned up on a lathe. The machined face must be perpendicular to the bore. The **drive** (front) endplate fixes the rotor's position and cannot normally be machined if it shows wear.

NOTE: Casting repairs should always be done by a qualified machinist. Contact your distributor for the rebuilding service in your area.

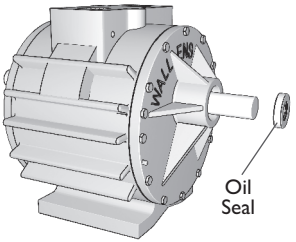
Bearings are responsible for maintaining the rotor's internal clearances. If a rotor shaft shows even the slightest amount of play the bearings should be replaced. Always replace oil seals when changing bearings. Wallenstein Pumps incorporate ball bearings on the drive end and roller bearings on the non drive end.

Roller Bearing Replacement

Remove the fan assembly, oil line, and rear endplate as described in the procedure for checking vanes *(Pg. 18)*. Remove oil seal and roller bearing from endplate. Press a new roller bearing into place.



Slide the endplate assembly with the new bearing onto the pump shaft where it rides on the inner race. Check for play in the bearing. If no play is evident then inner race replacement will not be necessary. If inner race is burnished or worn then pull it from the shaft. Heat may be required. Tap a new inner race into place. If inner race is loose on the shaft then a new race must be installed using Loc-Tite. Lightly knurl the shaft prior to assembly as the inner race must be tight.



Replace oil seal after the endplate has been bolted back in place.

Ball Bearing Replacement

Disconnect the oil line, remove endplate bolts, bearing cap, locknut and lockwasher. Pull the endplate from the rotor shaft using a small mechanic's puller. Press the ball bearing from the endplate and clean all parts. Insert a new ball bearing and press in place until it bottoms against the retaining ring. Slide on bearing cap and tap the assembly onto the rotor shaft until it bottoms against the spacer ring.

Remove bearing endcap and install lockwasher and locknut. Spin the endplate and check gap to make sure endplate is square on shaft. The gap between the endplate and the rotor should be about .005”

If the housing, rotor and endplates pass inspection they are ready for assembly. In a major overhaul, the vanes, bearings and seals are always replaced. The following assembly outline applies to all models.

Rotor & Front Endplate

Set the rotor on the edge of a workbench with the drive shaft facing out. Install a new ball bearing in the front plate as described under ball bearing replacement *(see previous page)*. Tap the endplate into place.

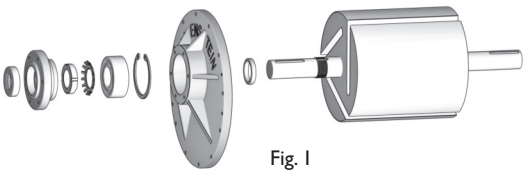


Fig. 1

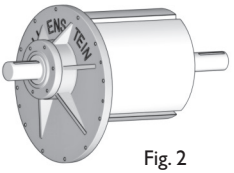
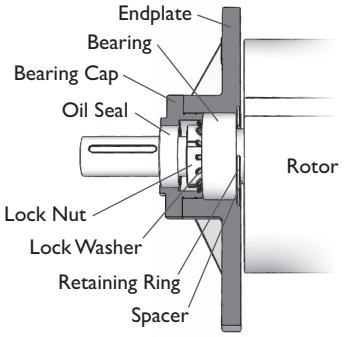


Fig. 2

The front endplate and the spacer ring are precision machined to maintain the proper distance or gap between the rotor and the endplate. This assembly "locks" the rotor in place between the endplates. The front gap is about .005" and it must be correct before installing the rotor assembly into the housing.



Install bearing and bearing cap into endplate. Tap assembly onto shaft until the bearing rests against the spacer ring. Remove bearing cap, install lock washer and locknut. Tighten locknut and fold one ear of lock washer into slot on locknut. Bolt bearing cap into place and check gap. Spin endplate to make sure it is square on shaft. Finally, install oil seal into bearing cap.

The rotor and endplate assembly is now ready to install into the housing.

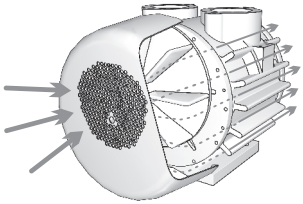
If the pump housing has been machined it will be necessary to reset the clearance between the rotor and housing and to re-dowel the endplates to their new position. If the clearance is too great it will allow air to "blow by" and result in greatly reduced pump efficiency.

Air Cooled pumps utilize ambient air and inlet air for cooling purposes. Rotational speed, duty cycle, air temperature and product temperature all impact pump cooling. In general terms, shaft mounted fans are utilized for continuous duty to 15" HG. Independent cooling fans and internal air cooling (ICS) are used for higher levels of performance.

MODEL CODE A

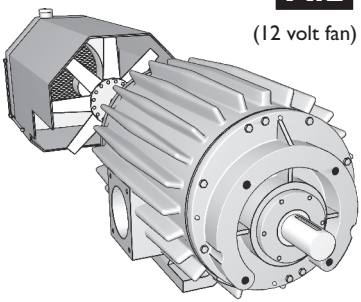
(Shaft Mounted Fan)

Shaft mounted fans pull air through the end cover and direct it across the pump's cooling fins. It is important to keep the pump housing clean to maximize this heat transfer. On pumps with shaft mounted fans the fan will be removed when checking vanes. Always grease shaft thoroughly to avoid rust build up on shaft and to aid in future fan removal.



MODEL CODE AI2

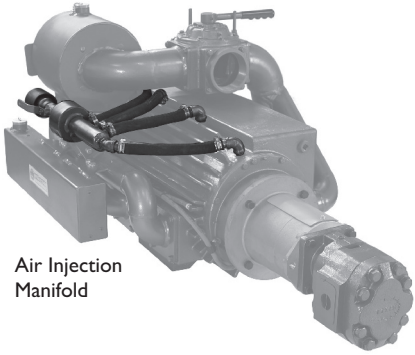
(12 volt fan)



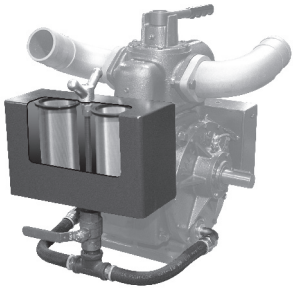
Larger air cooled pumps employ independent cooling fans which rotate at much higher RPM than shaft speed. These fans can be left running between cycles.

The Internal Cooling System cools the rotor and vanes directly with outside air. Air is drawn in through filters on the exhaust side of the pump.
Clean ICS filters on a regular basis.

Air cooling may be combined with liquid cooling for even greater versatility on truck mount vacuum systems.



Air Injection Manifold

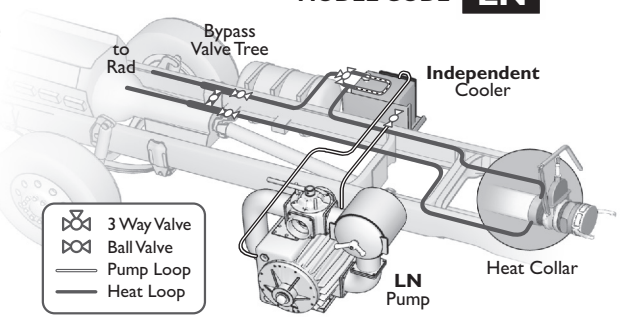


ICS Filter Box cut away to show filter elements

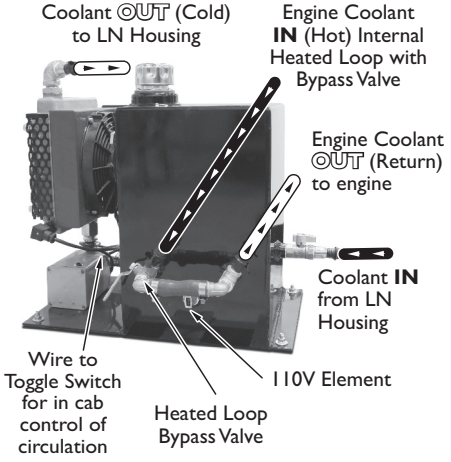
MODEL CODE i

MODEL CODE LN

Liquid cooled pumps utilize water or anti-freeze to normalize the pump's temperature and extend it's operating range.



Designated as **LN**, these liquid normalized pumps are often used for pre-warming purposes in cold climates or where product vapour can gel onto the pump's internal surfaces. LN pumps have a liquid jacket cast into the exhaust side of the pump housing for heat transfer.



In extremely hot climates and for longer duty cycles, an LN COOLER with a separate reservoir is used. A circulation pump pulls coolant from a coolant tank and directs it to the bottom of the liquid jacket. The coolant flows through the jacket and exits at the other end at the top. It then flows to the bottom of the radiator where a cooling fan dissipates the heat. After flowing through the radiator, the cooled liquid is returned to tank.

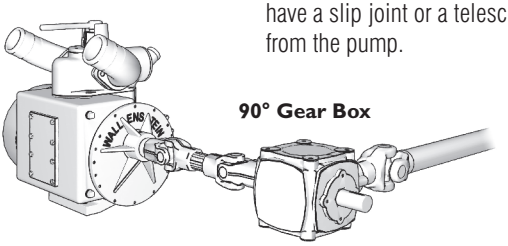
Vacuum trucks sometimes use the engine cooling system to normalize the pump. A circulation pump is installed which pulls the coolant from the cold end of the radiator. The cooled liquid is directed to the bottom of the LN jacket, picking up heat, and then returned to the radiator to be cooled by the truck's fan.

In some cases a cab heater line can be used. If the truck has an "open center" style of heater then coolant will always be flowing. Simply connect the heater return line to the LN cooler and pump before it returns to the truck's system. If the truck has a "closed center" style of heater, then it is normally best to use nylon "Y" fittings in both the heater feed and return lines.

Direct mechanical drive is common on vacuum trucks because it can transfer high power requirements without overheating, and often at a relatively low cost. Direct drive is best suited for stationary loading and discharge. The two main methods are drive shaft and close coupling. Usually a 90 degree gear box is employed so that the vacuum pump can be mounted outboard on the truck's frame where it is easily accessed by the operator.

Drive Shaft

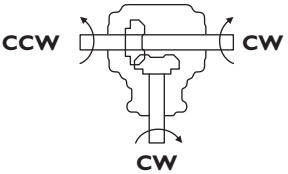
Drivelines must be sized to the pump's horsepower requirements. Check that set screws are tight and grease universal joint on a regular basis. Each driveline must have a slip joint or a telescopic section to isolate vibration from the pump.



90° Gear Box

Some drivelines have a shear pin assembly to protect the pump should jamming occur.

Gear box drive is available in many sizes and styles. For vacuum truck use the most common style is the 90 degree T box. Since the T box has two output shafts, it is often possible to flip it over to achieve the desired rotation.



The rotation of PTO, gearbox and the Wallenstein vacuum pump must be verified before new installations. Operating against the intended rotation may cause equipment damage. *(To determine vacuum pump shaft rotation refer to Page 34)*

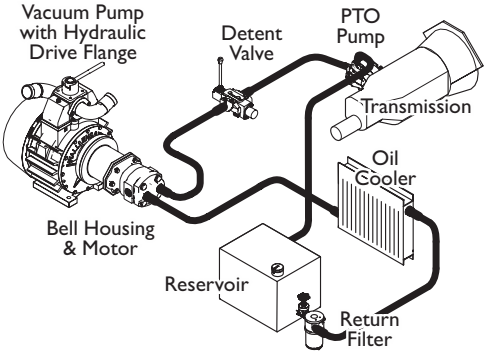
Close Coupling

Close couplings can isolate the vacuum pump from shock loads, vibration, and end thrust. Some couplings will work only if angular misalignment is less than 1 degree and parallel misalignment is less than .015" Use extreme care in choice and alignment. Close couplings are often oversized for vacuum pumps because of frequent starts.

Hydraulic drive can be employed in two forms depending on the relative size and duty cycle of the vacuum pump. Smaller models can be powered continuously with **open loop** conventional hydraulic components. Larger sizes require **closed loop** hydrostatic systems and/or hydraulic oil coolers to run continuously.

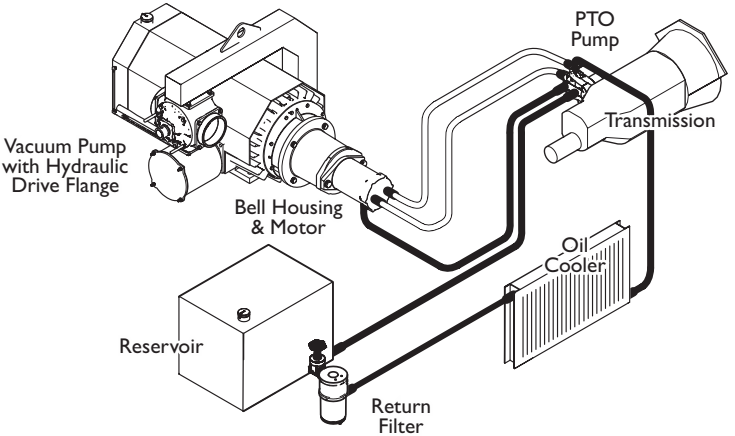
Open Loop Conventional Hydraulics

Open loop systems employ a hydraulic pump *(often a gear type pump)* to pull oil from a reservoir and then deliver it under pressure to a hydraulic motor. The oil flows back to the reservoir after passing through the motor. An oil cooler is often required.



Closed Loop Hydrostatic Drive

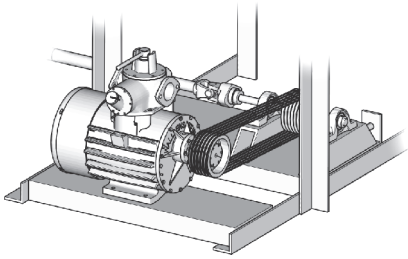
Closed loop hydrostatic systems employ a hydrostatic pump to pressurize the oil and send it to the piston motor. After passing through the motor the oil is returned directly to the hydrostatic pump inlet (shown as white lines below). The drain and charge lines (black) keep the system primed.

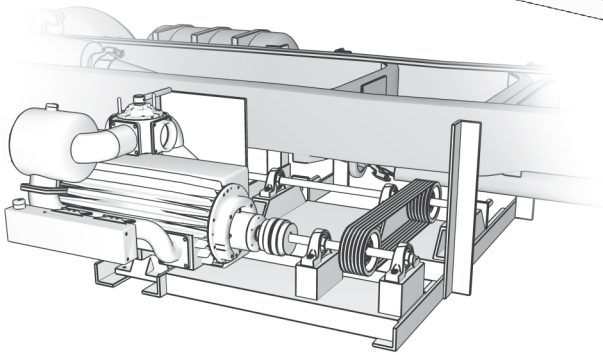


Belt and pulley drive is used extensively for vacuum pump drive. Belt drive systems are simple, inexpensive and do not require axially aligned drive shafts. Belts help to protect the vacuum pump from overloading and jamming, and also run smoothly with little noise. Power transmission is achieved with the use of specially selected belts and pulleys (sheaves), depending on the power requirements. Rubber v-belts and pulleys with matching grooves are used because they eliminate slippage and provide the best combination of traction, bearing load, and long service life.

PTO Jack Shaft Drive

On frame mounted vacuum pumps, a transmission power take off (PTO) drive line is used.

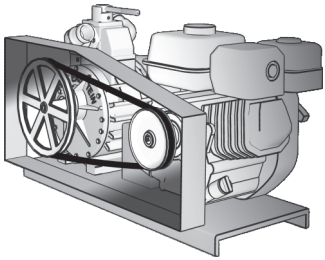




Pumps are mounted so that the pump drive shaft is parallel to the main chassis drive line. The adjustable jack shaft is coupled to the main drive line.

Engine Drive

Gas or diesel engines with a belt drive vacuum pump stand offer a complete, powerful vacuum source with no need for PTO or other drive. This compact option is ideal for flat deck truck mount, trailers, or for fixed locations.



The main factors in any successful belt drive setup are the proper **ratio**, the pulley **alignment**, the belt **tension** and the belt grip.

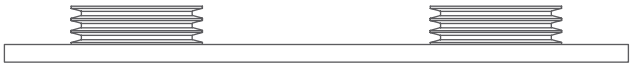
Drive Ratio

Select the proper pulley sizes given the available horsepower and the speed of the driver mechanism. On drive units with variable RPM it is important to avoid overspeeding of the vacuum pump.

$$\frac{\text{driver RPM X driver pitch diameter}}{\text{driven pitch diameter}} = \text{Pump RPM}$$

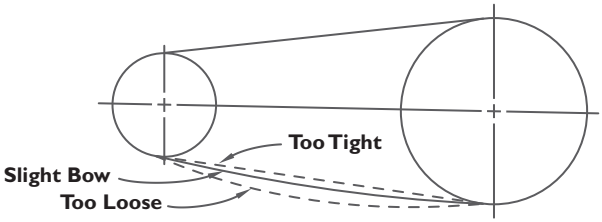
Alignment

Pulley alignment is important for both belt and bearing life. Check alignment by holding a straight edge on the side of the pulleys before tightening pulleys onto shaft. No gap should be evident.



Tension

Apply tension to the belts by increasing the center distance until the belts are snug. Operate the drive a few minutes to seat the belts in the grooves and then observe the belts under the highest load condition. A slight bowing of the slack side of the drive indicates proper tension. Check the tension frequently on a new drive during the first day by observing the slack side span. After a few days operation the belts will seat themselves in the grooves and it may become necessary to readjust so that the drive again shows a slight bow in the slack side.



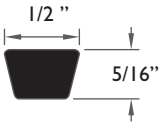
By far the most important factor in the successful operation of V-belt drive is proper belt tensioning. If the belts squeal they are not tight enough to deliver the torque demanded by the pump. Tension must be sufficient to overcome slipping under maximum peak load.

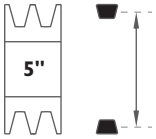
If belt tension is too great it will lead to premature bearing failure, and in extreme cases, damage to the pump shaft. Pulleys must be selected which provide the proper belt pull, arc of contact, and number of belts.

Belt Grip

On vacuum pump installations it is often best to use a pump pulley that through experience has proven to be adequate to drive the pump under the highest load condition. Adjustment can then be made to the driver pulley size to arrive at the correct ratio. The following general recommendations are intended as a starting point for pulley selection on conventional V-Belt drives.

"A" Belt

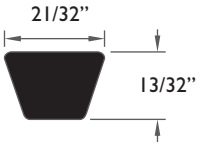


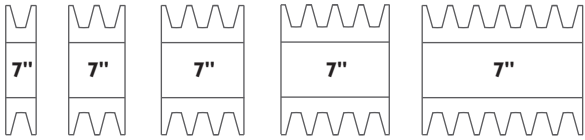


151

Values indicate the minimum pitch diameter of the driven pulley.

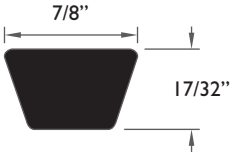
"B" Belt



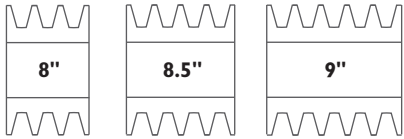


151 | 202, 302, W5, W7.5 | 402, 403, 403LN, 553 | 753, 753LN | 1053, 1054

"C" Belt



Use Notched Belts On C Drive



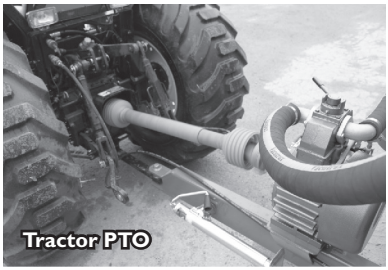
1053, 1054 | 1504LN, 1604 | 2104

If the correct size and quantity of belts are used, and if the pulleys are large enough to provide an adequate arc of contact, then damage due to overtightening of belts will be minimized. Proper belt drive can act as a safety device should pump jamming occur.

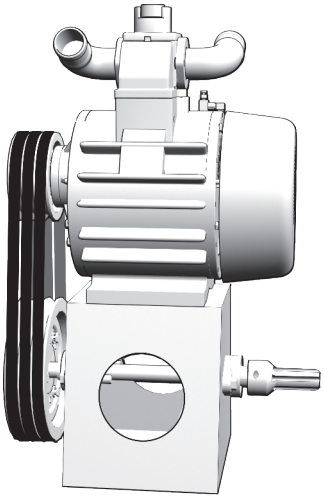
Tractor PTO Drive Vacuum Spreader

Vacuum tankers used to haul and spread liquid manure offer many advantages including better performance, simple operation, and versatility for other tasks such as clearing plugged pipelines and flushing out gutters. Vacuum spreaders may be truck mounted for highway use, or trailer mounted for pulling behind a farm tractor.

Trailer mounted vacuum tankers are designed so that the splined PTO output shaft on the towing tractor (either 540 or 1000 RPM) can be easily connected and disconnected to the input shaft on the Wallenstein Vacuum Pump, by using a flexible drive shaft which is compatible in length, power capacity, and includes safety shielding.



Belt and pulley drive configurations are often used on vacuum manure spreader trailers together with the flexible drive shaft tractor PTO, and offer protection from overloading and jamming. *(See pages 24-26 for more information on belt drive)*



Vertical Belt Drive Stand with splined shaft adaptor, clockwise (R) vacuum pump

Tractor and spreader designs vary between manufacturers. Be sure to follow all operating instructions, and to use only parts that are recommended by the original equipment manufacturer.

With modern tractors, the PTO is controlled by push button or selector switches that engage the PTO and set the RPM speed. It is important to always engage and disengage the PTO at a low RPM, then increase the throttle to full RPM. At slow speed, vane "chatter" may be heard because the centrifugal force is too low. The operating RPM must be faster than this speed. *(See page 9, Startup RPM)*

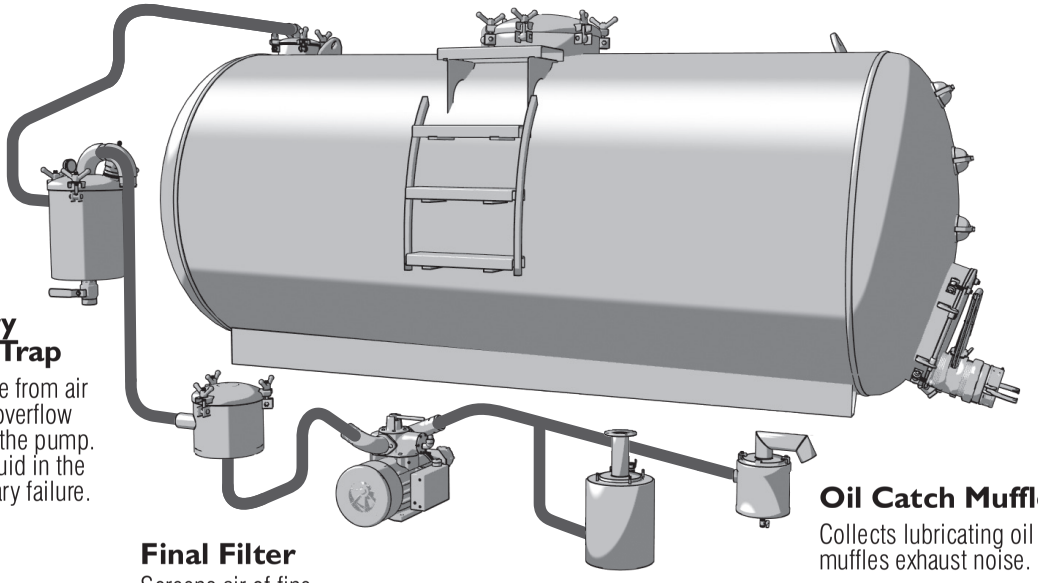
Liquid waste service requires several important devices to protect the pump and allow successful operation. These traps and filters come in various sizes and must be matched in size to the pump under consideration. Normally they are classified according to the inlet/outlet port size and also to the volume of air that they are intended to handle.

This chart shows the standard component sizing for various CFM levels on liquid waste trucks. Often safety devices on truck mounted vacuum systems are smaller than safeties on comparable industrial applications due to chassis space limitations inherent with truck mounting.

MINIMUM SAFETY COMPONENT SIZING

1"	1.5"	2"	3"	4"	5"+
80 CFM	120	200	500	1000	2000+
151	151 202	202 302 402	403 403LN 553 753 753LN	1054 1054LN 1504 1604LN 2104	2106 Duplex

Three important components must be present for every truck mounted liquid waste system. These are the primary check valve, the secondary moisture trap and the oil catch muffler. For industrial applications most vacuum systems will also include a final filter in the vacuum line ahead of the pump. For mobile off loading (field spreading), most vacuum systems will also include an air precleaner.



Primary Check Valve
Stops liquid when tank is full

Secondary Moisture Trap
Spins moisture from air and prevents overflow from entering the pump. Also stops liquid in the event of Primary failure.

Final Filter
Screens air of fine particulate matter

Air Pre-Cleaner
Filters air for mobile offloading.

Oil Catch Muffler
Collects lubricating oil and muffles exhaust noise.

Presented below are some recommended maintenance schedules for vacuum pumps in the liquid waste industry. Please consult your original equipment manufacturer or equipment manuals for further advice.

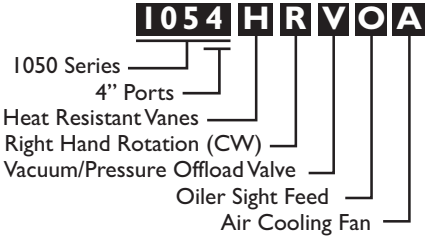
Maintenance	Procedure	Frequency
Check Oil Flow	Inspect the sight feed valves or inspect the oil delivery lines. *(Page 9)*	Monitor oil flow during operation
Check Oil Level	Inspect level indicator on side of oil reservoir. *(Page 9)*	Before each use
Check Vanes for wear	Remove non-drive endplate and perform internal inspection. *(Page 18)*	Varies based upon pump application
Check V/P Valve	Apply grease to nipple. *(Page 17)*	Once a month
Check Drive Shaft	Apply grease to joints and shafts.	Once a month
Check Final Filter	Remove and clean filter. *(Page 31)*	Daily
Check Pump Safeties	Inspect shut-off components, drain canisters, clean internal parts. *(Page 31)*	Drain daily, clean weekly
Flush Vacuum Pump	Add diesel oil to flush port. *(Page 15*	Regularly, and also any time carry-over into the pump is suspected.
Flush Oil Reservoir	Clean with diesel or kerosene. *(Page 16)*	Once a year
Flush Lubricating Pump	Clean mechanical lubricating pump with diesel or kerosene. *(Page 16)*	Once a year

Presented below are some basic conditions that may be encountered during **any** rotary vane vacuum pump operation. If your condition is not listed please consult your original equipment manufacturer for further advice.

Condition:	**Solution:**
Pumping time is too slow	Increase loading hose diameter, use two hoses
Pump works hard & will not load tank	Check for collapsed hose, or internal hose liner
Pump works easy & will not load tank	Check for air leaks in system and hoses
Liquid enters vacuum pump	Correct safeties, flush pump & lines, resume
Pump will not rotate by hand	Check for freezing or damaged vanes
Vanes are split	Excessive heat, improve cooling
Vanes are chipped	Operation while vanes not sliding freely
Vanes are worn unevenly	Check for over speeding, reduce RPM
Vanes are gouged or sheared in half	Insufficient lubrication or excessive pressure
Pump leaks oil at shaft on pressure	Oil seal is worn, remove and replace
Oil flow too slow in winter operation	Oil is too thick, use lighter weight oil
Oil flow too fast in summer operation	Oil is too light, use heavier weight oil
New pump starts to vibrate	Vane may be warped, remove and straighten
Old pump starts to vibrate	Vanes may be worn too far, remove and replace
Pump vibrates after checking vanes	Drive system may be out of balance, correct drive
Vanes wear too fast	Check housing for wear, hone if scored/scratched
Pump will not fill tank to top	Vertical lift may be too high, measure distance
Vertical lift is too high	Take air in with waste to break the column
Tank will not fill even with air intake	Pump too small or loading hose too large diameter
Pump runs very hot	Inspect and correct cooling system
Cooling system OK, pump still hot	Excessive duty cycle, limit RPM or vacuum level
Pump too hot for intended service	Improve cooling system
Pump seizes	Allow to cool, rotate by hand, resume
Pump spins backwards	Check ball or flap not working, inspect & correct
Pump makes loud metallic noise	Housing may be scored, inspect & hone housing
Pump makes high pitched squeal	Bearing may be worn, inspect and replace
Vacuum loss, pump wears too fast	Rebuild pump, improve air filtration
Exhaust smoke a problem in-plant	Use smoke filter after oil catch muffler
Exhaust smoke a problem outdoors	Install high level exhaust

Model Codes

The pump head series & port size are indicated by the first numbers in the model code, followed by the exact pump configuration codes.

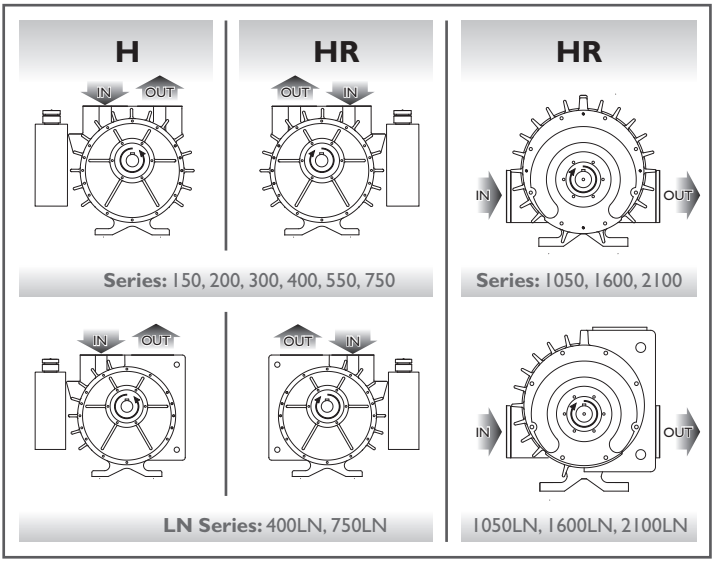


LN	**L**iquid **N**ormalized housing
H	**H**eat resistant Vanes
R	**R**ight hand shaft rotation
V	Control **V**alve, Vacuum/Pressure
O	Sight Feed Valve **O**iler

A	**A**ir cooling fan
P	Mechanical oil **P**ump
i	Air **I**njection cooling system
C	12v **C**lutch; type C6, C7 or CS
12	fan motor voltage (**12**)

Pump Shaft Rotation

Identify rotation while viewing the drive end of the pump. Arrow on end of shaft will show direction. Outline illustrations may also be used to identify rotation.



wallenstein
vacuum . pumps

Manufacturers Warranty

Wallenstein Vacuum Pumps are warranted to be free of defects in materials and workmanship for a two year period from the date of first use.

Specifically excluded from this warranty is product failure due to improper installation or operation, and damage from foreign material, water, or ice.

Manufacturers Warranty is limited to pump repair or replacement, excluding transportation.

Please direct warranty claims to your original tank manufacturer.

20 Martin LN
Elmira, Ontario, Canada N3B 2A1
1-800-801-6663

EM elmira machine industries inc.

Owner's Record:

Pump Model Number

Pump Serial Number

Date of Purchase

Distributor's Name

Salesman's Name

Installed On (Chassis I.D.)

Distributed By:

Printed in Canada