



Vacuum Tank Maintenance and Operations Manual

Revised January 1, 2013

Customer Name: _____

Job Number: _____

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I. Preface

With the purchase of this Amthor equipment, you have made an excellent choice.

Before using this equipment, it is essential that you read this manual very carefully. In following the directions both for maintenance and operation instructions, you will profit most by your equipment. By following all instructions, this equipment should last a long time.

Customer Responsibility

It is the customer's responsibility to read the operators manual and know the correct and safe procedures. To train their employees in the proper, correct and safe operation procedures of this equipment.

The customer is also responsible for a few "wear" items which are not covered under warranty. These items include but not limited to vanes, oil, grease, etc. The warranties on our equipment are designed to protect the customer against defective material and/or workmanship. It is not intended to cover depreciation of damage caused by normal wear, accident, improper maintenance, improper protection or improper use. Please review all warranties on tank and equipment to familiarize yourself with it.

Amthor's Responsibility

Amthor shall be responsible to the customer to correct any failure due to defective material and workmanship during the period of the customer's warranty. We shall be responsible to determine the cause of failure and make a fair and just judgment according to the warranty procedure.

Important Safety Notice

If you decide to open either the tank primary or manways please make sure you remove and release all the pressure in the tank to avoid serious injury.

If you are to go inside the tank make sure you are aware of and follow all of OSHA approved confined space entry regulations and the entire interior of the tank is clean.

II. Vacuum Pump Speed

For a vacuum pump to operate properly, it must operate at the proper RPM(revolution per minute). The vanes have to be forced out to run against the inside wall of the pump housing. It is also important not to over speed the pump as it will cause excessive wear.

The vacuum pump supplied with this unit is a:

Model: _____

The power takeoff is a:

Model: _____

% of engine RPM: _____

It is equipped with right angle gear box:

Model: _____

Ratio: _____

If hydraulic drive, hydraulic pump model: _____

Hydraulic Motor Model: _____

Vacuum pump should operate between _____ RPM and a maximum of _____ RPM.

With the engine at _____ RPM, the vacuum pump will run _____ RPM.

With the engine at _____ RPM, the vacuum pump will run _____ RPM.

With the engine at _____ RPM, the vacuum pump will run _____ RPM. **MAXIMUM (Intermittent pump operation)**

III. Vacuum Tank Operations

Normal Operating Conditions

- The tank draws in when the valve is in the **VACUUM** or **SUCTION** position.
- The tank discharges when the valve is in the **PUMP** or **PRESSURE** position.
- The tank does nothing when the valve is in the **NEUTRAL** or **MIDDLE** position.

Loading

1. Check the following components in the truck:
 - Transmission oil
 - Engine oil
 - Fuel
 - Tires
2. Check the following components on the vacuum pump system
 - Vacuum oil
 - Oil catch muffler (should be drained)
 - Primary shutoff filter
 - Moisture trap/scrubber (secondary trap)
 - Hoses and connections
3. Try turning the pump by hand before start-up to ensure that it is not frozen (in winter)
4. Start the truck, and allow it to warm up (the unit is warmed up when the valve heating jackets are warm to the touch if applicable)
5. Position the truck, put the parking brake on and put the transmission in neutral.
6. Close the valves at the back of the pumper tank.
7. Remove the dust caps from the suction and discharge valves.
8. Position the pump handle to the **NEUTRAL** or **MIDDLE** position.
9. Engage the PTO. Always with engine at idle
10. The engine RPM is automatically set at a recommended RPM setting by the pump manufacturer – as recommended for maximum vacuum. Use cruise control on other trucks. Increase RPM with cruise control. Some smaller trucks will have to have their parking brake on.
11. Connect the suction/discharge hose to the suction Camlock fitting at the back of the tank, and insert the other end of the hose into the septic tank.
12. Move the pump handle into the **VACUUM** position.
13. Wait until the pressure on the gauge reads **negative 18" - 22 inches mercury**.
14. Open the suction valve at the back of the tank
15. When sewage rises to the lowest sight glass, slowly close the main valve.
16. Put the pump handle into the **MIDDLE** or **NEUTRAL** position.
17. Disconnect the hose from the suction fitting, and connect the hose to the discharge fitting. An alternative is to use two lengths of hoses, one each connected to the suction fitting and the discharge fitting.

18. Push the other end of the hose as far into the septic tank as you can.
19. Move the pump handle into the **PRESSURE** position.
20. Wait until the pressure on the gauge reads **positive 5 psi**.
21. Slowly open the discharge valve. This will swirl the contents of the tank around and create a slurry that you can pump out.
22. Slowly close the discharge valve when it seems the tank is nearly empty.
23. Put the pump handle into the **MIDDLE** or **NEUTRAL** position.
24. Disconnect the hose from the discharge fitting and re-connect the hose to the suction fitting. (If you are using two lengths of hose, one attached to each fitting, this is unnecessary).
25. Pull the hose up into the middle of the septic tank liquid.
26. Move the pump handle into the **VACUUM** position.
27. Wait until the pressure on the gauge reads negative **18-22 inches mercury**.
28. Slowly open the suction valve.
29. Close the suction valve at the back of the tank when the tank is getting full (The sewage will be visible at the highest sight glass).
30. Idle the engine by pressing the brake or turning off the cruise control.
31. Disengage the PTO.
32. Put the pump handle into the **MIDDLE** or **NEUTRAL** position.
33. Disconnect the hose.

Unloading

1. Drive the sludge pumper to the designated area for septic tank sludge.
2. Position the truck; put the parking brake on and the transmission in neutral.
3. Position the pump handle to the **NEUTRAL** or **MIDDLE** position.
4. Remove the caps from the suction and discharge valves.
5. Connect the suction/discharge hose to the discharge Camlock fitting at the back of the tank, and place the other end of the hose in the place where you are discharging the sewage.
6. Open the discharge valve and let sewage start flowing.
7. Engage the PTO.
8. Increase the engine RPM as necessary. Pressuring the tank is normally not needed for discharge, but do not exceed 1250 RPM if needed. Press the PTO engage button to engage the PTO. Increase RPM as necessary. Pressuring the tank is normally not needed, but will help speed up the unloading, especially with heavy sludge.
9. The sludge in the pumper may flow out without being pumped. If you don't need the pump to unload the tank, go to Step 16 of the Loading Section.
10. Move the pump handle toward the **PRESSURE** position.
11. Close the discharge valve at the back of the pumper tank when it is empty.

12. Idle the engine by pressing the brake or turning off the cruise control.
13. Disengage the PTO.
14. Move the pump handle into the **MIDDLE** or **NEUTRAL** position.
15. Disconnect and drain the suction/discharge hose.

Clean-Up

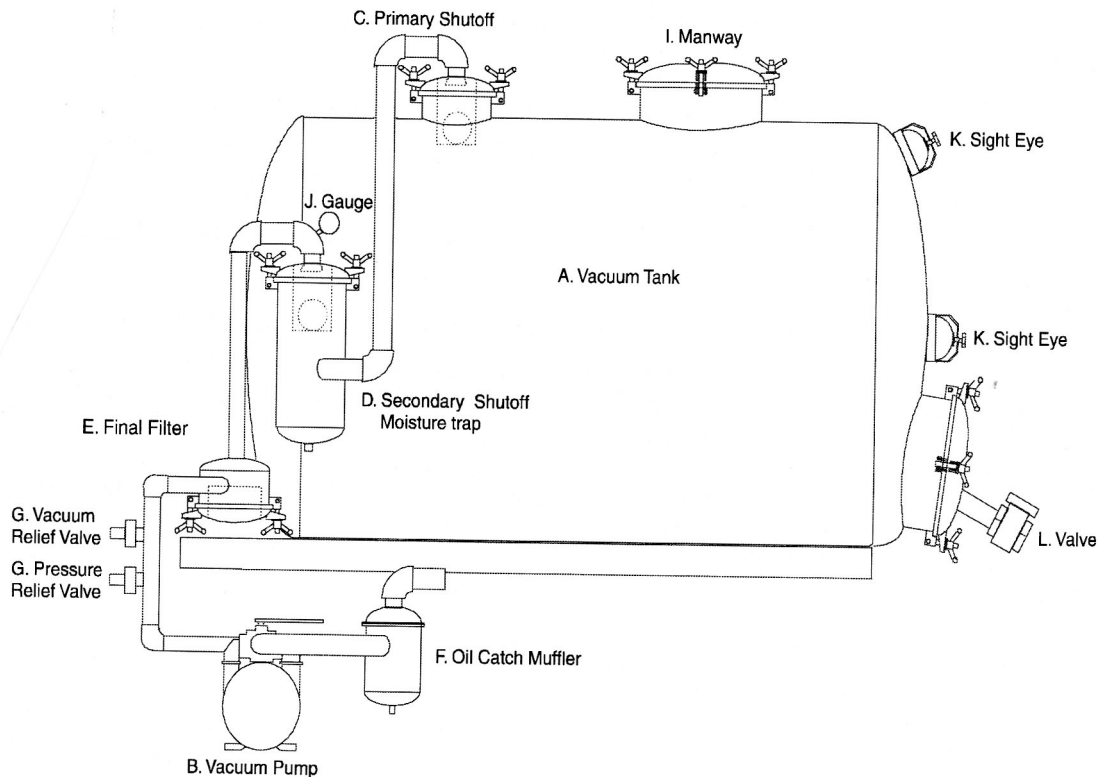
When the hose is uncoupled from the pumper tank fitting, a bucket should be placed under it to catch dripping sewage. Elevate the end of the hose and its entire length to drain the sewage back into the septic tank before laying the hose down. **Be sure to keep children and animals away from the work site.** Record the amount of waste pumped into the landfill site. Keep this record on file.

IV. Vacuum System Breakdown

A vacuum truck operates by evacuating the air from a pressure vessel by means of a vacuum pump. A hose attached to the pressure vessel is placed in the fluid to be pumped and a valve is opened. The fluid is then drawn in to the tank by vacuum

The fact that fluid does not run through the pump makes vacuum ideal for liquid waste pumping.

System components



Typical component layout.

A vacuum tank can be made from **aluminum, carbon steel or stainless steel**. They usually have domed tank heads, and interior tank baffles. The most common vacuum pump is a **rotary vane**. They are low cost versus performance and commonly used in size range from 25 – 1000 + C.F.M. They come in air cooled, ballast cooled, fan cooled and water cooled.

There are also **rotary lobe blowers and piston pumps**. Rotary lobe blowers are most common in high air flow applications above 700 C.F.M. Piston pumps are common in the oil fields because they have high pressure capabilities. They have not had acceptance in most other applications because of relatively low airflow and high cost

Size

It is important to match the size of a vacuum pump to the size of the tank. A good rule of thumb is 10 C.F.M @ 15" Hg. for every 100 gallon of tank capacity. **Note if you are in higher elevations you will need to compensate for your "x" feet above sea level and the rule of thumb is you lose 1 cfm for 1,000 feet above sea level.**

Drive Systems

Most systems are driven by P.T.O. that is mounted on the side of the transmission; a drive shaft goes back to a right angle gear box or belt drive. It is important to lubricate the U-joints in the drive shaft. Also the gear box should be checked for oil level, do not over fill the gear box. Check the belt tension on a belt drive system. There are a few systems that run with a separate power unit

Speed

Most pumps have an optimum operating speed. Check your pump manual for the correct speed. Do not over speed as this will not help the performance and will only create more heat and wear the vanes faster.

Rating

Pump ratings are in C.F.M. (cubic feet per minute). As the inches of mercury go up (" Hg.) the C.F.M. goes down. Example: NVE607 vacuum pump, with pump r.p.m. @ 1250, 0" Hg. 290 C.F.M. (free flow) @ 10" Hg. 275 C.F.M., @ 15" Hg. 269 C.F.M., @ 20" Hg. 252 C.F.M. (this pump can run @ 1500 r.p.m. for intermittent operation only). Most vacuum pumps will go to 27" Hg., if the pump is in good condition, and there are no leaks in the system. Check your manual for proper speed of your vacuum pump.

Duty Cycle

Because all rotary vacuum pumps generate heat in normal operation, duty cycle is an important consideration in all vacuum pump applications. Duty cycle is the length of time a pump will be run at a particular vacuum level

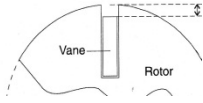
Components

Make sure to use the proper components, like the primary, secondary and muffler/oil catch. Also proper size piping and hose between components in order not to restrict air flow. Place components in order for the operator to access all system components for easy service.

Maintenance

1. Keep the pump clean. All pumps need to radiate heat away. Keeping the pump exterior clean aids in cooling. This is particularly important for fan cooled pumps.
2. Clean the pump internally. Most manufacturers suggest regular flushing of the pump. This is normally accomplished by running diesel fuel through the pump at low vacuum and low r.p.m. Frequency of flushing will vary depending on the use of the pump. We recommend flushing every week at a minimum. To remove any carbon build up and keep the vane slots clean for proper operation.
3. Check primary to make sure that you do not have any build up of grease etc. You want to make sure that the float ball can operate properly
4. Also check the secondary trap for the same reason. It is a good idea to drain it daily.
5. Muffler/oil catch. Drain daily. Make sure the drain is not plugged. Remember this becomes your vacuum pump intake when you are pressurizing the tank. If it is full of dirty oil this will get sucked into the vacuum pump and do a lot of damage.

Check Vane Wear



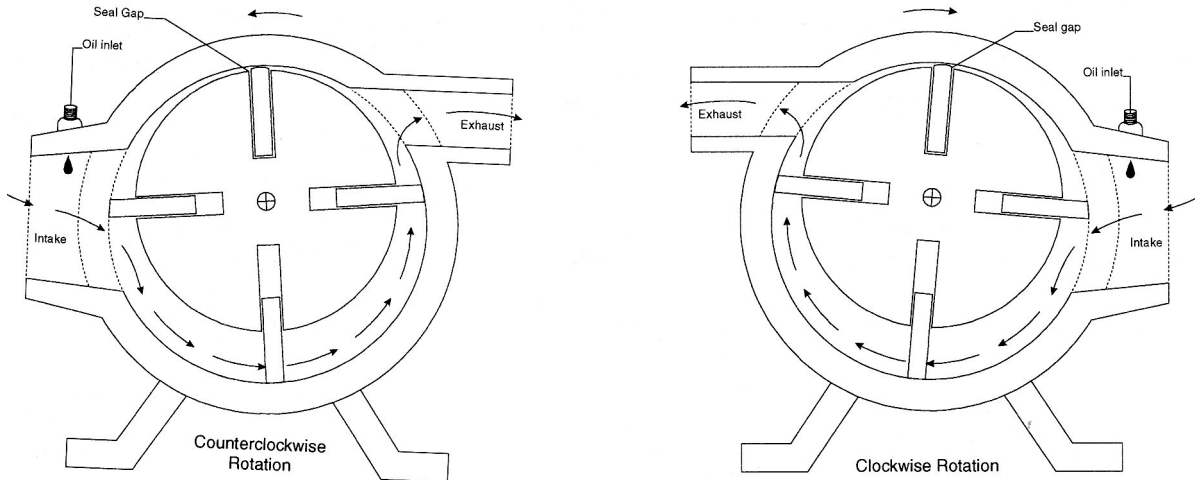
Vane wear should be checked at least every 12 months. The pump owner's manual will indicate acceptable tolerances.

Oil Level

Keep the oil tank full, and be sure pump is oiling properly. It is critical for the operation and long term life of the pump to ensure that the lubrication system has oil and is properly working. Estimated oil usage is – 3.3 oz. per port for each hour of operation.

If the oil tank is attached to the end of the vacuum pump, it may collect some condensation; drain the water out once in a while. This may occur more often in cold weather operation.

Determining Pump Rotation



To determine pump rotation you must first know where the seal gap and intake port are located. The **seal gap** is the closest clearance between the rotor and housing. The **intake port** is the port that extends furthest away from the seal gap. **A vacuum pump always turns from the seal gap toward the intake port.**

V. Routine Maintenance and Inspection

This maintenance schedule assumes an operating season in the summer months. See the manufacturer's literature (Operator's Manuals) in the truck for more specific information on the truck's engine, chassis, and transmission maintenance. See the manufacturer's literature (Owner's Manuals) for more specific information on each component of the vacuum system. Listed below are the most basic routine maintenance tasks, with the vacuum equipment emphasized.

Daily

- Drain air brake pressure tanks.

Before Each Use

- The diesel engine requires good quality diesel fuel. Use fresh fuel, not old "flat" fuel.
- Check the pump system oil. See manual for recommended oil.
- Check the air filter on the truck and replace if necessary.
- Check the transmission oil in the truck.
- Check the tires for proper air pressure, and check the wheel bearings and lug nut tightness.
- Check the hoses and connections for wear and tightness and replace if necessary. Check the suction and discharge valves on the rear of the tank. Check the vacuum/pressure gauge, safety relief valve, and sight glasses.

During Operation

- Make sure oil is flowing to the vacuum pump (watch for small bubbles in the clear lines from the vacuum pump oiler pump to verify the oil is being injected).
- Make sure the vacuum gauge is operating properly.
- Check that the relief valve on the secondary trap/scrubber is working. You should be able to press it down or feel air around it at negative 24 inches mercury.
- Check the main valves and the hoses for air leakage.

After Each Use

- Drain the secondary trap/scrubber only if primary failed
- Drain the oil catch muffler at end of day
- Clean the pre-filter periodically

After Every 5 Operating Hours

- Wash the air filter in diesel fuel inlet pre-filter, only periodically
- Check the secondary trap/scrubber ball filter and seat. (See the manufacturer's literature).

Monthly

- Clean the pre-filter.
- Clean the oil tank.
- Grease the jack-shaft spline and universal joints. (Or every 10 hours of operations)
- Check the PTO coupling for wear.
- Flush the vacuum pump (see the manufacturer's literature). Make sure the pump is flushed thoroughly before winter storage.
- Grease the vacuum pump.
- Clean and lubricate the shafts of all valves with a light weight machine oil. Tighten packing around the valve handles.
- Grease all points of unit, vacuum pump, boom swivel, and vacuum pump drive line.

- Check all bolts on unit and tighten as required, especially the bolts mounting the vacuum pump and the vacuum tank.
- Check the fittings on the loading hoses. Make sure all gaskets are in place.
- The truck should be started monthly, even outside of operating season.
- Check and tighten tank tie-down system once every 30 days. Torque rating to be 100 ft. lbs. excluding spring mounted front tie-downs, a 1/8" space to be left between springs coils at all times. Failure to perform this may cause many problems with the vessel, which may or may not be covered under the manufacturer's warranty.

Annually

- Use only recommended oil as per pump manual. Keep container clean.
- On older pumps where oil tank is attached to the pump, it can collect condensation. It needs to be drained on a regular basis, especially in cold weather climate.
- Change the air filter.

Every 5 Years

- Change the vanes. (Overhaul the Vacuum Pump).

Paint

Frequent and regular washing will lengthen the life of your vehicle's painted finish.

Washing

Wash your vehicle often with warm or cold water to remove dirt and preserve the original luster of the paint. Never was the vehicle in direct rays of the sun nor when sheet metal is hot to touch, as this may cause streaks on the finish. Do not use hot water, strong soaps, detergents or wipe off dirt when the surface is dry as this will scratch the paint. Check with factory on recommendations for the proper soap to use. DO NOT use an automatic car wash.

Waxing and Polishing

Avoid waxing and polishing of new vehicles. With the paint materials that we use, it can be harmful to the life of the paint to use any kind of polish on a new unit. Polished and combination cleaner and polish waxes all contain abrasives which cut through the skin of the enamel film, thus exposing the pigment to ultraviolet attack which accelerates chalking and dulling of the paint. After 90 days, or if the vehicle paint has chalked or dulled from age or weather conditions, a good polish, wax, or preservative could be used.

When polishing an aluminum tank, please follow these procedures:

1. Wash the tank completely with a non-detergent soap to remove all residue
2. Allow to dry completely before starting polishing
3. Use a small amount of polish with a high-speed buffer to polish tank to a luster
4. Use a small amount of polish with an Orbital (vibratory) buffer to remove impurities and further polish.
5. Apply a small amount of household flour to Orbital (vibratory) buffer to remove impurities and further polish

Note: When polishing, make sure the grain of the material is followed at all times for best results

Lubrication and Equipment Maintenance

It's extremely important to have the unit properly lubricated at regular intervals. Many areas of maintenance on the tank equipment are covered in their respective manuals. Normal use of the tank truck causes metal-to-

metal movement at certain points in the cab and body. Noise, wear and improper operation at these points will result when a protective film of lubricant is not provided.

For exposed surfaces, such as door, lock bolts, striker plates, etc please apply a thin film of engine oil.

Body Mounts

Check and tighten tank tie-down system once every 30 days. Torque rating to be 100 ft. lbs. excluding spring mounted front tie-downs, a 1/8" space to be left between spring coils at all times.

VI. Portable Toilet Unit Operation

Normal Operating Conditions

- The tank draws in when the valve is in the **VACUUM** or **SUCTION** position.
- The tank discharges when the valve is in the **PUMP** or **PRESSURE** position.
- The tank does nothing when the valve is in the **NEUTRAL** or **MIDDLE** position.

Loading

Check the following components in the truck:

1. Transmission oil
2. Engine oil
3. Fuel
4. Tires

Check the following components on the vacuum pump system

1. Vacuum oil
2. Oil catch muffler (should be drained)
3. Primary shutoff filter
4. Moisture trap/scrubber (secondary trap)
5. Hoses and connections

Try turning the pump by hand before start-up to ensure that it is not frozen (in winter)

Start the truck, and allow it to warm up (the unit is warmed up when the valve heating jackets are warm to the touch if applicable)

Position the truck, put the parking brake on and put the transmission in neutral.

Close the valves.

Position the pump handle to the **NEUTRAL** or **MIDDLE** position.

Engage the PTO. (Always with engine at idle) Increase to proper R.P.M.

Move pump handle to the vacuum position

Remove waste from the Portable Toilet

Replace hose and valve on side of tank, move pump handle to neutral and disengage PTO

Clean toilet as per your procedure, and recharge the waste tank

Make sure toilet carrier is **locked** in place when **up or down**

Dispose of waste as per local regulation

At the end of the day drain the secondary trap and the oil catch muffler

Unloading

1. Drive the sludge pumper to the designated area for septic tank sludge.
2. Position the truck; put the parking brake on and the transmission in neutral.
3. Position the pump handle to the **NEUTRAL** or **MIDDLE** position.
4. Remove the caps from the discharge valve.

5. Connect the suction/discharge hose to the discharge Camlock fitting at the back or side of the tank, and place the other end of the hose in the place where you are discharging the sewage.
6. Open the discharge valve and let sewage start flowing.
7. Engage the PTO.
8. Increase the engine RPM as necessary. Pressuring the tank is normally not needed for discharge. Increase RPM as necessary. Pressuring the tank is normally not needed, but will help speed up the unloading, especially with heavy sludge.
9. The sludge in the pumper may flow out without being pumped.
10. Move the pump handle toward the **PRESSURE** position.
11. Close the discharge valve at the back of the pumper tank when it is empty.
12. Idle the engine by pressing the brake or turning off the cruise control.
13. Disengage the PTO.
14. Move the pump handle into the **MIDDLE** or **NEUTRAL** position.
15. Disconnect and drain the suction/discharge hose.

Clean-Up

When the hose is uncoupled from the pumper tank fitting, a bucket should be placed under it to catch dripping sewage. Elevate the end of the hose and its entire length to drain the sewage back into the septic tank before laying the hose down. **Be sure to keep children and animals away from the work site.** Record the amount of waste pumped into the landfill site. Keep this record on file.

VII. Hydraulic Full Opening Rear Door Operation

1. Engage the PTO, keep engine at idle
2. Create vacuum on the tank
3. Disconnect quick coupler on the heat jacket hoses (if equipped)
4. Undo wing nuts and pull them back in order not to hang up
5. Make sure that no one is directly behind the unit
6. Release the vacuum by moving pump handle to neutral
7. Take hydraulic control valve to raise the door
8. Now take the other hydraulic control valve to raise the tank
9. When tank is empty, lower the tank
10. Make sure that the gasket is clean
11. Lower the door
12. Start the vacuum pump and create a vacuum in the tank
13. When door is sucked tight to the gasket
14. Put the wing nuts in place and hand tighten
15. Do not over tighten the wing nuts
16. With vacuum on the tank, just hand tightening is enough

Always operate this equipment safely. If you have questions about the tank or its operations you can call, Amthor International 1-434-656-6233. If you have questions about the vacuum pump. Please follow all directions in the chassis manual and the vacuum pump manual.

VIII. Common Operational Problems

PROBLEM	POSSIBLE CAUSE	POSSIBLE REMEDY
Pump runs but no pressure change (no intake or discharge)	Air filter is clogged	Clean or replace the filter
Delivery of pump is decreasing over time	Hose is clogged or leaking	Clear the hose or repair leaks
Oil is leaking around the shaft	Lip seals on the shaft are damaged or worn	Replace the oil seal and possibly the shaft sleeve
Excess heat and noise	Clogged filters, valves or plumbing	Clear or change filters
	Pressure or vacuum reliefs are improperly installed or set	Re-adjust or replace the relief valves
	Incorrect oil flow rate or type of lubricant	Drain the oil tank and re-fill with proper lubricant
	Oil pump is failing	Replace the oil pump
	Water jacket is contaminated	Dismantle and clean the jacket
Rattling noise	Foreign object in the pump or a vane is damaged	Remove the object and/or check the vane condition
Unsmooth running of vacuum pump	Improper clearance between rotor and cylinder	Dismantle and adjust the clearance
	Bearings are worn	Replace the bearing, oil seals and spacers as required
Pump spins back when disengaged	Non-return valve is damaged or stuck	Repair or replace the non-return valve