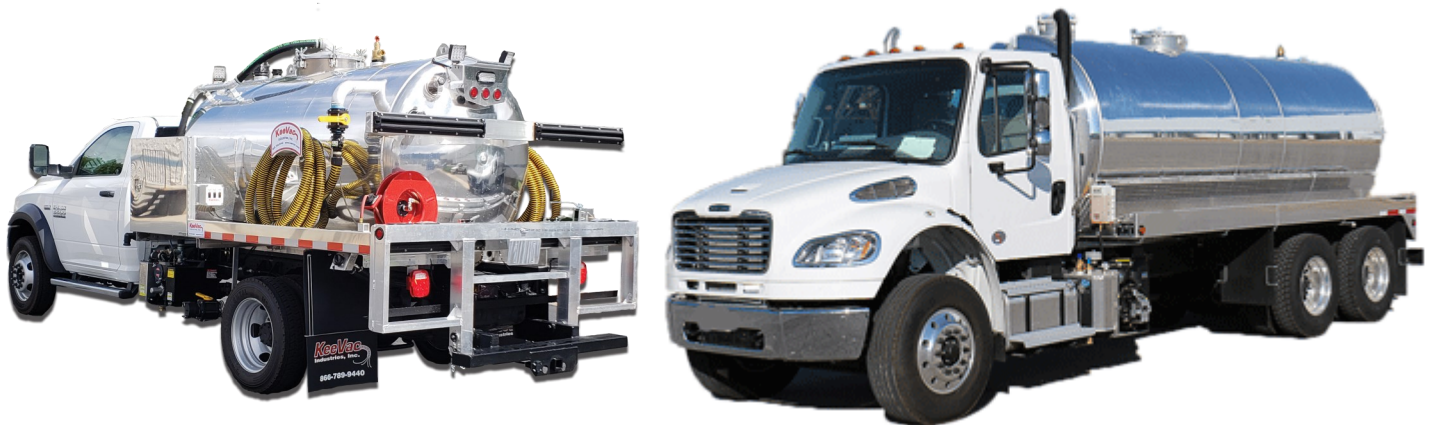




VACUUM TANKER OPERATOR'S MANUAL



Covers general information that will be useful for most vacuum tankers. This manual is not specific to any truck brand. For brand specific information, please consult your manufacturer's manual.

Date of Purchase: _____

Truck Model: _____

VIN Number: _____

Tank Model: _____

Tank Serial Number: _____

The manufacturer reserves the right to change specifications or make improvements without notice and without incurring obligations to products previously sold. Information contained herein is from data available at time of printing. As the tank installer, the customer assumes all risk and liabilities associated with mounting and operating the tank.

TO THE PURCHASER

Congratulations on the purchase of your vacuum tank. Your truck mounted vacuum tanker will give you years of dependable service if the proper operating and maintenance instructions are observed. We recommend you read this manual carefully to become familiar with your tanker equipment prior to operation.

This manual contains sections on safety, specifications, operation, maintenance, and trouble shooting. Each section in this manual is clearly identified to help you easily find the information you need.

The safety alert symbol will identify important safety messages. When you see this symbol, carefully read the message that follows.

It is important to record your tank model number, tank serial number, and date of purchase in the spaces provided on page 1. This information will be useful to your dealer when ordering parts for repair.

WARNING: Study this manual before operating or maintaining your vacuum tanker and any of its components. You must understand and follow the instructions in this manual; otherwise you and/or others can be seriously injured. **DO NOT** operate this equipment if you have not read and understood all of the safety and operating instructions. Also, **DO NOT** allow any other person to operate this equipment if they have not read and understood all of the safety and operating instructions.



This safety alert symbol will identify important safety messages. When you see this symbol, carefully read the message that follows.

The information in this manual covers all Vacuum Tanks. It is important to record your tank model number, tank serial number, and date of purchase in the spaces provided on page 1. This information will be useful to your dealer when ordering parts for repair.

Your vacuum tank warranty appears on the last page of this manual. Please read it carefully, making sure you understand the warranty coverage as well as its exceptions and limitations. The warranty for your equipment is through the original manufacturer and additional warranty information can be found by calling the manufacturer.



Precautionary statements dealing with machine safety are preceded by signal words **NOTICE** and **IMPORTANT**. These precautions are intended to help protect against damage to your equipment and to inform operators of helpful information.

SAFETY PRECAUTIONS

Throughout this manual, and on machine decals, you will find precautionary statements followed by specific instructions. In the interest of safety, take the time to learn these precautions.

Precautionary statements dealing with personal safety are preceded by the signal words **DANGER**, **WARNING**, and **CAUTION**. These precautions are intended for your personal safety and for the safety of those working with you.

DANGER

Indicates a hazard or unsafe practice that, if not avoided, could result in serious injury or death.

WARNING

Indicates a hazard or unsafe practice that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazard or unsafe practice that, if not avoided, could result in death or serious injury.

NOTICE

Indicates a possibly dangerous situation that, if not avoided, could result in damage to equipment.

IMPORTANT

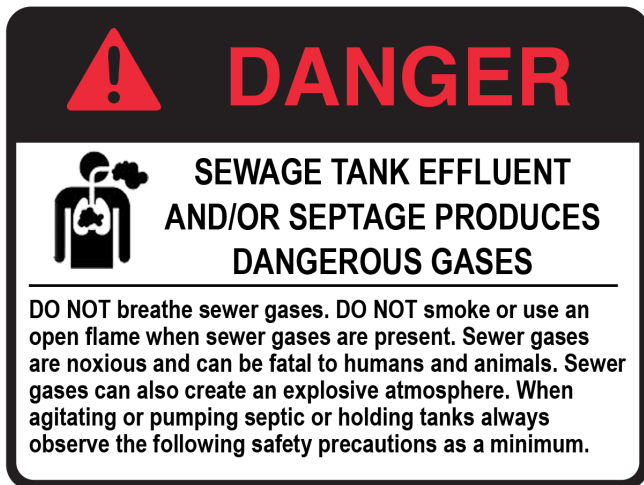
Indicates helpful information on operation of equipment.

GENERAL SAFETY PRECAUTIONS

Follow these safety precautions and insist that those working with you follow them.

Most industrial equipment accidents can be avoided by observing safety precautions. Remember: a careful operator is the best insurance against an accident.

SAFETY PRECAUTIONS FOR HANDLING EFFLUENT



WARNING

Sewage effluent and/or septage produces dangerous gases. **DO NOT** breathe sewer gases. **DO NOT** smoke or use an open flame when sewer gases are present. Sewer gases are noxious and can be fatal to humans and animals. Sewer gases can also create an explosive atmosphere. When agitating or pumping sewage effluent, always observe the following safety precautions as a minimum.

DANGER

DO NOT stand near the oil catch muffler or discharge valve when loading or unloading the tank. Sewer gases vented out of the oil catch muffler will settle downward. Sewer gases can also be expelled out of the discharge valve when releasing tank pressure. Inhaling sewer gases can cause severe injury or death.

WARNING

DO NOT allow children or irresponsible people or unauthorized persons near the work area or equipment. Ensure everyone is clear of the truck and immediate area before starting the engine, engaging power, and operating the equipment. The hazards of septic pumping can cause serious injury or death to untrained persons that enter this area.

WARNING


Secure all access covers against unauthorized entry after pumping a septic/holding tank. Fatalities have occurred where children have fallen into septic/holding tank openings that had not been properly secured. Securely chain and padlock above ground access openings. Bury underground access openings by at least six inches of dirt.

WARNING


Sewage and wastewater contain bacteria, fungi, parasites, and viruses that can cause disease. While handling sewage or waste water effluents, sewage workers may be exposed to a variety of these diseases causing organisms including, but not limited to: E-coli, hepatitis A virus (HAV), salmonella, typhi (which can cause typhoid fever), shigella (which can cause dysentery) and parasitic protozoa and worms (such as *Guardia lamblia* and roundworm).

Proper work practices and personal protective equipment (PPE) can help protect you from becoming infected by these agents. When handling sewage and/or wastewater effluents, or after contact with surfaces exposed to them, observe the following recommendations (as a minimum) regarding work practices and PPE.

SAFETY PRECAUTIONS FOR ENTERING TANKS



DANGER



ENTERING A TANK THAT HAS BEEN EXPOSED TO SEWAGE EFFLUENT IS HAZARDOUS.

If it is absolutely necessary to enter a transport, septic, or holding tank that has been exposed to sewage effluent, regardless of how long ago, it is absolutely necessary to observe the following safety precautions.

DANGER

DO NOT enter a transport, septic, or holding tank without first cleaning and providing adequate ventilation to the interior of the tank. Sewer gas is deadly if inhaled; in addition, it depletes the oxygen in a confined space, which can cause asphyxiation.

DANGER

DO NOT enter a transport, septic, or holding tank without using a respirator that supplies grade D breathing air or a self-contained breathing apparatus. In addition, **DO NOT** use this equipment without training and familiarity with it. Entering a tank exposed to sewage effluent without a correct breathing apparatus, or with improper use of it can cause death.

DANGER

DO NOT enter a transport, septic, or holding tank without protective clothing. Sewer gas can be absorbed through the skin causing serious injury or death.

WARNING


When entering a transport, septic, or holding tank, always have someone standing by to aid, and always have a respiratory that supplies grade D breathing air or a self-contained breathing apparatus on hand for them. In the event of an attempted rescue, this equipment is necessary to prevent death of the rescuer.

WARNING

Attach a safety-harness and rope to any person that enters a transport, septic, or holding tank. Have the safety-harness rope held by a person standing by to aid outside the tank. An attempted rescue without the advantage of a rope and harness can be life threatening to the rescuer.

WARNING

Entry into a transport, septic, or holding tank is confined space entry. Persons entering these tanks for any purpose must be trained in and follow OSHA confined space safety procedures.



WARNING

VACUUM TANKER OPERATION INVOLVES POTENTIAL HAZARDS

Personal injury may result if certain safety precautions are not followed while operating vacuum tanker trucks. While these may not cover all possible hazardous situations, carefully learn and observe the following safety precautions as a minimum.

WARNING

Always wear protective gloves, eye protection and, appropriate clothing when working with sewage effluent or septage. These materials may contain hazardous chemicals and bacteria, which can cause infection, injury, or even death due to contact.

WARNING

DO NOT reach into the tank for cleaning without protective clothing. Sewer gas can be absorbed through the skin causing serious injury.

■ IMPORTANT

- **DO NOT** eat, drink, or smoke while you are working with, or in the area of sewage effluent.
- Wash your hands thoroughly with clean water and soap before eating, drinking, or smoking and at the end of your work day.
- The Portable Sanitation Association International (PSAI) recommends rubbing your hands together for at least ten (10) to fifteen (15) seconds after you have worked up a good lather with the soap. The friction of rubbing your hands together loosens bacteria from your skin and traps them in the lather to be rinsed down the sink.
- Use PPE such as coveralls or water-resistant suit, water-proof gloves and boots, respirators, safety glasses, goggles, and face shields.
- Properly store, clean or dispose of contaminated PPE.
- Keep all cuts and wounds covered with clean, dry bandages and protect them from exposure to sewage effluent.
- Change out of your work clothing and boots before leaving work. **DO NOT** wear them home. **DO NOT** keep your soiled clothing with your other or your family's clothes. Wash your work clothing separately in hot water.
- Both the CDC (Center for Disease Control) and the Building and Construction Trades Department of the AFL-CIO recommend that sewage workers maintain up-to-date tetanus-diphtheria immunizations to counter the risk of soil-contaminated injuries.
- While studies in Scandinavia, England, and the United States have not found a substantial increase in the prevalence of HAV among sewage workers (CDC publication: MMWR, Vol. 48, No. RR-12), stay advised of any Hepatitis A outbreaks in your area, and contact your doctor about a vaccination should you have any concerns about coming in contact with this virus.
- While the fecal coli form bacteria E-Coli has been regarded mainly as a food-borne illness, contact with farm animals and contaminated water have arisen as other sources of infection. In a number of cases, water supplies were contaminated due to runoff from structures such as septic systems and agricultural manure lagoons that contain human and animal fecal material respectively. For more information on this and other example cases, please visit the CDC website.
- In addition, even though public concern remains high, the blood-borne viruses Hepatitis B and HIV (Aids) have not been linked in the U.S. to exposure to sewage. For more information, visit the Center to Protect Workers' Rights.

- Finally, as more data is collected on biohazards, and as new biological threats emerge, it is your responsibility as a waste industry worker to remain educated about the hazards involved in working with sewage and wastewater effluents. Several sources for obtaining up-to-date information are listed below:

National Center for Infectious Diseases (NCID)

www.cdc.gov/ncidod

National Institute for Occupational Safety and Health (NIOSH)

[1-800-35-NIOSH](tel:1-800-35-NIOSH) or www.cdec.gov/niosh

OSHA

[1-800-321-OSHA](tel:1-800-321-OSHA) or www.osha.gov

SAFETY PRECAUTIONS FOR OPERATING EQUIPMENT

DANGER

Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing any component under the truck; this includes lubricating the vacuum pump or the PTO driveline. Contact with a rotating mechanism can cause entanglement that can lead to death. A truck that begins to roll is a crushing hazard that can lead to death.

WARNING

Keep hands, feet, hair, and clothing away from moving parts. Contact with a moving mechanism can cause entanglement that can lead to dismemberment or death.

WARNING

Escaping hydraulic oil under pressure can have enough force to penetrate your skin, which can cause serious injury. Before operating hydraulic components, be sure all connections are tight, and hoses are not damaged. Relieve all pressure before disconnecting hydraulic lines or repairing leaks.

CAUTION

When off-loading under pressure, maintain control of the end of the hose. Pressurized discharge can cause a hose end to whip about and create the potential for spraying persons in the area with effluent.

WARNING

Keep all shields in place. Shields and covers are designed to protect the operator from entanglement in moving parts, which can lead to serious injury or death. **DO NOT** remove shields from the unit except when servicing; then, replace immediately.

WARNING

The truck's cornering and braking abilities are reduced when the tank is loaded. Drive at a reasonable speed with a loaded tank; reduce speed on rough or hilly terrain, before making an anticipated stop, and when cornering.

WARNING

Make certain everyone is clear of the tanker truck and the immediate area before starting the engine, engaging power, and operating the equipment. The inherent hazards of septic pumping can cause serious injury or death to untrained persons that enter this area.

WARNING

DO NOT allow anyone to ride on the outside of the tanker truck when it is in motion. Failure to follow this precaution could result in persons falling off the truck and possibly getting run over, which could cause serious injury or death.

WARNING

Before backing-up the truck, inspect the area to be backed into, and clear all hazards, pets, and people from it. Make sure that backup lights and the backup alarm are maintained and in good working condition. The driver will experience a large blind spot behind the truck. Fatalities have occurred when persons were run over by a tanker truck.

CAUTION

Avoid contact with the vacuum pump during or immediately after operation. Operating temperatures can range from near 200°F to over 300°F, depending on the make and model of pump and on the working conditions. Contact with a hot vacuum pump can cause severe burns.

OPERATION

KeeVac Truck Mounted Vacuum Tankers are custom designed to meet our customer's individual needs. Some of the most common configurations are illustrated in Figure 1.1 on pages 10-11. Use this illustration to acquaint yourself with the main components on your vacuum tanker.

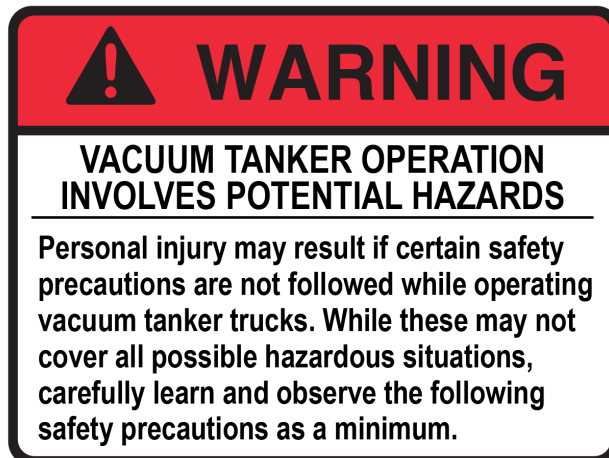


OPERATION SAFETY

Operating vacuum tankers, and pumping septic and/or holding tanks, involves potential hazards. Before operating your vacuum tanker, you must understand and follow all safety precautions in this manual.

Hazards frequently encountered in pumping include confined spaces, dangerous chemicals, exposure to bacteria, explosive atmospheres, falls, high-pressure water jets, pressurized hydraulic lines, rotating drivelines, and poisonous gasses. As each pumping job is unique, you may experience other hazards as well.

When dangerous situations arise, it is your responsibility to make sure that no harm comes to persons, equipment, or the surrounding environment. Make sure your job site is secured and safe for others both when you carry out the job and when the job is complete.



VACUUM RELIEF VALVE

For more information, consult your pump manufacturer's manual.

The vacuum relief valve serves to safeguard against vacuum pump damage. It is located on your secondary, pump, or in the airline circuit (Figure 1.1). The vacuum relief valve is factory set to the pump manufacturer's maximum continuous vacuum rating (MCVR). For more information, consult the manual for your specific pump.

If you notice that the vacuum relief valve is not relieving vacuum when your tank reaches the MCVR level for your specific pump, you may need to reset it. Use the following procedure to set the valve:

1. Loosen the locking nut located near the top of the vacuum relief valve. Rotate the inner cylinder clockwise one to two revolutions to reduce the setting at which the valve opens. Retighten the locking nut after making the adjustment.
2. Run the pump in the vacuum mode, and check to see if the valve opens at the MCVR as listed in your OEM pump manual.
3. Repeat steps one and two until you attain the proper setting.

NOTICE

DO NOT run your vacuum pump above the pump manufacturer's maximum continuous vacuum rating. Exceeding the maximum vacuum rating could cause damage to the pump and/or tank.

WARNING

DO NOT exceed a maximum pressure of 15psi with your vacuum tank. Exceeding 15psi pressure can cause the tank to rupture, which could result in serious injury or death to persons in the area.

PRESSURE RELIEF VALVE

For more information, consult your pump manufacturer's manual.

A pressure relief valve is located on your secondary or in the airline circuit (Figure 1.1). This valve serves to prevent damage to the tank. It opens, to release air, when the pressure in the tank reaches the factory predetermined setting:

- The pressure relief valve on truck mounted vacuum tankers is factory set at 10psi.
- The pressure relief valve on portable sanitation service units is factory set at 5-7psi.

When the pressure relief valve opens to release excess air, it creates a hissing sound that you should be able to hear. Listen for this sound, and if the valve does not open at the specified pressure as listed above, reset it. Your vacuum tank is not a pressure vessel, and exceeding a maximum pressure of 15psi is dangerous.

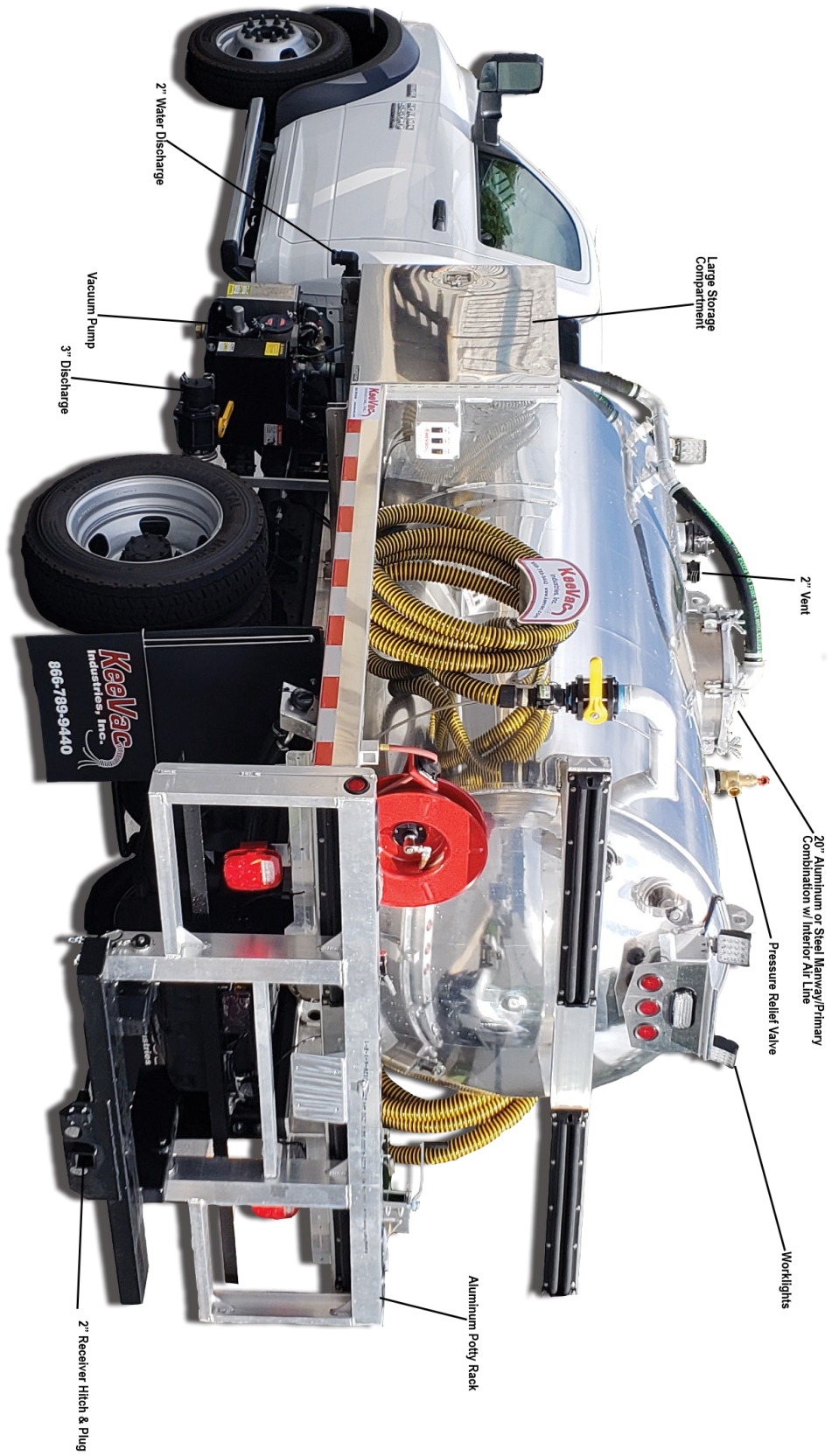
Use the following procedure to set the pressure relief valve:

1. Purge all air from the tank by slowly opening one of the rea valves. Stand off to the side of the valve to prevent possible injury from the direct flow of releasing pressure.
2. After purging the tank of air, loosen the setscrew located near the top of the pressure relief valve. Rotate the inner cylinder clockwise one to two revolutions to reduce the setting at which the valve opens. Retighten the setscrew after making the adjustment.
3. Run the vacuum pump in the pressure mode, and check to see if the valve opens at the specified setting as listed above.
4. Repeat step one through three until you attain the proper setting.

COMMERCIAL WASTE UNIT Figure 1.1



PORTABLE RESTROOM SERVICE UNIT Figure 1.1



VACUUM/PRESSURE GAUGE

A vacuum/pressure gauge is located on your tank or in the airline circuit (Figure 1.1, on pages 10-11). As the gauge needle moves counterclockwise of zero, the gauge reads vacuum in inches of Mercury (in.Hg). As the gauge needle moves clockwise of zero, the gauge reads pressure in pounds per square inch (psi) (Figure 1.2). Use the gauge to determine when the tank has reached operating vacuum or pressure.

Figure 1.2 Vacuum/Pressure Gauge



MOISTURE TRAP (SECONDARY SHUTOFF)

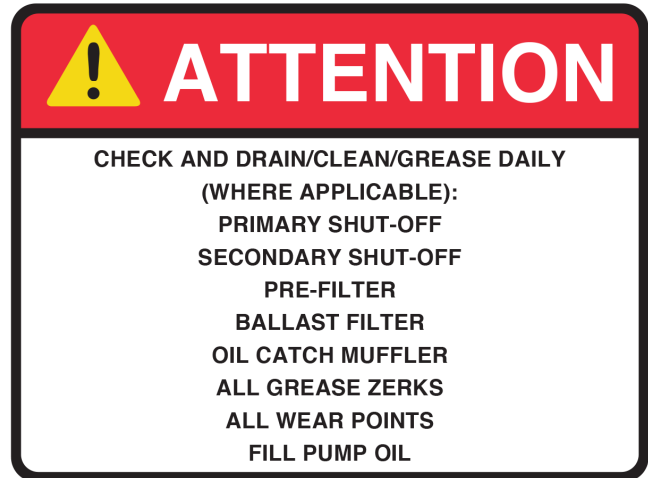
The moisture trap serves as a safety device to prevent liquid from entering the vacuum pump. Check the moisture trap daily for accumulation of liquid.

On tank mounted moisture traps, use the easy access drain, both to check for, and to drain off any liquid. The drain is located at the bottom of the moisture trap. On frame mounted moisture traps, check for accumulated liquid by viewing through the sight eye to drain liquid, remove the cover.

While the moisture trap helps prevent liquid from entering the pump, excess accumulation may be an indicator that some contamination has passed into the pump. When excess liquid shows up in your moisture trap, clean your vacuum pump using the procedure on pages 35-38 of this manual.

■ IMPORTANT

Anytime that excess liquid accumulates in the moisture trap, clean the inside of your pump. Liquid contamination that enters the pump can cause damage if you do not clean the pump shortly thereafter.



FINAL FILTER

The final filter serves as a safety device to prevent contaminants from entering the vacuum pump. Depending upon the lint content of the material being pumped, clean the final filter as often as every day.

When cleaning the final filter, provide yourself with gloves, eye protection, and protective clothing. Then, use the following procedure:

1. Loosen the wing nuts and remove the cover.
2. Remove the nut on top of the filter and remove the canister.
3. Clean the lint from the filter screen. If necessary, swirl the filter in a pan of soapy water to loosen the lint.
4. Reassemble in the reverse order.

WARNING

Wear protective gloves, eye protection, and appropriate clothing when cleaning the final filter. Being a component of the vacuum system, the filter is subject to exposure by sewage effluent or septage. These materials may contain hazardous chemicals and bacteria, which can cause infection, injury, or even death due to contact.

IMPORTANT

Clean the final filter regularly. An excess buildup of lint in the final filter can reduce airflow in the vacuum system, reducing performance of the vacuum pump. Also, reduced airflow through the vacuum pump can result in overheating, leading to eventual pump damage.

OIL CATCH MUFFLER

The oil catch muffler collects oil expelled from the vacuum pump and reduces pump noise.

Drain the oil catch muffler daily by opening the drain at the base of the muffler chamber. You may need to drain the pump more frequently when subjecting it to heavy use. Properly dispose of the used oil. **DO NOT REUSE IT.**

Anytime you notice water has collected in the oil catch muffler, dry out the vacuum pump interior using the procedure outlined on pages 35-36.

PTO DRIVE

Your truck is equipped with a power take off (PTO) drive for powering your vacuum pump. An OEM manual for the drive on your system is included in the literature packet that you received. Review and follow the operation procedures outlined in the manual. Supplementary instructions are included below:

Engage PTO drive in order to run the vacuum pump. When finished loading or pressure dumping your tank, disengage the PTO drive to shut down the vacuum pump.

NOTICE

Disengage the PTO to stop pump operation upon completion of loading or pressure dumping your tank. Failure to disengage the PTO will keep the pump in operation and lead to overheating and damage to the equipment.

In extremely cold weather, the transmission oil in the truck has high viscosity until it warms up. Viscous drag can cause power shift PTOs to momentarily transmit high torque, which can cause output rotation in the disengaged position. This rotation could have enough force to damage a pump frozen with ice. Make sure your pump is not frozen before starting the truck in cold weather.

DO NOT engage PTO driven equipment until the vehicle has warmed up. If the POT begins to rotate in the disengaged position, the PTO gears may not mesh properly. As slippage occurs between the PTO clutch plates, the oil will rapidly heat, and the viscous drag will quickly decrease.

IMPORTANT

During cold weather operation, power shift PTOs may rotate in the disengaged position when you start your truck. To avoid damage to equipment, ensure the vacuum pump is not frozen before starting the truck, and **DO NOT** engage the PTO until the truck has warmed up.

FILL INDICATOR

There are three different types of fill indicators: sight tubes, sight eyes, and float level indicators (Figure 1.3). All fill indicators function automatically, as the tank is loaded or unloaded.

A sight tube or float level indicator always displays the liquid level in the tank. Sight eyes displays the liquid level in the tank at the indicator positions.

LOAD AND DUMP VALVES

Each tanker has either manual or automatic load and dump valves. Automatic valves may be air, hydraulic, or electric operated.

On manual valves, use the handle mounted to the valve to open and close it. On air, hydraulic, or electric valves, use the switch on the truck cab or rear step bumper to actuate the valve. Switches mounted on the rear step bumper are usually located on the driver's side, inside surface of the bumper.

To allow for easy coupling to a vacuum or discharge hose, both the load and the dump valves are equipped with camlock-fittings. After you uncouple the hoses, use the camlock-fitting covers to keep dirt and debris from collecting in the valves.

Some air valves may have a pressure regulator plumbed into the airline. The pressure regulator is factory set to close the valve at 30 psi. If you need to readjust the regulator, set the pressure so that the valve just completely closes. If a pressure gauge is available, set the valve to close at 30 psi. Turning the adjustment knob clockwise increases pressure. Turning the adjustment knob counterclockwise decreases pressure.

■ IMPORTANT

On air valves with a pressure regulator, **DO NOT** set the closing pressure above 30 psi. A higher pressure setting may cause the valve gate to wedge shut, making it difficult to reopen.

VACUUM PUMP

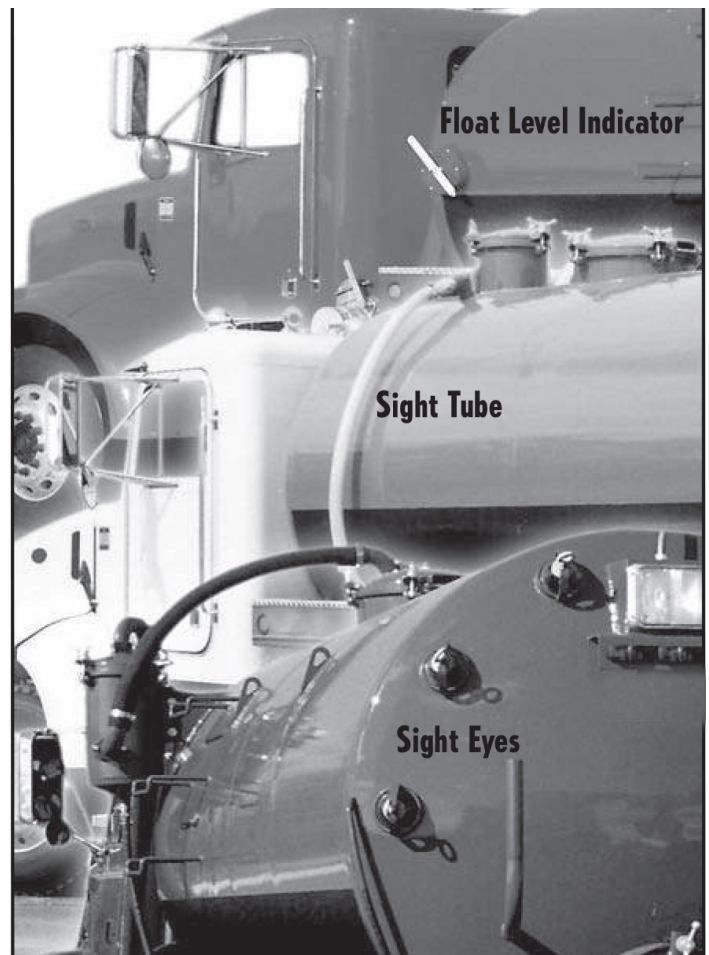
The OEM Operation Manual for your vacuum pump is included in the literature packet you received with your truck. Review and follow the operation procedures outlined in that manual.

KeeVac Industries offers the following information to provide a better understanding of your vacuum equipment. This information is intended to supplement (not replace) the OEM instructions for your specific pump.

■ IMPORTANT

Follow the operation procedures outlined in your OEM pump manual in order to keep your warranty valid and to receive maximum service life from your pump.

FIGURE 1.3 Fill Level Indicators



SAFETY SUGGESTIONS FOR VACUUM PUMPS

DANGER

Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing any component under the truck, including lubricating the vacuum pump or the PTO driveline. Contact with a rotating mechanism can cause entanglement that can lead to death. A truck that begins to roll is a crushing hazard that can lead to death.

WARNING

Keep hands, feet, hair, and clothing away from moving parts. Contact with a moving mechanism can cause entanglement, which can lead to dismemberment or death.

CAUTION

Avoid contact with the vacuum pump during or immediately after operation. Operating temperatures can range from near 200°F to over 300°F, depending on the make and model of pump and on the working conditions. Contact with a hot vacuum pump can cause severe burns.

VACUUM PUMP PRE-STARTUP PROCEDURE

Perform the following procedure each time before you operate the vacuum pump:

- Make sure the rotor shaft turns freely by hand. This is especially important in cold weather to ensure pump is not frozen with ice.
- Check level in the oil reservoir. Most pumps have a dipstick for checking oil. The oil in the reservoir requires periodic refilling because the pump consumes oil in the process of lubrication.

- Use only OEM recommended types and brand of oil for your pump. Table 1.2 lists the manufacturer recommended lubricants for the most popular vacuum pumps supplied by KeeVac Industries. If you have difficulty finding a manufacturer recommended oil, contact KeeVac Industries about its availability.
- If your pump model has grease fitting over the bearings, add grease. It is important not to over grease pump bearings. Use only one or two pumps on the grease gun when greasing.

NOTICE

Check the oil level in the rear housing at regular intervals. Allowing the pump to run low on oil during operation will result in damage to the pump.

IMPORTANT

DO NOT over grease the pump bearings. Over greasing can cause damage to the seals.

VACUUM/PRESSURE CONTROL HANDLE

On most vacuum/pressure pumps, locating the control handle in the center of its travel will cause the pump to operate in a neutral free flow mode.

To change to either vacuum or pressure, move the handle clockwise or counterclockwise according to the instruction in your OEM pump manual. In addition, you can observe the vacuum/pressure gauge to verify which mode you are operating in.

VACUUM PUMP OPERATION

After performing the pump pre-startup procedure, position the vacuum/pressure control handle in the neutral position and engage the PTO.

When the pump is running, check oil flow in the drip oiler sight window to ensure that the proper lubrication is reaching the pump (Figure 1.2). Refer to your OEM pump manual to determine specific oiling rate (drip rate) for your pump.

If your vacuum pump is equipped with a manual adjust drip oiler, pay close attention to the drip rate and regulate it as necessary. Manual drip oilers require periodic checking and adjustment in addition, readjust the drip oiler when changing oil weight in your pump. See your OEM pump manual for specific instructions on adjusting the drip oiler.

If your vacuum pump has an auto-lube oiler, the oiler pump is preset at the factory and requires little periodic adjustment. These oilers are adjustable; however, they may go out of tune due to normal operating conditions. See your OEM pump manual for specific instructions on adjusting auto-lube oilers.

■ IMPORTANT

When adjusting your vacuum pump oiler, use small adjustment increments (no more than one turn at a time). This helps protect against running the pump dry due to turning the adjustment knob to lean or in the wrong direction.

Also, to ensure the pump is running smoothly by listening for a pump sound with minimum vibration.

Before using the pump to load the tank, actuate the vacuum/pressure handle to be sure the pump is operating in each mode.

▶ NOTICE

If proper oiling is not achieved within a few minutes, shut down pump and see “Trouble Shooting” section on page 39 or consult a KeeVac Representative at **866-789-9440**.

LOADING THE TANK

Use the following procedure (in addition to the information provided in your OEM pump manual) to load your vacuum tank:

- Remove the camlock fitting covers on the desired load inlet.
- Couple the filler hose to the inlet.
- Set the vacuum/pressure handle on the pump to the “vacuum” mode.
- Start the truck engine and engage the PTO. Run the engine up to the recommended RPMs for your pump. Refer to the label affixed to your truck dashboard, to your OEM pump manual, or to the pump housing to determine the recommended RPMs for your vacuum pump.
- Allow the vacuum to build to the desired level (usually about 15” Hg), and then open the inlet/outlet valve and load the tank.
- When the tank is full, close the fill valve and disengage the PTO in order to shut down the pump.

Pay close attention to the fill indicator on your tank so you can promptly shut down the vacuum pump when the tank is full.

If for any reason, you cannot visually tell when the tank is full, listen for a change of sound in the vacuum pump. When the tank is full, the primary shutoff stops airflow, creating a noticeable change in the sound of the vacuum pump.

In the unlikely event that the primary or secondary shutoff activates due to extreme air velocity, promptly shut down your vacuum pump. Again, a change of sound in the vacuum pump is your indicator to stop operation. This will deactivate the shutoff, at which point, you can resume operation.

- After disengaging the PTO, deactivate the throttle control to reduce the engine RPMs.

Table 1.2 Vacuum Pump Recommended Oils—Pump Housing*

Fruitland RCF Pumps		
Brand/Type	Cold Weather	Warm Weather
Any	W30 Non-detergent	W50 non-detergent
Jurop PNR Series Pumps		
Brand/Type	Cold Weather	Warm Weather
AGIP/ISO 150	Acer 150	Acer 150
BP/ISO 150	Energol CS 150	Energol CS 150
ESSO/ISO 150	Nuto 150	Nuto 150
SHELL/ISO 150	Vitrea/Tellus 150	Vitrea/Tellus 150
ELF/ISO 150	Polytellis 150	Polytellis 150
Masport Vacuum Pumps		
Brand/Type	Cold Weather	Warm Weather
Masport Vacuum Pump Oil	10W	20W
Amocon	Amocon 32	Amocon 68
Shell Turbo T Oils	Turbo T 32	Turbo T 68
Monolec Compressor Oil**	✓	✓
Mobil SHC 500	✓	✓
Anderol 497	✓	✓
Cheveron GST Oil***	GST46	GST 68
Pennzbell TO Oils	✓	✓
Rega Oil	R&O 32	R&O 68
NVE Pumps-360 AL Challenger-MEC 5000/P-MEC 6500/P-MEC 8000/P		
Brand/Type****	Cold Weather	Warm Weather
Penzoil	Penzabell 68 T.O.	Penzabell 68 T.O.
Shell	Turbo 68	Turbo 68
Mobil	D.T.E. Heavy—Medium	D.T.E. Heavy—Medium
Texaco	Regal R.N.O. 68	Regal R.N.O. 68
Battioni WPT Series Pumps		
Brand/Type****	Cold Weather	Warm Weather
Penzoil	Penzabell 68 T.O.	Penzabell 68 T.O.
Shell	Turbo 68	Turbo 68
Mobil	D.T.E. Heavy-Medium	D.T.E. Heavy-Medium
Texaco	Regal R.N.O. 68	Regal R.N.O. 68

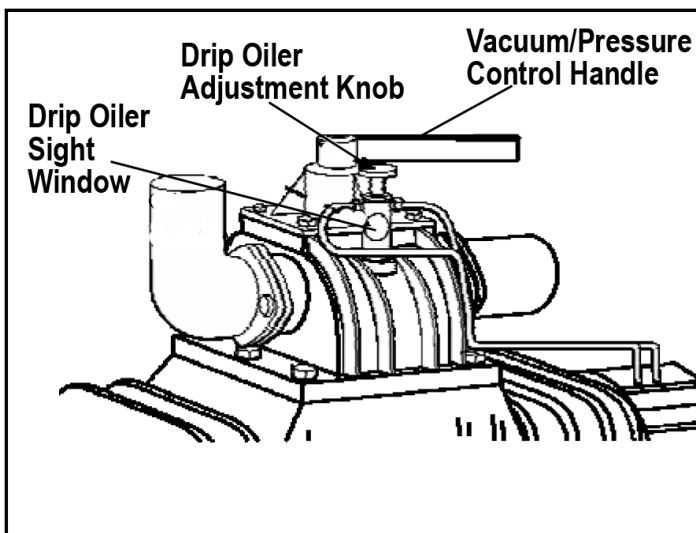
*Information on vacuum pump oils is from data available at time of printing. Specifications may change without notice.

**Monolec Compressor Oil is colored red and should not be confused with transmission fluid.

***Cheveron GST Oil (a turbine grade oil) is the preferred lubricant for Masport Pumps.

****The recommended lubricants for NVE and Battioni pumps are turbine grade oils.

FIGURE 1.4 VACUUM PUMP DRIP OILER AND VACUUM/PRESSURE CONTROL HANDLE



MECHANICS OF PNEUMATIC-TRANSPORT (transfer by means of vacuum)

A vacuum, when pumping liquid waste, is a space with some of the air removed from it. Your vacuum pump extracts air from your vacuum tank, lowering the pressure inside of it. Atmospheric pressure pushing against the liquid does the actual loading of your vacuum tank. The liquid flows toward the area of lower pressure created in the tank.

Vacuum is measured in inches of Mercury (in.Hg. Or "Hg."). This type of measurement is based on a barometric mercury column. Standard atmospheric pressure at sea level causes the mercury in this instrument to rise 30 inches up into a glass tube with a vacuum. The dial type pressure/vacuum gauge on your tank (Figure 1.3) gives the same in.Hg. reading as a mercury column.

Usually, 15" Hg of vacuum is sufficient to load the tank without placing undue stress on your pump. Table 1.3 lists the approximate vacuum levels required to lift water a given distance. However, these figures must be adjusted to compensate for the weight of the material and the length and diameter of suction hose being used. Effluent or septage may often weigh more than water. Also, pumping these products through a hose induces friction. Both factors result in reduced lifting efficiency. In addition, both attainable vacuum pumping height decrease at higher altitudes. This is because atmospheric pressure decreases with height. Therefore, there is less pressure at hand to load your tank. Table 1.4 lists the percentage loss of attainable vacuum for every 1000-foot rise in elevation over sea level.

► NOTICE

DO NOT operate the pump faster than the recommended rpm. Operation above the recommended rpm will cause the pump to overheat, resulting in damage to the pump.

► NOTICE

Shut down your vacuum pump promptly when the tank is full. In addition, any time the primary or secondary shutoff activates, stop pump operation. At the point when either of the shutoffs activates, the pump is susceptible to overheating if kept running. This can damage your pump.

While it is necessary to create enough vacuum to handle pumping height, product weight, and hose friction, it is important not to overstress the pump. Pay close attention to your pump if it is **necessary** to operate at a high in.Hg vacuum level. Air-cooled pumps are especially vulnerable to overheating when being operated for extended periods at high vacuum levels. Liquid cooled pumps can handle this type of operation much more readily.

Operation at high in.Hg levels can also result in moisture condensation in the pump. As vacuum increases, water begins to evaporate from the surface of the of the liquid in the tank. Anytime that vacuum pump operation exceeds 15”Hg, water vapor can begin to show up in the air circulating in the vacuum system.

While most of this moisture collects in the oil catch muffler, some of it will also accumulate inside the pump. In order to prevent problems connected with water collecting in your vacuum pump, dry it out anytime that you notice water has collected in the oil catch muffler.

Use the following procedure to dry out the pump:

- Unload the tank
- Open a load or dump valve (to keep from building vacuum)
- Run the pump in vacuum mode for two to five minutes

If water remains in your vacuum pump can diminish performance and cause serious damage. When water is present inside the pump, sludge forms. This can restrict the vanes from moving freely inside the rotor slots, reducing the efficiency of your pump. Water inside your vacuum pump can freeze during cold weather operation. Attempting to operate your pump if it is frozen inside with ice will damage it.

Table 1.3 Vacuum Levels vs. Lift Height

Vacuum in.Hg	Lift Height (for water)
10	11'4"
15	17'
20	22'8"
21	23'8"
22	24'9"
23	26'
24	27'2"
25	28'4"
26	29'5"
27	30'6"
28	31'7"
29	32'8"
30	34'

▶ NOTICE

DO NOT run your vacuum pump above the pump manufacturer’s maximum continuous vacuum rating. Exceeding the maximum vacuum rating could damage to the pump and/or tank.

■ IMPORTANT

After operating your pump at high in.Hg vacuum levels, dry the pump interior out using the procedure outlined above. Water in your vacuum pump can cause sludge formation and freeze up in cold weather.

UNLOADING

You have two options when unloading your tank, gravity dumping or pressure dumping. Either method will effectively empty the tank; however, pressure dumping increases discharge flow rate.

Begin the unloading procedure by placing the vacuum pump control handle into neutral to relieve any vacuum in the system, then use one of the following procedures.

For gravity dumping, use the following procedure:

1. Set the control handle on the pump to the “pressure” mode.
2. Open the dump valve.

For pressure dumping, use the following procedure:

1. Set the control handle on the pump to the “pressure” mode.
2. Engage the tractor PTO to start the pump and run up to the recommended RPM for your vacuum pump model.
3. Open the dump valve to begin unloading when the pressure reaches the desired level (up to the maximum psi set on the pressure relief valve).

After unloading the tank, disengage the PTO and close the dump valve. It is important to disengage the PTO before closing the valve to avoid pressure buildup in the system.

WARNING

DO NOT exceed the maximum pressure of 15 psi with your vacuum tank. Exceeding 15 psi pressure could cause the tank to rupture, resulting in serious injury or death to persons in the area.

Table 1.4 Vacuum vs. Elevation

Elevation	Attainable Maximum Vacuum Level	Percentage of loss per 1,000 feet elevation
0	29.921	—
1,000	28.85	3.6%
2,000	27.82	7.0%
3,000	26.82	10.4%
4,000	25.84	13.6%
5,000	24.89	16.8%
6,000	23.98	19.9%
7,000	23.06	22.9%
8,000	22.20	25.7%
9,000	21.38	28.5%

HYDRAULIC COMPONENTS

Each tanker is available with a variety of hydraulic operated and driven components. Some of these components include hydraulic hoists, hydraulic hatches, and hydraulic pump drives.

Use toggle switch mounted either inside or outside the truck cab to actuate the hydraulic components on your vacuum tanker, except for hoist cylinder.

On trucks with air brakes, use the air feathering control lever mounted on the floor of the truck cab to operate the hoist cylinder. On trucks without air brakes, a feathering control cannot be installed. These trucks use a non-feathering lever control to activate the hoist cylinder.

HOIST VACUUM TANKERS

Use the control lever mounted in the truck cab to raise the tank for dumping sludge or other solids from your hoist tanker. Before dumping the solids from the tank, drain all liquid from the tank.

WARNING

Drain all liquid from your load before lifting the tank and dumping the solids from it. Your hoist vacuum tanker is not designed to handle the forces generated by large volumes of moving liquid. Attempting to raise the tank for dumping, with liquid in it, can cause your truck to overturn. An overturned truck can cause death or serious injury to the operator and persons in the area.

Trucks that have an air compressor system (e.g. a truck with air brakes) use an air feathering control to activate the hoist cylinder. The feathering control allows the operator to prevent the jerking movement that occurs with sudden starting and stopping of the hydraulic cylinder. It also allows the ability to vary the speed of cylinder movement.

When moving the control lever increasingly more in the direction of actuation, the speed of movement increases.

Usually, smaller trucks do not have an air compressor system, and will therefore have a cable control installed. On these trucks, use the lever control inside the truck cab to actuate the hoist cylinder.

Single hydraulic-component hoist tankers with a feathering control, incorporate a limit switch that pulls the control lever into neutral before the cylinder reaches the end of its stroke.

Hoist tankers with a multiple hydraulic-component system and hoist tankers with cable control **DO NOT** have a built in limit switch. When operating the hoist cylinder on these types of systems, move the control lever to neutral before the cylinder reaches the end of its stroke. If you do not stop the cylinder movement before the end of the stroke, excessive pressure can build in the cylinder tube causing it to distort and/or rupture.

NOTICE

If your hoist cylinder does not have a stroke limiter installed, **DO NOT** run the cylinder to the end of its stroke. Over pressurizing of the cylinder will result if it is run at full pressure to the end of its stroke, causing damage to the equipment.

A safety brace (referred to as a body prop) is provided with your hoist tanker. The stop braces the tank in the erect position if the hydraulic cylinder should creep downward due to inherent oil seepage past the valves in the system.

Use the body prop anytime you need to work under the raised tank. Only put the body prop into use on an unloaded tank. Never allow persons under the raised tank if it has not been emptied.

The body prop mounts to the inside of the truck frame. Make sure the body prop is in good condition, and then use the following procedure to place it into service:

1. Remove the body prop from its mounting bracket.
2. Slide the end of the body prop with the hole in it over the pin that protrudes from the tank skid.
3. Position the body prop so that it hangs vertically.
4. Lower the tank until the body prop is just resting against the truck frame.

As a secondary precautionary measure when working under the raised tank, place a hardwood block across both frame members just ahead of the rear hinge.

WARNING

Properly place the provided body prop securely in position when you or anyone else is under a raised tank for any reason. This stop is for use under and empty tank only. Never allow persons under the raised tank if it has not been emptied. Failure to properly use this safety stop could result in serious injury or death due to crushing.

WASHDOWN SYSTEMS

If your truck is equipped with a wash-down system (Figure 1.5), you will have received an OEM manual for the pressure water pump (included in your literature packet). Review and follow the operation procedures outlined in that manual. Supplementary instructions are included below.

To operate the pressure water pump for the small size wash-down system, make sure there is water in the water tank, and then turn the pump switch on. This pump does not require priming.

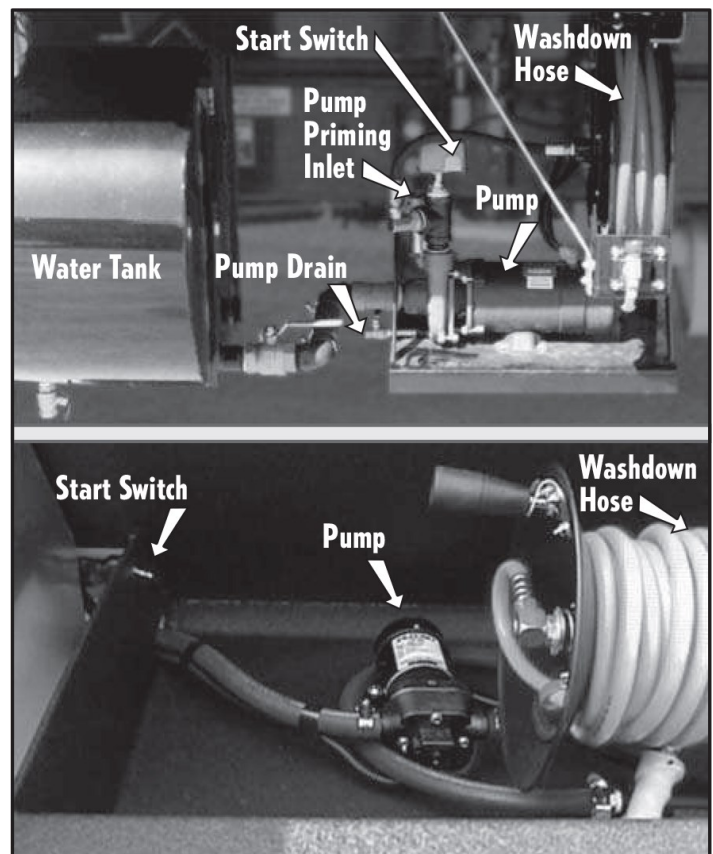
To operate pressure water pump on the large size wash-down system, use the following procedure:

1. Open the ball valve attached to the pipe nipple that comes out of your truck's water tank.
2. Check to make sure the pump is primed by opening the camlock-fitting cap attached to the pump housing.
 - If water flows out from the camlock fitting, the pump is primed and the cap can be replaced.
 - If no water flows out of the camlock fitting, add water until the pump housing is full. Replace the cap after filling the pump.

3. Press the on/off switch positioned at the top of the pump housing.
4. When the water tank is empty, promptly shut the pump off. As water flows through the pump it lubricates the pump seal. Running the pump dry (without water flowing through it) will damage the seal.

During cold weather (below 32°), drain the liquid from your pressure water pump to prevent freezing and damage to the pump housing. This applies to both types of systems. Drain all water lines and filters to protect them from freezing.

FIGURE 1.5 Washdown Systems: large size top; small size bottom



► NOTICE

DO NOT start the DC-10 water pump, included with the large size system, until you are sure it is primed with water. Starting or running the pump dry will cause scoring of the mechanical seal, resulting in damage to the pump.

► NOTICE

DO NOT allow water to freeze inside the pump. **DO NOT** attempt to start the pump if water has frozen inside it. Freezing water can damage your pump. Take the truck into a warm area and allow the

COLD WEATHER OPERATION

Use the following guidelines when operating your vacuum tank in temperatures below 32°F.

Extremely cold weather can result in formation of ice inside the vacuum pump, due to residual moisture. If the pump freezes up due to ice, take the truck into a warm area and allow the pump to thaw. **DO NOT** use a blowtorch or other similar device to attempt to thaw a frozen vacuum pump.

Before starting your truck engine, make sure that your pump is not frozen up inside the ice. This is important because extremely cold weather can cause power shift PTOs to momentarily transmit high torque, which can cause PTO output rotation in the disengaged position. This type of PTO rotation could have enough force to damage a pump that is frozen.

DO NOT engage the PTO driven equipment until the vehicle has warmed up. If the PTO begins to rotate in the disengaged position, the PTO gears may not mesh when attempting to engage the PTO.

Extremely cold weather could also cause the dump or load valves to freeze shut. Hot water poured over a frozen valve should loosen the ice. **DO NOT** use a blowtorch or similar device to thaw a frozen valve. This method could damage the valve.

Before operating your hydraulic system allow adequate time for your hydraulic motor to warm up. Premature operation could result in damage to your hydraulic pump or other equipment.

MAINTENANCE

Safe and reliable service for your truck mounted vacuum tanker depends on a regular schedule of lubrication and maintenance. Table 1.5 and 1.6 list intervals for lubrication and maintenance. The following sections detail the required lubrication and maintenance for individual components.

WARNING

Before performing any lubrication and maintenance, review and follow the “SAFETY PRECAUTIONS” on pages 4-6 and all safety precautions listed below.

MOISTURE TRAP/SECONDARY

SHUTOFF

Check the moisture trap daily for collected liquid (Figure 1.7).

On tank mounted moisture traps, use the easy access drain both to check for and to drain off any liquid. The drain is located at the bottom of the moisture trap.

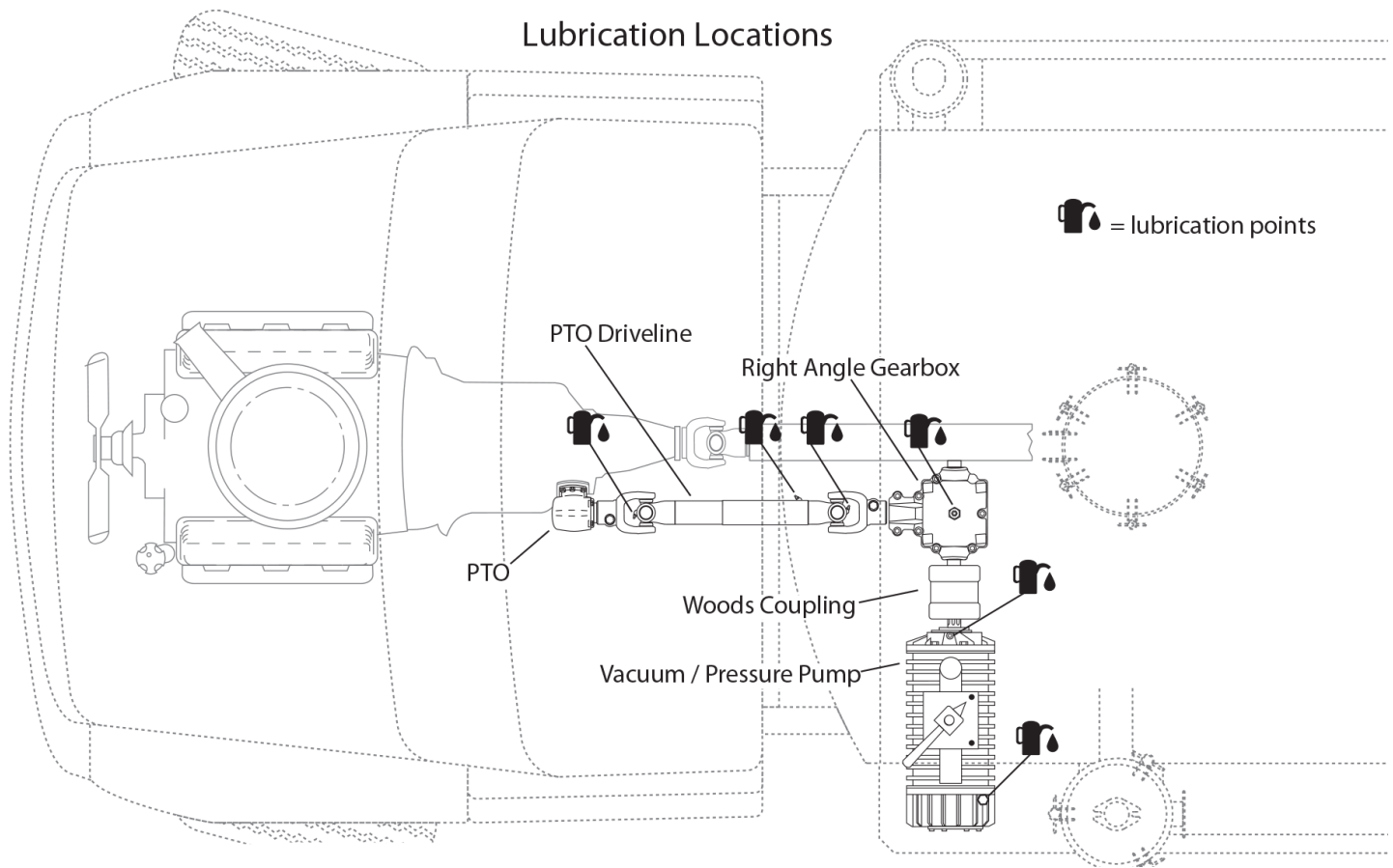
On frame mounted moisture traps, check for collected liquid by viewing through the sight eye. To drain liquid, remove the cover.

It is also important to inspect the ball seat and the fasteners every two (2) weeks.

Table 1.5 Lubrication Intervals

Required Lubrication	Lubrication Interval
Vacuum Pump - Re-fill oil level in the rear housing	Per pump manufacturers recommendations or at a minimum every 4 hours of operation / daily
Vacuum Pump - Grease front bearing at grease fitting	Per pump manufacturers recommendations or at a minimum every 4 hours of operation / daily
Right Angle Gearbox - Check the oil levels in the gearbox	Weekly
Vacuum Pump - Change oil in the rear housing	To correspond with oil weight requirements for given air temperatures.
PTO Driveline - Grease at fittings	-Weekly during summer conditions -Daily during winter travel over salty roads
PTO Integral part of vehicle’s motor transmission	Check and change transmission fluid per the vehicle manufacturer’s recommendation for severe service.
Hydraulic Equipped Tanker Trucks - Check hydraulic oil level	Daily
Hoist Cylinder on Hoist Tanks - Grease at fittings	Weekly

FIGURE 1.6 Vacuum Pump Driveline Lubrication Locations



Note: see the maintenance subsections in this manual for specific lubricant types and lubrication levels.

Check all moisture trap fasteners and tighten as necessary. Driving the truck with an empty tank causes vibration that over time can loosen fasteners. Remove the moisture trap cover to examine the ball seat for hardened rubber, nicks in the rubber, and buildup of debris. Any of these conditions may prevent proper sealing. Clean and/or replace the ball seat as necessary.

Any time that **excess** liquid accumulates in the moisture trap, clean the inside of your pump. While the moisture trap helps prevent liquid from entering the pump, excess accumulation may be an indicator that some contamination has passed into the pump.

Contaminates entering the pump (including effluent) is a major cause of pump failure. See pages 35-38 for vacuum pump cleaning procedure.

Clean and/or replace the ball seat in the primary shutoff any time that excess liquid accumulates in the moisture trap. Excessive liquid in the moisture trap can often be traced to improper sealing of the ball seat in the primary.

■ IMPORTANT

Any time that **excess** liquid accumulates in the moisture trap, clean the inside of your pump. Liquid contamination that enters the pump can cause damage if you do not clean the pump shortly thereafter.

FINAL FILTER

Clean the final filter as often as every day, depending upon the lint content of the material being pumped. For example, lint is more of a problem when pumping holding tanks than when pumping septic tanks, where paper fibers in the effluent decompose.

When cleaning the final filter, provide yourself with gloves, eye protection, and protective clothing and then use the following procedure:

1. Loosen the wing nuts and remove the cover.
2. Remove the nut on top of the filter and remove the canister.
3. Clean the lint from the filter screen. If necessary, swirl the filter in a pan of soapy water to loosen the lint.
4. Reassemble in the reverse order.

WARNING

Wear protective gloves, eye protection, and appropriate clothing when cleaning the final filter. Being a component of the vacuum system, the filter is subject to expose by sewage effluent or septage. These materials may contain hazardous chemicals and bacteria, which can cause infection, injury, or even death due to contact.

IMPORTANT

Clean the final filter regularly. An excess buildup of lint in the final filter can reduce airflow in the vacuum system, reducing performance of the vacuum pump. Also, reduced airflow through the vacuum pump can result in overheating, leading to eventual pump damage.

PRIMARY SHUTOFF

Inspect the primary shutoff every two (2) weeks to check the rubber ball seat and the tightness of all fasteners.

Your vacuum tanker is equipped with one of two styles of primary shutoff, depending on which type of air-line system the tank has.

To inspect the ball seat on external air-line systems (Figure 1.8), begin by removing the primary shutoff access lid.

Next, remove the float cage to gain access the ball seat. Examine the ball seat for hardened rubber, nicks in the rubber, and a buildup of debris. Any of these conditions may prevent proper sealing. Clean or replace the ball seat as necessary. Reassemble in the reverse order. Be sure to tighten all fasteners adequately.

To inspect the ball seat on through-the-tank air-line systems (Figure 1.9), begin by removing the primary shutoff access lid.

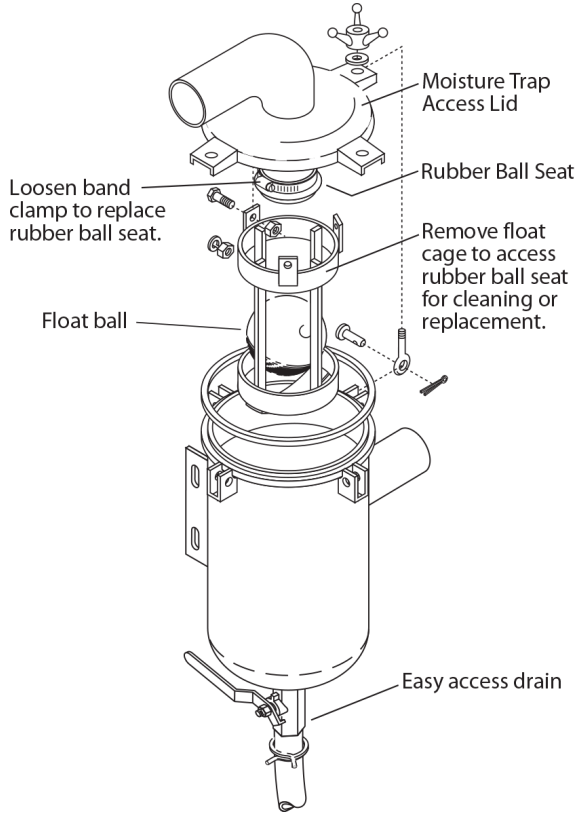
Next, remove the elbow by disassembling the two-bolt flange. The ball seat will lift out with the elbow. Examine the ball seat for hardened rubber, nicks in the rubber, and a buildup of debris. After cleaning or replacing the ball seat, reassemble in the reverse order, being sure to tighten all fasteners adequately.

Also inspect all fasteners for tightness. Fasteners may become loose due to vibration. This is especially critical when driving extensive miles with an empty tank.

Table 1.6 Maintenance Intervals (in addition to lubrication)

Component	Required Maintenance	Maintenance Interval
Moisture Trap	Check for accumulation of liquid	Daily
Final Filter	Clean filter screen	Daily— <i>pumping high lint content material</i> Weekly— <i>pumping low lint content material</i>
Primary Shutoff	Clean rubber ball seat, check fastener tightness	Every Two (2) Weeks
Moisture Trap	Clean rubber ball seat, check for hardened rubber, nicks in the rubber, and build up of debris. Also check fasteners tightness	Every Two (2) Weeks
Mounting Brackets	Check tension on spring mounts	Every Month
Standoff Wear-Plate	Inspect	Weekly— <i>pumping high grit content material</i> Every Three (3) Months— <i>pumping septage & sewage</i>
Standoff Wear-Plate	Replace	When worn through
Vacuum Pump	Clean pump interior. Check for excess moisture, liquid, dirt, and contaminants.	Every Three (3) Months
Vacuum Pump	Clean pump exterior (to avoid overheating)	Regularly
Vacuum Pump	Clean drip oiler sight glass	Periodically
Vacuum Pump	Check rotor vane wear	Per pump manufacturers recommendations. (Replace vanes that exceed 1/4" wear limit)
Hydraulic System	Change Filter	Every Six (6) Months

FIGURE 1.7 Tank Mounted Moisture Trap



! WARNING

Wear protective gloves, eye protection, and appropriate clothing when inspecting and cleaning the primary shutoff. Being a component of the vacuum system, the shutoff is subject to exposure by sewage effluent or septage. These materials may contain hazardous chemicals and bacteria, which can cause infection, injury, or even death due to contact.

■ IMPORTANT

Check the primary shutoff regularly for the condition of the ball seat and fastener tightness. Improper maintenance of the primary shutoff may allow liquid to flow into the vacuum pump, which will result in damage to the unit.

FIGURE 1.8 Primary Shutoff for External Air-line Tanks

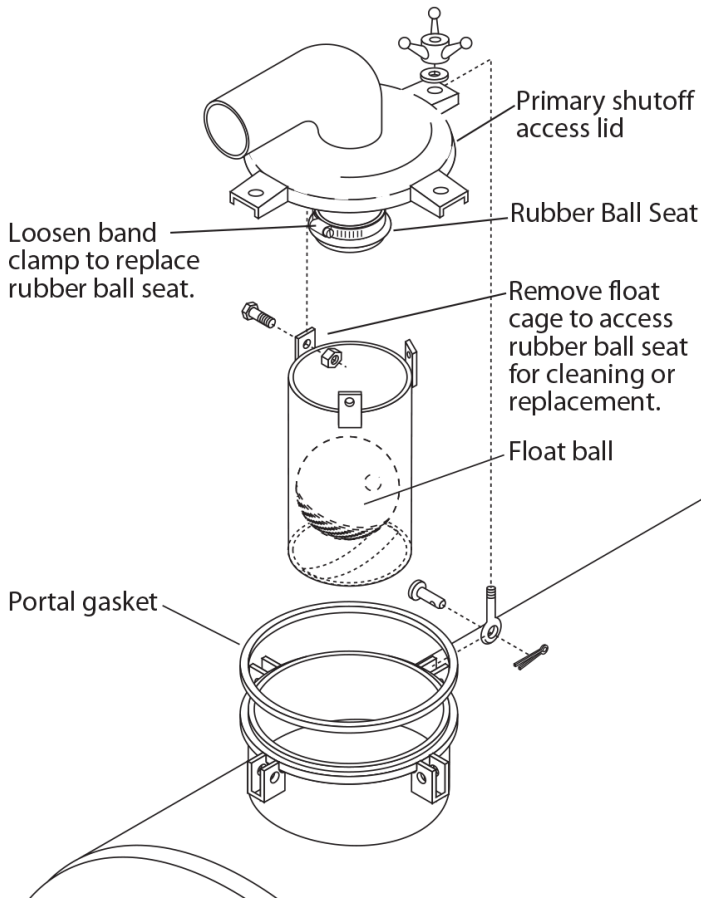
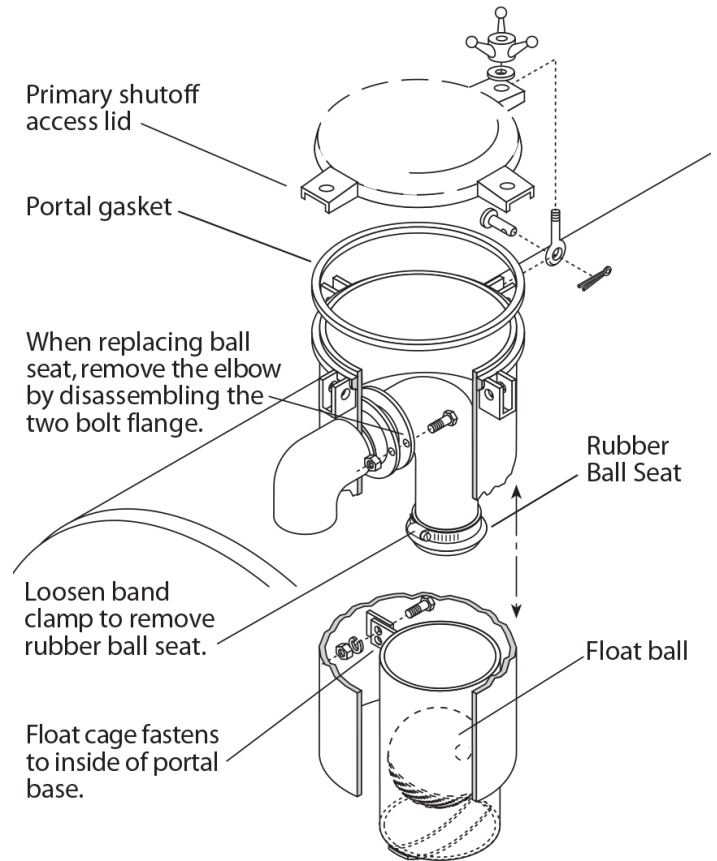


FIGURE 1.9 Primary Shutoff for Through the Tank Air-line Systems



PTO

After installation, the PTO becomes an integral part of the transmission on the vehicle's motor and is lubricated by the transmission oil per the vehicle manufacturer's recommendation for severe service.

PTO DRIVELINE

Grease the PTO driveline weekly during the spring, summer, and fall. Grease the PTO driveline daily when operating during winter conditions (such as when there is salt on the roads).

There is a grease fitting on each of the universal joints and a grease fitting for the telescoping shaft (see Figure 1.6).

RIGHT ANGLE GEAR BOX

Check the gear lube level in the right-angle gearbox weekly. Add gear lube if the level drops below the bottom of the gearbox shaft. Use EP 80/90 gear lube in the gearbox. Fill the gearbox to ½ full maximum (halfway up the shaft).

The gearbox is located under the truck and is mounted to the inside of the vacuum pump on the vacuum pump mounting stand (see Figure 1.6, page 25). Depending on the style of truck frame and the size of vacuum tank, there may be very little clearance to access the fill plug on top of the gearbox.

To check the oil level, use an improvised dipstick (a drinking straw works well) inserted into the fill plug opening. Before removing the dipstick, place your finger on it to mark the top surface of the gearbox housing.

Optimally, the oil level should be 1/3 way up the shaft, which is centered vertically in the gearbox housing. Overfilling the gearbox with oil can create the potential to damage the seals due to an excess buildup of pressure.

► NOTICE

DO NOT overfill the right-angle gearbox with oil. Overfilling the gearbox can cause seal damage, resulting in gearbox failure.

CAPTURED MOUNTING BRACKET SPRINGS

Check the tension on the springs mounts monthly. Examine the spring mounts to make sure they have not loosened up due to vibration. Adjust the springs on the captured mounting brackets to a compressed length of 3 1/2" (Figure 1.10).

STANDOFF WEAR-PLATE

A standoff assembly, for increasing airflow while gravity dumping, is an available option for your vacuum tanker. If your vacuum tanker is equipped with a standoff assembly, the attached wear-plate requires periodic inspection and replacement. The abrasion resistant wear-plate protects the interior of your tank barrel from eroding due to abrasive substances in the material being pumped (Figure 1.11).

Maintenance intervals for wear-plate inspection and replacement vary depending on what material is pumped. For example, car wash sludge contains much sand, which is highly abrasive. This type of material will cause the wear-plate to wear out much more quickly than pumping septage or sewage.

Inspect the wear-plate at an interval based upon comparing your usage to these examples:

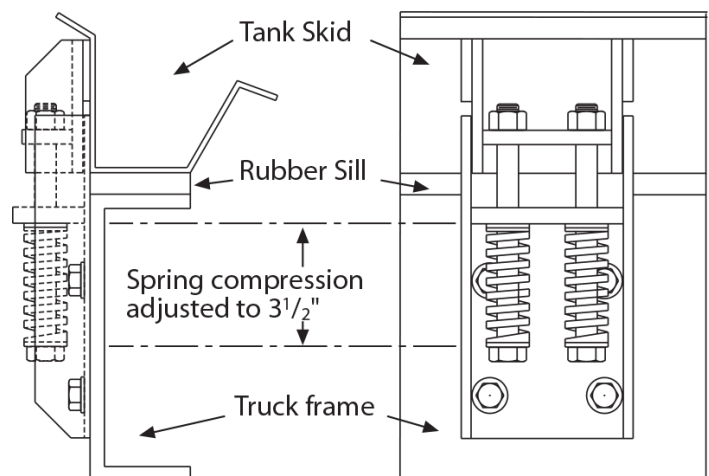
- When pumping car wash sludge, check the wear-plate at least once a week.
- When pumping septage or sewage, check the wear-plate at least every three months.

It is important to maintain a regular schedule of inspecting the wear-plate so that it can be replaced promptly when worn through – before damage to the tank occurs. Continued operation after the wear-plate is worn through will result in erosion of the tank wall. This is especially important for aluminum tanks.

► NOTICE

Replace the standoff wear-plate promptly after it becomes worn through. Prolonging operation of your vacuum tanker after the wear-plate is worn out will damage the tank.

FIGURE 1.10 Mounting Bracket Assembly



To inspect the wear-plate, stand outside the tank and look up through the rear hatch with the aid of a flashlight. When the wear-plate wears through a large hole will develop. This will be readily apparent with a visual inspection. Replace the wear-plate now.

Replacing the wear-plate requires that you enter the tank. Use all appropriate precautions when entering the tank. The precautions are listed below and must be followed because of the inherent hazards of entering a tank that is used for holding septage or sewage. These effluents, and the residue from them, give off deadly gasses that can paralyze the olfactory system (a person's sense of smell).

! DANGER

DO NOT enter a transport, septic, or holding tank without first cleaning and providing adequate ventilation to the interior of the tank. Sewer gas is deadly if inhaled and depletes the oxygen in a confined space, which can cause asphyxiation.

! DANGER

ENTERING A TANK THAT HAS BEEN EXPOSED TO SEWAGE EFFLUENT IS HAZARDOUS.

If it is absolutely necessary to enter a transport, septic, or holding tank that has been exposed to sewage effluent, regardless of how long ago, it is absolutely necessary to observe the following safety precautions.

! DANGER

DO NOT enter a transport, septic, or holding tank without protective clothing. Sewer gas can be absorbed through the skin causing serious injury or death.

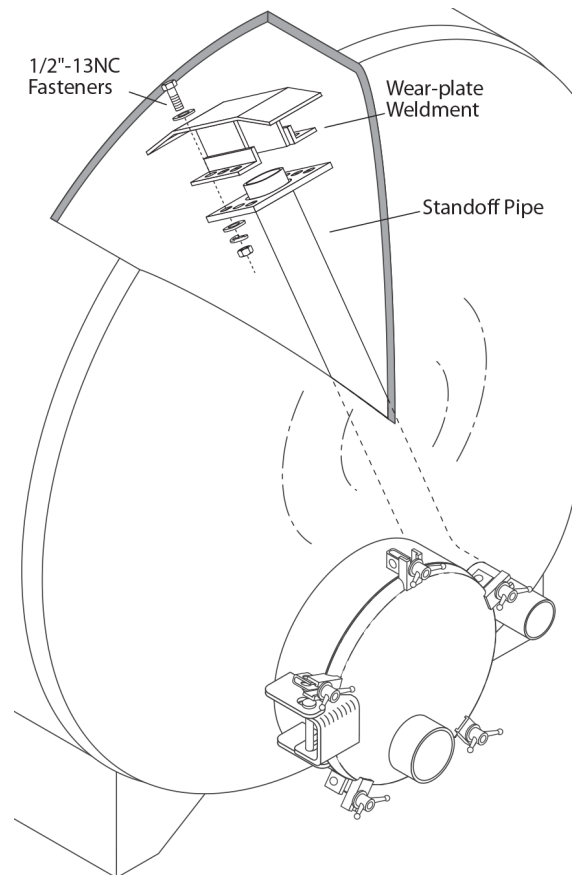
! DANGER

DO NOT enter a transport, septic, or holding tank without using a respirator that supplies grade D breathing air or a self-contained breathing apparatus. In addition, **DO NOT** use this equipment without training the familiarity with it. Entering a tank exposed to sewage effluent without a correct breathing apparatus, or with improper use of it can cause death.

! WARNING

When entering a transport, septic, or holding tank, always have someone standing by to offer assistance, and always have a respirator that supplies grade D breathing air or a self-contained breathing apparatus on hand for them. In the event of an attempted rescue, this equipment is necessary to prevent death of the rescuer.

FIGURE 1.11 Standoff Wear-plate Replacement



WARNING

Attach a safety-harness and rope to any person that enters a transport, septic, or holding tank. Have a safety-harness rope held by a person standing by to offer assistance outside the tank. An attempted rescue without the advantage of a rope and harness can be life threatening to the rescuer.

WARNING

Entry into a transport, septic, or holding tank is confined space entry. Persons entering these tanks for any purpose must be trained in and follow OSHA confined space safety procedures.

To replace the wear plate, unbolt the six ½"-13NC hex head screws that fasten it to the collar on the standoff pipe. Have replacement fasteners on hand in case any of the existing ones are damaged during removal. Aluminum tanks require stainless steel fasteners and steel tanks use zinc plated fasteners. Along with each hex head screw and nut, use two flat washers and one lock washer. Aluminum tanks use a gasket between the standoff collar and the wear-plate to separate the dissimilar metals used in the two. Keep replacement gaskets on hand when changing the wear-plate on these types of tanks.

LIGHTING DEVICES

Lighting devices referred to under this section are those built into your vacuum tanker. For instructions on chassis-cab lighting devices, refer to your OEM vehicle manufacturer's operation/maintenance manual.

Standard lighting devices on your vacuum tanker include stop/turn-signal/tail lamps, backup lamps, identification lamps, and license plate lamps. The stop/turn-signal/tail lamps and the backup lamps are built into the step bumper at the rear of the tank.

The side-marker lamps are built into the side of the step bumper and into the rails of the hose platforms. Finally, the license plate lamp and bracket is usually mounted at the base of the step bumper.

The stop/turn-signal/tail lamps, backup lamps, and side-marker lamps have a sealed beam design, which makes replacement easy (Figure 1.12). To replace these lamps, use the following procedure:

1. Use a screwdriver to pry the sealed beam unit from the rubber mounting grommet.
2. Detach the three-prong connector from the back of the lamp unit.
3. Attach the three-prong connector to the back of the replacement lamp. Then, using hand pressure only, press the lamp back into the rubber mounting grommet.

FIGURE 1.12 Lighting Devices

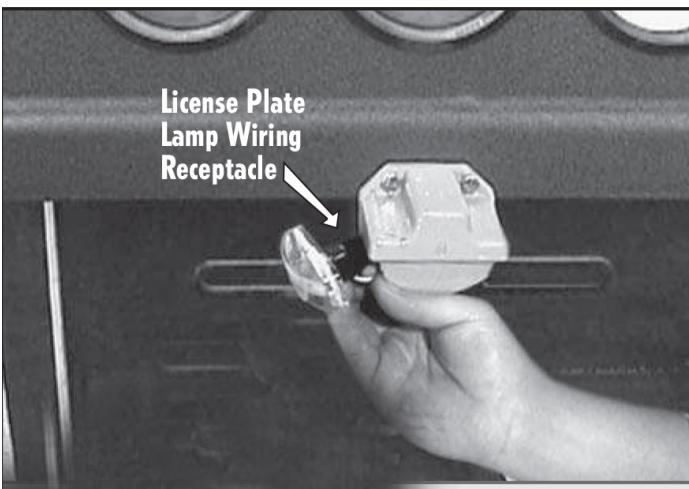


The license plate lamp also uses a sealed beam design and is held into the lamp housing with two locking tabs (Figure 1.13). Use the following procedure to replace the license plate lamp:

1. Remove the two bolts that fasten the lamp housing to the step bumper.
2. Remove the sealed beam unit by pressing against it from inside the housing.
3. Detach the connector from the replacement lamp unit to the wiring harness receptacle.
4. Attach the connector from the replacement lamp unit to the wiring harness receptacle.
5. Make sure the license plate lamp is operating correctly, and then refasten the lamp housing using the mounting bolts, lock washers, and nuts.

The identification lamps, located at the top rear of the tank, use the same procedure as the stop/turn-signal/tail lamps. Refer to Figure 1.14.

FIGURE 1.13 License Plate Lamp Replacement



BACKUP ALARM

The backup alarm is an important component in protecting against accidents during operation of your vacuum tanker. This alarm creates an audible beeping sound when the truck is placed in reverse. If the backup alarm stops working, replace it immediately.

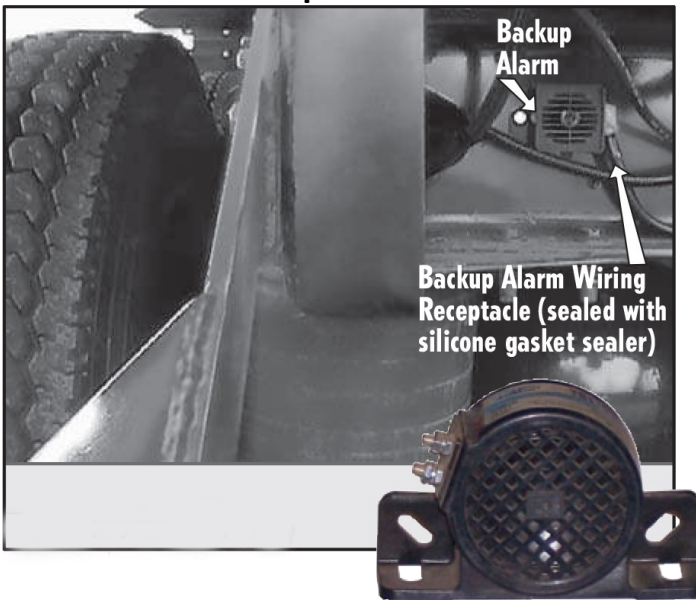
Use the following procedure to replace the backup alarm (refer to Figure 1.14):

1. Detach the wiring connector from the alarm unit. You may need to remove the factory applied silicone sealant in order to free the connector.
2. Remove the two bolts that fasten the alarm to the truck frame rear cross-member.
3. Mount the replacement backup alarm previously disassembled bolts, lock washers, and nuts.
4. Attach the wiring connector to the replacement unit.
5. Check to make sure the alarm is operational, and then seal the connection at the alarm unit with silicone sealant. This will help prevent corrosion.

FIGURE 1.14 Safety Lighting



FIGURE 1.15 Backup Alarm



! WARNING

Make sure that backup lights and the backup alarm are maintained and in good working condition. Because of the truck mounted tank, the driver will experience a large blind spot behind the truck. Fatalities have occurred when persons were run over by a tanker truck.

HYDRAULIC COMPONENTS

If your vacuum tanker has hydraulic components or drives, the hydraulic system requires periodic checking and maintenance. Check the oil in the hydraulic reservoir daily. Keep the reservoir filled with AW-32 or equivalent hydraulic oil.

If the oil level drops, fill the reservoir, and then inspect the complete system for leakage. Before making any repairs, be sure to relieve all pressure in the system.

Most hydraulic systems will have a filter included in the system. Change the filter every six (6) months.

! WARNING

Escaping hydraulic oil under pressure can have enough force to penetrate your skin, which can cause serious injury. Before operating hydraulic components, be sure all connections are tight, and hoses are not damaged. Relieve all pressure before disconnecting hydraulic lines or repairing leaks.

HOIST VACUUM TANKERS

Hoist vacuum tankers have a hoist cylinder that raises the front of the tank to allow solids to slide out the rear dump hatch.

Grease the hoist system weekly at the lubrication points described in Table 1.7.

VACUUM PUMP

The OEM operation manual for your vacuum pump is included in the literature packet you received with your vacuum tanker. Review and follow the maintenance procedures outlined in that manual.

The following information is to provide a better understanding of your vacuum equipment. This information is intended to augment (not replace) the OEM instructions for your specific pump.

■ IMPORTANT

Follow the maintenance procedures outlined in your OEM pump manual in order to keep your warranty valid and to receive maximum service life from your pump.

BASIC VACUUM PUMP MAINTENANCE

Basic maintenance on your vacuum pump involves maintaining proper oil flow, keeping the pump filled with oil, and greasing the bearings.

- Using the oiler sight window, check for the proper oil flow every time you operate your pump (Figure 1.4, page 18). Refer to your OEM pump manual to determine specific oiling rate (drip rate) for your pump.

If your vacuum pump is equipped with a manual adjust drip oiler, pay close attention to the drip rate and regulate it as necessary. Manual drip oilers require periodic checking and adjustment. See your OEM pump manual for specific instructions on adjusting the drip oiler.

If your vacuum pump has an auto-lube oiler, the oiler pump is preset at the factory and requires little periodic adjustment. These oilers are adjustable, should they go out of tune due to normal operating conditions. See your OEM pump manual for specific instructions on adjusting auto-lube oilers.

■ IMPORTANT

When adjusting your vacuum pump oiler, use small adjustment increments (no more than one turn at a time). This helps protect against running the pump dry due to turning the adjustment knob too lean or in the wrong direction.

- Check and refill the vacuum pump oil reservoir every 4 hours of operation daily.

It is essential to check the oil level regularly because the pump consumes oil in the process of lubrication. See your OEM manual for estimated average oil usage for your specific pump.

Use only OEM recommended types and brands of oil for your pump. Table 1.2 lists the manufacturer recommended lubricants for the most popular vacuum pumps. If you have difficulty obtaining a manufacturer recommended oil, contact KeeVac Industries for availability.

Some pump manufacturers recommend changing the oil weight for summer and winter operation. If you have a manual drip oiler on your pump, it is necessary to adjust the drip rate when changing to a different weight oil. Reference your OEM vacuum pump manual for instructions on adjusting the drip oiler before you change the weight of oil in your pump.

- Grease the pump bearings every 4 hours of operation daily.

It is important not to over grease the pump bearings. Use only one or two pumps on the grease gun when greasing.

▶ NOTICE

Check the oil level in the rear housing at regular intervals. Allowing the pump to run low on oil during operation will result in damage to the pump.

▶ NOTICE

Follow the manufacturers recommended lubricants for your specific vacuum pump. Because of differing oil pump types and heat generation characteristics among vacuum pumps, using the incorrect oil can lead to overheating and mechanical failure.

■ IMPORTANT

DO NOT over grease the pump bearings. Over greasing can cause damage to the seals.

TABLE 1.7 Additional Lubrication for Hoist Vacuum Tankers

Required Lubrication	Lube Interval
Rear Hinge Assembly— Two grease fittings	Weekly
Upper & Lower Hoist Cylinder Trunion Pins— Four grease fittings	Weekly
Upper Alignment Collar— Two grease fittings	Weekly

PERIODIC VACUUM PUMP MAINTENANCE

Please refer to your OEM vacuum pump manual. This information is intended to supplement the OEM manuals. Other maintenance for your vacuum pump includes cleaning the exterior of the pump, cleaning of the pump interior, checking the rotor vane wear, and replacing worn rotor vanes.

CLEANING THE EXTERIOR OF THE VACUUM PUMP

Clean the mud and dirt off the exterior of your vacuum pump on a regular basis. This is especially important for air-cooled pumps that needed to be clean to allow heat to radiate from them.

CLEANING THE INSIDE OF THE VACUUM PUMP

Occasionally a small amount of liquid, dirt, or other contaminate may enter the pump, restricting the ability of the vanes to glide in the rotor slots. To prevent vane-restricting buildup in your vacuum pump, clean the inside of your pump with a flushing fluid at least every three (3) months.

Clean the inside of your pump any time water shows up in the oil catch muffler or if excess moisture begins to accumulate in the moisture trap. Pay attention to periodic cleaning because it will increase the life of your pump.

DANGER

Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing the vacuum pump. Contact with a rotating mechanism can cause entanglement that can lead to death. A truck that begins to roll is a crushing hazard that can lead to death.

Use the following procedure to clean your vacuum pump:

1. Disengage the PTO and make sure your pump is in the non-operating mode
2. Remove the pump intake or exhaust inlet hose, or the inlet access plug (Figure 1.16). Use the most accessible inlet to clean your pump.
3. Create a flushing fluid with a 50/50 mixture of diesel fuel and vacuum pump oil. Pour ½ pint of this mixture directly into the pump inlet.
 - When adding flushing fluid to the intake inlet, place the control handle in the vacuum mode.
 - When adding flushing fluid to the exhaust inlet, place control handle in the pressure mode.
4. Next, turn the control handle to the neutral position to close the changeover valve.
5. Replace the inlet plug or inlet hose.
6. Engage the PTO and run the pump at operating speed for about one minute.
7. Next, disengage the PTO, and then use the control handle to switch the pump to vacuum mode.

■ IMPORTANT

Be sure to replace the inlet plug or inlet hose before placing the pump in the vacuum mode to expel the flushing fluid.

CAUTION

DO NOT position the control handle to the pressure mode, which would expel the fuel through the pump inlet. Incorrectly expelling the flushing fluid through an open inlet (without the inlet plug or inlet hose replaced) could cause it to spew out at the operator.

8. Re-engage the PTO and run the pump at operating speed for about ten (10) seconds.
9. After completing the above cleaning sequence, use the correct safety procedures and then rotate the driveline slowly by hand. Listen for a clicking sound as each rotor vane drops in its slot. If not all the vanes are sliding freely in the pump rotor slots, repeat the above procedure until they do slide freely.

DANGER

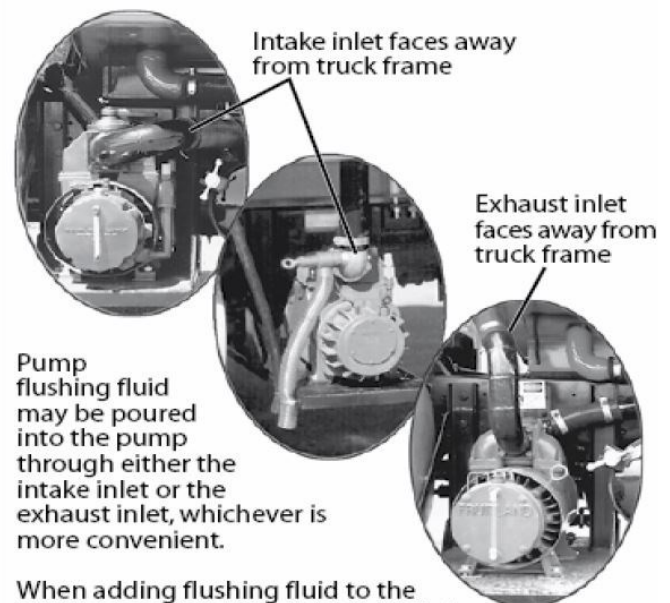
Before rotating the driveline manually, disengage the PTO, stop the truck motor, remove all persons from the truck cab, and chock the truck tires.

10. After completing the pump cleaning, pour 4-8 ounces of oil into the pump, reassemble the intake or exhaust hose (or access plug), and run the pump in neutral for about one (1) minute. Finally, drain the oil catch muffler of the used flushing fluid, and properly dispose of it. Your pump is now ready to put back into service.

NOTICE

Add oil directly into the pump after cleaning and before putting back into service. This is important because the cleaning procedure will rid the pump of both dirt and the necessary oil for lubrication.

FIGURE 1.16 Vacuum Pump Cleaning



When adding flushing fluid to the intake inlet, place the control handle in the vacuum mode.

When adding flushing fluid to the exhaust inlet, place the control handle in the pressure mode.

After flushing fluid has been added, place the control handle in the neutral position before cycling the pump.

Also, be sure to reassemble the intake or exhaust hose (or access plug) before cycling the pump - in order to guard against inadvertent discharge of flushing fluid through the opening.

CHECKING ROTOR VANE WEAR

Check vane wear at the interval recommended in your OEM pump manual. It is important to stay on top of vane wear because most pump manufacturers do not warranty damage caused by vane breakage. Recommended intervals for checking vane wear varies from one manufacturer to the next, however vane wear more often depends on operating conditions than on pump design.

You may need to check your vanes more often than the manufacturer's recommendation if your pump is subjected to the very heavy use. See table 1.8 for examples of heavy use factors that can shorten vane life.

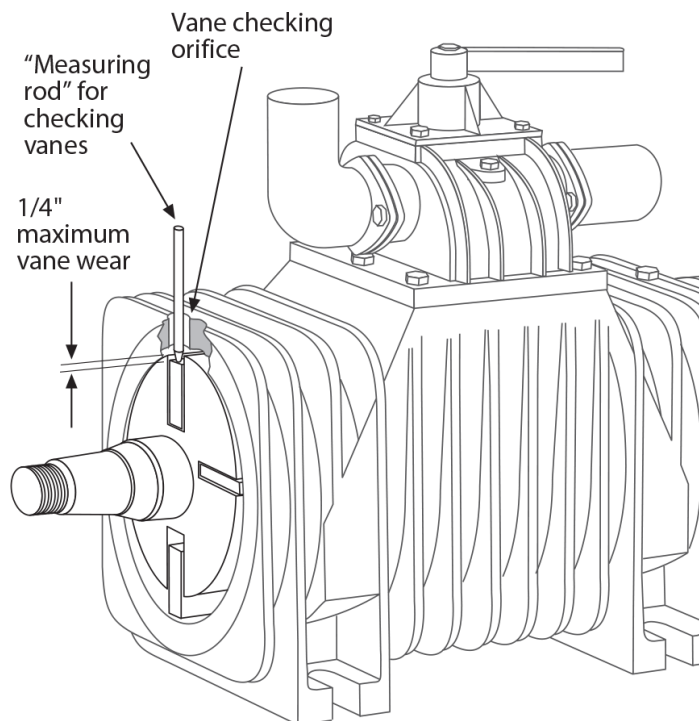
When vane wear exceeds $\frac{1}{4}$ " (for most pumps), the vanes must be replaced.

On pumps that do not have an inspection orifice, follow the OEM instructions for checking vanes. This will usually involve pulling the oil pump and end plate from the pump in order to gain access to the rotor. On these types of pumps, it may be advantageous to have a spare set of vanes on hand before checking. Then the new vanes will be ready for installation if you need them.

Some pumps have an orifice for checking vane wear. For these types of pumps, use the following procedure to check rotor vane wear:

1. Make a "measuring rod" to check vane wear by using a $\frac{1}{4}$ " diameter steel rod with one end ground to a blunt point.
2. Unscrew the plug from the rotor vane checking port located in the top of the pump housing (Figure 1.17).
3. Place the measuring rod into the port. Turn the rotor manually by means of the drive shaft to make sure that the rod is resting on the outside diameter of the rotor.
4. Place a scribe mark on the rod at the level of the plug tap-hole.
5. Manually turn the rotor so that the blunt point of the measuring rod drops into one of the rotor slots. Make another mark on the measuring rod at the level of the tap-hole, and then measure the difference between the two marks on the rod. The difference between the two marks on the measuring rod can be up to $\frac{1}{4}$ " before the rotor vanes must be replaced (Figure 1.17).
6. After checking the vane wear, replace the plug in the checking port and tighten.

FIGURE 1.17 Checking Vacuum Pump Vane Wear



■ IMPORTANT

Be sure to replace the plug in the vane wear checking port after performing a check. Failure to replace the plug will result in lower pump vacuum and suction capacity of the tank.

REPLACING ROTOR VANES

When changing the rotor vanes in your vacuum pump, follow the specific instructions in your OEM pump manual. This is essential as the procedure for changing vanes varies based on the pump design and the manufacturer.

If you are replacing the rotor vanes with the pump mounted to the truck, use the appropriate safety precautions.

DANGER

Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing any component under the truck. This includes changing rotor vanes. Contact with a rotating mechanism can cause entanglement that can lead to death. A truck that begins to roll is a crushing hazard that can lead to death.

WARNING

Wear protective gloves, eye protection, and appropriate clothing when working with sewage effluent or septage. These materials may contain hazardous chemicals, disposed of through the drain, which can cause sever injury or even death due to contact. These effluents also contain bacteria that can be a source of infection, especially if exposed to open cuts or sores.

■ IMPORTANT

When replacing rotor vanes, be sure to have replacement gaskets, O-rings, and seals on hand in case any of these items should need replacing and/or be damaged during disassembly.

Changing the rotor vanes includes the following general steps:

1. Drain and remove the oil tank from the pump.
2. Remove the oil pump (Note: on some pumps the oil pump and mounting flange may be removed as one unit—see your OEM instructions).
3. Remove the oil pump mounting flange or housing.

■ IMPORTANT

The rotor bearings will usually remain pressed into the mounting flange upon removal. Be careful when pulling the bearings free of the rotor shaft that the rotor does not fall inside the pump housing. It may be necessary to provide a means of support for the rotor, such as a block of wood under the rotor shaft.

4. Remove the end plate from the pump.
5. Remove old vanes and replace the new vanes that have been dipped in oil.

■ IMPORTANT

Always replace vanes in sets.

6. Before reassembling, inspect the rotor bore, bearings, seals, and gaskets, and replace as necessary. Seals should be soft and pliable, gaskets should not be torn, and bearings should turn freely.
7. Reassemble the pump in the reverse order of disassembly.

Table 1.8 High Vane Wear Operating Conditions

The conditions below will reduce vane life and necessitate more frequent vane wear checking.

- Fine grit in intake air (e.g. sand, rust, or soil dust particles)
- Many long intervals of operation *
- Many intervals of high Hg. Operation * (e.g. as when required to lift product a great distance).
- Consistent use of pressure dumping
- Running the pump dry of oil
- Using the wrong oil in pump (use only manufacturer recommended oil in your pump).
- Any situation in which the pump overheats
- Lack of periodic pump flushing maintenance
- Lack of pump flushing maintenance after water has entered the pump.
- Attempting to engage a pump that is frozen with ice (before thawing the pump completely)

Table 1.9 Trouble Shooting Vacuum /Pressure Pumps

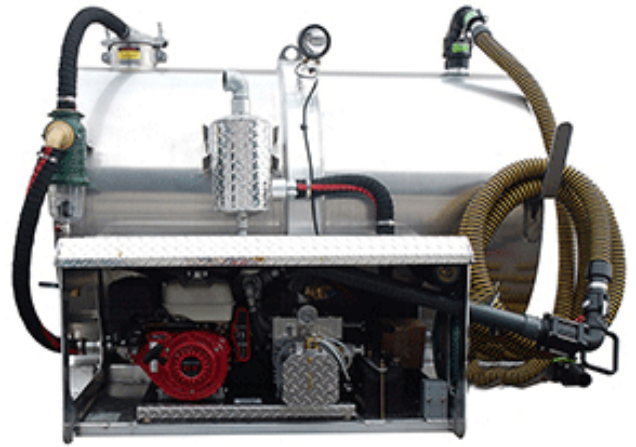
SYMPTOM	CAUSE	SOLUTION
ROTOR DOES NOT TURN	Broken vanes (due to foreign objects or lack of lubrication)	Disassemble, clean well, change vanes, check oil level, and check float on tank
	Frozen pump due to ice	Take slide-in unit into warm area and thaw out
	Frozen pump due to corrosion	Take pump apart and replace necessary parts
	Problem in the drive train	Check driveline, reduction gearbox, and couplings for mal-
	Pump endplate bolts too tight (and in effect caus-	Loosen the bolts
PUMP IS NOT GETTING OIL	Not enough oil in housing	Fill rear housing
	Oil weight too heavy	Check for correct oil weight per table 3.1
	The oil line is blocked	Remove and clean
	The filter on the oil pump is blocked	Remove and clean
	The oil pump piston is jammed on the bushing	Remove oil pump and examine spring and piston
	The oil pump worm gear is out of alignment	Remove rear cover and re-align oil pump
PUMP OVERHEATS	Not enough oil in pump	Fill oil tank
	Oil flow rate set too lean	Readjust the drip rate of the oiler
	The pump isn't receiving lubrication	Check to make sure the oil pump is working
	Incorrect oil type or oil weight used in pump	Replace oil in pump with OEM recommended oil.
	RPM too high	Reduce RPM
	The pump operation interval is too long, or the	Stop the pump and let it cool
PUMP CONSUMES TOO MUCH OIL	Oiler set too rich	Re-adjust oiler per instructions in OEM pump manual
	Oiler set light	Replace oil with correct weight per OEM pump manual
	Pin in drip oiler not seating	Clean the related seat
LITTLE OR NO VACUUM PRESSURE IN TANK	Control handle in the neutral position	Place the control lever in the "vacuum" position
	Primary shutoff seal leaking	Clean or replace the seal
	Pump rpm-s not high enough	Run pump up to OEM recommended rpm
	Worn vanes	Replace vanes
	Vacuum line between pump and tank blocked	Remove blockage from line
	Intake/Suction line blocked	Remove blockage from line
	Valve, gasket, or pipes leak on tank	Locate and repair leaks
	Vacuum or pressure relief valves leaking and/or set too low	Repair or reset valve (WARNING: DO NOT set pressure or vacuum relief valves above the maximum settings listed on pages xx & XX of this manual)

Table 6.1 Styles of Slide-In Units



SC Model—Rear Engine (RE)

- Flat Head Model
- Tank-in-a-tank Design
- Rear Engine



SC Model—Side Engine (SE)

- Flat Head Model
- Tank-in-a-tank Design
- Side Engine

SC Model—Transverse Engine (TV)

- Flat Head Model
- Tank-in-a-tank Design
- Transverse Engine
- Dual Service Standard



FD Model—Rear Engine (RE)

- Flanged and Dished Heads
- Side-by-side Design
- Rear Engine



FD Model—Side Engine (SE)

- Flanged and Dished Heads
- Side-by-side Design
- Side Engine