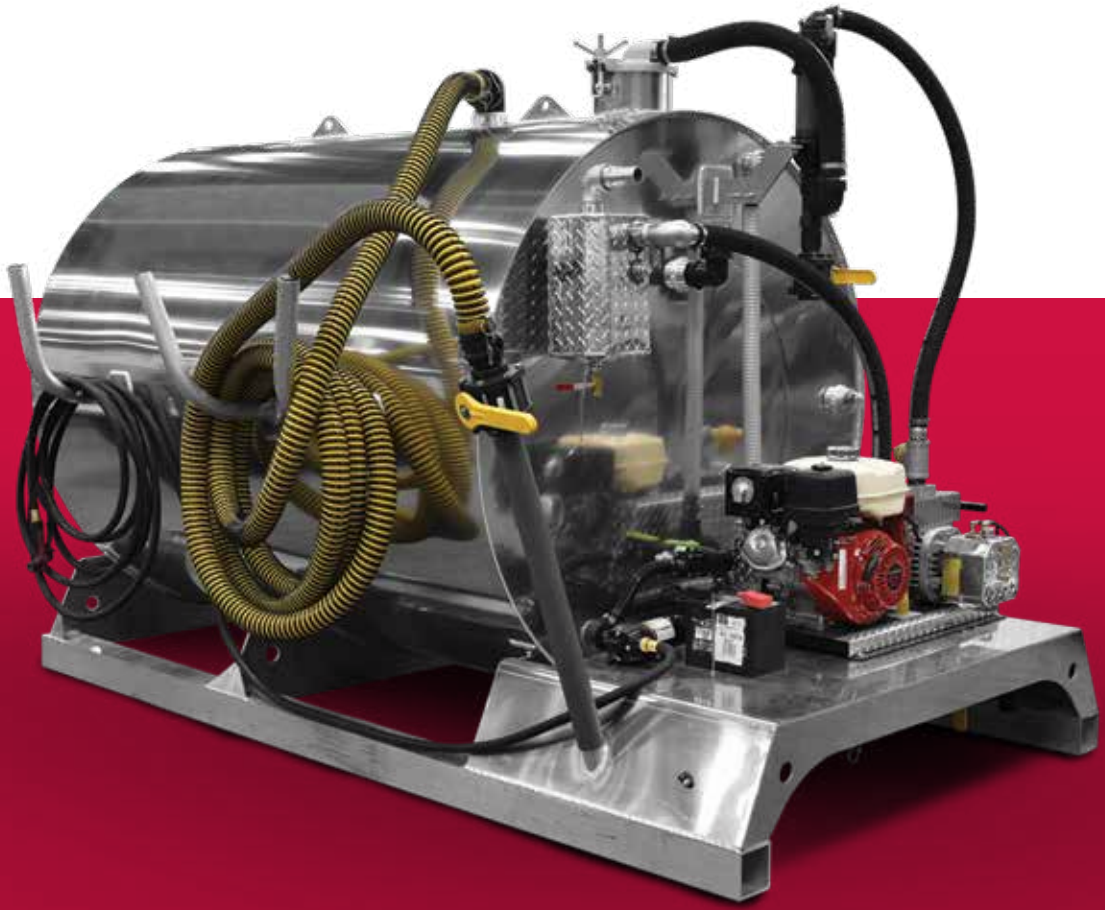
SLIDE-IN VACUUM TANK OPERATOR'S MANUAL

Vol. 1 January, 2024



SATELLITEINDUSTRIES.COM | PARTS.SATELLITEINDUSTRIES.COM | INFORMATION@SATELLITEINDUSTRIES.COM | 1.800.883.1123

TABLE OF CONTENT

TO THE PURCHASER

01

TO THE PURCHASER

Congratulations on your purchase of a Satellite product. To ensure years of dependable service, please follow this manual's proper operating and maintenance instructions and familiarize yourself with your slide-in equipment before operation. This guide has important information about properly using and caring for your device. It has safety tips, setup instructions, details on operating it, and even troubleshooting advice. And to make things easy, each section is clearly labeled so you can find what you need in a snap.

WARNING

Study this manual and read all warnings before operating or maintaining your slide-in vacuum tank and any components. It is imperative that the instructions outlined in this manual be strictly adhered to in order to avoid any potential for serious injury or death. Only operate this equipment if you have read and understood the safety and operating instructions. Also, DO NOT allow any other person to operate this equipment if they have not read and understood the safety and operating instructions.

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

Please make sure to record the model number, serial number, and purchase date on page 1 of the manual for any future part orders. This will ensure that you have all the information you need to easily order any necessary replacements. The warranty for your vacuum tank can be found on the last page of this manual. It's important to read it carefully so you can know what's covered, what's not covered, and any limitations that may apply.

Date Of Purchase: _____

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 the time of printing.

Satellite is not responsible for improperly installed slide-in units or any damage resulting from such installations. Users must ensure that all equipment is installed according to the manufacturer's guidelines and industry standards. Failure to properly install, maintain, or use the equipment may void the warranty and result in unsafe operation. Satellite is not liable for any injuries, damages, or losses caused by unauthorized modifications or misuse of its products. It is the user's responsibility to maintain the equipment in a safe and operational condition and to be aware of all relevant safety regulations and procedures.

SAFETY PRECAUTIONS

02

SAFETY PRECAUTIONS

As you go through this manual and see the warnings on the machine itself, you'll notice that they're always followed by important information instructions. We want to make sure you're safe while installing, operating, and maintaining this equipment, read and understand 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 the safety of those working with you.

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

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, will result in death or serious injury.

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

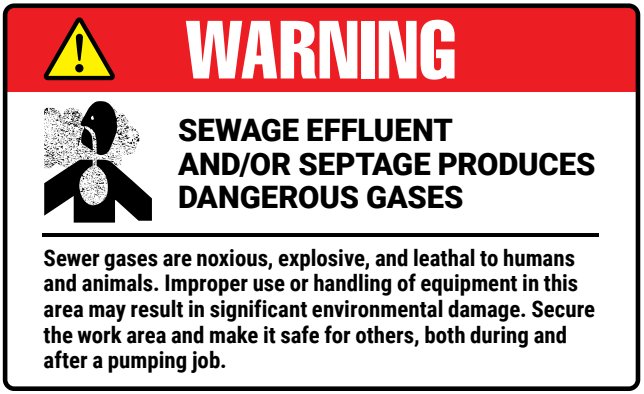
NOTICE: Indicates a possibly dangerous situation that, if not avoided, could result in damage to equipment.

IMPORTANT: Indicates helpful information on the operation of equipment.

GENERAL SAFETY PRECAUTIONS

It's always important to make sure you and your colleagues are being safe when using industrial equipment. Taking care and being cautious is the best way to avoid any accidents. So, let's be careful out there!

Safety Precautions for Handling Effluent



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 from the discharge valve when tank pressure is released.

DANGER: DO NOT inhale sewer gas! Inhaling sewer gases can cause severe injury or death.

WARNING: DO NOT allow children, irresponsible people, or unauthorized persons near your work area or equipment. Make certain everyone is clear of the 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 who enter this area.

PPE WARNING: Sewage and wastewater contain bacteria, fungi, parasites, and viruses that can cause disease. While handling sewage or wastewater effluents, sewage workers may be exposed to a variety of these disease-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-s:

EXPLOSION WARNING: DO NOT smoke due to explosion potential

PPE WARNING: DO NOT eat or drink while 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 workday.

The Portable Sanitation Association International (PSAI) recommends rubbing your hands together for at least ten to 15 seconds after working 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 personal protective equipment such as coveralls or a water-resistant suit, water-proof gloves and boots, respirators, safety glasses, goggles, and face shields.
- Properly store, clean, or dispose of contaminated personal protection equipment.
- Keep all cuts and wounds covered with clean, dry bandages and protect them from exposure to sewage effluent.
- Change out of your work clothes and boots before leaving work; DO NOT wear them home. DO NOT keep your dirty work clothes with your own or your family's clothes. Wash your work clothes separately in hot water.
- The CDC (Center for Disease Control) and the Building and Construction Trades Dept. 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 abreast of any Hepatitis A outbreaks in your area, and contact your doctor about 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 foodborne 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 example, a CDC survey after the Midwest floods of 1993 found E. coli in 11.1% of the samples collected from more than 5500 domestic wells. In identifying potential contamination sources within 100 feet of the wells, the CDC found 47.1% of it coming from septic systems, according to Homer Emery, Ph.D., in Coli form bacteria, biosolids, and health risks, October 2000, the Pumper.

Knowing that E. coli can be present in sewage effluent must signal to sewage workers that they must wear PPEs and wash their hands thoroughly before eating, drinking, or smoking.

- 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 - according to the hazard alert released by the Center to Protect Workers' Rights (which is the research and development institute of the Building and Construction Trades Dept., AFL-CIO) titled Biological Hazards in Sewage and Wastewater Treatment Plants ©2000.

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

National Center for Infectious Diseases (NCID) at (https://www.cdc.gov/ddid/centers.html) National Institute for Occupational Safety and Health (NIOSH) at (1-800-232-4636 or https://www.cdc.gov/niosh/index.htm)

OSHA (1-800-321-OSHA or www.osha.gov)

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

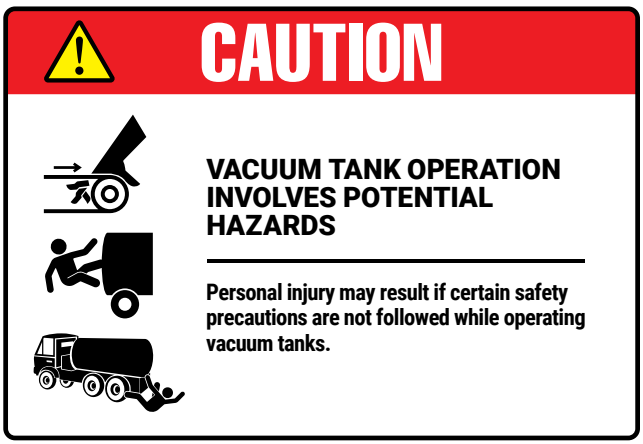
Safety Precautions for Confined Spaces

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

WARNING: DO NOT attempt to enter the tank of a portable slide-in unit. The hatch is intended to provide reach-in access for cleaning only.

DANGER: DO NOT place your face or head into the tank when reaching into the space. These tanks are not designed to permit entry; any attempt to enter them could result in serious injury or death.

Safety Precautions for Operating Equipment



DANGER: A truck that begins to roll is a crushing hazard that can lead to death. Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing any components on your slide-in unit.

DANGER: Ensure the gas engine on your slide-in unit is shut off before servicing the vacuum pump. Contact with a rotating mechanism can cause entanglement that can lead to death.

MOVING MACHINERY WARNING: Keep hands, feet, hair, and clothing away from moving parts. Contact with a moving mechanism can cause entanglement, leading to dismemberment or death.

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

WARNING: When the tank capacity is full, the truck's cornering and braking abilities are reduced. Drive reasonably when tank is full; reduce speed on rough or hilly terrain before making an anticipated stop and when cornering.

WARNING: DO NOT allow anyone to ride in the bed of the truck when the slide-in unit is installed in it. 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.

HIGH PRESSURE WARNING: 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.

BURN WARNING: 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 the pump and the working conditions. Contact with a hot vacuum pump can cause severe burns.

HAZARD KEY

- **PPE WARNING**
- **EXPLOSION WARNING**
- **MOVING MACHINERY WARNING**
- **UNSECURED LOAD WARNING**
- **SHOCK WARNING**
- **HIGH PRESSURE WARNING**
- **BURN WARNING**
- **SLIPPERY SURFACE WARNING**
- **BIOHAZARD WARNING**

SPECIFICATIONS

03

SPECIFICATIONS

General SPECIFICATIONS FOR YOUR PORTABLE SLIDE-IN UNIT ARE LISTED IN Table 2.1 below.
All dimensions are given in inches.

Table 2.1 Slide-in Specifications

MODEL	MAL 300	MAL 450	MAL 550	MAL 650	MAL 900
Waste Capacity	200 gal	300 gal	370 gal	430 gal	600 gal
Fresh Capacity	100 gal	150 gal	180 gal	220 gal	300 gal
Material	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Overall Length	88.25"	94.625"	88.25"	101.25"	101.44"
Skid Width	48"	48"	52"	52"	59.5"
Overall Height	57.5"	57.5"	64.375"	64.375"	74.42"
Empty Weight	1,000 lbs	1,250 lbs	1,400 lbs	1,500 lbs	1,900 lbs
Aproximate Loaded Weight	2,520 lbs*	3,764 lbs*	4,601 lbs*	5,460 lbs*	7,560 lbs*
Engine	Honda or Kohler	Honda or Kohler	Honda or Kohler	Honda or Kohler	Honda or Kohler
Vacuum Pump	Conde or Masport	Conde or Masport	Conde or Masport	Conde or Masport	Conde or Masport
Water Pump	Flojet 4300 (or similar)	Flojet 4300 (or similar)	Flojet 4300 (or similar)	Flojet 4300 (or similar)	Flojet 4300 (or similar)
Inlet Coupling	2" Cam Lock	2" Cam Lock	2" Cam Lock	2" Cam Lock	2" Cam Lock
Outlet Coupling	3" Cam Lock	3" Cam Lock	3" Cam Lock	3" Cam Lock	3" Cam Lock

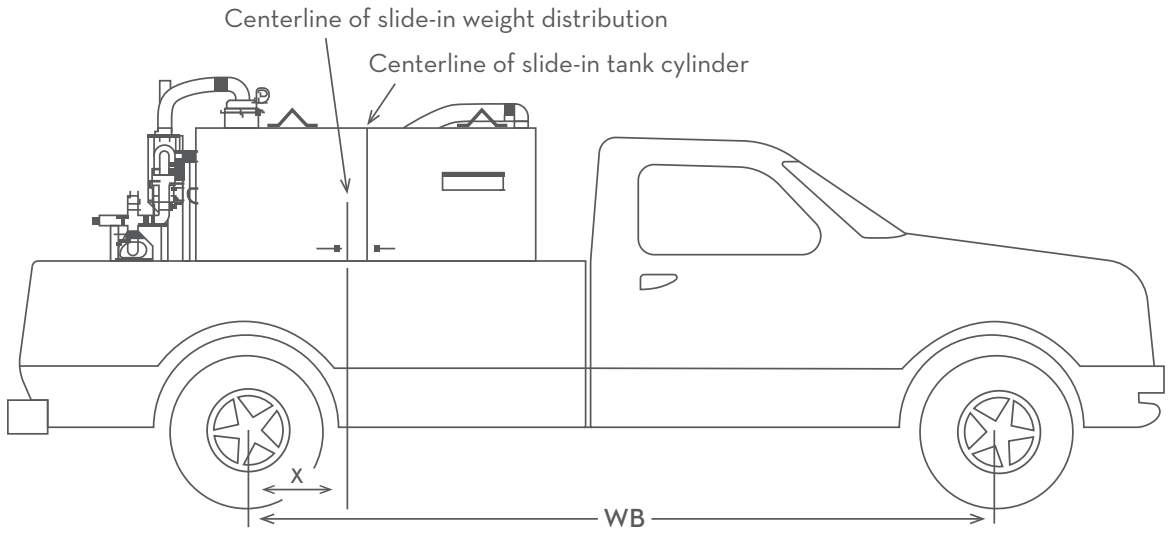
*Note: Loaded weights are based on a full septic compartment and a 1/4 full fresh water compartment (under normal operating conditions, both compartments will not be full simultaneously).

SET UP

Once your slide-in unit arrives, you'll be happy to know it's fully assembled and ready to use with just a few steps to get started. All you'll need to do is lift and secure the unit in your truck bed, connect the battery cable to start the engine and install the vacuum/pressure gauge. It's that easy!

04

Figure 2.1 Calculating GAWR. Note: Total slide-in weight includes combined weight of unit and the liquid inside it



$$\frac{\text{Total Slide-in Weight(lbs)} \cdot X}{WB} = \text{Added weight on front axle}$$

Total Slide-in Weight(lbs) - Added weight on font axle = Added weight on rear axle

**This diagram for 300 and 450 modules only.

Vehicle Weight Requirements

WARNING: DO NOT exceed your vehicle's Gross Vehicle Weight Rating (GVWR) or the Gross Axle Weight Rating (GAWR) when carrying your portable slide-in unit. Exceeding the GVWR or the GAWR of your vehicle can cause damage to the vehicle.

DANGER: Exceeding the GVWR or the GAWR of your vehicle can impede the vehicle's braking performance, which can cause traffic accidents and, or severe injury or death to others.

Before setup, be sure that the truck you use to carry your slide-in unit has a Gross Vehicle Weight Rating (GVWR) and a Gross Axle Weight Rating (GAWR) high enough to handle the combined weight of the slide-in unit and the liquid inside it. Exceeding the GVWR or GAWR of your truck could damage it. More importantly, exceeding these ratings could impede your ability to brake safely. In addition, federal DOT regulations prohibit a vehicle that exceeds its GVWR or GAWR from operating on public roadways. The GVWR of your truck minus its base weight equals the total vehicle payload that can be carried. The surest way to verify the maximum payload a given vehicle can carry is by having your truck weighed at a certified scale.

As a note of caution, the advertised payload weight for a particular truck may not be the actual load you can carry. Advertised payloads often don't consider the weight of options such as automatic transmissions that can add up to 100 pounds to your vehicle. In addition, the advertised payloads may not consider the weight of passengers and gear (such as tools) being carried. Failure to consider these factors may lead to your truck being deemed overweight during a roadside weight check. A certified scale can provide an accurate base weight of your vehicle, accounting for all weight-varying factors. Once the base weight of the vehicle is known, subtract this from the GVWR of your truck to give the payload weight that can be carried. The payload capacity must be equal to or greater than the weight of the slide unit (and all liquid inside it) you wish to carry. Loaded and unloaded weights of the various slide-in units can be found in the specifications table on page 10.

To determine if the GAWR of your truck can handle the load of a liquid-filled slide-in unit, first, obtain the weights of the vehicle with just the front tires on the scale and then with just the rear tires on the scale. Note that the approach and exit to the scale must be level with the surface for these weights to be accurate. An inclined approach will shift the weight toward the rear axle when the front wheels are on the scale, skewing the weight readings. Next, take measurements to determine where the slide-in unit will be positioned in the truck bed. With the unit's position determined, measure the center of weight for the slide-in as per Figure 2.1. Use this measurement in the formula in Figure 2.1 to calculate the weight added to each axle when carrying your slide-in unit (reference the loaded and unloaded weights of the slide-in units in the specifications table on page 7). The scaled weight plus the added weight provided by the slide-in unit must remain with the GAWR.

Lifting Slide-In Unit into Truck

WARNING: Operating or lifting slide-in unit improperly can result in serious personal injury. Always follow safety guidelines, use proper lifting techniques, and ensure the unit is secure before handling. Use protective gear as required.

Use a hoist with at least a one (1) ton capacity rating to lift your slide-in unit into the truck bed. To rig for lifting, fasten the hoist chains to the built-in lift hooks on the slide-in unit (Figure 2.2).

Figure 2.2 Hoisting Slide-in Unit for Installation in truck bed

Securing Slide-In Unit to Prevent Sliding

DANGER: Slide-in installations will vary based on the specific vehicle model. Failure to install the tank correctly can result in serious injury or death. It is essential to follow all installation instructions and safety guidelines. Professional installation is highly recommended.

After lifting the slide-in unit into the truck bed, fasten it securely to prevent sliding. If allowed to slide, the slide-in

unit can wear on the bed floor and crash into and break the tailgate. Satellite Industries recommends using the optional Mounting Kit to fasten your slide-in unit through the truck bed to the truck frame. The Slide-In Mounting Kit requires that holes be drilled into the truck's frame. Because the frame is the truck's backbone, proper frame integrity must be maintained when attaching components or equipment.

Observe the following precautions when making any alterations to your truck frame:
Avoid applying heat to the frame with a torch or any other such equipment.
Avoid welding on the frame.
DO NOT use a torch to cut holes into the frame.
DO NOT cut notches in the frame rails.
DO NOT drill holes in the frame rail flanges; drill holes only in the web area of the frame. New holes should be drilled as close as possible to the neutral axis of the web (halfway between the flanges) or on the same horizontal line as adjacent holes.

If you're unsure about drilling your truck's frame for bracket attachment, it's always a good idea to reach out to your local dealership for advice. They can help you obtain a body builder's guide with specific recommendations for alterations, which will give you peace of mind and help you make the best decisions for your vehicle. Following all relevant precautions, use the procedure below, while referring to Figure 2.3, to install the mounting kit:

Determine an area of the frame to which the lower mounting brackets can be bolted. The positioning of these brackets will have to consider frame braces and

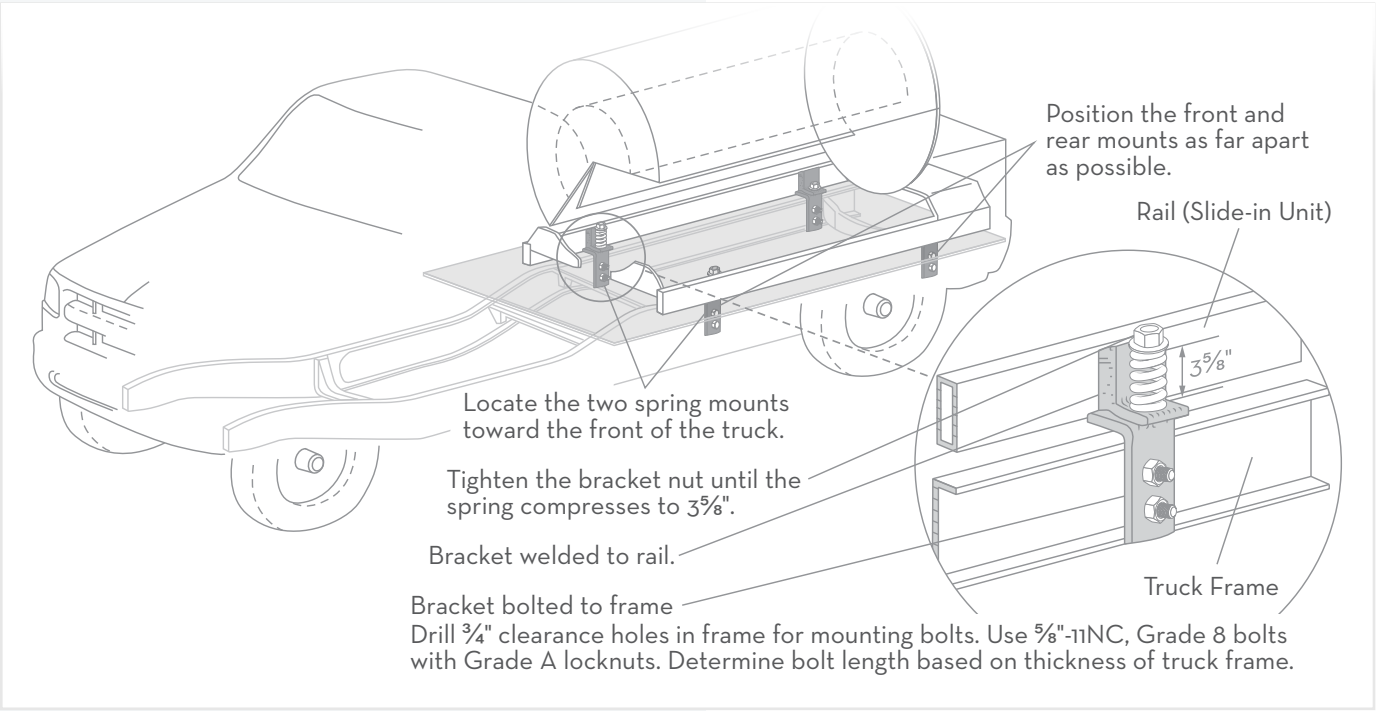


Figure 2.3 Slide-in Tank Mounting Kit

other frame-mounted components. Place the mounting points as far apart as possible (within the length of the slide-in rails) while locating them in an area with enough space for drilling and bolting through the truck frame.

Position the brackets against the frame so that the top face of the bracket angle is about level with the top of the frame. Ensure adequate clearance between the top of the bracket and the underside of the truck bed to allow for the normal flexing of the truck. After determining the position of the brackets, drill two 11/16" clearance holes in the long leg of each bracket. Then, using the brackets as a template, mark the hole locations and drill 11/16" diameter clearance holes through the truck frame.

Bolt the lower brackets to the truck frame using 5/8"-11NC grade 8 bolts. These bolts are not included in the mounting kit and must be purchased in the correct length for your specific installation. Use 5/8"-11NC crown locknuts with these bolts. Fasten the brackets to the outside of the truck frame rails with the short leg of the bracket pointing outward (Figure 2.3).

Next, using the hole in the short leg of the bracket as a guide, drill an 11/16" diameter clearance hole up through the truck bed. Be careful when drilling up through the thin gauge metal of the truck bed. If possible, grind a sheet metal drilling point on the drill bit. Otherwise, use a center-drill, then step up to the final hole size using several drill bits.

EXPLOSION WARNING: Before welding, make sure the cap on the engine gas tank is affixed tightly, disconnect the battery terminals (Figure 2.4), and attach the ground cable of the welder as close as possible to the welded area.DO NOT perform welding if gas fumes are present.

Figure 2.4 Battery Connection

The next step involves welding the upper brackets to the slide-in rails. Take the appropriate precautions before performing this welding. This includes making sure the cap on the engine gas tank is affixed tightly, disconnecting the battery terminals, and attaching the ground cable of the welder as close as possible to the welded area. Be on the alert for spilled gasoline or gasoline fumes. DO NOT weld if either of these is present.

From the top side of the truck bed, confirm the measurements for the hole locations and transfer these to the slide-in unit rails. With the locations verified, clamp the upper brackets to the rails so that the bottom of the short leg face is slightly above level with the bottom of the rail. Ensure there is at least a slight clearance between the bracket and the truck bed. Then, weld the upper brackets to the slide-in rails.

After the top brackets are welded to the rails, lift the slide-in unit into the truck bed using the procedure outlined in the previous section. To finish assembling the mounting kit, place 5/8" bolts purchased to the correct length for your installation through the frame bracket, the clearance hole in the truck bed, and the top bracket.

Fasten the two springs included with the kit over the two front-most bracket bolts using 5/8" flat-washers and crown locknuts. Compress the springs to a measurement of 3/8". The rear brackets do not use springs and use a shorter bolt length. Use 5/8" washers and crown locknuts on these bolts and tighten them securely. With your slide-in unit bolted in using the mounting kit brackets, you can safely transport your unit without the danger of sliding it around in the truck bed. When you need to use your truck for other tasks, simply unbolt the slide-in unit and lift it out of the truck.

UNSECURED LOAD WARNING: Before transporting your slide-in unit, ensure it is securely fastened into the truck bed to keep it from sliding. If not fastened, the unit can crash into and break the tailgate and possibly fall from the truck, causing a traffic accident and severe injury or death to persons in the area.

Electrical Setup

SHOCK WARNING: Improper installation of the slide-in unit can result in electrical shock. Always disconnect the power source before installation and ensure all electrical connections are properly secured. Failure to follow these instructions can cause serious injury or death. Professional installation is recommended.

Your portable slide-in unit comes with a 12-volt battery for powering the electric start gas engine and the motor for the water pump. Connect a charging wire from the truck's battery to the slide in units battery to allow for the electric pump to operate without draining the slide in units batter. In addition, check the 15 amp system fuse to ensure it has not been damaged during shipment (Figure 2.5).

Vacuum / Pressure Gauge Setup

Both the vacuum relief and the pressure relief have been set at the factory for proper operation.

Figure 2.5 System

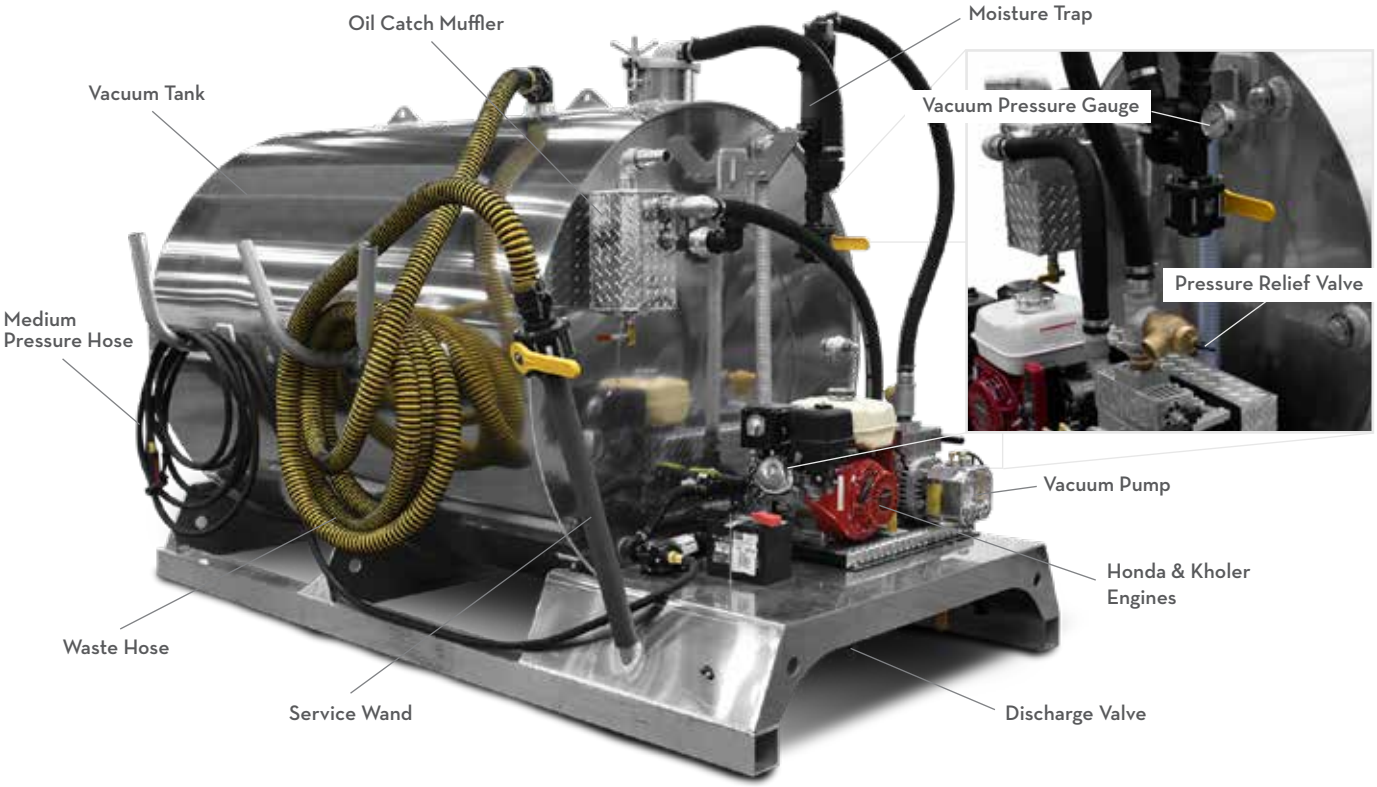


Figure 3.1 Main Components of the Portable Slide-in Unit

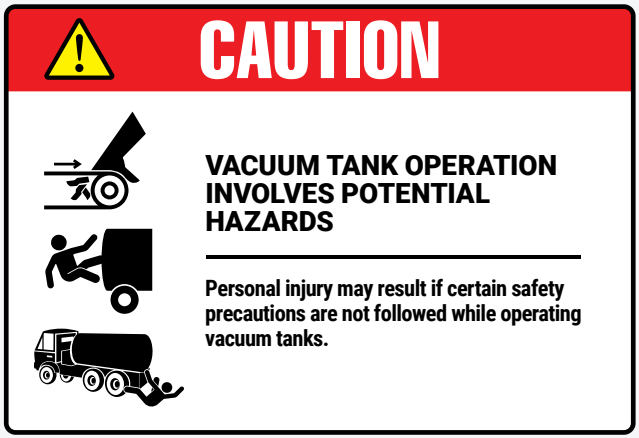
OPERATION

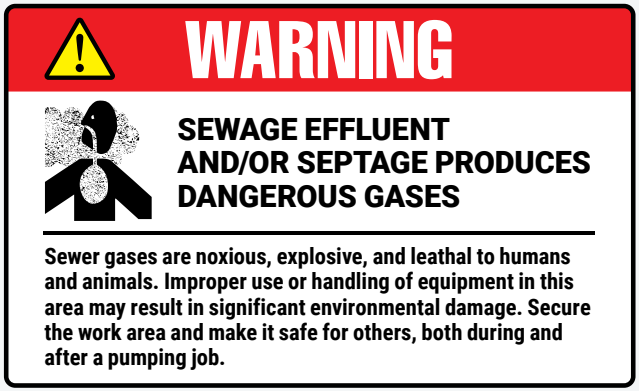
You'll find Figure 3.1 to be a helpful reference as you get acquainted with the main components of your Portable Slide-in Unit. This illustration will prove useful for future reference as you navigate the various elements of your slide-in, which are detailed throughout the manual.

05

Operation Safety

When using your portable slide-in unit to pump septic effluent, it's crucial to follow safety precautions. The manual provides helpful guidance on how to do so. Hazards frequently encountered in pumping include dangerous chemicals, exposure to bacteria, explosive atmospheres, falls, high-pressure water jets, rotating drive lines, and poisonous gases. Because each pumping job is unique, you may also experience other hazards. When dangerous situations arise, you must ensure that no harm occurs to persons, equipment, or the surrounding environment. Ensure that your job site is secured and safe for others both when you do the job and when the job is complete.





Vacuum Relief Valve

HIGH PRESSURE WARNING: Improper operation of the vacuum pump can lead to injury due to high-pressure hazards. Always follow the manufacturer's operating instructions and safety procedures. Failure to do so may result in serious injury or equipment damage.

The vacuum relief valve serves to safeguard against vacuum pump damage. It is located in the airline circuit just above the vacuum pump (Figure 3.1). The vacuum relief valve is factory set to 18"/Hg. This is the maximum continuous vacuum rating (MCVR) of the vacuum pump. This vacuum level also generates the recommended maximum limit on horsepower draw for the engine. If you notice that the vacuum relief valve is not relieving the vacuum when your tank reaches 18"/Hg, you might 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 adjusting.

2) Run the pump in the vacuum mode and check if the valve opens at the MCVR as listed above.

3) Repeat steps one and two until you attain the proper setting.

NOTICE: DO NOT run your vacuum pump above the manufacturer's maximum continuous vacuum rating. Exceeding the maximum vacuum rating could cause damage to the pump and unit.

Pressure Relief Valve

A pressure relief valve is located in the airline circuit next to the vacuum relief valve (Figure 3.1). This valve serves to prevent damage to the tank and motor. It opens to release air when the pressure exceeds 5 psi. 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 above pressure, reset it. Exceeding the recommended 6 psi to 8 psi pressure can create excessive horsepower draw on your engine, causing it to overheat.

CAUTION: DO NOT exceed a maximum pressure of 6 to 8 psi with your vacuum tank. Exceeding the pressure can cause the engine to overheat, which could damage equipment. Use the following procedure to set the pressure relief valve:

1) Purge all air from the tank by slowly opening the rear dump valve. Stand off to the side of the valve to prevent possible injury from the direct flow of releasing pressure.

2) After purging the air tank, loosen the setscrew 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. Re-tighten the setscrew after adjusting.

3) Run the vacuum pump in the pressure mode and check if the valve opens at the specified setting above.

4) Repeat steps one through three until you attain the proper setting.

Vacuum / Pressure Gauge

A vacuum/pressure gauge is located on your tank

Figure 3.2 Vacuum / Pressure Gauge

(Figure 3.1). As the gauge needle moves counterclockwise of zero, the indicator 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 3.2). Use the gauge to determine when the tank has reached operating vacuum or pressure.

Moisture Trap (Secondary Shutoff)

The moisture trap (also referred to as the secondary shutoff) serves as a safety device to prevent liquid from entering the vacuum pump. Check the moisture trap daily for the accumulation of fluid. Use the easy-access drain valve to empty the trap. The drain is located at the bottom of the moisture trap. While the moisture trap helps prevent liquid from entering the pump, excess accumulation may indicate that some contamination has passed into the pump. When excess liquid is in your moisture trap, clean your vacuum pump using the procedure on page 25 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.

Oil Catch Muffler

The oil catch muffler collects oil expelled from the vacuum pump, reducing 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 muffler more frequently when subjecting the pump to heavy use. Properly dispose of the used oil. DO NOT reuse it. Furthermore, anytime you notice that water has collected in the oil catch muffler, dry out the vacuum pump interior using the procedure outlined on page 25.

Sight Glass

Your portable slide-in unit has a sight tube and a fill indicator (Figure 3.4). The sight glass displays the septic fluid level in sewage compartment. The sight tube shows the liquid level in the freshawter compartment.

Figure 3.4 Sight Glass

Load and Dump Valves

Your slide-in unit has manual load and dump valves (Figures 3.5 and 3.6). Use the handle mounted to each valve to open and close it. Both the load and the dump valves are equipped with cam lock fittings to allow for easy coupling and uncoupling of the vacuum or discharge hose. There is a cam lock fitting cover for the dump valve. When the discharge hose is uncoupled, place this cover over the dump valve opening to keep dirt and debris from collecting. Because dumping arrangements vary widely from one operation to another, a discharge hose is not included with your slide-in unit. Based upon your specific requirements, procure the correct length of a 3" discharge hose and a 3" cam lock attachment to couple to the discharge outlet.

Figure 3.5 Cam lock Coupling & Load Valve (on load hose)

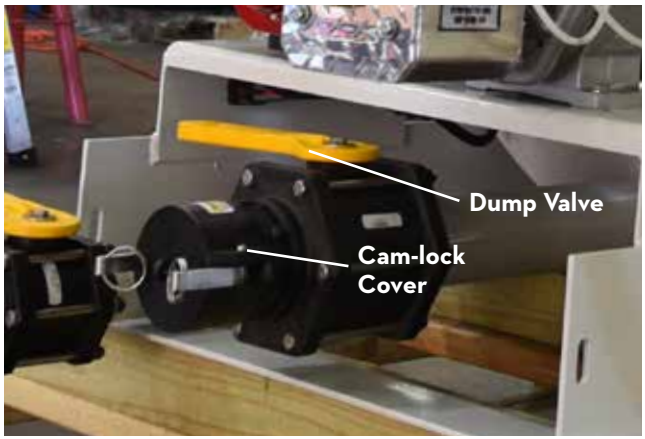


Figure 3.6 Dump Valve & Cam lock

Vacuum Pump

The OEM Operation Manual for your Masport HXL3V or Conde Model 6 vacuum pump is included in the literature packet you received with your slide-in Unit. Review and follow the operation procedures outlined in that manual. Satellite Industries furnishes the following information to provide a better understanding of your vacuum equipment. This information is intended to augment (not replace) the OEM instructions for your pump.

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

Safety Suggestions for Vacuum Pump

BURN WARNING: Improper operation of the vacuum pump may cause burns due to high temperatures. Follow all operating instructions carefully. Failure to do so can result in serious injury.

DANGER: 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 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 that the rotor shaft turns freely. This is especially important in cold weather to ensure the pump is not frozen with ice.

To verify that the rotor shaft turns freely, make sure that the ignition switch on the gas engine is in the off position, and then pull once on the starter rope.

Table 3.1 Vacuum Pump Recommended Oils – Pump Housing*

Masport and Conde Model 6		
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

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

Check the level of the oil reservoir. Use the dipstick at the rear of the pump (on the oil reservoir) to check the oil level. Add oil, as needed, through the dipstick port. The oil in the reservoir requires periodic refilling because the pump consumes oil in the process of lubrication.

Use only OEM-recommended types and brands of oil for your pump. Table 3.1 lists the manufacturer-recommended lubricants for the Masport HXL3V and Conde Model 6 vacuum pump supplied with your slide-in unit. If you need help obtaining manufacturer-recommended oil, contact Satellite about its availability.

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.

Vacuum / Pressure Control Handle

On your Masport HXL3V and Conde Model 6 vacuum pump, locating the control handle in the center of its travel will cause the pump to operate in a neutral free-flow mode. In addition, use the control handle to select either the vacuum or pressure modes. Figure 3.7 details the handle position in relation to the pump orientation for vacuum and pressure functions. You can also observe the vacuum/pressure gauge to verify your operating mode.

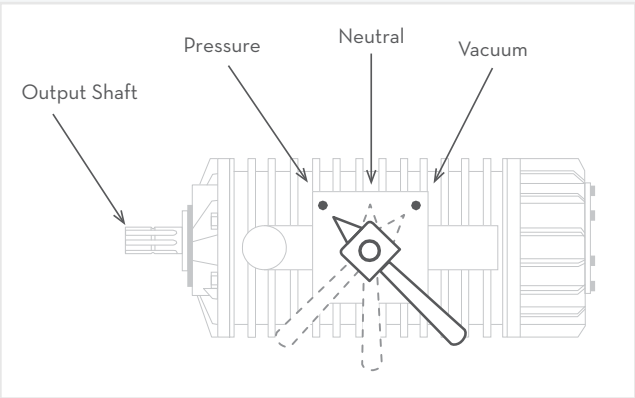


Figure 3.7 Handle Positions / Vacuum Pump

Vacuum Pump Operation

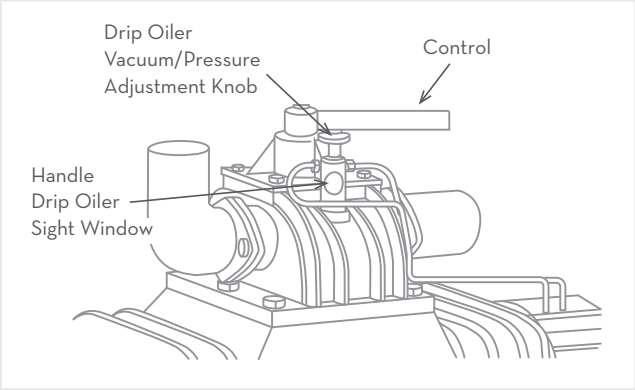


Figure 3.8 Vacuum Pump Drip Oiler & Vacuum/Pressure Control Handle

After performing the pre-startup procedure, you can operate your vacuum pump. An 8-hp Honda gas engine drives the Masport or Conde pump on your portable slide-in unit. Before starting the engine, position the vacuum/pressure control handle on the pump in the neutral position. Next, move the throttle lever on the gas engine away from the SLOW position, about 1/3 of the way toward the FAST position, and start the gas engine to put the pump into operation. Ensure the pump is running smoothly by listening for a pump sound with minimum vibration. If the engine is not running fast enough, the vanes in the vacuum pump rotor will not have enough centrifugal force to keep them expanded in the rotor slots. This will result in excessive vibration as the vanes move in and out in the rotor slots, and pound against the cylinder wall. In this case, increase the engine speed to eliminate the vacuum pump vibration and protect against vacuum pump damage. Finally, before using the pump to load the tank, actuate the vacuum/pressure handle to be sure that the pump is operating in each mode.

NOTICE: DO NOT run your vacuum pump at too slow a speed when starting it. If excessive vibration is evident, speed up the gas engine drive until the pump runs smoothly. Allowing the rotor vanes to pound against the cylinder wall by running too slowly will damage the vacuum pump.

NOTICE: If proper oiling is not achieved within a few minutes, shut down the pump and see the "Troubleshooting" section on page 42 or consult your sales representative.

Loading or Filling the Tank

With the pump in operation, use the following procedure to load the tank on your slide-in unit:

- Set the vacuum/pressure handle on the pump to the "vacuum" mode.
- Move the throttle control lever on the gas engine to about 3/4 of the way toward the FAST position (Figure 3.9). This will provide the recommended 1250 to 1300 rpm at the vacuum pump.

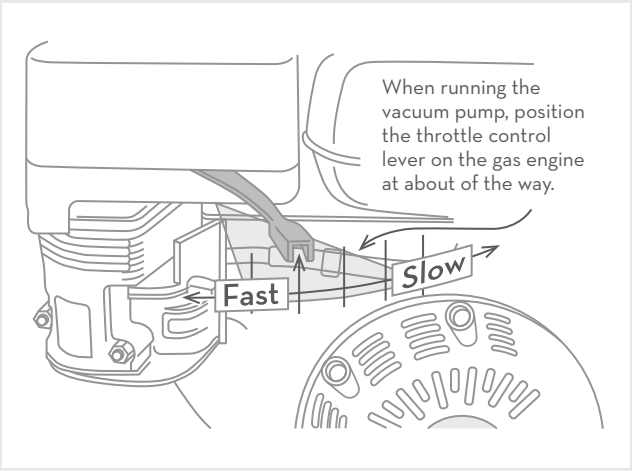


Figure 3.9 Throttle Control Lever Operating

CAUTION: Moving the throttle lever all the way open will result in about 1600 rpm at the vacuum pump. Because this is over the 1300 rpm, the pump is rated for; the engine throttle lever must be backed down just a bit from the full throttle position.

Ensuring the throttle on the gas engine is set to provide the optimal pump speed requires the operator's attentive observation. If the pump runs too slow, the vanes will make a clanking sound as they move in the rotor slots. If the pump is running too fast, it will overheat.

- Allow the vacuum to build to the desired level (usually about 15"/Hg), and then open the valve on the suction wand and load the tank.
- When the tank is full, close the fill valve and turn off the engine to shut down the pump.

Pay close attention to the fill indicator on your tank so that you can promptly shut down your vacuum pump when the tank is full. If you can't visually tell when the tank is full, listen for a sound change in the vacuum pump. When the tank is full, the primary shutoff stops airflow, creating a noticeable difference in the sound of the vacuum pump. Also, 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.

NOTICE: DO NOT operate the pump faster than the recommended rpm. Operation above the recommended rpm will cause the pump to overheat, damaging 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 the pump operation. At the point when either of the shut-offs activates, the pump is susceptible to overheating if kept running. This can damage your pump.

Mechanics of Pneumatic-Transport (transfer by means of vacuum)

A vacuum, as pertaining to the pumping of liquid waste, is a space with some air removed. 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.

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'

Table 3.3 Vacuum Levels vs Lift Height

The fluid 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. Your tank's dial-type pressure/ vacuum gauge (Figure 3.2, page 21) 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 3.3 lists the approximate vacuum levels required to lift water at a given distance. However, these figures must be adjusted to compensate for the weight of the material and the length and diameter of the suction hose being used. Effluent or sewage may often weigh more than water. Also, pumping these products through a hose induces friction. Both of these factors result in reduced lifting efficiency.

In addition, both attainable vacuum and 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 3.4 lists the percentage loss of attainable vacuum for every 1000-foot rise in elevation over sea level. While creating enough vacuum to handle pumping height, product weight, and hose friction is necessary, it is important not to overstress the pump. Pay close attention to your pump if it is required to operate at a high in./Hg vacuum level. Air-cooled pumps are especially vulnerable to overheating when operating at high vacuum levels for extended periods. Liquid-cooled pumps can handle this type of operation much more readily.

In addition, operation at high in./Hg levels can also result

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%

Table 3.4 Vacuum vs Elevation

in moisture condensation in the pump. As the vacuum increases, water evaporates from the liquid's surface in the tank. Anytime that vacuum pump operation exceeds 15"/Hg, water vapor can appear in the air circulating in the vacuum system.

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

Use the following procedure to dry the pump out:

1) Unload the tank (see page 27)

2) Open a load or dump valve (to keep from building vacuum)

3) Run the pump in vacuum mode for two to five minutes

Water allowed to remain in your vacuum pump can diminish performance and cause severe 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. In addition, water inside your vacuum pump can freeze during cold weather operations. Attempting to operate your pump if it is frozen inside with ice will cause damage.

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

IMPORTANT: After operating your pump at high in./Hg vacuum levels, dry the pump interior out using the procedure outlined above (see page 27). Water in your vacuum pump can cause sludge formation and freeze up in cold weather.

Unloading or Emptying

SLIPPERY SURFACE WARNING: Emptying the slide-in tank may cause spillage, leading to a slippery surface. Proceed with caution and ensure proper drainage to avoid accidents.

You have two options when unloading the tank on your slide-in unit: gravity or pressure dumping. Either method will effectively empty the tank; however, pressure dumping increases the 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) Place the pump into operation using the procedures in the pre-startup and operation sections on pages 16-18.

2) Set the pump's vacuum/pressure control handle to the "pressure" mode.

3) Move the throttle control lever on the gas engine to about ¾ of the way toward the FAST position (Figure 3.9, page 25).

4) Open the pump valve to begin unloading when the pressure reaches the desired level (up to the maximum psi on the pressure relief valve).

CAUTION: DO NOT exceed a maximum pressure of 6 to 8 psi with your vacuum tank. Exceeding this pressure can cause the engine to overheat, which could result in damage to equipment. After unloading the tank, stop the gas engine and close the dump valve. It is crucial to stop the engine before closing the valve to avoid pressure buildup in the system.

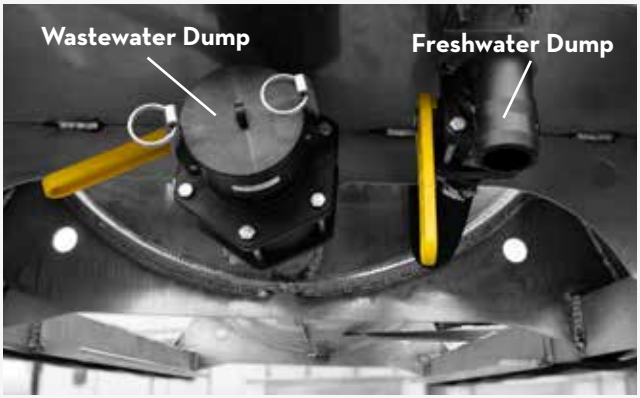


Figure 3.10 Wash Down System

Wash-Down System

BIOHAZARD WARNING: Wear 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.

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. Before operating the wash-down system on your slide-in unit, fill the water compartment through the freshwater inlet using a smaller diameter hose than the inlet opening (Figure 3.10).

CAUTION: DO NOT use a tight-fitting on the inlet because this will not allow the fill port to self-vent.

When using the pressure water pump, you will need to run the gas engine to provide a charge to the battery. Be sure to open the valve on the suction wand (load valve) and place the vacuum pump in the vacuum mode. This will allow air to flow freely through the vacuum pump, preventing it from overheating. With the load valve and vacuum pump set as instructed above, use the following procedure to operate your pressure water pump:

1. Make sure there is water in the slide-in fresh water compartment.
2. Start the gas engine and run at about 3/4 throttle (per the instructions on page 25).
3. Turn the pump start switch on (Figure 3.11). The pump does not require priming.
4. When the water tank is empty, promptly shut the water pump off to prevent overheating.

5) Shut the gas engine off to prevent overheating the vacuum pump.

Running the gas engine while using the water pump will help recharge the slide-in unit's 12-volt battery; however, the generator on the gas engine cannot keep up with the significant amperage drawn from the water pump. Additionally, the gas engine will also provide a charge to the battery when the sewage compartment is being filled (during which time the water pump is not in use). This will further add to the battery charge; however, large water pump demands can still deplete the battery.

When using the water pump frequently throughout the day, it is necessary to recharge the battery using a charger. Usually, this can be done at the end of the day to avoid interfering with normal operations. As an alternative, frequent high amperage demand on the water pump can be met by wiring the unit into your truck's electrical system. This is a relatively straightforward process requiring the following materials:

- Number 12 automotive wiring
- A 15 amp fuse assembly
- A toggle switch assembly

Install the new circuit for the water pump by splicing it into an unused auxiliary circuit under the dashboard. Most vehicles have some unused auxiliary circuits available for various vehicle options. Use a test meter to verify which line in the circuit has an amperage draw and which is the ground wire. Route the wiring from under the dashboard to the back of the truck, where the toggle switch will be located. Mount the toggle switch in a convenient location, such as on the weldment stand that supports the slide-in engine and pump assembly. Splice the fuse assembly into the wiring run to be in an accessible location. Then, wire the run to the newly installed toggle switch. Finally, attach the water pump wiring from the existing switch to the new one. The water pump will start when the truck ignition key is in the accessory position and the toggle switch is on. As an added note to pump operation, during cold weather (below 32°F), drain the liquid from your pressure water pump to prevent freezing and damage to the pump housing. In addition, drain all water lines and filters to protect them from freeze-up.

Required Lubrication	Lubrication Interval
Gas Engine – Check engine oil level	Every time before startup
Vacuum Pump – Grease front bearing at grease fitting	Per pump manufacturers recommendations or at a minimum every 4 hours of operation / daily
Vacuum Pump – Re-fill oil level in the rear housing	Per pump manufacturers recommendations or at a minimum every 4 hours of operation / daily
Reduction Gearbox – Check the oil level in the gearbox	Weekly
Gas Engine – Check transmission oil level	Weekly
Vacuum Pump – Change oil in the rear housing	To correspond with oil weight requirements for given air temperature

Table 4.1 Lubrication Intervals

WARNING: DO NOT use a tight-fitting on the freshwater compartment fill port. This port is designed to be self-venting and performs this function using your fill line of a smaller diameter. Failure to allow the vent to function can damage the tank and serious personal injury.

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 pump to thaw out.

Cold Weather Operation

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

Freezing weather can result in the formation of ice inside the vacuum pump due to residual moisture. If the pump freezes due to ice, take the truck into a warm area and allow the pump to thaw.

NOTICE: DO NOT use a blowtorch or other similar device to attempt to thaw a frozen vacuum pump. Frigid temperatures could also cause the dump or load valves to freeze shut. Hot water poured over a frozen valve should loosen the ice.

NOTICE: DO NOT use a blowtorch or similar device to thaw a frozen valve. This method could damage the valve.

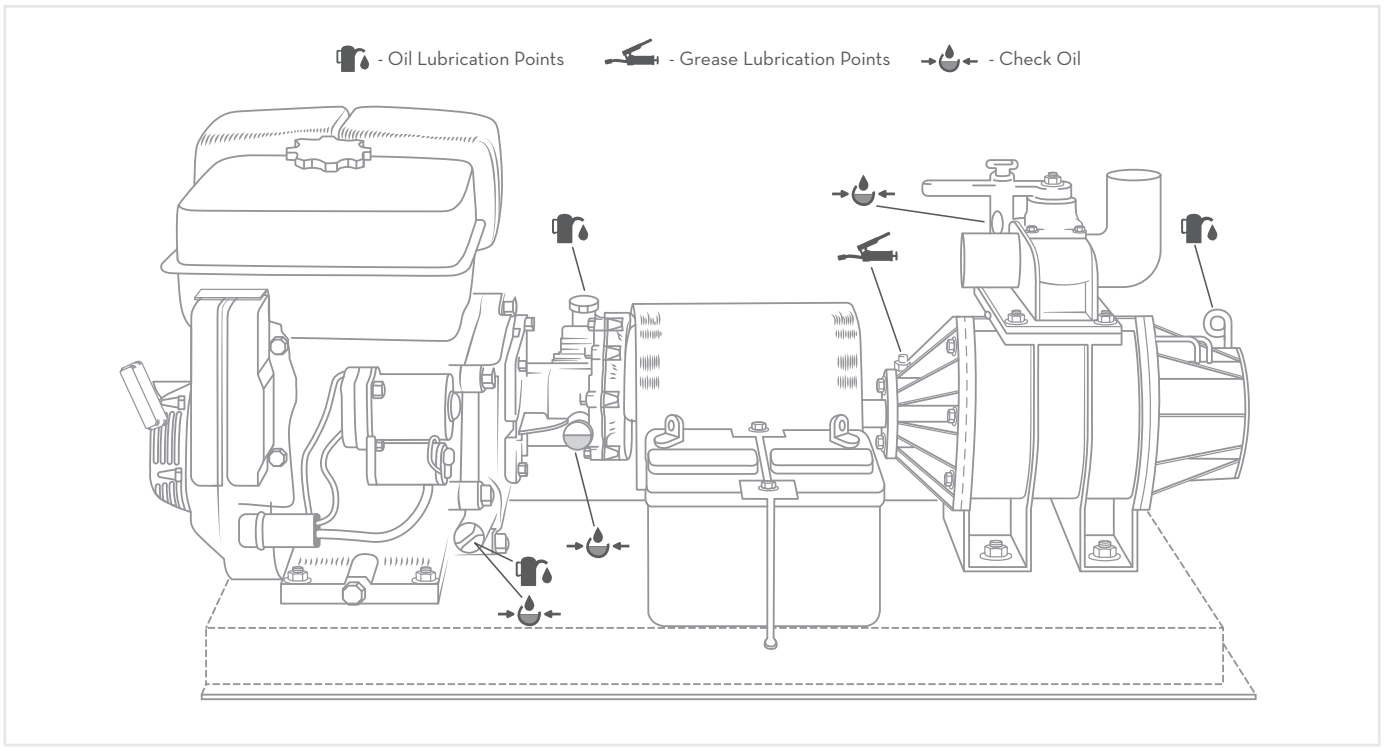


Figure 4.1 Slide-in Lubrication Locations

Note: See the maintenance subsections in this manual for specific lubricant types and lubrications intervals.

MAINTENANCE

06

Lubrication and Maintenance Intervals

Taking good care of your slide-in unit service is crucial for its safe and reliable operation. To help you out, we've included Figure 4.1 which shows the locations for lubrication, as well as Tables 4.1 and 4.2 that provide the recommended intervals for maintenance and lubrication. Also, we've outlined the necessary maintenance and lubrication procedures for each component in the following sections.

WARNING: Before performing any lubrication and maintenance, review and follow the "SAFETY PRECAUTIONS" on pages 4-7 and all safety precautions listed below.

Moisture Trap / Secondary Shut Off

It's important to keep an eye on the moisture trap and make sure to use the drain valve at the bottom to get rid of any liquid that's accumulated. Don't forget to do this daily. In addition to checking for liquid, inspect the ball seat and the fasteners every two weeks. Check all moisture trap fasteners and tighten them as necessary. Road vibration over time can loosen fasteners. Remove the moisture trap cover to examine the ball seat for hardened rubber, nicks in the rubber, and debris buildup. Any of these conditions may prevent proper sealing. Clean and replace the ball seat as necessary. Any time that excess liquid accumulates in the moisture trap, you should clean the inside of your pump. While the moisture trap helps prevent fluid from entering the pump, excess accumulation may indicate that some contamination has passed into the pump. Contaminates entering the pump (including effluent) is a major cause of pump failure. See page 34 for the vacuum pump cleaning procedure. In addition, clean and/or replace the ball seat in the primary shutoff any time excess liquid accumulates in the moisture trap. Excessive fluid in the moisture trap can often be traced to improper sealing of the ball seat in the primary.

IMPORTANT: Any time 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.

Primary Shutoff

Inspect the primary shutoff every two weeks to check the rubber ball seat and the tightness of all fasteners. First, to inspect the ball seat, remove the cap screws that fasten the primary shutoff access lid to the portal flange on the tank (Figure 4.2). After removing the fasteners, lift the entire shutoff assembly (fastened to the access lid) out of the tank. Be careful not to let the portal gasket fall on the ground or into the tank. Next, remove the cap screw at the bottom of the float cage and reach up through the cage tube to remove the seat. Next, remove the cap screw at the bottom of the float cage and reach up through the cage tube to remove the seat. Examine the ball seat for hardened rubber, nicks in the rubber, and debris buildup. Any of these conditions may prevent proper sealing. Clean or replace the seat as necessary Reassemble the primary shutoff in the reverse order. Be sure to tighten all fasteners adequately. This is important because fasteners may become loose due to vibration. This is especially critical when driving extensive miles with an empty tank. Wear protective gloves, eye protection, and appropriate clothing when inspecting and cleaning the primary shut-off. As a vacuum system component, the shut-off is subject to exposure to 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, damaging the unit.

Fresh-water Compartment Coating Procedure

On slide-in units with a serial number before C29973, you can apply a coating to the tank interior to keep your freshwater looking good by preventing rust formation inside the tank. A coating material for this purpose, named Type A coating, can be ordered from Satellite. Use the following procedure to apply the coating to your tank interior:

1) Fill the fresh water compartment with clear water to the lowest level of the sight tube.
2) Add two quarts of Type A coating to the tank. Then, allow a few minutes for it to settle.
3) Fill the tank completely with clear water and slosh around to coat all surfaces, including the top of the interior.

After you are satisfied that the tank has been completely coated, drain the tank as slowly and entirely as possible. Allow the drained tank to set overnight, after which time the tank is ready for use.

Vacuum Pump

The OEM Operation Manual for your vacuum pump is included in the literature packet you received with your slide-In Unit. Review and follow the maintenance procedures outlined in that manual. Satellite Industries furnishes the following information to understand your vacuum equipment better. This information is intended to augment (not replace) the OEM instructions for your specific pump.

Component	Required Maintenance	Maintenance Interval
Moisture Trap	Check for accumulation of liquid	Daily
Primary Shutoff	Clean rubber ball seat; check fastener tightness	Every two weeks
Moisture Trap	Clean rubber ball seat; check fastener tightness	Every two weeks
Mounting Brackets	Check tension on spring mounts	Every month
Vacuum Pump	Clean pump interior	Every three months
Vacuum Pump	Clean pump exterior (to avoid build up)	Regularly
Vacuum Pump	Check rotor vane wear	Per pump manufacturers recommendations (replace vanes that exceed 1/4" wear limit)

Table 4.1 Lubrication Intervals

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

Basic Vacuum Pump Maintenance

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

It is essential to check the oil level regularly because the pump consumes oil during lubrication. Average oil usage is approximately 1-2 quarts per 40 hours, depending on the type of operation the pump is subjected to. Use only OEM-recommended types and brands of oil for your pump. Table 3.1, page 23, lists the manufacturer-recommended lubricants for the Masport HXL3V or Conde Model 6 vacuum pump supplied with your slide-in unit. If you need help obtaining manufacturer-recommended oil, contact Satellite Industries about its availability. In addition to maintaining the proper oil level in the pump, it is also necessary to use the correct oil weight depending on the air temperature in which the pump will operate. See Table 3.1, page 23, for recommendations on oil weights and corresponding air temperature. When changing to a different weight oil, the manual drip oiler must be checked for the proper drip rate and adjusted if necessary. See the "Vacuum Pump Operation" section, page 24, for the drip oiler adjustment procedure.

- Grease the pump bearings every 4 hours of operation or 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 damage the pump.

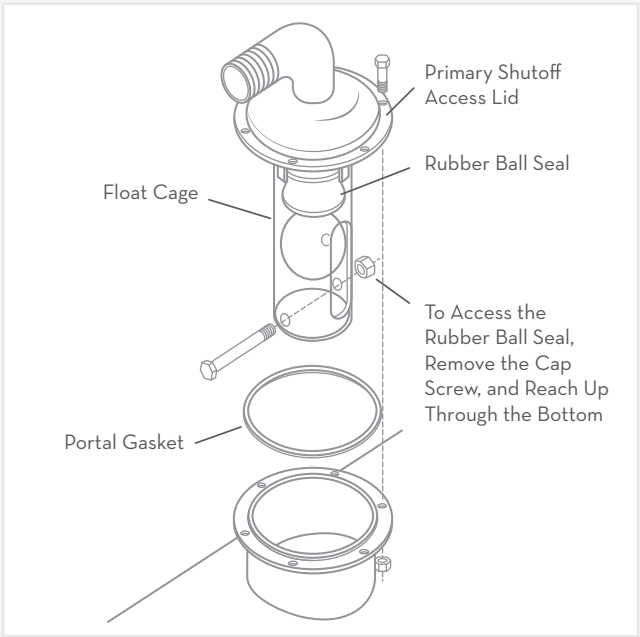


Figure 4.2 Primary Shutoff for Slide-in Units

Pump flushing fluid may be poured into the pump through either the intake inlet or the exhaust inlet, whichever is more convenient. 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.

Figure 4.3 Vacuum Pump Cleaning

NOTICE: Follow the manufacturer's recommended lubrication for your specific vacuum pump. Using the incorrect oil can lead to overheating and mechanical failure because of differing oil pump types and heat generation characteristics among vacuum pumps.

IMPORTANT: DO NOT over-grease the pump bearings. Over-greasing can cause seals damage.

Periodic Vacuum Pump Maintenance

Other maintenance for your vacuum pump includes cleaning the pump's exterior, cleaning the interior, checking 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 regularly. This is especially important for air-cooled pumps that must be clean to allow heat to radiate.

Cleaning Inside of the Vacuum Pump

DANGER: Stop the truck motor, remove all persons from the truck cab, and chock the truck tires before servicing the vacuum pump. A truck that begins to roll is a crushing hazard that can lead to death.

DANGER: Ensure the gas engine on your slide-in unit is shut off before servicing the vacuum pump. Contact with a rotating mechanism can cause entanglement that can lead to death.

Occasionally, a small amount of liquid, dirt, or other contamination 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 with a flushing fluid at least every three months. In addition, clean the inside of your pump any time water shows up in the oil catch muffler or if excess moisture accumulates in the trap. Please pay attention to periodic cleaning because it will increase the life of your pump.

Use the following procedure to clean your vacuum pump:

1) Turn the gas engine off, ensure the ignition switch is turned off, and make sure your pump is in the non-operating mode.
2) Remove the vacuum relief valve from the air line. (Figure 4.3).
3) Create a flushing fluid with a 50/50 diesel fuel and vacuum pump oil mixture. Place the control handle on the pump in the vacuum mode, and then pour 1/2 pint of the flushing mix directly into the pump inlet.
4) Turn the control handle to the neutral position to close the changeover valve.
5) Replace the vacuum relief valve.
6) Start the gas engine and run the pump at operating speed for about one minute.
7) Stop the gas engine, and then use the control handle to switch the pump to vacuum mode.

IMPORTANT: Be sure to replace the vacuum relief valve in the inlet air line 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 vacuum relief valve replaced) could cause it to spew out at the operator.

8) Restart the gas engine, run the pump at operating speed for about ten seconds, and then stop the engine.

9) After completing the above cleaning sequence, ensure that the ignition switch on the gas engine is off, and then rotate the driveline slowly by pulling on the gas engine starter rope. Listen for a clicking sound as each rotor vane drops in its slot. If not all vanes slide freely in the pump rotor slots, repeat the above procedure until they slide freely.

DANGER: Before manually rotating the driveline by pulling the gas engine starter rope, ensure the ignition switch is turned off. Contact with a rotating mechanism can cause entanglement that can lead to death.

10) After cleaning the pump, pour 4 to 8 oz. of oil into the pump. This will require you to remove and reassemble the vacuum relief valve again. At this point, use Teflon tape, Teflon thread sealant, or any other good quality thread sealant for the final reassembly of the valve.

11) Finally, run the pump in neutral for about a minute, and then drain the oil catch muffler of the used flushing fluid. Properly dispose of the used flushing fluid. Your pump is now ready to put back into service.

NOTICE: Add oil directly into the pump after cleaning and before returning it to service. This is important because the cleaning procedure will rid the pump of dirt and the necessary oil for lubrication.

Checking Rotor Vane Wear

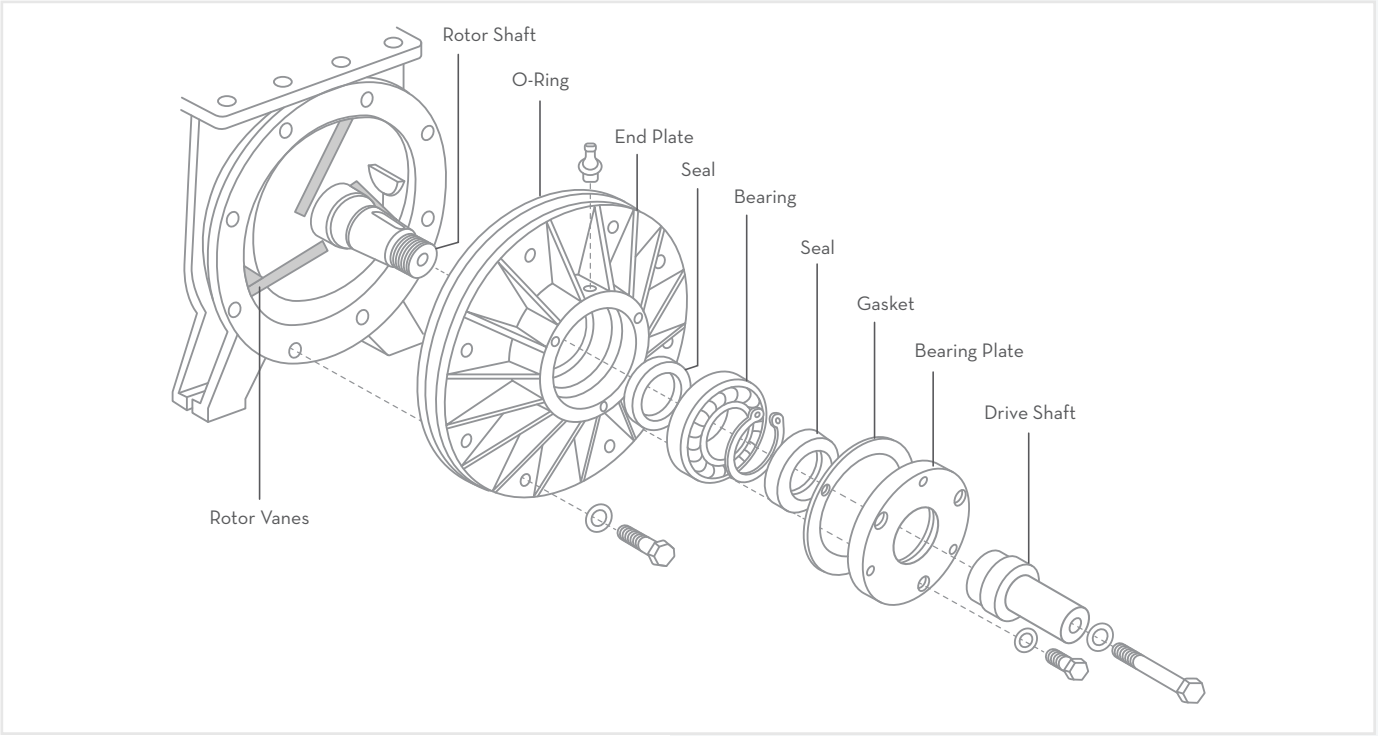
Check vane wear at the interval recommended in your OEM pump manual. Staying on top of vane wear is essential because most pump manufacturers do not warrant damage caused by vane breakage. You may need to change your vanes more often than the manufacturer's recommendation if your pump is subjected to very heavy use. See Table 4.4 for examples of heavy-use factors that can shorten vane life. You should replace the vanes on a vacuum pump when you notice signs of significant wear like visible chips, cupping on the flat side of the vane, excessive wear compared to the recommended dimensions, or if the pump starts making unusual noises, indicating the vanes are worn down and no longer creating a proper seal within the pump housing; always consult your pump manufacturer's specifications for proper vane replacement guidelines. When bottomed in the rotor slots, new vanes will be flush with the outside diameter of the rotor. As such, vane wear is determined by measuring how deep the worn vane's edge sits below

Table 4.4 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 in 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 on 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 out)

*Note: Pumps rated for continuous or heavy duty operation (such as liquid cooled pumps) can handle these conditions more readily.

Figure 4.4 Slide-in Vacuum Pump – Front End



the rotor's outside. In addition, if the pump volume declines significantly (i.e., it takes longer and longer to fill the tank), the vanes probably need to be changed. Checking the vanes of the Conde vacuum pump supplied with your slide-in unit involves disassembling one of the end plates from the pump to gain access to the rotor. Because of the time this entails, having a fresh set of vanes on hand is advantageous before checking. Then the new vanes will be ready for installation if you need them.

Replacing Rotor Vanes

Refer to the following instructions and the pump assembly diagram in Figure 4.4 when changing the rotor vanes on your vacuum pump. Replacing the rotor vanes requires removing the pump from the slide-in unit. To remove the pump, first, remove the coupling guard and the inlet and outlet airline hoses. Then, unbolt the pump from the slide-in mounting stand. Remove the pump along with the pump side of the coupling. The coupling should separate freely. Place the pump on a solid workbench to ready it for changing the vanes.

BIOHAZARD WARNING: Wear 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.

IMPORTANT: When replacing rotor vanes, be sure to have replacement gaskets, O-rings, and seals on hand if any of these items need replacing and are damaged during disassembly.

IMPORTANT: It may be advantageous to replace gaskets, O-rings, seals, and bearings when replacing rotor vanes. Your CALUMET dealer offers a rebuild kit that includes these items.

Proper Tools for the Job

Replacing rotor vanes will require disassembling the front end of the vacuum pump, including removing bearings and covers that may be press-fit into place. It is important to gather the correct tools for pulling parts free from press-fits before beginning the job.

IMPORTANT: Be careful not to damage bearings, shaft threads, or sealing surfaces by hammering, prying, or gripping with pliers.

Assemble the following tools before replacing the rotor vanes:

- Stiff blade putty knife
- Wrench set
- Pry bars (two blunt-tip pry bars or two heavy-duty, flat screwdrivers)
- Properly sized sleeves for installing bearings
- Replacement gaskets, O-rings, and seals, or a rebuild kit
- Soft head mallet

Replacement Procedure

Use the following procedure to replace the rotor vanes in your vacuum pump:

1) Remove the coupling half attached to the drive shaft, then unbolt the drive shaft from the rotor shaft.

2) Remove the drive shaft from the end of the rotor shaft. If needed, tap the drive shaft with a soft mallet to help free it from the tapered rotor shaft.

3) Remove the bolts from the bearing plate, then remove the bearing plate from the end plate. The bearing plate should come off relatively quickly, and the seal should stay with it.

NOTICE: Be careful to avoid damaging the seal as it slides off of the rotor shaft. In addition, be careful not to damage the gasket between the bearing and end plates.

4) Unbolt the end plate, and then remove it from the pump housing. Use the following procedure to remove the end plate:

- Use a stiff-bladed putty knife to pry the cover away from the housing until there is a small gap.
- Once there is a big enough gap behind the end plate, use two blunt-tipped pry bars or two flat-head screwdrivers opposite each other to pry the cover (and bearing) free of the rotor shaft.

NOTICE: Be careful not to damage the O-ring between the end plate and the pump housing.

IMPORTANT: After removal, the rotor bearing will usually remain pressed into the end plate. Be careful when pulling the bearing free of the rotor shaft so the rotor does not fall inside the pump housing. It may be necessary to provide support for the rotor, such as a block of wood under the rotor shaft.

5) Remove the rotor vanes, one at a time, by rotating the rotor to position a vane at the bottom of the housing. With the vane placed downward, there will be enough clearance around the rotor to grasp the vane and slide it out the end of the rotor slot.

6) After removing each vane, simply slide a new vane (that

has been dipped in oil) into the rotor slot.

IMPORTANT: Always replace vanes in sets.

7) Before reassembling, inspect the rotor bore, bearings, seals, and gaskets and replace them as necessary. Seals should be soft and pliable, gaskets should not be torn, and bearings should turn freely.

8) Reassemble the vacuum pump in the reverse order of disassembly. Finally, reassemble the vacuum pump and coupling assembly onto the slide-in unit. Be sure to replace the coupling guard after assembly.

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

IMPORTANT: Be sure to use the correct size sleeve (one that fits against the inner race of the bearing) when installing the bearing back onto the rotor shaft. Use a soft mallet against the sleeve to press fit the bearing onto the shaft.

TROUBLESHOOTING

07

Troubleshooting Vacuum/Pressure Pumps

Reference Table 5.1 below for possible causes of Vacuum Pressure pump problems and the most likely solutions.

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 part
	Problem in the drive train	Check driveline, reduction gearbox, and couplings for malfuction
	Pump endplate bolts too tight (and in effect causing pinching of rotor), pinching of rotor	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, page 17
	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 pump is operated at excessive vacuum or pressure	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 level 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 page 13 & 14 of this manual)

Table 5.1 Troubleshooting Vacuum/Pressure Pumps