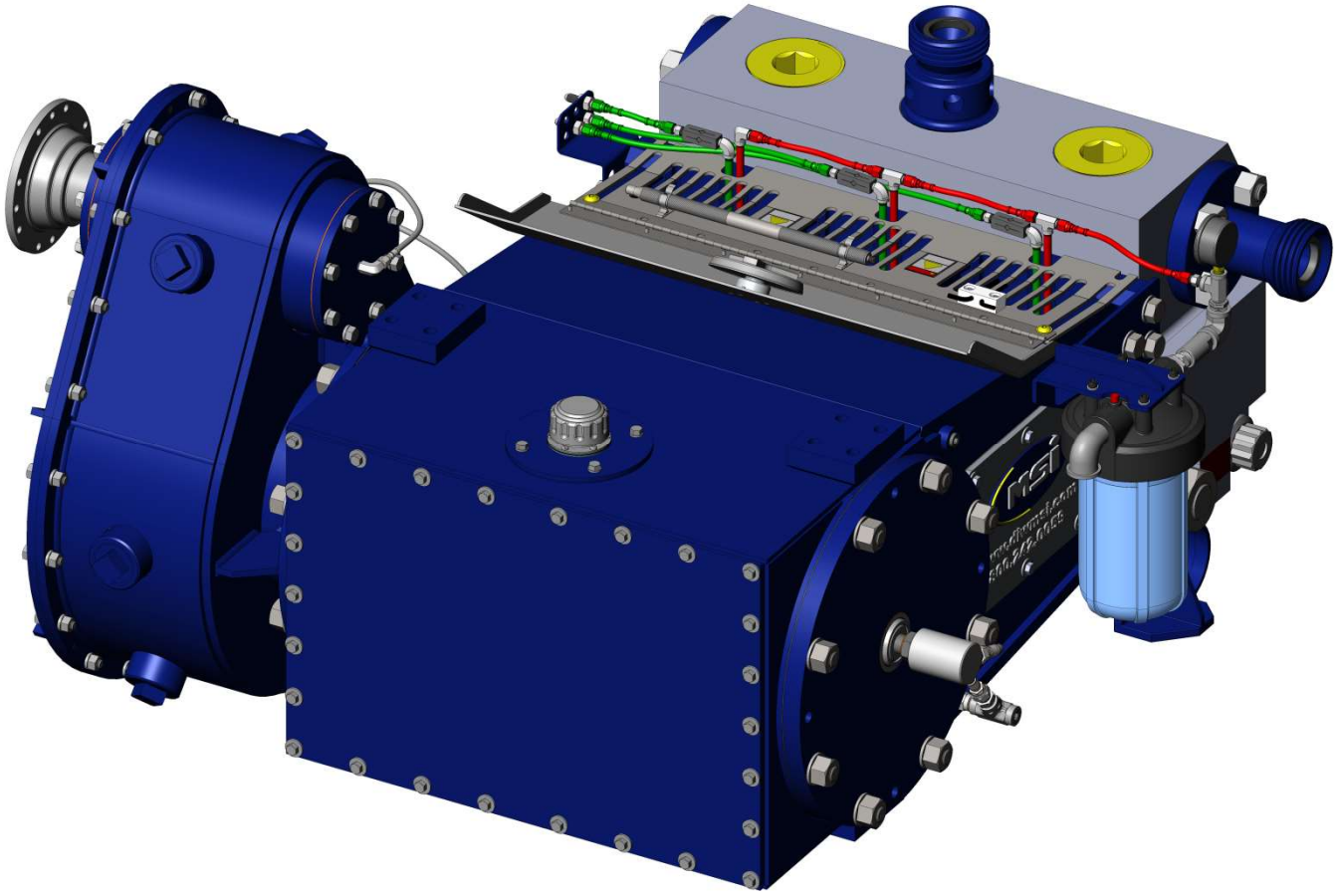
# Technical Manual
# Plunger Lube Relief System



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Revision B

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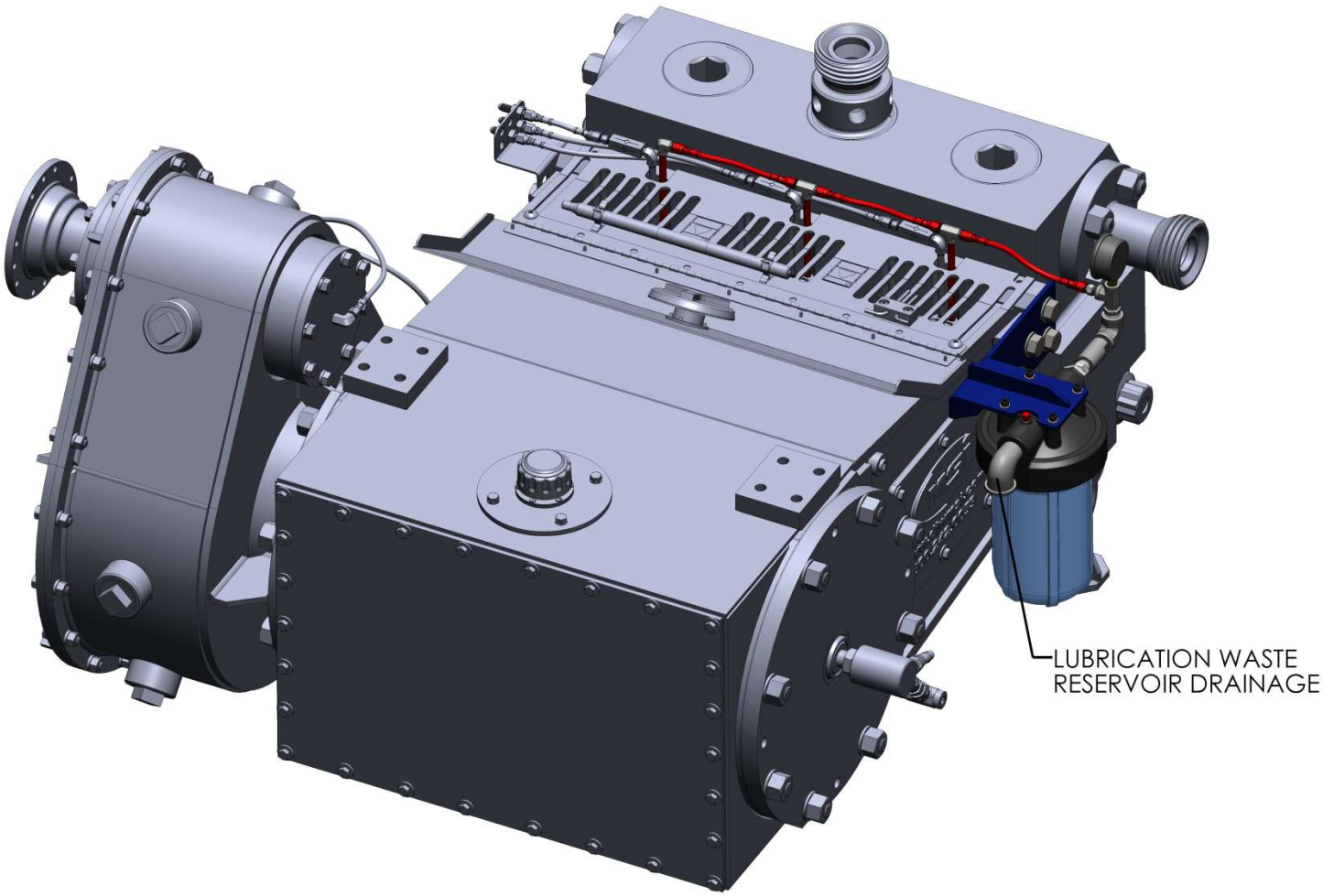
## SECTION 1 WARNINGS

The Plunger Lube Relief System has hoses and fittings that are connected to high pressure equipment. High pressure equipment, if not used and maintained properly, can cause serious injury and damage to equipment. Not taking proper precautions and failing to perform routine maintenance and inspections can also contribute to loss of plunger lubrication, and such loss could cause damage to equipment and property.

Never plug or obstruct the lubrication waste reservoir downspout as this would cause pressure to build in the reservoir. This reservoir is not intended to retain lubrication under pressure and therefore would likely fail if exposed to pressure buildup. Failure to do so may cause serious injury and/or damage to equipment.

**ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD BE THOROUGHLY TRAINED IN THE SAFE OPERATION, MAINTENANCE, AND INSPECTION OF THIS EQUIPMENT.**





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## SECTION 2 PRODUCT OVERVIEW

### 2.1 General Lube Relief System Description

The Plunger Lube Relief System (PLRS) is a bolt-on package designed for use on any MSI Hybrid™ Well Service Pump. It is compatible with oil or grease but is most effective when used with a positive displacement automatic greasing system. The PLRS can act as a standalone installment or be combined with the MSI Auto-Lube™ System for exceptional lubrication performance. This system has been designed to significantly improve packing life and eliminate the mess usually associated with lubrication systems that "flood" the packing gland with grease.

As high pressure grease enters the packing gland, small voids in the packing set are filled with incompressible fluid. A power stroke immediately following this filling cycle will create extreme pressures inside the packing and force the lubricant out of the voids toward the path of least resistance. Depending on the dynamics, the pressure will either unload the packing and force grease into the pumpage, or be ejected between the plunger and wiper seal. Unloading of the packing causes header ring "nibbling" which attributes to short packing life and leaks. Reversing the wiper seals is a commonly used method to allow this excess pressure to vent and improve packing life. However, allowing this bypass results in grease building at the back of the packing nut and in extreme cases of maintenance negligence, fill the entire packing access ports. This accumulated grease results in potential contamination issues, environmental concerns, and is untidy in appearance.

Through implementation of a pressure regulated discharge circuit, the PLRS eliminates the typical mess of an automatic grease system and vastly improves packing life over pumps that do not incorporate pressure relieving. Since a controlled path of least resistance is provided, it is not necessary to reverse the packing gland wiper seal and packing unloading is eliminated. The wiper seal is now allowed to function as designed and results in a much cleaner pump with significantly less contamination and environmental concerns. Pressure regulation permits positive pressure to be maintained in the packing gland which keeps packing and plunger well lubricated and cooled. The waste reservoir stores the excess lubricant in an environmentally responsible manner and is easily maintained.

### 2.2 Lube Relief System Assembly Description

The PLRS is offered in Triplex and Quintuplex configurations. It consists of lubrication connections that join together to form a single stream of used lubrication going towards a waste reservoir. The PLRS includes the plumbing, mounting bracket (left or right side mount), waste reservoir, pressure gauge, and mounting hardware.


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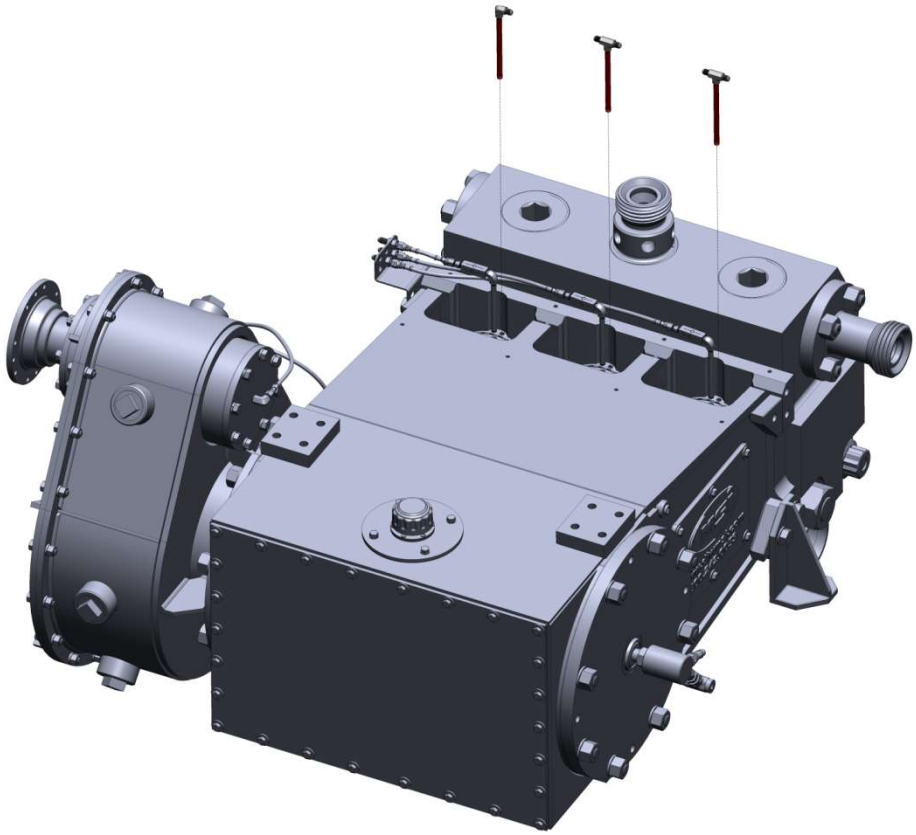
## SECTION 3 INSTALLATION

### 3.1 Lube Relief System Installation

The PLRS is designed for quick, simple installation using common hand tools and can be ordered to mount on either the right or left side of the pump. For a pump with the gear reducer on the left side of the pump (from back of power end) a right side mounted ("R" version) system should be used. For a pump with the gear reducer on the right side of the pump (from back of power end) a left side mounted ("L" version) system should be used.

NOTE: All pipe threads shall be wrapped with PTFE (Teflon®) tape prior to installation, MSI recommends liquid pipe thread sealant not be used. Make sure the tape is not covering the hole. Tighten pipe fittings 2 full turns beyond hand tight. Hose fittings should be tightened 2 flats from wrench resistance (FFWR) or approximately 13 ft-$lb_f$ torque. Back-up fittings with a wrench when tightening connections to prevent transfer of force to the pipe nipple. Failure to do this may result in damage to the pipe nipple or fluid end adapter. The waste reservoir is shipped from the factory pre-assembled with most connections already properly made.

1) Loosen the screws on the plunger safety cover one full turn and slide it towards the rear of the pump to expose the packing service port.
2) Remove pipe plugs from unused holes.
3) Install the pipe nipples as shown, the nipple with a street elbow should be installed furthest from the waste reservoir.

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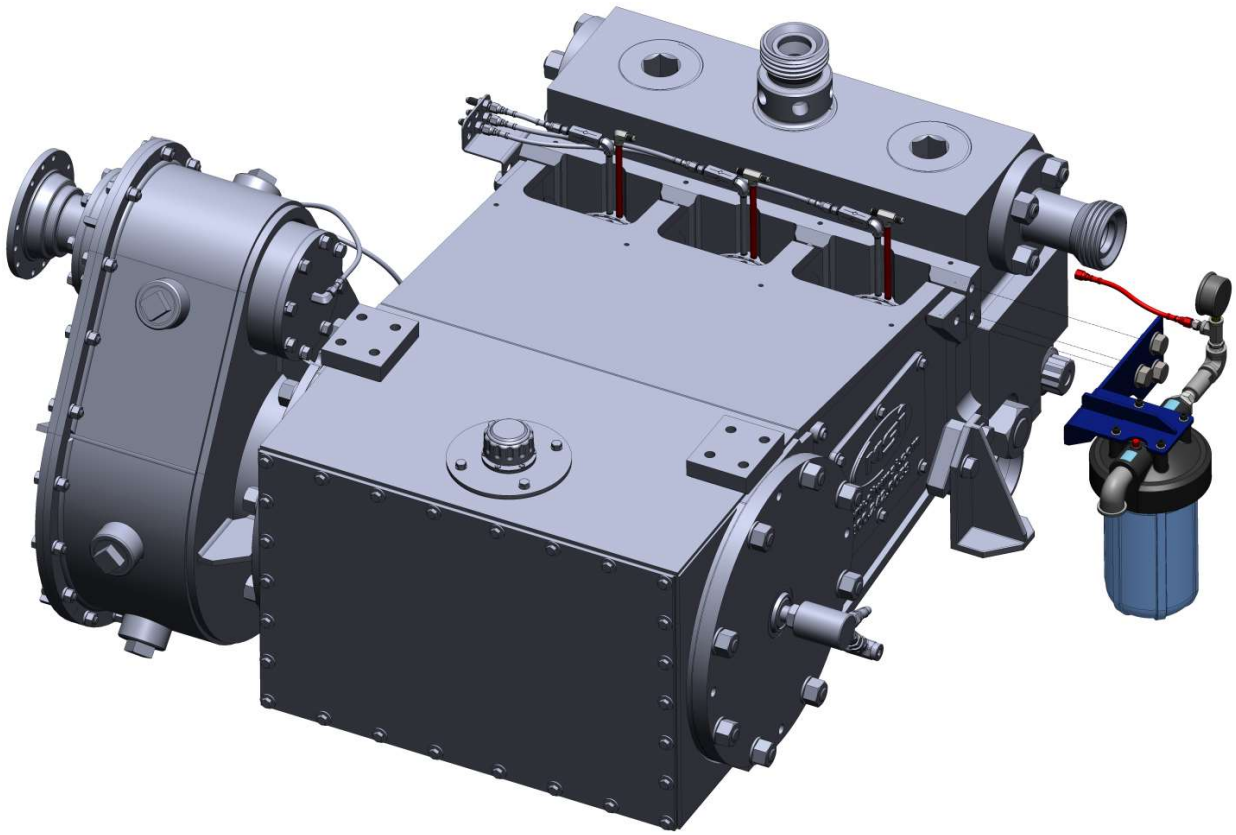
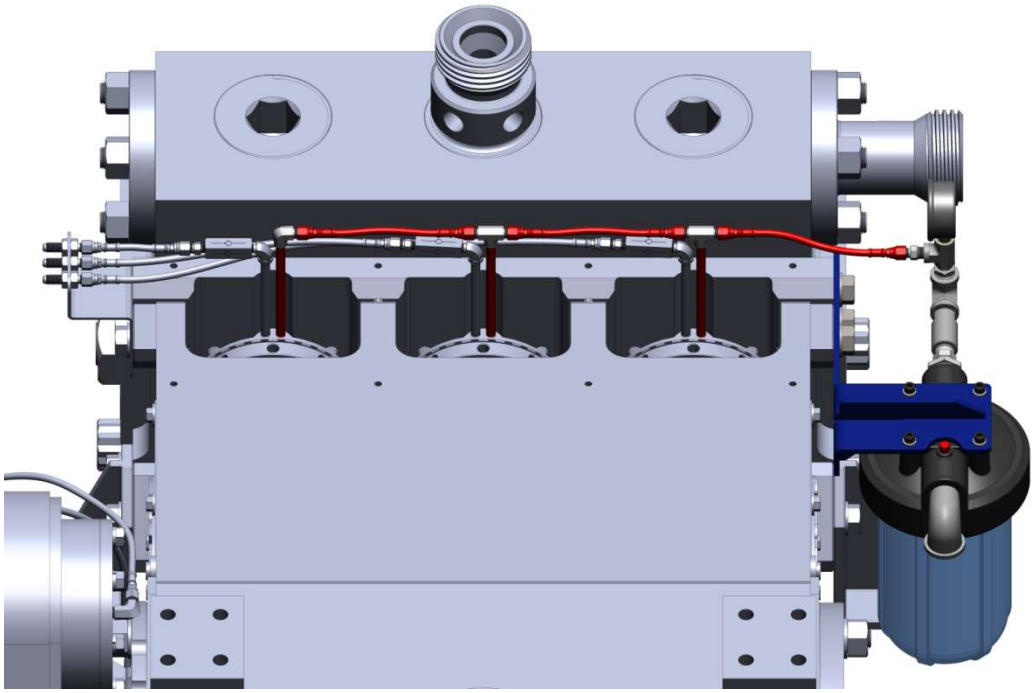
4) Install the waste reservoir sub-assembly by attaching the mounting bracket to the upper power frame attachment holes using the supplied screws and washers.

   Note: The hose from the pre-assembled nipples to the waste reservoir is longer than the rest. Keep this hose connected to the waste reservoir sub-assembly to avoid installation in the wrong order.



5) Make-up hose connections.

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## 3.2 Wiper Seal Installation

A critical aspect of correct PLRS operation is that the packing nut wiper seal must be oriented such that the lubricant is contained within the gland. If the system is used on a pump with reversed wiper seals, the PLRS will be almost entirely defeated. The following procedure is only required if the wiper seals must be reversed, this will be the case will practically any pump configured for use with an automatic greasing system.

**CAUTION:** Do not perform any service on the fluid end until you have verified that there is no pressure in the discharge system, the suction charge pump is off and isolated, and suction pressure has been relieved. A closed valve near the discharge can trap pressure between the discharge and the closed suction valves of the pump. Bleed off this pressure before continuing. Do not perform service on the fluid end with the drive engine running. If there is a bladder-type pulsation dampener on the system, either isolate it or bleed the nitrogen pressure from the bladder. Failure to follow these precautions can lead to serious injury.

1) After heeding the safety precautions, remove the suction cover using a valve cover tool and a 10 lb. hammer.

**CAUTION:** Well service fluid may be trapped between the inlet and outlet valves and will spill out when removing the suction valve covers. Expectation of and preparation for this is important for safety and environmental reasons. A catch pan, appropriate absorbent materials, and personal protective equipment (PPE) will be needed.

2) Back the packing nut retention screw out approximately 2 turns, this will free the packing nut and allow it to rotate. Loosen the packing nut at least one full turn.

3) Unscrew the fluid end plunger from the power end plunger and extract it from the fluid cylinder through the suction cover bore. Be careful not to damage the fluid end plunger while removing it.

4) Continue unscrewing the packing nut until the threads are no longer engaged yet the nut is still supported by the fluid end adapter, then turn until the tapped hole is facing up. Screw the threaded end of the packing nut tool into the packing nut and extract through the packing service port.

5) Remove the stuffing box adapter from the packing nut by tapping out with a brass punch, be careful not to damage the seal bore.

6) Remove the packing set, lantern ring, and wiper seal from the packing nut.

7) Blow compressed air through each lubrication port on the packing nut to ensure that the lubrication passage is unobstructed.

**CAUTION**: Always wear appropriate PPE, especially eye protection, when using compressed air to clean pump parts.

8) Reinstall packing in the reverse order from which it was removed: wiper seal **(with cup facing out, towards fluid end)**, lantern ring, packing set (header ring last), stuffing box adapter. Lightly coat all parts with assembly grease such as Lubriplate® No. 105 Assembly Paste. See image below for correct seal orientation.

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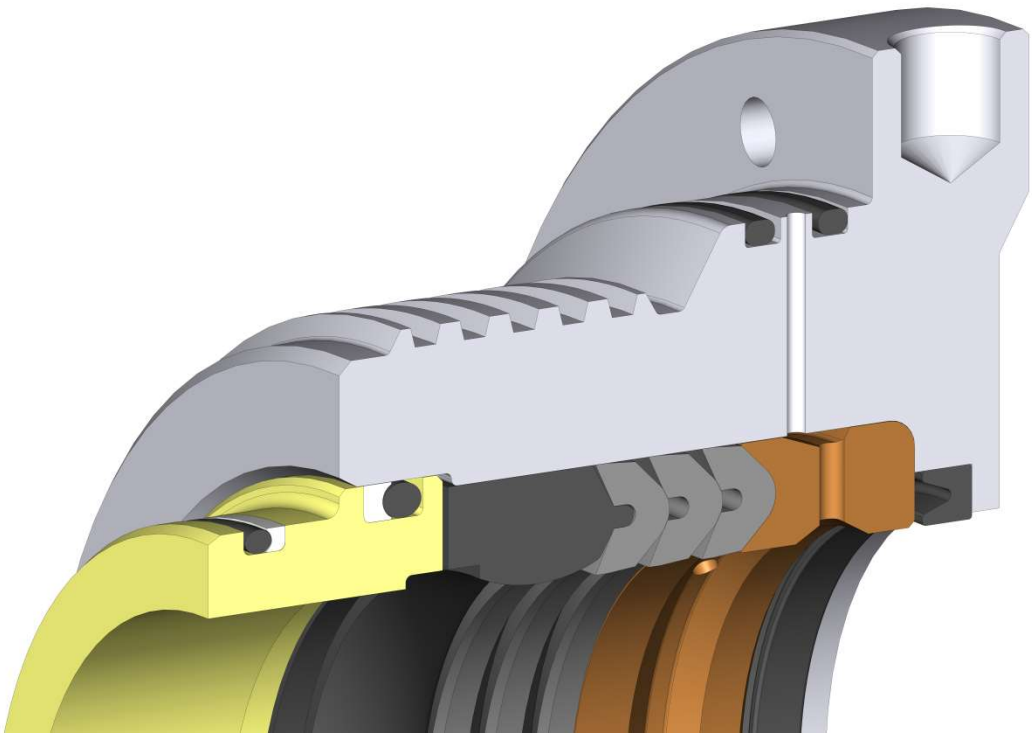

9) Reinstall the packing nut using the packing nut tool. Screw in until tight and then back it out one full turn. This will reduce the chances of damaging the packing seals when installing the fluid end plunger.

10) Clean the fluid end plunger and lubricate the threads with an anti-seize thread compound. Coat the hard surface area of each plunger with a light lubricant only, and insert it into the packing. Using the plunger tool and a 10 lb. hammer, bump the plunger into the packing while holding it as straight as possible to the packing bore centerline. Continue bumping the plunger through the packing until the threaded end just passes through the packing nut. Using the driveline, turn the crankshaft slowly until the power end plunger contacts the threaded end of the fluid end plunger. Tighten the fluid end plunger to 300 ft-$lb_f$ of torque.

11) Tighten each packing nut until it comes to a sudden stop. There should be about 1/32" gap between the packing nut face and fluid end adapter face. This indicates that the packing nut is fully engaged.

12) Screw the packing nut retention screw clockwise until the hex end is flush with the packing nut face. There are slots machined in the fluid end adapter to help in locating a hole to engage the screw. The nut may need to be rotated counterclockwise slightly to engage the next closest hole.

NOTE: The packing nut retention screw does not need to be screwed in tight, just until the back face is flush with the back of the packing nut. A nylon patch on the thread prevents it from disengaging (backing out) in service. There are only holes in the top third of the fluid end adapter so it may be necessary to move the retention screw to one of the other tapped holes in order to engage a hole. This would however only be required if the packing nuts are not installed from the same bore they were removed.

13) Reinstall the suction covers using the valve cover tool and a 10 lb. hammer.

14) Slide the safety cover back over the packing access ports and re-tighten the screws.


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## SECTION 4 SYSTEM OPERATION

Generally, the system is maintenance free other than needing to periodically empty the waste reservoir. The maintenance frequency is best determined on a case by case basis and is dependent on lubrication rates. The reservoir will hold approximately one gallon of fluid. A downspout is installed at the reservoir outlet and functions as an emergency drain/breather, and prevents rainwater from entering. **Do not plug or otherwise obstruct this port.** The reservoir is not designed to sustain pumping pressure (100 psig max) and may fail abruptly if not provided a means to relieve excess pressure. In the highly unlikely event the downspout becomes plugged, the red button located on top of the reservoir can be used to relieve pressure and allow the reservoir to be serviced.

A pressure gauge is provided to allow the pump operator to know when the system is in operation and confirm it is properly operating. This gauge can also be used when priming lubrication lines by acting as a visual indication of fluid flow.

Residual lubrication pressure is regulated via a non-adjustable inline relief valve that maintains 40 psi positive pressure within the packing gland guaranteeing that lubricant is in contact with the plunger and packing.

See **Appendix A** for troubleshooting guidance.

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## Appendix A TROUBLESHOOTING

Listed below are some known possible malfunction symptoms and their solutions:

| ***Symptom*** | ***Likely Cause*** | ***Solution*** |
|---|---|---|
| | | |
| Lubricant coming out of downspout | Waste reservoir full | Empty waste reservoir, increase service interval |
| | | |
| High lubrication waste | Lubrication rate too high | Reduce lubrication rate to suitable level |
| | | |
| No lubrication collects in reservoir, packing has short life | Lubrication rate too low | Increase lubrication rate until some lubricant is discharged to waste reservoir |
| | | |
| Little to no lubrication in reservoir, packing life is good | Lubrication rate slightly low to just right | Continue to monitor packing life or slightly increase lubrication rate to keep lubricant supply fresh |
| | Wiper seal is incorrectly installed | Remove packing and verify wiper seal is in good working order and in correct orientation |
| | | |
| Lubricant exiting between plunger and wiper seal | Wiper seal is damaged or incorrectly installed | Remove packing and verify wiper seal is in good working order and in correct orientation |


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