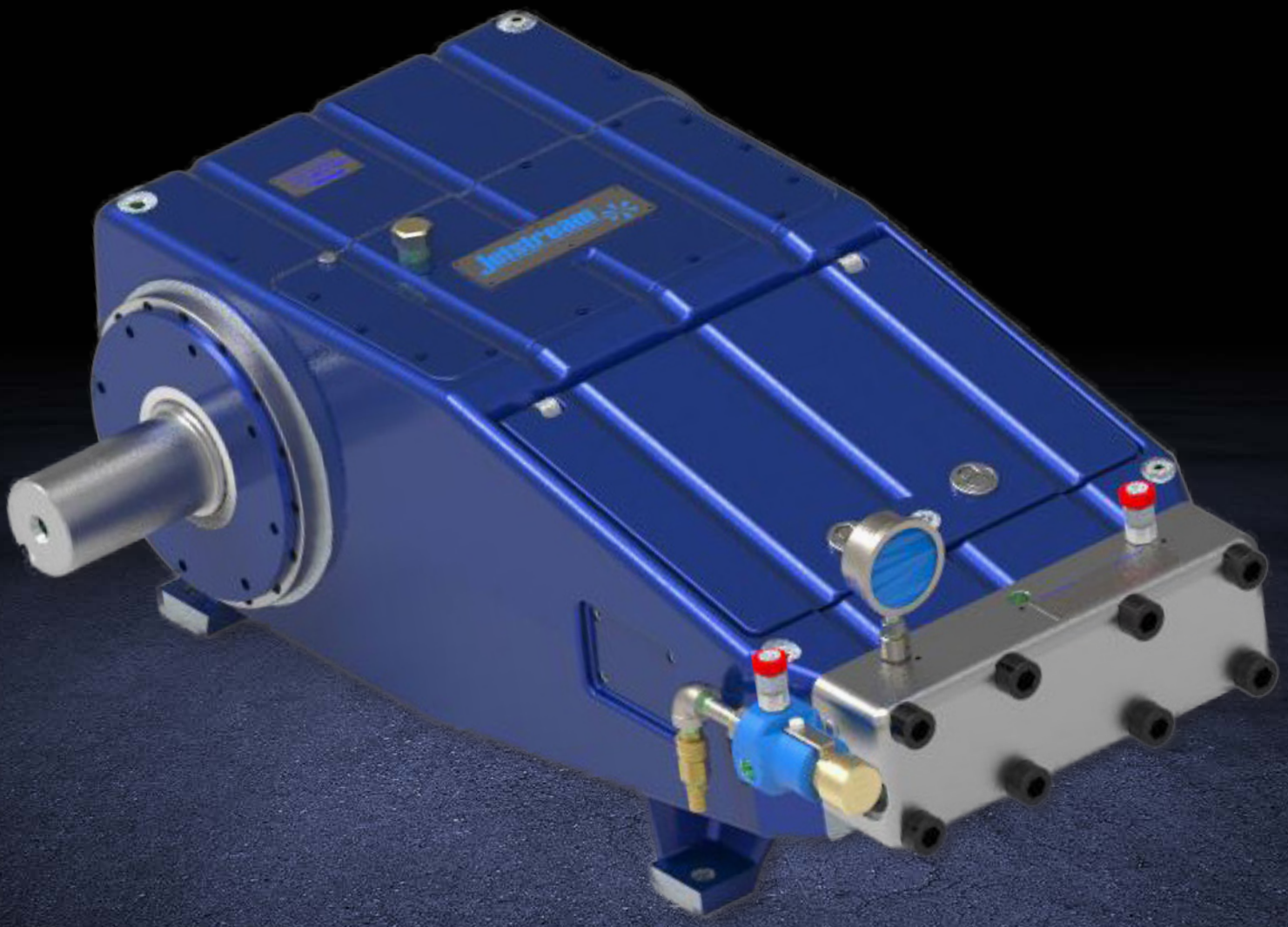
Jetstream®

Subsidiary of Federal Signal Corporation



OPERATION MANUAL

UNx™ Bareshaft Pump

Protect Workers and Equipment with the Jetstream®

Visual Safety System*

Yellow	Green	Blue	Orange
10,000 PSI	15,000 PSI	20,000 PSI	40,000 PSI
690 Bar	1,034 Bar	1,379 Bar	2,758 Bar

Be sure operators are using the right equipment.

New color coded parts and accessories clearly show water-blast components in use are correctly and safely suited to current pump pressures with the Visual Safety System.

- Easy to use and implement
- Easy to see at a distance
- Helps keep workers safe
- Helps prevent equipment damage

WJTA
WaterJet Technology Association

*Complies with WJTA visual safety system color guidelines

Published in USA
P/N 65179
Revision K

Jetstream of Houston, LLP
5905 Thomas Road, Houston, TX 77041
(832) 590-1300 • (800) 231-8192
www.waterblast.com

WARRANTY

Limited Warranty - Each Waterblast Unit, Bareshaft Pump, and Fluid End manufactured by Jetstream is warranted against defects in material and workmanship for a period of 12 months or 1,000 hours, provided it is used in a normal and reasonable manner and in accordance with all operating instructions. If sold to an end user, the applicable warranty period commences from the date of delivery to the end user. If used for rental purposes, the applicable warranty period commences from the date of delivery to the party holding the equipment available for rent. This limited warranty may be enforced by any subsequent transferee during the warranty period. This limited warranty is the sole and exclusive warranty given by Jetstream.

Exclusive Remedy - Should any warranted product fail during the warranty period, Jetstream will cause to be repaired or replaced, as Jetstream may elect, any part or parts of such Waterblast Unit, Bareshaft Pump, or Fluid End that the examination discloses in Jetstream's sole judgment to be defective in material or factory workmanship. Repairs or replacements are to be made at Jetstream in Houston, Jetstream FS Solutions Rental Center, the customer's location, or at other locations approved by Jetstream. Labor is furnished only when the unit or part is returned to the factory or when travel and expenses are paid by the purchaser. **Freight, travel and expenses incurred in connection with repair or warranty are excluded from this warranty and shall be paid by the purchaser.** The foregoing remedies shall be the sole and exclusive remedies of any party making a valid warranty claim.

The Jetstream Limited Warranty shall NOT apply to (and Jetstream shall NOT be responsible for):

1. Major components or trade accessories that have a separate warranty from their original manufacturer, such as, but not limited to: diesel engines, electric motors, electronic soft starter and/or across the line starter panels, axles, PTO's, clutch packs, high pressure gauges, high pressure hoses, flex lances, etc.
2. Normal adjustments and maintenance services.
3. Normal wear parts such as, but not limited to: oil, clutches, belts, filters, packing, cartridges, univalves, face seals, diffusers, gland nut bushings, plungers, nozzles, rupture disks, etc.
4. Failures resulting from the machine being operated in a manner or for a purpose not recommended by Jetstream including failures or malfunctions resulting from corrosion, misapplication, overpressurization, inadequate pump suction conditions, improper water quality, improper maintenance, or misuse.
5. Repairs, modifications or alterations which in Jetstream's sole judgment, have adversely affected the machine's stability, operation or reliability as originally designed and manufactured.
6. Items subject to misuse, negligence, accident or improper maintenance.

NOTE - The use of any part other than those approved by Jetstream may invalidate this warranty. Jetstream reserves the right to determine, at its sole discretion, if the use of non-approved parts invalidates the warranty. Nothing contained in this warranty shall make Jetstream liable for loss, injury, or damage of any kind to any person or entity resulting from any defect or failure in the machine or part.

THIS WARRANTY IS, AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE DISCLAIMED. THIS DISCLAIMER AND EXCLUSION SHALL APPLY EVEN IF ANY WARRANTY POSSIBLY ASSERTED FAILS OF ITS ESSENTIAL PURPOSE.

This warranty is in lieu of all other obligations or liabilities, contractual and otherwise, on the part of Jetstream. **For the avoidance of doubt, Jetstream shall not be liable for any indirect, special, incidental or consequential damages, including, but not limited to, loss of use or lost profits.** Jetstream makes no representation that the unit has the capacity to perform any functions other than as contained in Jetstream's written literature, catalogs or specifications accompanying delivery of the machine. No person or affiliated company representative is authorized to alter the terms of this warranty, to give any other warranties or to assume any other liability on behalf of Jetstream in connection with the sale, servicing or repair of any machine manufactured by Jetstream. Any legal action based hereon must be commenced within eighteen (18) months of the event or facts giving rise to such action.

Jetstream reserves the right to make design changes or improvements in its products without imposing any obligation upon itself to change or improve previously manufactured products.

Jetstream
Subsidiary of Federal Signal Corporation

5905 Thomas Rd.
Houston, TX 77041
800-231-8192
832-590-1300

Table of Contents

Visual Safety System ii

WATERBLAST SAFETY 1

Recognizing Safety Information 1

Understanding Signal Words 1

Waterblast Safety Manual 1

General Safety Precautions 2

Read Instructions 2

Inspect Equipment 2

Check Pressure Ratings 2

Rupture Discs 2

Check Connections 2

Tighten Connections 2

Use Two Operators 2

Purge the System 3

Test the System 3

Slowly Increase Pressure 3

Use the Minimum Pressure Required 3

Be Prepared 3

Performing Maintenance or Repairs 3

Freezing Conditions 3

Store Components Properly 3

COMPONENT IDENTIFICATION 5

UNx Pump 5

Manifold 5

Manifold Drain Valve 5

Water Lubrication System 5

Pressure Gauge 5

Rupture Discs 6

Bypass Valve 6

Regulator Valve (Not Shown) 6

Discharge Fitting 6

Supply Couplings 7

Secondary Filter (40K Units) 7

Fluid End Identification 7

Jetstream 3000/3600/4200 Bareshaft Pump Installation Guidelines 8

Models 8

Water Supply 8

Pulsation 8

Lubrication 8

Jetstream 5200 Bareshaft Pump Installation Guidelines 9

Water Supply 9

Rod Box 9

Side Bypass 9

Jetstream 6000 Bareshaft Pump Installation Guidelines 10

Water Supply 10

Lubrication 10

Unit Design 11

Technical Notes 11

OPERATION 13
Recommended Equipment 13
Hose and Water Supply Requirements 13
Start-up Preparation 14
Flushing the System 15
Checking the Water Lubrication System 16
Raising System Pressure 17
Breaking in New Packing 18
Monitoring Weep Holes 19

MAINTENANCE 21
Daily 21
50 Hours 21
100 Hours 21
500 Hours 21
1000 Hours 21
Winterizing The Pump 22

WATER 23
Water Quality Requirements 23
Fluid Compatibility with Jetstream Pumps 23
Secondary Filter (40k Operation Only) 24
Filter Cartridge Replacement 25
Switch Adjustment 25
Uni-Valve Life 25

PRESSURE CONVERSION 27
Converting a Pump 27
40K Hose Connections 34

SERVICE 35
Fluid End 35
Checking Manifold Bolt Torque 35
Rupture Disc Inspection 36
Packing Replacement 36
Uni-Valve Service 42
40K Face Seal Replacement 43
15K, 20K Uni-Valve Service 45
40K Uni-Valve Service 49
Bypass Valve Cartridge Replacement 53
Power End 54
Checking Power End Oil Level 54
Changing the Power End Oil 55
Crosshead Pony Rod Seals 56
Rod Journal Bearings 59
Crosshead and Connecting Rod Assembly 63

UNx Pump 65
Crankshaft 67

TROUBLESHOOTING 71

TRAINING 73
Safety Training 73
New Start-up Training 73
FS Solutions Training 73
Additional Training Opportunities 73

INDEX IND-1

Jetstream®
Subsidiary of Federal Signal Corporation

WATERBLAST SAFETY

Recognizing Safety Information

One of Jetstream's ongoing endeavors is to minimize or elminate the risk of injury to the product user. Jetstream has taken every effort to alert the user to potential safety risks through the use of cautionary statements within the operator manual and safety decals on its products. Be sure to take the time to identify and understand these notifications wherever they may be.

Always follow recommended precautions and safe operating practices.

Understanding Signal Words

This is the safety-alert symbol. When you see this symbol on your unit or in this manual, be alert to the potential for personal injury. The safety-alert symbol is often used in conjunction with signal words.

A signal word – DANGER, WARNING, or CAUTION – is used with the safety-alert symbol. DANGER identifies the most serious hazards.

This symbol and these signal words appear on the unit and in this manual. Read and understand the following definitions of the signal words before operating or working on the unit.

DANGER

Danger is used to indicate the presence of a hazard which WILL cause severe physical injury or death if proper precautions are not taken.

WARNING

Warning is used to indicate the presence of a hazard which MAY cause serious physical injury or death, and can result in serious property damange if proper precautions are not taken.

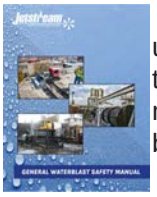
CAUTION

Caution is used to indicate the presence of a hazard which MAY cause some physical injury or property damage if proper precautions are not taken.

ATTENTION

Attention indicates installation, operation, or maintenance information which is important but is not considered a hazard.

Waterblast Safety Manual



A safety manual is shipped with each unit. It provides guidelines and instructions for maintaining a safe work environment while using and maintaining waterblast equipment.

All operators and maintenance personnel should read and understand the content of this manual to help maintain a safe work environment.

ATTENTION

The Waterblast safety manual should be kept with the unit at all times

Contact Jetstream for additional copies of the safety manual.

General Safety Precautions

Read Instructions

Read and follow all the manufacturer's instructions prior to using any waterblast product. Contact the manufacturer if unsure of any details.

Further instructions for safe operation are located in the Jetstream Safety Manual. Read this manual before operating the equipment.

Inspect Equipment

Inspect the condition of all components prior to use. Do not use any item that is in suspect condition. If unsure about the condition of a component, ask a supervisor or maintenance personnel for instructions. Use only components that are marked with a recommended operating pressure. Never exceed the operating pressure of the weakest component in the system.

Check Pressure Ratings

All components in the system must be properly rated for the intended operating pressure. Refer to the Safety Manual for more information on pressure ratings.

Rupture Discs

Installation of two rupture discs is necessary to protect the pump and operators.

- Rupture disc ratings: one at 120% of operating pressure, one at 140% of operating pressure

Check Connections

Check the condition of the connection threads prior to making any high pressure connection. For 15,000 psi (1000 bar) and lower pressures use at least four wraps of Teflon tape on male pipe (NPT) threads for sealing purposes. Do not allow any tape to overlap the end of the fitting. Tape fragments may enter the system's water stream and clog the nozzle's orifices. Apply a coat of anti-seize compound over the Teflon sealant to prevent "galling" or seizing of threads. For "Jetstream® 20K"; "type M"; "MP (20K)" and "HP (40K)" connections use anti-seize compound on the threads and the male cone.

Tighten Connections

Properly tighten all high pressure connections. Hand-tighten pipe (NPT) fittings and then tighten with a wrench another 1-1/2 to 2 full revolutions. Do not exceed two revolutions on NPT threaded connections. \

Use caution when using a pipe wrench. Pipe wrenches can cause deep scoring leading to weakened components.

Refer to the Technical sections in the 15K, 20K and 40K catalogs or at the following web page for more information and torque specifications for the various fittings used on these units.

http://www.waterblast.com/Service_and_Support/Resources/Download_Literature.aspx

Purge the System

Before attaching a nozzle to the control gun or tube cleaning lance, operate the pump at low speed to purge dirt and debris from the system. Dirt and debris can clog nozzle orifice(s) and cause excessive system pressures.

Test the System

With the nozzle installed, operate the pump at low speed (low pressure) to test the system. Should system repairs or adjustments be necessary, stop the pump and relieve all pressure before performing any required repairs or adjustments.

Slowly Increase Pressure

Visually inspect all fittings for leaks at 1000 psi (69 bar), and then again once the system reaches full pressure. Do not use your hand to find leaks. If leaks are evident, turn the system off and relieve the pressure. Remove the leaking fitting, clean and inspect. If the fitting looks undamaged, re-install the fitting. If the leak persists, the fitting must be replaced. Leaking fittings can cause fitting damage and very dangerous injection wounds.

With the system operating properly, slowly increase pump speed until operating pressure is reached.

Use the Minimum Pressure Required

Do not exceed the operating pressure of the system's lowest pressure-rated component. Use of lower pressure-rated components in a system should be avoided if possible. Components with a lower pressure rating can be overlooked and explode if vigilance is not maintained. Keep equipment pressure rating and warning tags intact.

Be Prepared

If equipment malfunctions or a malfunction is suspected, immediately stop the cleaning activity and relieve the pressure in the system before attempting any repair. Always follow manufacturer's repair instructions.

Performing Maintenance or Repairs

Because of the hazards involved with water blasting, maintenance or repairs may only be performed by service personnel that are properly trained to maintain this equipment. Training is available through Jetstream® and can be requested from the Jetstream website (www.waterblast.com) or FS Solutions rental centers.

Following repairs or maintenance, operate the system at low pressure to test the system. Adjust the pressure slowly during operation.

Freezing Conditions

After shutting down in freezing conditions, even for brief periods, drain the water from all components. Prior to starting the equipment after a freeze, the operation of all equipment components must be checked carefully to ensure they are not frozen, or cracked, and are still in safe operating condition. Refer to"Winterizing the Pump" on page 21" for details.

Store Components Properly

Properly store components to protect from damage when not in use. Ensure all warning tags and markers remain intact for the next usage.

Jetstream®
Subsidiary of Federal Signal Corporation

COMPONENT IDENTIFICATION

Before operating the unit it is necessary to fully understand each component and how it functions. Following is a brief description of the unit's main components.

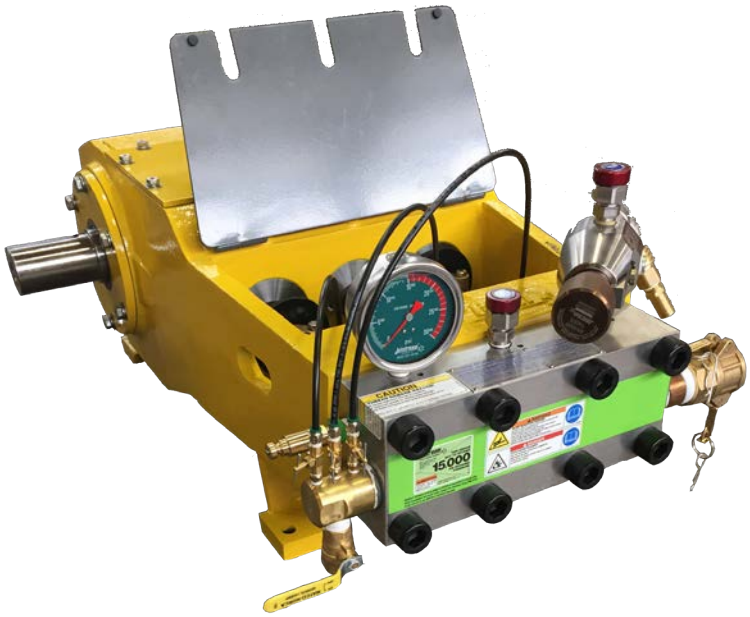


Figure 1: Bareshaft Pump.

UNx Pump

The UNx pump uses the power from the engine to pressurize the source water into high pressure output. The pump is separated into two sections, the power end and the fluid end.

The power end contains the components that drive the pump. It is also referred to as the "crank end" because it contains a crankshaft.

The fluid end contains the components that determine the output pressure of the pump. The operator may change the output pressure and flow of the pump by changing the components in the fluid end. The fluid end is also referred to as the "wet" end as this is where the water travels in and out of the pump.

Refer to the pressure specific catalogs (15K, 20K and 40K) for detailed exploded views and component part numbers for the fluid and power ends. The catalogs are available at the following website:

http://www.waterblast.com/Service_and_Support/Resources/Download_Literature.aspx

Manifold

The manifold houses many of the components that make up the fluid end of the pump including the uni-valves. The three uni-valves each consist of a suction and discharge valve combined into one assembly. The valves convert low pressure water to high pressure water.

Manifold Drain Valve

The manifold drain valve allows the manifold to be flushed of contaminants prior to pump usage. It is also used to purge air during operation start up.

Water Lubrication System

The water lubrication system provides water to the packing in the pump. The water lubricates and cools for optimum operation of the pump. The system includes a manifold and three water lines. The needle valves control the amount of flow to each stuffing box and must be properly adjusted during operation.

Pressure Gauge

The liquid filled pressure gauge allows the operator controlling the pump to monitor the pressure of the system.

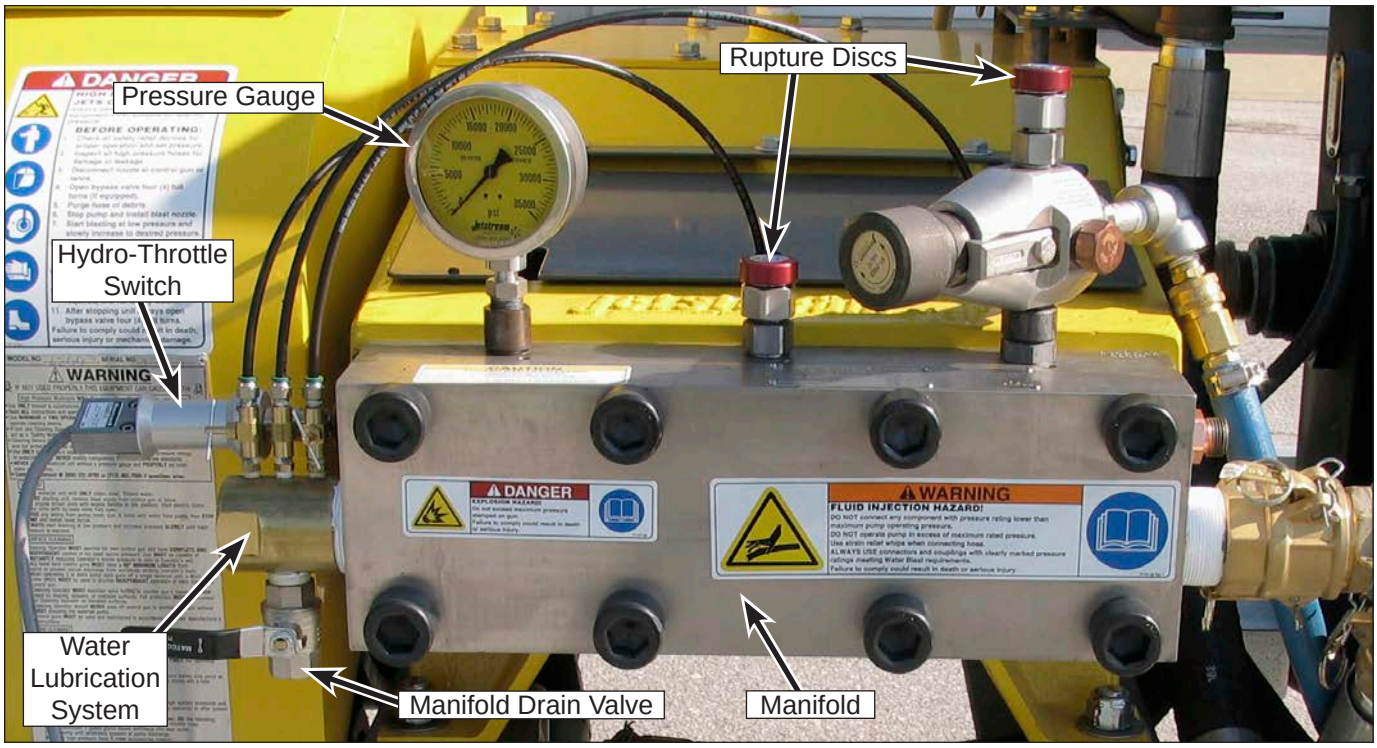


Figure 2: Pump Components.

Rupture Discs

Two rupture discs are used in the system. The rupture discs provide protection from excess pressure in the system. If system pressure were to exceed the rated pressure of the discs, the discs would burst. If a disc bursts, water will flow through the ruptured disc to provide relief for the system and protect components from excess pressure. Check the discs before operating the pump. Keep a supply of rupture discs on hand for use. If a rupture disc should burst, there is no way to build pressure until the disc is replaced. Use only genuine Jetstream rupture discs properly rated for the intended operating pressure.

Bypass Valve

The bypass valve controls the pump pressure by bleeding off excess water and diffusing it to low pressure. Turning the knob allows the operator to adjust pressure during operation and relieve pressure when not waterblasting.

The bypass valve controls pressure by allowing water to bypass though the valve. A discharge hose is attached to the bypass valve. The hose extends to the other side of the unit where it is attached to a drain elbow. Water that bypasses the valve will drain from the bypass drain throughout operation.

The proper use of the bypass valve is to install the correct size nozzle in the system so that the bypass valve can be closed during operation. A combination of plunger size, engine rpm, and nozzle will allow the bypass valve to close at almost all flow rates.

Note: *For pumps employing a shut in system, a regulator valve is substituted for a bypass valve.*

Regulator Valve (Not Shown)

For shut-in systems (where no low pressure water dumps from the gun), the bypass valve is replaced with a regulator valve. The regulator maintains constant system pressure when operating one or more shut-in devices. When a gun or other device is disengaged, the regulator automatically adjusts to shift the excess flow to a low pressure outlet while maintaining system pressure. Because shut-in systems maintain constant system pressure, the hydro-throttle does not function in these applications.

Discharge Fitting

The discharge fitting allows the connection of a high pressure hose. High pressure water exits from this fitting. On 15K manifolds, a quick disconnect is recommended to prevent galling of pipe threads and damage to the manifold.

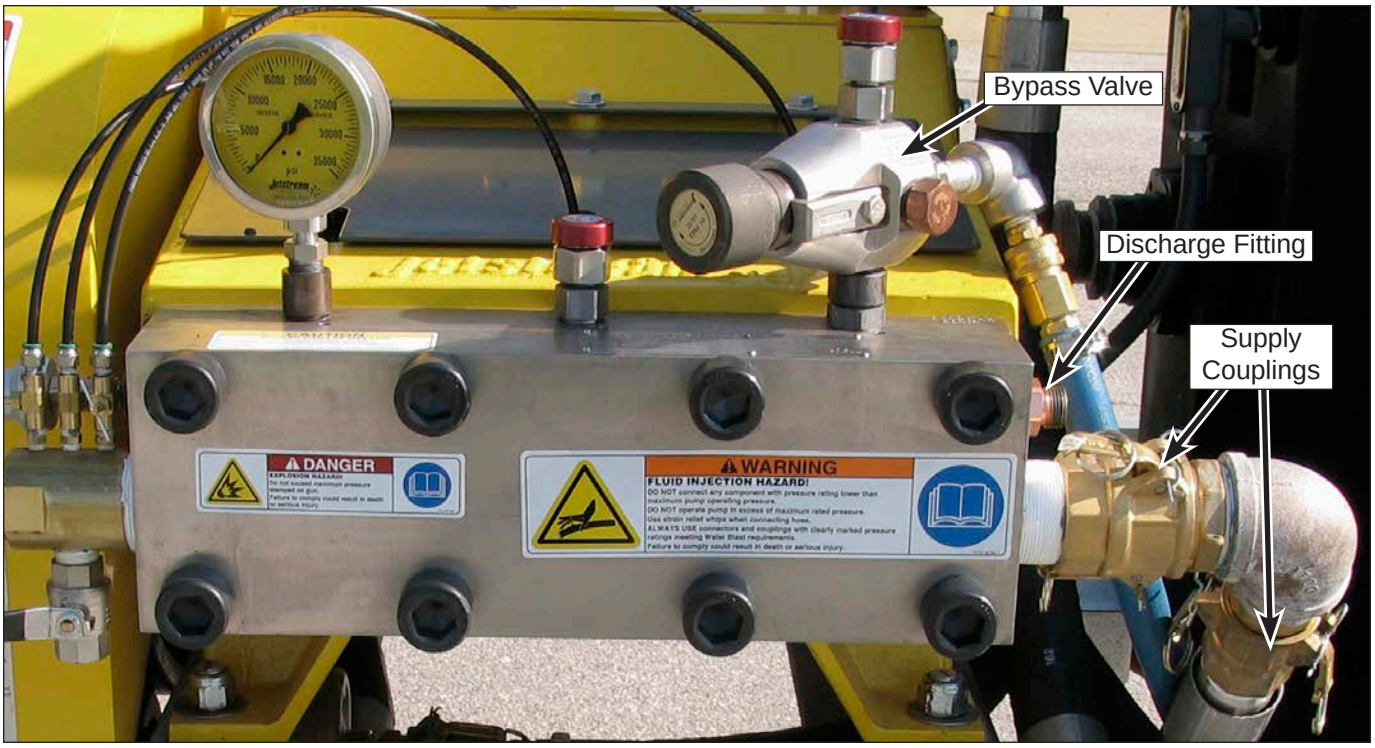


Figure 3: Pump Components (Continued).

Supply Couplings

The supply couplings provide a quick method for attaching the supply hose to the manifold.

Secondary Filter (40K Units)

A secondary filter (Figure 4) is mounted on top of the pump for use when operating at “40K”. The filter is not connected during 15K or 20K operation.

A pressure gauge is mounted on the filter to monitor pressure in the filter.

A differential pressure switch is mounted in the filter circuit to monitor proper flow through the filter. If the filter becomes plugged and flow is insufficient, the switch will cause the engine to shut off. “Emergency Stop” will be displayed on the control panel.

A drain valve is located on the filter cover that allows the operator to purge air from the filter at startup.

Fluid End Identification

A plate (Figure 5) is attached to all fluid end manifolds. The plate is stamped with the fluid end model number. In addition, the plate is stamped with plunger size and output pressure related to that plunger size. Refer to this plate before operating the pump.

Figure 4: Secondary Filter.

Figure 5: Fluid End Rating Plate.

Jetstream 3000/3600/4200 Bareshaft Pump Installation Guidelines

Models

The Jetstream UNx bareshaft pump is available in three horsepower ranges and three pressure ranges – 15,000 psi, 20,000 psi, or 40,000 psi and can be supplied with an optional geardrive. The gear drive unit requires inline drive with flexible coupling***. The standard unit can be inline or belt driven via pulleys exerting a side load on the crankshaft. All Jetstream powerends have a preferred rotation direction (top of crankshaft towards the fluid end) that is marked on the casting. However reverse rotation operation is allowed with the addition of optional reverse rotation oil scrapers. The gear drive requires a clockwise input rotation direction.

3000 series	200 hp max	600 rpm max
3600 series	175 hp max	550 rpm max
4200 series	325 hp max	518 rpm max

Water Supply

The 15K and 20K versions can be gravity fed (water level 3’ minimum above the manifold suction inlet). The 40K version requires 40 psi minimum supply pressure at full pump speed to operate. The 3040 pump with #7 plungers requires 65 psi suction pressure. All fluid ends have a maximum inlet supply pressure of 75 psi.****

The supply water should be clean and cold. The maximum allowed inlet water temperature is 125°F. Ideally the water should be filtered to 25 micron (3 micron for 40K) and 40-80°F for maximum packing life. Severly reduced packing life will be encountered with warmer water. The inlet supply hose should be 3” ID if gravity fed and 2” ID if pressure fed. Jetstream recommends oilfield suction hose as it has proven to be durable with a relatively small bend radius. The hose should be as short and straight as possible with no additional fittings (elbows) - especially important with gravity fed setup. If bends are required it is best to bend the hose without the use of elbows. Reduction of suction hose diameter is not recommended and may cause pulsation and valve problems.

The plunger packing is lubricated with the supply water and is not adjustable on normal gravity fed 15K/20K systems. On 40K and pressure fed systems, the lube harness needs to be equipped with needle valves to allow adjustment of the lube water flow. The cooling water should exit the rear of the gland nuts with a steady stream (more than a drip) but not enough to be splashed onto the pony rod during operation.

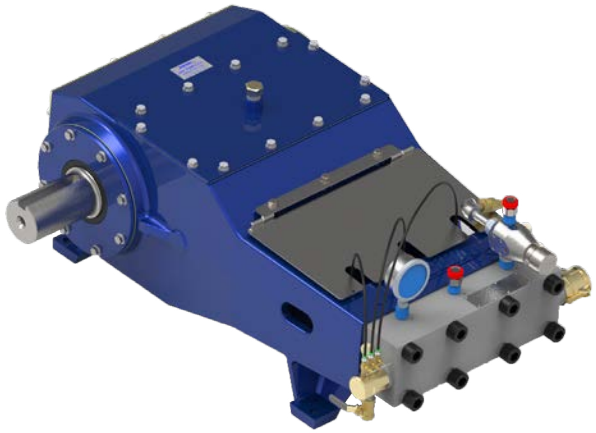
Pulsation

Positive displacement pumps create pulsation in the high pressure discharge line. For this reason, it is extremely important to utilize flexible hoses (ie rubber, thermoplastic) in lieu of rigid piping to minimize water hammer and vibration. If rigid piping is necessary, it should not be installed at the pump discharge. A 25’ or 50’ section of hose should be installed at the pump discharge. This length can be coiled and hung for space savings. A high pressure pulsation damper may be beneficial in some cases. Short on/off cycles at high pressure will create the largest spikes of pressure and require care to dampen. Flow controls or other means to slow the abrupt change of pressure will smooth these pulsations.

Lubrication

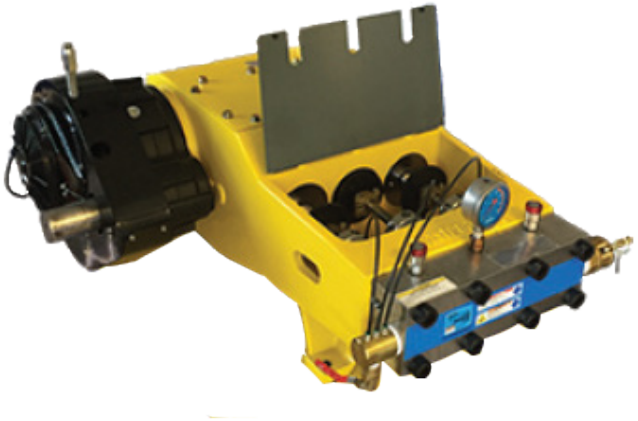
The powerend is lubricated via 80W90 gear oil (non detergent only) in the sump of the housing. The journal bearings, crossheads, and connecting rod bushings are supplied oil via gravity from a collection trough above the crossheads. The powerend has a level requirement to ensure oil lubricates the crankshaft tapered roller bearings and stays in contact with the crankshaft. Front to back level specification is 7° and side to side level is 10°. Both a low oil level shutdown and a high oil temperature shutdown are available as options.

The powerend oil has a recommended maximum temperature of 190°F and can be comfortably run in most environments. Extremely hot or cold environments (i.e. Middle East, Canada) may require oil cooler or synthetic oil. Contact Jetstream Engineering for assistance.



Gear Drive

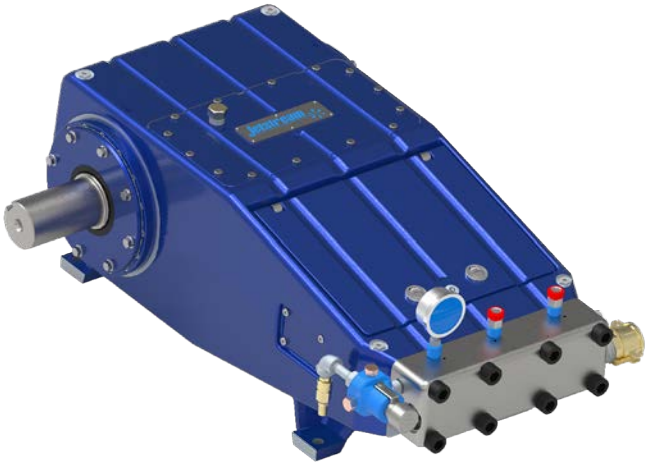
The gear drive is available in four different gear ratios to support diesel engine or electric motor input speeds. Both styles can be supplied left hand drive or right hand drive (as viewed from FE) and the gear drive model's input shaft can also be clocked to five different positions. The input shaft must be turned clockwise. The 3000 gear drive does not require cooling up to and including 150 hp, but does require installation of a cooling coil for 200 hp. The cooling coil should be supplied with <85°F water at 1 gpm to keep the gear drive within a 200-250°F range. The cooling coil can also be specified at lower horsepower in high temperature applications. The 4200 gear drive is fan cooled and available as either 12V or 24V.



Jetstream 5200 Bareshaft Pump Installation Guidelines

All of the previous requirements for the 4200 are the same for 5200 except as noted below:

5200 series 400 hp max 518 rpm max



Water Supply

The 5200 pump cannot be gravity fed and requires 40-50 psi suction water pressure at full pump speed to operate. As such, it is supplied with lube water flow control valves mounted on a manifold in the rod box area. All fluid ends have a maximum inlet supply pressure of 75 psi.****

Rod Box

The 5200 pump is supplied with a keyed locking rod box that is enclosed from the elements.

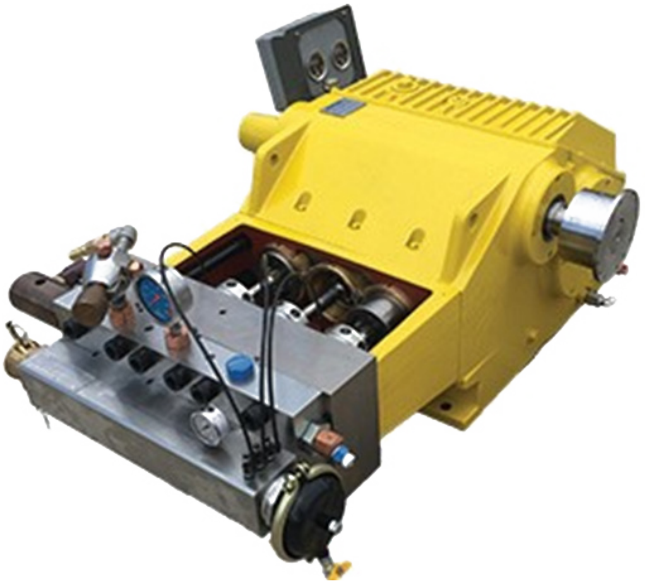
Side Bypass

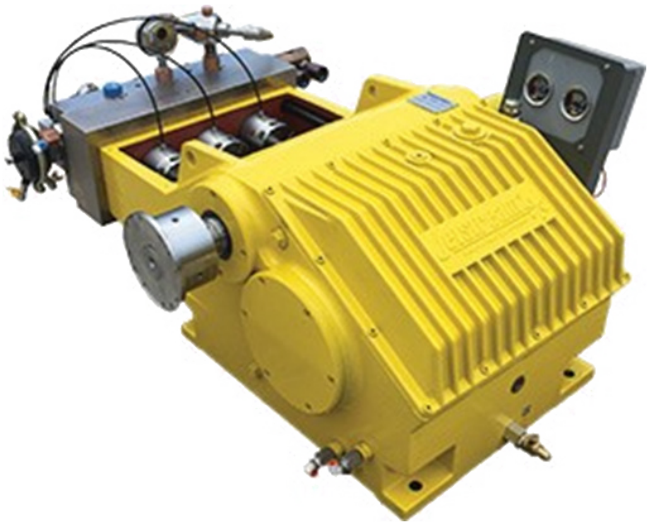
The 5200 pump has been developed in conjunction with a side mounted bypass to reduce clutter on the top of the Fluid End. This new bypass valve is also equipped with large internal passages so that the high pressure discharge hose can be attached to the bypass without excessive pressure drop.

Gear Drive

The gear drive is available in four different gear ratios to support diesel engine or electric motor input speeds. Both styles can be supplied left hand drive or right hand drive (as viewed from FE) and the gear drive model's input shaft can also be clocked to five different positions. The input shaft must be turned clockwise. The 5200 gear drive is fan cooled and available as either 12V or 24V.

Jetstream 6000 Bareshaft Pump Installation Guidelines





All of the previous requirements are the same for 6000 except as noted below:

The 6000 powerend is internally geared and requires inline drive with flexible coupling ***. It is available in four different gear ratios to support diesel engine or electric motor input speeds. It can be supplied left or right hand drive but must be driven with input shaft rotating top towards rear (i.e. LH requires CCW and RH requires CW at input shaft).

6000 series 600 hp max 457 rpm max

Water Supply

The 6000 pump cannot be gravity fed and requires 40-50 psi suction water pressure at full pump speed to operate. As such it is supplied with lube water flow control valves mounted on the suction manifold. All fluid ends have a maximum inlet supply pressure of 75 psi.****

Lubrication

The powerend is lubricated with 12 gallons of ISO 320 gear oil. Only the following brands are allowed:

- Aral Motanol HP 320
- Mobil DTE. Oil AA 320
- BP Energol CS 320
- Shell Vitrea 320
- Castrol Alpha ZN 320
- Valvoline IRF 320
- Dea Oursa OEL P 320
- Elf Polytelis 320
- Esso Nuto 320

The 6000 powerend is equipped with an oil temperature shutdown gauge and the maximum allowed oil temperature is 190°F (normal range is 160-170°F). An integrated oil cooler (dual loop) is located inside the powerend sump and uses 3-5 gpm (15-20 lpm) of suction water to cool the oil. The warm water outlet of this cooler will need to be plumbed back into the cold water supply tank or routed to an appropriate drain. The oil is pumped via external oil pump through external filter and routed inside powerend to critical points. It is supplied with an oil pressure shutdown gauge and requires 30 psi minimum (normal operating range is 60-70 psi). The filter should be changed every 500 hours.

Unit Design

Unit design and layout including water supply, filtration, shutdown protections, pump rotation, belt drive, overhung load, and suction and discharge plumbing are critical for smooth operation and maximum component life. Please contact Jetstream engineering for a design review before installing Jetstream bareshaft. Failure to consult with Jetstream prior to bareshaft installation could result in product failure not covered under Jetstream warranty.

Technical Notes

*** Driver selection and coupling selection requires engineering analysis of torsional loads and vibrations (TVA). Jetstream can supply the mass-elastic data for the pump but it is customer's responsibility to perform TVA of the system. Coupling failure, engine damage, and powerend damage can result from incorrect coupling selection.

****All pumps have a minimum inlet pressure necessary to prevent cavitation.

Additionally, Jetstream (and many other) pumps have a maximum allowable inlet pressure. Excessive inlet pressure will not affect the operation or life of the fluid end, but can negatively affect the power end.

The connecting rods are equipped with plain bearings where they contact the crankshaft. These bearings require lubrication to survive. When the crankshaft rotates and pulls the crosshead backwards through the suction stroke, the force between the connecting rod journal bearing and the crankshaft decreases greatly. This reduction in force and the rotation of the crankshaft causes oil to be drawn into the small space between the connecting rod journal bearing and the crankshaft. As there is no oil pump in the 3000/3600/4200/5200 series, this is the only mechanism that lubricates the journal bearings.

High pressure on the plungers during the suction stroke can prevent oil from being drawn into the space between the connecting rod journal bearing and the crankshaft. The lack of lubrication can cause journal bearings to fail in only a few hours. This problem is worse with large plungers, high inlet pressure, and low speeds.

Following Jetstream's maximum allowable fluid end inlet pressure of 75 psi and minimum pump speeds of 200 rpm for the 3000, 183 rpm for the 3600, 173 rpm for the 4200/5200, and 100 rpm for the 6000 series will prevent this type of failure.

Jetstream®
Subsidiary of Federal Signal Corporation

OPERATION

Recommended Equipment

Jetstream equips the waterblast units with the components they recommend for safe operation. Those components include:

- Pressure Gauge
- Two Rupture Disc Assemblies
- Bypass Valve or Regulator Valve
- Discharge Quick Disconnect Coupling.

ATTENTION

Installation of two rupture discs is required by Jetstream for warranty coverage on this pump. One rupture disc must be rated at 120% of the fluid end stamped pressure rating. The other disc must be rated at 140% of the fluid end stamped pressure rating.

Keep a supply of rupture discs on hand for operation at different pressures and for replacement in the event of a rupture.

WARNING

Do not operate the engine without water in the system. Damage to the charge pump will occur.

ATTENTION

A quick disconnect coupling is an important means of protecting the manifold from wear at the high pressure discharge hose connection port. If the internal threads on the manifold become worn or damaged the cost to repair them is far greater than replacing a coupling. The manifold would need to be shipped back to Jetstream for repair or replacement.

Hose and Water Supply Requirements

– The water supply hose inside diameter must be large enough to supply 150% of the unit's maximum flow requirements.

– The inside diameter of the high pressure discharge hose will be determined by the necessary length of hose and the amount of flow passing through the hose length. Contact your Jetstream representative for proper hose sizing.

– Supply pressure must be no greater than 150 psi (10.3 bar) into the waer tank. If pressure exceeds 150 psi (10.3 bar), install a pressure regulator large enough to meet flow requirements. Regulators are available from Jetstream.

– Water temperature 125°F maximum.

Start-up Preparation

1. Inspect the filter bags. Inspect the secondary filter cartridge if operating at 40K.
2. Check the tightness of the gland nuts on each stuffing box.
3. Inspect all equipment. Ensure that every piece of equipment in the pressure circuit is properly rated for the intended operating pressure. Replace any component that is not properly rated.
4. Connect the supply hose and verify the drain valve is closed.
5. Open the water supply valve and allow the tank to fill. Any valves between the water tank and the pump must be open.
6. Install the discharge hose onto the fitting on the manifold along with a hose safety check.
7. Open the bypass valve by turning the knob fully counter-clockwise until the O-ring is visible (where the knob enters the valve body) or four full turns counter-clockwise from the closed position. This allows the engine to start without a load from the pump.
8. On a 6000 series pump, momentarily open the valves on the pulsation dampener. This allows the damper to fill with air. If the damper valves have not been opened for an extended time, it may be neccessary to blow compressed air into the front valve to reset the diaphragm to the correct position.

⚠ *WARNING*

Anytime the system has been opened, the system must be purged.

When the high pressure hose is first connected to the unit or when extra hose lengths are added to the hose string, the hose must be purged of all dirt and debris. Do not connect the control gun or tool to the high pressure hose until the hose has been purged of dirt and debris with water flow from the pump. Failure to purge debris inside a hose may result in clogging of the cleaning nozzle and excess pressure in the system.

Flushing the System

With the engine at idle, warming to operating temperature, flush the system of any debris. Flushing the system prevents any debris from clogging the cleaning nozzles and valves which will cause excessive pressure in the system. Nozzles must be removed from all equipment during flushing.

1. If operating at 40K, first open the bleed valve (“Figure 6: Secondary Filter Bleed Valve.” on page 15) and allow any air to purge from the secondary filter. Once a steady flow of water exits the filter, close the valve.
2. Open the manifold drain valve. Allow water to drain from the valve for approximately 5-10 seconds. (“Figure 7: Flushing the Manifold.” on page 15).

⚠ *WARNING*

Two operators are required to flush the discharge hose and equipment. One operator must be stationed at the unit and the other at the discharge device.

3. Hold the discharge hose stationary (Figure 8).
4. With the manifold free of debris, the engine at normal operating temperature (160°F (71°C) - 185°F (85°C)) and at idle speed, engage the clutch.
5. Turn the bypass valve clockwise just enough to obtain a generous flow of water through the discharge hose. Allow the hose to flush for about 30 seconds.

Note: *A substantial amount of thrust may occur at the discharge end while flushing.*

6. Decrease flow to the hose by fully opening (counter-clockwise) the bypass valve. Some water will continue to flow from the hose.
7. With the engine at idle speed, shift the transmission to Neutral.
8. Connect the control gun (or other equipment being used) to the discharge hose.
9. With the hose secure and equipment controlled by another operator, engage the clutch.
10. Turn the bypass valve clockwise to increase flow through the discharge device(s). Allow the control gun to flush for about 30 seconds.
11. Reduce the discharge flow by fully opening the bypass valve.
12. With the engine at idle speed, disengage the clutch.
13. The nozzles can now be installed on the discharge device(s).
14. Before waterblasting, adjust the lubrication line needle valves, if equipped. Refer to “Checknig the Water Lubrication System” on page 16 .

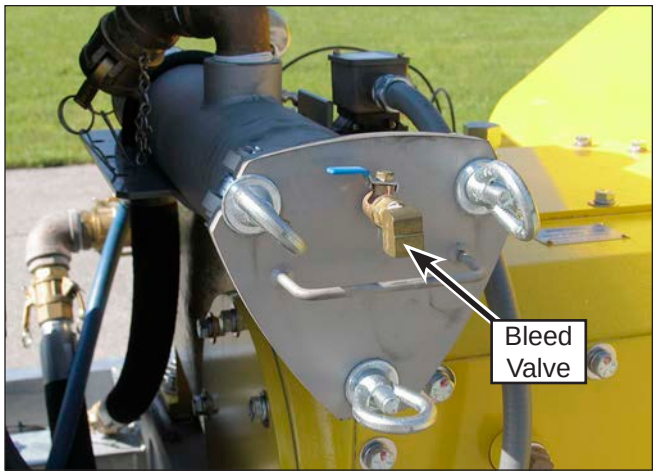


Figure 6: Secondary Filter Bleed Valve.

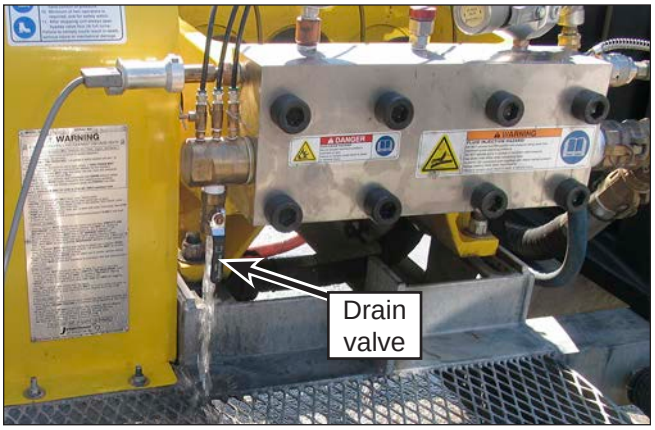


Figure 7: Flushing the Manifold.

Figure 8: Flushing the Discharge Hose.

Checking the Water Lubrication System

1. Lift the rod box cover to view the water lubrication system.

⚠ WARNING

There are moving parts inside the rod box that can cause serious injury. Use extreme caution. Keep all tools out of the rod box while the pump is running.

2. Look into the rod box and verify that lubrication water is flowing between the gland nuts and the plungers. On 6000 series pumps, the water will flow from the small holes in the bottom of the gland nut wrench holes. (Figure 9).
3. Next, check the stuffing box temperature by very carefully placing your finger tips on the top of the stuffing box. The temperature should be cool to warm but still cool enough that you can keep your fingers on it for 10 seconds.

   If there is no water flow, or the temperature is too hot, or if steam is visible, the needle valves need to be adjusted.
4. If needed, adjust the needle valves (Figure 10) to change the water flow. Needle valve location for the water lube will vary depending on the pump. A very small, but steady stream is all the is required. On the 6000 series, the water should not overflow the top-most hole. Too much flow will cause excessive splashing, which could cause water to be drawn into the power end, contaminating the oil. Adjust the needle valves to prevent excessive lubrication water flow. Re-check the lubrication water flow periodically during operation.
5. Once properly adjusted, system pressure can be raised for waterblasting.

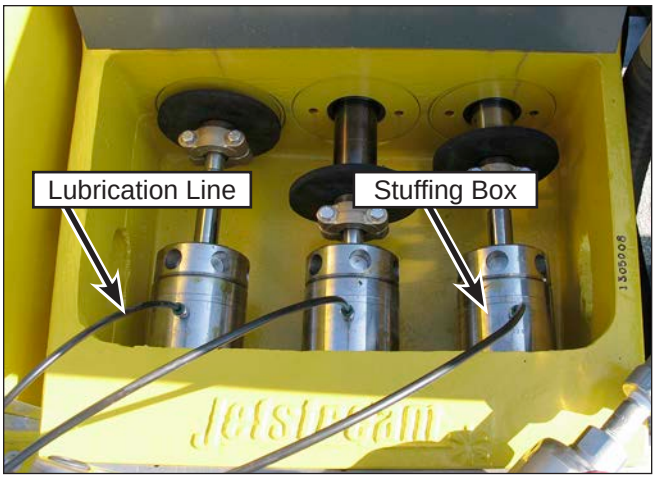


Figure 9: Checking Lubrication.

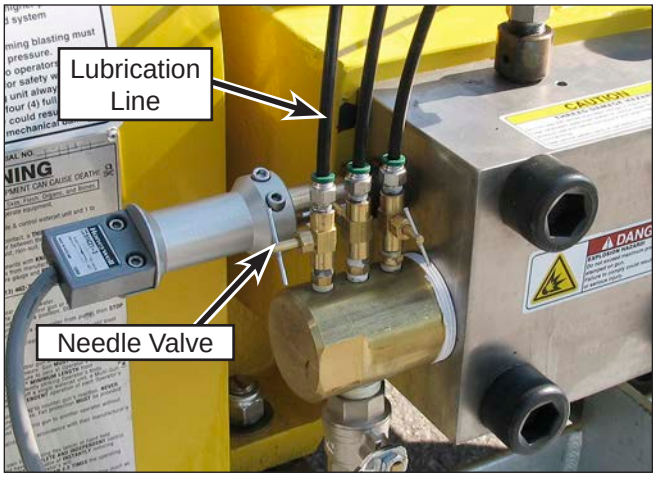


Figure 10: Needle Valve Adjustment (40K).

Raising System Pressure

WARNING

Before building pressure, contain the high pressure discharge hose. Failure to contain and control the high pressure water can result in death or serious injury. The water is considered "contained" if it is allowed to discharge from the system through a "manned" control gun or a "manned" lance inserted in a tube. Control guns can produce a tremendous amount of reverse thrust based on flow and pressure.

Discharge must be in an enclosed space where no one can get injected and the end of the hose is restrained from moving.

Never use open lengths of high pressure hose for anything but purging at low pump speed.

Install whip checks at all hose connections.

CAUTION

When operating in cold temperatures, allow ample time for the pump oil to warm before raising system pressure.

ATTENTION

If new packing was installed or if operating the pump for the first time, the pump packing must be broken in properly. Refer to "Breaking In New Packing" for instructions.

ATTENTION

Always blast with the bypass valve fully closed. This will ensure the most efficient operation with all water being utilized. If less water volume is required, reduce the engine rpm to control the flow amount. If bypassing flow is necessary, the bypass valve cartridge and the bypass valve diffuser will wear and these parts may need replacing regularly. Bypassing water also wastes water and wastes fuel as this is lost horsepower.

WARNING

Do not operate the pump under a load at engine speeds below 1400 rpm. This will lug the engine and cause excessive vibration leading to engine damage and cracked brackets, guards and fittings.

Breaking in New Packing

ATTENTION

This procedure is only applicable for 15K and 20K molded packing. It is not required for plastic packing.

New packing must be broken in to prevent damage and ensure optimal performance. Break-in should occur in three to four pressure increases over a 5 minute period.

1. Adjust the engine speed to 1400 rpm.
2. Adjust the discharge pressure to 3,000 psi (200 bar) by slowly closing the bypass valve (all dump valves closed).
3. When the coolant temperature reaches 120°F (49°C), increase engine speed to 2100 rpm.
4. Continue to bring the discharge pressure up to full operating pressure in about three equal steps while operating 1 minute for each step. Check the lubrication water and carefully feel the stuffing boxes for excess temperatures. Stuffing boxes and gland nuts should only be slightly warm to the touch when the pump is running at the rated operating pressure. Hot stuffing boxes and gland nuts may be caused by insufficient water lubrication or tight fitting packing. If insufficient lubrication water flow cannot be corrected by readjusting the needle valves, stop the pump and correct the problem.

Monitoring Weep Holes

Weep holes are manufactured into the manifold to alert the operator when seals have failed. If a seal fails, the water will leak from its associated leakage hole.

There are two types of weep holes, the high pressure face seal weep holes that are rectangular slots (Figure 11) and the low pressure uni-valve seal weep holes that are round. There are three of each type located along the top of the manifold.

ATTENTION

On 20K manifolds, the rectangular weep holes also communicates with the top pressure ports. If water is observed at the rectangular weep holes, first check the corresponding 20K port connection. The 20K seal pill may need repositioning or replacing.

If water is leaking from one of the rectangular weep holes, one of the forward seals on the uni-valve has failed. On 15K and 20K pumps, this could be either the face O-ring that seals the valve to the stuffing Box (Figure 12) or the larger O-ring and backup ring on the outside of the valve (Figure 13). On 40K pumps, this could be the face seal in the stuffing box (Figure 12) or the large O-ring on the outside of the valve.

If water is leaking from the round weep holes (Figure 11), one of the rear seals on the uni-valve has failed. On 15K and 20K pumps, This could be either the smaller O-ring and backup ring on the outside of the valve (Figure 13) or the face o-ring that seals the back of valve to the manifold. On 40K pumps, this could be O-ring near the middle of the valve or the cup seal and backup ring at the rear of the valve.

Monitor the manifold for leakage during operation. If leakage occurs, immediately repair the leak.

WARNING

If leaks are allowed to continue, expensive damage to the valves or manifold block could occur.

Inspect the valve seats during seal replacement and lap the valves if necessary. Refer to “Valve Lapping” for instructions.

Monitor the manifold for leakage during operation. If leakage occurs, immediately replace all of the seals on the leaking valve.

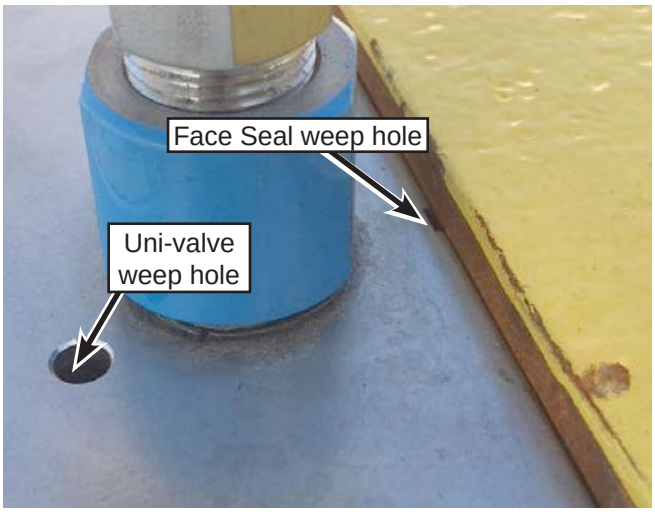


Figure 11: Weep Holes

Figure 12: Uni-valve to Stuffing Box Seals.

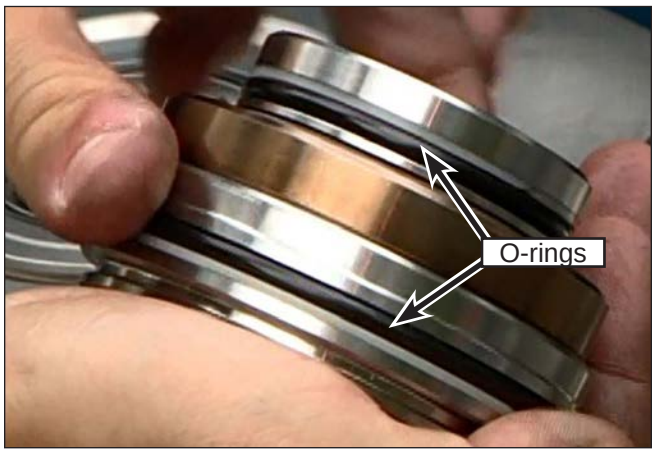


Figure 13: Outer O-rings.

Jetstream®
Subsidiary of Federal Signal Corporation

MAINTENANCE

Daily

1. **Check Power End Oil Level** - Add oil as necessary. Refer to “Checking Power End Oil Level” on page 54 for instructions.
2. **Check Gland Nut Torque** - Ensure the gland nuts are properly tightened for operation. Refer to “Checking Gland Nut Torque” on page 35 for instructions.
3. **Adjust Water Lubrication System** - Ensure the water is properly adjusted on pressure fed manifolds equipped with needle valves. Refer to “Checking the Water Lubrication System” on page 16.
4. **Inspect Rupture Discs** - Ensure the rupture discs are installed and inspect for damage. Refer to “Rupture Disc Inspection” on page 36. Verify extra replacement discs are on hand in case of a rupture.

50 Hours

1. **Uni-Valve Inspection** - Inspect the seals for damage and the valve seats for deposits, jetting or other damage. Refer to “Valve Inspection” on page 52 .
2. **Inspect Pump Breather** - Remove the breather and inspect for dirt and debris. Clean or replace as necessary.

100 Hours

1. **Initial Power End Oil Change** - After the first 100 hours of operation on a new unit, change the power end oil. Refer to “Changing the Power End Oil” on page 55.
2. **Initial Stuffing Box Lubrication Check** - Remove stuffing boxes, clean powerframe bore, lubricate with anti-seize or petroleum jelly, and replace stuffing boxes.

500 Hours

1. **Regular Power End Oil Change** - Change the power end oil. Refer to “Changing the Power End Oil” on page 55.
2. **Regular Stuffing Box Lubrication Check** - Remove stuffing boxes, clean powerframe bore, lubricate with anti-seize or petroleum jelly, and replace stuffing boxes.

1000 Hours

1. **Journal Bearing Inspection -** Replace as necessary.

Winterizing The Pump

Severe damage can result if the waterblast unit is not protected from freezing conditions. The stuffing boxes hold water that can freeze, causing damage to the stuffing boxes, uni-valves, plungers and manifold. To prevent freezing, drain the water from all hoses, charge pump and tanks, and add anti-freeze to the stuffing boxes.

If the unit is to be idle for any period of time that would allow freezing in the pump or piping, utilize the following procedure:

1. Drain the water from the tank.
2. Disconnect the water supply suction line and high pressure discharge hose from the manifold.
3. Drain the manifold of water and close the drain.
4. Assemble pipe fittings into a funnel assembly as shown in (Figure 14).
5. Install the assembly on the suction side of the manifold.
6. Pour a glycol based anti-freeze solution into the funnel (Figure 15). Approximately 0.5 gal. (2 L) of anti-freeze is required.
7. Before starting the engine, check the area in the path of the discharge fitting on the manifold. Ensure the area is clear. Anti-freeze will be discharged from the discharge fitting during this procedure.
8. Start the engine.
9. With the engine idling, gently feather the clutch by applying light pressure to the clutch handle in the engagement direction. Watch the plungers move back and forth slowly until anti-freeze is discharged from the manifold port as shown in (Figure 16).
10. Once anti-freeze has been discharged from the discharge port, disengage the clutch and shut off the engine.
11. Remove the funnel assembly from the suction port and reconnect the suction hose.
12. Disconnect the water lubrication lines from the stuffing boxes and drain the lines.

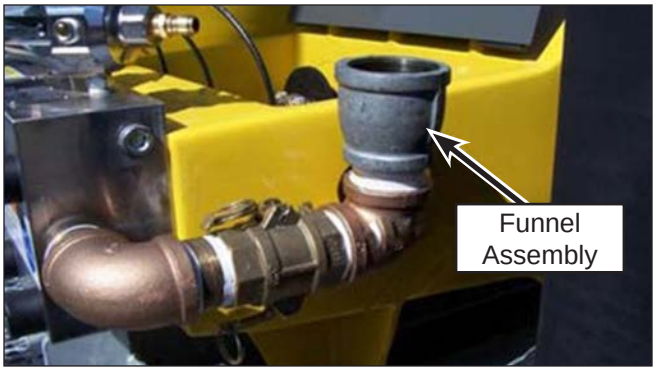


Figure 14: Funnel Assembly Installation.

Figure 15: Adding Anti-Freeze.

Figure 16: Draining the Anti-Freeze.

WATER

Water Quality Requirements

The quality of water that is supplied to your Jetstream pump can have a direct impact on performance. Items like dissolved solids and pH values out of the allowable range can, either by themselves, or together with other properties of the water, lead to premature failure (such as cracking) of pump components and related accessories.

Suspended gasses (tiny bubbles) in the water can also lead to premature component failure. These gases can sometimes be detected visually by inspecting the water in the inlet tank for tiny bubbles or a milky appearance.

As part of the installation and or operating procedures of this pump, an expert that specializes in water quality must perform a water quality test. If your water is found to exceed any of the allowable measurements in the chart below, consult a specialist in water purification and conditioning.

Recommended water quality levels:

Substance	Maximum Allowed (mg/L)
Silica	1.0
Calcium	0.5
Magnesium	0.5
Iron	0.1
Manganese	0.1
Chloride	5.0
Sulfate	25.0
Nitrate	25.0
Carbon Dioxide	0
Total Dissolved Solids	50.0
pH	6.8 – 7.5
Specific Conductivity	50 micro-mhos/cm

Note: *Boiler water additives with either ammonia or amines are not allowed.*

Note: *If water that has been treated by either reverse osmosis or deionization is to be used in your pump, it is important that it does not have a total dissolved solids (TDS) reading of less than 0.5 ppm. Water with a TDS reading of 0.5 ppm or less has been known to attack carbide components such as plungers and back-up rings.*

Fluid Compatibility with Jetstream Pumps

Jetstream pumps are designed and built primarily for pumping water at various pressure ratings. Jetstream does not have a compatible fluids list at this time. The use of any fluids other than water void warranty.

There are special considerations for seawater applications. Please consult the factory for a specific application.

There are instances where fluids besides water to be pumped are considered for use in Jetstream pumps. Jetstream does not approve the suitability of their pumps for use with any other fluid besides water, for the following primary reasons:

- **Safety and Environmental:** Water leakages in the high pressure system, pump, waste water, bypass water, etc., are normally quite easily contained (if necessary) and/or produce zero-risk to low-risk situations.
- **Corrosion Resistant Pump Components:** The stainless steel components in the fluid handling portion of the Jetstream pump offer good corrosion resistance to water.
- **Operational Characteristics:** The plunger sealing elements are designed to be compatible with and exhibit long operational lifetimes when using clean cold water. Other fluids can significantly shorten the life of the packing material through any number of failure mechanisms, including chemical reactions or dissolving the packing material, or offering inadequate lubrication to the packing. High temperature water is also problematic, as the packing can only tolerate approximately 125°F water. At elevated temperatures the packing life decreases substantially.

Suggestion: To understand the effects of a fluid on pump internals and fluid conductors, it is suggested to put a univalve part, an o-ring from the valve, a packing set and a piece of high pressure hose into a jar of this fluid and observe the effect over time.

Secondary Filter (40k Operation Only)

The secondary filter, or polishing filter, is used for 40K operation only. When operating at 40K, monitor the filter pressure gauge (Figure 17) for an indication of filter condition. During normal operation, the pressure gauge should be within the 30 to 40 psi (2 to 2.75 bar) range. When differential pressure inside the filter housing between the clean side and the dirty side reaches approximately 7 to 10 psi (0.48 to 0.69 bar), the pressure switch on the filter housing will trip and the engine will shut off to protect the unit from damage. Replace the dirty filter cartridge if this occurs.

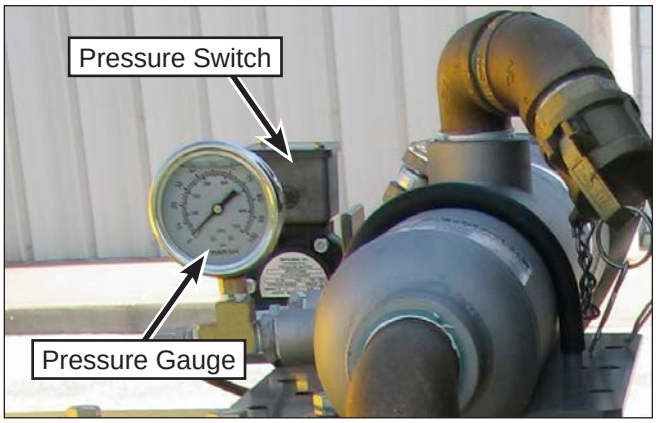


Figure 17: Secondary Filter Assembly.

ATTENTION

Extended operation with a dirty filter will lead to filter failure and allow debris to reach the valves, causing damage to the valves.

It is important to know the condition of your filter cartridge. Standard units come with a pressure gauge on the filter. In order to monitor the condition of the filter it is important to note the engine operating speed and housing pressure when the filter is first changed. Refer to “Filter Cartridge Replacement” on page 25 for more information.

Filter Cartridge Replacement

1. Relieve pressure from the housing using the bleed valve then loosen the three eye-nuts (Figure 18) on the filter cover.
2. Slowly open the cover and capture the spring (Figure 19) and spring keeper.
3. Remove the filter cartridge.
4. Install the new filter cartridge onto the guide rod. Ensure the guide rod is correctly seated into the bottom of the housing.
5. Inspect the O-ring and install a new one if necessary.
6. Place the spring keeper and spring into place on the end of the filter cartridge.
7. Move the filter cover into position and tighten the eye-nuts.
8. Prepare the pump for operation and start the unit. Start a typical blast operation and record the following:
   - Engine rpm
   - Gauge pressure on the secondary filter
9. Save this record for monitoring the status of the secondary filter. Monitor the pressure gauge as more hours of operation are accumulated on the filter cartridge. When the pressure on the filter gauge has dropped approximately 7 to 10 psi (0.48 to 0.69 bar) (with the unit operating at the same rpm as earlier recorded), the filter must be replaced.

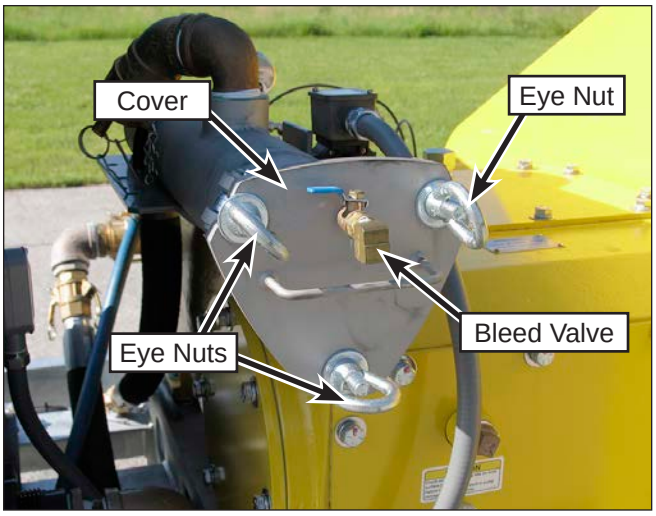


Figure 18: Filter Cover.

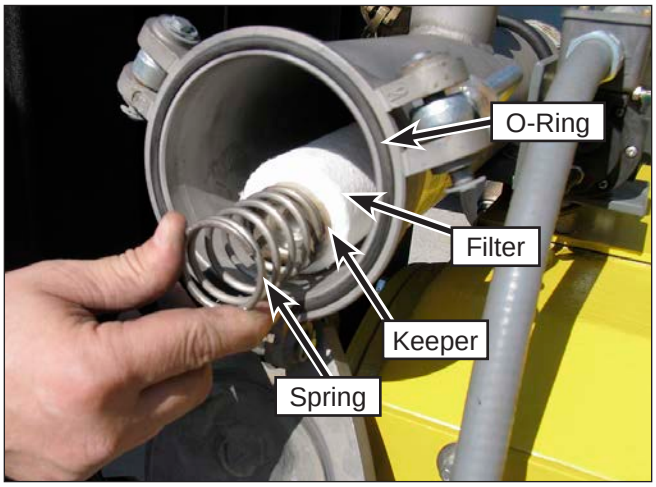


Figure 19: Cartridge Removal.

Switch Adjustment

The differential pressure switch will shut down the unit when the pressure drop across the filter is approximately 7 to 10 psi (0.48 to 0.69 bar). If the switch doesn't close within the 7 to 10 psi (0.48 to 0.69 bar) range, it may need to be adjusted. Contact Jetstream for switch adjustment instructions.

Uni-Valve Life

The uni-valve seats can be damaged by dirty water. It is important to change filters regularly to improve pump performance and prolong valve life. (Nozzles and bypass cartridges are also adversely affected by dirty water).

Inspect uni-valve seats regularly to monitor condition and lap the valve seats when necessary. Refer to "Valve Lapping" on page 52 for lapping instructions.

Jetstream®
Subsidiary of Federal Signal Corporation

PRESSURE CONVERSION

The versatility of the Jetstream waterblast pump allows operators to modify the pump to change to different operating pressure ranges when necessary.

There are three ranges of pressure usually referred to as 15K, 20K, and 40K. These are abbreviated names to easily denote the maximum operating pressure.

- The 15K fluid end can operate up to 15,000 psi (1034 bar).
- The 20K fluid end can operate up to 20,000 psi (1379 bar).
- The 40K fluid end can operate up to 40,000 psi (2758 bar).

When converting a fluid end to a different pressure, it is necessary to exchange the stuffing boxes and manifold with the proper components for the new operating pressure.

⚠ *WARNING*

When switching to higher operating pressures, it is necessary that all equipment be properly pressure rated. Refer to the Jetstream Safety Manual for specific guidelines for hoses, fittings, etc.

Converting a Pump

Use the following procedure to convert a pump to a different pressure.

1. Relieve pressure from the pump, shut off the engine, and disengage the clutch.
2. Turn off the water supply, drain the water tank.
3. Remove the two bolts that secure the hydro-throttle switch aluminum housing (Figure 20) to the brass cartridge in the manifold. Remove the switch and housing and set aside.
4. Disconnect the bypass drain hose and the supply coupling from the manifold (Figure 21).
5. Open the rod box cover and disconnect the lubrication lines from the stuffing box fittings (Figure 22).

Figure 20: Hydro-Throttle Switch.

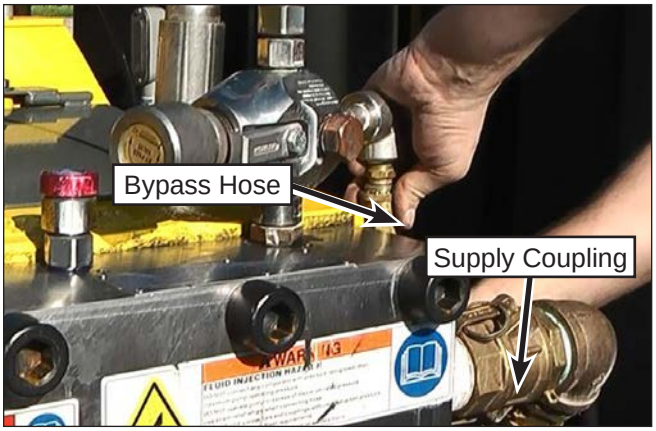


Figure 21: Line Removal.

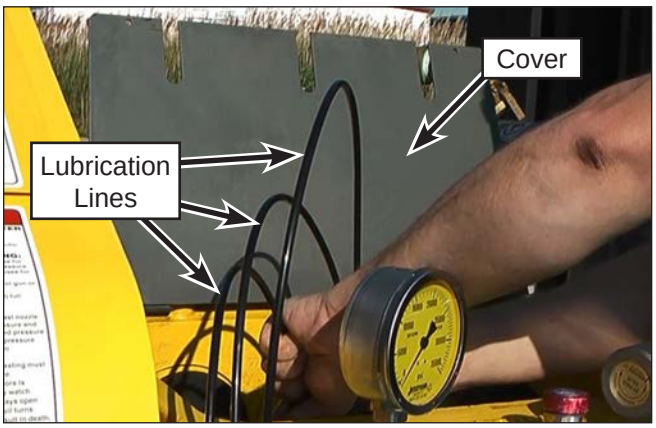


Figure 22: Disconnecting Lubrication Lines.

6. Remove the cotter pin (Figure 23) from the hinge rod and remove the rod.
7. Remove the top manifold bolts (Figure 24) at each corner.

Note: *The pump wrench can be used with a hammer to remove the manifold bolts.*

8. Install manifold mounting studs (Figure 25) into the two open holes to allow for easier installation of the new manifold.

Note: *Manifold mounting studs can be purchased from Jetstream.*
5200 / 4200 / 3600 - p/n 54261
3000 - p/n 56742

9. Continue removing the remaining manifold bolts.

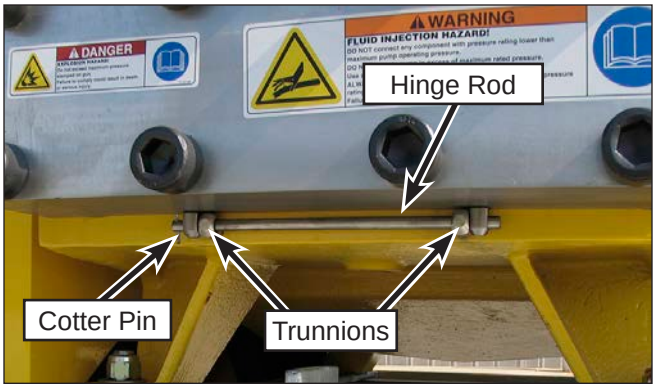


Figure 23: Hinge Rod, Trunnions, and Cotter Pin.

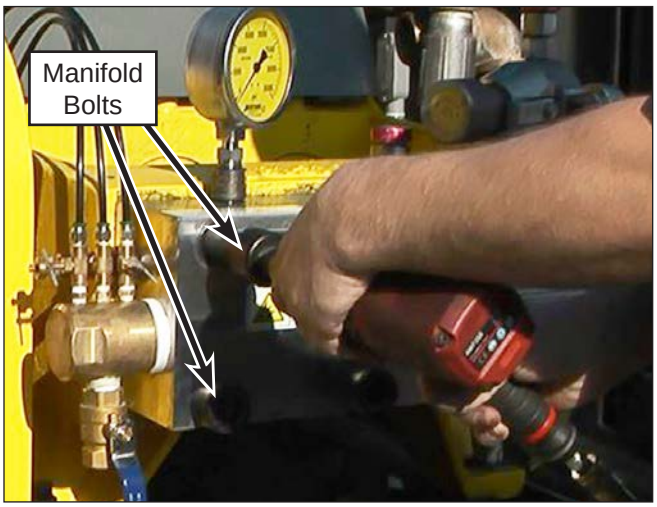


Figure 24: Manifold Bolt Removal.

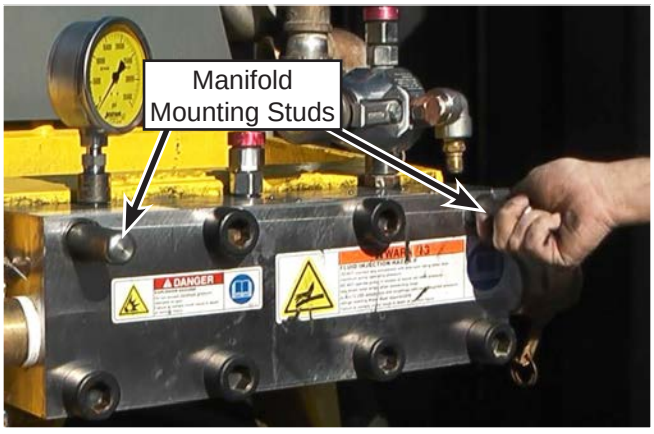


Figure 25: Manifold Mounting Stud Installation.

10. Once all of the bolts are removed, lift the manifold off the pump (Figure 26).

CAUTION

Use two people to lift the manifold. The manifold is heavy and failure to use two people may cause serious injury.

Note: *The weight of the manifold is approximately:*

- 3000 Series: 90 lb. (41 kg)
- 3600/4200/5200 Series: 165 lb. (75 kg)
- 6000 Series: 370 lb. (168 kg)

11. Remove the water lubrication fitting (Figure 27) from each stuffing box.
12. Remove the two bolts that secure each plunger coupling (Figure 28) to the plungers and remove the three couplings.

Note: *The coupling halves are matched and must be kept together.*

Figure 26: Manifold Removal.

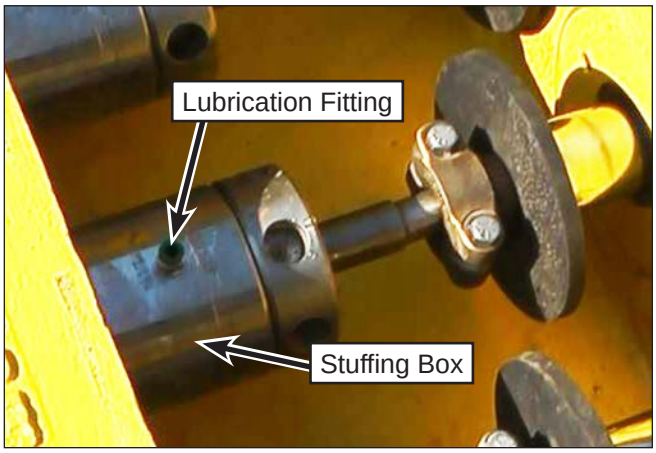


Figure 27: Lubrication Fittings.

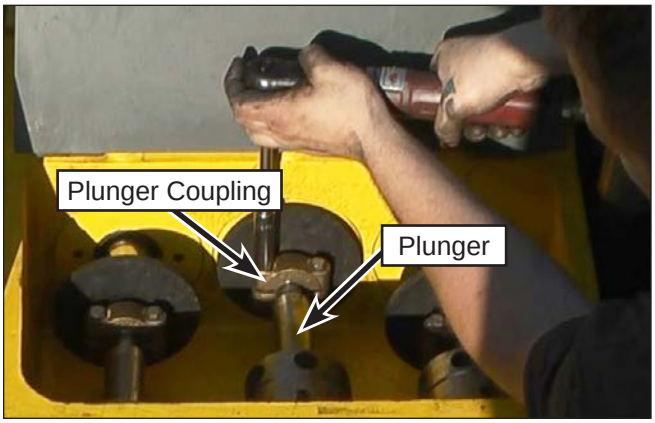


Figure 28: Plunger Coupling Removal.

13. Pull each stuffing box from the pump case (Figure 29).
14. Clean the stuffing box bore thoroughly and apply petroleum jelly or Anti-Seize to the bores.

ATTENTION

Apply petroleum jelly or Anti-Seize to each stuffing box bore when installing stuffing boxes to help prevent corrosion and extend pump life.

15. Install the new stuffing boxes into the pump case. Orient the stuffing boxes so the flat face on the outer diameter matches the flat face in each case bore.
16. Extend the plunger from each stuffing box until it mates with the opposing crosshead pony rods. Install the plunger coupling (Figure 30) on each plunger and secure with the two bolts. Tighten the bolts to 20 ft.-lb.(27 N·m).
17. Ensure the gland nuts are tight. Use the pump wrench and a 5 lb. (2 kg) hammer to tighten the gland nuts to approximately 250 ft.-lb.(338 N·m) (Figure 31). Hit the wrench about three times using moderate power. This should supply sufficient torque on the nut.

Figure 29: Stuffing Box Removal.

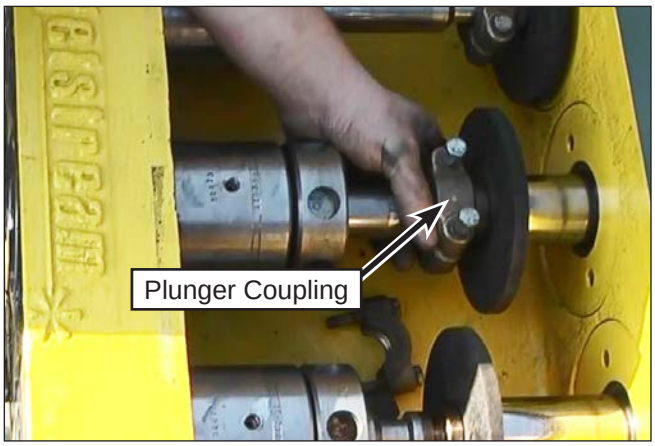


Figure 30: Plunger Coupling Installation.

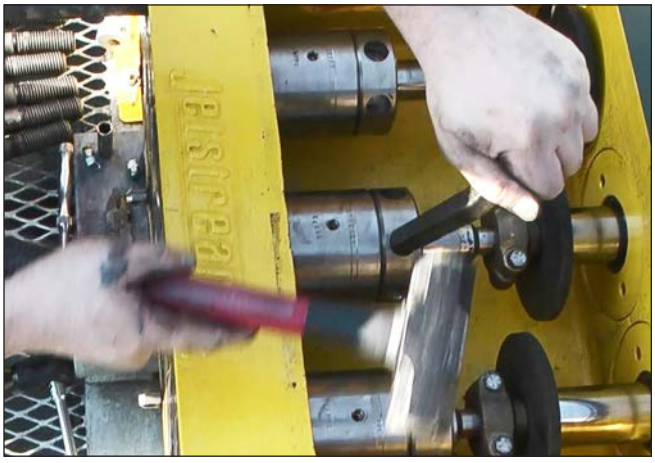


Figure 31: Tightening the Gland Nuts.

18. Apply Teflon tape to the threads of the lubrication line fittings (Figure 32). Install the fittings onto the stuffing boxes.
19. Apply a light coating of petroleum jelly or Anti-Seize to the mounting face of the power end. This will greatly reduce the buildup of corrosion.
20. Lift the new manifold onto the manifold mounting studs (Figure 33).

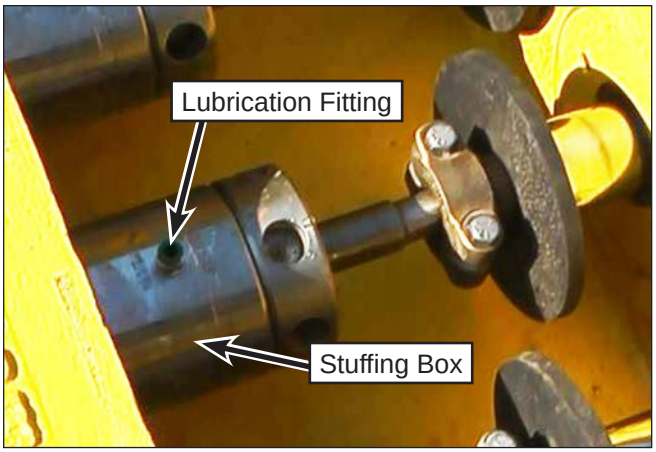


Figure 32: Lubrication Line Fittings.

⚠ CAUTION

Use two people to lift the manifold. The manifold is heavy and failure to use two people may cause serious injury.

21. Install and adjust the trunnion rod as follows:

Manifold Trunnion Adjustment

The trunnions in the manifold must be adjusted such that the hinge rod supports the manifold to allow the capscrews to be screwed in or out by hand. The manifold holes need to be centered over the tapped holes in the powerframe (or adapter plate). This configuration will put the hinge rod in a substantial bind and it will be bent down slightly at the ends since it will be supporting the weight of the manifold block. This centered position of the manifold will also ensure proper operation of the valves and seals at all pressures.

Figure 33: Lift the New Manifold onto the Mounting Studs.

a. Remove two manifold bolts and install two manifold mounting studs. Remove remaining manifold bolts.
4200 / 3600 - p/n 54261
3000 - p/n 56742
b. Slide the manifold away from the powerframe (or adapter plate) a few inches (Figure 34, A). This will allow room to adjust the threaded trunnions in the bottom of the manifold.
c. Screw both manifold trunnions (Figure 34, B) in completely and then back them out approximately 2-1/2 turns. Slide the manifold back against the powerframe (or adapter plate).

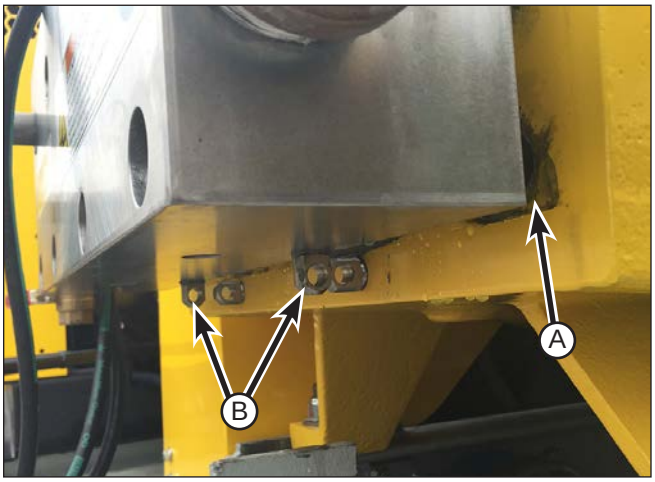


Figure 34: Manifold in Adjustment Position.

d. To install the hinge rod (Figure 35), it will be necessary to either lift the manifold or use a screwdriver to flex the rod while simultaneously tapping the end with a hammer to get the rod through the second set of trunnions. Check for correct alignment and free rotation of the manifold bolts.

⚠ CAUTION

Use two people to lift the manifold. The manifold is heavy and failure to use two people may cause serious injury.

e. Repeat as necessary making half turn adjustments to both trunnions up or down until the manifold bolts thread in and out easily.

22. Install the manifold bolts (Figure 36) in the open holes and hand-tighten.
23. Remove the manifold mounting studs (Figure 36).
24. Install the remaining two bolts. Tighten all of the bolts in a crisscross sequence (Figure 37). Proper torque is 350 ft.-lb. (470 N·m).

Figure 35: Hinge Rod Installation.

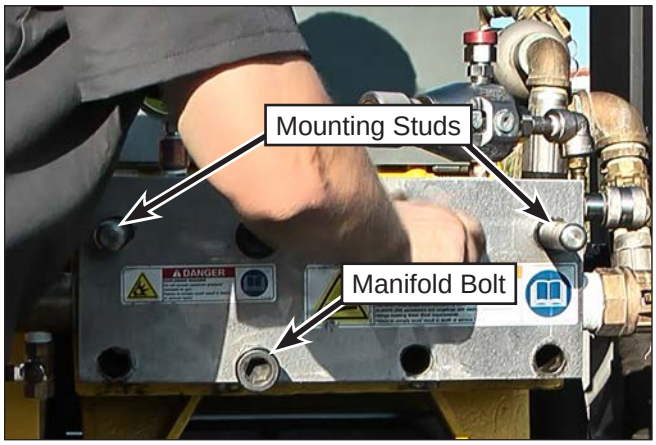


Figure 36: New Manifold Installation.

Figure 37: Tightening Sequence.

25. Connect the water lubrication lines (Figure 38) to the fittings on the stuffing boxes.
26. Connect the supply coupling (Figure 39) and the bypass hose to the manifold.
27. Place the hydro-throttle switch and housing (Figure 40) into position and install the two bolts that secure it.

ATTENTION

If converting to a 40K fluid end, the secondary filter must be plumbed for operation. Refer to "40K Hose Connections".

When converting to 40K, a charge pump is required to force the water through the secondary filter. If the 40K manifold is not pressurized, the univalves will be damaged. If your unit is not equipped with a charge pump, it cannot be converted to a 40K fluid end. Units equipped with a charge pump are plumbed so that the charge pump feeds the manifold at all times with the clutch engaged. The charge pump is belt driven by the PTO.

28. Verify all connections, glands and bolts were properly tightened.
29. Ensure the water lubrication system is properly adjusted, if equipped, before waterblasting. Refer to "Checking the Water Lubrication System" on page 16 for instructions.
30. If new packing was installed, break in the packing as outlined in "Breaking in New Packing" on page 18.

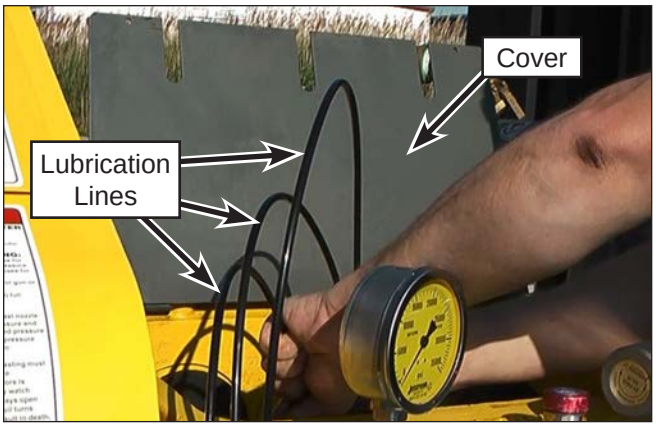


Figure 38: Connecting the Water Lubrication Lines.

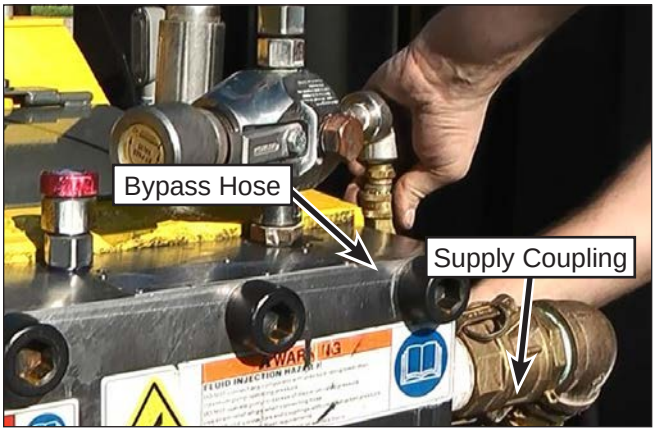


Figure 39: Connecting Bypass Hose and Supply Coupling.

Figure 40: Hydro-Throttle Switch and Housing Installation.

40K Hose Connections

1. Remove the supply hose (Figure 41) (supply from charge pump) from the suction elbow fitting on the 15K/20K manifold.
2. Install the 40K manifold as outlined earlier in this chapter.
3. Remove the plug from the filter outlet hose (Figure 42). Connect the hose to the elbow on the 40K manifold.
4. Remove the cap from the secondary filter inlet coupling (Figure 43).
5. Install the charge pump supply hose on the secondary filter inlet coupling.

⚠ CAUTION

When flushing the system before operation, purge the secondary filter of air. Failure to do so could cause pump cavitation and damage. Use the bleed valve (Figure 43) on the filter to purge the air from the filter.

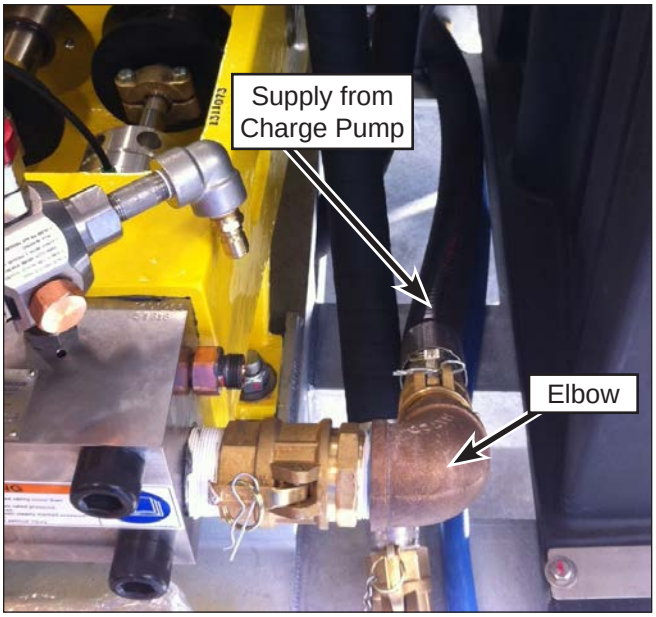


Figure 41: Supply Hose from Charge Pump.

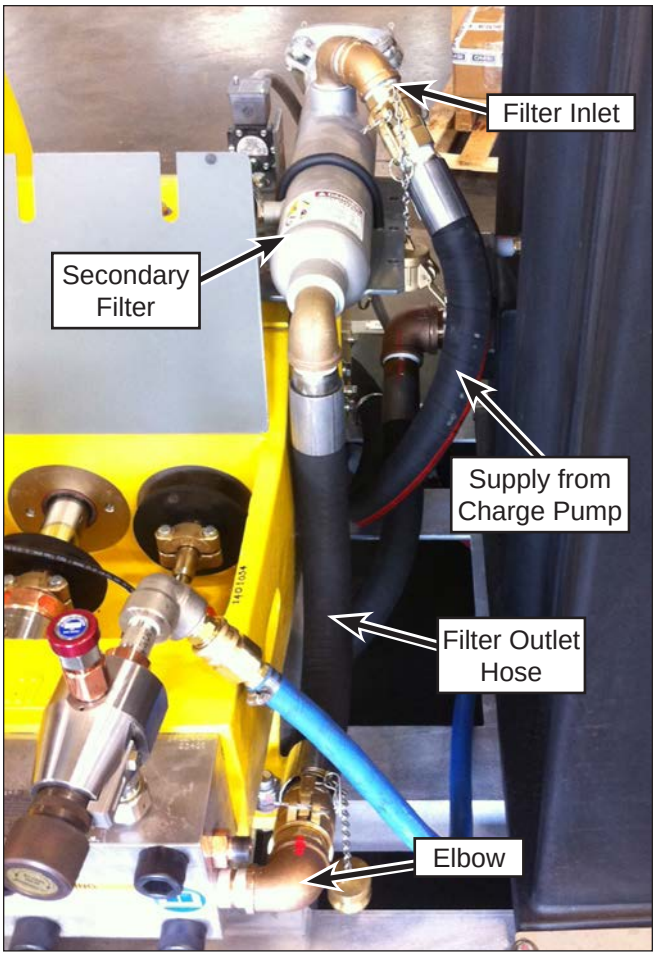


Figure 42: Plumbing.

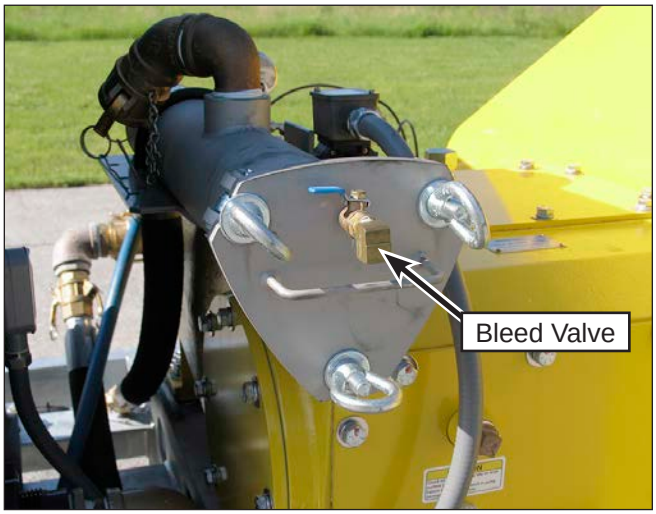


Figure 43: Secondary Filter Bleed Valve.

SERVICE

Fluid End

Checking Manifold Bolt Torque

Verify the head bolts are properly tightened. Check the bolt torque in a crisscross sequence starting with the center bolts (Figure 44). Proper torque is 350 ft.-lb. (470 N·m) which can be achieved with a few hammer strikes on the pump wrench.

Figure 44: Tightening Sequence.

Checking Gland Nut Torque

1. Open the rod box cover.
2. Place the long end of the pump wrench in one of the gland nut holes.
3. Use a 5 lb. (2 kg) hammer to hit the wrench in the direction to tighten the gland nuts. Hit the wrench about three times using moderate force. This will supply sufficient torque on the nut.
4. Repeat for the remaining nuts.
5. Close the rod box cover.

Figure 45: Tightening the Gland Nut.

ATTENTION

It is helpful to mark gland nuts once they are confirmed to be operating correctly. A permanent marker can be used to mark a line across the top of the gland nut and stuffing box. This will allow easy visual confirmation that the gland nuts are properly torqued.

Rupture Disc Inspection

1. Use an adjustable wrench to remove the cap (Figure 46) from the rupture disc assembly.
2. Remove the rupture disc from the base and inspect.
3. Verify a disc is installed and has not been damaged. Replace as necessary.

ATTENTION

Installation of rupture discs with a burst pressure no greater than 1.4 times the working pressure is required by Jetstream for warranty coverage on this pump.

4. Install the upper housing back onto the assembly.
5. Repeat for the remaining rupture disc.

Packing Replacement

Removal

1. Relieve pressure from the pump, shut off the engine and disengage the clutch.
2. Turn off the water supply and drain the water tank.
3. Open the rod box cover.
4. Disconnect the water lubrication lines, if equipped.
5. Position the plunger to be serviced so that it is at bottom dead center (pony rod is fully retracted towards crankshaft). Pull the drive belts to rotate the pump (Figure 48)

WARNING

Use caution when rotating the pump as this can be a pinch hazard.

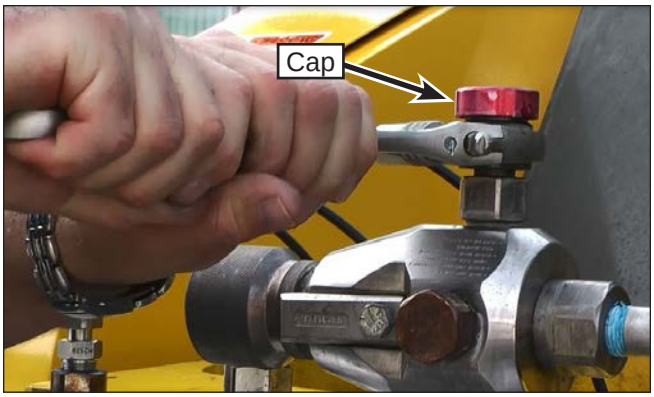


Figure 46: Housing/Cap Removal (15K Manifold Shown).

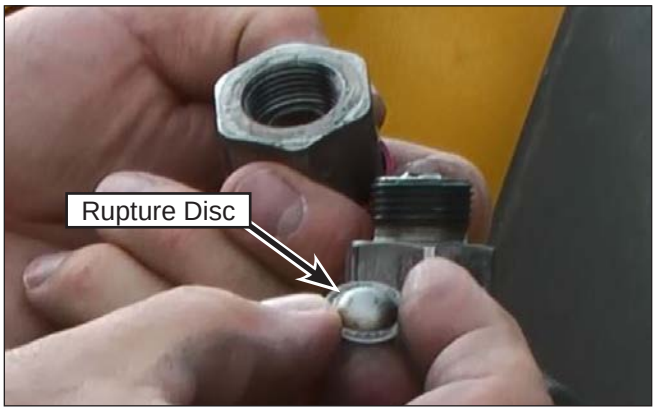


Figure 47: Disc Removal.

Figure 48: Rotating the Belt Drive.

6. Insert the rounded end of the pump wrench (Figure 49) into one of the holes in the gland nut and tap the top of the wrench sharply with a heavy hammer to loosen. When loose, unscrew the gland nut from the stuffing box by hand.
7. Remove the two bolts that secure the plunger coupling (Figure 50) to the plunger and remove the coupling. Push the plunger into the stuffing box for clearance.
8. Remove the gland nut and plunger from the stuffing box. It may require effort to wiggle the packing out by moving the plunger from side to side and up and down.
9. Remove the packing set (Figure 51).

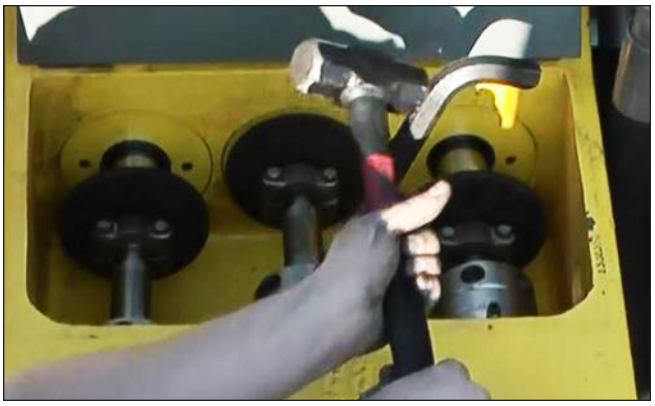


Figure 49: Loosening the Gland Nut.

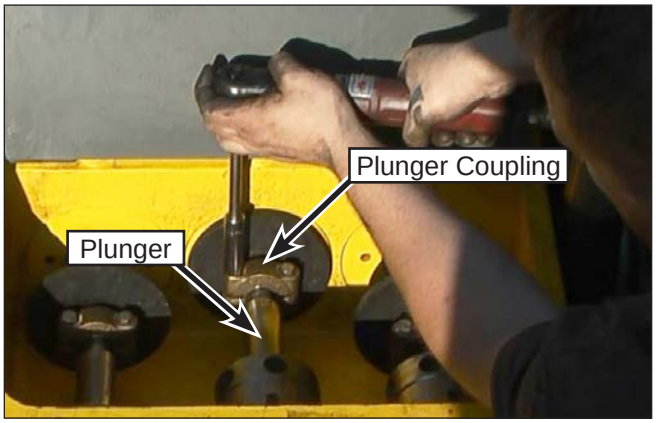


Figure 50: Plunger Coupling Removal.

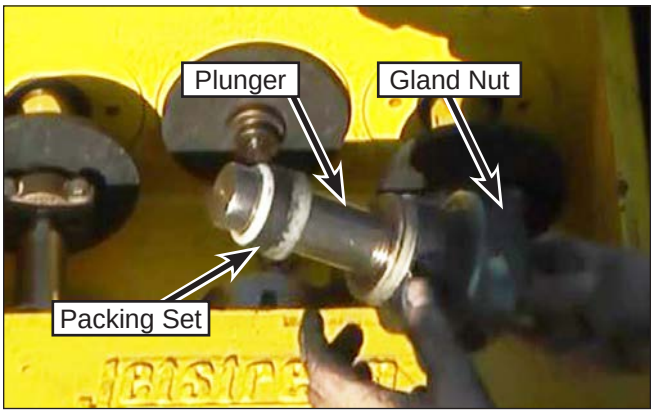


Figure 51: Packing Removal.

10. Remove the plunger and guide bushing (Figure 52) from the gland nut and inspect.

Note: *The guide bushing may be stuck and require some force to remove. Use a tool in the cutout (Figure 53) to push the bushing out. Use caution to avoid damaging the gland nut.*

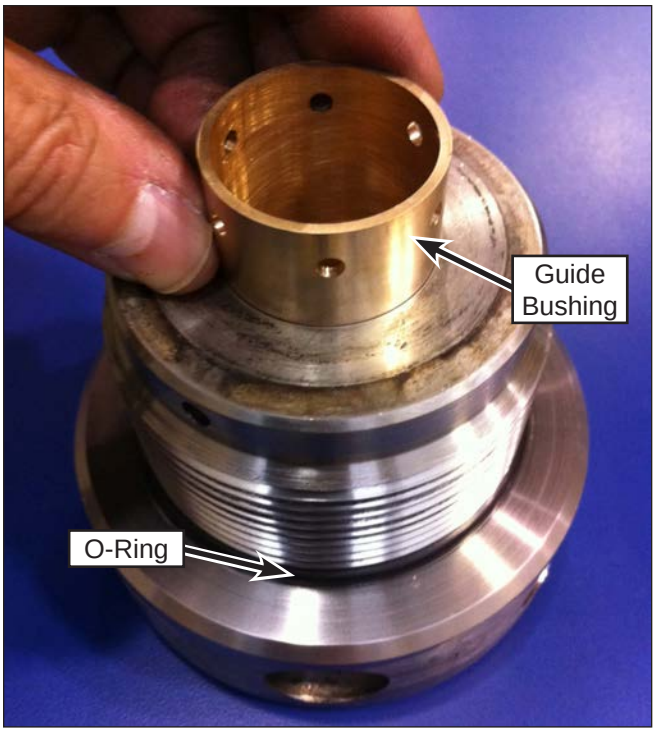


Figure 52: Guide Bushing Removal (15K/20K Gland Nuts).

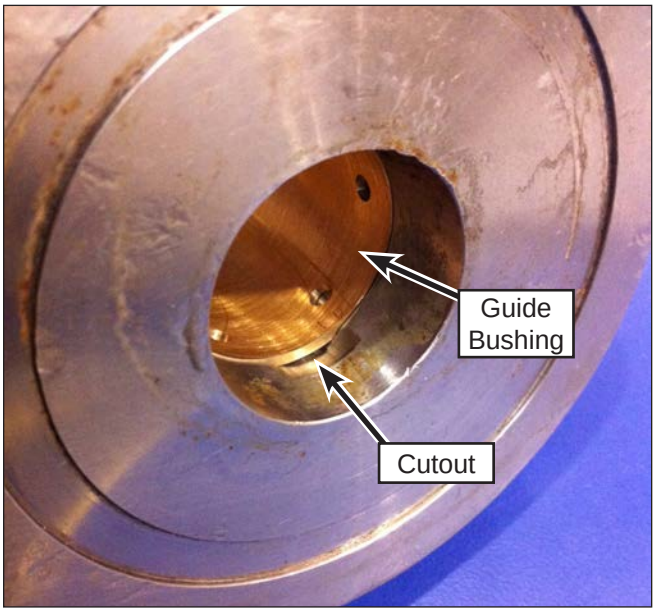


Figure 53: Stuck Bushing.

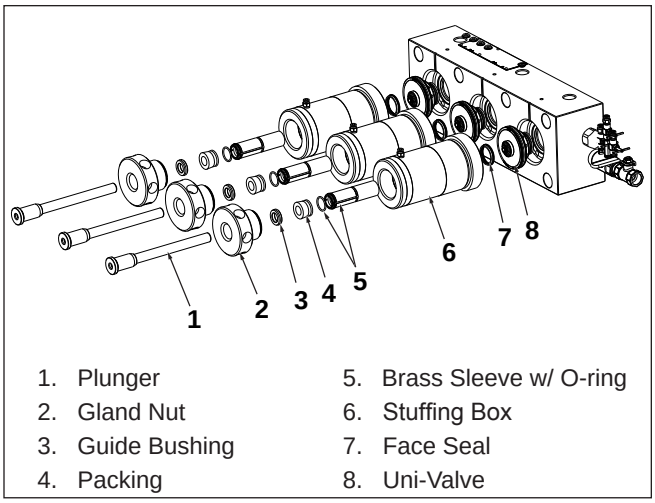
Note: *On 40K fluid ends, the brass sleeve (Figure 54) inside the stuffing box does not need to be removed unless the plunger shows evidence of rubbing on the sleeve.*

11. Remove the O-ring (Figure 56) from the gland nut.
12. Repeat the previous steps for the remaining stuffing boxes if packing is to be replaced.

Inspection

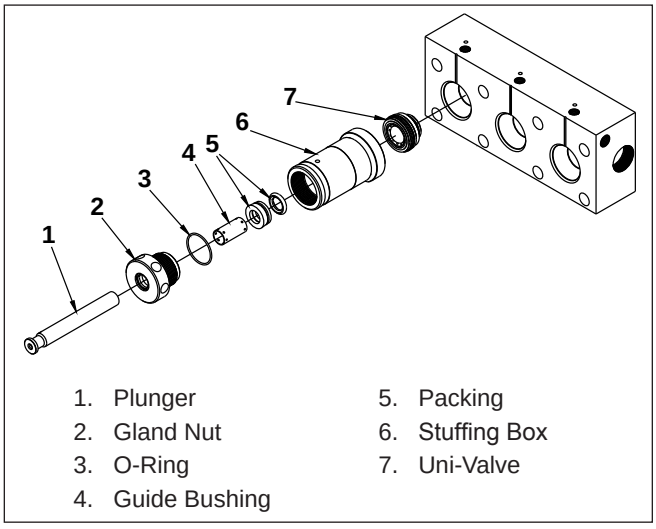
1. Inspect the plunger for scratched or deep scores. Discard damaged plungers.
2. On 40K units, measure the diameter of the guide bushing (Figure 56, A). If the diameter exceeds the Dimension A specification listed in the "40K Guide Bushing Replacement Table" below, replace the bushing. If the bushing shows scoring or if the edge is chipped, replace the bushing.

40K Guide Bushing Replacement Diameter		
Fluid End	**Plunger Size**	**Dimension A**
3040	# 5	0.533 in. (13.54 mm)
3640	# 6	0.603 in. (15.32 mm)
4240	# 7	0.673 in. (17.09 mm)
4240	# 8	0.733 in. (18.62 mm)



1. Plunger
2. Gland Nut
3. Guide Bushing
4. Packing
5. Brass Sleeve w/ O-ring
6. Stuffing Box
7. Face Seal
8. Uni-Valve

Figure 54: 40K Fluid End (Some Components Not Shown).



1. Plunger
2. Gland Nut
3. O-Ring
4. Guide Bushing
5. Packing
6. Stuffing Box
7. Uni-Valve

Figure 55: 15K/20K Fluid End (Some Components Not Shown).

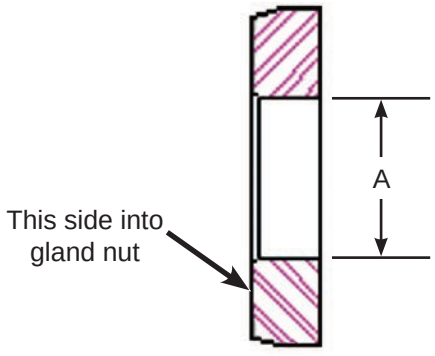


Figure 56: Guide Bushing Check (40K Only).

Installation

1. Install a new O-ring (Figure 56) onto the gland nut.
2. Install the guide bushing (Figure 57) and plunger into the gland nut.
3. Place the new packing and guide bushing onto the plunger. Orient the packing as shown in (Figure 54) for 15K/20K and (Figure 55) for 40K.
4. Lubricate the gland nut with anti-seize compound. Apply the compound to the threads and on the small face that contacts the inside of the stuffing box (Figure 58). Place the assembly into the stuffing box. Hand-tighten the gland.

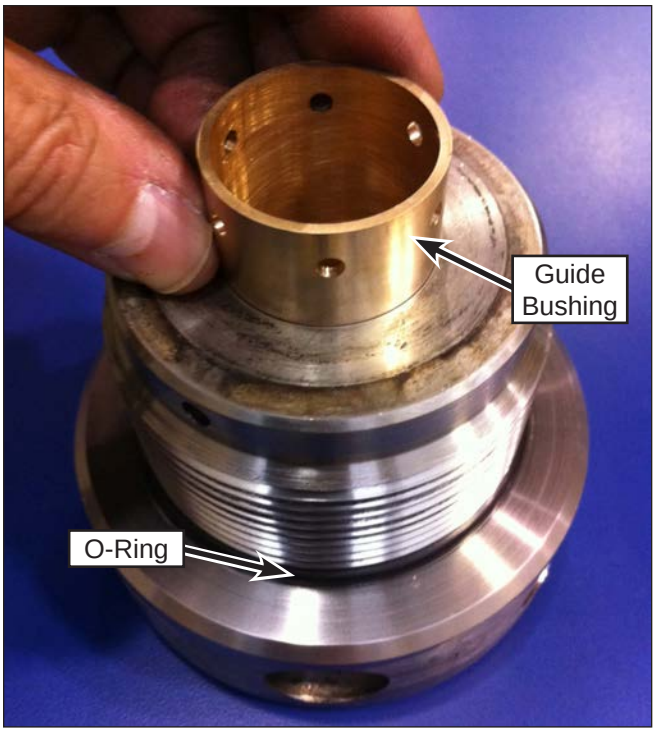


Figure 57: Guide Bushing Installation.

Figure 58: Applying Anti-Seize.

5. Pull the plunger (Figure 59) back to meet the crosshead pony rod. If the packing is too tight to move the plunger by hand, the pump can be rotated by hand (via the belts) to move the pony rod to meet the plunger.
6. Place the plunger coupling into position and install the coupling bolts (Figure 60). Tighten the bolts to 20 ft.-lb.(27 N·m).
7. Use the pump wrench and a 5 lb. (2 kg) hammer to tighten the gland nuts to approximately 250 ft.-lb.(338 N·m). Hit the wrench about three times using moderate force (Figure 61). This will supply sufficient torque on the nut.
8. Repeat the previous steps for the remaining stuffing boxes.
9. Connect the water lubrication lines and close the rod box cover.
10. It is necessary to break-in new packing properly to ensure optimal performance and a proper seal. Refer to “Breaking in New Packing” on page 18 for the proper break-in procedure.

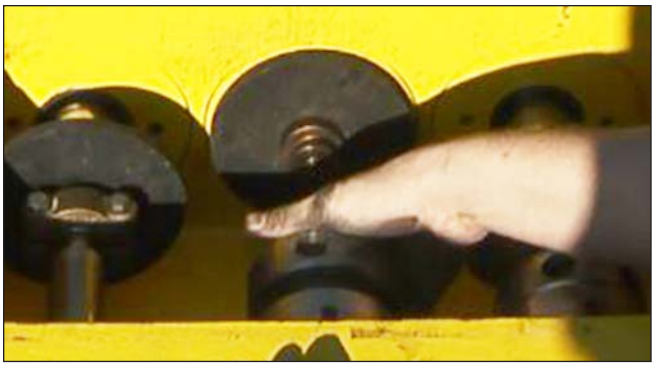


Figure 59: Gland Installation.

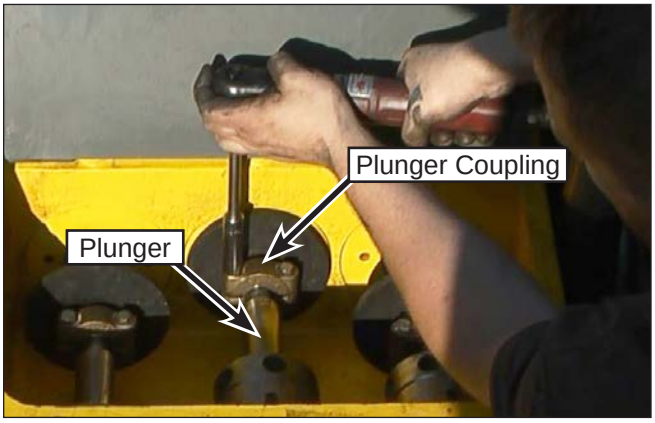


Figure 60: Plunger Coupling Installation.

Figure 61: Tightening the Gland.

Uni-Valve Service

Removal

1. Relieve pressure from the pump, shut off the engine, and disengage the clutch.
2. Turn off the water supply and drain the water tank.
3. Disconnect the bypass drain hose and the supply coupling from the manifold (Figure 62).
4. Open the rod box cover (Figure 63) and disconnect the lubrication lines from the stuffing box fittings.
5. Remove the manifold bolts (Figure 64). Ensure the hinge rod (Figure 65) is installed before removing the bolts.

⚠ *WARNING*

If the hinge rod is missing, the manifold can fall and cause serious injury.

Note: *The pump wrench can be used with a hammer to remove the manifold bolts.*

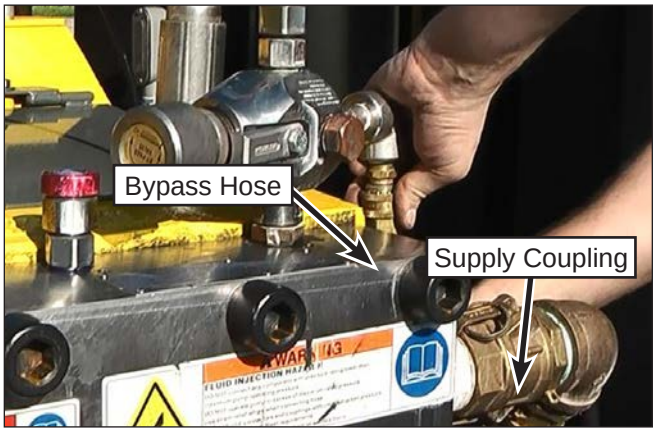


Figure 62: Line Removal.

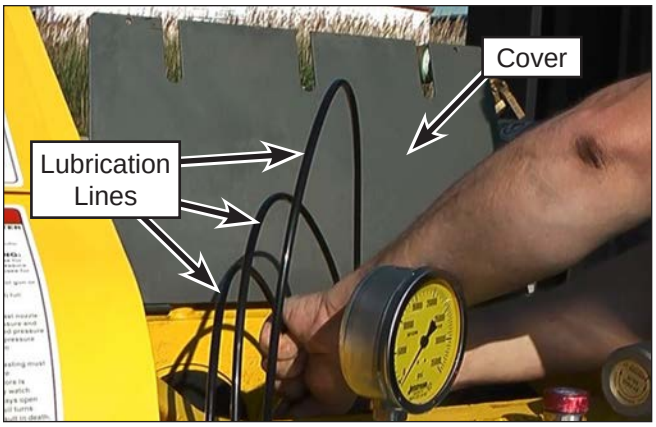


Figure 63: Disconnecting the Lubrication Lines.

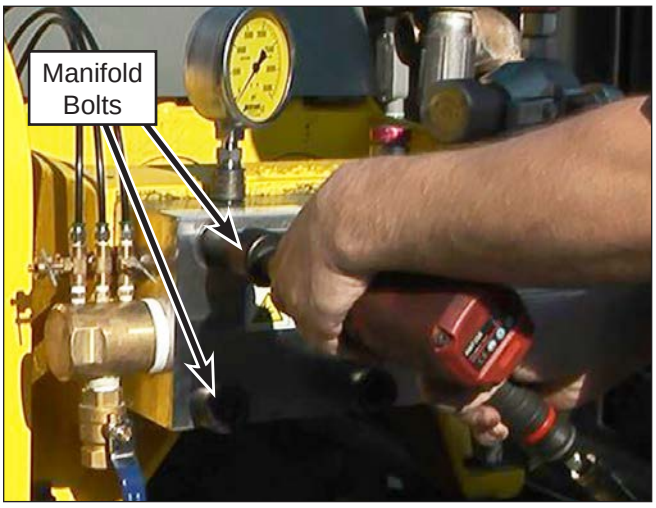


Figure 64: Removing the Manifold Bolts.

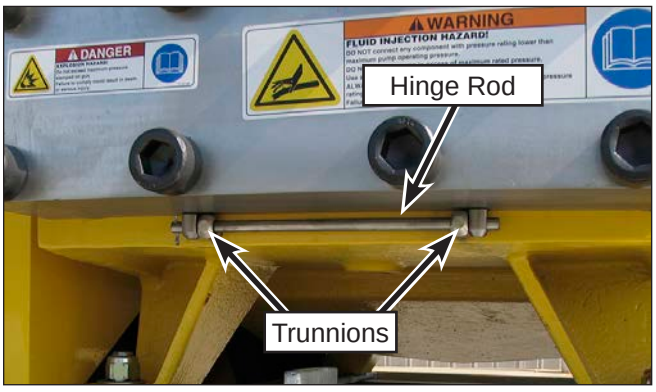


Figure 65: Hinge Rod and Trunnions.

6. Slowly swing the manifold downward to the manifold support rest. The weight of the manifold is approximately:
   - 3600/4200 Series: 165 lb. (75 kg)
   - 3000 Series: 90 lb. (41 kg)
7. Use two small pry bars (Jetstream p/n 70179) to pry the valve out of the manifold as shown (Figure 66).
8. Remove the remaining valves. Refer to the topics on valve service later in this chapter for disassembly and maintenance instructions.

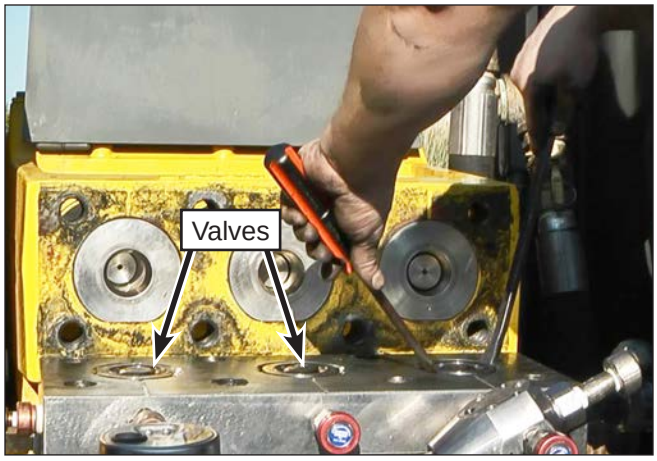


Figure 66: Valve Removal.

CAUTION

Jetstream uni-valves must be lapped regularly to minimize damage to the seating surfaces and maximize valve life. Service intervals depend on many variables including water quality, filter maintenance, and hourly usage. Refer to "Valve Lapping" on page 52 for instructions.

40K Face Seal Replacement

Because the valves on 40K manifolds do not have exterior O-rings that seal the manifold to the pump frame, the stuffing boxes contain a face seal to seal the two surfaces. Perform the following to replace.

1. Press slightly behind the face seal using your finger and gently pull the seal out (Figure 67).

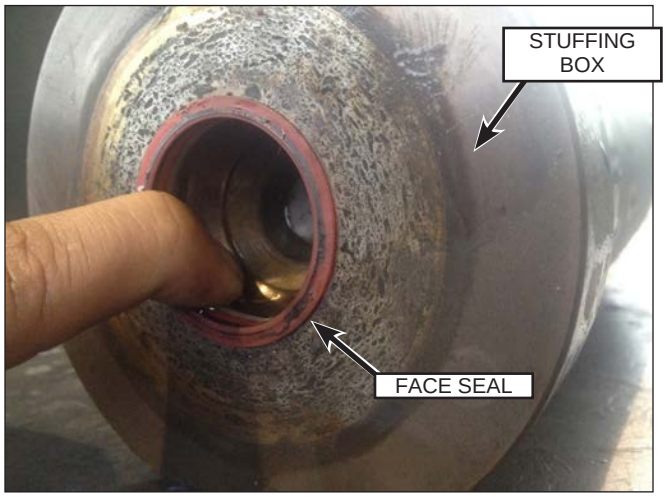


Figure 67: Face Seal Removal.

CAUTION

Do not use hard metal tools such as screwdrivers or picks to remove the face seal. Doing so may cause damage to the stuffing box and sealing surface to the point where the box must be discarded.

2. Wipe the seal retaining area and inspect.
3. Apply O-ring lubricant to the entire area of the new seal.
4. With the sealing lip facing away from the stuffing box, press the new seal into place by hand until seated.
5. Ensure the seal stays in place until the manifold is in place and tightened.

Installation

1. Place the valve into position on the manifold. Using the palms of your hands, press the valve into the manifold as shown (Figure 68).
2. Install the remaining valves.
3. Swing the manifold upward to install the bolts.
4. Install the manifold bolts and tighten in a criss-cross sequence starting with the center bolts (Figure 69). Proper torque is 350 ft.-lb. (470 N·m).
5. Connect the water lubrication lines (Figure 70) to the stuffing boxes and close the rod box cover.
6. Connect the supply coupling (Figure 71) and the bypass hose to the manifold.

Figure 68: Installing the Valves.

Figure 69: Tightening Sequence.

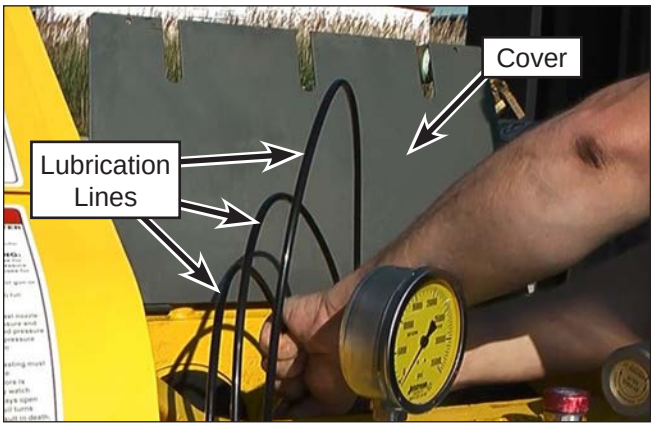


Figure 70: Connecting the Water Lubrication Lines.

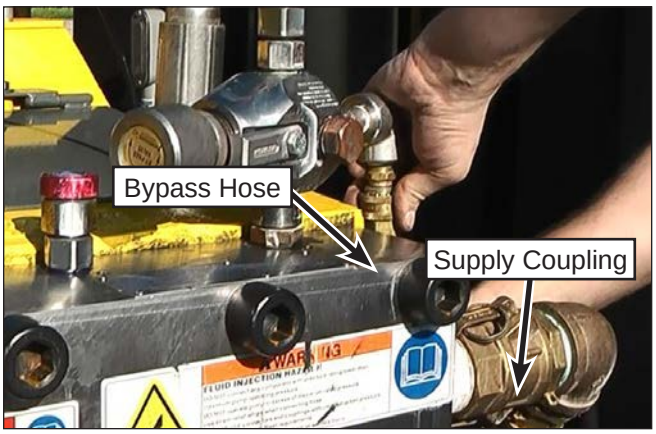


Figure 71: Hose Connections.

15K, 20K Uni-Valve Service

Disassembly

1. Remove the O-ring at each end of the valve (Figure 72). Discard the O-rings.
2. Locate the slits in the two white backup rings and carefully remove the rings. Remove the companion O-rings, as well (Figure 73). Discard the O-rings and backup rings.

   Note: *Note the orientation of the seals for installation.*

3. Use a small screwdriver to depress the spring retainer. Use another screwdriver to remove the retaining ring. Insert the blade under the slit and rotate the ring out of the groove. Use caution to prevent bending or distorting the ring (Figure 74).

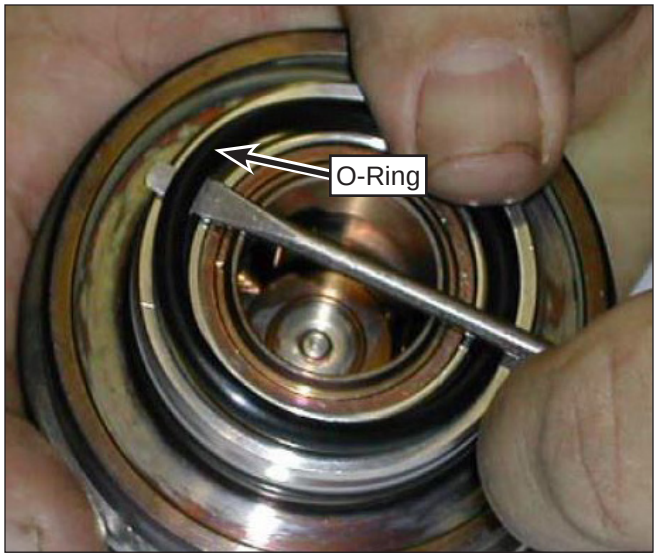


Figure 72: O-Ring Removal.

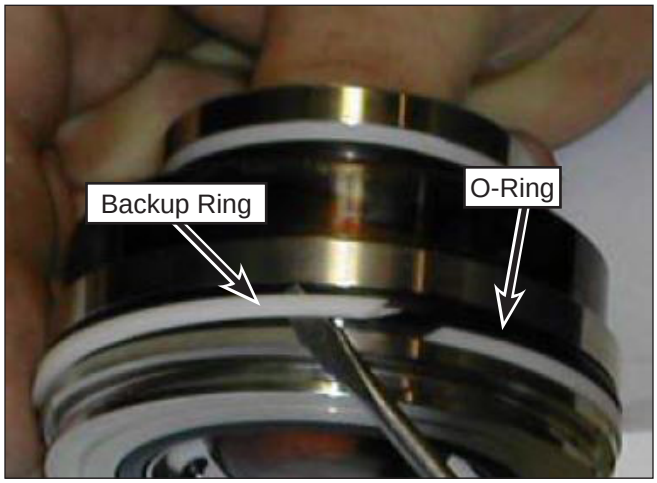


Figure 73: Backup Ring and O-Ring Removal.

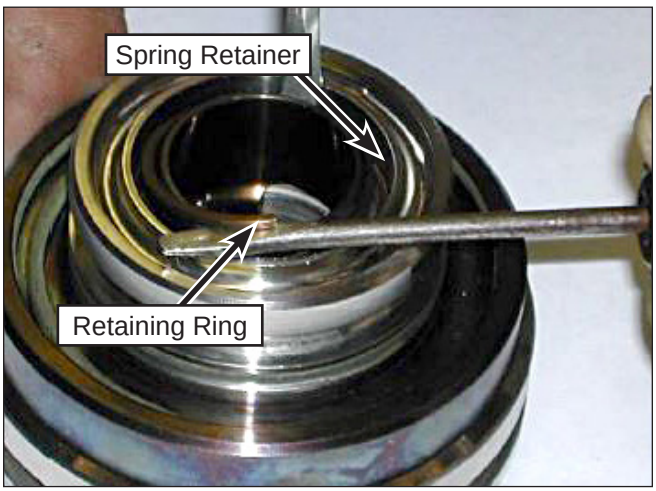


Figure 74: Removing the Retaining Ring.

4. Remove the valve spring retainer and valve spring (Figure 75).
5. Lift the assembly off of the suction valve and set the suction valve aside.
6. Insert a small screwdriver under the discharge spring (Figure 76). Carefully rotate the screwdriver until the spring releases from the groove.

   Note: *3015 valves are equipped with a retaining ring to secure the discharge spring (Figure 77).*

7. Remove the discharge valve and discharge spring.
8. Inspect the valves. Refer to “Valve Inspection” on page 52 for inspection criteria.

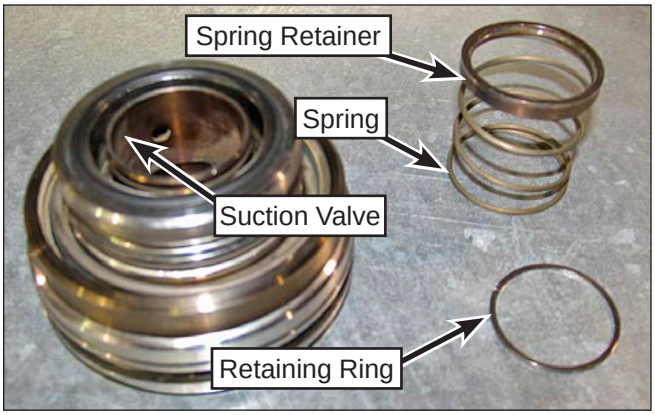


Figure 75: Retaining Ring and Spring Removal.

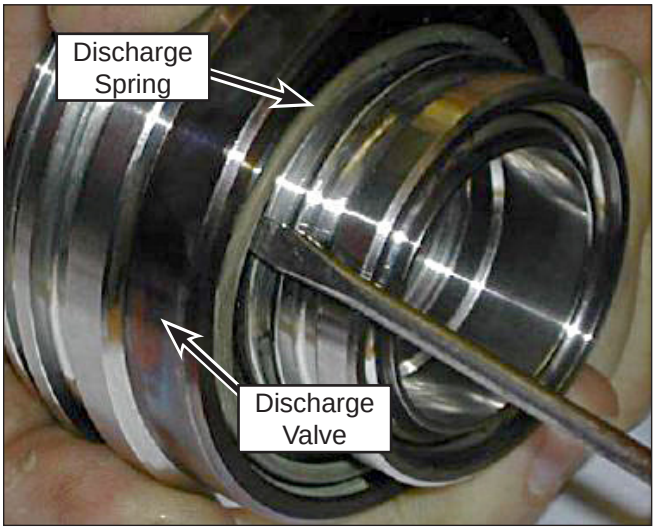
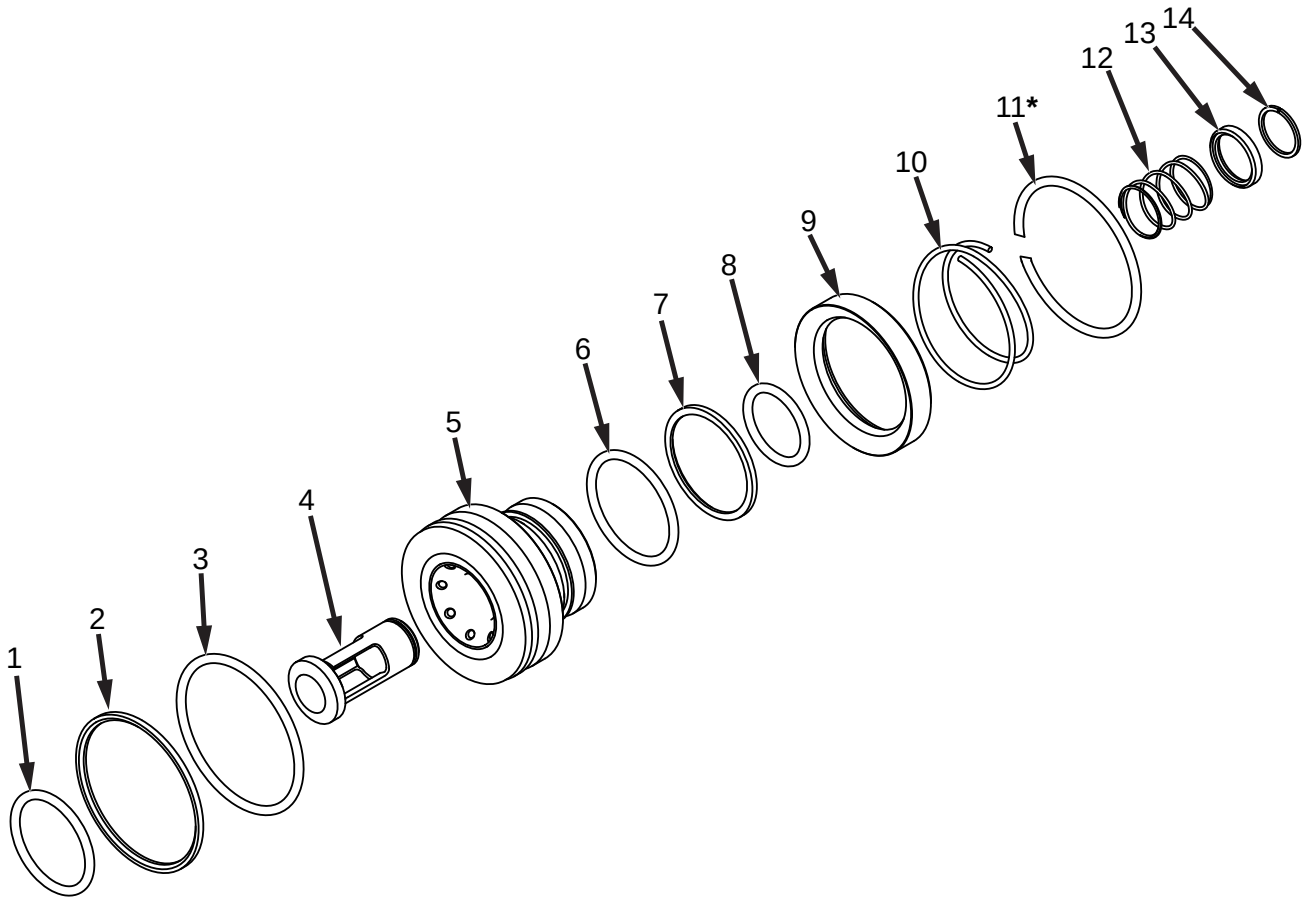


Figure 76: Discharge Spring and Valve Removal.



1. O-Ring
2. Backup Ring
3. O-Ring
4. Suction Valve
5. Discharge Valve Body
6. O-Ring
7. Backup Ring
8. O-Ring
9. Discharge Valve
10. Discharge Valve Spring
11. Retaining Ring (3015 Valves Only)
12. Suction Valve Spring
13. Spring Retainer
14. Retaining Ring

Figure 77: 15/20K Uni-Valve Exploded View.

Assembly

1. Install the discharge valve onto the valve body. The shiny mating surface faces the holes on the valve body. Place the discharge spring into position on the valve (Figure 78).
2. Lock the spring in its retaining groove. Use a screwdriver to push the spring in place. Start at the base of the spring and follow along the coils to the top of the spring until it locks in its retaining groove.
3. Position the suction valve in the valve body (Figure 79).
4. Insert the suction valve spring and spring retainer into the valve body. Ensure the ledge the retaining ring sits on is positioned properly (Figure 80).
5. Press the spring retainer downward and install the retaining ring onto the suction valve.
6. Install the new O-rings and backup rings into their respective positions on the assembly (Figure 77).

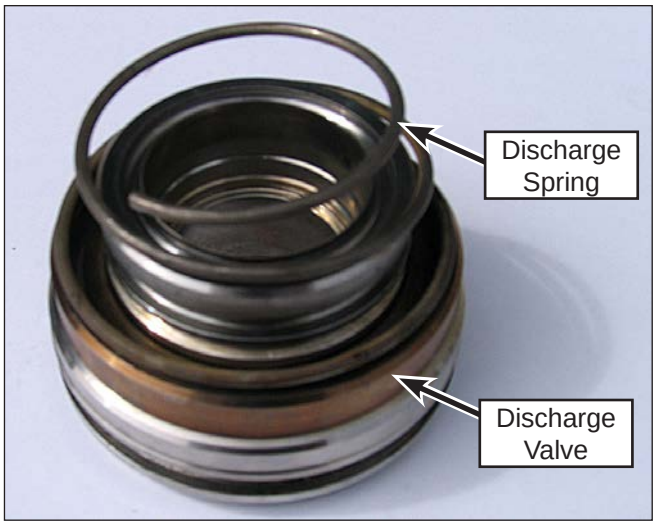


Figure 78: Discharge Installation.

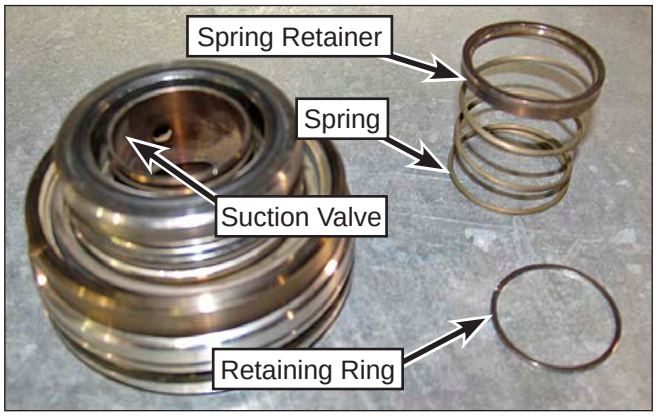


Figure 79: Suction Valve Installation.

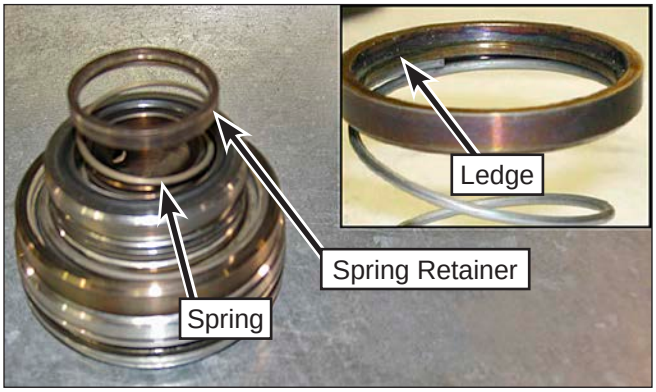


Figure 80: Spring and Retainer Installation.

40K Uni-Valve Service

Disassembly

1. Use a small screwdriver to remove the two black O-rings from the valve (Figure 81).
2. Use the screwdriver to remove the seal retaining ring. Insert the blade under the slit and rotate the ring out of the groove (Figure 82). Use caution to prevent bending or distorting the ring.
3. Use the screwdriver to remove the ring seal (Figure 83) and seal support ring.
4. Turn the valve over.

Figure 81: O-Ring Removal.

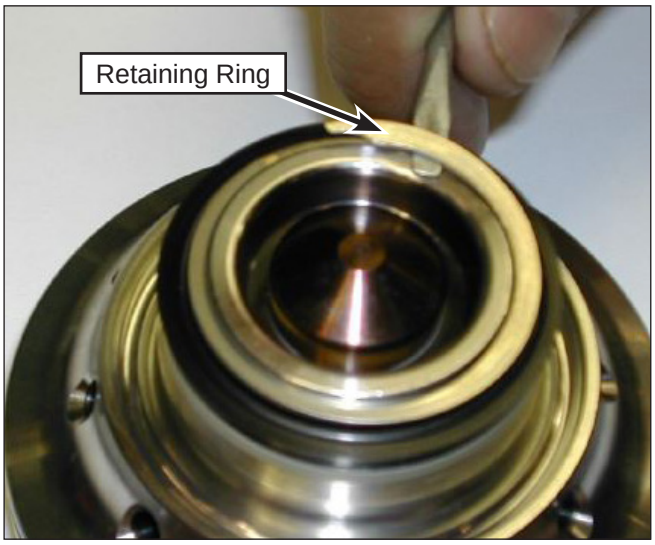


Figure 82: Retaining Ring Removal.

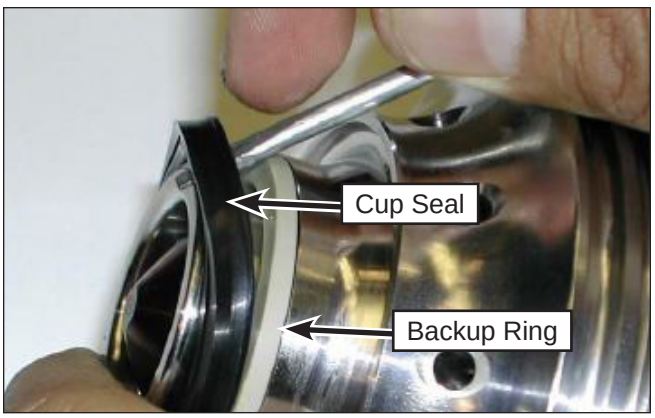


Figure 83: Cup Seal Removal.

5. Press down on the valve spring retainer and slide the spring keepers out from the assembly (Figure 84).
6. Remove the valve spring and valve spring retainer.
7. Remove the suction and discharge valves (Figure 85).
8. Inspect the valves. Refer to “Valve Inspection” on page 52 for inspection criteria.

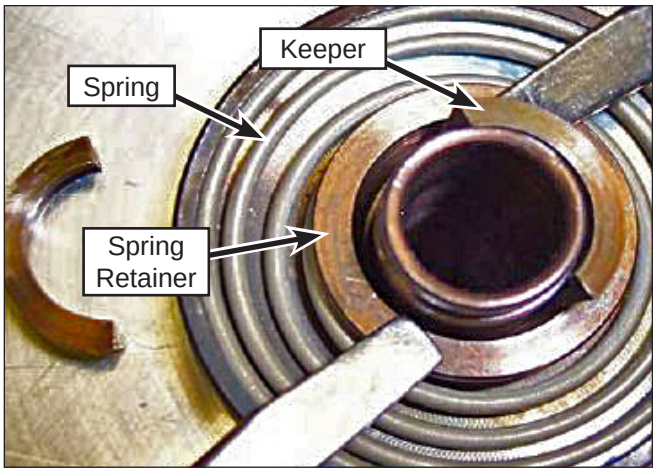


Figure 84: Spring Retainer Removal.

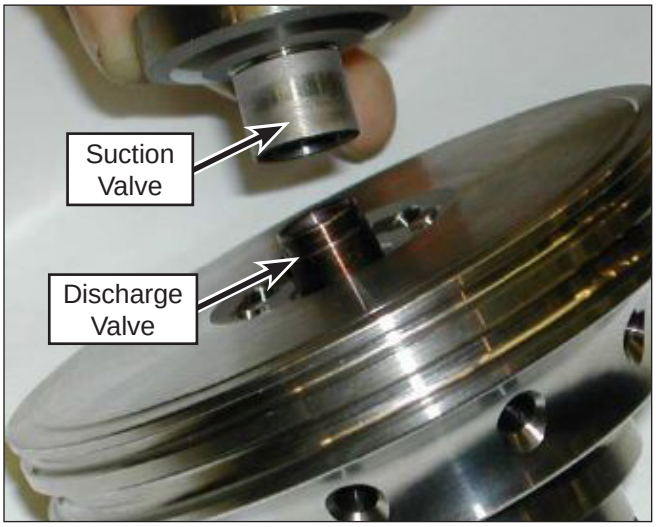


Figure 85: Valve Removal.

Assembly

1. Install the discharge valve into the valve body (Figure 86).
2. Position the valve spring and valve spring retainer into place on the suction valve. Press down on the spring retainer to insert the keepers (Figure 87).
3. Place the backup ring (Figure 88) onto the assembly. Note the chamfer on the inside diameter of the backup ring. Orient the back-up ring so the chamfer faces the valve body and the flat side of the ring faces the cup seal. Install the cup seal and the retaining ring.
4. Install the two O-rings (Figure 89).

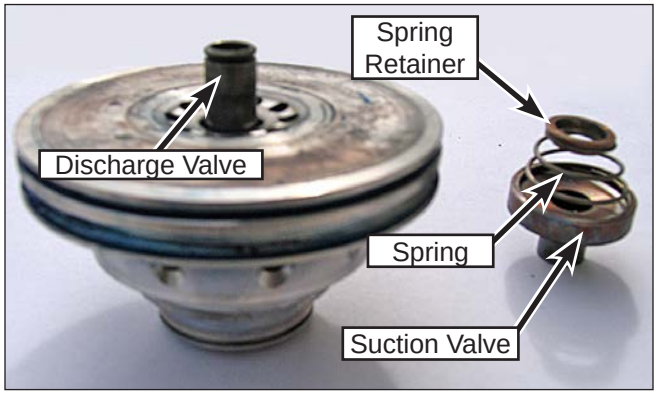


Figure 86: Valve Installation.

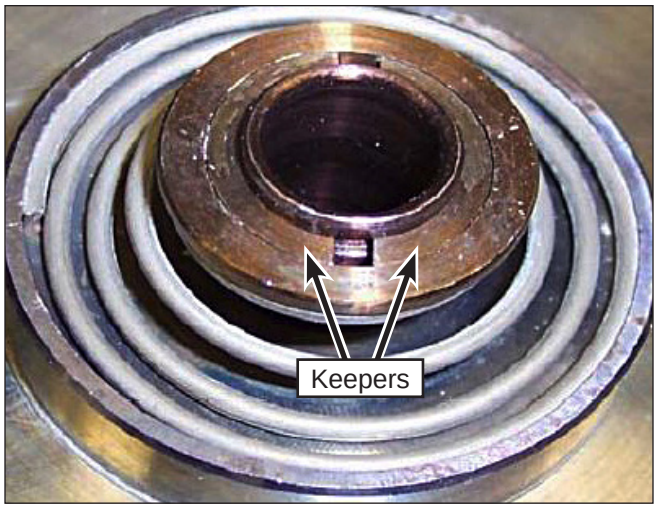


Figure 87: Installing the Keepers.

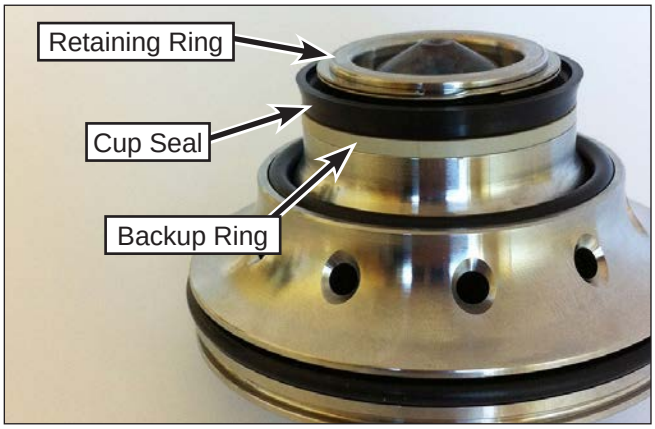


Figure 88: Install the Seal Ring.

Figure 89: Install the O-Rings.

Valve Inspection

1. Inspect all seals and discard as necessary.
2. Inspect the valve components. Discard excessively pitted or otherwise damaged components (Figure 90).
3. For valves with minor wear or corrosion, recondition the valves as outlined in Valve Lapping.

Valve Lapping

Lapping is a polishing process in which two surfaces are rubbed together with an abrasive between them. Lapping the valves at regular intervals ensures a tight fit between the valves and valve seat for proper sealing. Regularly lapping the valves allows the pump to operate efficiently and helps increase valve life.

ATTENTION

Use silicon carbide lapping compound, 220 grit medium fine.

1. Disassemble the valve.
2. Apply lapping compound to the mating surface on the suction valve (Figure 91).
3. Place the valve into position on the valve body. Rotate the valve and valve body in opposite directions with a light pressure for approximately 30 seconds.
4. Pause lapping momentarily by disengaging surfaces. Rotate the parts in the opposite direction approximately 90 degrees. Do this a few times during lapping. This will ensure that the lapping compound distributes evenly along the valve and valve seat interface.

   Repeat for approximately 2-5 minutes, until an even dull grey circular ring can be seen without any remaining pits or surface imperfections.
5. Clean off the excess lapping compound with a clean dry cloth. Inspect the contact surfaces for uniform, dull gray sealing rings (Figure 92).
6. Continue the lapping process until the desired sealing surface is achieved.
7. Repeat the lapping process for the discharge valve.
8. When completed, clean all metal parts by submerging in a mineral spirits solution for a few minutes. Remove and air dry thoroughly with compressed air. Ensure that no compound or solution remains in the cross holes.

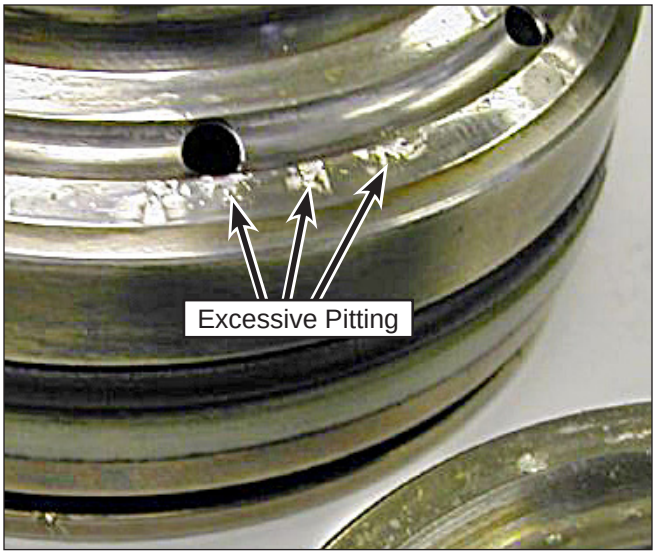


Figure 90: Valve Pitting.

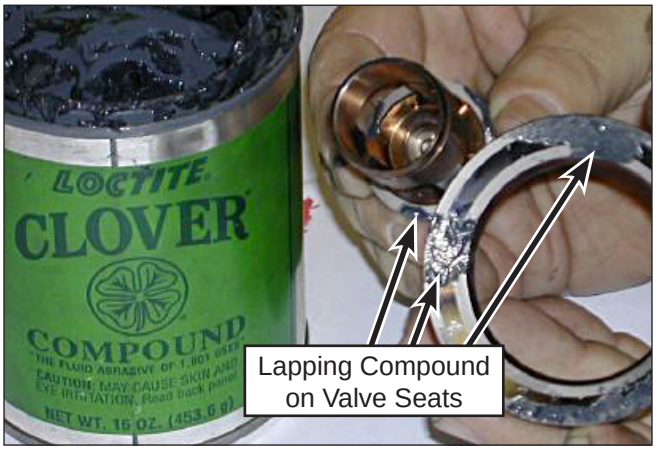


Figure 91: Typical Example of Lapping Compound Application.

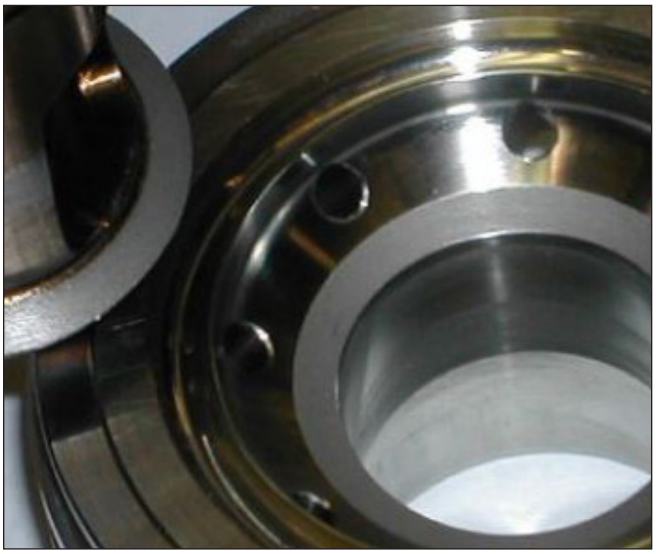


Figure 92: Properly Lapped Valve Seats.

Bypass Valve Cartridge Replacement

1. Remove the dump hose (Figure 93) from the bypass valve.
2. Using an adjustable wrench, remove the cartridge housing (Figure 94) from the valve.
3. Pull the cartridge (Figure 95) from the housing.
4. Inspect the diffuser (Figure 96) for jetting damage. Replace if damage is extensive.
5. Push the new cartridge into the housing until it snaps into place.
6. Install the cartridge housing back onto the bypass valve.
7. Install the dump hose onto the bypass valve.

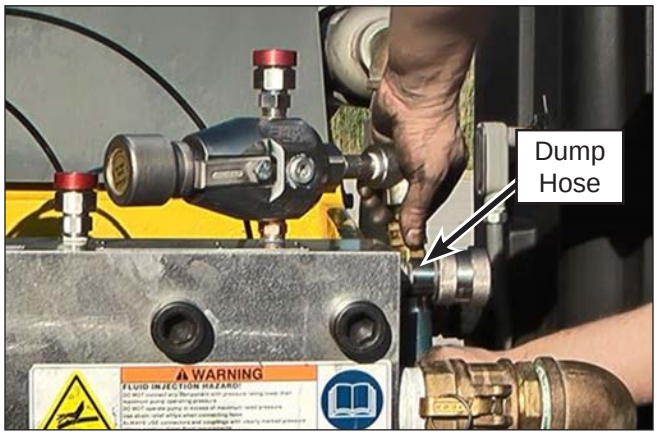


Figure 93: Dump Hose Removal.

Figure 94: Cartridge Housing Removal.

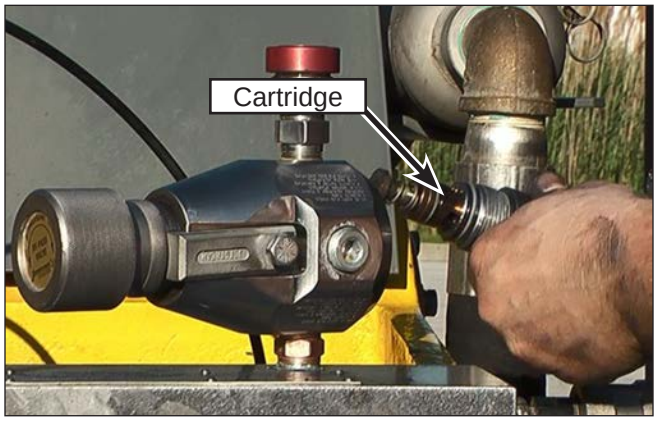


Figure 95: Cartridge Removal.

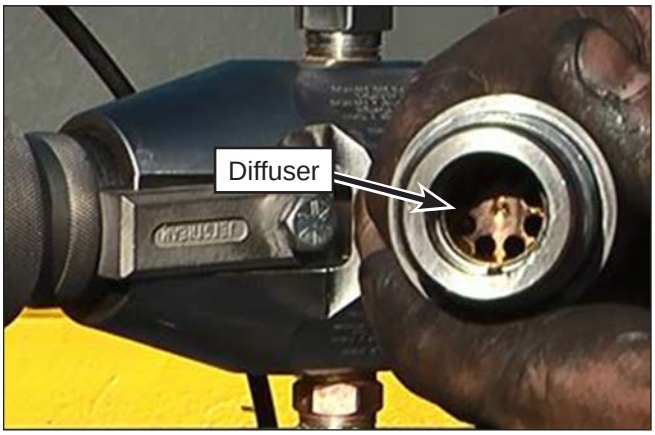


Figure 96: Seating Surface Inspection.

Power End

Checking Power End Oil Level

The most accurate method to check the oil is when the unit is on level ground and has not been in use for 5 to 8 hours. If the pump has been in use and the oil needs to be checked refer to the alternate methods as outlined in “Alternate Oil Check Methods” following this procedure.

Note: *Because of varying factors such as temperature, the oil in the pump will completely settle between 5 and 8 hours.*

1. Locate the sight gauge (Figure 97) on the back of the power end case. With the pump off (for 5 to 8 hours), the oil should be at the Full level.
2. If the reservoir is low, add 80W/90 detergent free gear oil while the engine is off. Remove the fill plug and add oil through the port in the back plate.

⚠ *CAUTION*

Under no circumstances should you operate the pump if there is no oil visible in the sight gauge at rest no matter what method is used to check the oil level.

Alternate Oil Check Methods

Method 1: If the pump is at or near operating temperature and needs to be stopped during operation for purposes of checking the oil, stop the pump, wait 1-2 minutes and check the sight gauge. As long as oil is visible in the gauge, the oil level is acceptable. If oil needs to be added, add 80W/90 detergent free gear oil while the engine is off. Remove the fill plug and add oil through the port.

Method 2: If the pump has been run recently, but it is not known how long it has been standing idle, the oil level can still be reliably checked. With the unit on level ground and the engine running at slow speed, engage the PTO so the pump turns over slowly for 10-15 seconds. Disengage the PTO. Check the oil-level at the site gauge. If the oil level is still visible in the gauge, there is sufficient oil in the crankcase to run the pump. Optimally, the level should be halfway between the bottom of the site glass and the ADD line.

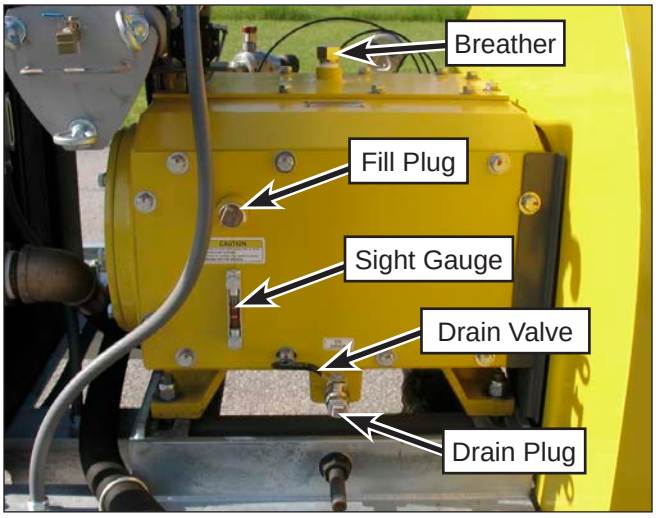


Figure 97: Oil Check and Change.

The typical oil level for a pump that has been operating and then brought to a stop is shown in (Figure 98). The oil level will be at or near the full mark only after the pump has been at rest for 5 to 8 hours.

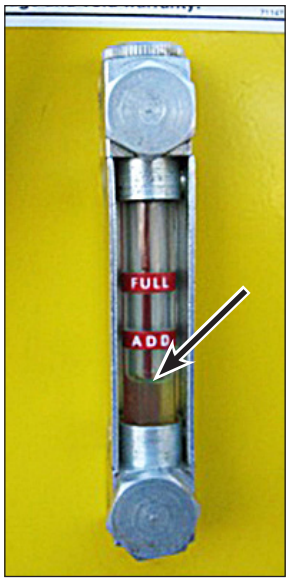


Figure 98: Typical Oil Level for Recently Operated Pumps.

Changing the Power End Oil

1. With the engine off, remove the drain plug (Figure 97) from the oil drain valve located on the back of the power end case.
2. Place a container below the valve large enough to capture the oil. Refer to the oil capacities listed below.
3. Install an extension hose/pipe to extend the drain past the trailer frame, if desired.
4. Open the ball valve to drain the oil.
5. After the oil has drained from the case, close the ball valve and install the plug.
6. Remove the back cover plate and inspect the magnets at the bottom of the pump for metal shavings or filings. Clean the magnet. If excessive shavings or filings were present, inspect the crankshaft journal bearings.
7. Install the back cover plate.
8. Add 80W/90 gear oil through the fill plug.
   - 3000 Series Pumps: 5 gal. (19 L)
   - 3600/4200/5200 Series Pumps: 9 gal. (34 L)
9. Install the fill plug when done filling.

Crosshead Pony Rod Seals

Removal

1. Relieve pressure from the pump, shut off the engine, and disengage the clutch.
2. Turn off the water supply and drain the water tank.
3. Drain the oil from the crankcase. Refer to “Changing the Power End Oil” on page 55 for instructions.
4. Open the rod box cover.
5. Disconnect the water lubrication lines if desired for easier access.
6. Position the pony rod to be serviced so that it is at top dead center (plunger fully extended towards the crankshaft). Pull on the drive belts to rotate the pump (Figure 99).

⚠ WARNING

Use caution when rotating the pump as this can be a pinch hazard.

7. Remove the two capscrews that secure the plunger coupling (Figure 100) to the plunger and remove the coupling. Rotate the pump until the pony rod is fully retracted.

Note: *The coupling halves are a machined pair. Keep the two halves together.*

8. Slide the rubber deflector (Figure 100) off of the pony rod.
9. Remove the three capscrews and washers that secure the rod box cover to the frame. Remove the cover. Remove the rubber washers that sit below the mounting plate.
10. Using a 1/4” hex driver, loosen the set screw inside the bolt hole 2-3 full revolutions (Figure 101).

Figure 99: Rotating the Belt Drive.

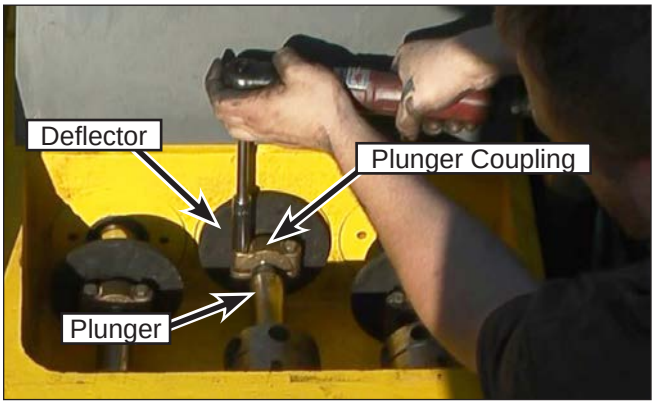


Figure 100: Plunger Coupling Removal.

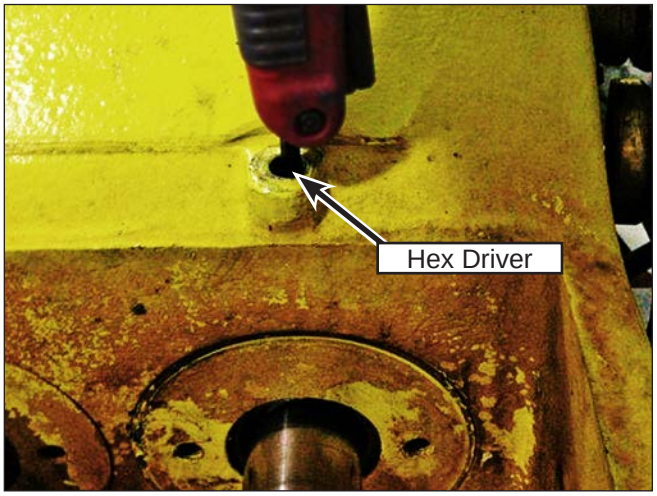


Figure 101: Set Screw Access.

11. Install two 1/2”-13 UNC capscrews (Figure 102) into the seal plate.
12. It may be necessary to use a long pry bar with the power frame as a lever to pry the back of the bolts. The seal plate should pop out from its bore. Remove the plate (Figure 103).
13. Remove the O-ring and press the seals from the plate. Discard the O-ring and seals.
14. Repeat for the remaining crosshead seals, if necessary.

Installation

1. Place the seal plate in a hydraulic or arbor press with the inboard side facing up. Place the red outboard seal into position and orient the seal (Figure 104).
2. Use the press to press the seal into the plate until it is flush with the face of the plate. Use caution to avoid damaging the seal.

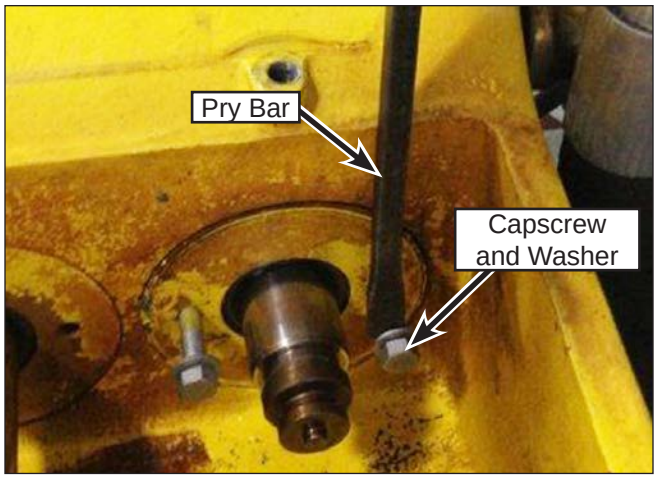


Figure 102: Seal Plate Removal.

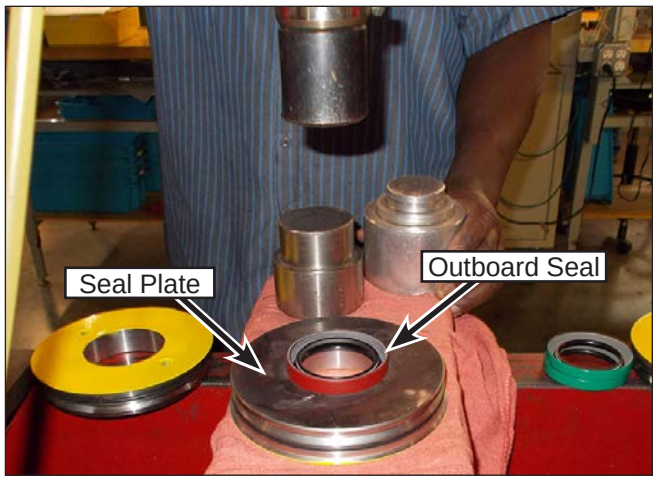


Figure 103: Outboard Seal Installation.

Figure 104: Pressing the Seal.

3. Place the green inboard seal into position on top of the outboard seal and orient the seal (Figure 105). Press the seal into the plate until it is flush with the face of the plate. Use caution to avoid damaging the seal.
4. Install a new O-ring (Figure 106) onto the seal plate. Lubricate the O-ring with O-ring lubricant.
5. Lubricate the inner seals with clean oil.
6. Repeat the prior steps for the remaining seal plates, if necessary.
7. Clean the seal plate bore and chamfer with emery cloth. Smooth any rough edges that can cut or damage the O-ring.
8. Carefully install the seal plate onto the pony rod and into the bore using hand pressure only. Do not hammer the plate into place. The plates must be flush with the frame.
9. Using a 1/4” hex drive, tighten the set screw that secures the plate to 15 in.-lb. (1694 mN·m) inside the access holes.
10. Install the deflector (Figure 107) onto the pony rod.
11. Extend the plunger from the stuffing box to meet the pony rod.
12. Place the plunger coupling into position and install the capscrews that secure the plunger. Tighten to 20 ft.-lb.(27 N·m).
13. Place the rubber washers into position on the frame and then place the cover into position. Install the three capscrews and washers that secure the cover.
14. Add oil to the crankcase as outlined in “Changing the Power End Oil” on page 55.

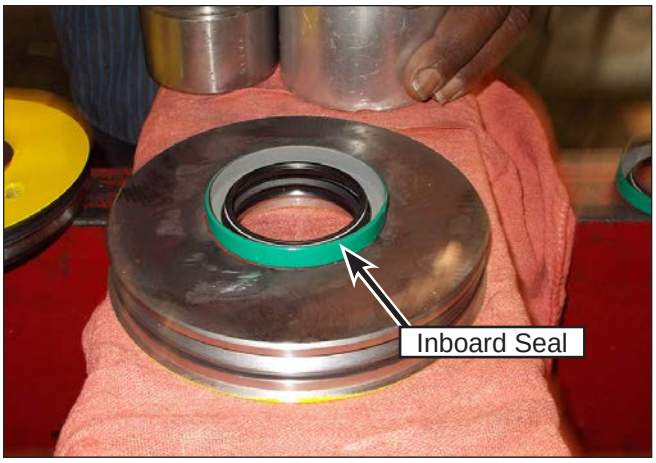


Figure 105: Inboard Seal Installation.

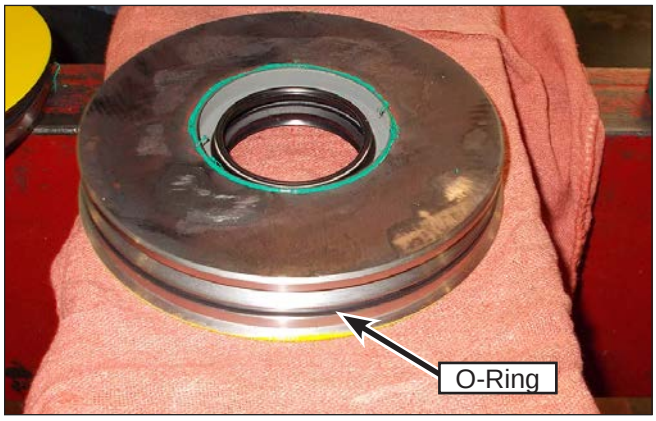


Figure 106: O-Ring Installation.

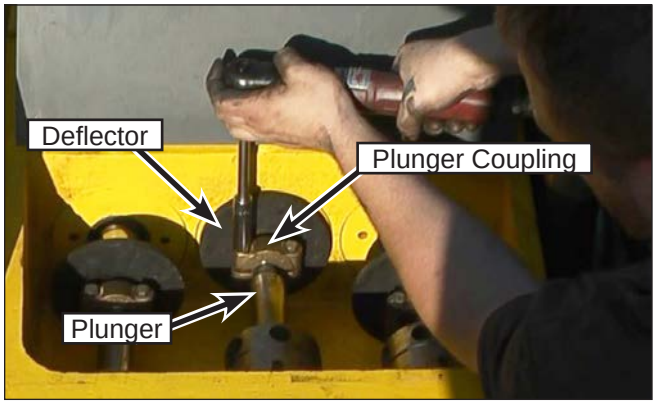


Figure 107: Plunger Connection.

Rod Journal Bearings

Removal

1. Drain the oil from the power end as outlined in “Changing the Power End Oil” on page 55.
2. Once drained, remove the capscrews, washers and lockwashers from the back plate (Figure 108). Remove the plate, belt guard and gasket. If the gasket is stuck to the frame, it can remain.
3. Remove the rod cap capscrews (Figure 109) from each rod journal. Rotate the pump by pulling on the belts (Figure 110), to gain access to the capscrews as needed.

WARNING

Use caution when rotating the pump as this can be a pinch hazard.

4. Once the capscrews are removed, remove each rod cap from the crankshaft. Observe the stamp marks on the top of the cap and rod for correct assembly.
5. To check the bearing life, proceed to Inspection. If the bearings are known to be worn, continue to the following step.

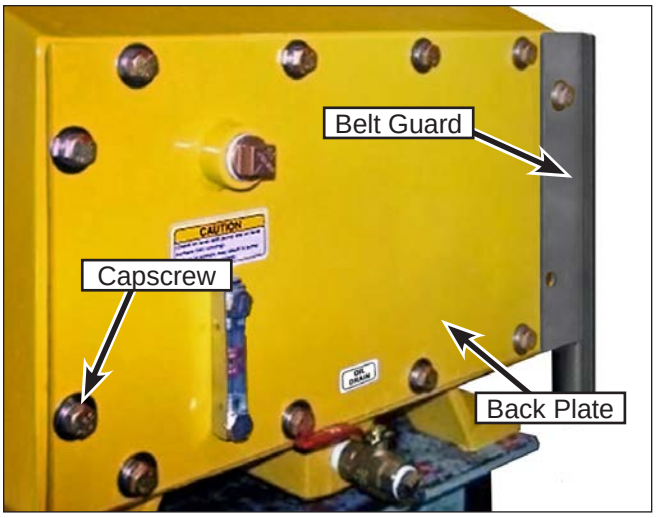


Figure 108: Back Plate Removal.

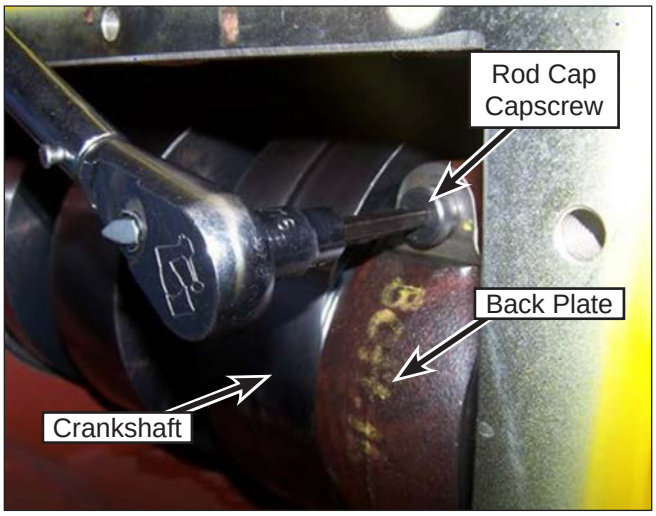


Figure 109: Rod Cap Removal.

Figure 110: Rotating the Pump.

6. Remove the journal bearing from the rod cap and discard (Figure 111).
7. To access the inner journal bearing (Figure 112), push the connecting rod away from the crankshaft. Slide the bearing from the rod.

Inspection

1. Wipe the excess oil from the end cap bearings.
2. Install a small strip of plasti-gauge onto the end cap bearing (Figure 113).
3. Position the end cap with capscrews back onto the matching connecting rod.
4. Screw in the capscrews by hand and then tighten to the proper torque:
   - 3000 Series Pumps: 45 ft.lb (61 N·m)
   - 3600/4200 Series Pumps: 80 ft.lb (108 N·m)
5. Remove the end cap.

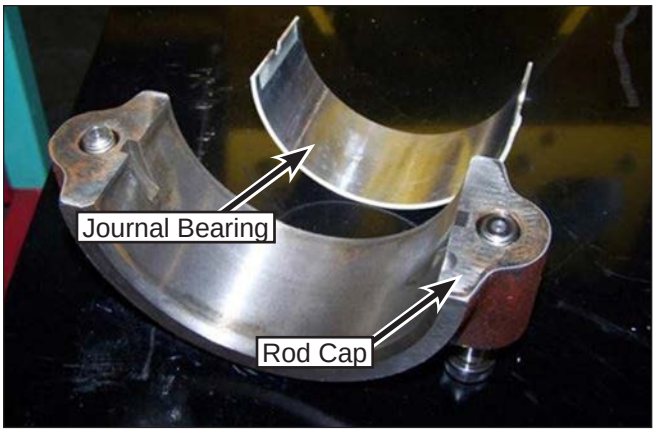


Figure 111: Bearing Removal.

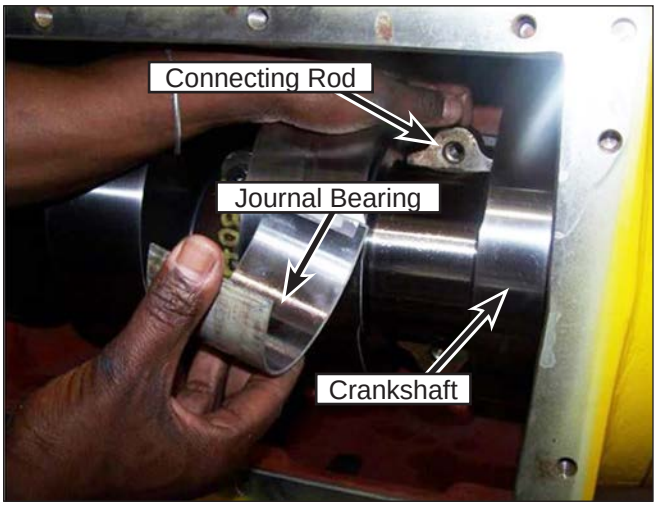


Figure 112: Inner Bearing Removal.

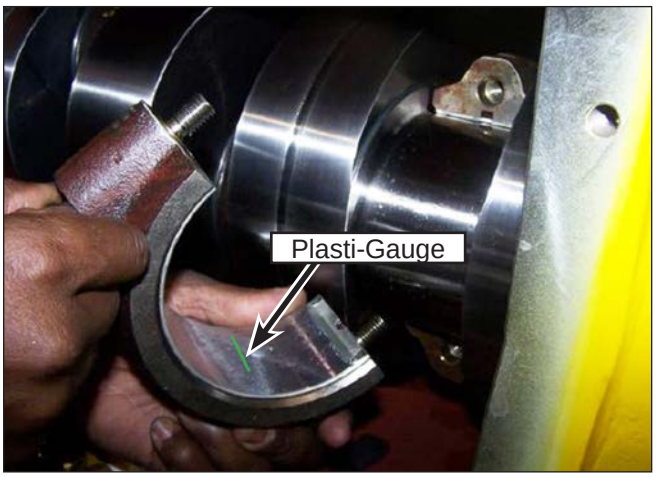


Figure 113: Plasti-Gauge Installation.

6. Measure the flattened plasti-gauge using the gauge wrapper (Figure 114).
7. If the thickness of the plasti-gauge exceeds 0.012 in. (0.31 mm), replace the bearings. If the bearings do not exceed the criteria, the bearings can be reused.

Note: *New part clearances are as follows:*

- Series 3000: 0.001 in. (0.025 mm) - 0.005 in. (0.13 mm)
- Series 3600/4200: 0.002 in. (.05 mm) - 0.005 in. (0.13 mm)

Installation

1. Apply clean new oil to the new connecting rod journal bearing (inner diameter only) (Figure 115).
2. Slide the bearing (Figure 116) into the connecting rod from below the crankshaft journal.

ATTENTION

The journal bearings have tabs that match the inner diameter of the connecting rods. Ensure the bearings are properly oriented in the tabs when installing (Figure 117).

3. Apply oil to the inner surface of the cap end bearing.
4. Properly orient the grooves and install the bearing in the rod cap.
5. Place the two capscrews into the rod cap.

Figure 114: Plasti-Guage Measurement.

Figure 115: Lubricating the Bearing.

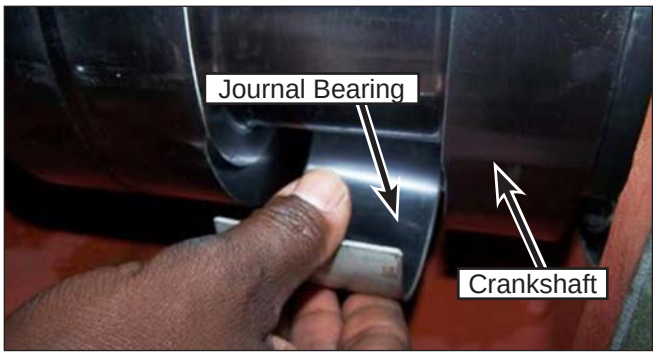


Figure 116: Rod Bearing Installation.

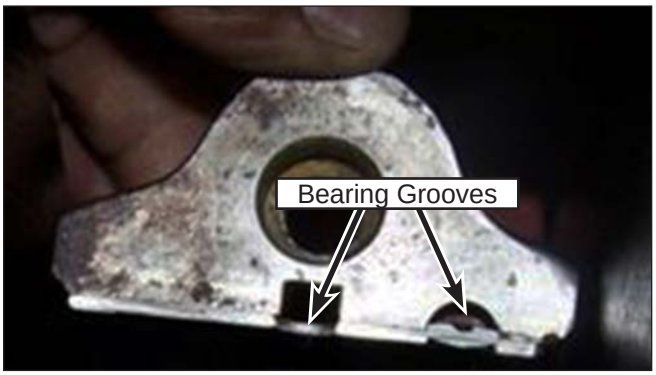


Figure 117: Bearing Grooves.

6. Pull the connecting rod (Figure 118) onto the crankshaft and place the rod cap into position aligned with the connecting rod. Ensure the stampings (Figure 119) on the cap and rod match.
7. Screw in the capscrews by hand and then tighten to the proper torque:
   - 3000 Series Pumps: 45 ft.lb (61 N·m)
   - 3600/4200 Series Pumps: 80 ft.lb (108 N·m)
8. With the first rod connected, rotate the pump by pulling the belts. Allow the crankshaft to turn a few revolutions to ensure the rod was properly installed.

   If the crankshaft spins freely, the bearings were properly installed.

   If the crankshaft does not spin freely, remove the journal bearings and replace with another set.
9. Repeat the previous steps for installation of the remaining journal bearings.
10. Place the back plate (Figure 120), belt guard and gasket into position on the frame.
11. Install the capscrews, lock washers and flat washers. Tighten the capscrews to the proper torque.
    - 3000 Series Pumps: 20 ft.lb (27 N·m)
    - 3600/4200 Series Pumps: 35 ft.lb (47 N·m)
12. Fill the power end with oil as outlined in “Changing the Power End Oil” on page 55.

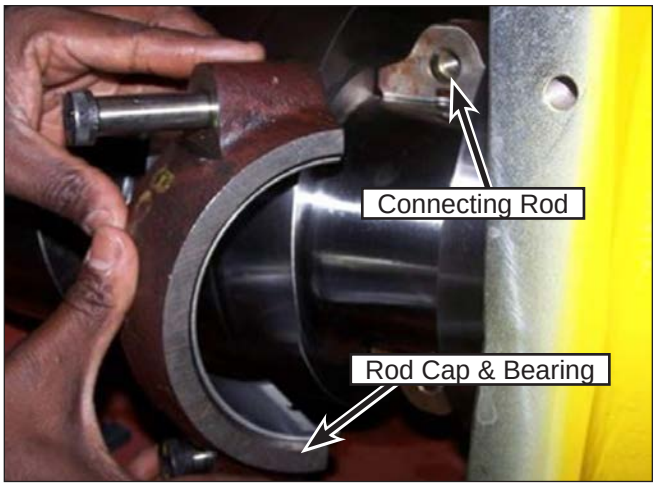


Figure 118: Rod Cap Installation.

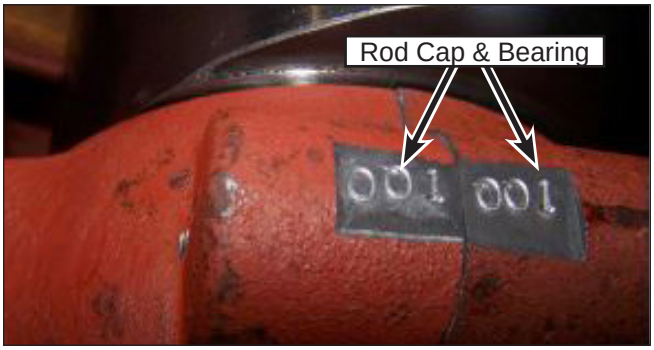


Figure 119: Matched Parts Stampings.

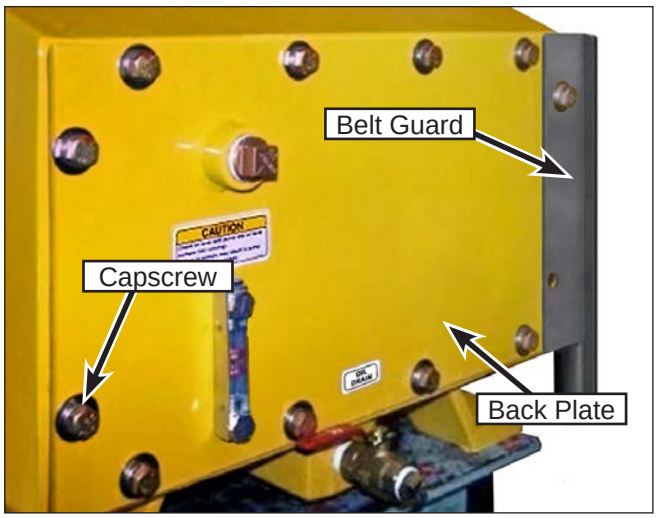


Figure 120: Cover Plate Installation.

Crosshead and Connecting Rod Assembly

Removal

1. Remove the crankshaft from the pump as outlined in “Crankshaft” on page 67.
2. Use two people to lift the crosshead/connecting rod assemblies from the crankcase. The weight and location of the assemblies make it difficult for one person to remove on their own.

Disassembly

1. Remove the two set screws from the crosshead (Figure 121). The set screws are installed on top of one another in the same hole.
2. Slide the pin out from the assembly (Figure 122).
3. Remove the connecting rod from the crosshead.
4. Keep the components for each assembly together.
5. Disassemble the remaining assemblies.

Bushing Inspection

1. Use a micrometer to measure the outer diameter of the pin in three places and record the measurements.
2. Add the three measurements and divide by 3 to get the average diameter.
3. Use an inside micrometer to measure the bushing in the connecting rod in three places and record the measurements.
4. Add the three measurements and divide by 3 to get the average diameter.
5. Subtract the diameter of the pin from the inside diameter of the bushing. If the remainder is greater than 0.008 in. (0.2 mm), the bushing must be replaced. Note the new bushing will require honing after installation into the connecting rod to achieve the clearance listed below.

Note: *New part clearances are as follows:*

- Series 3000: 0.0030 in. (0.08 mm) - 0.0037 in. (0.09 mm)
- Series 3600/4200: 0.0040 in. (0.1 mm) - 0.0047 in. (0.12 mm)

6. Repeat for the remaining assemblies.

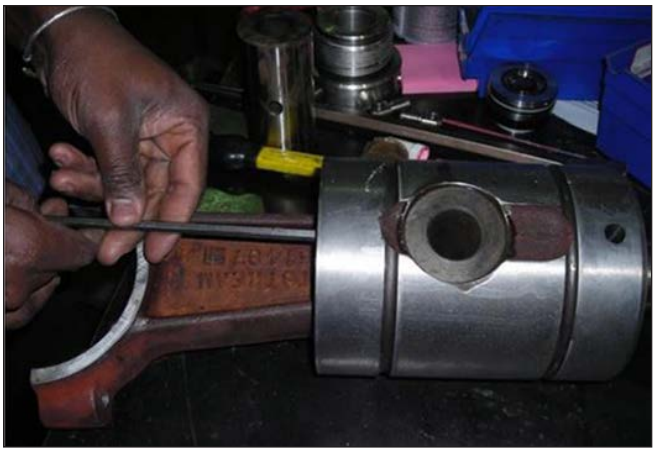


Figure 121: Set Screw Removal.

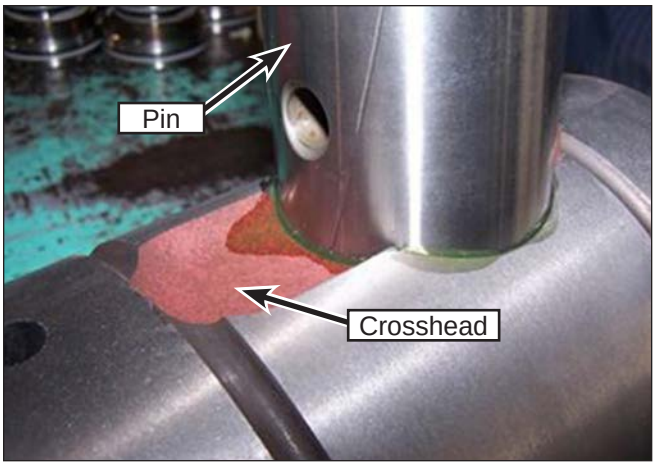


Figure 122: Pin Removal.

Crosshead Inspection

1. Use a micrometer to measure the outer diameter of the crosshead in three places and record the measurements.
2. Add the three measurements and divide by 3 to get the average diameter.
3. Use an inside micrometer to measure the crosshead bore in the power frame in three places and record the measurements.
4. Add the three measurements and divide by 3 to get the average diameter.
5. Subtract the diameter of the crosshead from the inside diameter of the crosshead bore. If the remainder is greater than 0.012 in. (0.31 mm), the crosshead must be replaced.

Note: *New part clearances are as follows:*

- Series 3000: 0.004 in. (0.1 mm) - 0.007 in.(0.2 mm)
- Series 3600/4200: 0.006 in. (0.15 mm) - 0.009 in. (0.23 mm)

6. Repeat for the remaining assemblies.

Assembly

1. Clean all surfaces of the crossheads, pins, and connecting rods using brake cleaner.
2. Inspect all surfaces of the crossheads, pins, and connecting rods for any signs of damage. Replace any suspect or damaged parts.
3. Inspect the long bore oil passage through the length of the connecting rod. Use a wire or a long handle brush to clear passage if necessary.
4. Insert the connecting rod into the bottom of the crosshead and line up the bores.
5. Lubricate the pin (Figure 123) with clean oil and insert the pin into the hole in the side of the crosshead.
6. Align the hole in the connecting rod with the pin as it is slipped in.
7. Thread the first set screw into the crosshead hole until it touches the pin, then back off a 1/4 turn. Slide the pin into position and tighten the set screw ensuring the screw is engaged in the counterbore of the pin. Tighten the set screw to 30 ft lb (41 N·m).
8. Apply Loctite Red-271© onto the threads of the second backup set screw.
9. Install the second set screw on top of the first set screw. Tighten to 36 ft lb (49 N·m) (Figure 124).
10. The crosshead is now ready for installation in the pump.

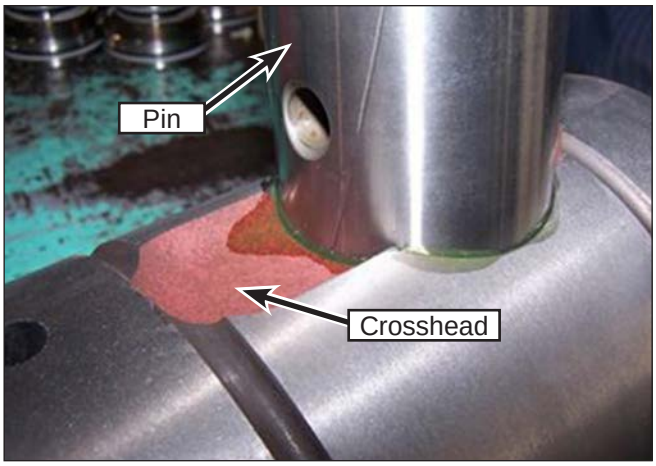


Figure 123: Pin Placement.

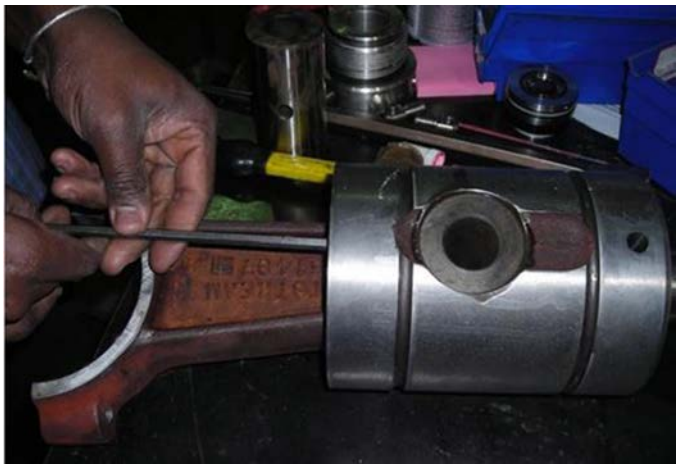


Figure 124: Second Set Screw Installation.

Installation

1. Place the crosshead/connecting rod assemblies into position inside of the crankcase.
2. Install the crankshaft as outlined in “Installation” on page 68.

UNx Pump

Removal

1. Drain the water tank.
2. Remove the bypass hose and supply hose (Figure 125). If the supply hose is connected to the secondary filter, disconnect it from the filter.
3. Remove the two screws that secure the hydro-throttle switch housing to the cartridge and disconnect the switch.
4. If equipped, the secondary filter switch must be disconnected. Remove the two screws that secure the switch cover (Figure 126) and disconnect the wiring. Unscrew the conduit fitting from the switch housing and lay the conduit and wiring aside.
5. Remove the belts.
6. Use a marker to mark the location of the pump footings for easier installation.
7. Remove the four pump mounting capscrews and nuts.
8. Attach a hoist and lifting apparatus to the pump as shown (Figure 127). The weight of the pump is approximately:
   - 3000 Series: 1200 lb. (544 kg)
   - 3600/4200 Series: 2200 lb. (998 kg)
9. Lift the pump from the unit and place in a suitable location for servicing.
10. If shims were under the pump, keep the shims together and note their proper location.

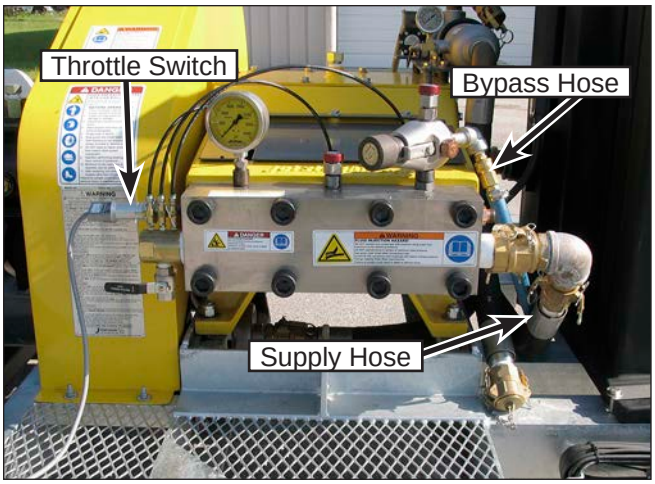


Figure 125: Pump Removal Preparation.

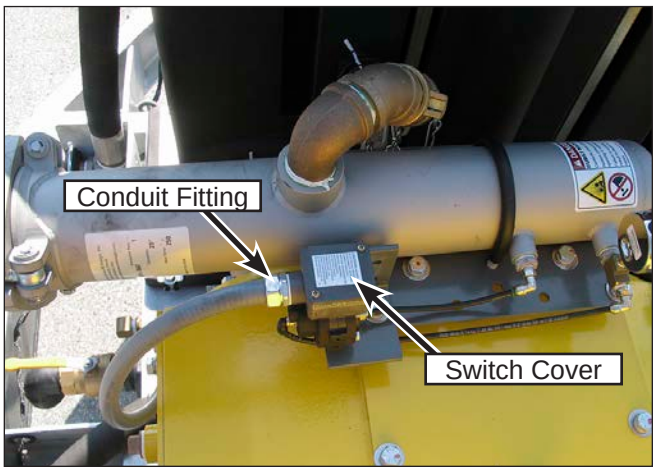


Figure 126: 40K Switch Wiring.

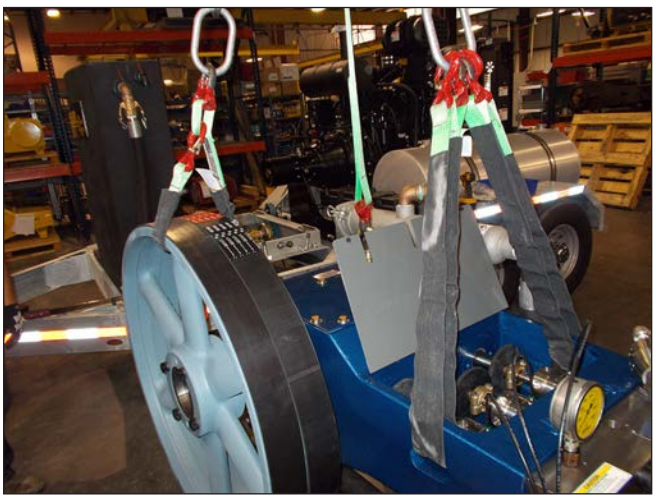


Figure 127: Lifting the Pump.

Installation

1. If shims were under the pump, place the shims in their proper location.
2. Apply an anti-seize compound to the four pump mount channels (Figure 128).
3. Attach a hoist and lifting apparatus to the pump as shown (Figure 129). The weight of the pump is approximately:
   - 3000 Series: 1200 lb. (544 kg)
   - 3600/4200 Series: 2200 lb. (998 kg)
4. Place the pump into position on the unit and position the pump near the position markings that were made during removal. Once in position, remove the lifting apparatus.
5. Loosely install the pump hardware.
6. Install the belts onto the pulleys. Adjust the belt tension per manufacturer specifications.
7. Install the belt guard.
8. If equipped with a secondary filter, insert the switch wiring into the switch housing and connect the conduit fitting (Figure 130) to the housing. Connect the wires and install the switch cover.
9. Place the hydro-throttle switch (Figure 131) in place on the hydro-throttle cartridge. Install the two screws that secure the hydro-throttle switch to the cartridge.
10. Install the bypass hose (Figure 131) and supply hose.

Figure 128: Apply Anti-Seize to the Pump Channels.

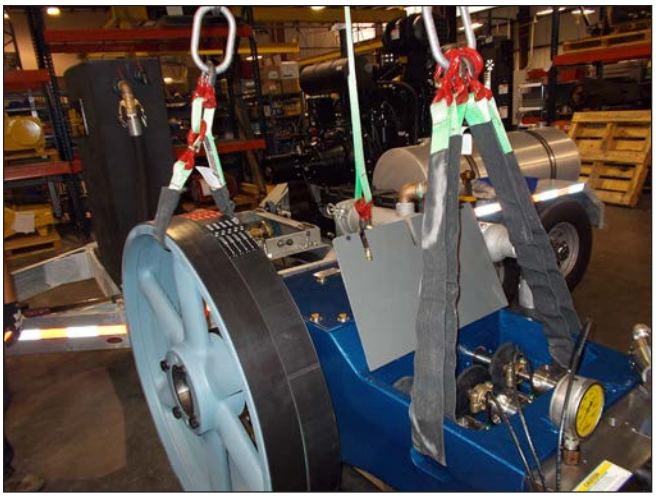


Figure 129: Lifting the Pump.

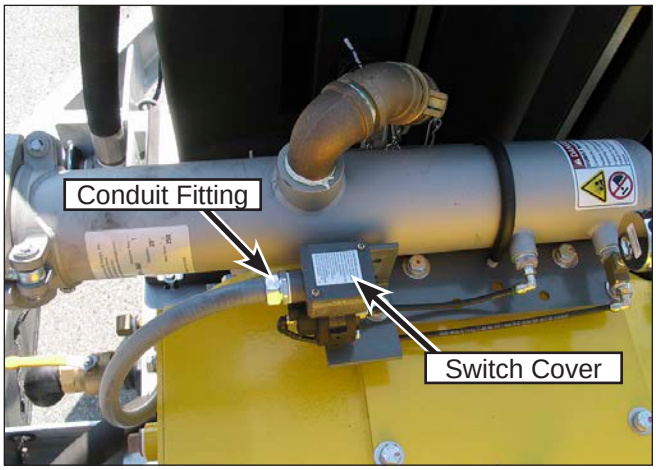


Figure 130: 40K Switch Wiring.

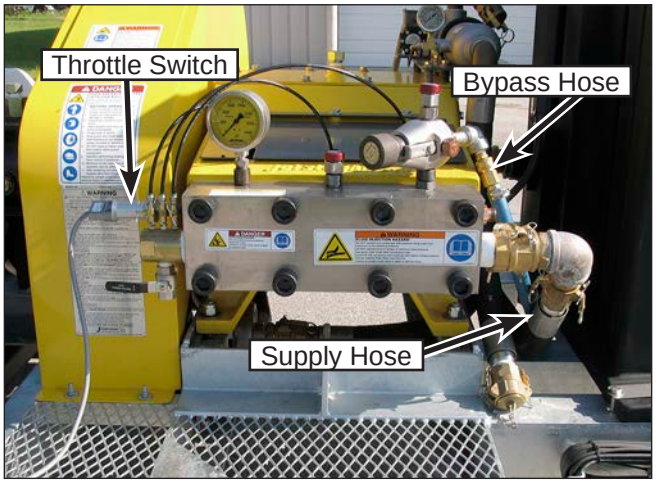


Figure 131: Connect the Switch and Hoses.

Crankshaft

Removal

1. Remove the pump from the unit. Refer to “UNx Pump” on page 65.
2. Open the rod box cover and remove the two capscrews that secure the plunger coupling (Figure 132) to the plunger and remove the coupling.

Note: *The coupling halves are a machined pair. Keep the two halves together.*

3. Remove the connecting rod end caps as outlined in “Rod Journal Bearings” on page 59.
4. Remove the 12 capscrews and washers that secure the top cover (Figure 133) to the power frame. Remove the cover and the gasket.
5. Remove the 12 capscrews and washers that secure the rear cover (Figure 133) and belt guard to the power frame. Remove the cover, guard and gasket.
6. Pull the three connecting rod/crosshead assemblies towards the fluid end as far as possible.
7. Remove the eight capscrews and washers that secure the inboard side plate (Figure 133) to the power frame.
8. Remove the side plate and shims. Keep the shims together.
9. Remove the eight capscrews and washers that secure the outboard side plate (Figure 133) to the power frame.

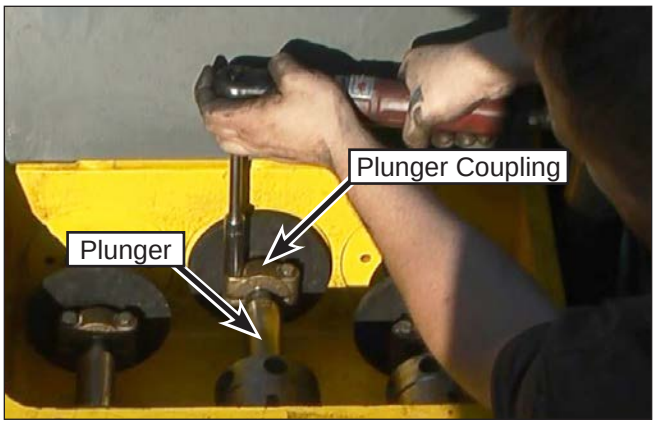
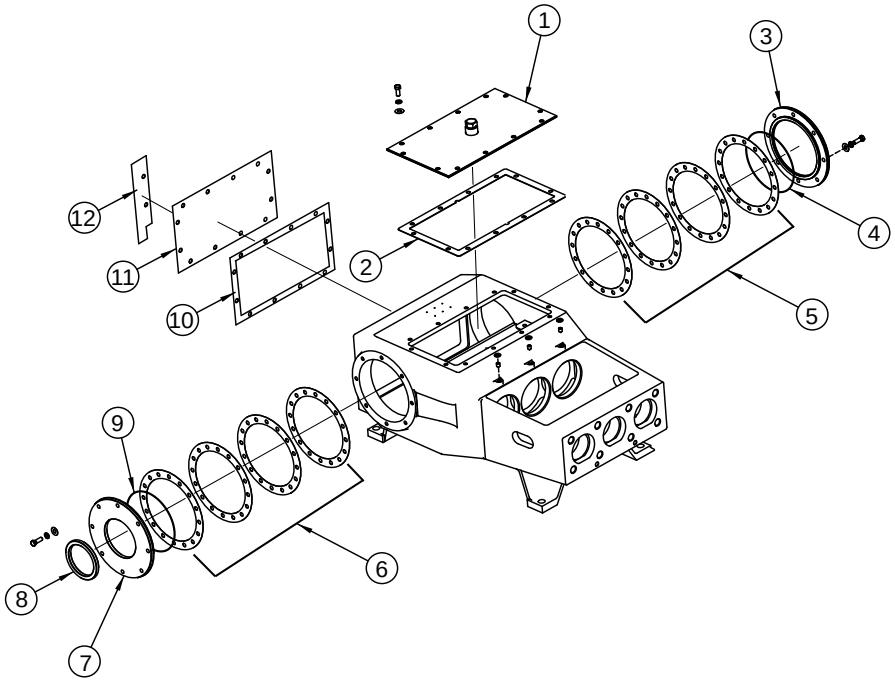


Figure 132: Plunger Coupling Removal.



1. Top Cover
2. Gasket
3. Outboard Side Plate
4. O-ring
5. Shim Pack
6. Shim Pack
7. Inboard Side Plate
8. Oil seal
9. O-Ring
10. Gasket
11. Rear Cover
12. Belt Guard

Figure 133: Power End Covers.

10. Remove the side plate and shims while supporting the crankshaft. Keep the shims together.
11. Using a wood block and a hammer, hit either end of the crankshaft to unseat it from its bearing bores.

⚠ WARNING

Use caution when unseating the crankshaft. The crankshaft will fall approximately 1 in. (25 mm) as it slides out of the tapered race and can cause bodily harm.

12. Install two threaded rods (1 in.-8NC x 8 in.) into the ends of the crankshaft to aid in removal.
13. Using two people, lift the crankshaft from the power frame. The weight of the crankshaft is approximately:
    - 3000 Series: 125 lb. (57 kg)
    - 3600/4200 Series: 325 lb. (147 kg)
14. Remove the bearings from the crankshaft. Contact Jetstream for assistance with this task.

Installation

1. Heat the crankshaft bearings in a 250°F (121°C) oven for 20 minutes. Check the bearing color as they are heated. If the bearings turn blue or black they are overheated.

⚠ CAUTION

Temperatures in excess of 250°F (121°C) will damage the bearing. If the bearings have been heated over the limit, discard the bearings.

2. When ready, slide the bearings onto each end of the crankshaft until they are fully seated (Figure 134).
3. Verify that the bearing turns on the shaft.
4. Allow the crankshaft assembly to cool.
5. Install the outer bearing race (Figure 135) onto the inboard bearing.
6. Install the outer bearing race (Figure 136) into the power frame using a rubber mallet. Install the race so it is flush with the face of the case.

Figure 134: Bearing Installation.

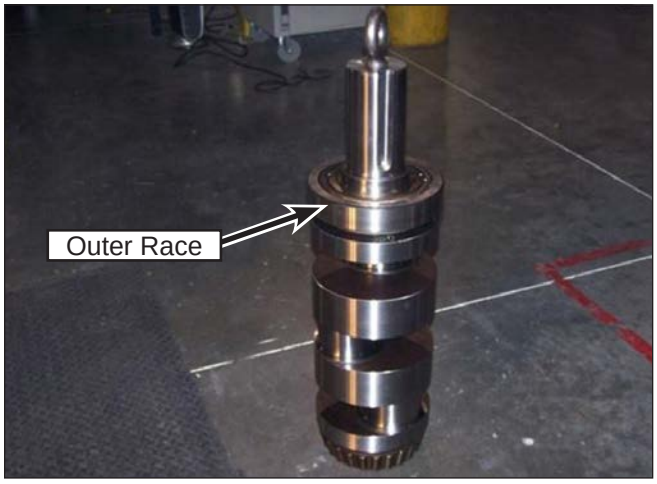


Figure 135: Outer Race Installation.

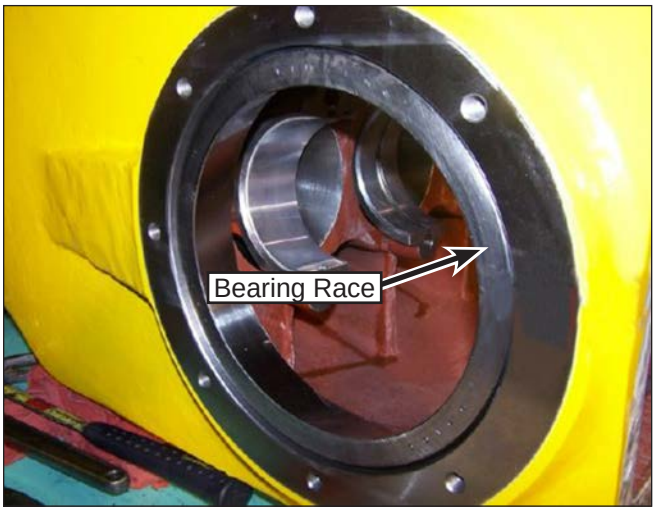


Figure 136: Bearing Race Installation.

7. Place the three crosshead/connecting rod assemblies into place (Figure 137). Allow clearance for the crankshaft by pushing them towards the fluid end.
8. Install two threaded rods (1 in.-8NC x 8 in.) into the ends of the crankshaft to aid in installation.
9. Using two people, lift the crankshaft into the power frame. The weight of the crankshaft is approximately:
   - 3000 Series: 125 lb. (57 kg)
   - 3600/4200 Series: 325 lb. (147 kg)
10. Using a wood block and a hammer, hit either end of the crankshaft to seat it in the bearing bore. Ensure the outer bearing race (Figure 138) is inside the power frame case.
11. Tap in the bearing race on the opposite end of the crankshaft if not already installed.
12. Install a new oil seal and O-ring onto the inboard side plate. Install the outboard and inboard side plates with the original shim packs. Ensure the thickness of each shim pack is equal on both ends. Install four equally spaced side plate capscrews and tighten to 50 ft.lb (68 N·m) (Figure 139).

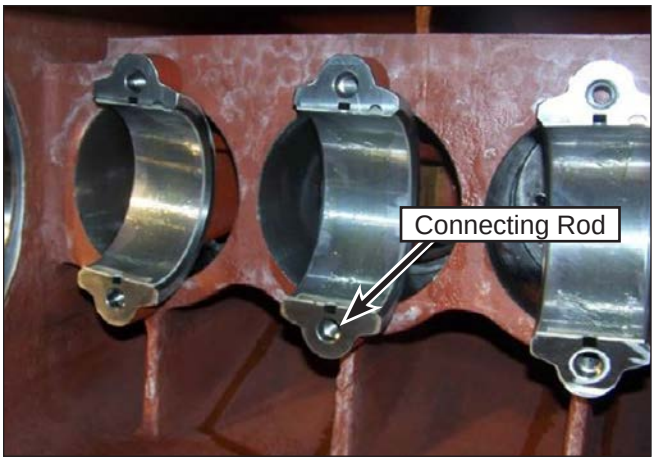


Figure 137: Connecting Rod Installation.

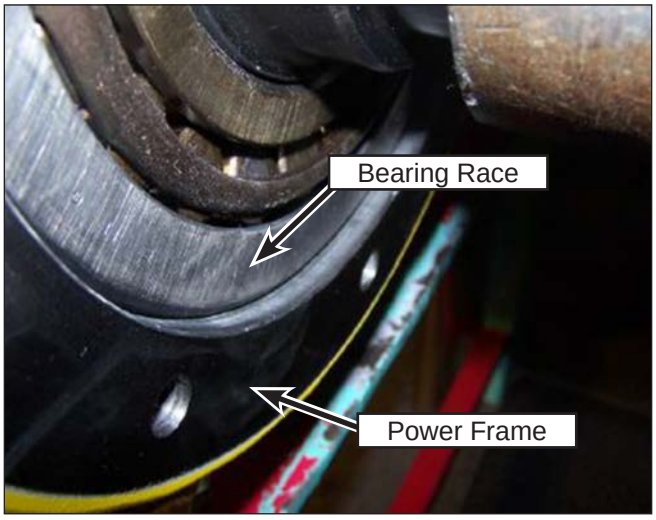


Figure 138: Crankshaft Seating.

Figure 139: Side Plate Installation.

13. Mount a magnetic base dial indicator on the crankshaft with the indicator pin on the inside edge of the rear opening, as shown.
14. With a firm, slow, but not sudden pull in both directions the total end play should read within 0.001 inch (0.03 mm) - 0.004 inch (0.10 mm) tolerances.
15. Use a prybar (approx. 3 ft. (91 cm)) to move the crankshaft back and forth from left to right. Use firm, but not hard pressure. Record the movement of the indicator while prying in both directions. Add the measurements. Total indicator reading (sum of movement in both directions) should be 0.001 in. (0.0254 mm) - 0.004 in. (0.1016 mm). Check several times for consistency.
16. Add or remove shims as necessary to bring the endplay within the specified range. Keep the shim packs within 0.010 in. (0.254 mm) of each other.
17. Install the remaining capscrews onto the inboard and outboard side plates. Tighten the capscrews to 50 ft.lb (68 N·m).
18. Oil the bearings and install the connecting rods onto the crankshaft and install the crankcase cover as outlined in “Rod Journal Bearings” on page 59.
19. Install the three plunger couplings, connecting the plungers to the pony rods.
20. Place the top cover and gasket into place. Install the 12 capscrews and washers that secure the top cover to the power frame. Tighten the capscrews to 50 ft.lb (68 N·m).
21. Position the rear cover, belt guard and gasket into place. Install the 12 capscrews and washers that secure the components to the power frame. Tighten the capscrews to 50 ft.lb (68 N·m).
22. Add oil to the crankcase. Refer to “Changing the Power End Oil” on page 55.

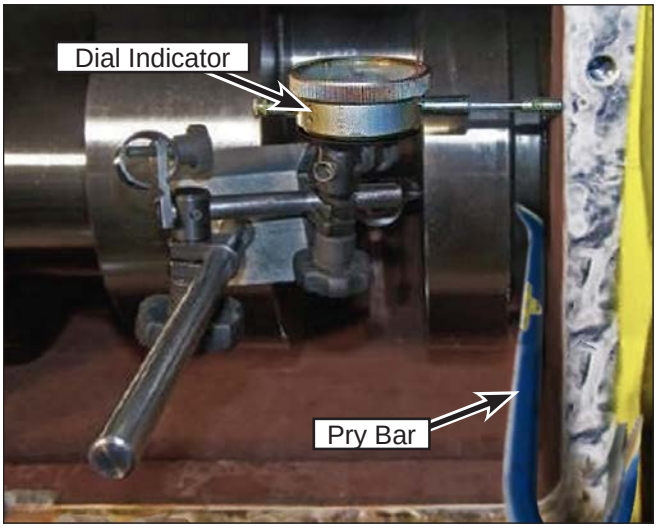


Figure 140: Dial Indicator Mounting.

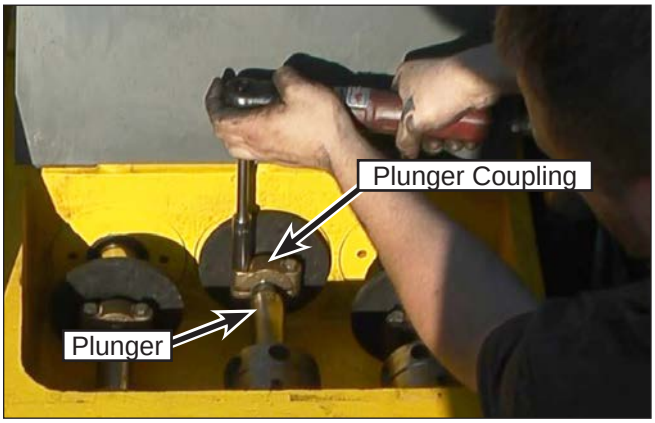


Figure 141: Plunger Coupling Installation.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
High discharge pressure	Nozzle too small	Replace nozzle
	Restriction in hose or lance	Test hose/lance without nozzle
	Inaccurate pressure gauge	Replace gauge
Low discharge pressure	Nozzle too large	Replace nozzle
	Nozzle worn	Replace nozzle
	Insufficient water tank level	Fill tank, unplug vent
	Inaccurate pressure gauge	Replace gauge
	Belts slipping	Increase belt tension
	Leaking or sticking pump valves	Service or replace valves
	Worn pump plunger packing	Replace packing
	Leaking control gun, hose, fitting	Repair or replace
	Dirty filter bag	Replace filter bag
Excessive pulsation in pump discharge	Low water tank level	Fill tank, unplug vent
	Leaking pump valves	Repair or replace valves
	Broken pump valve springs	Replace springs
	Worn pump plunger packing	Replace packing
	Belts slipping	Increase belt tension
	Dirty filter bag	Replace filter bag
Vibration in unit	Pump pulsating excessively	See Excessive pulsation above
High pump packing gland temperature	Insufficient packing lube water flow	Increase lube hose pressure
		Clean guide bushing holes
	Water too hot	125°F max
Pump noise	Low lubricant level	Fill with lubricant
	Pump cavitation	See “Excessive pulsation in pump discharge” above
	Loose plunger clamps	Tighten plunger clamps
	Worn bearings	Replace bearings
	Worn crosshead(s)	Replace crosshead(s)/repair crosshead
	Excessive crankshaft end play	Adjust endplay
Leakage from pump manifold leakage holes	Damaged valve seal	Replace seal
Leakage from hydraulic throttle control	Damaged piston seal	Replace seal

PROBLEM	POSSIBLE CAUSE	REMEDY
Insufficient water lubrication	Needle valves not properly adjusted	Adjust the needle valves
	Air in the system	Open the manifold drain with pump on
	Plugged lines	Remove debris from lubrication lines
Leakage from pump manifold uni-valve leakage holes	Damaged valve seal	Replace seals
Leakage from discharge fitting leakage holes	Damaged fittings or seals	Replace the fittings and/or seals
Pump oil leaking from breather	Check oil level	Add oill as necessary
	Verify use of proper oil type	See “Oil Specifications” on page 62
Water in pump oil	Cross head oil seal leak	Replace seal
	Cold oil	Continue to run until oil temp increases to adequate temperature
Engine will not return to idle when control gun dumping	Excessive hose back pressure	Reduce hose string length
	Throttle control piston sticking	Repair throttle control unit
Engine will not increase in speed when control gun first closes	Engine idle speed too low	Increase idle speed
	Large gun nozzle	Decrease nozzle size
Insufficient water lubrication	Needle valves not properly adjusted	Adjust the needle valves
	Air in the system	Open the manifold drain with pump on
	Plugged lines	Remove debris from lubrication lines
Poor packing life	Hot water	125°F max
	Insufficient water flow	Adjust water flow
	Dirty water	Clean/replace filter
	Scored/pitted plunger	Replace plunger
	Gland nut loose	Tighten nut

TRAINING

Safety Training

Only trained personnel may setup, operate, or maintain this equipment.

Waterblast operators must be aware of the dangers that exist while using water blasting equipment. The cleaning nozzle's discharge jet(s) can inflict serious bodily injury. Jetstream® recommends demonstrating to new operators the potential damage of the discharge jet(s). This can be done by showing the effect of a waterjet from a straight tip nozzle cutting a scrap piece of 2 in. x 4 in. (50 mm x 100 mm) wood.

A safety training DVD is available from Jetstream® at their website (www.waterblast.com).

Training materials are also available from the Water Jet Technology Association (WJTA) (www.wjta.org).

New Start-up Training

In order to ensure customer satisfaction, Jetstream has developed the Right Start program, a four-step plan designed to provide the owners and operators of new Jetstream waterblast units with the knowledge and support needed to feel familiar, confident and satisfied with Jetstream equipment and personnel.

1. Transportation

Once a new waterblaster is built and thoroughly tested, the Shipping Manager contacts the new owner to arrange for the unit's arrival to the right place at the right time.

2. Training

All new waterblasters include personal training by the Right Start Technician. Training involves both classroom and "hands-on" instruction to make sure that each operator is thoroughly familiar with the design and function of the unit and accessories, enabling him to safely put the new equipment to optimal use.

3. Follow-up

Within thirty days of delivery, and again within sixty days, the Solutions Provider will call to answer any questions and ensure complete satisfaction.

4. Trust

If any questions or problems arise, the Jetstream team is available and committed to providing prompt answers and solutions.

FS Solutions Training

FS Solutions training begins where Right Start training stops. Our certified training covers all skill levels and incorporates: safety, application, troubleshooting, and field maintenance training.

For more information contact Jetstream.

Additional Training Opportunities

Jetstream offers multiple certified training classes designed to promote safe, effecient, and profitable operation.

For more information on any of the other available Jetstream training opportunities please contact Jetstream at 1-800-231-8192 or visit us at www.waterblast.com.

Jetstream®
Subsidiary of Federal Signal Corporation

INDEX

C

COMPONENT IDENTIFICATION *5*, *8*
- Bypass Valve *6*
- Discharge Fitting *6*
- Fluid End and Unit Identification *7*
- Manifold *5*
- Manifold Drain Valve *5*
- Pressure Gauge *5*
- Regulator Valve *6*
- Rupture Discs *6*
- Secondary Filter (40K Units) *7*
- Supply Couplings *7*
- UNx Pump *5*
- Water Lubrication System *5*
- Water Tank and Filters *5*

M

MAINTENANCE *19*
- Unit Maintenance *19*
  - 50 Hours *19*
  - 100 Hours *19*
  - 500 Hours *19*
- Winterizing the Unit *19*

O

OPERATION *11*
- Breaking in New Packing *16*
- Checking The Water Lubrication System *14*
- Flushing The System *13*
- Hose and Water Supply Requirements *11*
- Monitoring Weep Holes *17*
- Preparing the Unit *11*
- Raising System Pressure *14*
- Recommended Equipment *11*
- Starting the Unit *12*
- Start-up Preparation *11*
- Using the Hydro-Throttle (Dump System Only) *16*

P

PRESSURE CONVERSION *25*
- 40K Hose Connections *32*
- Converting a Pump *25*
  - Manifold Trunnion Adjustment *29*

S

SERVICE *33*
- Fluid End *33*
  - 15K, 20K Uni-Valve Service *43*
    - Assembly *46*
    - Disassembly *43*
  - 40K Face Seal Replacement *41*
    - Installation *42*
  - 40K Uni-Valve Service *47*
    - Assembly *49*
    - Disassembly *47*
    - Valve Inspection *50*
    - Valve Lapping *50*
  - Bypass Valve Cartridge Replacement *51*
  - Checking Gland Nut Torque *33*
  - Checking Manifold Bolt Torque *33*
  - Packing Replacement *34*
    - Inspection *37*
    - Installation *38*
    - Removal *34*
  - Rupture Disc Inspection *34*
  - Uni-Valve Service *40*
    - Removal *40*
- Power End *52*
  - Changing the Power End Oil *53*
  - Checking Power End Oil Level *52*
    - Alternate Oil Check Methods *52*
  - Checking PTO Oil Level *54*
  - Crankshaft *65*
    - Installation *66*
    - Removal *65*
  - Crosshead and Connecting Rod Assembly *61*
    - Assembly *62*
    - Bushing Inspection *61*
    - Crosshead Inspection *62*
    - Disassembly *61*
    - Installation *63*
    - Removal *61*
  - Crosshead Pony Rod Seals *54*
    - Installation *55*
    - Removal *54*
  - Rod Journal Bearings *57*
    - Inspection *58*
    - Installation *59*
    - Removal *57*
  - UNx Pump *63*
    - Installation *64*

Removal *63*

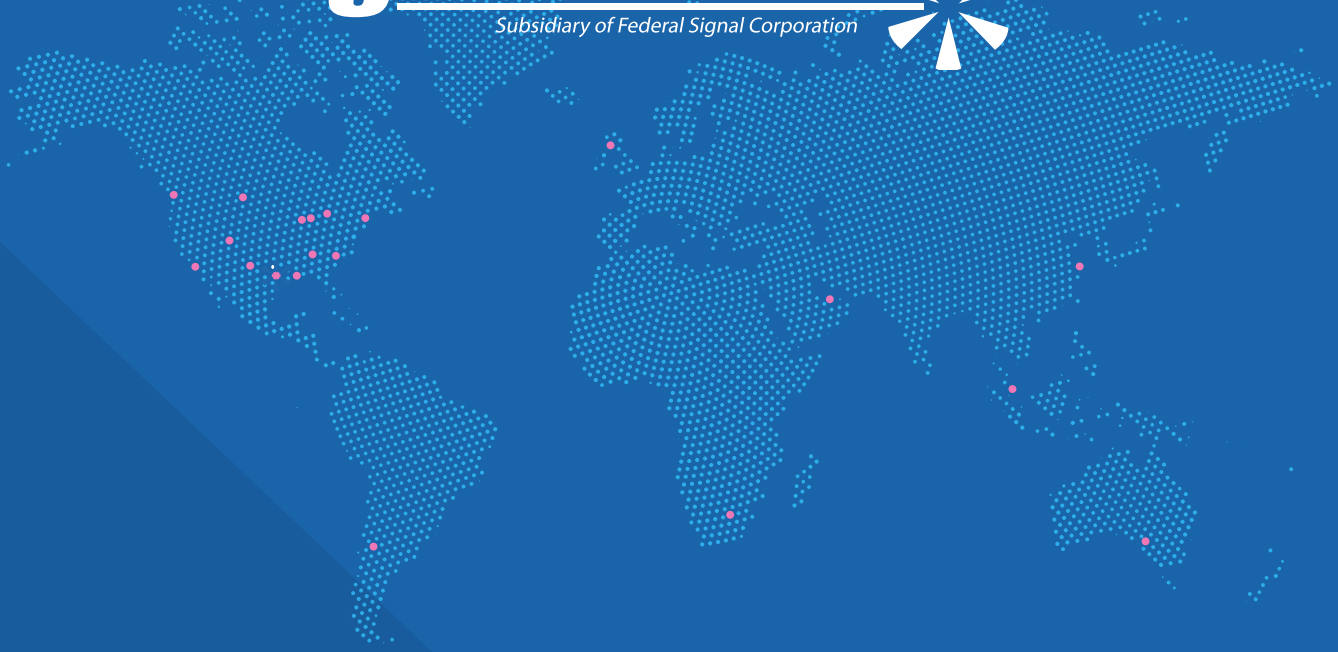
T

TRAINING *71*
Additional Training Opportunities *71*
FS Solutions Training *71*
New Start-up Training *71*
Safety Training *71*
TROUBLESHOOTING *69*

W

WATERBLAST SAFETY *1*
General Safety Precautions *2*
Be prepared *3*
Check Connections *2*
Check Pressure Ratings *2*
Freezing Conditions *3*
Inspect Equipment *2*
Performing Maintenance Or Repairs *3*
Purge The System *3*
Read Instructions *2*
Rupture Discs *2*
Slowly Increase pressure *3*
Store Components Properly *3*
Test The system *3*
Tighten Connections *2*
Use The minimum Pressure Required *3*
Use Two Operators *2*
Recognizing Safety Information *1*
Understanding Signal Words *1*
Waterblast Safety Manual *1*
WATER TANK AND FILTRATION *21*
Water Quality Requirements *21*
Water Tank With Filters *21*
Filter Cartridge Replacement *23*
Secondary Filter (40K Operation Only) *21*
Switch Adjustment *23*
Uni-Valve Life *23*

Jetstream®
Subsidiary of Federal Signal Corporation



Streator, IL
(815) 672-6028

Toledo, OH
(888) 415-7368

New Brunswick, NJ
(732) 448-7830

Highland, IN
(219) 924-3180

Lexington, SC
(803) 996-0741

Leeds, AL
(800) 822-8785

Williston, ND
(701) 572-7421

La Porte, TX
(281) 674-8668

Gonzales, LA
(225) 647-0660

Midland, TX
(432) 563-4450

Salt Lake City, UT
(801) 808-4590

Long Beach, CA
(866) 515-9891

Lakewood, WA
(253) 584-0653

Jetstream has the most comprehensive products, service, rental, and training in the industry. Whether you are looking to purchase or rent water blasting equipment, or if you need service and support for your existing equipment, we've got you covered with the most experienced and customer-focused team in the industry.

In the United States, our products are serviced by FS Solutions. With 13 convenient locations, FS Solutions provides high-performance parts and accessories, Jetstream rentals, repair and rebuild, and safety training services. In Canada, Joe Johnson Equipment (JJE) is there to handle your every need.

Jetstream is a subsidiary of Federal Signal Corporation and has the financial strength, backing, and network of distributors around the world to support any customer.

INTERNATIONAL DISTRIBUTORS

Orbitec
Santiago, Chile

Powerjet Rentals
Glasgow, Scotand

Asia Waterjet
Dubai, UAE

Total Blasting
Johannesburg, South Africa

Metco
Adelaide, Australia

FS Asia
Shanghai, China

Asia Waterjet
Singapore

JETSTREAM OF HOUSTON

5905 THOMAS ROAD
HOUSTON, TEXAS 77041

(832) 590-1300

(800) 231-8192

FS Solutions®

P/N 65179-K