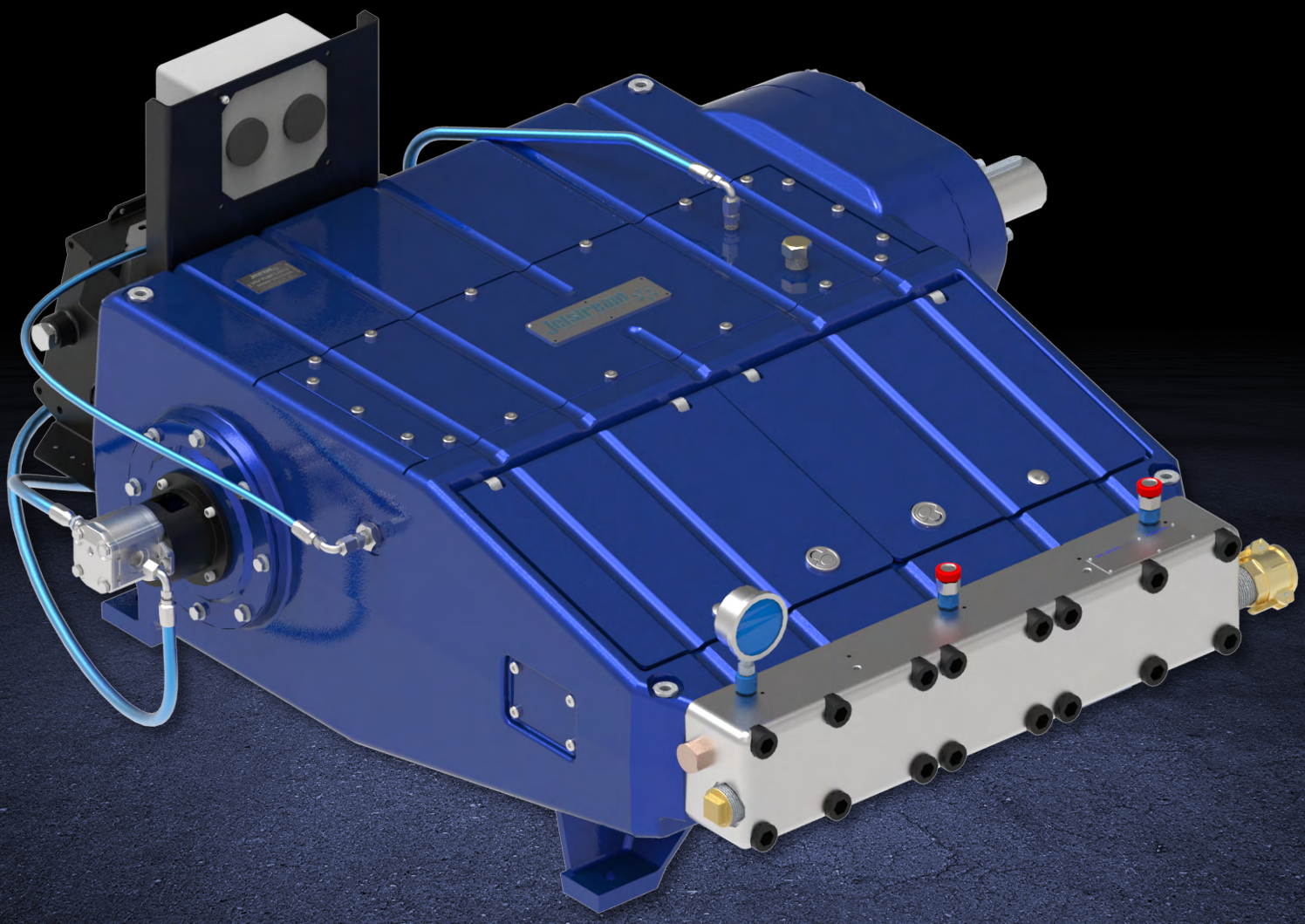
Jetstream®

Subsidiary of Federal Signal Corporation



OPERATION MANUAL

UNx™ Bareshaft Pump

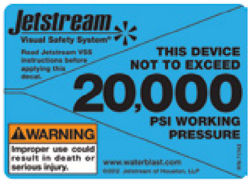
Protect Workers and Equipment with the Jetstream®

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

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P/N 65179
Revision J

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(832) 590-1300 • (800) 231-8192
www.waterblast.com

LIMITED WARRANTY - Jetstream of Houston LLC warrants that each new Jetstream pump or fluid end (the “Product” or “Products”) is free from defects in material and workmanship for a period of five (5) years or four thousand (4,000) operating hours, whichever occurs first, provided it is used in a normal and reasonable manner and in accordance with all operating and safety instructions.

Products must be registered within 60 days of delivery for warranty to be considered valid. Register your pump or fluid end by filling out the warranty registration form, available at waterblast.com/warrantyform or by contacting Jetstream via phone at 832-590-1300 or email to customerservice@waterblast.com. The warranty period begins on the date of delivery of the Product to the first end-user customer (or, if the Product is initially placed into rental service, on the date of delivery to the rental company or leasing entity), provided warranty registration has been submitted appropriately. 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. This limited warranty applies only to pump and fluid end Products manufactured and delivered after January 1st, 2025.

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 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, or other components carrying a warranty from their original manufacturer.
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 Product or Products being operated in a manner or for a purpose not recommended by Jetstream including failures or malfunctions resulting from corrosion, misapplication, over-pressurization, inadequate pump suction conditions, improper water quality, improper maintenance, misuse or use not in accordance with Jetstream’s operating and safety instructions. A finding of such shall be in the sole discretion of Jetstream.
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 twelve (12) months of the event or facts giving rise to such action.

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

Contact Jetstream Customer Service by calling 832-590-1300 or by visiting waterblast.com

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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.

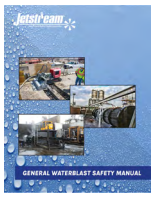
CAUTION

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.

Look for additional Literature resources at: https://waterblast.com/literature/

Use Two Operators

Use at least two operators when waterblasting. The primary operator handling the cleaning device must maintain control of the water discharge at all times. The secondary operator controlling the waterblast unit must be positioned a safe distance of at least 12 ft. (3.7 m) from the blast operation.

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 page 23" 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.

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.

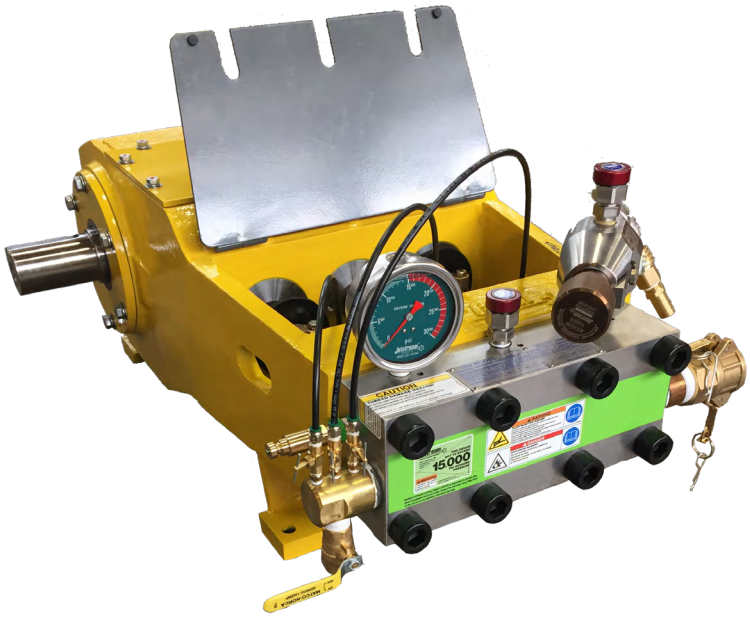


Figure 1: Bareshaft Pump.

UNx Classic 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.

Contact Jetstream for any for detailed exploded views and component part numbers for the Classic fluid and power ends.

The pump is supplied with a covered rod box that is enclosed from the elements.

Contact Jetstream for any further information on Classic bareshaft pumps

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.

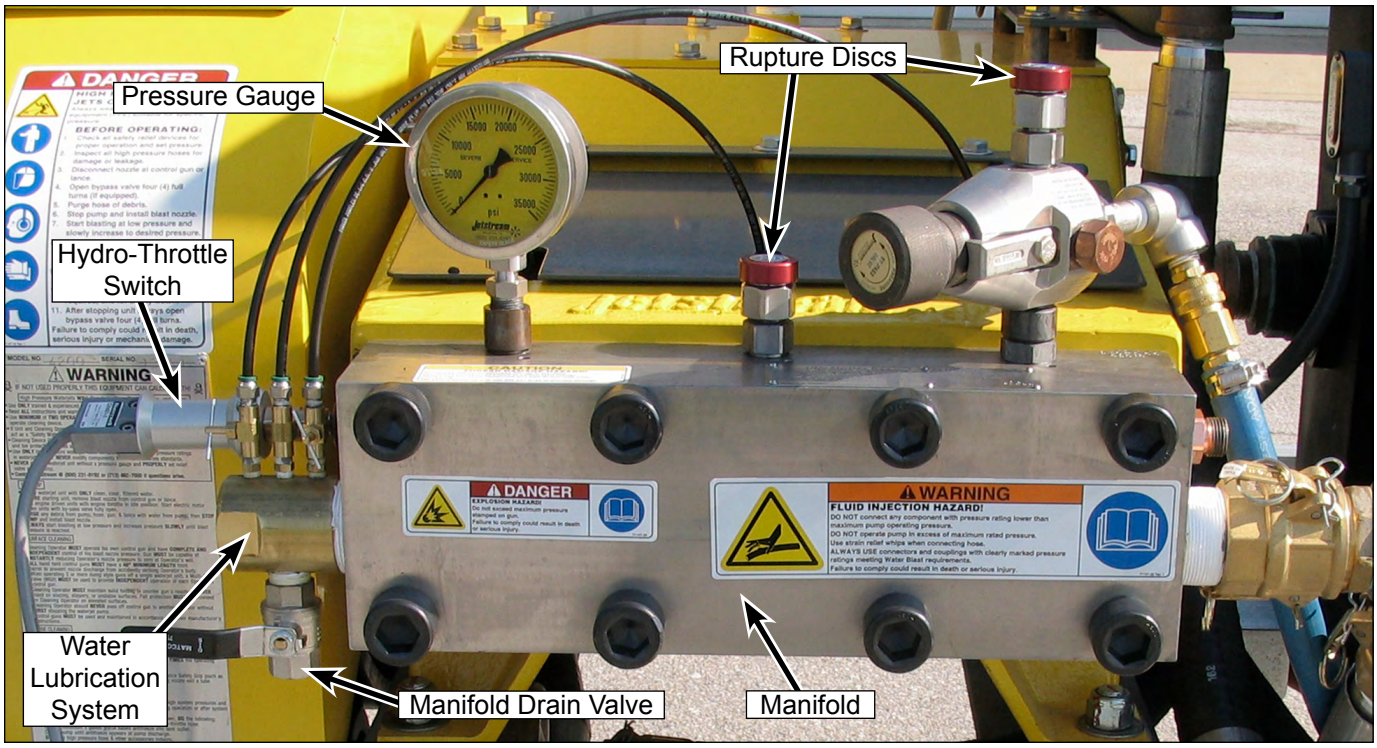


Figure 2: Pump Components.

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.*

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.

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.

Figure 3: Pump Components (Continued).

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.

Supply Couplings

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

Secondary Filter (40K Units)

A secondary filter known as a “polishing 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.

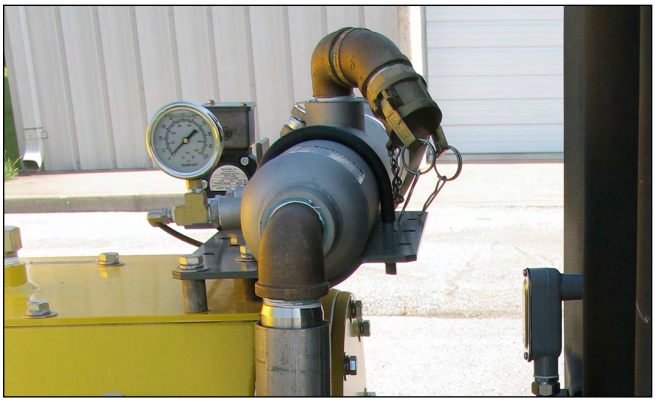


Figure 4: Secondary Filter (Polishing Filter).

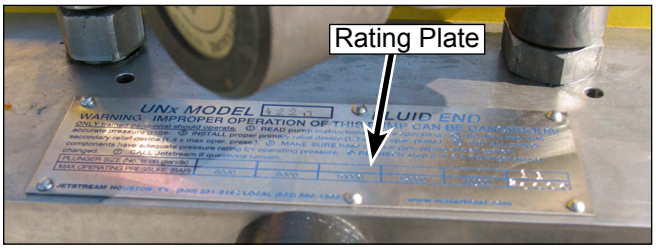
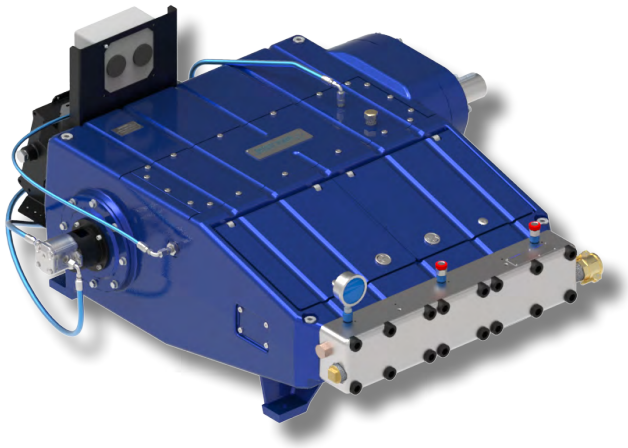
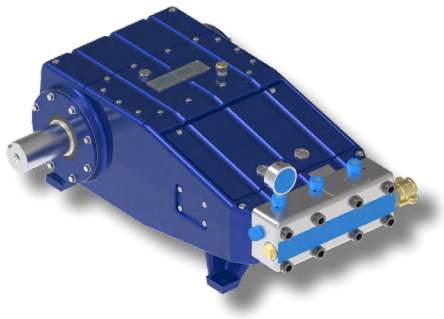


Figure 5: Fluid End Rating Plate mounted on top of Manifold.

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.





UNx Gen 2 Pumps

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 compo- nent part numbers for the fluid and power ends.

Look for additional Literature resources at: https://waterblast.com/literature/

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 in- cludes a manifold and water lines. The needle valves control the amount of flow to each stuffing box and must be properly adjusted during operation. 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.

Figure 6: Water Lubrication System

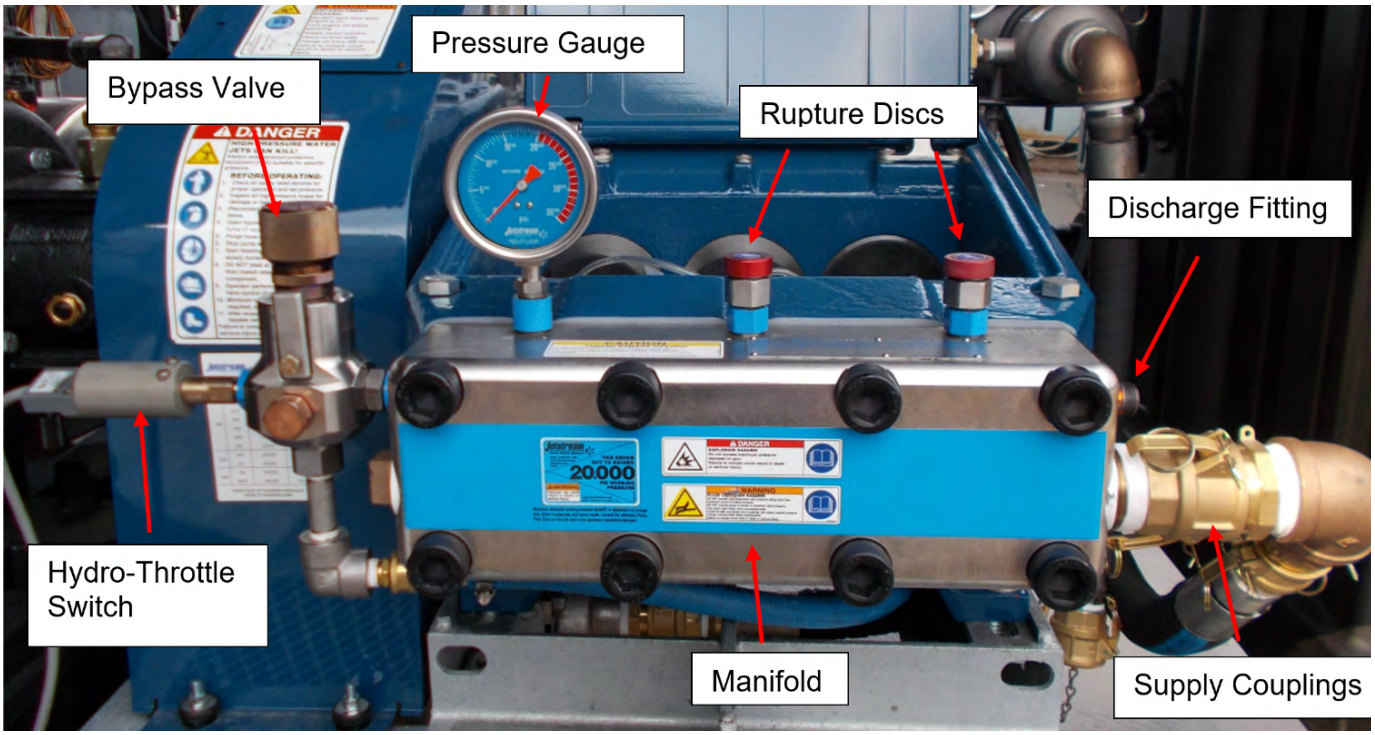


Figure 7: Gen 2 Pump Components

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. Water that bypasses the valve will drain from the bypass hose 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.

Discharge Fitting

The discharge fitting allows the connection of a high pressure hose. High pressure water exits from this fitting.

Supply Couplings

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

Manifold

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

Pressure Gauge

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

Fluid End Identification

A plate (Figure 8) is attached to all fluid end manifolds. The plate is stamped with the fluid end model number. A separate decal mounted on the unit details available plunger sizes, pressures and flows..

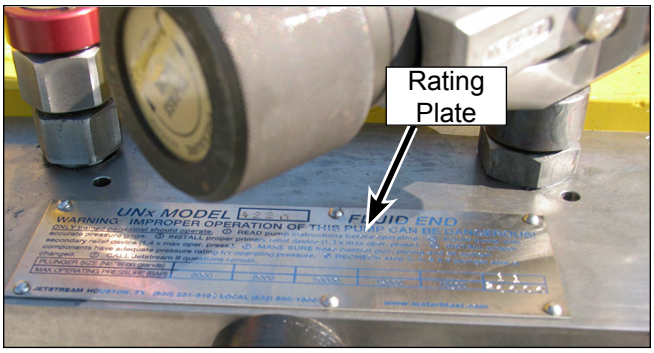


Figure 8: Fluid End Rating Plate mounted on top of Manifold

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

Secondary Filter (40K Units) – non 2000 series pumps

A secondary filter, or polishing filter, with cartridge(1 or 3 micron) is used for 40K operation only. The filter configuration will vary depending on pump series. When operating at 40K, monitor the filter pressure gauge (Figure 9) for an indication of filter condition. 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 cartridge filter is dirty and needs replaced. See unit manual for replacement procedure.

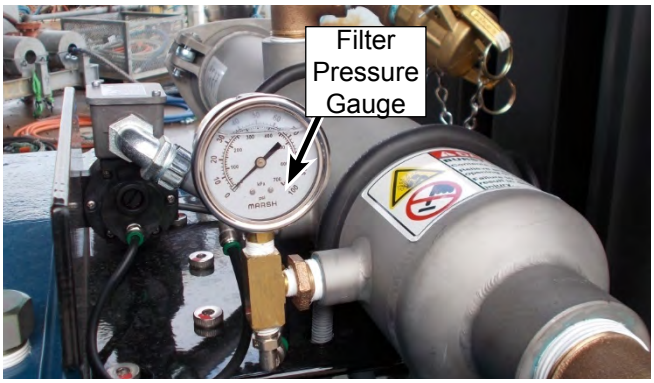


Figure 9: Secondary Filter System (Polishing filter)

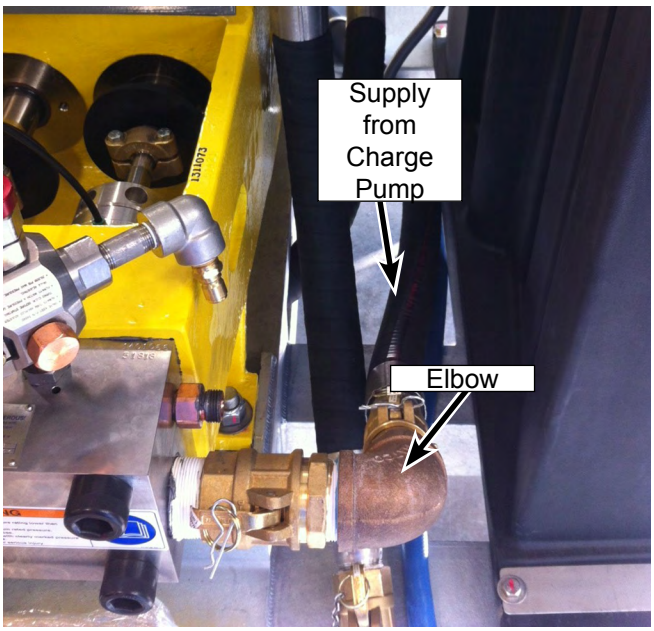


Figure 10: Supply Hose from Charge Pump

40K Hose Connections (non-2000 series)

1. Remove the supply hose (Figure 12) (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 secondary filter outlet hose. Connect the hose to the elbow on the 40K manifold. (Figure 12)
4. Remove the cap from the secondary filter inlet coupling (Figure 12).
5. Install the charge pump supply hose on the secondary filter inlet coupling.

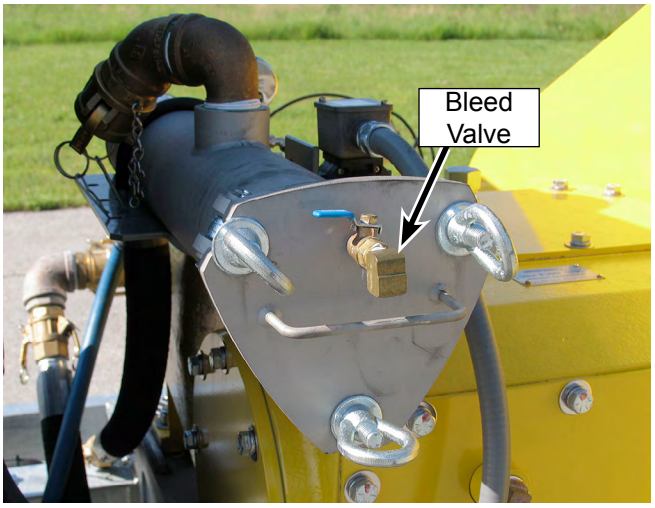


Figure 11: Secondary Filter Rear View

⚠ CAUTION

When flushing the system before operation, purge the secondary filter of air. Failure to do so could cause pump pulsation and damage. Use the bleed valve (Figure 11) on the filter to purge the air from the filter

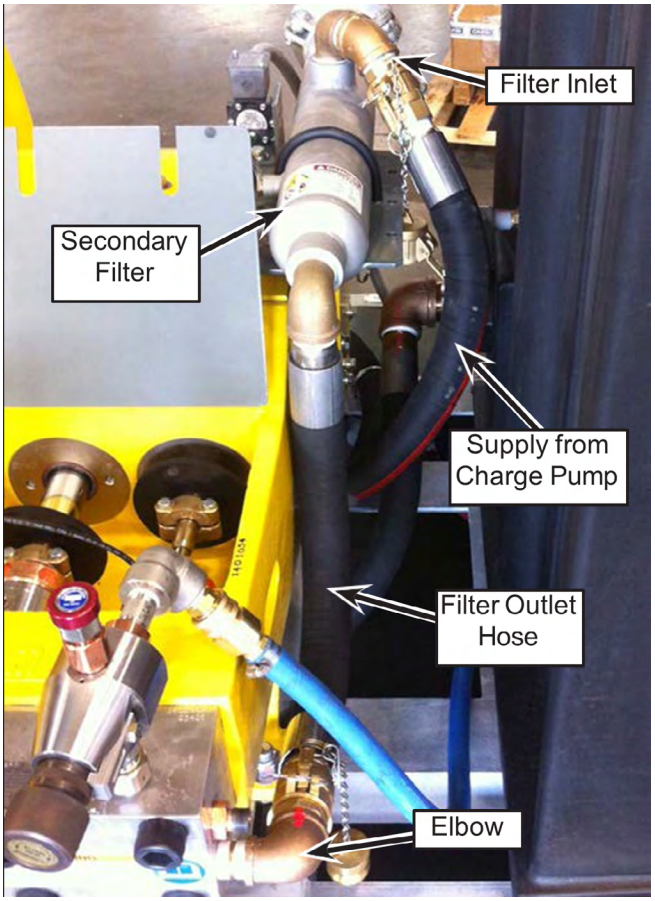


Figure 12: Secondary Filter Plumbing Components

GEN 2 PUMP INSTALLATION GUIDELINES

Models

The Jetstream UNx bareshaft pumps are available in many horsepower ranges and three pressure ranges – 15,000 psi, 20,000 psi, or 40,000 psi and can be supplied with an optional gear drive(depending on pump). The pumps without gear drives may be inline or belt driven via sheaves exerting a side load on the crankshaft. The gear drive option requires inline drive with flexible coupling***. All Jetstream power ends have a preferred rotation direction arrow that is cast into the powerframe on the top of the casting above each side seal plate . However, reverse rotation operation is allowed with the addition of optional reverse rotation oil scrapers(depending on pump). All gear driven pumps require a clockwise input rotation direction. Contact Jetstream for a gear drive order form depending on pump.

**** 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 power end damage can result from incorrect coupling selection.*

Series	Horsepower	RPM
2000 series	75hp max	800 rpm max
3000 series	200 hp max	600 rpm max
3600 series	175 hp max	550 rpm max
4200 series	325 hp max	518 rpm max
5200 series	400 hp max	518 rpm max
5200Q series	700hp max	548 rpm max

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 power end is lubricated via 80W90 gear oil (non detergent only) in the sump of the powerframe. The journal bearings, crossheads, and connecting rod bushings are supplied oil via gravity from a collection trough above the crossheads or pressure fed(depending on pump). The power end has a level requirement to ensure oil lubricates the crank- shaft tapered roller bearings and stays in contact with the crankshaft. Front to back level specification is 7° and side to side level is 10°. A low oil level shutdown is available as an option.

Pumps with external gear drives have a separate oil supply. Although external gear drives use the same 80W-90 gear oil as the crankshaft portion of the pump, the gear drive oil supply is completely isolated from the rest of the pump. Therefore, the gear drive oil supply must be checked independently of the main power end oil supply.

The power end oil has a recommended maximum temperature of 220°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.

GEN 2 PUMP INSTALLATION GUIDELINES

Water Supply

The supply water should be clean and cold. The maximum allowed inlet water temperature is 125°F. Ideally the water should be filtered to 10 micron (3 micron for 40K) and 40-80°F for maximum packing life. Severely reduced packing life will be encountered with warmer water.

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.

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.

Jetstream strongly discourages the use of aluminum or galvanized fittings in the water system. These may corrode and send particulate through the pump valves which could cause damage.

Water Quality Requirements

The quality of water that is supplied to your Jet- stream 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 com- ponents 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 special- ist 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.*

GEN 2 PUMP INSTALLATION GUIDELINES

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 ap- plications. 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.

Jetstream Unit Design Guidelines

Unit design and layout including water supply, filtration, shutdown protections, pump rotation, belt drive, overhung load along with suction and discharge plumbing are critical for smooth operation and maximum component life. Failure to comply with all Jetstream requirements could result in product failure not covered under Jetstream warranty.

Discharge Hose Requirements

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

Recommended Equipment

Jetstream equips the waterblast pumps 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 separate rupture discs in two separate rupture disc holders 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

Technical Notes

The connecting rods are equipped with plain bearings where they contact the crankshaft. These bearings require lubrication to survive. When the crank- shaft 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 2000/3000/3600/4200/5200 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.

Follow Jetstream's maximum allowable fluid end inlet pressures as defined in the Water Supply sections of the individual pumps sections below and minimum pump speeds per our catalogs to prevent this type of failure.

2000 Series Pump Installation Guidelines

All of the previous installation guidelines apply except as follows.

Water Supply

The 2000 pump can NOT be gravity fed and 15K/20K requires 35-50 psi suction water pressure at full pump speed to operate. 40K requires 40 - 50 psi suction water pressure. All fluid ends have a maximum inlet supply pressure of 75 psi.

Bypass

Jetstream recommends a needle valve, bypass valve, unloader, or other means of pressure control be included in the high pressure plumbing to allow unloaded startup of the pump.

Drive Sheave Placement

The position of any belt drive system on the input shaft must be no greater than the distance from the centerline of the 2000 pump foot bolt to the centerline of the sheave as shown in Figure 1. This is required to minimize crankshaft deflections.

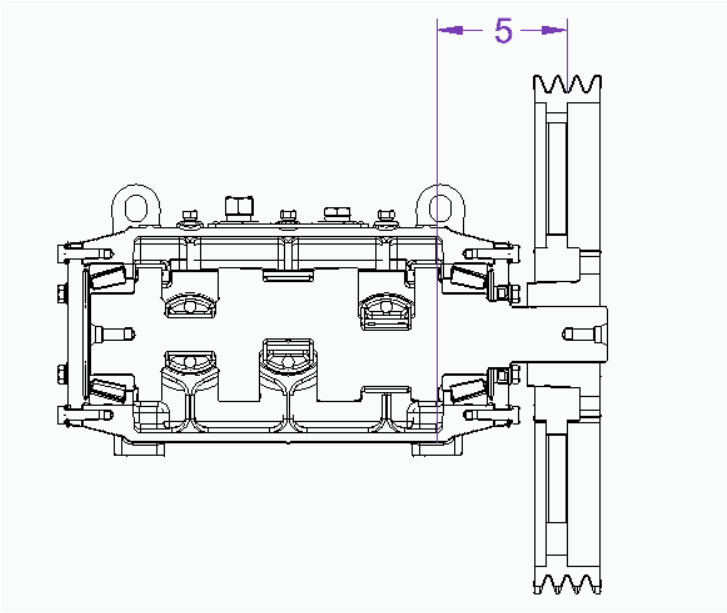
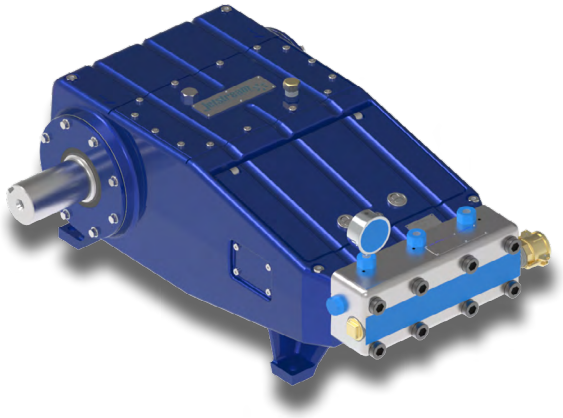


Figure 1: Drive Sheave Placement

Jetstream 3000/3600/4200 Series Pump Installation Guidelines



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(200hp) requires 65 psi suction pressure at full speed. All fluid ends have a maximum inlet supply pressure of 75 psi flow.

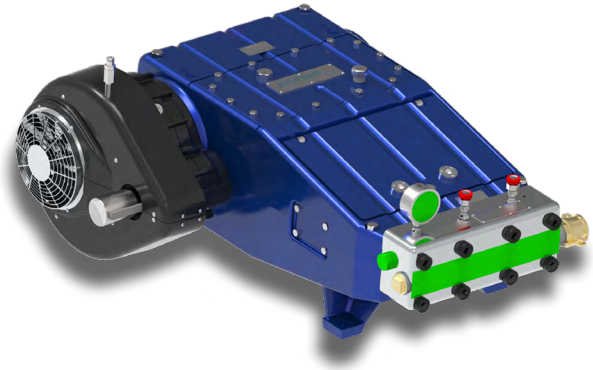
The inlet supply hose should be 3" ID if gravity fed and 2" ID if pressure fed. The water supply hose inside diameter must be large enough to supply 150% of the unit's maximum flow requirements.

Top or Side Bypass

A top or side mounted bypass is available. The side mounted bypass was developed to help 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

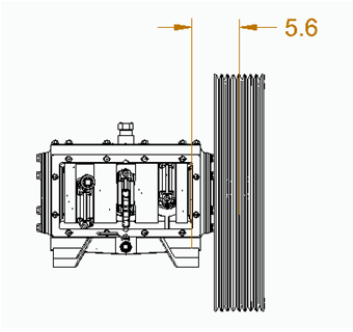
A gear drive is available in four different gear ratios to support diesel engine or electric motor input speeds. Both styles can be supplied left hand drive or right hand drive (as viewed from FE) and the gear drive model's input shaft can also be clocked to five different positions. The input shaft 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 below 250°F. 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. See Gear Drive Product instructions (PI163 and PI172) for further details and maintenance requirements.



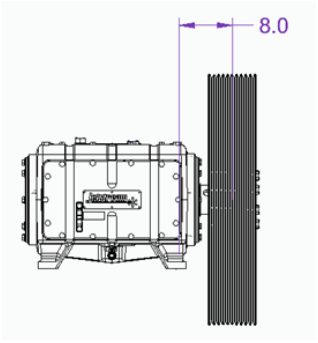
Drive Sheave Placement

The position of any belt drive system on the input shaft must be no greater than the dimensions shown in figures below from the centerline of the associated pump foot bolt to the centerline of the sheave. This is required to minimize crankshaft deflections.

3000 Pump Sheave Placement



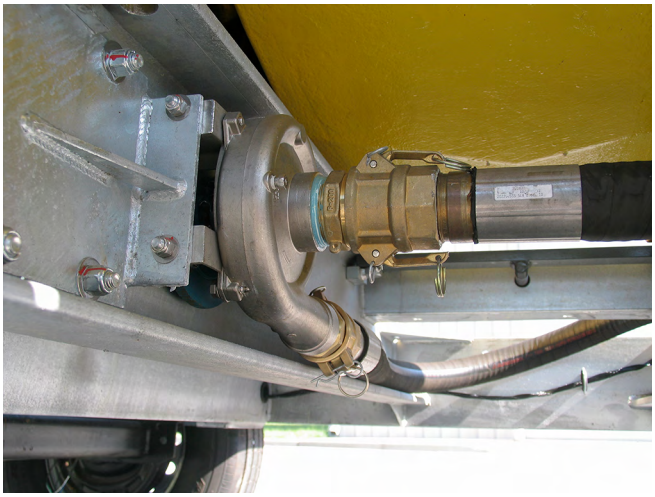
4200 / 5200 Pump Sheave Placement



Jetstream 5200 Bareshaft Pump Installation Guidelines

Water Supply

The 5200 pump can NOT be gravity fed and requires 40-50 psi suction water pressure at full pump speed to operate. All fluid ends have a maximum inlet supply pressure of 75 psi.



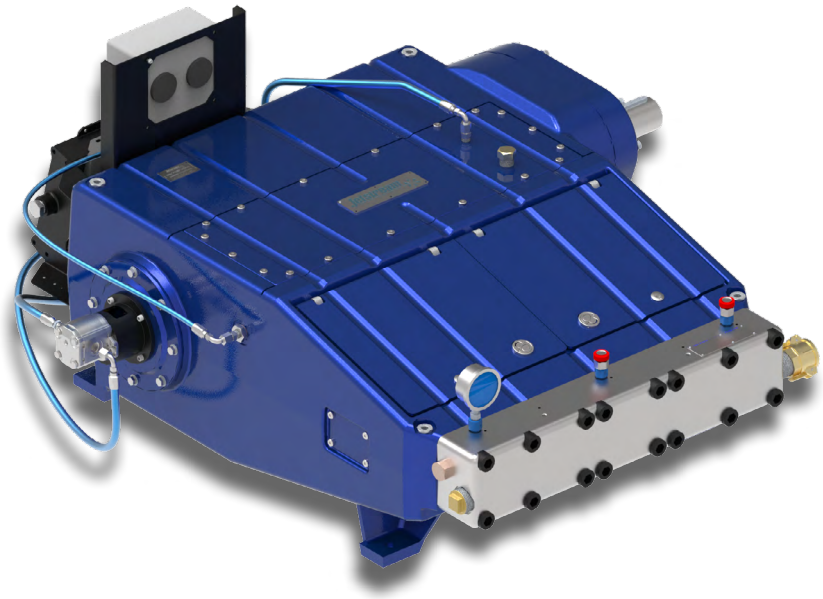
Jetstream 5200Q Bareshaft Pump Installation Guidelines

The requirements for the 5200Q pump are the same as the 4200/5200 pump except :

The 5200Q power end is internally geared and requires an inline drive system. A belt drive which would apply a side load to the input shaft is not allowed. It is available in two different gear ratios to support diesel engine or electric motor input speeds. It is only supplied as a right hand drive and must be driven with input shaft rotating CW. Water Supply

Water Supply

The 5200Q pump can NOT be gravity fed and requires 70-80 psi suction water pressure at full pump speed to operate. All 5200Q fluid ends have a maximum inlet supply pressure of 85 psi.



Jetstream 5200Q Bareshaft Pump Installation Guidelines

Lubrication

The power end is lubricated with 27 gallons of 80W90 gear oil (non detergent only) in the sump of the housing. The 5200Q power end is equipped with an oil temperature gauge and an oil pressure gauge. Both of these gauges have integral shut-down switches. The maximum allowed oil temperature is 200°F (normal range is 160-185°F). A 12/24V (20/9 amps) fan driven oil cooler is mounted on the rear of the pump to cool the oil. The oil is pumped via an external oil pump through an external filter and routed inside the power end to critical points. The oil filter (10 micron/microglass) should be changed with every oil change (500 hours). The minimum allowed oil pressure is 30 PSI (normal operating range is 60-70 psi). The control system will need to ignore the low oil pressure switch for 10 seconds after the crankshaft begins to rotate to allow oil pressure to build."

Oil Filter on rear of pump

Oil temperature and oil pressure shutdown field wiring

Pump Electrical Connections

The 5200Q power end is provided with a wire harness that utilizes a Metripack connector for connecting 12/24V battery power to the pump in the field. This harness is prewired to the cooling fan system that turns the fan on and off based on the temperature switch provided on the pump. The cooling fan turns on when the temperature of the oil reaches 180F

12/24V Field wiring to pump harness

PUMP OPERATION GUIDELINES

Flushing the System: See Unit Manual

Start-up Preparation - Pump

1. 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. Re- place any component that is not properly rated.
4. Install the discharge hose onto the fitting on the manifold along with a hose safety check.
5. 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.

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

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 engine without water in the system. Damage to the charge pump will occur.

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.

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 (Figure 6). On 6000 series pumps, the water will flow from the small holes in the bottom of the gland nut wrench holes.
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 to change the water flow.
   *Needle valve location for the water lube will vary depending on the pump series. A very small, but steady stream is all the is required. 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.

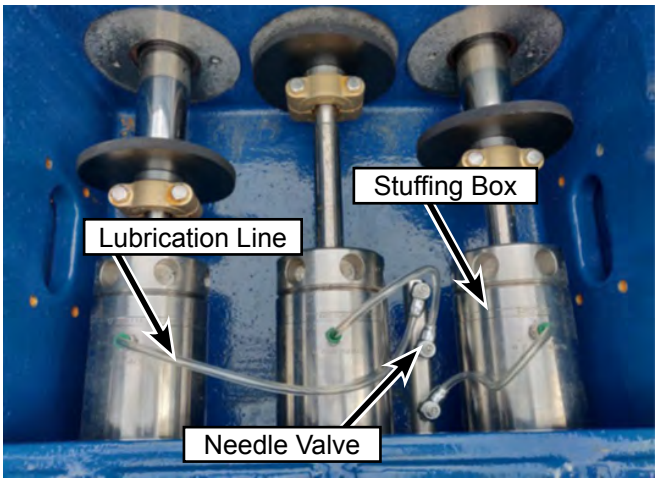


Figure 6: Gen 2 Pump Internal Lube Layout

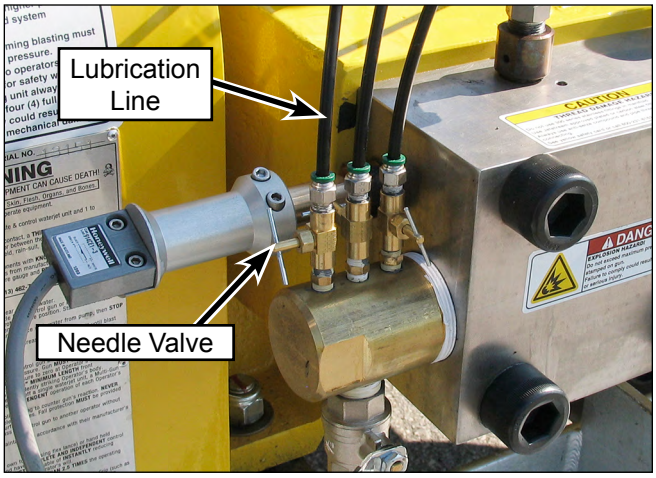


Figure 7: Classic Series Pump External Lube Layout

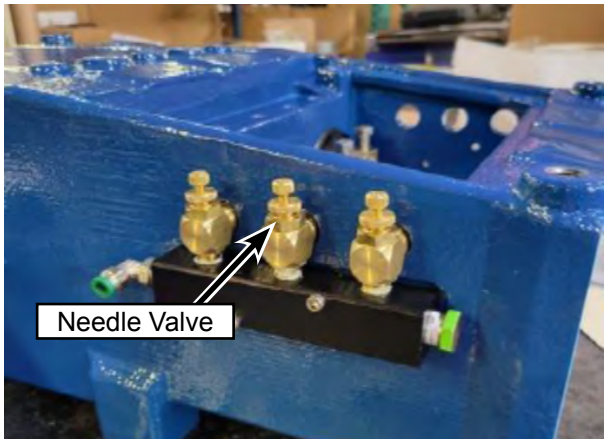


Figure 8: 2000 Series External Lube Layout

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 9) 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 10) or the larger O-ring and backup ring on the outside of the valve (Figure 11).
- On 40K pumps, this could be the face seal in the stuffing box (Figure 10) or the large O-ring on the outside of the valve.

If water is leaking from the round weep holes (Figure 9), 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 11) 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.

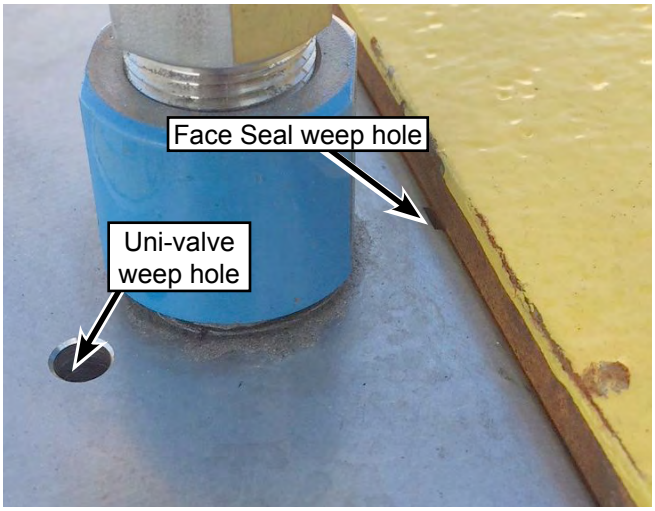


Figure 9: Weep Holes

Figure 10: Uni-valve to Stuffing Box Seals.

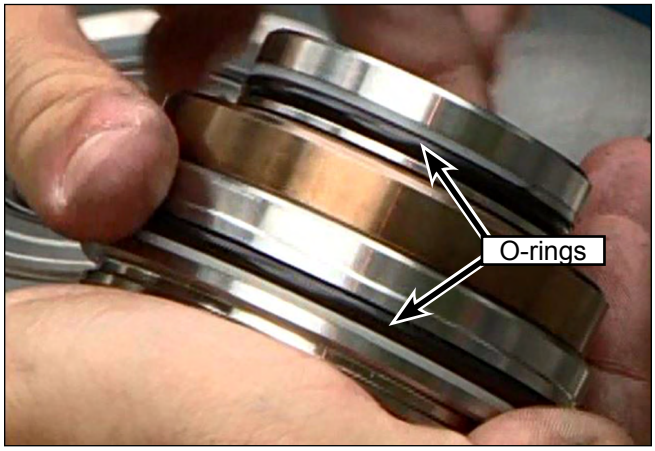


Figure 11: Outer O-rings.

MAINTENANCE

Daily

1. **Check Power End Oil Level** - Add oil as necessary. Refer to “Checking Power End Oil Level” on page 60 for instructions.
2. **Check Gland Nut Torque** - Ensure the gland nuts are properly tightened for operation. Refer to “Checking Gland Nut Torque” on page 37 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 20.
4. **Inspect Rupture Discs** - Ensure the rupture discs are installed and inspect for damage. Refer to “Rupture Disc Inspection” on page 38. 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 58 .
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 62.
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 62.
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 12).
5. Install the assembly on the suction side of the manifold.
6. Pour a glycol based anti-freeze solution into the funnel (Figure 13). 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 14).
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.

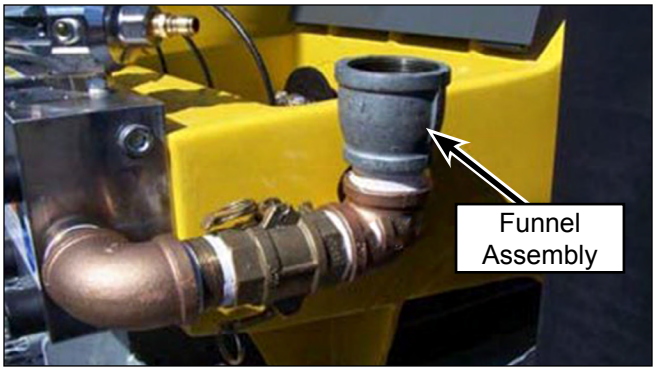


Figure 12: Funnel Assembly Installation.

Figure 13: Adding Anti-Freeze.

Figure 14: Draining the Anti-Freeze.

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 all 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 (non 5200Q)

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 pump.
2. Turn off the water supply, drain the water tank.
3. Remove the two bolts that secure the hydro-throttle switch aluminum housing to the brass cartridge in the manifold (if installed). Remove the switch and housing and set aside. (Figure 15)
4. Disconnect the bypass drain hose and the supply coupling from the manifold. (Figure 16)
5. Disconnect the lube water line from the fluid end (2000 series pump).
6. Remove the cotter pin from the hinge rod and remove the rod (Figure 17).
7. Remove the top manifold bolts at each corner and install manifold mounting studs into the two open holes to allow for easier installation of the new manifold (Figure 18, following page)

Note: *The pump wrench can be used with a hammer to remove the manifold bolts. Manifold mounting studs can be purchased from Jetstream.*

5200 / 4200 / 3600 - p/n 54261
3000 - p/n 56742
2000 - p/n 70341

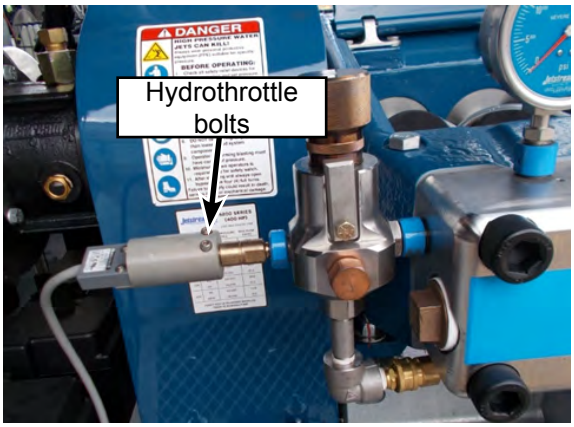


Figure 15: Hydro-Throttle Switch.

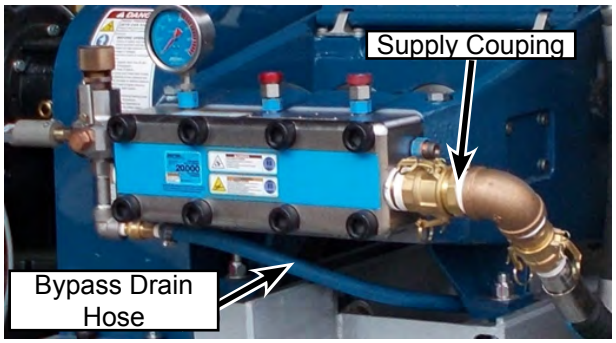


Figure 16: Line Removal.

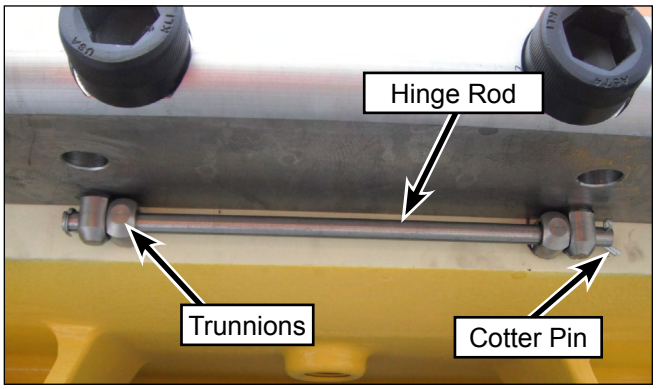


Figure 17: Hinge Rod, Trunnions, and Cotter Pin.

8. Continue removing the remaining manifold bolts.

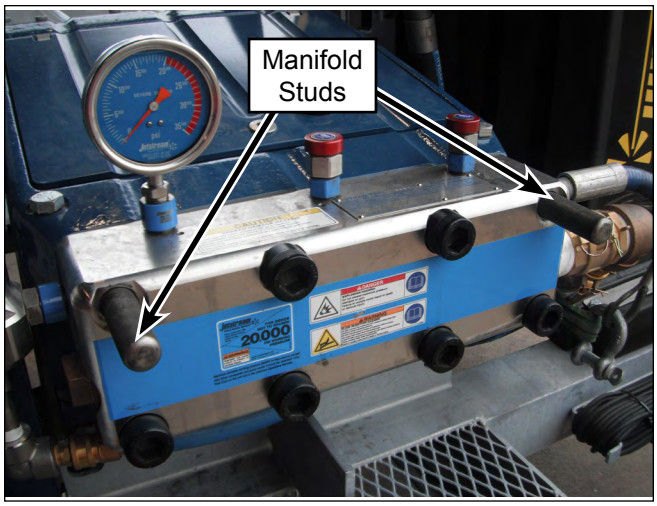


Figure 18: Using Manifold Studs

9. Once all of the bolts are removed, lift the manifold off the pump (Figure 19).

⚠ 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:*

- 2000 Series: 53 lb. (24 kg)
- 3000 Series: 90 lb. (41 kg)
- 3600/4200/5200 Series: 165 lb. (75 kg)

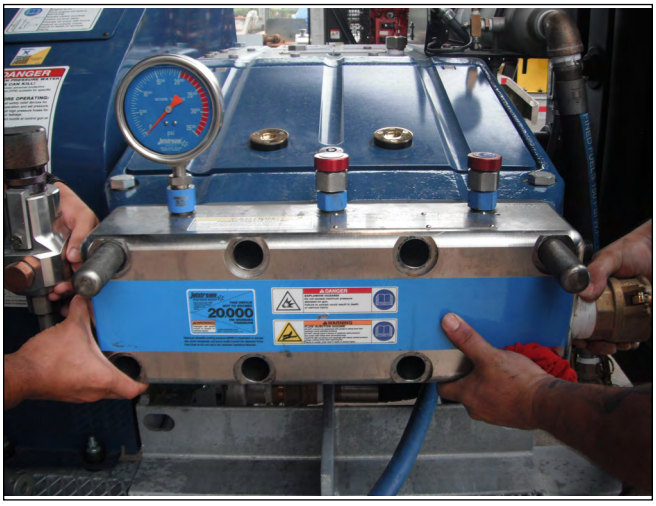


Figure 19: Removing the Manifold.

10. Remove the water lubrication fitting (Figure 20) from each stuffing box.

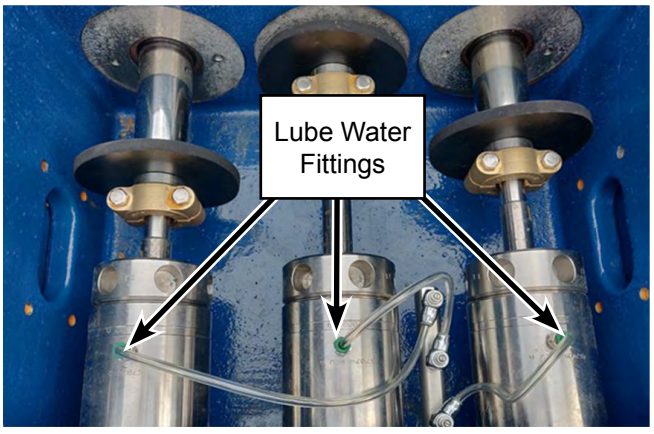


Figure 20: Lube Water Stuffing Box Connections.

11. Remove the two bolts that secure each plunger coupling (Figure 21) to the plungers and remove the three couplings.

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

12. Pull each stuffing box from the pump case (Figure 22).
13. Clean the stuffing box bore thoroughly and apply petroleum jelly or Anti-Seize to the bores.

ATTENTION

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

14. 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.
15. Extend the plunger from each stuffing box until it mates with the opposing crosshead pony rods. Install the plunger coupling (Figure 21) on each plunger and secure with the two bolts. Tighten the bolts to 20 ft.-lb.(27 N·m).
16. 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).Hit the wrench about three times using moderate power (Figure 23). This should supply sufficient torque on the nut.

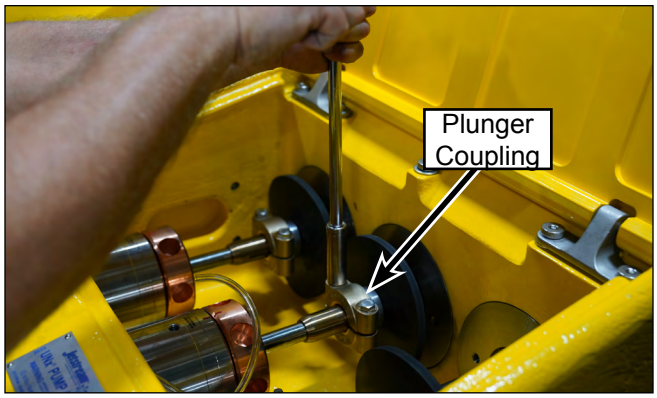


Figure 21: Plunger Couplings.

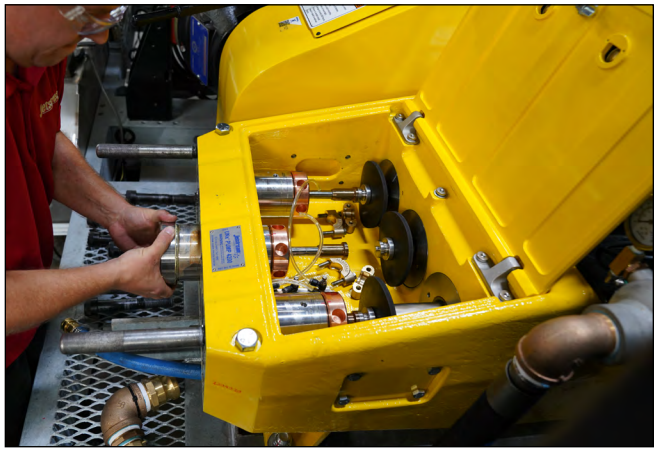


Figure 22: Removing Old Stuffing Box and Installing New Stuffing Box.

Figure 23a: 2000 Pump Gland Nut Installation

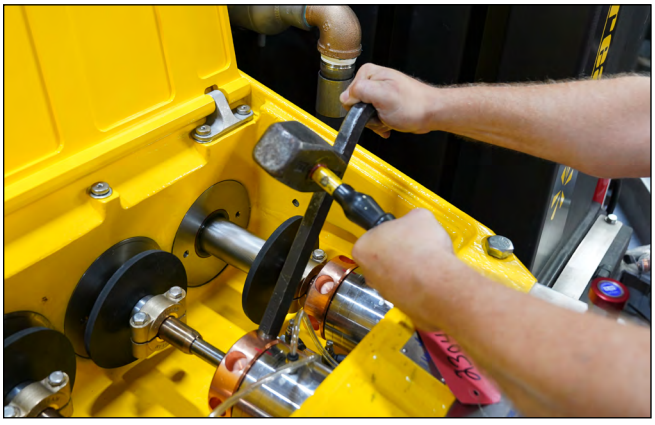


Figure 23: Installing Gland Nut.

17. Apply thread sealant to the threads of the lubrication line fittings. Install the fittings onto the stuffing boxes. Re-Install the water lube lines. (Figure 24)
18. 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.
19. Lift the new manifold onto the manifold mounting studs (Figure 25). Trunnion adjustment continued on next page.
20. 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.

a. Remove two manifold bolts and install two manifold mounting studs. Remove remaining manifold bolts.
5200Q / 5200 / 4200 / 3600 - p/n 54261
3000 - p/n 56742
2000 - p/n 70341
b. Slide the manifold away from the powerframe (or adapter plate) a few inches (Figure 26). This will allow room to adjust the threaded trunnions in the bottom of the manifold.
c. Screw both manifold trunnions (Figure 27) in completely and then back them out approximately 2-1/2 turns. Slide the manifold back against the powerframe (or adapter plate).

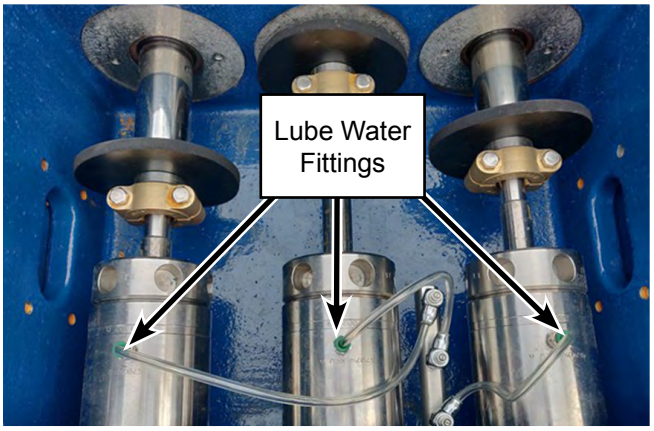


Figure 24: Reinstall Fittings and Lube Lines

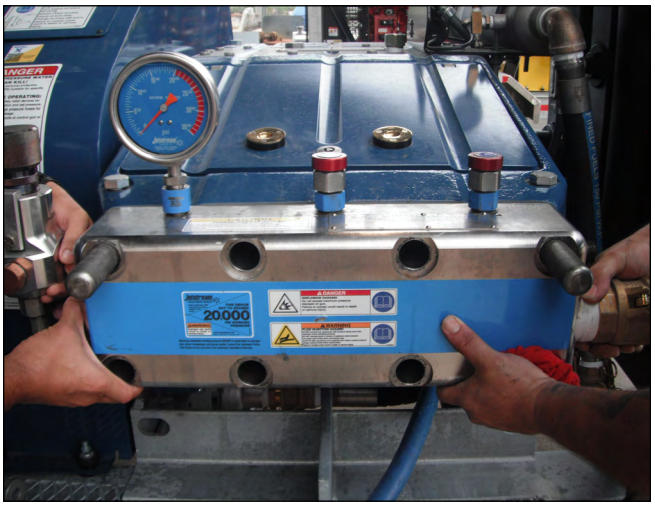


Figure 25: Install the New Manifold.

Figure 26: Manifold in Adjustment Position.

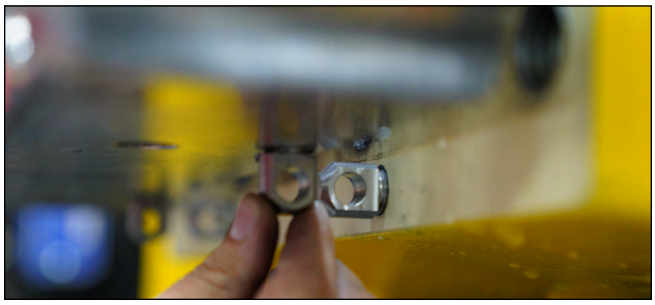


Figure 27: Screw in Manifold Trunnions.

d. To install the hinge rod (Figure 26), 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.

21. Install the manifold bolts in the open holes and hand-tighten. (Figure 29)

22. Remove the two manifold mounting studs and install the remaining two bolts. Tighten all of the bolts in a crisscross sequence (Figure 30).

    Proper torque is 350 ft.-lb. (470 N·m) for 3000/4200/5200 pumps.

    Proper torque is 120 ft-lbs(162 Nm) for 2000 pump.

    Due to the hydraulically biased Uni-Valve design, it is not necessary to use a torque wrench. The pump wrench and a hammer is adequate.

Figure 28: Install Hinge Rod.

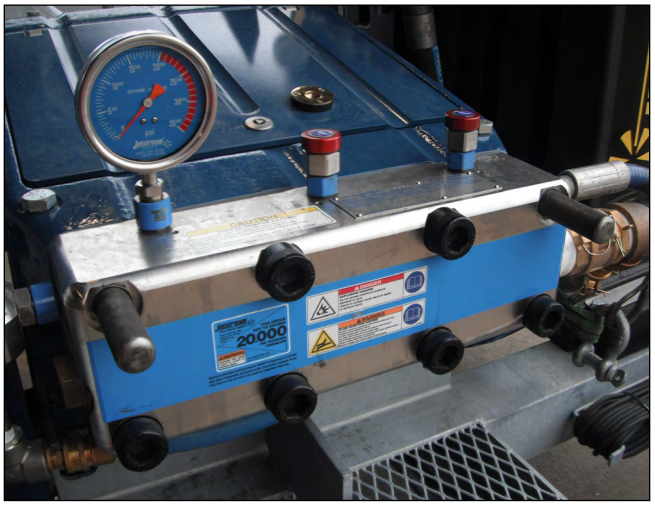


Figure 29: Installing Gland Nut.

Figure 30: Bolt Tightening Sequence.

23. Connect the supply coupling and the bypass hose to the manifold.
24. Reinstall the hydro-throttle switch housing.
25. Verify all connections, glands and bolts were properly tightened.
26. Ensure the water lubrication system is properly adjusted, if equipped, before waterblasting. Refer to “Checking the Water Lubrication System” on page 20 for instructions.
27. If new packing was installed, break in the packing as outlined in “Breaking in New Packing” on page 44

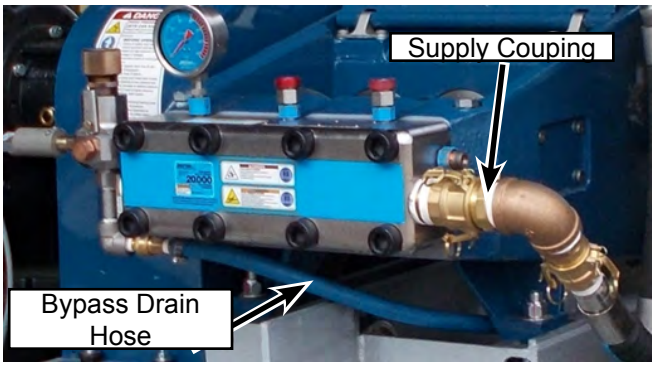


Figure 31: Connect Supply and Bypass Lines

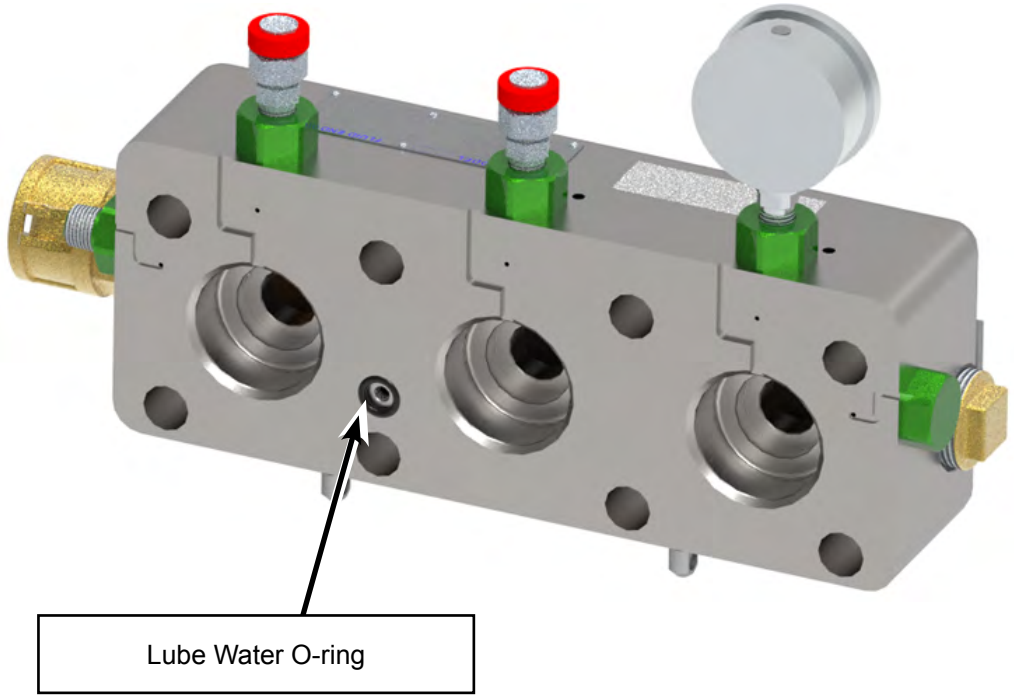
ATTENTION

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

When converting to 40K, please note the pressure requirements of the individual pump as defined in the pump specific portion of this manual.

ATTENTION

When converting from one FE to another on a non-2000 series pump, make sure the lube water o-ring is installed in the FE manifold. See below:



Converting a 5200Q 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 pump.
2. Turn off the water supply, drain the water tank.
3. Disconnect the bypass drain hose and the supply coupling from the manifold (Figure 32).

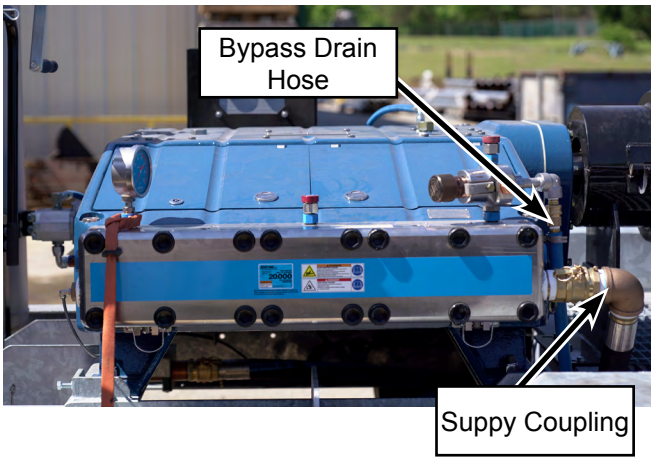


Figure 32: Disconnect Bypass Hose and Supply Coupling.

4. Remove the hinges pins from the hinge blocks. (Figure 33)

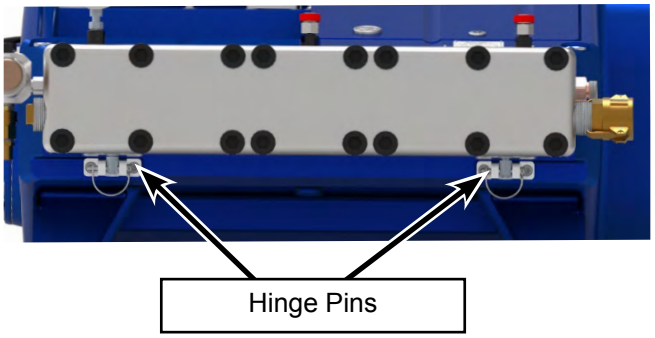


Figure 33: Remove Hinge Pins.

5. Attach a lifting device such as a jib crane as shown to the manifold with 2x ¾-10UNC lifting eyes in the holes in the top of the fluid end.

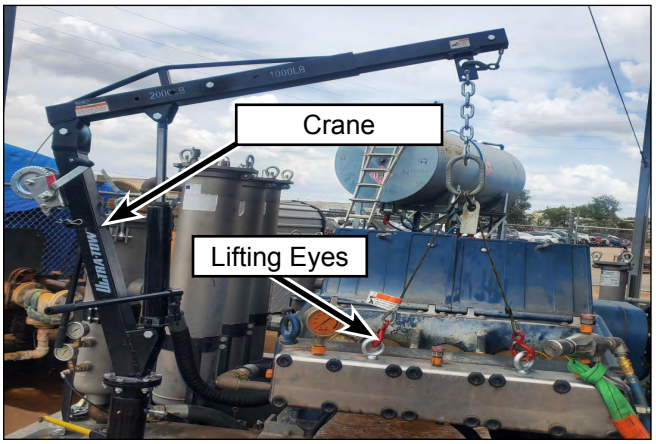


Figure 34: Attach Lifting Device.

6. Remove the top manifold bolts at each corner and install manifold mounting studs PN 54261 into the two open holes to allow for easier installation of the new manifold (Figure 35)

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

7. Continue removing the remaining manifold bolts.

8. Once all of the bolts are removed, make sure that the lifting device is holding the weight of the manifold off the studs. Slide the manifold off the studs and lift the manifold off the pump.

   Note: *The weight of the manifold is approximately 350 lb. (168 kg)*

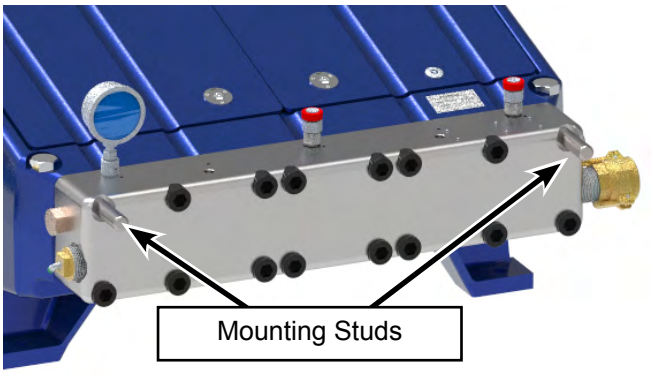


Figure 35: Install Mounting Studs.

9. Decouple the water lube line from each stuffing box. Remove the water lubrication fitting from each stuffing box (Figure 36).

10. Remove the two bolts that secure each plunger coupling to the plungers and remove the five couplings

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

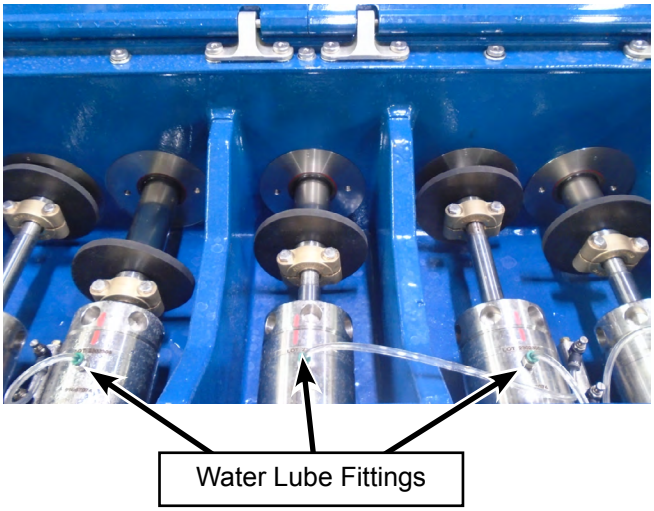


Figure 36: Remove Water Lube Lines and Fittings.

11. Pull each stuffing box from the pump case (Figure 37).
12. Clean the stuffing box bore thoroughly and apply petroleum jelly or Anti-Seize to the bores.

ATTENTION

Apply anti-seize comppounf to each stuffing box bore when installing stuffing boxes to help prevent corrosion and extend pump life.

13. 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 and the water lube inlet port is facing up.

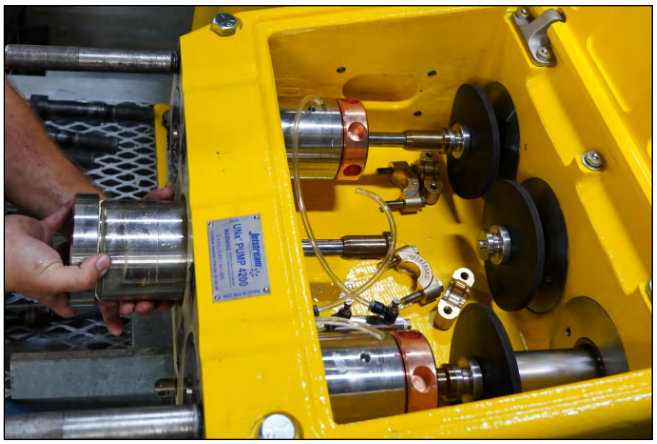


Figure 37: Remove Stuffing Boxes.

14. Extend the plunger from each stuffing box until it mates with the opposing crosshead pony rods. Install the plunger coupling on each plunger and secure with the two bolts. Tighten the bolts to 20 ft.-lb.(27 N·m). (Figure 38)

Figure 38: Connect Plunger and Pony Rod with Plunger Coupling.

15. 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) Hit the wrench about three times using moderate power. This should sup- ply sufficient torque on the nut. (Figure 39)

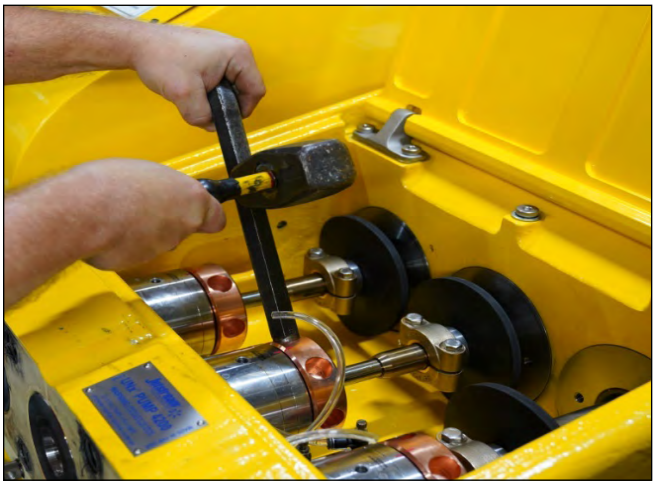


Figure 39: Install Manifold Studs.

16. Apply thread sealant to the threads of the lubrication line fittings. Install the fittings onto the stuffing boxes. Re-Install the water lube lines. (Figure 40)
17. Apply a light coating of anti-seize compound to the mounting face of the power end. This will greatly reduce the buildup of corrosion.
18. Using a lifting device, lift the new manifold onto the manifold mounting studs. (Figure 41)

⚠ CAUTION

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

19. Install and adjust the trunnion rod as follows:

Manifold Trunnion Adjustment on 5200Q

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 centered position of the manifold will also ensure proper operation of the valves and seals at all pressures.

a. If not already, remove two manifold bolts and install two manifold mounting studs p/n 54261. Remove remaining manifold bolts. Slide the manifold away from the powerframe (or adapter plate) a few inches. This will allow room to adjust the threaded trunnions in the bottom of the manifold.

b. Screw both manifold trunnions (Figure 42) in completely and then back them out approximately 2-1/2 turns. Slide the manifold back against the powerframe (or adapter plate).

c. Install the hinge pins (Figure 43). It may be necessary to either lift the manifold or use a prybar while simultaneously tapping the end of the pins with a hammer to get the hinge pin pass through the hole in the hinge block. 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.

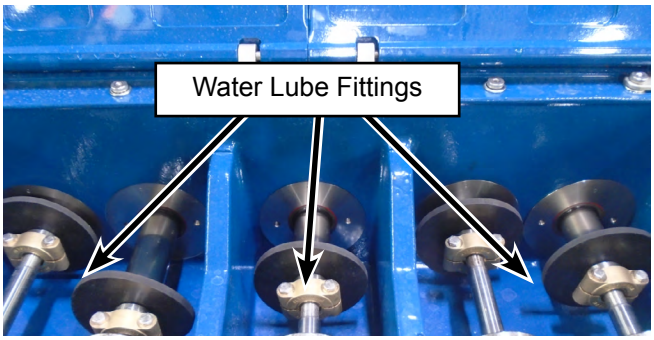


Figure 40: Apply Thread Sealant and Install Lube Fittings.

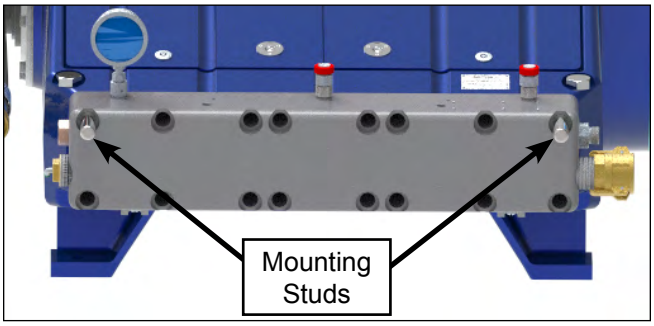


Figure 41: Lift New Manifold onto Mounting Studs.

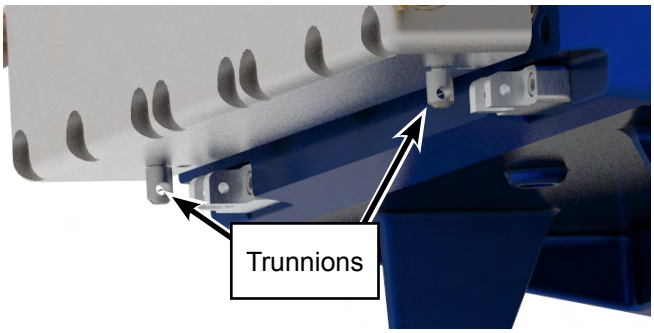


Figure 42: Adjust Trunnions.

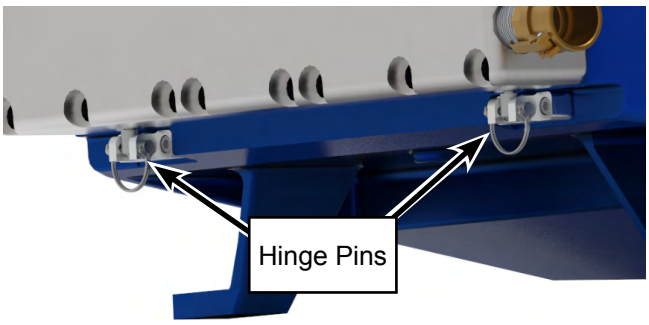


Figure 43: Install Hinge Pins.

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

20. Install the manifold bolts in the open holes and hand-tighten.(Figure 44)
21. Remove the manifold mounting studs .
22. Install the remaining two bolts. Tighten all of the bolts in a crisscross sequence (Figure 45). Proper torque is 350 ft.-lb. (470 N·m). Due to the hydraulically biased Uni-Valve design, it is not necessary to use a torque wrench. The pump wrench and a hammer is adequate.
23. Connect the supply coupling (Figure 46) and the bypass hose to the manifold.
24. Verify all connections, glands and bolts were properly tightened.
25. Ensure the water lubrication system is properly adjusted before waterblasting. Refer to “Checking the Water Lubrication System” on page page 20 for instructions.
26. If new packing was installed, break in the packing as outlined in “Breaking in New Packing” on pagepage 44.

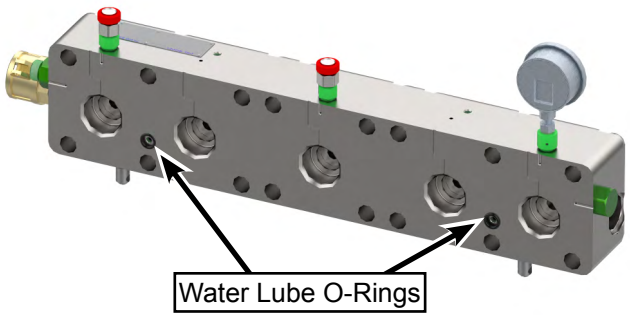
ATTENTION

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

When converting to 40K, please note the pressure requirements of the individual pump as defined in the pump specific portion of this manual.

ATTENTION

When converting from one FE to another, make sure 2 of the lube water o-rings are installed in the 5200Q FE manifold. See below



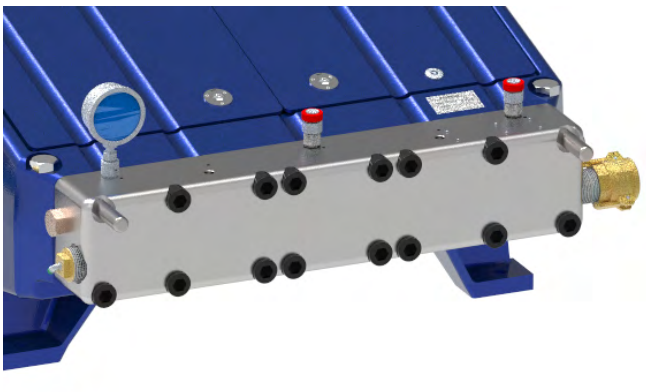


Figure 44: Install Manifold Bolts.

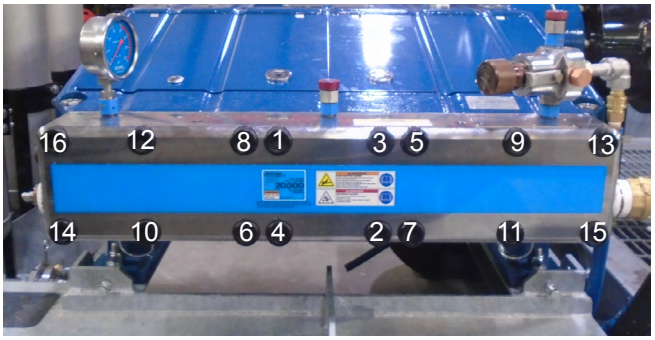


Figure 45: 5200Q Bolt Tightening Sequence

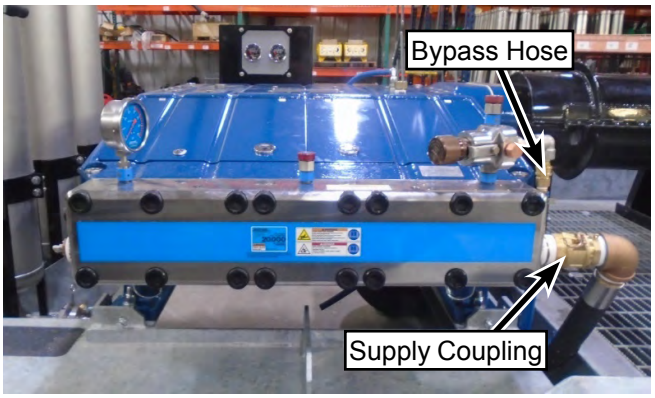


Figure 46: Connect Supply and Bypass Hoses

40K Hose Connnections (Typical)

1. Remove the supply hose (Figure 47) (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. Connect the hose to the elbow on the 40K manifold. (Figure 48)
4. Remove the cap from the secondary filter inlet coupling.
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 pulsation and damage. Use the bleed valve (Figure 49) on the filter to purge the air from the filter.

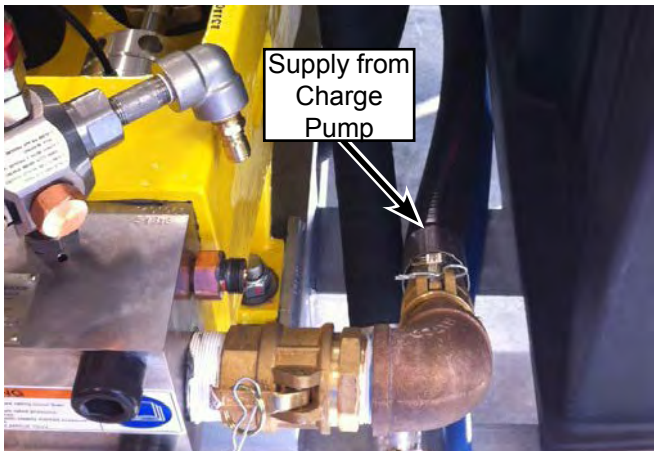


Figure 47: Remove Supply Hose

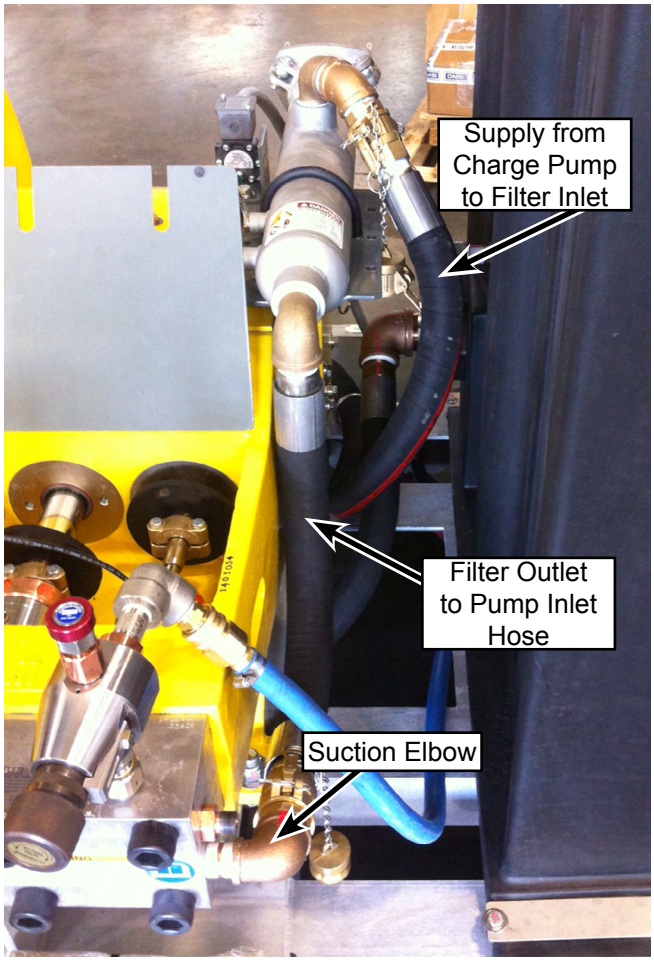


Figure 48: 40K Connection Layout (Typical)

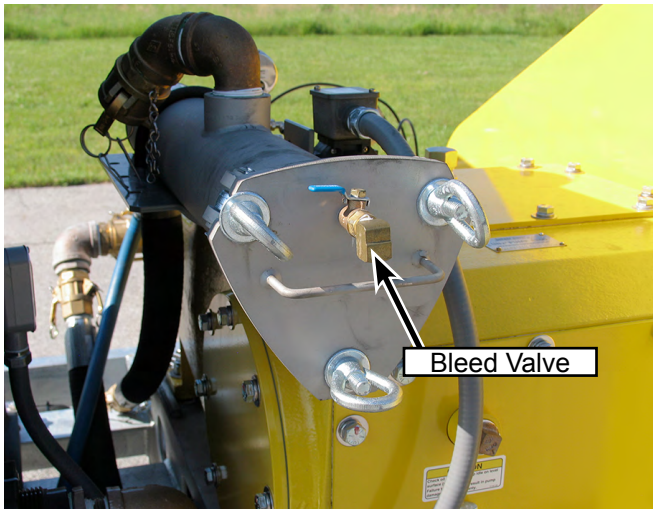


Figure 49: Purge Secondary Filter of Air

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 45).Proper torque is 350 ft.-lb. (470 N·m) . Proper torque for 2000 series pump is 120 ft-lb(162 Nm). This can be achieved with a few hammer strikes on the pump wrench. Due to the hydraulically biased Uni-Valve design, it is not necessary to use a torque wrench. The pump wrench and a hammer is adequate.

Figure 45: Tightening Sequences.

Checking Gland Nut Torque (non-2000 Series)

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.

Checking Gland Nut Torque(2000 series)

1. Open the rod box cover.
2. Place 20000 series gland wrench around one of the gland nuts as shown.
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.

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.

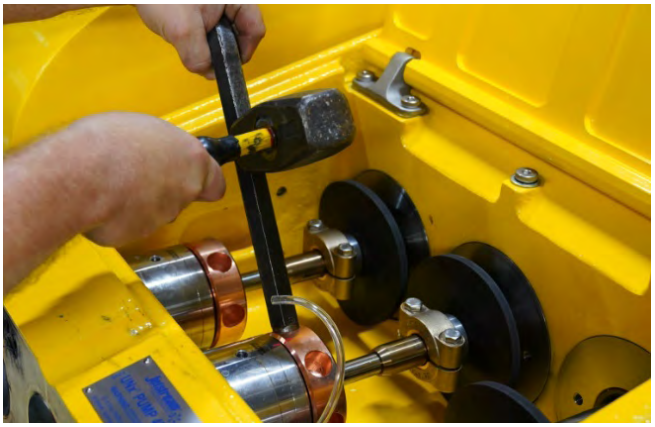


Figure 46: Tightening Gland Nuts.

Rupture Disc Inspection

1. Use an adjustable wrench to remove the cap (Figure 47) from the rupture disc assembly.
2. Remove the rupture disc from the base and inspect.(Figure 48)
3. Verify a disc is installed and has not been damaged. Replace as necessary.

ATTENTION

Installation of two separate rupture discs in two separate rupture disc holders 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.

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

Packing Replacement (Non-2000 Series)

Packing Removal

1. Relieve pressure from the pump, shut off the engine and disengage the pump drive system (pto, transmission, coupling, etc).Turn off the water supply and drain the water tank.
2. Open the rod box cover.
3. Disconnect the water lubrication lines, if equipped.
4. Position the plunger to be serviced so that it is at bottom dead center (pony rod is fully retracted towards crankshaft) (Figure 49). This can be achieved by one of the following methods:
   a. Belt drive – open belt guard access cover and pull belts towards you
   b. Transmission – rotate driveshaft by hand
   c. Coupling – Engage engine starter to rotate crankshaft as needed

WARNING

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

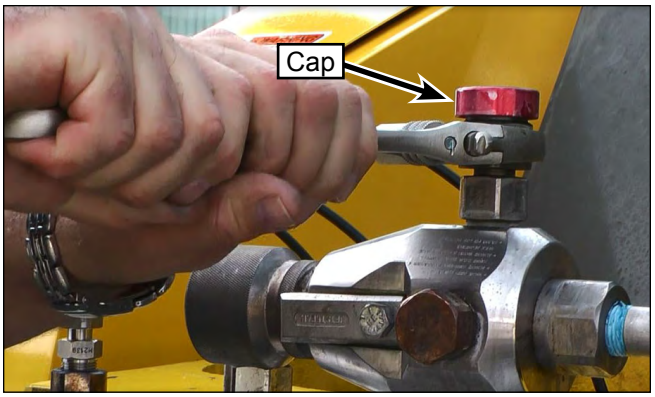


Figure 47: Housing/Cap Removal (15K Manifold Shown).

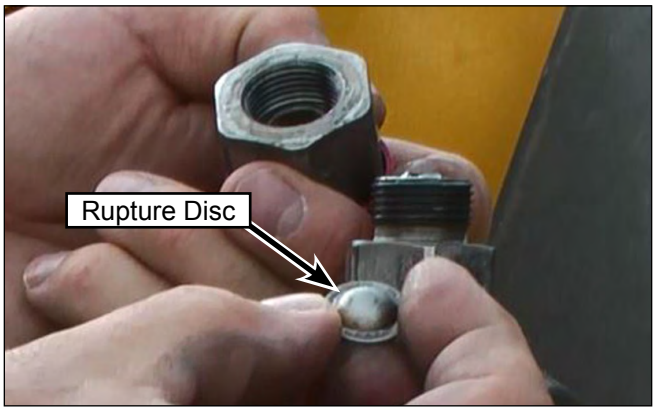


Figure 48: Disc Removal.

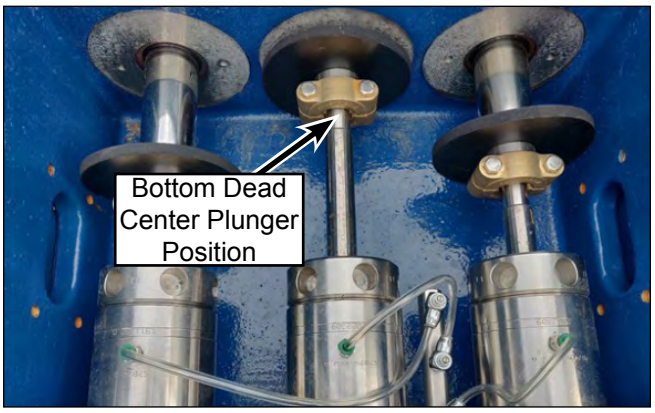


Figure 49: Position the plunger.

5. Insert the rounded end of the pump wrench (Figure 50) 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.

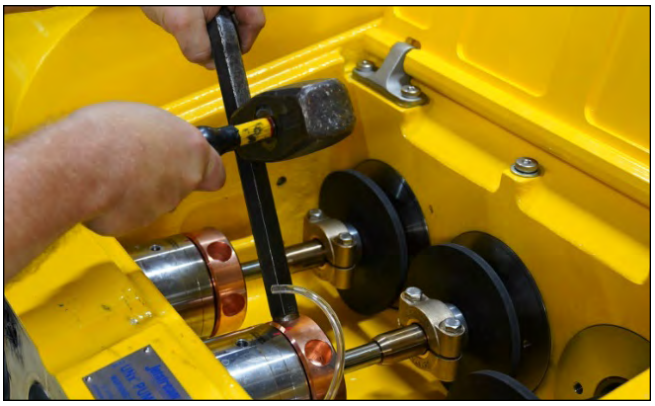


Figure 50: Loosening the Gland Nut.

6. Remove the two bolts that secure the plunger coupling (Figure 51) to the plunger and remove the coupling. Push the plunger into the stuffing box for clearance.

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

7. 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.

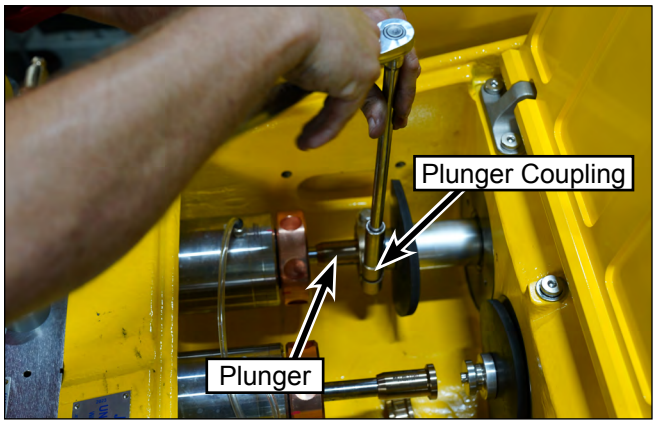


Figure 51: Plunger Coupling Removal.

8. Remove the packing set (Figure 52).

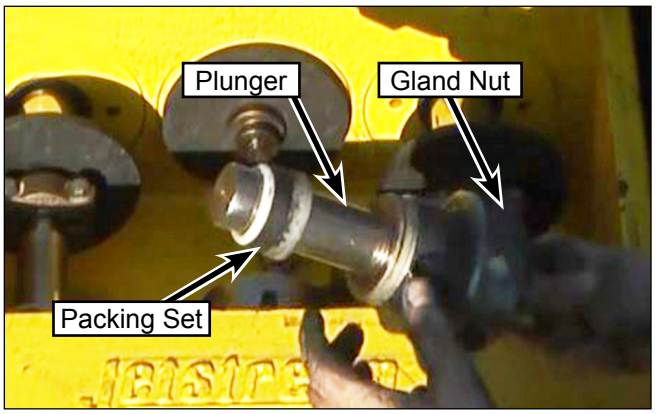


Figure 52: Packing Removal.

9. Remove the plunger and guide bushing from the gland nut and inspect (Figure 53).

   Note: *The guide bushing may be stuck and require some force to remove. Use a tool in the cutout (Figure 54) to push the bushing out. Use caution to avoid damaging the gland nut.*
   As an alternative, if the bushing can be moved out of the gland nut a small distance, then a plunger can be put through the bushing and the bushing can be gripped with a bench vise. (Figure 55). This allows a tight grip without crushing the bushing and causing it to become even more stuck. The gland nut can them be wiggled, rotated, and pulled away from the bushing and plunger.

10. Repeat the previous steps for the remaining stuffing boxes if packing is to be replaced.
11. Inspect the plunger for scratched or deep scores. Discard damaged plungers.

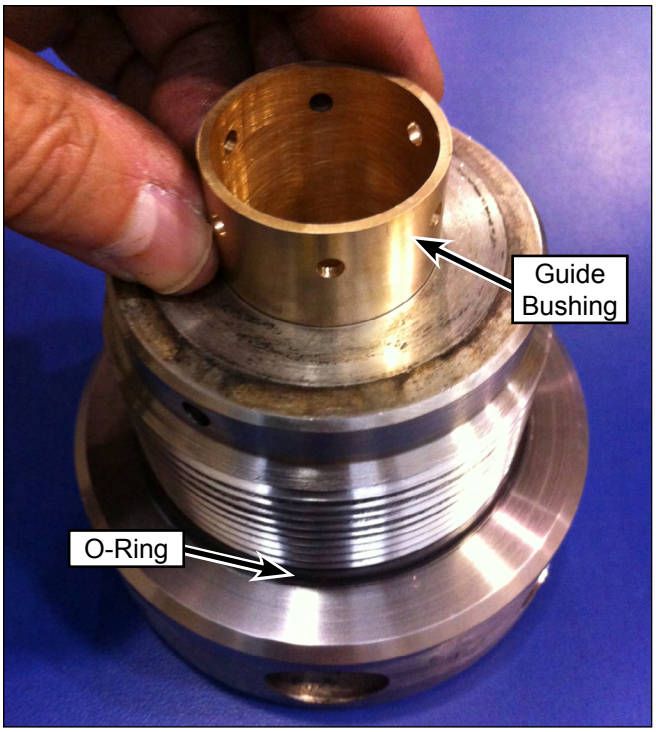


Figure 53: Guide Bushing Removal (15K/20K Gland Nuts).

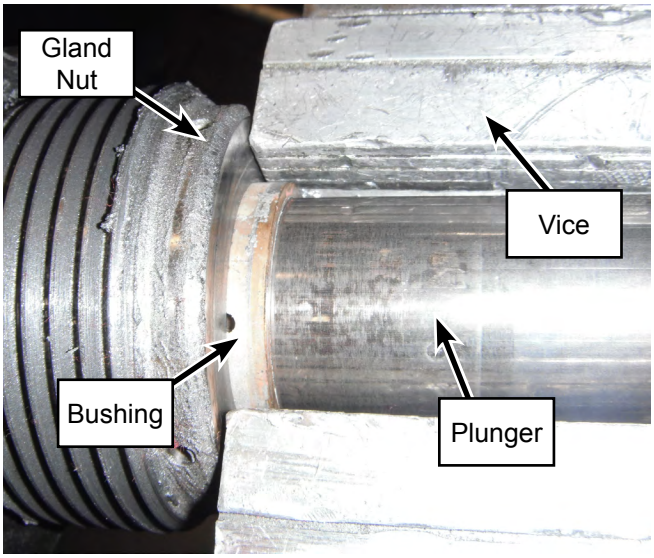


Figure 55: Using Vice to Remove A Stuck Bushing.

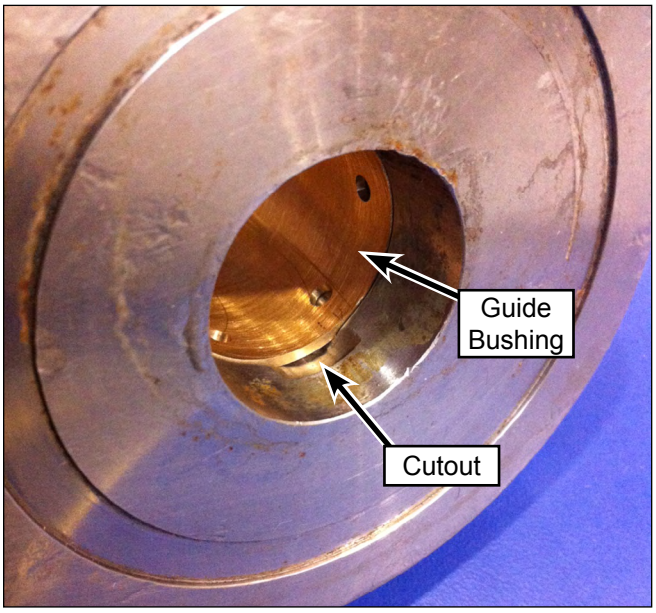


Figure 54: Stuck Bushing.

12. On 40K units, measure the diameter of the guide bushing (Figure 56). 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.

    Note: *On 40K fluid ends, the brass sleeve Item 5 of exploded view below inside the stuffing box does not need to be removed unless the plunger shows evidence of rubbing on the sleeve.*

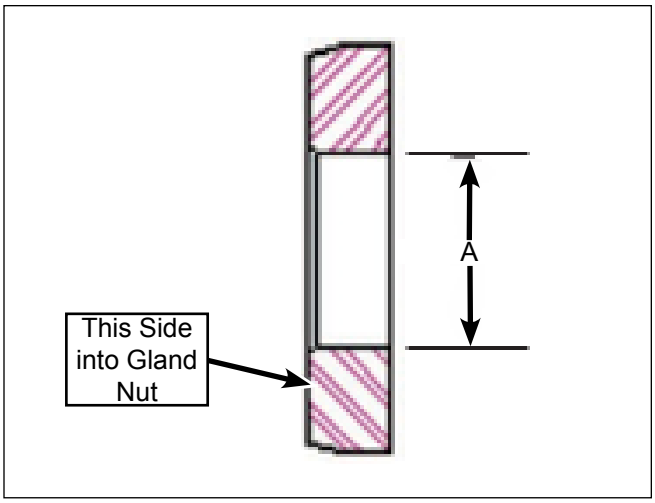
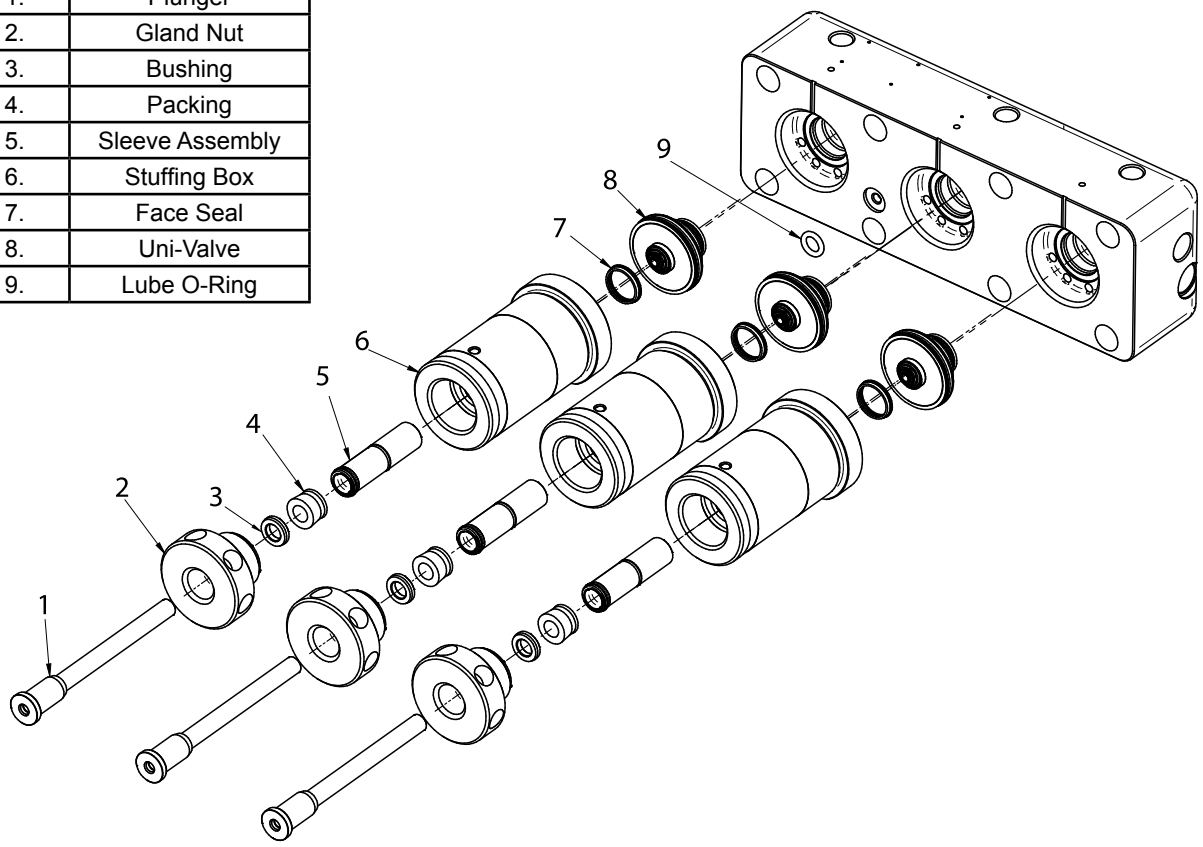


Figure 56: Guide Bushing interior dimension A.

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)
5240/4240	# 7	0.673 in. (17.09 mm)
5240/4240	# 8	0.733 in. (18.62 mm)

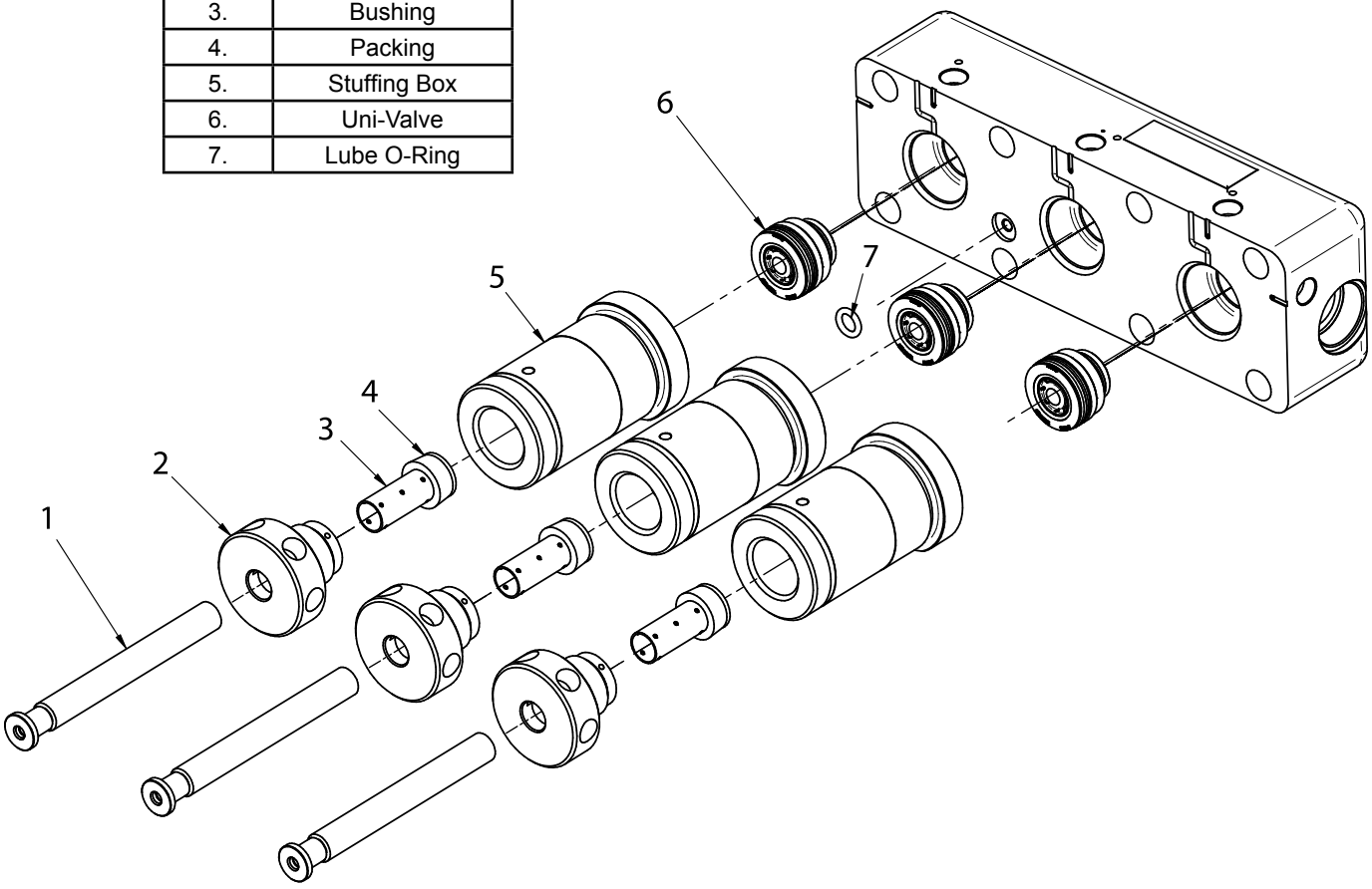
Typical 40K Fluid End Components – non-2000 series

Item	Description
1.	Plunger
2.	Gland Nut
3.	Bushing
4.	Packing
5.	Sleeve Assembly
6.	Stuffing Box
7.	Face Seal
8.	Uni-Valve
9.	Lube O-Ring



Typical 15K/20K Fluid End Components – non-2000 series

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



Packing Installation (non-2000 Series)

1. Install a new O-ring (Figure 57) onto the gland nut.
2. Install the guide bushing 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 (pg 41).
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).
5. Place the assembly into the stuffing box. Hand-tighten the gland (Figure 59)

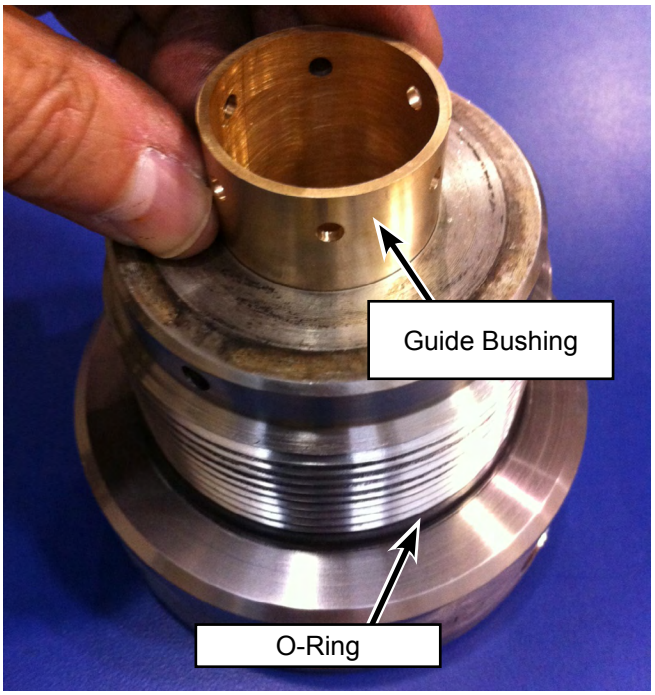


Figure 57: Guide Bushing Installation.

Figure 58: Applying Anti-Seize.

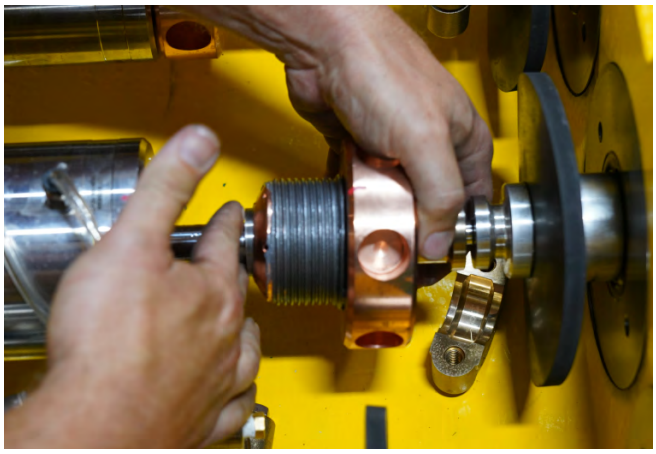


Figure 59: Reinstall the Plunger Assembly into Stuffing Box.

6. Pull the plunger 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.
7. Place the plunger coupling into position and install the coupling bolts (Figure 60). Tighten the bolts to 20 ft.-lb.(27 N·m).
8. 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. This will supply sufficient torque on the nut. (Figure 61)
9. Repeat the previous steps for the remaining stuffing boxes.
10. Connect the water lubrication lines and close the rod box cover.
11. It is necessary to break-in new packing properly to ensure optimal performance and a proper seal.

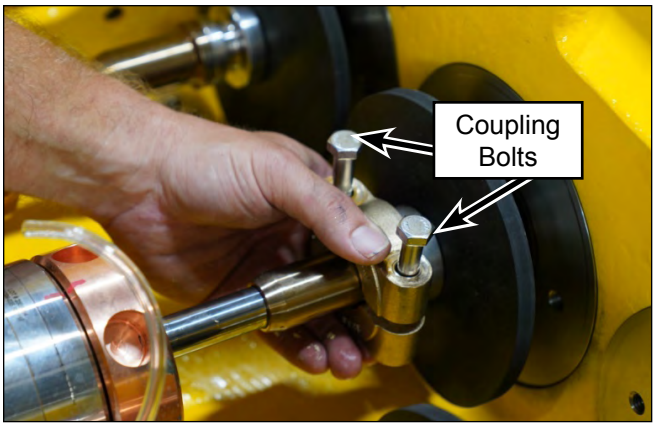


Figure 60: Install Coupling Bolts.

Breaking in New Packing

ATTENTION

Note: *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.*

This procedure is only applicable for 15K and 20K 3 piece molded packing. It is not required for 1 piece plastic packing.

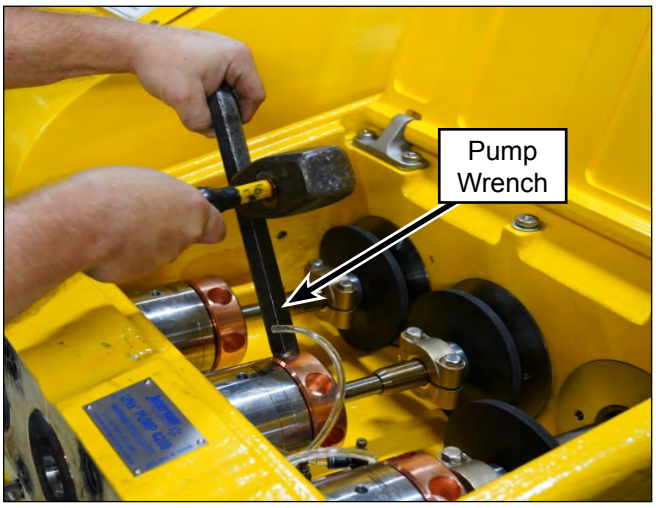


Figure 61: Tighten the Gland Nut.

1. Adjust the engine speed to around 1400 rpm.
2. Adjust the discharge pressure to 3,000 psi (200 bar) by slowly closing the bypass valve (all dump valves closed).
3. 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.

Packing Replacement (2000 series)

Packing Removal

1. Relieve pressure from the pump, shut off the engine and disengage the pump drive system (pto,transmission,coupling, etc).
2. Turn off the water supply and drain the water from the fluid end.
3. Open the rod box cover.
4. Position the plunger to be serviced so that it is at bottom dead center (pony rod is fully retracted towards crankshaft) (Figure 62). This can be achieved by one of the following methods:
   - Belt drive – open belt guard access cover and pull belts towards you
   - Transmission – rotate driveshaft by hand
   - Coupling – Engage engine starter to rotate crankshaft as needed

⚠ *WARNING*

***Use** caution when rotating the pump as thiscan be a pinch hazard.*

5. Install the 2000 pump gland nut wrench (part number 68256) around 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. (Figure 63)
6. Remove the two bolts that secure the plunger coupling (Figure 64) to the plunger and remove the coupling. Push the plunger into the stuffing box for clearance.

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

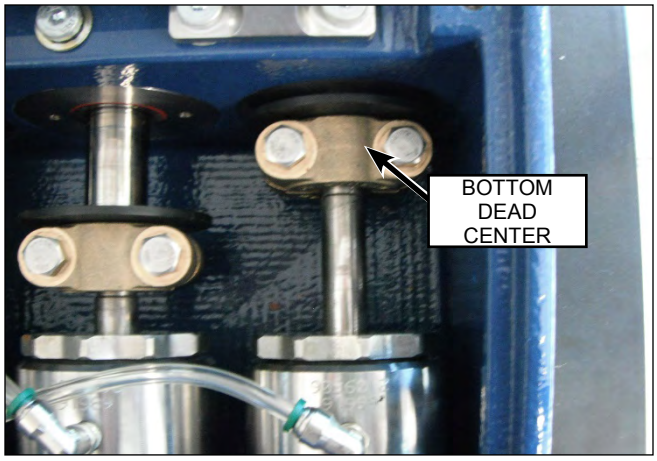


Figure 62: Bottom Dead Center Position.

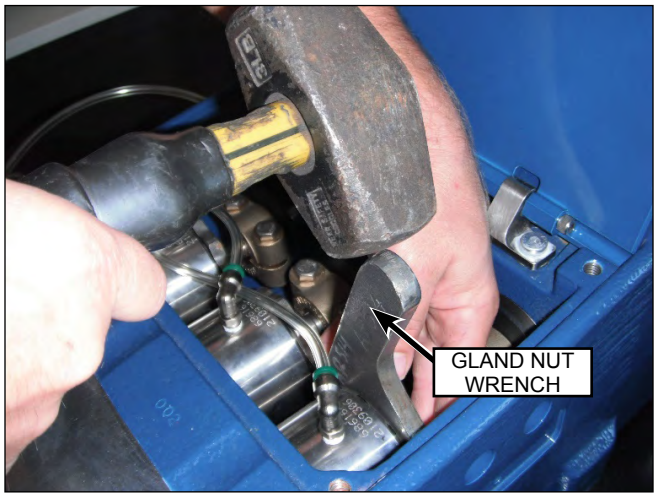


Figure 63: Remove Gland Nuts.

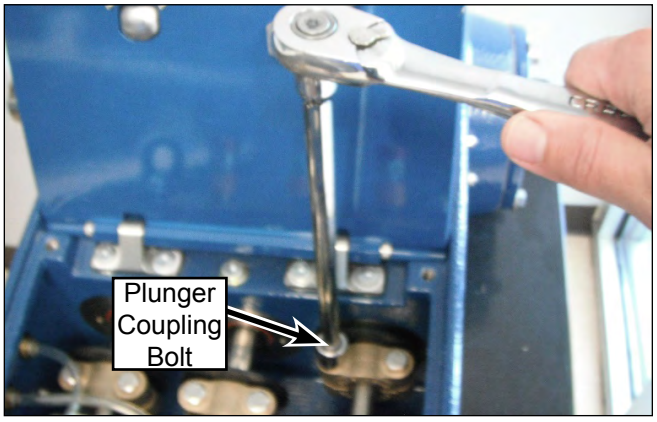
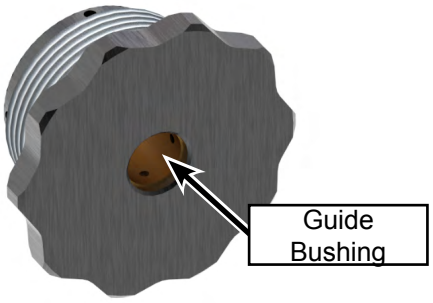


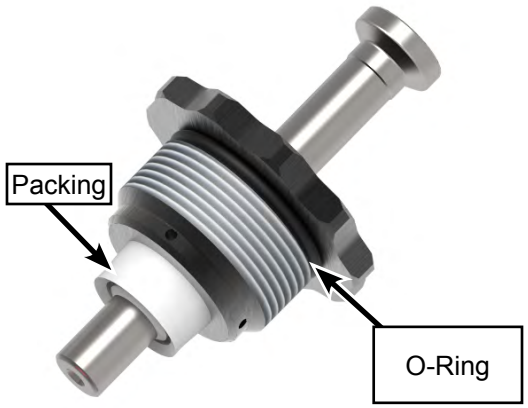
Figure 64: Remove Coupling Bolts.

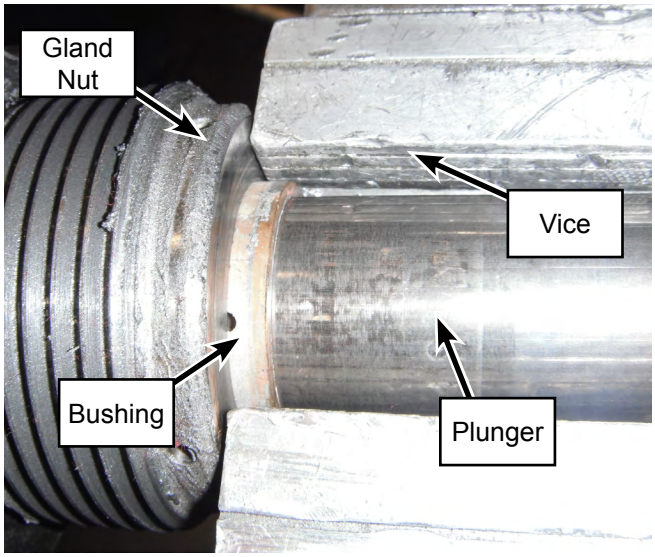
7. Remove the gland nut and plunger assembly from the stuffing box. It may require effort to wiggle the packing out by moving the plunger from side to side and up and down (Figure 65).
8. Remove the packing set from the plunger.
9. Remove the plunger and guide bushing from the gland nut and inspect. (Figure 66)

Note: *The guide bushing may be stuck and require some force to remove. Use a tool to push the bushing out. Use caution to avoid damaging the gland nut. As an alternative, if the bushing can be moved out of the gland nut a small distance, then a plunger can be put through the bushing and the bushing can be gripped with a bench vise. (Figure 67). This allows a tight grip without crushing the bushing and causing it to become even more stuck. The gland nut can them be wiggled, rotated, and pulled away from the bushing and plunger.*

Figure 65: Remove Gland Nut and Plunger Assembly.







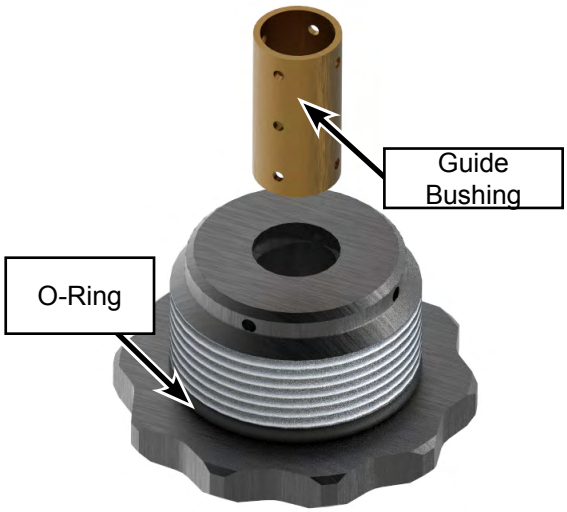


Figure 67: Using a Vice to Remove Stuck Bushing.

Figure 66: Remove Guide Bushing and O-Ring.

10. Remove the O-ring (Figure 66) from the gland nut.
11. Repeat the previous steps for the remaining stuffing boxes if packing is to be replaced.
12. Inspect the plunger for scratched or deep scores. Discard damaged plungers.

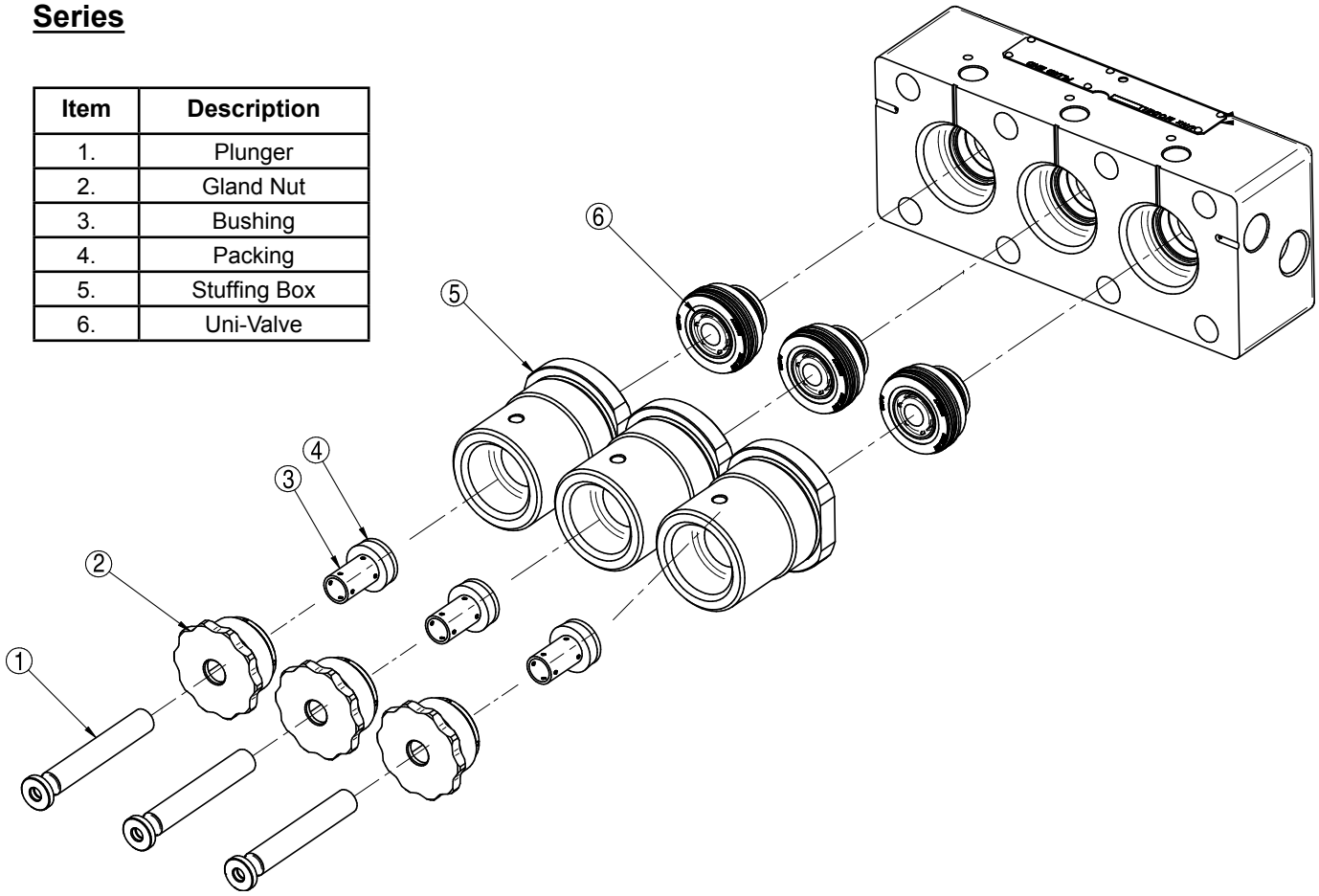
Packing Installation (2000 series)

1. Install a new O-ring onto the gland nut.
2. Install the guide bushing and plunger into the gland nut.
3. Place the new packing onto the plunger.
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 .
5. Place the assembly into the stuffing box (Figure 68). Hand-tighten the gland.

Figure 68: Install Gland Nut and Plunger Assembly.

Typical 15/20K Fluid End - 2000 Series

Item	Description
1.	Plunger
2.	Gland Nut
3.	Bushing
4.	Packing
5.	Stuffing Box
6.	Uni-Valve



6. Pull the plunger (Figure 69) back to meet the crosshead pony rod. If the packing is too tight to move the plunger by hand, the crankshaft should be rotated by hand to move the pony rod to meet the plunger.

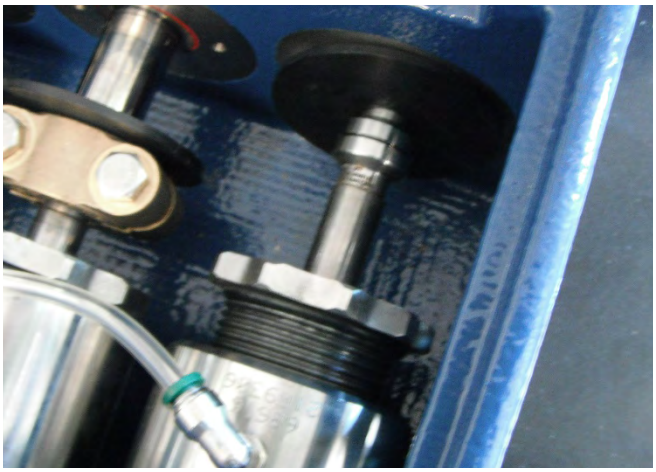


Figure 69: Pull Plunger to Meet Pony Rod.

7. Place the plunger coupling into position and install the coupling bolts (Figure 70). Tighten the bolts to 20 ft.-lb.(27 N·m).

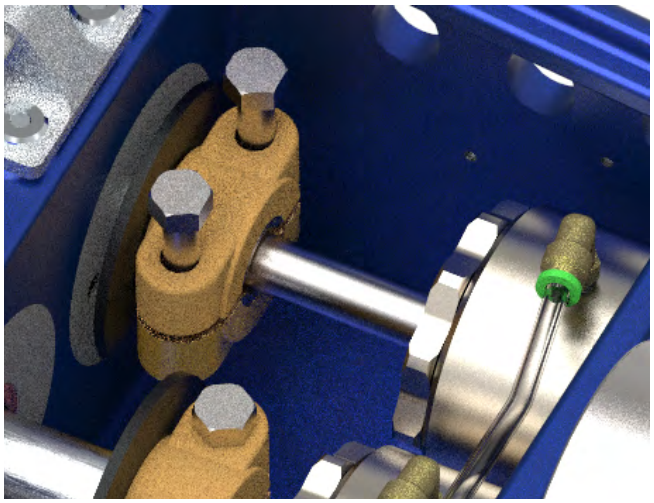


Figure 70: Install Plunger Coupling.

8. Use the 2000 pump gland nut wrench and a 5 lb. (2 kg) hammer to tighten the gland nuts. Hit the wrench about three times using moderate force (Figure 71) This will supply sufficient torque on the nut.
9. Repeat the previous steps for the remaining stuffing boxes.
10. Connect the water lubrication lines and close the rod box cover.
11. 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 page 44 for the proper break-in procedure.

Figure 71: Tighten Gland Nut.

Uni-Valve Service

Uni-valve 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 72).

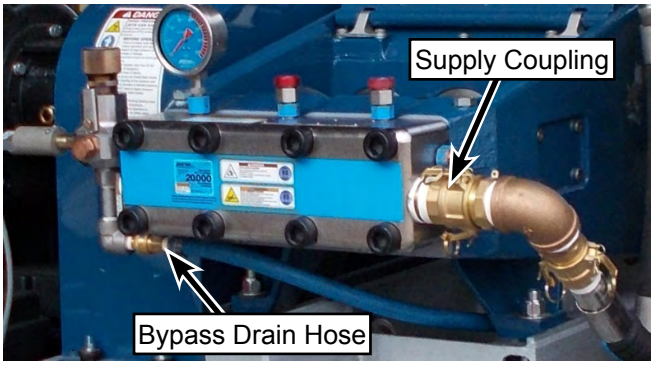


Figure 72: Disconnect Bypass Drain Hose and Supply Coupling.

4. Remove the two top left and right manifold bolts and replace with manifold studs. Remove remaining manifold bolts (Figure 73). Ensure the hinge rod is installed before removing the bolts. (Figure 74)

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

Figure 73: Install Manifold Studs.

⚠ *WARNING*

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

Figure 74: Check Trunnion Rod Before Lowering Manifold.

5. Slowly swing the manifold downward to the manifold support rest. The weight of the manifold is approximately:
   - 5200Q Series: 350 lb (160 kg)
   - 3600/4200 Series: 165 lb. (75 kg)
   - 3000 Series: 90 lb. (41 kg)
   - 2000 Series:53 lbs (24 kg)
6. Use two small pry bars (Jetstream p/n 70179) to pry the valve out of the manifold as shown (Figure 75).
7. Remove the remaining valves. Refer to the topics on valve service later in this chapter for disassembly and maintenance instructions.

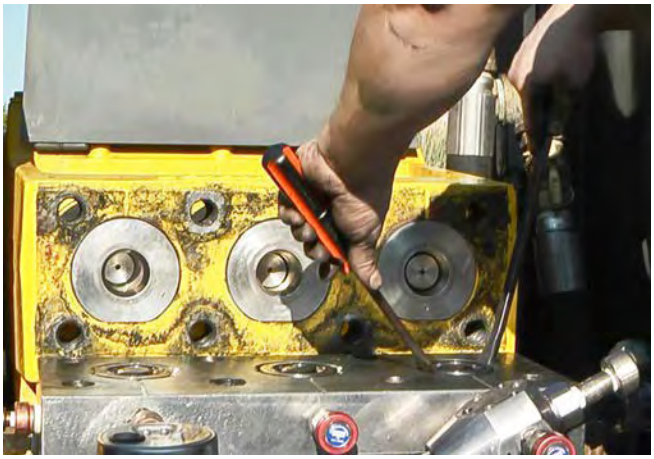


Figure 75: Pry Out Uni-Valves.

⚠ 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 58 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 76).

⚠ 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.

Figure 76: Gently Remove 40K Face Seal from Stuffing Box.

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.

Uni-Valve 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 77).
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 78). Proper torque is 350 ft.-lb. (470 N·m). For 2000 Series pumps, proper torque is 120 ft-lbs (162 Nm). Due to the hydraulically biased Uni-Valve design, it is not necessary to use a torque wrench. The pump wrench and a hammer is adequate.
5. Re-connect the supply coupling and the bypass hose to the manifold.

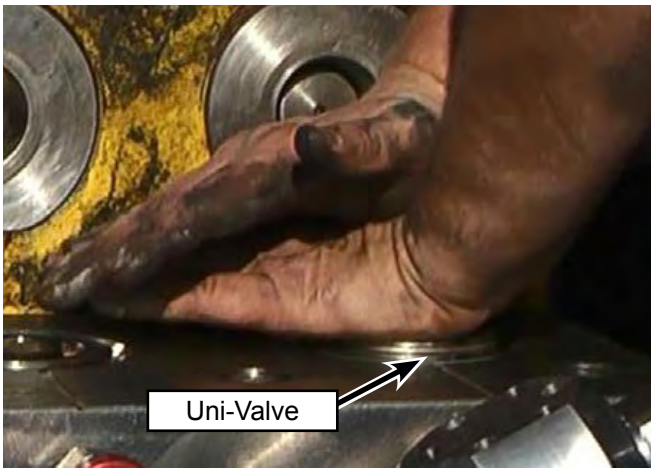


Figure 77: Press Uni-Valves into Manifold.

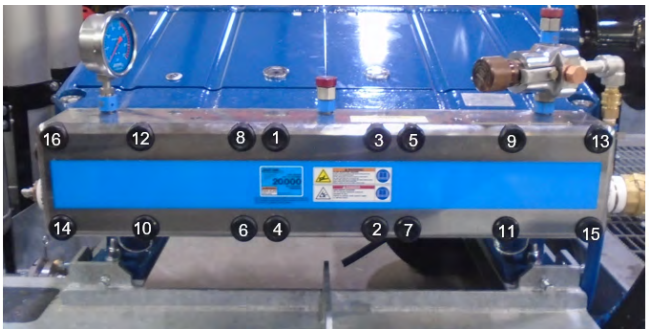


Figure 78: Manifold Bolt Tightening Sequences.

15K, 20K Uni-Valve Service

Disassembly

1. Remove the O-ring at each end of the valve (Figure 79). 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 80). 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 81).

Scan QR Code for Disassembly video:

https://www.youtube.com/watch?v=Yfa3OiC0mf0

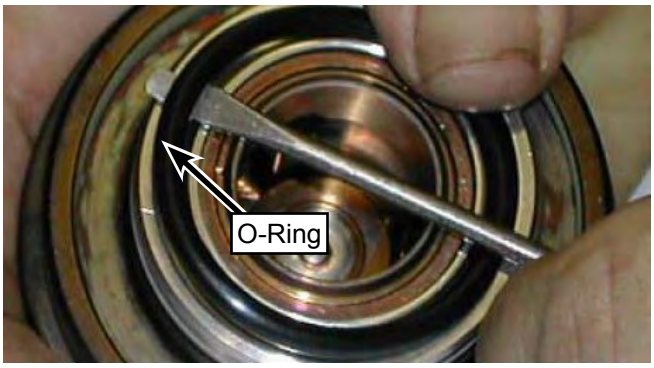


Figure 79: Remove O-Ring.

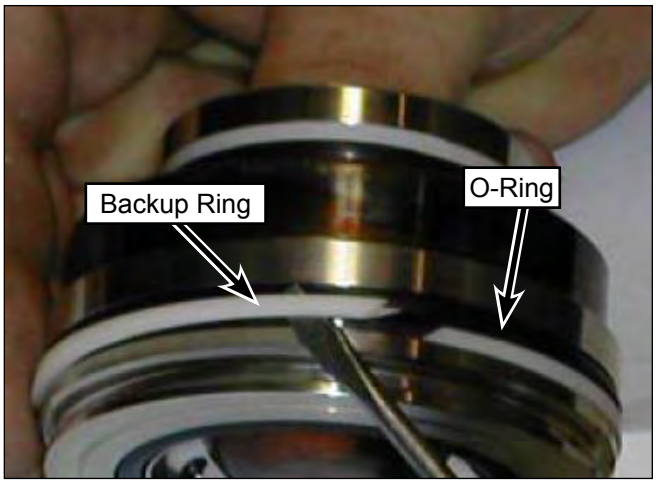


Figure 80: Remove O-Rings and Backup Rings.

Figure 81: Remove Spring Retainer.

4. Remove the suction valve spring retainer and valve spring (Figure 82).
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 83). 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.*

7. Remove the discharge valve and discharge spring.
8. Inspect the valves. Refer to “Valve Inspection” on page 58 for inspection criteria.

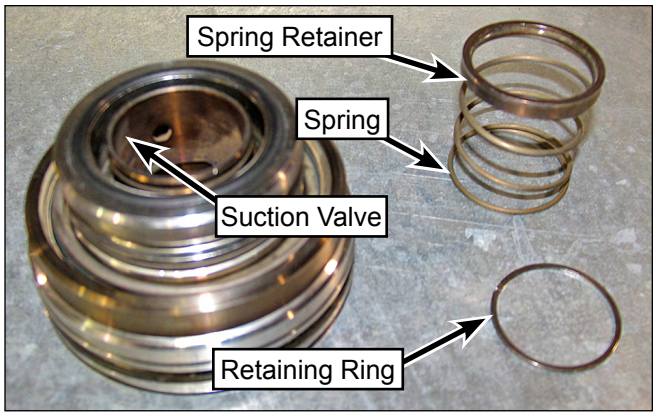


Figure 82: Remove Retaining Ring and Spring.

15K / 20K Common Parts Exploded View

Item	Description	Item	Description
1	Retaining Ring	8	O-Ring
2	Spring Retainer	9	Discharge Valve Body
3	Suction Valve Spring	10	Suction Valve
4	Discharge Valve Spring	11	O-Ring
5	Discharge Valve	12	Backup Ring
6	O-Ring	13	O-Ring
7	Backup Ring	14	Retaining Ring (not shown, 3015 only)

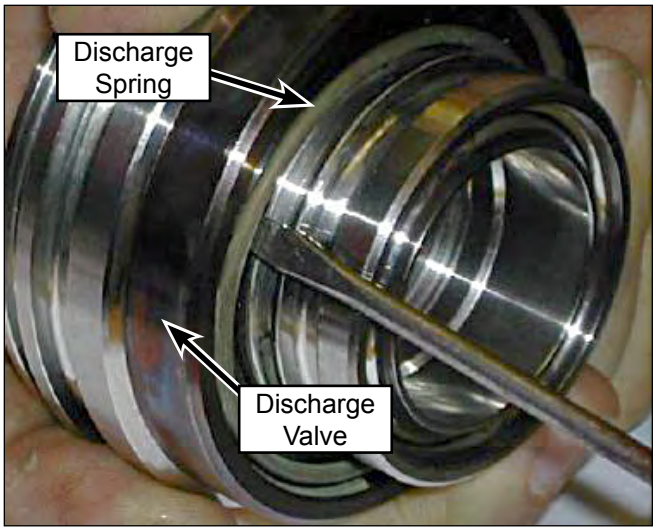
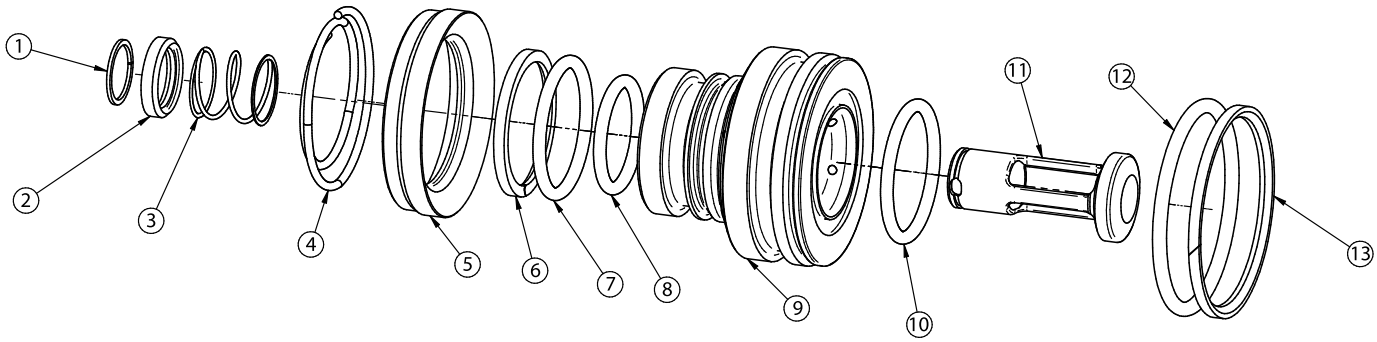


Figure 83: Remove Discharge Spring.



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 84).
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.

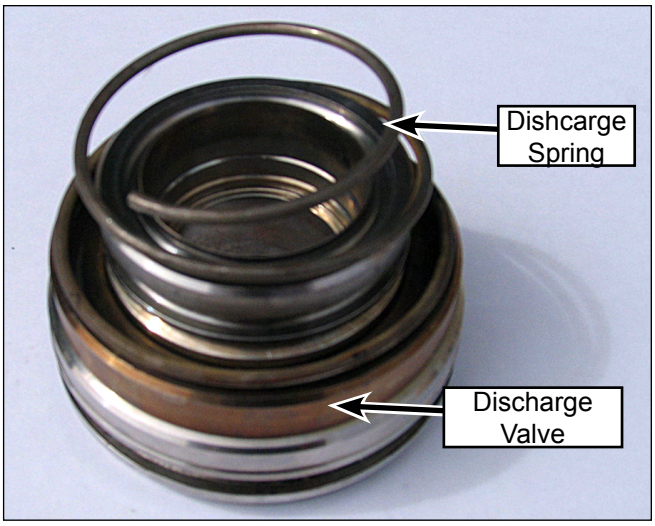


Figure 84: Install Discharge Valve and Spring.

3. Position the suction valve in the valve body (Figure 85).

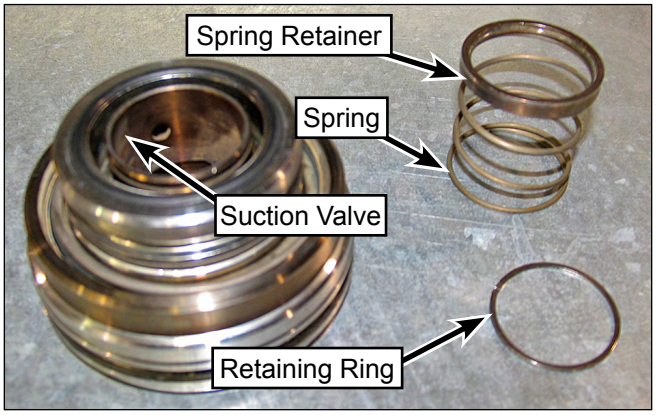


Figure 85: Install Suction Valve.

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 86).
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.

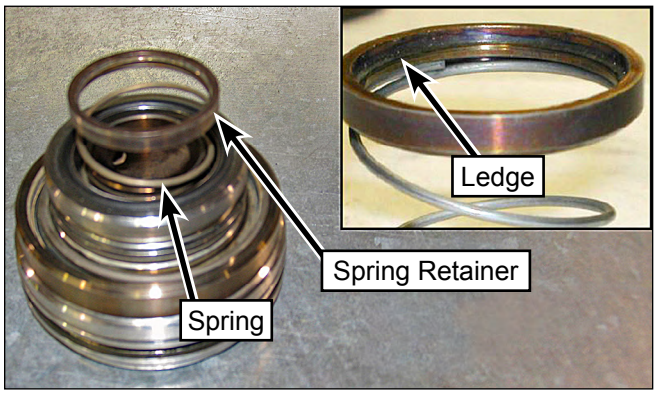


Figure 86: Install Suction Valve Spring and Retainer.

40K Uni-Valve Service

Disassembly

1. Use a small screwdriver to remove the two black O-rings from the valve (Figure 87).

Figure 87: Remove O-Rings.

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 88). Use caution to prevent bending or distorting the ring.

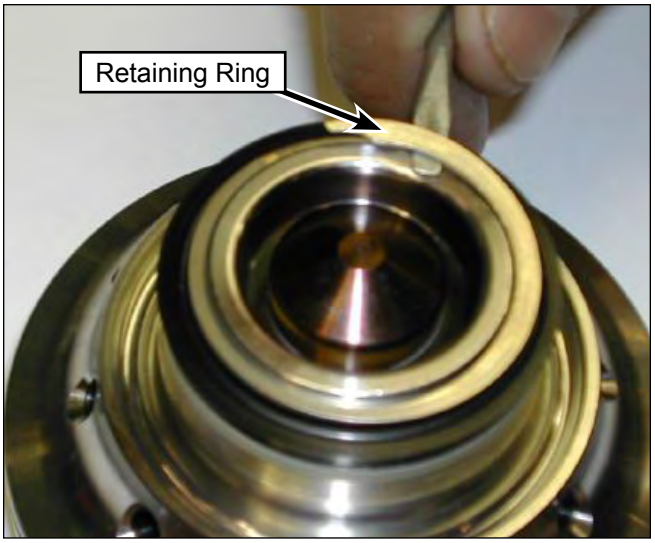


Figure 88: Remove Retaining Ring.

3. Use the screwdriver to remove the ring seal (Figure 89) and seal support ring.
4. Turn the valve over.

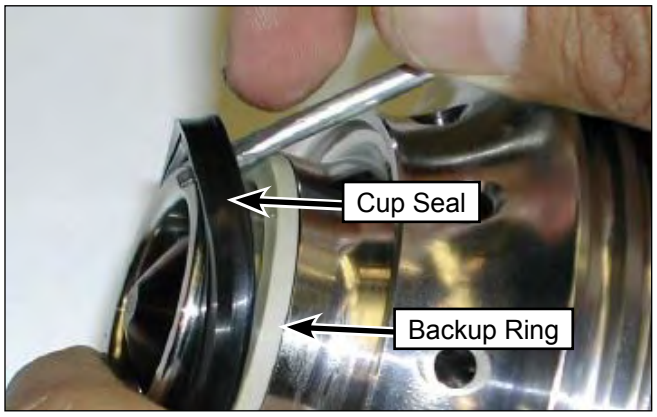


Figure 89: Remove Ring Seal and Support Ring.

5. Press down on the valve spring retainer and slide the spring keepers out from the assembly (Figure 90).
6. Remove the valve spring and valve spring retainer.

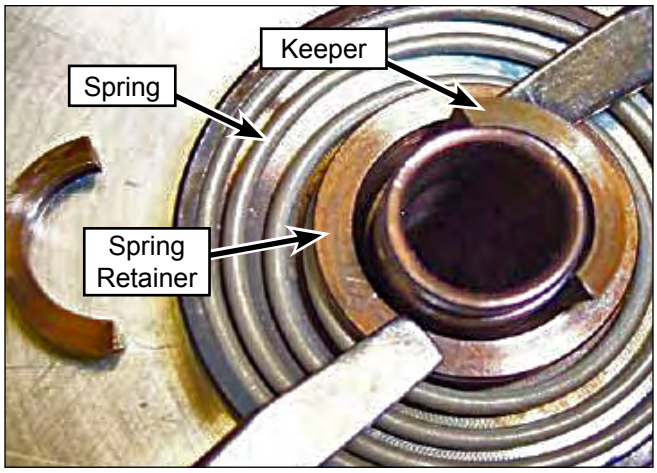


Figure 90: Remove Retainer and Spring Keepers.

7. Remove the suction and discharge valves (Figure 91).
8. Inspect the valves. Refer to “Valve Inspection” on page 58 for inspection criteria.

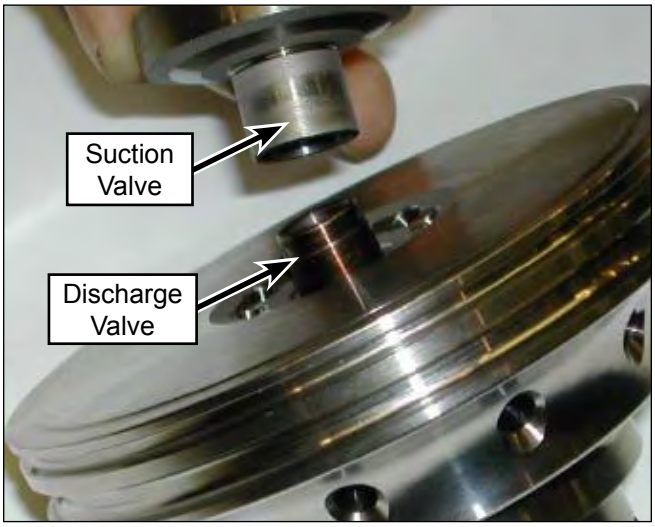


Figure 91: Remove Suction and Discharge Valves.

Assembly

1. Install the discharge valve into the valve body (Figure 92).
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 93).
3. Place the backup ring (Figure 94) onto the assembly. Note the chamfer on the inside diameter of the backup ring. Orient the backup 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 95).

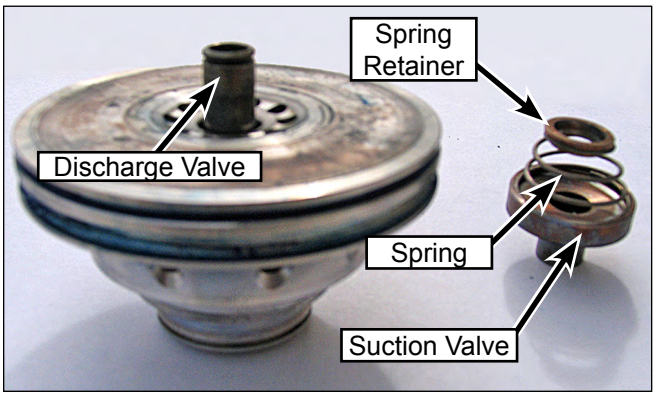


Figure 92: Install Discharge Valve.

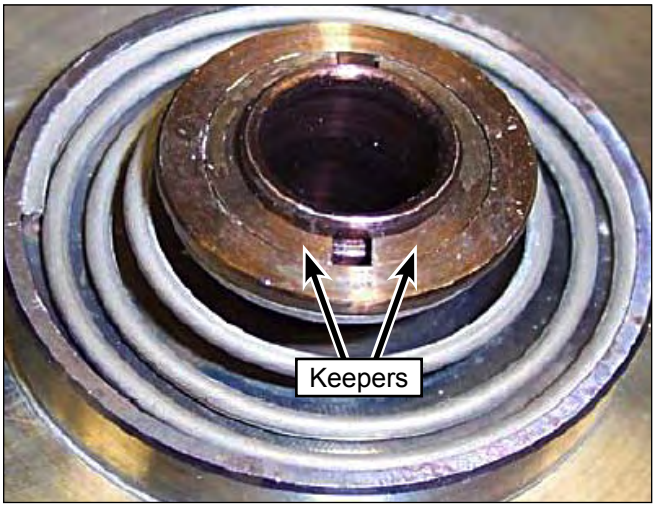


Figure 93: Install Valve Spring and Retainer.

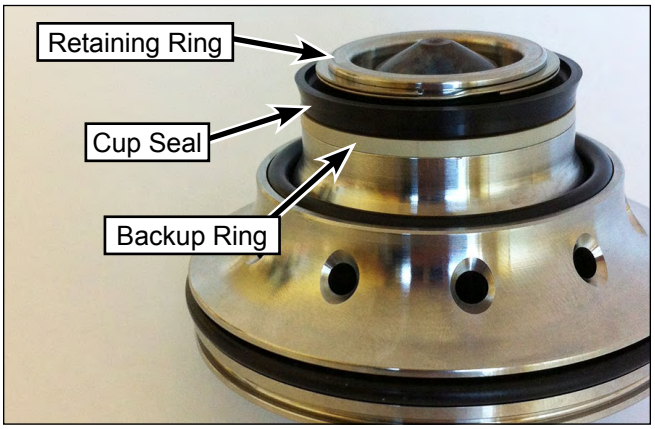


Figure 94: Install O-Ring, Seal, and Backup Ring.

Figure 95: Install 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 96).
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 97).
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 98).
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.

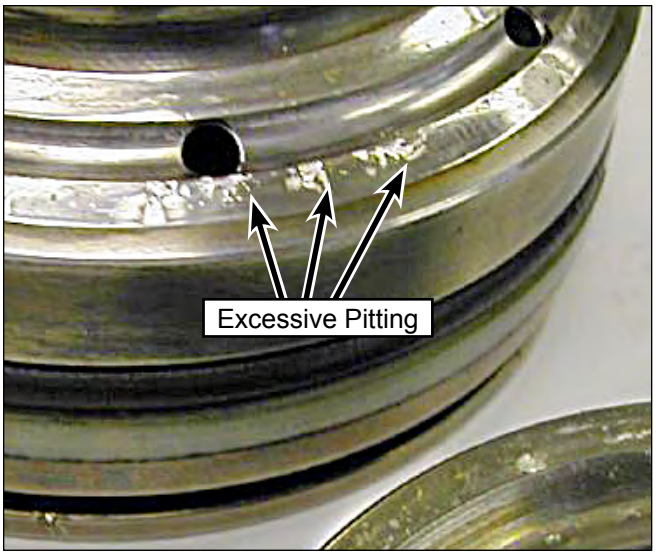


Figure 96: Damaged Valve Characteristics.

Figure 97: Apply Lapping Compound.

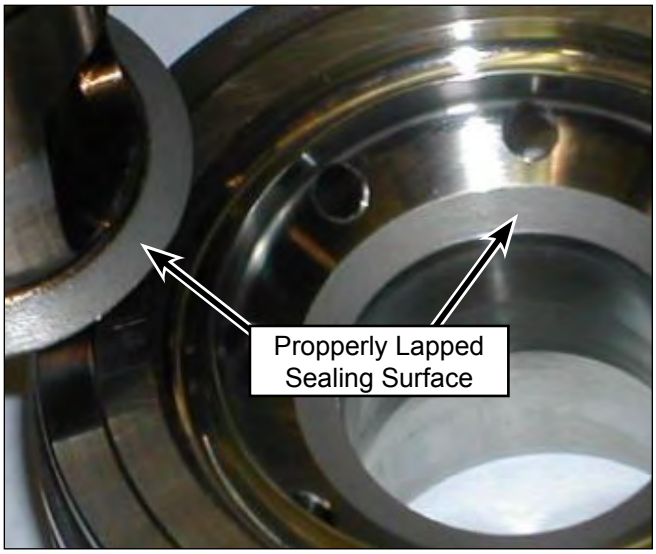


Figure 98: inspect Contact Surfaces.

Bypass Valve Cartridge Replacement

1. Remove the dump hose (Figure 99) from the bypass valve.
2. Using an adjustable wrench, remove the cartridge housing (Figure 100) from the valve.
3. Pull the cartridge (Figure 101) from the housing.
4. Inspect the diffuser (Figure 102) 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.

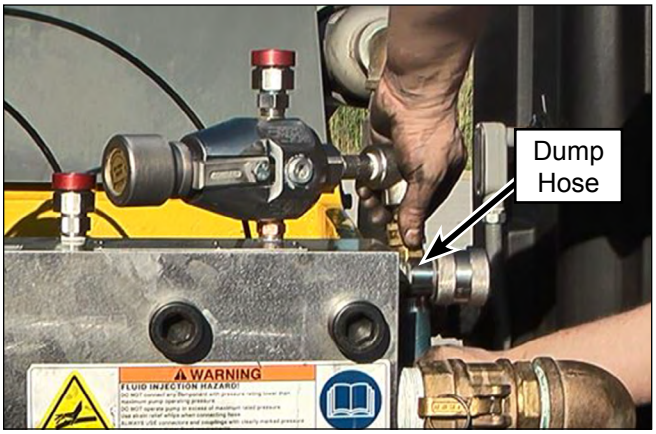


Figure 99: Remove Dump Hose.

Figure 100: Remove Cartridge Housing.

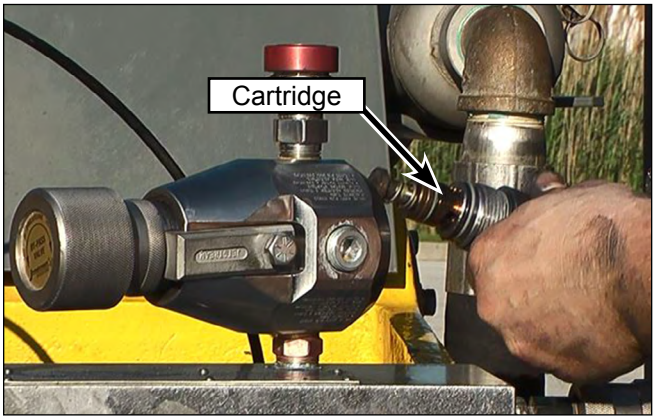


Figure 101: Remove Cartridge.

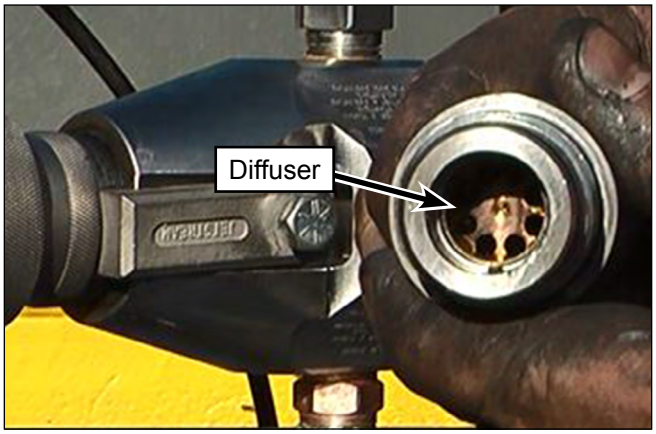


Figure 102: Inspect Diffuser.

Power End

Checking Power End Oil Level (non-2000 Series Pumps)

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 103) 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.

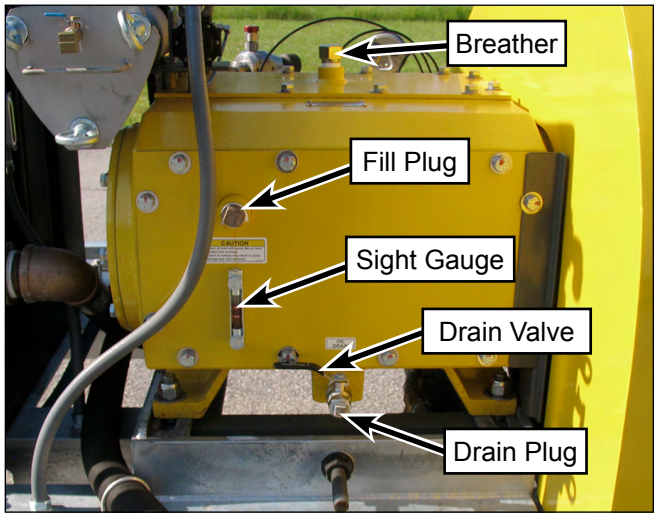


Figure 103: Non-2000 Series Rear Plate Components.

Checking Power End Oil Level (2000 Series Pumps)

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” on facing page 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 window (Figure 104) on the back of the power end case. With the pump off (for 5 to 8 hours), the oil should be at the mid point of the window
2. If the reservoir is low, add 80W/90 detergent free gear oil while the engine is off thru the fill port on the top of the pump.

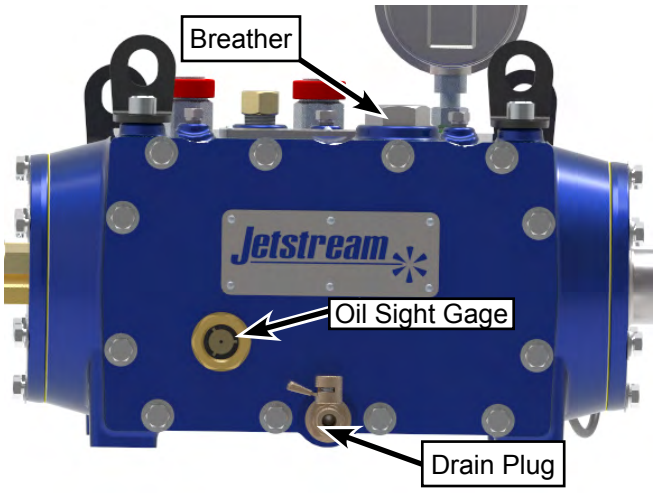


Figure 104: 2000 Series Rear Plate Components.

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 drive system so the pump turns over slowly for 10-15 seconds. Disengage the drive system. Check the oil-level at the sight gauge. If the oil level is still visible in the gauge, there is sufficient oil in the crankcase to run the pump.The typical oil level for a pump that has been operating and then brought to a stop is shown in (Figure 105). The oil level will be at or near the full mark only after the pump has been at rest for 5 to 8 hours.

- For non-2000 series pumps, the typical oil level for a pump that has been operating and then brought to a stop is shown in (Figure 103). The oil level will be at or near the full mark only after the pump has been at rest for 5 to 8 hours.

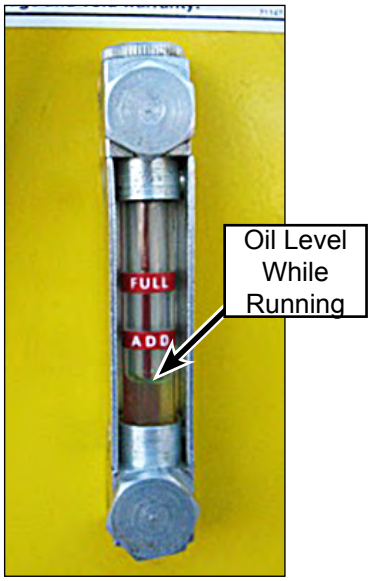


Figure 105: Running Oil Level.

Changing the Power End Oil

1. With the engine off, remove the drain plug (Figure 106) 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 magnets (Figure 107). 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.
   - 2000 Series pumps: 1 gal. (4 L)
   - 3000 Series Pumps: 5 gal. (19 L)
   - 3600/4200: 9 gal. (34 L)
   - 5200 Series Pumps: 10 gal. (38 L)
   - 5200Q Series Pumps: 27 gal (102 L)
9. Install the fill plug when done filling.

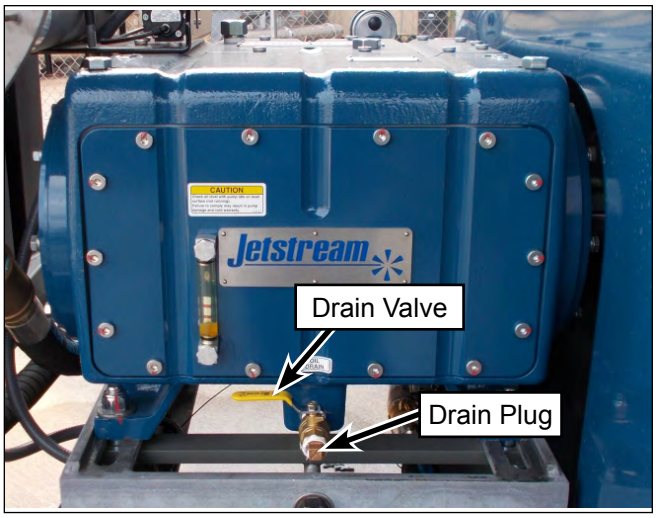


Figure 106: Remove Drain Plug.

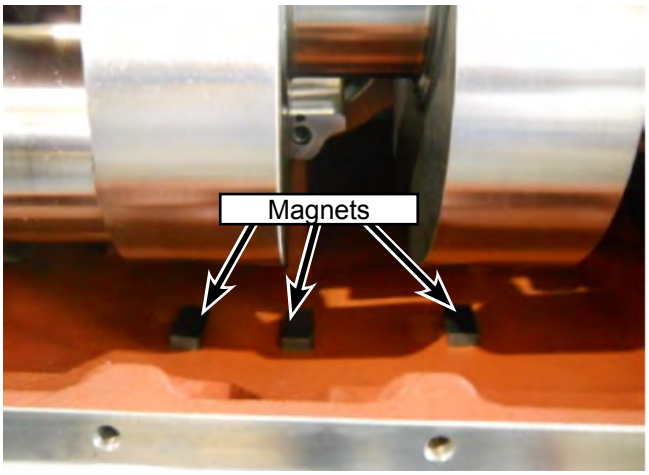


Figure 107: Inspect Magnets for Metal Shavings.

Crosshead Pony Rod Seals

Removal

1. Relieve pressure from the pump, shut off the engine and disengage the pump drive system (PTO, transmission, coupling, etc).
2. Disconnect the water supply from the fluid end.
3. Open the rod box cover.
4. Position the plunger to be serviced so that it is at bottom dead center (pony rod is fully retracted towards crankshaft) (Figure 108. This can be achieved by one of the following methods:
   - Belt drive – open belt guard access cover and pull belts towards you
   - Transmission – rotate driveshaft by hand
   - Coupling – Engage engine starter to rotate crankshaft as needed

WARNING

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

5. Remove the two capscrews that secure the plunger coupling (Figure 108) to the plunger and remove the coupling.

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

6. Slide the rubber deflector off of the pony rod.
7. Remove the capscrews that secure the rod box cover hinges to the frame as well as the center cap screw. Remove the cover. Remove the washers that sit below the hinges/bolt.
8. Using a 1/4” hex driver, loosen the set screw inside the bolt hole 2-3 full revolutions (Figure 109). Use a 3/16” hex driver for 2000 Series pumps.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.
9. Using seal plate removal tool, Install two 1/2”-13 UNC capscrews (Figure 110) into the seal plate(4200/5200/5200Q) or 3/8-16 UNC capscrews (3000) or ¼’-20 capscrews for 2000 pump.
   - 2000 pump tool: PN# 70398
   - 3000 pump tool: PN# 56950
   - 4200/5200/5200Q tool: PN# 56949

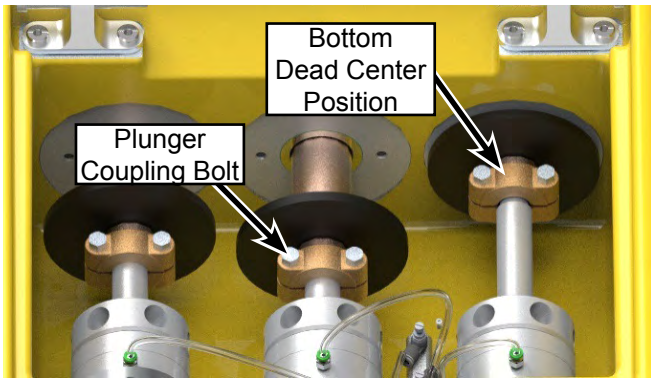


Figure 108: Remove Plunger Couplings.

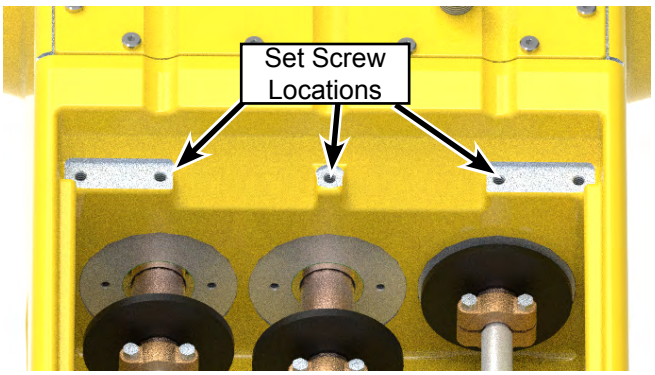


Figure 109: Loosen Set Screws.

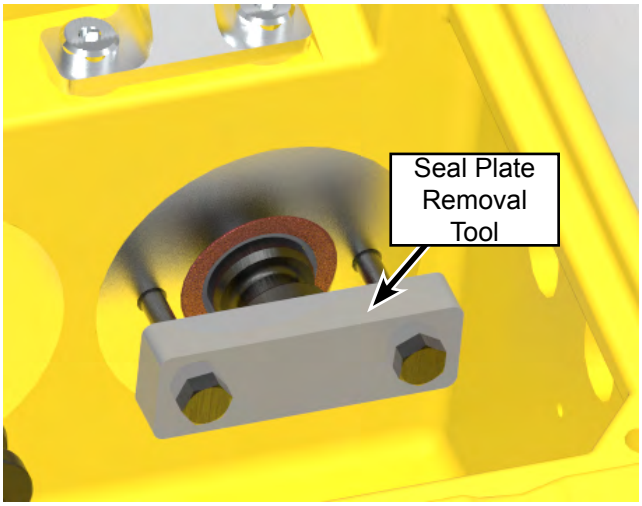


Figure 110: Install Seal Removal Tool.

10. Rotate the pump crankshaft per one of the previous mentioned methods to draw the seal plate out of the powerframe.
11. Remove the O-ring and press the old seals from the plate. Discard the O-ring and seals.
12. Repeat for the remaining crosshead seals, if necessary.

Seal 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 111).
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.
3. Place the green inboard seal into position on top of the outboard seal and orient the seal (Figure 112). 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 113) 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 (Figure 109).
10. Install the deflector 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 62.

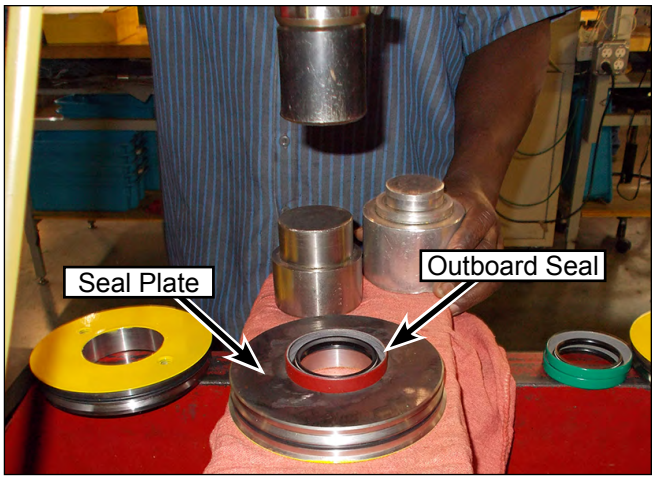


Figure 111: Install Outboard Seal.

Figure 112: Install Inboard Seal.

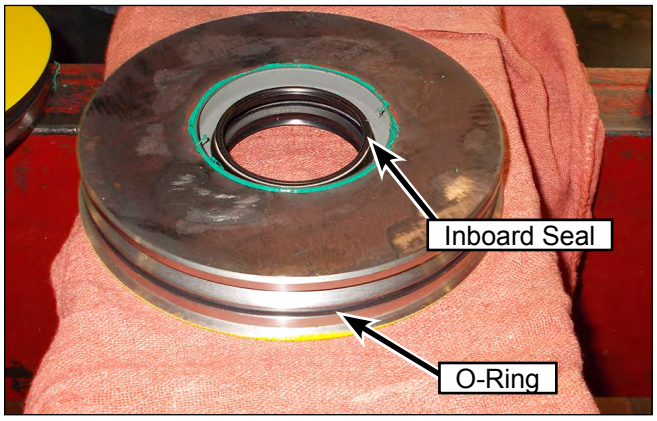


Figure 113: Install O-Ring.

Connecting Rod Journal Bearings

Rod Journal Bearing Removal

1. Relieve pressure from the pump, shut off the engine and disengage the pump drive system (PTO , transmission, coupling, etc).
2. Drain the oil from the power end as outlined in “Changing the Power End Oil” on page 62.
3. Once drained, remove the back plate (Figure 114).
4. Remove the rod cap capscrews (Figure 115) from each rod journal. Rotate the crankshaft to gain access to the capscrews as needed..

WARNING

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

5. 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.
6. To check the bearing life, proceed to Inspection. If the bearings are known to be worn, continue to the following step.
7. Remove the journal bearing from the rod cap and discard (Figure 116).
8. To access the inner journal bearing (Figure 117), push the connecting rod away from the crankshaft. Slide the bearing from the rod.

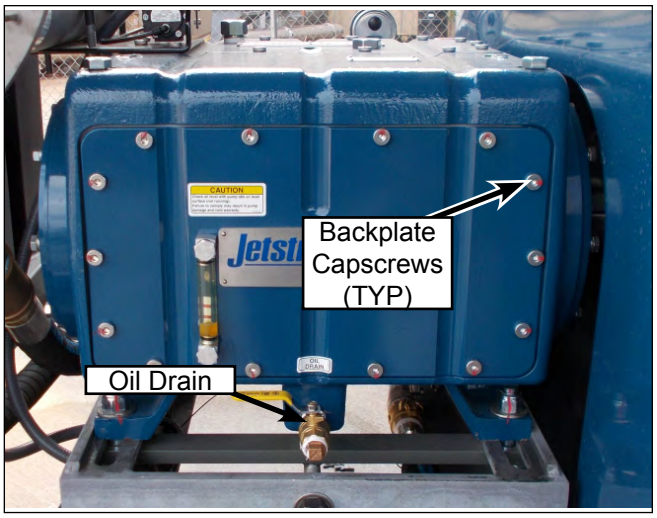


Figure 114: Drain Oil then Remove Back Plate

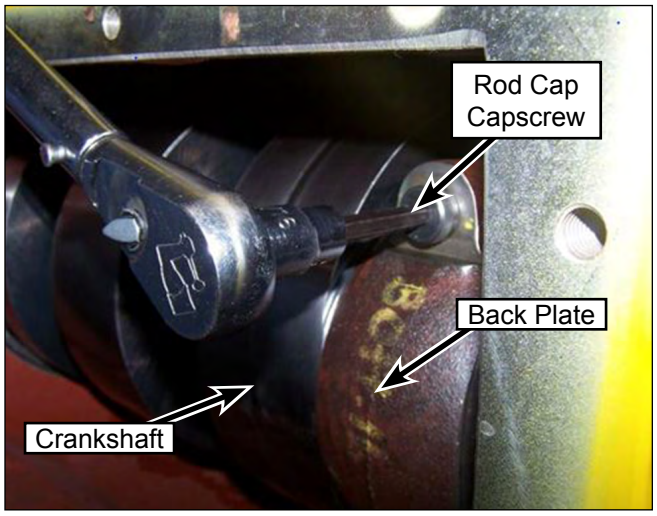


Figure 115: Remove Capscrews.

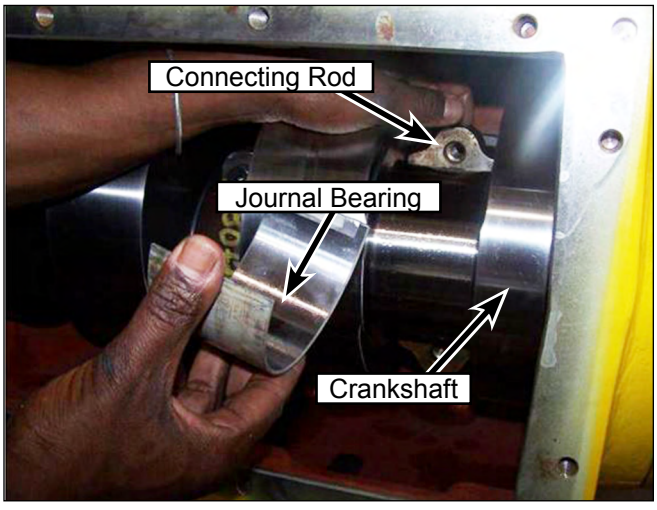


Figure 117: Push the Bearing Away from the Crankshaft.

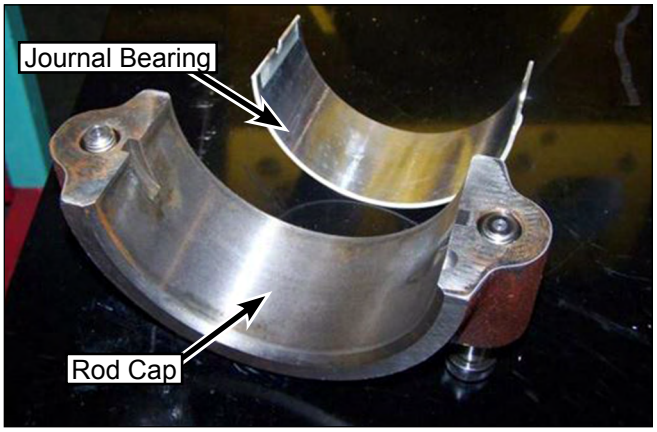


Figure 116: Discard Old Journal Bearings.

Journal Bearing Inspection

1. Remove all oil from the crankshaft journal, bearing halves, connecting rod and rod cap. Oil on these sufaces can take up space causing the bearing clearance to be tighter that it actually is.
2. Install a small strip of plasti-gauge onto the end cap bearing (Figure 118).
3. Position the end cap with capscrews back onto the matching connecting rod.
4. While taking care not to rotate the crankshaft, screw in the capscrews by hand and then tighten to the proper torque:
   - 2000 Series Pumps: 25 ft-lbs (34 Nm)
   - 3000 Series Pumps: 45 ft.lb (61 Nm)
   - 3600/4200/5200/5200Q Series Pumps: 80 ft.lb (108 N·m)
5. Remove the end cap.
6. Measure the flattened plasti-gauge using the gauge wrapper (Figure 119).
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:*

- 2000 Series: 0.001 in. (0.025 mm) - 0.004 in. (0.10 mm)
- 3000 Series: 0.001 in. (0.025 mm) - 0.005 in. (0.13 mm)
- 3600/4200/5200/5200Q Series: 0.002 in. (.05 mm) -0.005 in. (0.13 mm)

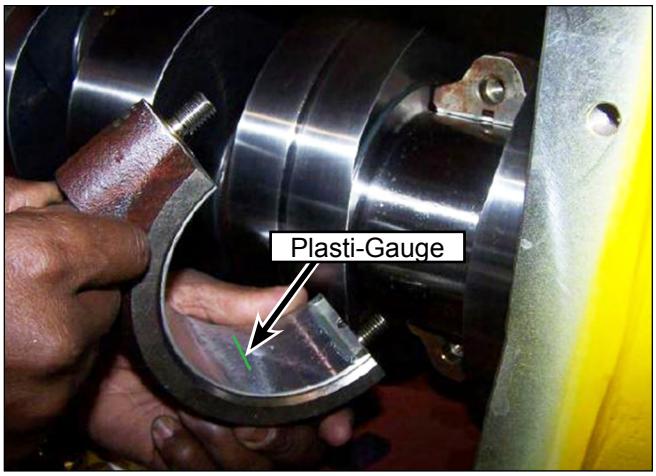


Figure 118: Apply Plasti-Gauge.

Figure 119: Measure Flattened Plasti-Gauge.

Journal Bearing Installation

1. Apply clean new oil to the new connecting rod journal bearing (inner diameter only) (Figure 120).

Figure 120: Apply New Oil.

2. Slide the bearing (Figure 121) 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 122).

3. Apply oil to the inner surface of the cap end bearing.

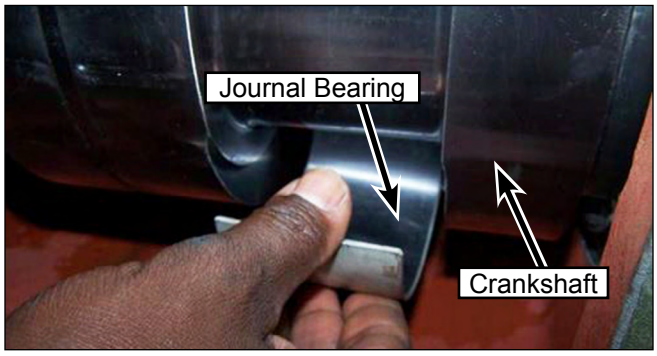


Figure 121: Install Journal Bearing.

4. Properly orient the grooves (Figure 122) and install the bearing in the rod cap.
5. Place the two capscrews into the rod cap.

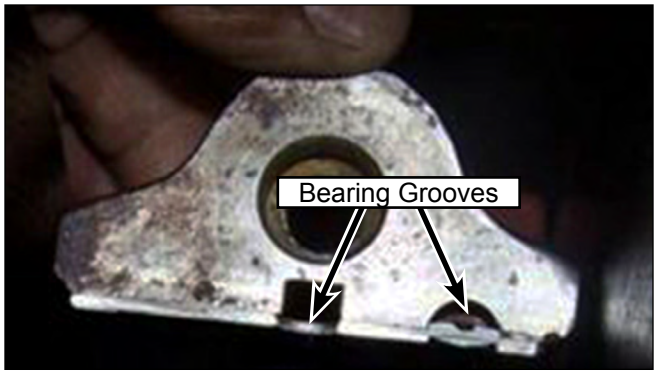


Figure 122: Proper Orientation.

6. Pull the connecting rod (Figure 123) onto the crankshaft and place the rod cap into position aligned with the connecting rod. Ensure the stampings (Figure 124) on the cap and rod match.
7. Screw in the capscrews by hand and then tighten to the proper torque:
   - 2000 Series Pumps: 25 ft-lb (34 Nm)
   - 3000 Series Pumps: 45 ft.lb (61 N·m)
   - 3600/4200/5200/5200Q Series Pumps: 80 ft.lb (108 N·m)
8. With the first rod connected, rotate the crankshaft. 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.

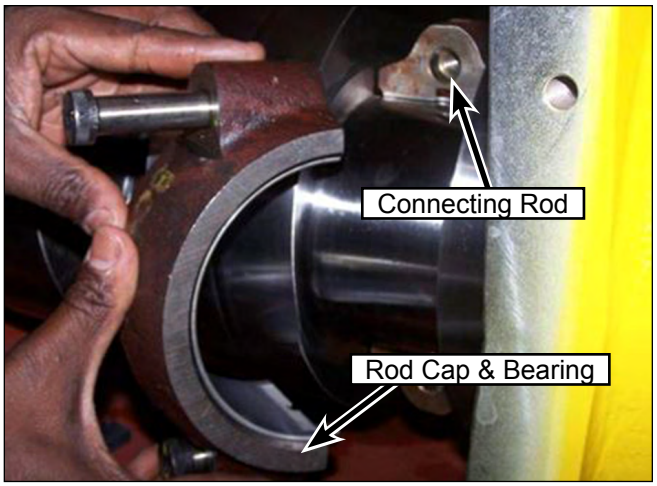


Figure 123: Rod Cap Installation.

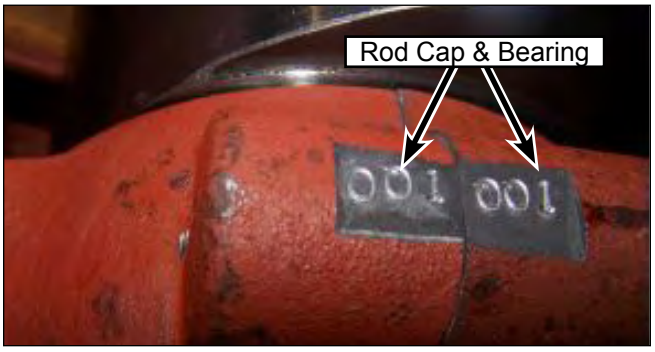


Figure 124: Matched Parts Stampings.

10. Place the back plate (Figure 125) into position on the frame.
11. Install and tighten the capscrews to the proper torque.
    - 2000 Series pumps: 25 ft-lb (34 Nm)
    - 3000 Series Pumps: 25 ft.lb (34 N·m)
    - 3600/4200/5200/5200Q 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 62.

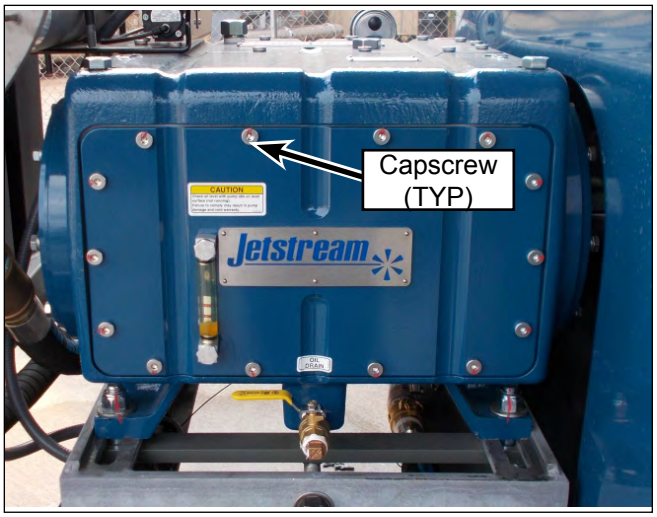


Figure 125: Install Capscrews with Proper Torque.

Crosshead and Connecting Rod Assembly

Removal

1. Remove the crankshaft from the pump as outlined in “Crankshaft” on page 75.
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 126). The set screws are installed on top of one another in the same hole.
2. Slide the pin out from the assembly (Figure 127).
3. Remove the connecting rod from the crosshead.
4. Keep the components for each assembly together.
5. Disassemble the remaining assemblies.

Connecting Rod 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:*

- 2000 Series: .002”(0.05 mm) - .0027” (0.07 mm)
- 3000 Series: 0.0020 in. (0.05 mm) - 0.0027in. (0.07 mm)
- 3600/4200/5200/5200Q Series: 0.003 in. (0.08 mm) - 0.0042 in. (0.11 mm)

6. Repeat for the remaining assemblies.

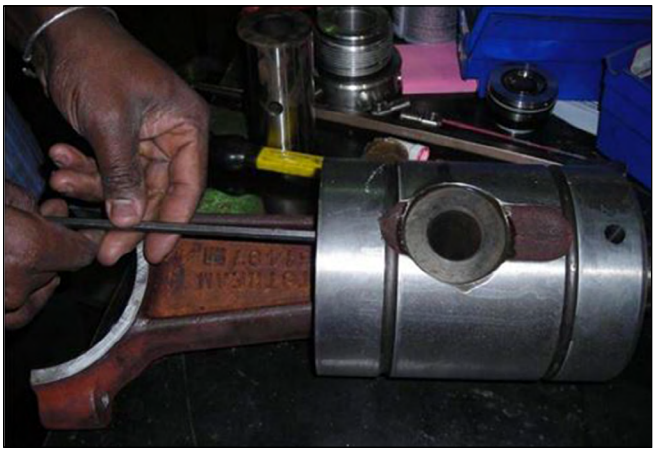


Figure 126: Set Screw Removal.

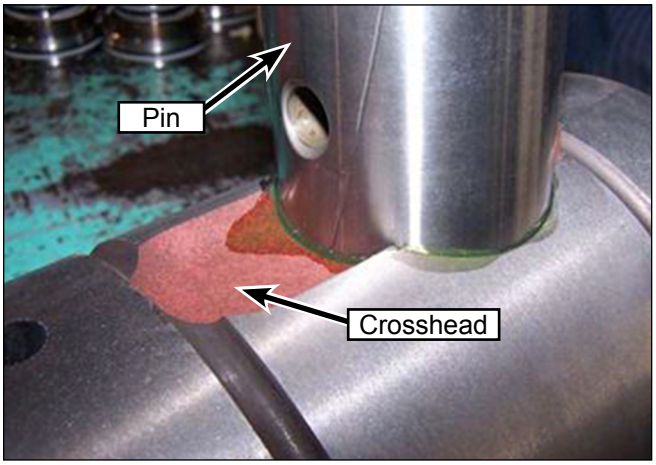


Figure 127: Pin Removal.

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:*

- 2000 Series:.003”(0.08 mm) - .006”(0.15mm)
- 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.

Crosshead 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 128) 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 129).
10. The crosshead is now ready for installation in the pump.

Crosshead Installation

1. Place the crosshead/connecting rod assemblies into position inside of the crankcase.
2. Install the crankshaft as outlined in “Installation” on page 86.

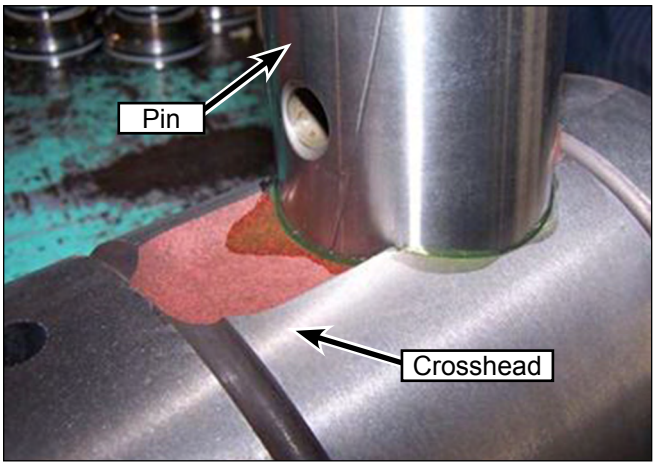


Figure 128: Pin Placement.

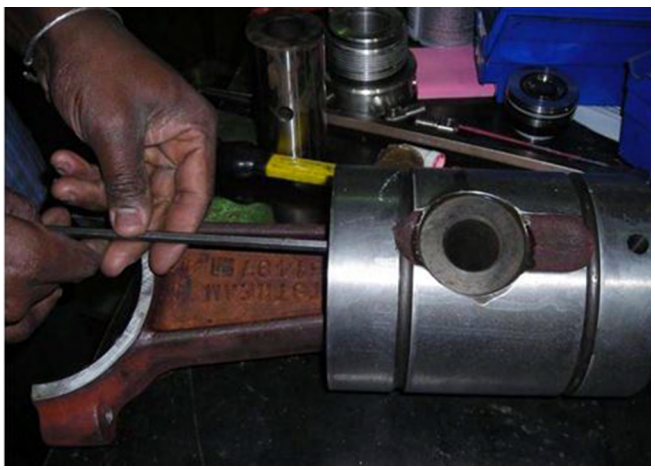


Figure 129: Second Set Screw Installation.

2000 Crankshaft

Crankshaft Removal

1. Remove the pump from the unit. Refer to “UNx Pump Removal” in Jetstream Unit Manual.
2. Open the rod box cover and remove the two capscrews that secure the plunger coupling (Figure 130) 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 “Connecting Rod Journal Bearings” on page 65.
4. Pull the three connecting rod/crosshead assemblies towards the fluid end as far as possible.
5. Remove the capscrews and washers that secure the inboard frame cap to the power frame. (Figure 131)
6. Remove the frame cap and shims. Keep the shims together.
7. Remove the capscrews and washers that secure the outboard frame cap to the power frame. (Figure 132)
8. Remove the outboard frame cap and shims. Keep the shims together (Figure 132).
9. Using a wood block and a hammer, hit either end of the crankshaft to unseat it from its bearing bores. Take care to capture the bearing races on either side as they may fall out causing the crankshaft to drop slightly
10. Pull the crankshaft out of the pump and place on workbench as needed. The crankshaft weight is 50 lbs (23 kg) (Figure 133)
11. Remove the bearings from the crankshaft. Contact Jetstream for assistance with this task.

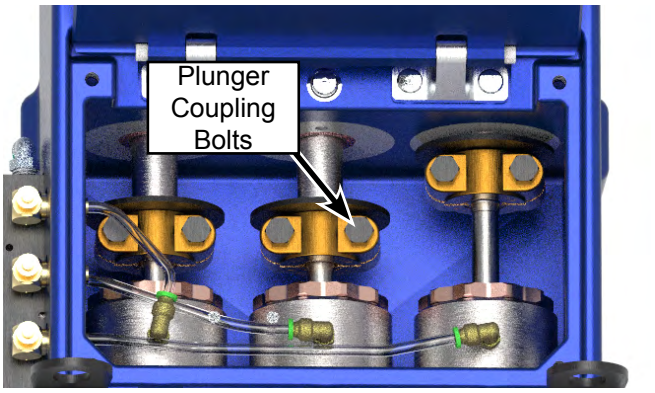


Figure 130: Remove Plunger Coupling.

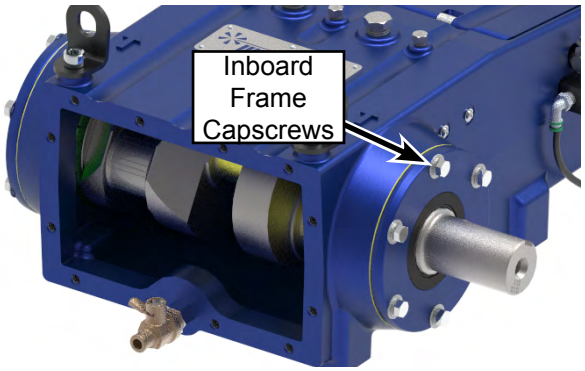


Figure 131: Remove Inboard Capscrews.

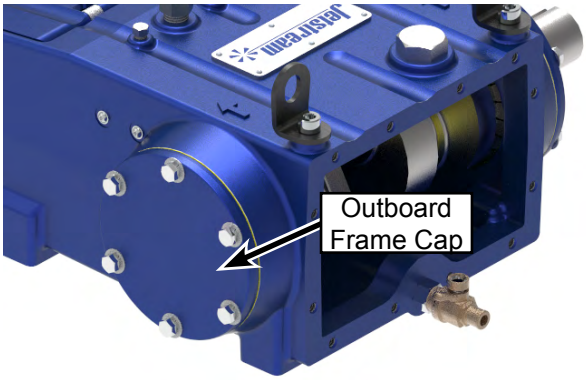


Figure 132: Remove Caps and Shims.

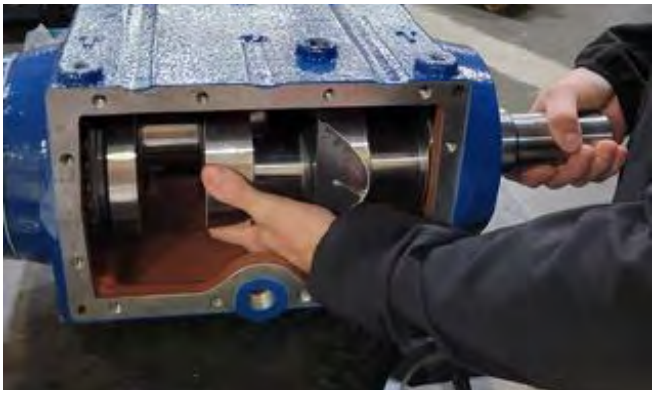


Figure 133: Remove Crankshaft from Pump.

2000 Crankshaft Bearing 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.
2. When ready, with the crankshaft positioned vertically, remove from oven and slide the bearings onto each end of the crankshaft until they are fully seated. (Figure 134)

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.

3. Verify that the bearing turns on the shaft. If the bearing does not turn, quickly tap it down using a punch/hammer against the inner race, working all around the bearing.
4. Allow the crankshaft assembly to cool.
5. Install the outer bearing race onto the inboard bearing on the crankshaft. (Figure 135)
6. Install the outer bearing race into the power frame using a rubber mallet if needed. Install the race so it is flush with the face of the case. (Figure 136)
7. Install the same shims that were removed during disassembly onto the outboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 3 capscrews, lock washers, and flat washers. (Figure 137) Torque to 25 ft/lbs (34 Nm)

Figure 134: Slide Hot Bearings onto Vertical Crankshaft.

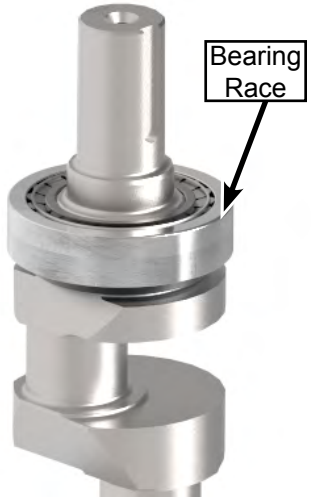


Figure 135: Install the Outer Bearing Race.

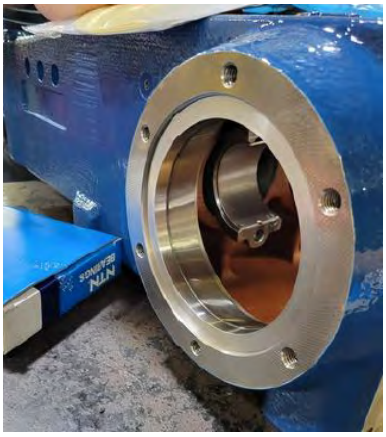


Figure 136: Outer Race Installation onto Power Frame.

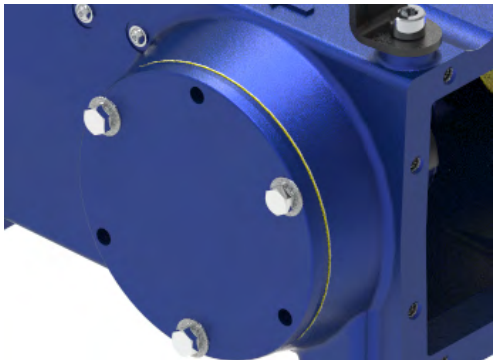


Figure 137: Install Shims and Outboard Cap.

8. Place the three crosshead/connecting rod assemblies into place (Figure 138). Allow clearance for the crankshaft by pushing them towards the fluid end.
9. Once the crankshaft/bearings have cooled, appl oil to the bearings on both ends of the crankshaft.
10. Slide the crankshaft into the drive side of the powerframe. Bearing race should already be on crankshaft. (Figure 139)
11. While supporting the drive end of the crankshaft to keep it oriented horizontally, tap the drive end side bearing race into the powerframe with a rubber mallet until it is flush with the outside of the case. (Figure 140)
12. Apply lube to lip of crankshaft and to inboard frame cap seal.
13. Install the same shims that were removed during disassembly onto the inboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 3 capscrews, lock washers, and flat washers. Torque to 25 ft/lbs (34 Nm) (Figure 141)

Continued on following page:

Figure 138: Connecting Rod Installation.

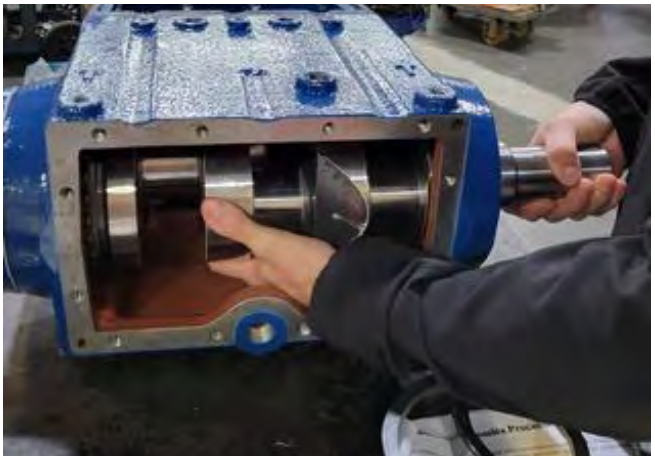


Figure 139: Crankshaft Seating.

Figure 141: Install Shims and Caps.

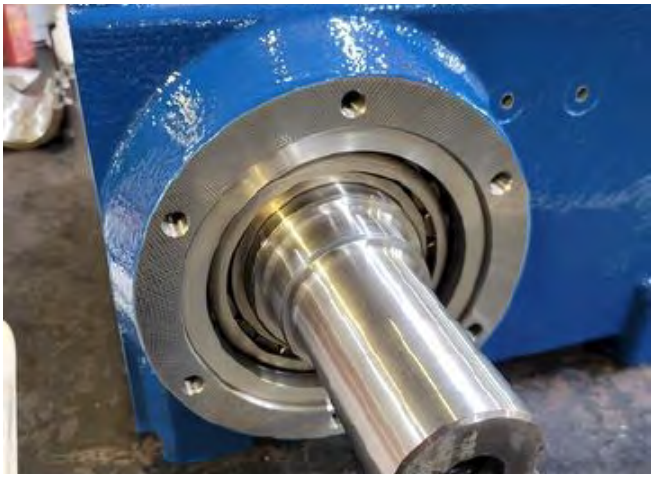


Figure 140: Install Side Bearing Race.

14. The crankshaft should now rotate by hand. If it doesn't rotate, add shims to the input side seal plate to increase end play. Mount a magnetic base dial indicator on the crankshaft with the indicator pin on the inside edge of the rear opening, as shown. (Figure 142)
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. (Figure 143)
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 frame caps. Tighten the capscrews to 25 ft.lb (34 N·m). (Figure 144)
18. Oil the bearings and install the connecting rods onto the crankshaft as outlined in Rod journal section on page 65.
19. Install the three plunger couplings, connecting the plungers to the pony rods. (Figure 145)

Figure 142: Mount Magnetic Base Dial Indicator

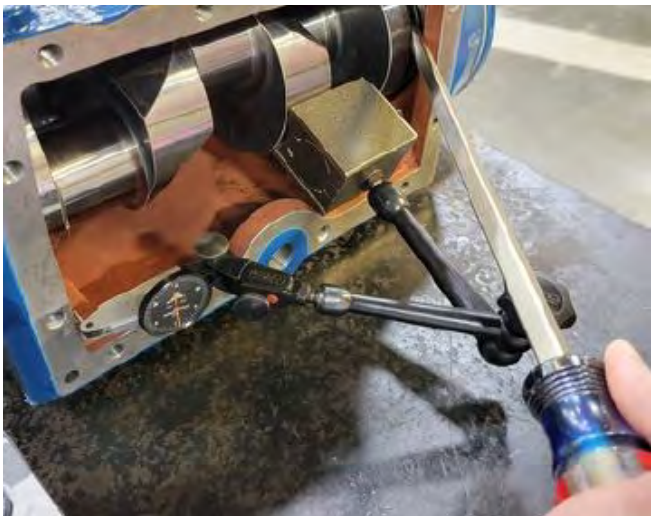


Figure 143: Wiggle Crankshaft with Prybar

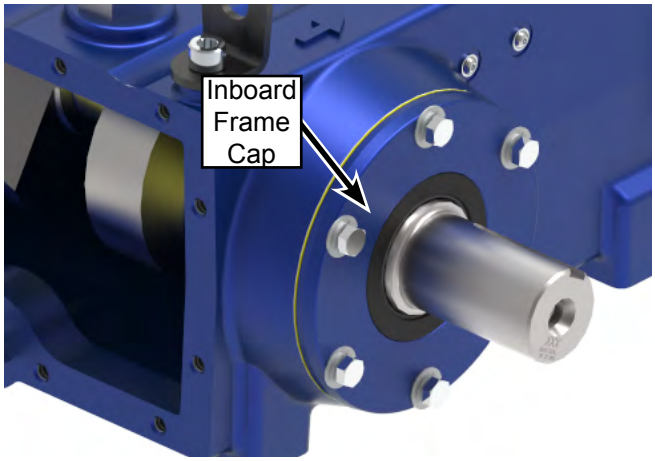


Figure 144: Install Capscrews

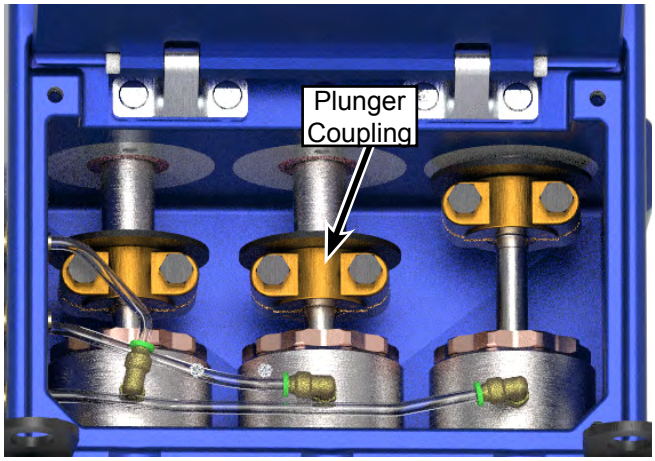


Figure 145: Install Plunger Couplings

4200/3600/3000 Crankshaft Removal

Removal

1. Remove the pump from the unit. Refer to “UNx Pump Removal” in Jetstream Unit Manual.
2. Open the rod box cover and remove the two capscrews that secure the plunger coupling to the plunger and remove the coupling. (Figure 146).

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

3. Remove the connecting rod end caps as outlined in “Connecting Rod Journal Bearings” on page 65.
4. Pull the three connecting rod/crosshead assemblies towards the fluid end as far as possible.
5. Remove the capscrews and washers that secure the inboard frame cap to the power frame. (Figure 147)
6. Remove the frame cap and shims. Keep the shims together.
7. Install crankshaft horizontal lifting tool (PN 58195) on the crankshaft output shaft and hoist until there is tension with the overhead crane. (Figure 148)
8. Remove the capscrews and washers that secure the outboard frame cap to the power frame. (Figure 149)
9. Remove the outboard frame cap and shims. Keep the shims together.
10. Using a wood block and a hammer, hit either end of the crankshaft to unseat it from its bearing bores. Take care to capture the bearing race on the outboard side as it may fall out.
11. Pull the crankshaft out of the pump with the lifting tool. Adjust the leveling wheel on the lifting tool as needed to keep it horizontal. (Figure 150)

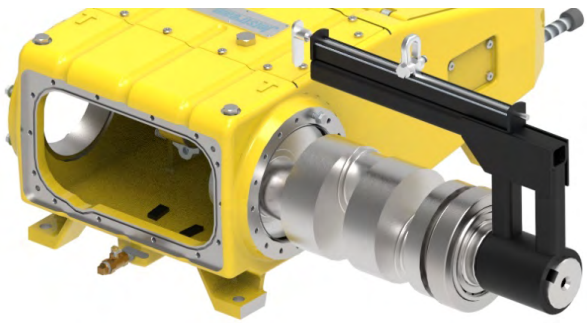


Figure 150: Remove Crankshaft

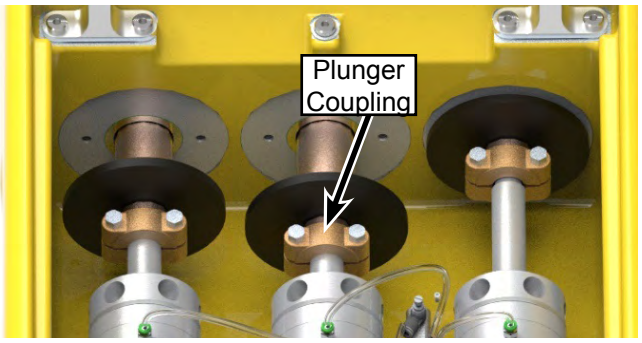


Figure 146: Remove Plunger Couplings

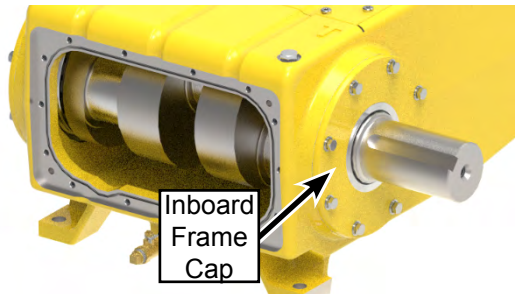


Figure 147: Remove Capscrews and Washers

Figure 148: Install Lifting Tool

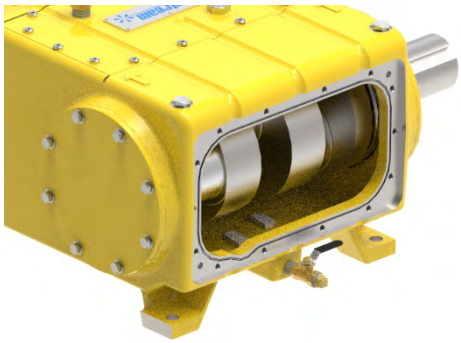


Figure 149: Remove Outboard Capscrews

12. Place the crankshaft on the floor or workbench as needed. Remove the lifting tool. The weight of the crankshaft is approximately:
    - 3000 Series: 125 lb. (57 kg)
    - 3600/4200 Series: 325 lb. (147 kg)
13. Remove the bearings from the crankshaft. Contact Jetstream for assistance with this task.

Installation

1. Heat the new 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, with the crankshaft positioned vertically, remove from oven and slide the bearings onto each end of the crankshaft until they are fully seated using appropriate PPE. (Figure 151)
3. Verify that the bearing turns on the shaft. If the bearing does not turn, quickly tap it down using a punch/hammer against the inner race, working all around the bearing. (Figure 152)
4. Allow the crankshaft assembly to cool.
5. Install the outer bearing race onto the inboard bearing on the crankshaft.
6. Install the outer bearing race into the power frame using a rubber mallet if needed. Install the race so it is flush with the face of the case. (Figure 153)
7. Install the same shims that were removed during disassembly onto the outboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 4 capscrews, lock washers, and flat washers. Torque to 50 ft/lbs (68 Nm) (Figure 154)

Figure 151: Install the Heated Bearing Using Proper PPE

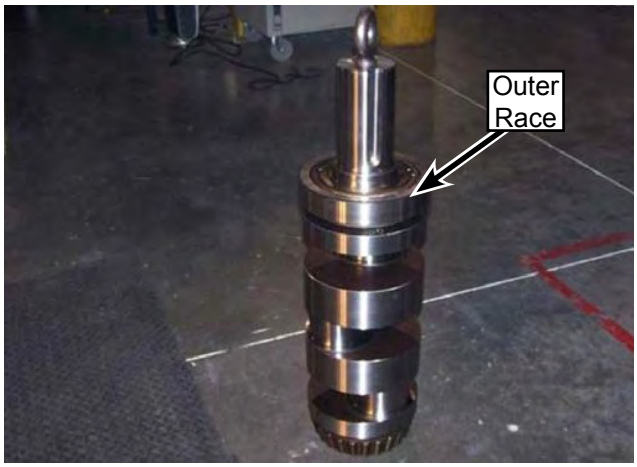


Figure 152: Install Outer Race

Figure 153: Install Outer Race in Pump Frame

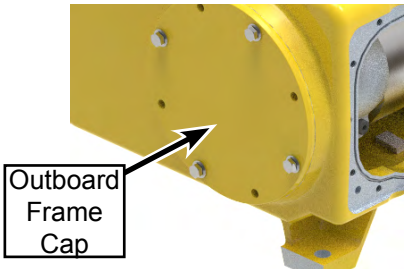


Figure 154: Install Shims and Cap

8. Place the three crosshead/connecting rod assemblies into place. Allow clearance for the crankshaft by pushing them towards the fluid end. (Figure 155)

Figure 155: Place Crosshead/Connecting Rod Assembly

9. Once the crankshaft/bearings have cooled, install crankshaft horizontal lifting tool (PN 58195) on the crankshaft output shaft and hoist as needed to install in powerframe. Bearing race should already be on crankshaft. (Figure 156)

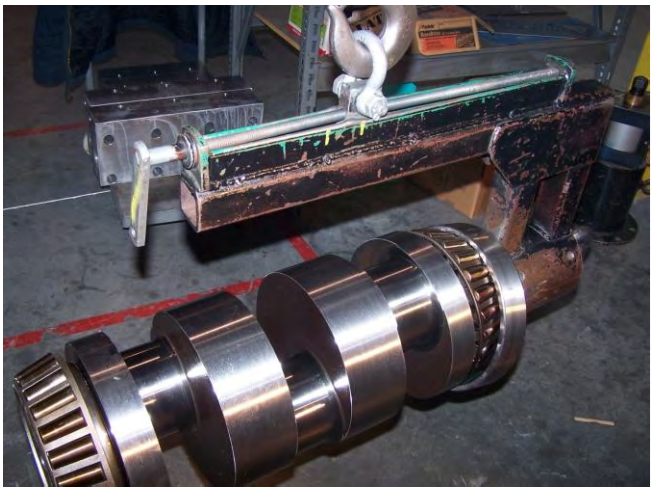


Figure 156: Install Crankshaft

10. Apply oil to bearings on both ends of crankshaft. (Figure 157)

Figure 157: Apply Oil to Bearings

11. Slide crankshaft into the drive side of the powerframe. Be sure to carefully guide the crankshaft into the previously installed race on the opposite side while clearing all the connecting rods.
12. Keeping the crankshaft supported with the crane, tap the drivers end side bearing race into the pump frame with a rubber mallet until flush with the outside of the case. (Figure 158)
13. Remove crankshaft install tool from crankshaft
14. Apply lube to lip of crankshaft and to inboard frame cap seal.
15. Install the same shims that were removed during disassembly onto the inboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 4 capscrews, lock washers, and flat washers. Torque to 50 ft/lbs (68 Nm). (Figure 159)

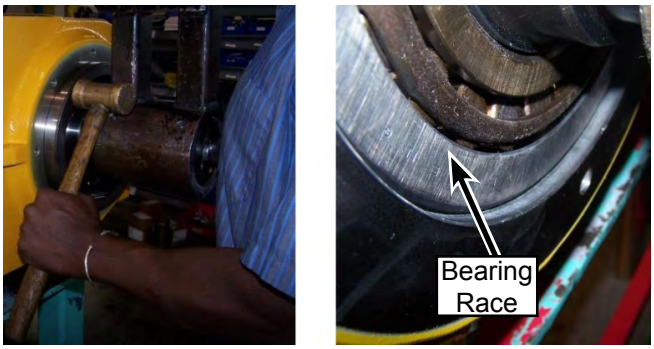


Figure 158: Tap in the Bearing Race

Figure 159: Install Shims and Cap

16. Mount a magnetic base dial indicator on the crankshaft with the indicator pin on the inside edge of the rear opening, as shown.
17. 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. (Figure 160)
18. 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.
19. Install the remaining capscrews onto the inboard and outboard frame caps. Tighten the capscrews to 50 ft.lb (68 N·m). 25 ft lbs (34 Nm) for the 2000 series.

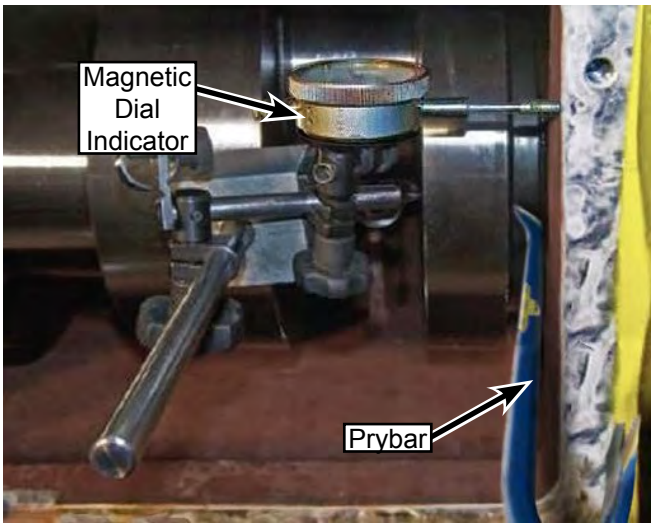


Figure 160: Mount Dial Indicator and Use Prybar

20. Oil the bearings and install the connecting rods onto the crankshaft as outlined in the Rod journal section on page 65.
21. Install the three plunger couplings, connecting the plungers to the pony rods. (Figure 161)
22. Verify the oring is installed in the rear cover area of the pump and in good condition. Install the rear cover onto the power frame. Tighten the capscrews to 50 ft.lb (68 N·m). 25 ft lbs for the 2000 series. (Figure 162)
23. Add oil to the crankcase. Refer to “Changing the Power End Oil” on pagepage 62.

5200 Crankshaft

(Contact Jetstream for 5200Q Cranshaft Maintenance)

Removal

1. Remove the pump from the unit. Refer to “UNx Pump Removal” in Jetstream Unit Manual.
2. Open the rod box cover and remove the two capscrews that secure the plunger coupling (Figure 163) to the plunger and remove the coupling on all 3 crosshead stubs.

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 page 65.
4. Pull the three connecting rod/crosshead assemblies towards the fluid end as far as possible.
5. Remove the counterweights from the two outer lobes of the crankshaft thru the back cover. (Figure 164)
6. Remove the capscrews and washers that secure the inboard frame cap to the power frame.
7. Remove the frame cap and shims. Keep the shims together.

Figure 165: Remove Inboard Frame Cap

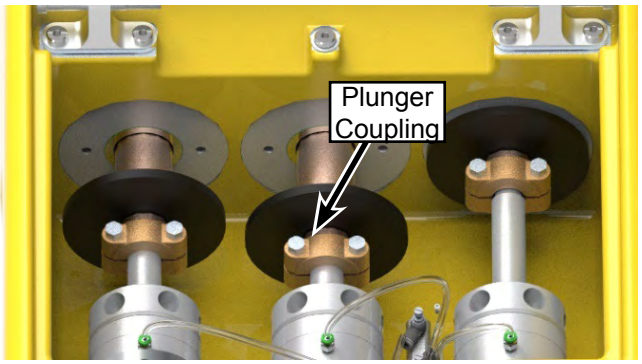


Figure 161: Install Plunger Couplings

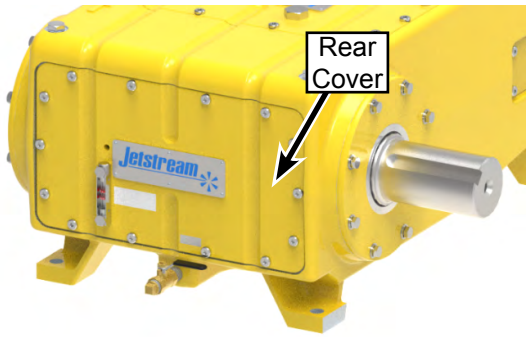


Figure 162: Install Rear Cover

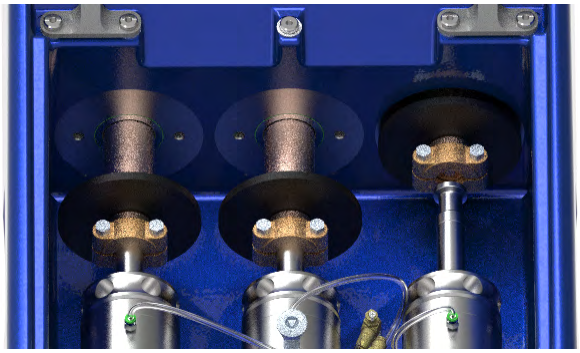


Figure 163: Remove Plunger Couplings

Figure 164: Remove Counterweights

8. Install crankshaft horizontal lifting tool (PN 58195) on the crankshaft output shaft and hoist until there is tension with the overhead crane. (Figure 166)
9. Remove the capscrews and washers that secure the outboard frame cap to the powerframe.
10. Remove the outboard frame cap and shims. 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. Take care the capture the bearing race on the outboard side as it may fall out.

Figure 166: Install Lifting Tool

12. Pull the crankshaft out of the pump with the lifting tool while adjusting the leveling wheel on the lifting tool as needed to keep it horizontal (Figure 167)

⚠ 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.

13. Place the crankshaft on the floor or workbench as needed. Remove the lifting tool.

    The weight of the 5200 Series crankshaft is approximately: 400 lb (182 kg)
14. Remove the bearings from the crankshaft. Contact Jetstream for assistance with this task.

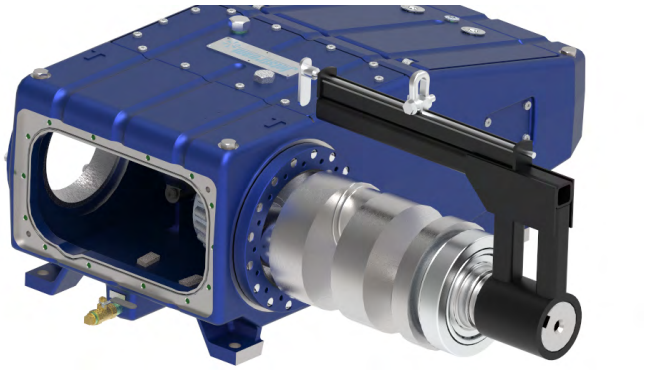


Figure 167: Pull Crankshaft from Pump

5200 Crankshaft 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 168)
3. Verify that the bearing turns on the shaft. If the bearing does not turn, quickly tap it down using a punch/hammer against the inner race, working all around the bearing.
4. Allow the crankshaft assembly to cool.

Figure 168: Place Heated Bearing

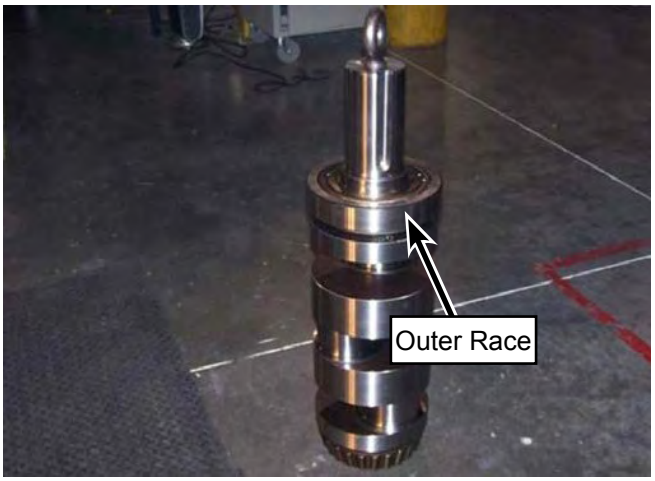


Figure 169: Install Outer Race

5. Install the outer bearing race into the power frame adapter on the outboard side using a rubber mallet. Install the race so it is flush with the face of the case. (Figure 170)

Continued on following page

Figure 170: Install Outer Race in Power Frame

6. Install the same shims that were removed during disassembly onto the outboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 4 capscrews, lock washers, and flat washers. Torque to 50 ft/lbs (68 Nm) (Figure 171)
7. Verify the three crosshead/connecting rod assemblies are pushed back towards the fluid end to allow clearance for the crankshaft. (Figure 172)
8. Once the crankshaft/bearings have cooled, install crankshaft horizontal lifting tool (PN 58195) on the crankshaft output shaft and hoist as needed to install in powerframe. Bearing race should already be on crankshaft. (Figure 173)
9. Apply oil to bearings on both ends of crankshaft. (Figure 174)

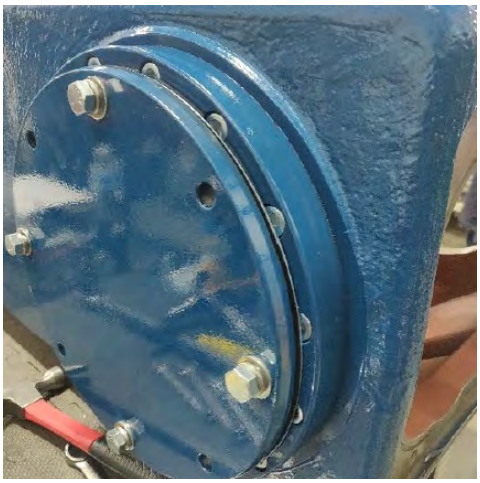


Figure 171: Install Shims and Cap

Figure 172: Push Back the Connecting Rod Assemblies

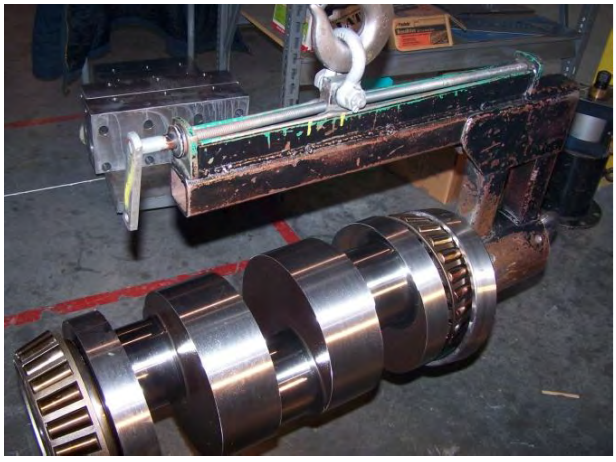


Figure 173: Mount Crankshaft on Lifting Tool

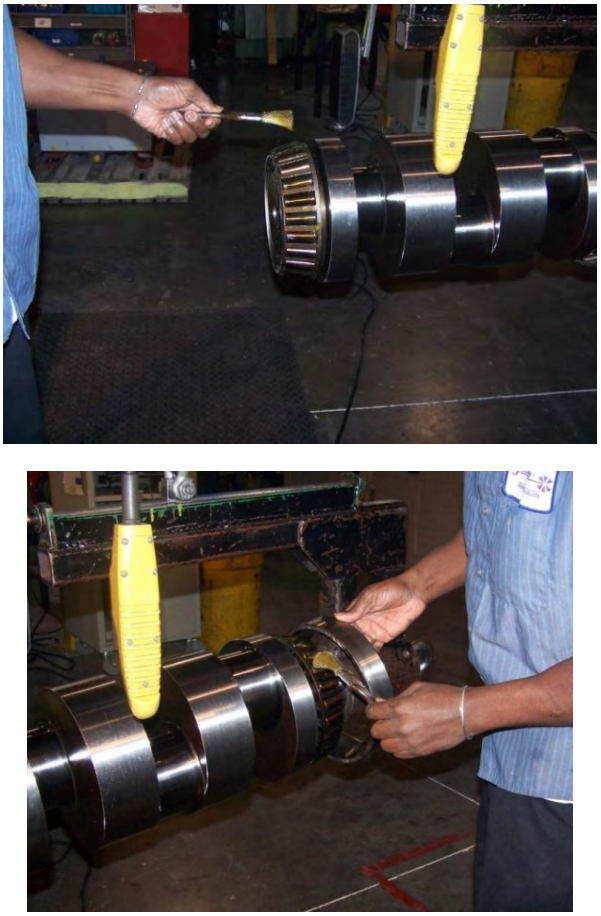


Figure 174: Apply Oil to Bearings

10. Slide crankshaft into the drive side of the powerframe. Be sure to carefully guide the crankshaft into the previously installed race on the opposite side while clearing all the connecting rods.
11. Keeping the crankshaft supported with the crane, tap the drivers end side bearing race into the pump frame with a rubber mallet until flush with the outside of the case. (Figure 175)
12. Remove crankshaft install tool from crankshaft
13. Apply lube to lip of crankshaft and to inboard frame cap seal.
14. Install the same shims that were removed during disassembly onto the inboard frame cap. If the shims are not known, start with 1 of each color (yellow, white, blue, brown). Install the outboard frame cap using only 3 capscrews, lock washers, and flat washers. Torque to 50 ft/lbs (68 Nm) (Figure 176)

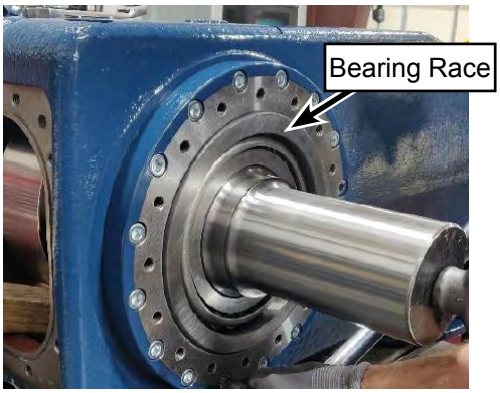


Figure 175: Install Bearing Race into Pump Frame

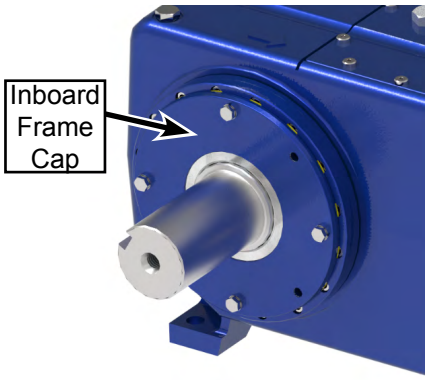


Figure 176: Install Shims and Inboard Frame Cap

15. Mount a magnetic base dial indicator on the crankshaft with the indicator pin on the inside edge of the rear opening, as shown. (Figure 177)
16. 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. (Figure 177)
17. 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.

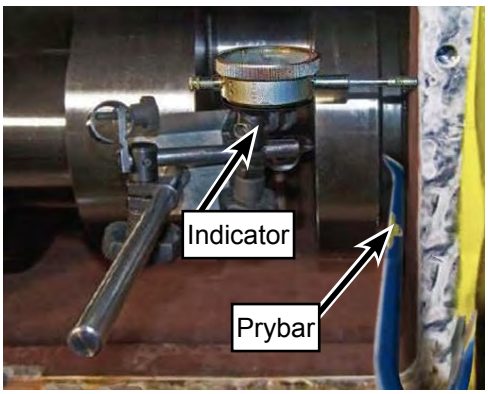


Figure 177: Use Indicator and Prybar to Test Movement

18. Install the remaining capscrews onto the inboard and outboard frame caps. Tighten the capscrews to 50 ft.lb (68 N·m). 25 ft lbs (34 Nm) for the 2000 series. (Figure 178)
19. Oil the bearings and install the connecting rods onto the as outlined in “Rod Journal Bearings” on page page 65
Continued on following page.

Figure 178: Install Remaining Capscrews and Apply Oil

20. Install the crankshaft counterweights on the two outer lobes. Torque to 120 ft-lbs. (163 Nm) (Figure 179)

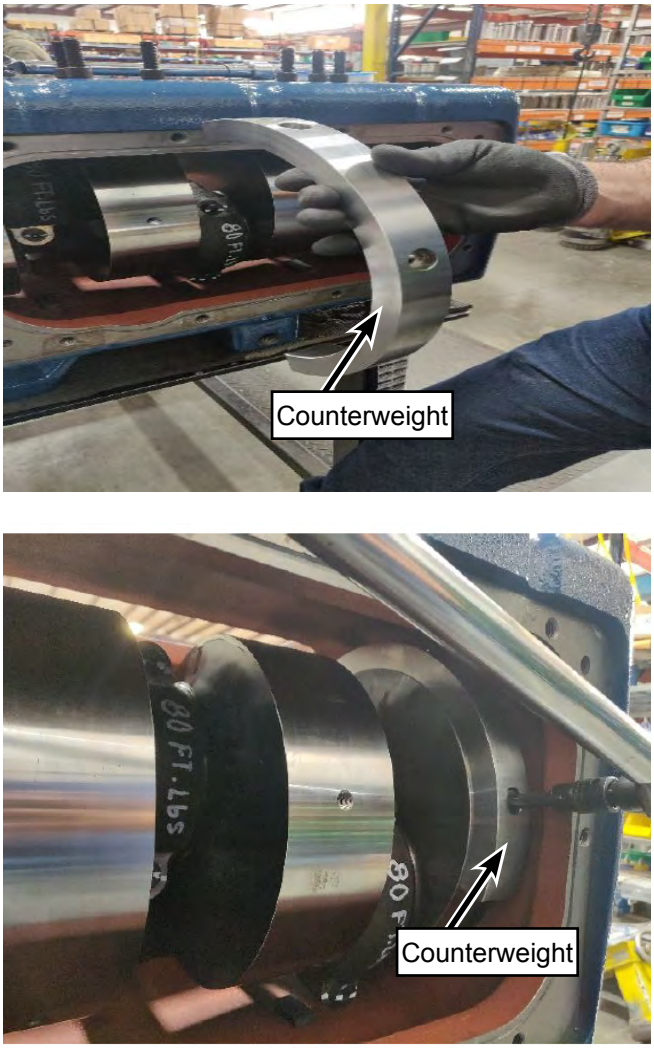


Figure 179: Install Counterweights

21. Install the three plunger couplings, connecting the plungers to the pony rods.(Figure 180)
22. Verify the oring is installed in the rear cover area of the pump and in good condition. Install the rear cover. Tighten the capscrews to 50 ft.lb (68 N·m). 25 ft lbs (34 Nm) for the 2000 series.
23. Add oil to the crankcase. Refer to “Changing the Power End Oil” on page page 62

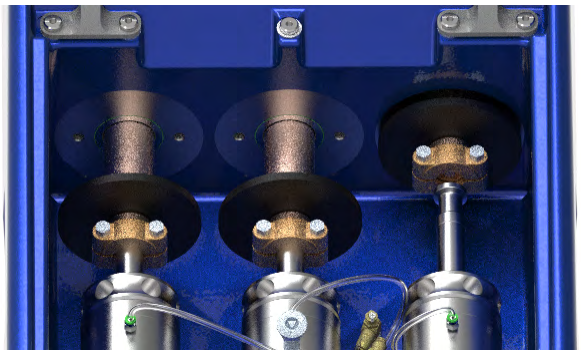


Figure 180: Install Plunger Couplings

Cover seal replacement (non-2000 series)

1. Remove top or rear cover as needed.
2. Remove o-ring from groove. Clean out any debris. (Figure 181)
3. Place the o-ring into the back face groove using o-ring lube to hold in place

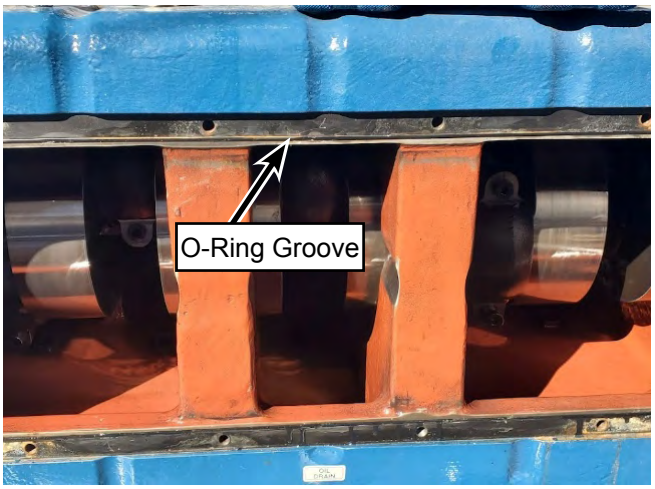


Figure 181: Remove O-Ring and Clean Groove

4. Cut the o-ring cord a little oversized by overlapping the two ends. Always best to cut oversized and then re-cutting than to undercut and make it too short. (Figure 182)

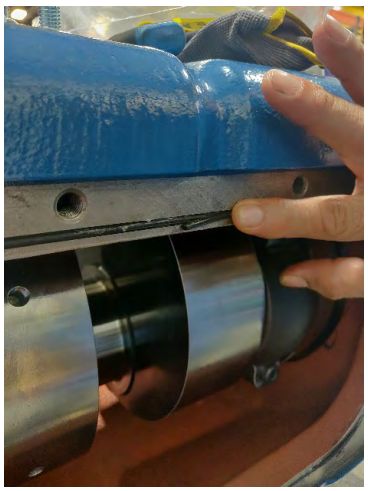


Figure 182: Place Oversized O-Ring Using O-Ring Lube

5. Lift both ends of the cut cord up and use black silicone at the location where the ends meet on the groove. Place the ends back on top of the silicone. Trim if needed for length. (Figure 183)
6. Install covers onto pump. Torque to 50 ft.lb (68 N·m).

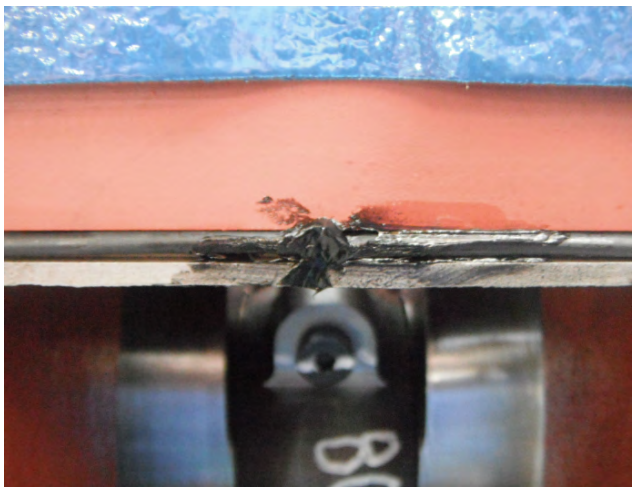


Figure 183: Apply Black Silicone and Trim O-Ring to Length

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.

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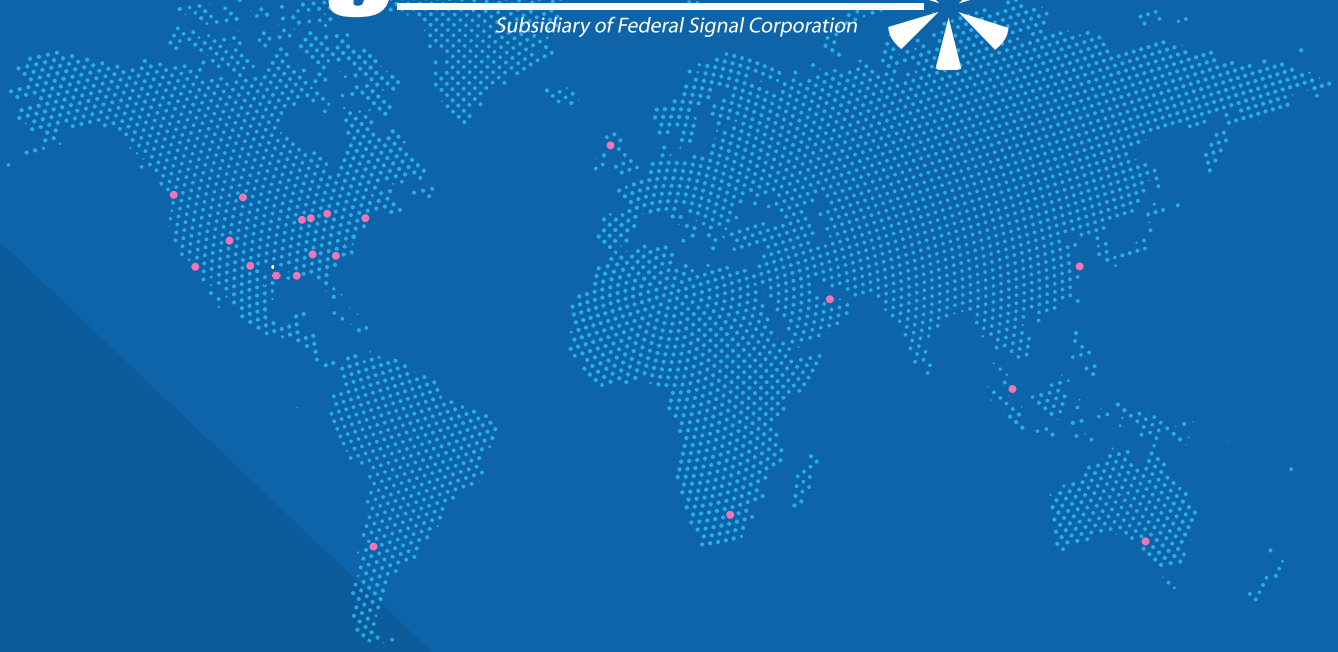

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