Jetstream®

Subsidiary of Federal Signal Corporation

OPERATION MANUAL

Electric Waterblast Unit

Jetstream
Subsidiary of Federal Signal Corporation

Jetstream manufactures industrial high-pressure waterblasting equipment operated at pressures up to 40,000 psi for a wide range of applications, including hydro-demolition, industrial cleaning and surface preparation. Backed by strong after-sales service and support, Jetstream product offerings include a complete line of skid and trailer-mounted pump units, control guns, valves, hoses, replacement parts, nozzles, and safety gear.

Jetstream® RightStart

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 ever arise, the Jetstream team is available and committed to providing prompt answers and solutions.

WARRANTY

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

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

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

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

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

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

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

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

Jetstream
Subsidiary of Federal Signal Corporation

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

Jetstream®
Subsidiary of Federal Signal Corporation

CONTENTS

Jetstream®
Subsidiary of Federal Signal Corporation

WATERBLAST SAFETY

RECOGNIZE SAFETY INFORMATION

⚠ 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.

Follow recommended precautions and safe operating practices.

UNDERSTAND 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 personal injury or death, if the warning is ignored.

⚠ WARNING WARNING is used to indicate the presence of a hazard which can cause severe personal injury or death, if the warning is ignored.

⚠ CAUTION CAUTION is used to indicate the presence of a hazard which will or can cause minor personal injury, if the warning is ignored.

NOTICE NOTICE indicates installation, operation, or maintenance information which is important but not hazard-related.

SAFETY TRAINING

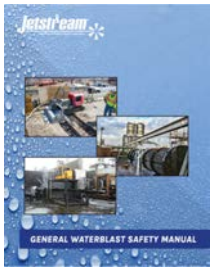
Only trained personnel may setup, operate, or maintain this equipment.

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).

GENERAL WATERBLAST SAFETY MANUAL

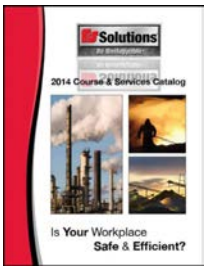


A safety manual is shipped with each unit. The safety manual provides various guidelines and instructions for maintaining a safe work environment while using and maintaining waterblast equipment.

Ensure all operators and maintenance personnel have read and understand the content in this manual in order to ensure a safe work environment.

Contact Jetstream for extra copies of the manual.

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.

NEW UNIT START UP TRAINING

Jetstream Right Start

At Jetstream, we think you need to know exactly what you're getting. Right Start is free unit start up training for U.S. customers and is designed to get you familiar with your new Jetstream waterblaster!

For more information on Right Start Training, contact Jetstream at 1-800-231-8192

JETSTREAM TRAINING

Jetstream Training Classes

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

For more information on Jetstream Training, contact Jetstream at 1-800-231-8192.

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)" & 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 - 2 full revolutions. Do not exceed two revolutions on NPT threaded connections.

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

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

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

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 the 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

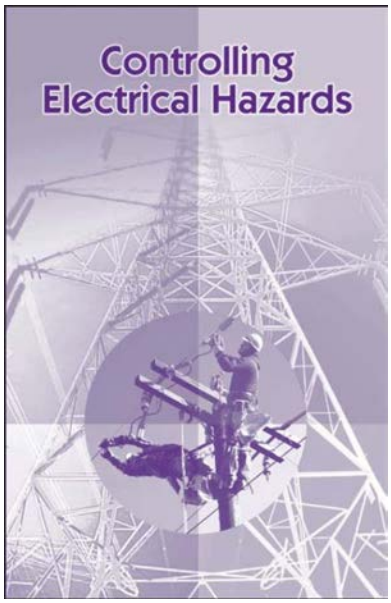
After shutting down in freezing conditions, even for brief periods, drain the water from all components. Prior to starting the equipment after a freeze, the operation of all equipment components must be checked carefully to ensure they are not frozen, or cracked, and are still in safe operating condition. Refer to "" on page 19 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.

GENERAL ELECTRICAL SAFETY

- Never operate electrical equipment while standing in water.
- Only qualified and authorized maintenance personnel may repair electrical cords or equipment.
- Have a qualified electrician inspect electrical equipment that has gotten wet before energizing it.
- If working in damp locations, inspect electric cords and equipment to ensure that they are in good condition and free of defects, and use a ground-fault circuit interrupter (GFCI).
- Always use caution when working near electricity.
- If your work site is metal (you stand on metal grids/ flooring) make sure you set an OSHA approved rubber mat down to stand on as an insulator, before working on electrical equipment.
- Refer to OSHA 375, Controlling Electrical Hazards, for more information on electrical hazards. This document can be obtained at https://www.OSHA.gov.



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.

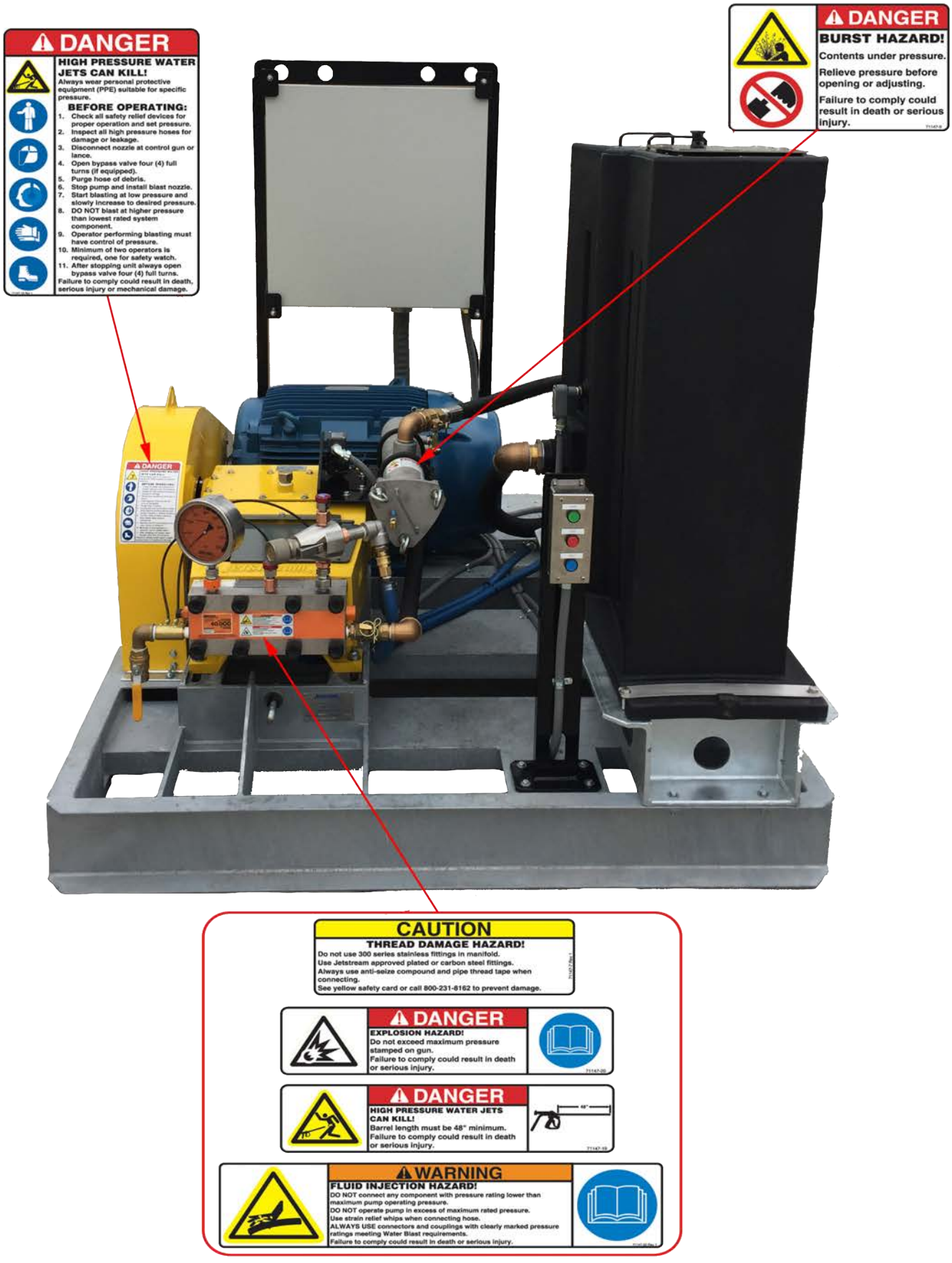
New color coded parts and accessories clearly show water-blast components in use are correctly and safely suited to current pump pressures with the Visual Safety System.

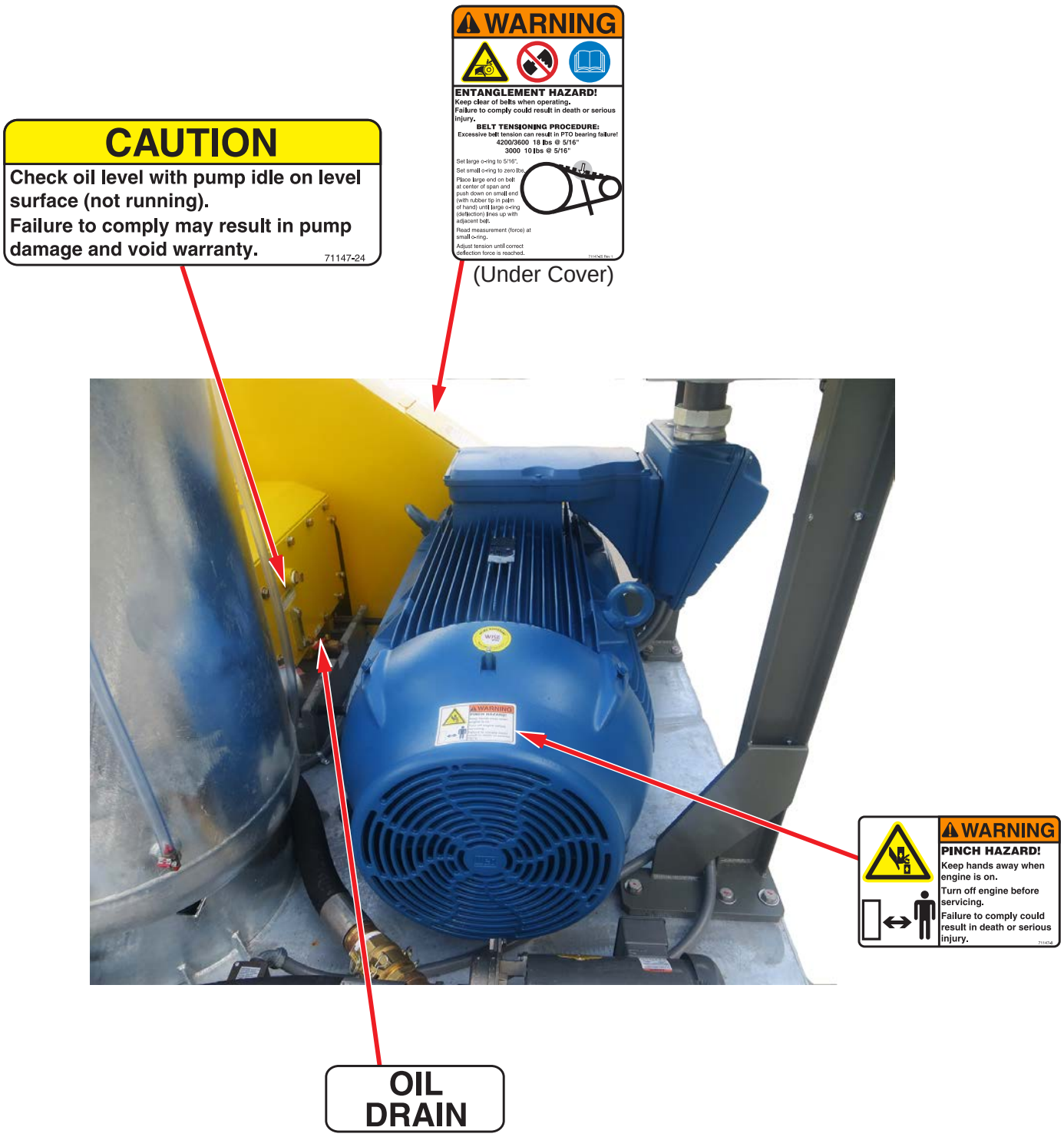
- Easy to use and implement
- Easy to see at a distance
- Helps keep workers safe
- Helps prevent equipment damage

WJTA
WaterJet Technology Association

*Complies with WJTA visual safety system color guidelines

SAFETY DECALS




CAUTION
Check oil level with pump idle on level surface (not running).
Failure to comply may result in pump damage and void warranty.
71147-24
WARNING
ENTANGLEMENT HAZARD!
Keep clear of belts when operating.
Failure to comply could result in death or serious injury.
BELT TENSIONING PROCEDURE:
Excessive belt tension can result in PTO bearing failure!
4200/3600 18 lbs @ 5/16"
3000 10 lbs @ 5/16"
Set large o-ring to 5/16".
Set small o-ring to zero lbs.
Place large end on belt at center of span and push down on small end (with rubber tip in palm of hand) until large o-ring (deflection) lines up with adjacent belt.
Read measurement (force) at small o-ring.
Adjust tension until correct deflection force is reached.
(Under Cover)
WARNING
PINCH HAZARD!
Keep hands away when engine is on.
Turn off engine before servicing.
Failure to comply could result in death or serious injury.
OIL DRAIN

Jetstream®
Subsidiary of Federal Signal Corporation

GENERAL INFORMATION

INSTALLATION

⚠ WARNING

The customer is responsible for the correct installation of the electric waterblast unit. The customer must ensure proper inline fault protection, e.g. surge protectors, line reactors, and circuit breakers, to avoid unit damage. A licensed electrician with industrial control knowledge is required for installation of the unit. Warranty of the unit and its electrical controls will be voided by improper installation or incorrect operation. Jetstream of Houston (FS Solutions, Federal Signal) is not responsible for the installation of electric waterblast units. See the accessory package in "Fig. 2: X-Series Waterblast Unit" on page 11 for the starter manual, wiring diagram and starter settings.

PUMP OPERATION

Jetstream electric pumps come in a wide variety of electric motors and waterblast output pressures. The units are skid mounted, but can be trailer mounted by request.

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

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

- The 15K pumps can operate up to 15,000 psi (1000 bar).
- The 20K pumps can operate up to 20,000 psi (1400 bar).
- The 40K pumps can operate up to 40,000 psi (2750 bar).

The three pressure ranges are achieved by converting the part of the pump known as the fluid end. Each pressure range has its own manifold, stuffing boxes and plungers. The materials and construction differs with the pressure range. The various plunger diameters control the discharge volume. The stuffing boxes are matched to the plungers in most cases, but some are used with a range of plunger sizes, so it is important to keep them together. Instructions for converting to other pressure ranges are detailed in "Pressure Conversion" on page 33. Contact Jetstream Customer Service or Engineering with any questions.

Because of space requirements, the layout for 3600/4200 series electric units varies from the 3000 units. Refer to (Fig. 1) for variations in layout.

3000 Electric Unit Layout

3600/4200 Electric Unit Layout

Fig. 1: Electric Waterblast Units

Jetstream®
Subsidiary of Federal Signal Corporation

COMPONENT IDENTIFICATION

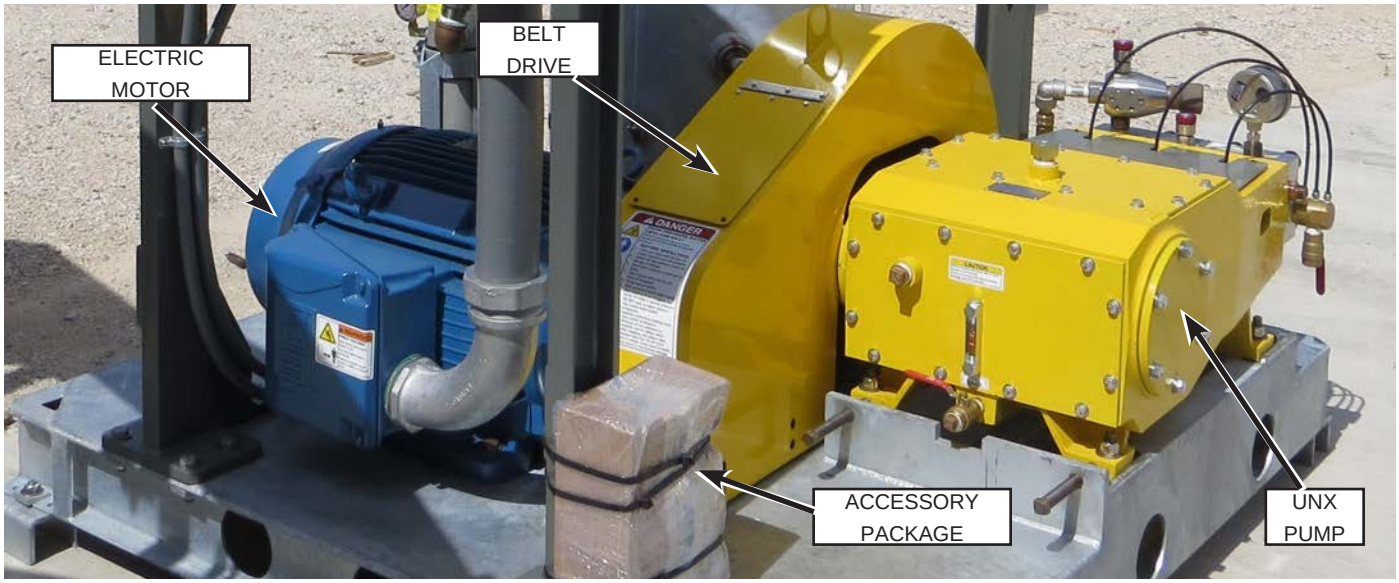


Fig. 2: X-Series Waterblast Unit

Before operating the pump, it is necessary to fully understand each component and how it functions. Following is a brief description of the main components that comprise the unit.

ELECTRIC MOTOR

The electric motor is the source of power to drive the pump. Several motor options provide a power range of 75-600 HP (55-447 kW).

BELT DRIVE

The belt drive is driven by the electric motor. A pulley is mounted on the motor shaft and, when powered on, drives the other pulley to operate the pump.

ROTATION DIRECTION

The power end has direction arrows cast into the top of the pump indicating crankshaft rotation. This must be confirmed at installation (top of the crankshaft toward fluid end). Severe damage will occur if the pump is operated in reverse. The charge pump rotation should be confirmed to be standard centrifugal pump as shown on the pump housing.

3000 series

4200 series

Charge pump

UNx PUMP

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

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

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

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

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

PUMP OPERATING TEMPERATURE

The normal operating temperature of the power end is 100-150° F. In hotter ambient conditions it may run between 150-190° F. Maximum allowed pump oil temperature is 190° F.

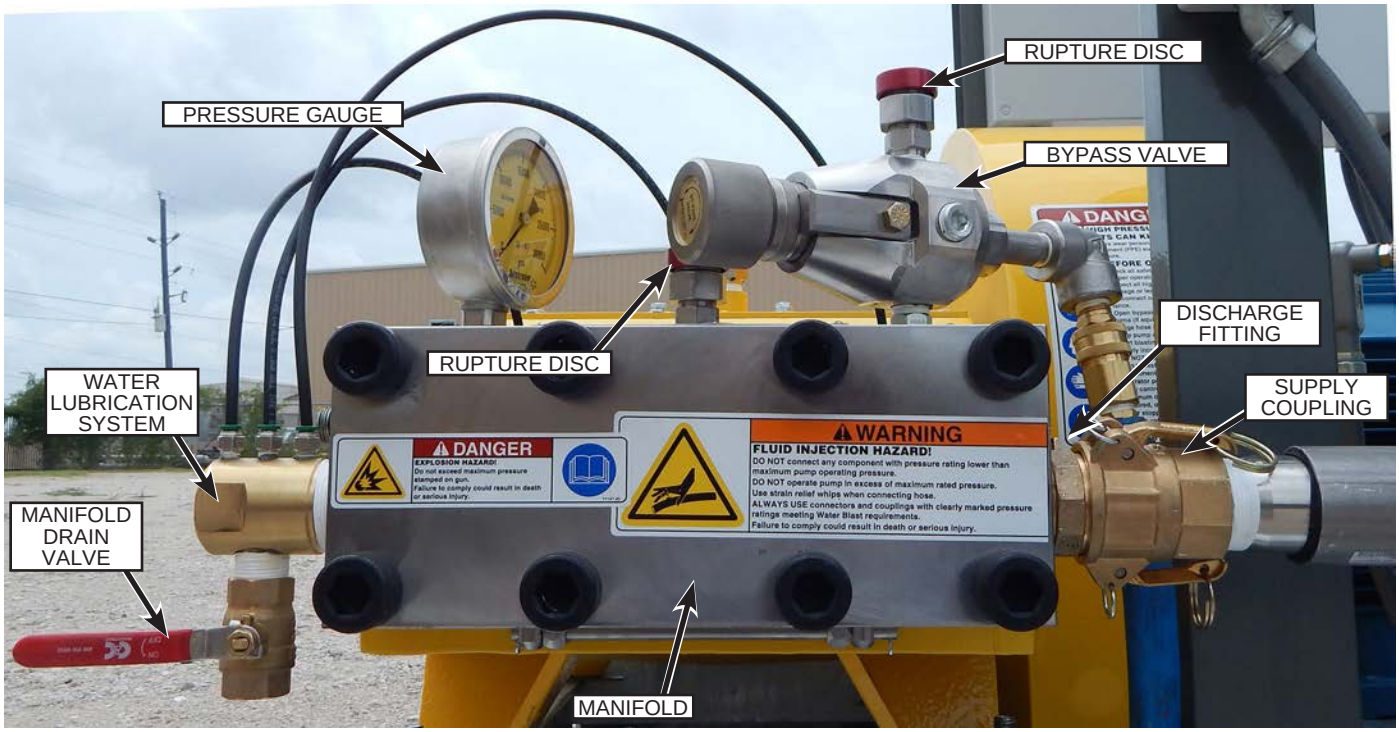


Fig. 3: Manifold Components

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 provides a way to drain the manifold. The drain allows the manifold to be flushed of contaminants prior to pump usage. It can 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. Needle valves are present on manifolds that are pressure fed (all 40K units). The needle valves control the amount of flow to each stuffing box and must be properly adjusted during operation. Manifolds that are not pressure fed have a fixed flow. Refer to “Charge Pump” on page 15 for more information on pressure fed manifolds.

PRESSURE GAUGE

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

RUPTURE DISCS

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

BYPASS VALVE

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

The bypass valve controls pressure by allowing water to bypass though the valve. A discharge hose is attached to the bypass valve. The hose extends to the other side of the unit where it is attached to a drain elbow (Fig. 6). 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, electric motor rpm, and nozzle will allow the bypass valve to close at almost all flow rates.

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

REGULATOR VALVE

For shut-in systems (where no low pressure water dumps from the tool), 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.

DISCHARGE FITTING

The discharge fitting (Fig. 3) allows the connection of a high pressure hose. High pressure water exits from this fitting. On 15K & 20K manifolds, a quick disconnect is recommended to prevent galling of pipe threads and/or damage to the manifold.

Note: Another discharge port is available on the other side of the manifold depending on customer preference.

SUPPLY COUPLINGS

The supply couplings (Fig. 3) provide a quick method for attaching the supply hose to the manifold.

CONTROL PANEL

The control panel is mounted at the rear of the unit. The panel allows the operator to start and stop the motor, control electric motor speeds, and view fault codes. Refer to “Control Panels” on page 17 for more information.

Fig. 4: Control Panel

REMOTE CONTROL PANEL

The remote control panel is mounted at the front of the pump for convenient control of the electric motor. The panel allows the operator to start, stop and jog the motor. Refer to “Control Panels” on page 17 for more information.

Fig. 5: Remote Control Panel and Water Tank

WATER TANK

The 100 gal. (440 L) water tank receives water from the water source. The tank contains a float valve that maintains the proper water level. A low level switch mounted on the back of the tank shuts off the electric motor in the event that the tank runs low on water.

The water tank is not intended to sustain blasting operations without a constant water supply.

Refer to “” on page 29 for more information on the water tank.

WATER FILTER (15K & 20K)

Two bag-type water filters (Fig. 6) are located inside the water tank.

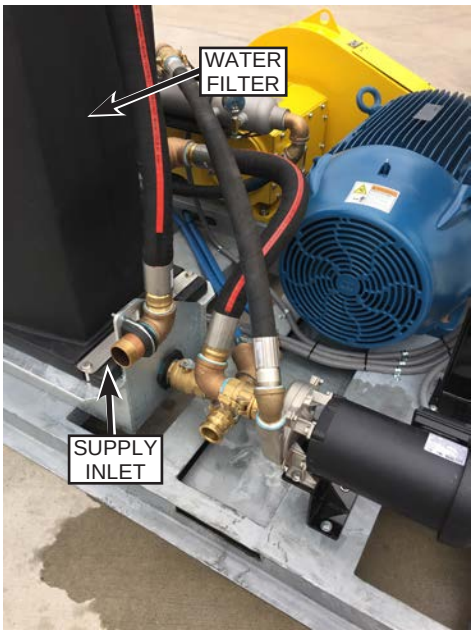


Fig. 6: Supply Inlet

Note: On 40K units, an additional cartridge-type filter is added to the system and causes changes in how the system is plumbed. In addition, a pressure switch is plumbed into the cartridge filter for system protection. Refer to "" on page 29 for more information on the water filters.

SUPPLY INLET

The supply inlet fitting (Fig. 6) is located next to the water tank. The water supply used for waterblasting is connected at this point.

40K FILTER (40K UNITS ONLY)

On 40K units, a larger bag-type filter serves as the primary filter. A secondary cartridge-type filter is mounted next to the primary filter. Two pressure gauges are mounted on the filter to monitor differential pressure in the filter. A bleed valve is mounted on the filter cover to purge air from the housing.

Refer to "" on page 29 for more information on the water filters.

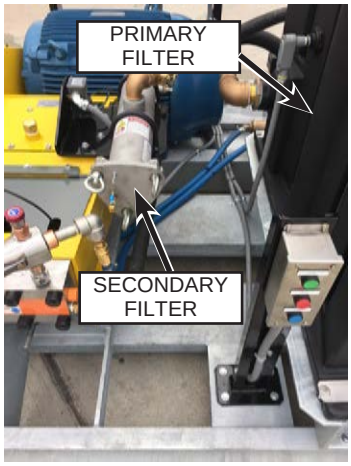


Fig. 7: Secondary Filter

WATER TANK DRAIN VALVE

The water tank is equipped with a drain at the bottom of the tank. A hose can be connected to the drain fitting in order to capture the water. Always drain the tank before moving the unit.

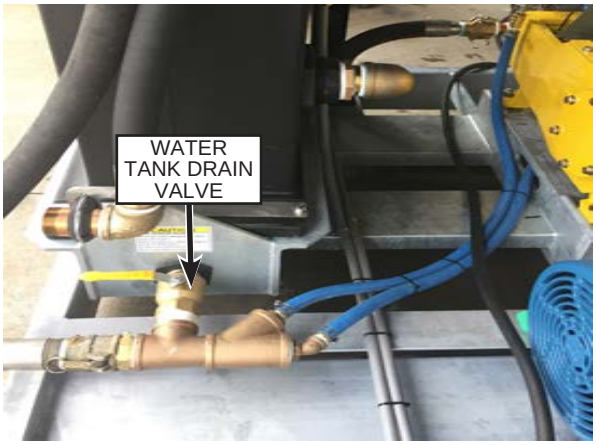


Fig. 8: Water Tank Drain Valve

BYPASS DRAIN

The bypass drain (Fig. 9) is connected to the bypass valve. Water will drain from the hose onto the ground during pump operation as explained in “Bypass Valve” on page 12. A longer hose can be plumbed to a tank for collection if required. An optional arrangement is available to return bypass water to the water tank. Contact Jetstream for details.

⚠ CAUTION

If a bypass discharge hose is connected back to the water tank or plumbed elsewhere, the hose must be properly sized to prevent excessive backpressure. Excess backpressure can cause vibration and pulsation in the system leading to damaged system components.

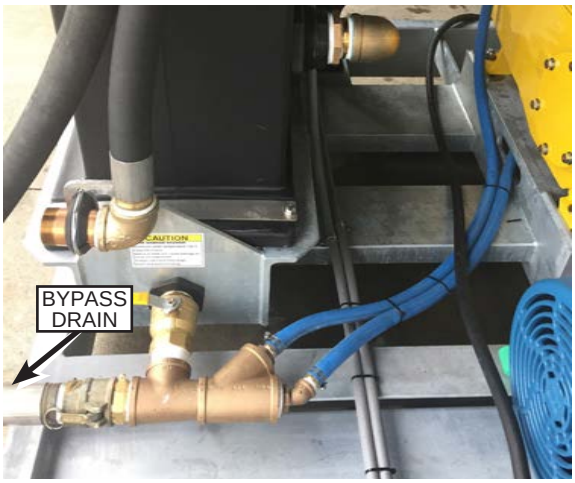


Fig. 9: Bypass Drain

CHARGE PUMP

A charge pump is mounted next to the electric motor. A 3 hp motor spins the pump. The charge pump is required to provide 40 - 50 psi (2.8 - 3.4 Bar) of water through the secondary filter on 40K equipped units. Other fluid end pressure ranges do not require secondary filtering.

Fig. 10: Charge Pump

⚠ CAUTION

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

FLUID END AND UNIT IDENTIFICATION

A rating plate (Fig. 11) 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.

Fig. 11: Fluid End Rating Plate

The serial number plate (Fig. 12) is attached to the front of the skid.

The serial number plate displays the model and serial number of the unit. Always refer to this serial number when contacting Jetstream for parts or service.

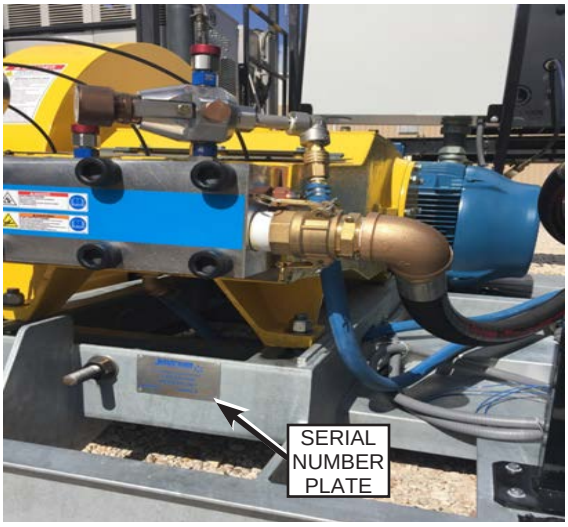


Fig. 12: Serial Number Plate

A pump plate (Fig. 13) is located at the top rear of the pump. The plate identifies the pump size and the year it was built.

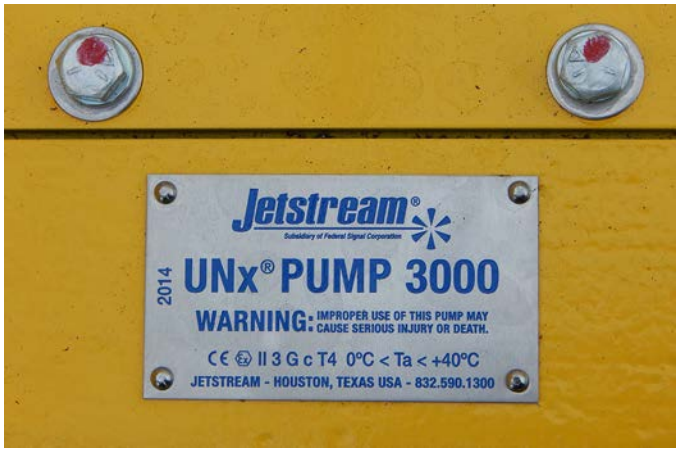


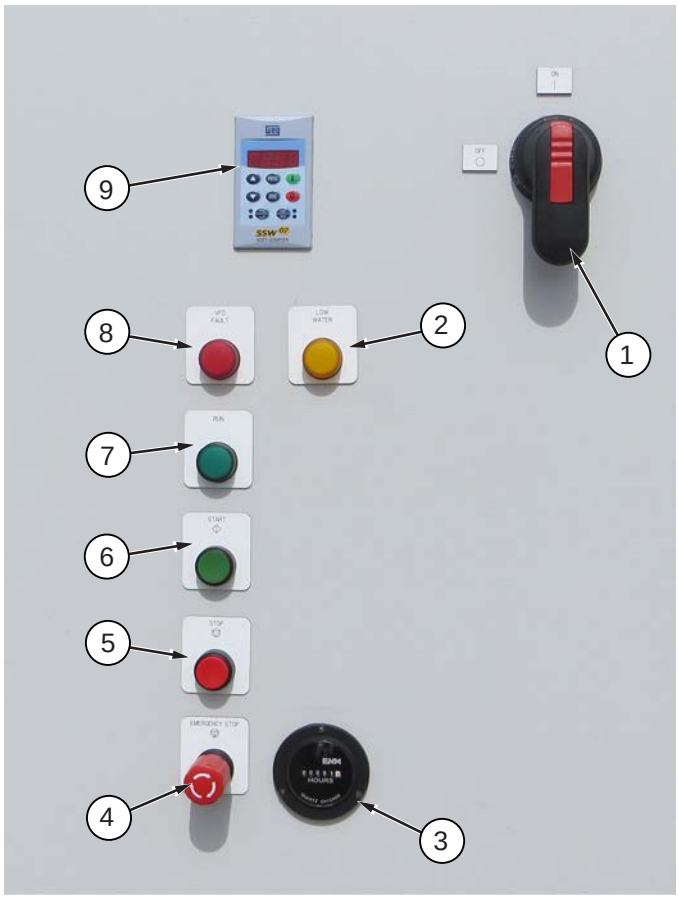
Fig. 13: Pump Plate

CONTROL PANELS

MAIN CONTROL PANEL

The main control panel (Fig. 14) is the entry route for the main power source to enter the electric unit. It also performs as the main power switch, transformer, distributor, main source of motor controls, and houses the LED fault indicators.

Note: The main control panel may vary per customer request. The typical panel is shown below.



1. On/Off Switch
2. Low Water LED
3. Motor Hour Meter
4. Emergency Stop Button
5. Stop Button
6. Start Button
7. Run LED
8. System Fault LED
9. Soft Start Keypad

Fig. 14: Main Control Panel

The main control panel consists of the following:

1. On/Off Switch: controls the core power source to operator the unit.
   The switch contains a pull out wing that allows the installation of a lock in case the unit is placed in lock-out / tag-out status. Refer to Fig. 15.
2. Low Water LED; indicates the water tank level is at a level that is not safe for operation.
3. Motor Hour Meter: monitors the motors run time.
4. Emergency Stop Button: immediately opens the main circuit and disconnects all operating power.
5. Stop Button: stops the electric motor, therefore ceasing drive power to the pump unit.
6. Start Button: starts the electric motor, therefore providing drive power to the pump unit.
7. Run LED: indicates the pump unit is operating.
8. System Fault LED: indicates a control fault or another issue with the controller.
9. Soft Start Keypad: used to set motor parameters, view codes, and control otherwise manual functions remotely.

Fig. 15: Lock-Out / Tag-Out

Soft Starter

Fig. 16: Soft Starter Keypad

The soft starter protects the electric motor from sudden influxes of power by regulating the large initial rush of current sometimes associated with motor startup. The starter gently graduates to full speed from startup, and and gradually stops the motor when the stop button is pressed.

The soft starter allows the operator to set control parameters, view codes, and control the unit remotely.

A separate manual accompanying the soft starter, from the manufacturer of the starter, contains directions on functionality and code checking.

REMOTE CONTROL PANEL

The remote control panel is located next to the pump manifold, opposite the main control panel, for easy access to the main controls: START, STOP, and an additional JOG button. The start and stop buttons on the remote control function the same as the start and stop buttons on the control panel. Jog is a button used for a brief operation of the unit. While the button is depressed, the unit will run. When the jog button is released, the unit will stop.

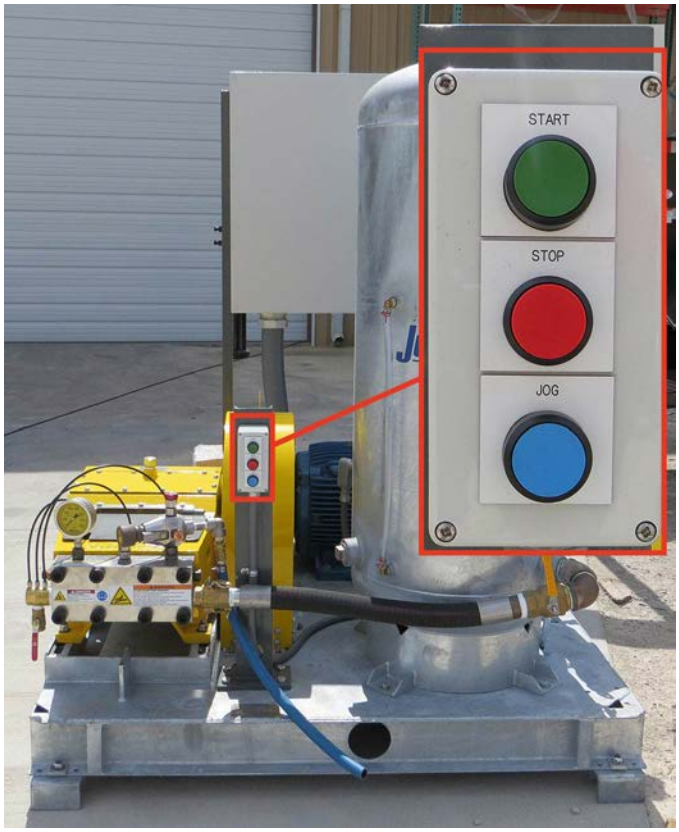


Fig. 17: Remote Control Panel

⚠ WARNING

Do not use the emergency stop button for daily operation of the unit. The start, stop and jog buttons are for normal operation. The emergency stop button kills all power to the drive, unlike the normal stop button which allows the drive to properly decelerate and perform the stop in a controlled manner.

Frequent use of the emergency stop button will cause damage and ultimately failure of the starter that will not be covered under warranty. Do not wire remote shutdowns into the emergency stop circuit. Contact the drive manufacturer for questions about wiring and operation.

MAINTENANCE

- Refer to the OEM manual for maintenance intervals and service instructions for the electric motor.

DAILY

1. **Check the Unit for Fluid Leaks** - Repair any leakage points found on the unit.
2. **Check the Water Filter Bag** - Inspect the bag for dirt and debris. Replace as necessary. Refer to “FILTER INSPECTION” on page 31 for instructions.
3. **Check Power End Oil Level** - Add oil as necessary. Refer to “Checking Power End Oil Level” on page 55 for instructions.
4. **Check Gland Nut Torque** - Ensure the gland nuts are properly tightened for operation. Refer to “Checking Gland Nut Torque” on page 39 for instructions.
5. **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 25.
6. **Inspect Rupture Discs** - Ensure the rupture discs are installed and inspect for damage. Refer to “Rupture Disc Inspection” on page 39. Verify extra replacement discs are on hand in case of a rupture.
7. **Secondary Filter** - Monitor the pressure on the secondary filter pressure gauge. The filter pressure must be monitored during operation to determine filter condition. Refer to “SECONDARY FILTER (40K OPERATION ONLY)” on page 31 and “FILTER CARTRIDGE REPLACEMENT” on page 32 for more information.

50 HOURS

1. **Check Pump Drive Belt Tension** - Ensure the belts are properly tensioned per the tension decal under the belt cover. Refer to “Checking Belt Tension” on page 56.
2. **Uni-Valve Inspection** - Inspect the seals for damage and the valve seats for deposits, jetting or other damage. Refer to “Valve Inspection” on page 52.
3. **Inspect Pump Breather** - Remove the breather and inspect for dirt and debris. Clean or replace as necessary.

100 HOURS

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

500 HOURS

1. **Regular Power End Oil Change** - Change the power end oil. Refer to “Changing The Power End Oil” on page 55.
2. **Belt Inspection** - Inspect the belts for cracks, damage, glazing or any other defect. Replace as necessary. Replace the belts as a set and adjust the new belts as outlined in “Adjusting Belt Tension” on page 56.
3. **Regular Stuffing Box Lubrication Check** - Remove stuffing boxes, clean power frame bore, lubricate with anti-seize or petroleum jelly, and replace stuffing boxes.

LONG TERM STORAGE

Refer to “LONG TERM STORAGE PROCEDURE” on page 89.

⚠ WARNING

If no power is supplied to the inverter for a long time, the performance of its large-capacity electrolytic capacitor declines.

When leaving the inverter unused for a long time, supply it with electricity once every two years, for 5 hours or more each, to recover the performance of the large-capacity electrolytic capacitor.

Also check the function of the inverter. It is advisable not to supply the commercial power directly to the inverter but to gradually increase the power supply voltage with a transformer, et

WINTERIZING THE UNIT

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, the water needs to be drained from all hoses, charge pump and tanks, and anti-freeze added to the stuffing boxes.

If the unit is to be idle overnight or for any extended period of time that would allow freezing in the pump or piping, the following freeze protection is recommended for the fluid end.

NOTICE

Some of the images shown in this procedure were taken from a diesel unit, however the instructions apply to electric units.

1. Close the water tank shut-off valve.
2. Drain the manifold of water and close the drain.
3. Disconnect the water supply suction line and high pressure discharge hose from the manifold.
4. Assemble pipe fittings into a funnel assembly as shown in (Fig. 18).
5. Install the assembly on the suction side of the manifold.

Fig. 18: Funnel Assembly Installation

6. Pour a glycol based anti-freeze solution into the funnel as shown in (Fig. 19). Approximately 0.5 gal. (2 L) of anti-freeze is required.

Fig. 19: Adding Anti-Freeze

7. Before starting the pump, 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. Jog the pump.
9. Watch the plungers move back and forth slowly until anti-freeze is discharged from the manifold port as shown in (Fig. 20).

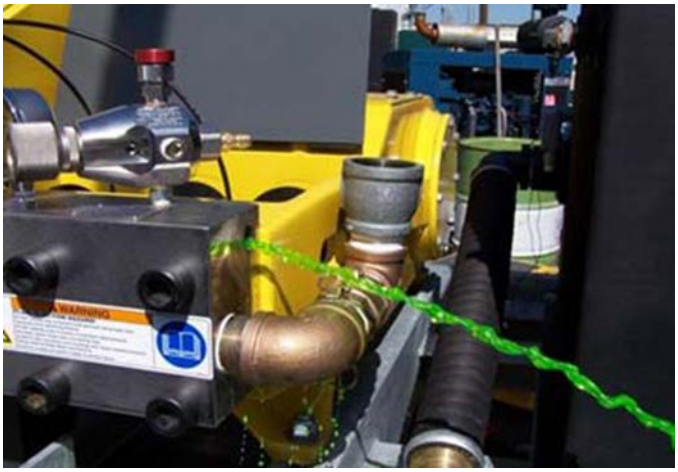


Fig. 20: Anti-Freeze Discharge

10. Once anti-freeze has been discharged from the discharge port, shut off the pump.
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.

13. (Charge pump-equipped units) Disconnect the discharge hose (Fig. 21) and inlet hose from the charge pump. Drain the water from the hoses and reconnect.

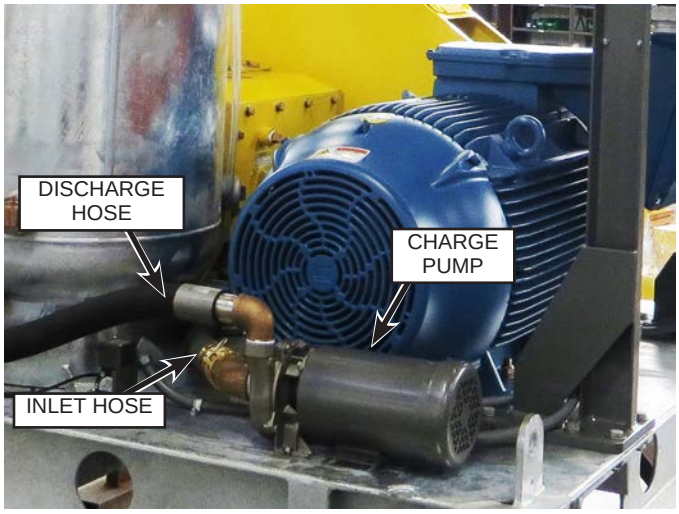


Fig. 21: Charge Pump

14. Rinse the anti-freeze completely off of the unit.
15. Ensure the supply water piping system is protected against freezing.

Jetstream®
Subsidiary of Federal Signal Corporation

OPERATION

PREPARING THE UNIT AFTER PURCHASE

Remove All Shipping Items

1. Remove the accessory package (Fig. 22) that is strapped to the unit.

Fig. 22: Package Removal

2. Remove the pump wrench (Fig. 23) from the rod box.

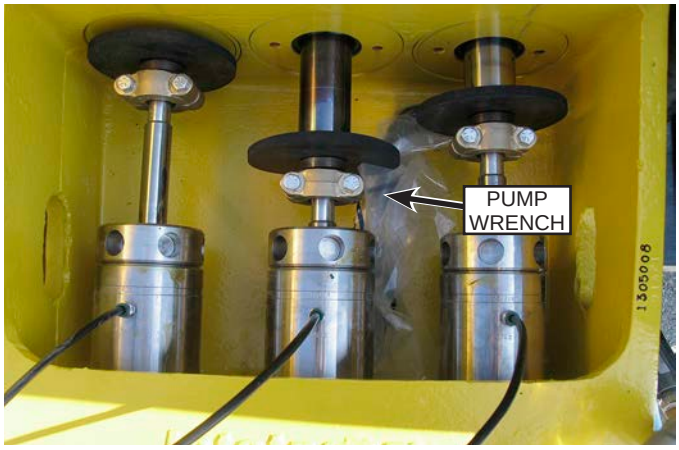


Fig. 23: Pump Wrench Removal

3. Inspect the unit and report any damage to your Jetstream representative.

RECOMMENDED EQUIPMENT

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

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

NOTICE

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

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

⚠ WARNING

Operating without any of these components can be unsafe and lead to equipment damage.

NOTICE

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

Hose and Water Supply Requirements

- The water supply hose inside diameter must be large enough to supply 150% of the unit's maximum flow requirements.
- The inside diameter of the high pressure discharge hose will be determined by the necessary length of hose and the amount of flow passing through the hose length. Contact your Jetstream representative for proper hose sizing.
- Supply pressure must be no greater than 100 psi (6.9 bar). If pressure exceeds 100 psi (6.9 bar), install a pressure regulator large enough to meet flow requirements. Regulators are available from Jetstream.

PREPARING FOR START-UP

1. Place the skid on a hard, level surface.
2. Check the power source and wiring.
3. Check the oil level in the pump
4. Inspect the filter bags. Inspect the secondary filter cartridge if operating at 40K.
5. Check the tightness of the gland nuts on each stuffing box.
6. Check the belt tension.
7. Inspect all equipment. Ensure that every piece of equipment in the pressure circuit is properly rated for the intended operating pressure. Replace any component that isn't properly rated.
8. Connect the water supply hose and verify the drain valve is closed.
9. Open the water supply valve and allow the tank to fill. Any valves between the water tank and the pump must be open.
10. Install the discharge hose onto the fitting on the manifold along with a hose safety check. Do not install a pressure device at this time.

⚠ WARNING

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

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

OPERATING THE PUMP

ENERGIZING THE UNIT

1. Verify the power source is on.
2. 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 motor to start without a load from the pump.
3. Move the power switch on the control panel to the ON position.

Fig. 24: Power Switch in ON Position

FLUSHING THE SYSTEM

Flushing the system will prevent any debris from clogging the cleaning nozzles and valves which will cause excessive pressure in system. Nozzles must be removed from all equipment during flushing.

1. Open the manifold drain valve. Allow water to drain from the valve for approximately 5-10 seconds. (Fig. 25).

Fig. 25: Flushing the Manifold

⚠ WARNING

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

2. Hold the discharge hose stationary as shown in Fig. 27.

3. With the manifold free of debris, start the pump by pressing the Start button (Fig. 26) on the remote control panel or the Start button on the main control panel.

Fig. 26: Remote Control Station

4. Turn the bypass valve clockwise just enough to obtain a generous flow of water through the discharge hose. Allow the hose to flush for about 30 seconds.

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

Fig. 27: Flushing the Discharge Hose

5. Decrease flow to the hose by fully opening (counter-clockwise) the bypass valve. Some water will continue to flow from the hose.
6. Press the Stop button on the remote control panel or the Stop button on the main control panel.
7. Connect the control gun (or other equipment being used) to the discharge hose.
8. With the hose secure and equipment controlled by another operator, start the pump.
9. Turn the bypass valve clockwise to increase flow through the discharge device(s). Allow the control gun to flush for about 30 seconds.
10. Reduce the discharge flow by fully opening the bypass valve.
11. Press the Stop button to stop the pump.
12. The nozzles can now be installed on the discharge device(s).
13. Before waterblasting, adjust the lubrication line needle valves, if equipped. Refer to “Checking The Water Lubrication System” on page 25.

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. With the pump operating, look into the rod box and verify that lubrication water is flowing from around the plunger opening of the stuffing box (Fig. 28) and down the back of the gland nut.

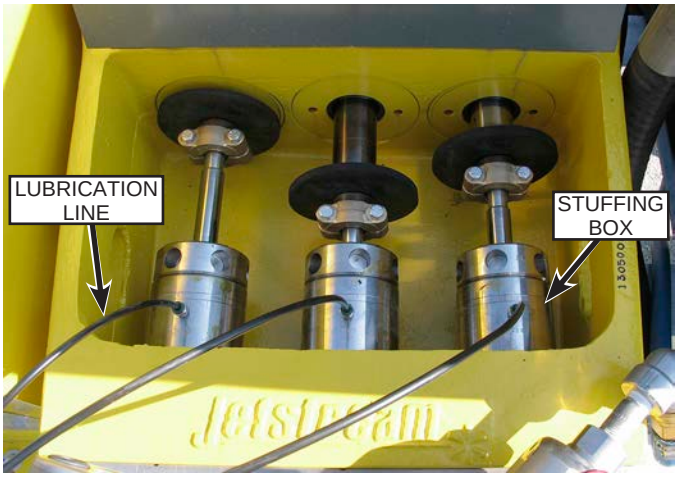


Fig. 28: Checking Lubrication

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 (40K fluid ends). On 15K/20K fluid ends, remove the blockages from the lubrication system. Proceed to the next step for needle valve adjustment.

4. Adjust the needle valves (Fig. 29) to increase the water flow. Turning the needle valves counter-clockwise will increase flow. Proper flow is achieved when a small stream (more than a drip) is visible without splashing past the deflectors onto the pony rods.

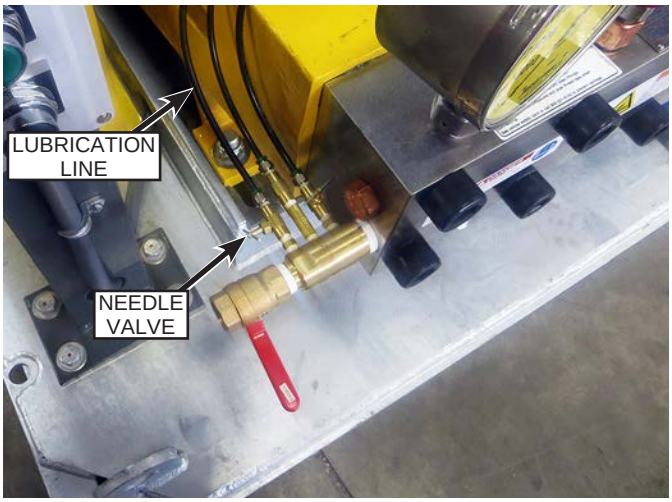


Fig. 29: Needle Valve Adjustment (40K)

5. Once properly adjusted, system pressure can be raised for waterblasting.

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 and lances 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.

Open lengths of high pressure hose must never be used for anything but purging at low pump speed and zero pressure.

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.

NOTICE

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" on page 26 for instructions.

1. Start the motor. The motor will operate at 1800 rpm @ 60 Hz or 1500 rpm @ 50 Hz. Refer to the soft start panel's operating manual for instructions on changing motor speed.

Fig. 30: Soft Start Panel

2. Slowly turn the bypass valve clockwise to start closing the bypass and build pressure.

NOTICE

Always blast with the bypass valve fully closed. This will ensure the most efficient operation with all water being utilized. If bypassing flow is necessary, the bypass valve cartridge and the bypass valve diffuser will wear and these parts may need replacing regularly.

BREAKING IN NEW PACKING

NOTICE

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

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

1. Start the motor.

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.

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 (Fig. 31) 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.

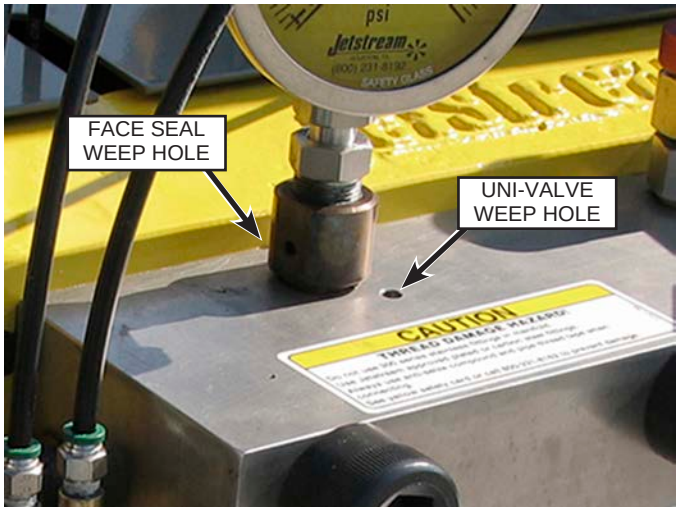


Fig. 31: Weep Holes

If water is leaking from one of the rectangular weep holes, the seal that seals the uni-valve to the stuffing box has failed. On 15K and 20K manifolds, the O-ring (Fig. 32) on the valve makes that seal. On 40K manifolds, there is no O-ring on the valve to seal the manifold. The stuffing box contains a face seal to seal this connection.

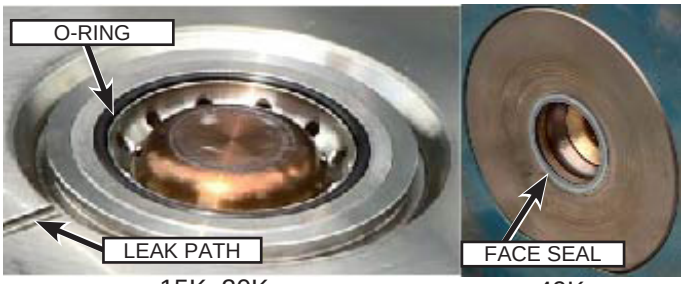


Fig. 32: Uni-valve to Stuffing Box Seals

NOTICE

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 the round weep holes (Fig. 31), the outer O-rings (Fig. 33) on the valves have failed. *Note: The larger O-ring will leak to the rectangular weep hole.*

Fig. 33: Outer O-rings

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

⚠ 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” on page 52 for instructions.

STOPPING THE UNIT

1. Open the bypass valve by turning counter-clockwise four full turns to relieve the system pressure. Monitor the gauge to ensure system pressure is at zero.
2. Press the Stop button on the remote control panel.
3. Turn the main power switch to the OFF position.

WATER TANK AND FILTRATION

WATER QUALITY REQUIREMENTS

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

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

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

Recommended water quality levels:

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

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

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

WATER TANK WITH FILTERS

The 100 gal. (440 L) water tank houses two filter bags (Figure 34) that filter supply water. Check the filter bags daily.

A float valve assembly automatically shuts off the water supply into the tank when the tank is full. When the float rises with the water level, a shut off valve attached to the float will close off the supply water. The assembly is non-adjustable and must be replaced as a unit.

An overflow port (elbow fitting) is located at the top of the tank should the float fail.

⚠ *WARNING*

Do not plug or plumb this port. This port acts as a vent and must remain open.

A low level switch (Figure 35) mounted on the back of the tank shuts off the motor in the event that the tank runs low on water. The control panel will display a fault light if this occurs.

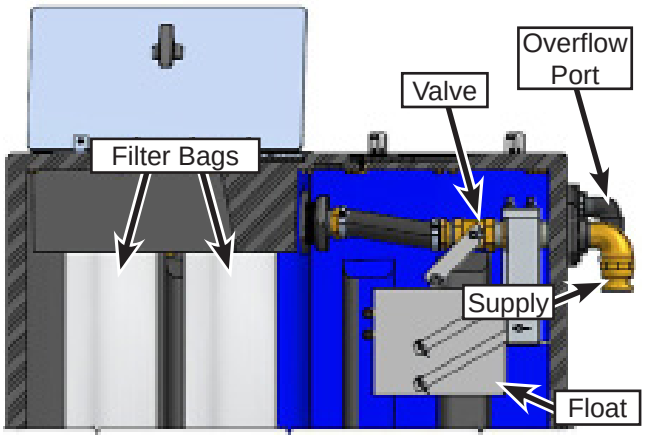


Figure 34: Water Tank Cutaway.

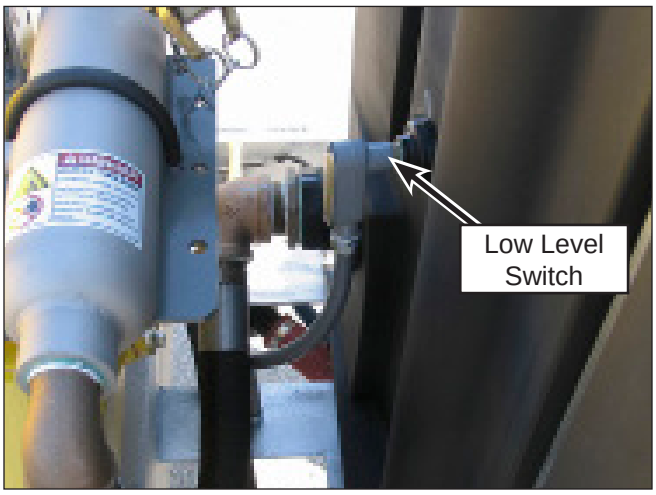


Figure 35: Low Level Switch.

FILTER INSPECTION

1. Rotate the handle (Figure 36, A) on the filter cover (Figure 36) and swing the cover open.
2. Unscrew the wing screw (Figure 37) that holds the filter retainer plate in place.
3. Remove the filter retainer plate.
4. Lift the filter bags (Figure 38) from the tank and inspect for debris. Replace as necessary.

ATTENTION

Filter bags are not washable. Any attempt to wash or flush a bag for reuse could damage the bag. This may allow debris past the filter and into the valves causing damage.

SECONDARY FILTER (40K OPERATION ONLY)

The secondary filter, or polishing filter, is used for 40K operation only. When operating at 40K, monitor the filter pressure gauge (Figure 39) for an indication of filter condition. During normal operation, the pressure gauge should be within the 30 to 40 psi (2 to 2.75 bar) range. When differential pressure inside the filter housing between the clean side and the dirty side drops approximately 7 to 10 psi (0.48 to 0.69 bar), the pressure switch on the filter housing will trip and the motor will shut off to protect the unit from damage. Replace the dirty filter cartridge if this occurs.

ATTENTION

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

It is important to know the condition of your filter cartridge. Standard units come with a pressure gauge on the filter. In order to monitor the condition of the filter it is important to note the motor operating speed and housing pressure when the filter is first changed. Refer to “FILTER CARTRIDGE REPLACEMENT” on page 32 for more information.

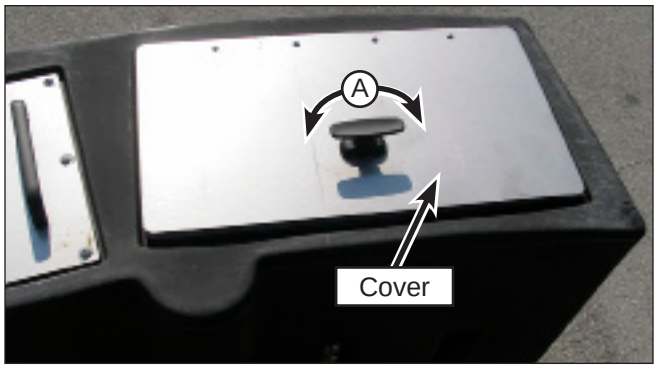


Figure 36: Filter Cover

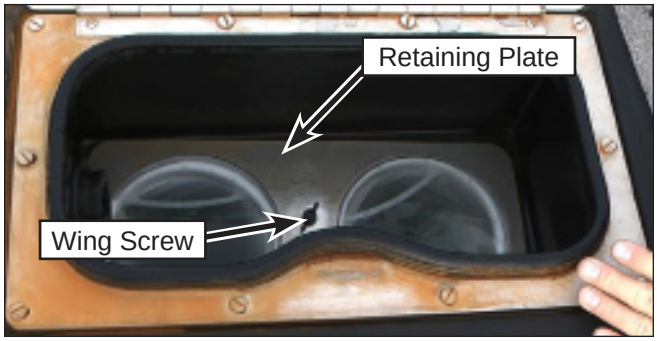


Figure 37: Retainer Plate Removal.

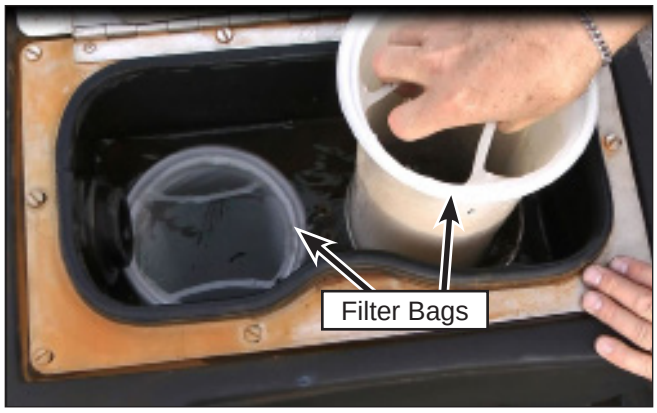


Figure 38: Filter Bag Removal.

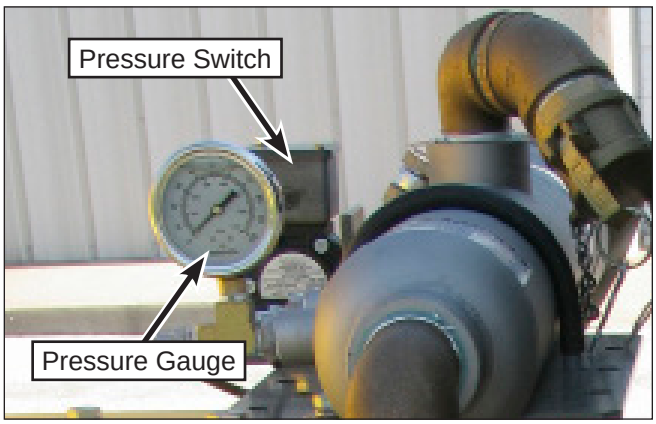


Figure 39: Secondary Filter Assembly.

FILTER CARTRIDGE REPLACEMENT

1. Relieve pressure from the housing using the bleed valve then loosen the three eye-nuts (Figure 40) on the filter cover.
2. Slowly open the cover and capture the spring (Figure 41) and spring keeper.
3. Remove the filter cartridge.
4. Install the new filter cartridge onto the guide rod. Ensure the guide rod is correctly seated into the bottom of the housing.
5. Inspect the O-ring and install a new one if necessary.
6. Place the spring keeper and spring into place on the end of the filter cartridge.
7. Move the filter cover into position and tighten the eye-nuts.
8. Prepare the pump for operation and start the unit. Start a typical blast operation and record the gauge pressure on the secondary filter.
9. Save this record for monitoring the status of the secondary filter. Monitor the pressure gauge as more hours of operation are accumulated on the filter cartridge. When the pressure on the filter gauge has dropped approximately 7 to 10 psi (0.48 to 0.69 bar) (with the unit operating at the same rpm as earlier recorded), the filter must be replaced.

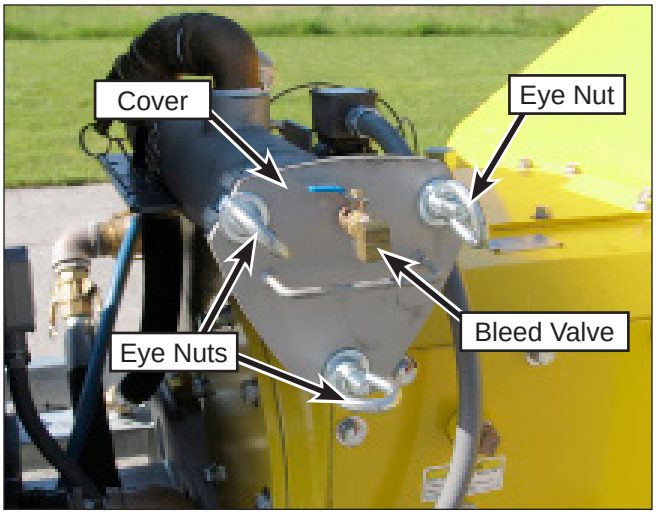


Figure 40: Filter Cover.

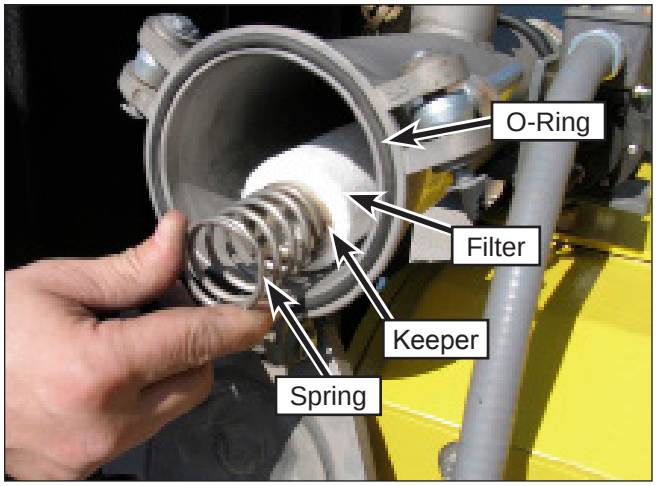


Figure 41: Cartridge Removal.

SWITCH ADJUSTMENT

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

UNI-VALVE LIFE

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

Inspect uni-valve seats regularly to monitor condition and lap the valve seats when necessary. Refer to "Valve Lapping" on page 64 for lapping instructions.

PRESSURE CONVERSION

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

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

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

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

⚠ WARNING

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

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

CONVERTING A PUMP

NOTICE

The images shown in this procedure were taken from a diesel unit, however the procedure is the same for electric units.

1. Relieve pressure from the pump and shut of the electric motor.
2. Turn off the water supply and drain the water tank.
3. Disconnect the bypass drain hose (Fig. 42) and the supply coupling from the manifold.

Fig. 42: Line Removal

4. Open the rod box cover (Fig. 43) and disconnect the lubrication lines from the stuffing box fittings.

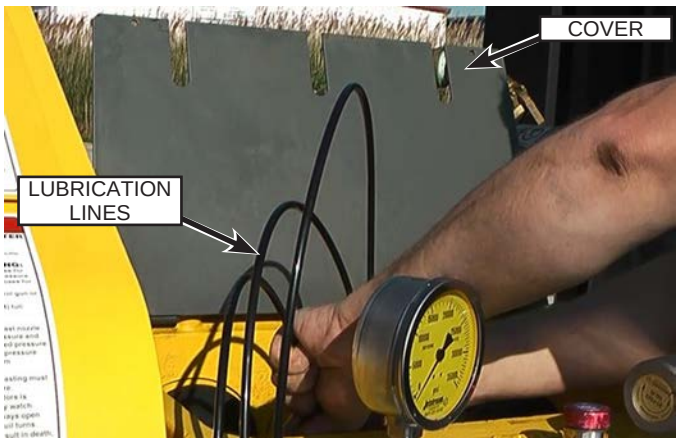


Fig. 43: Disconnecting Lubrication Lines

5. Remove the cotter pin (Fig. 44) from the hinge rod and remove the rod.

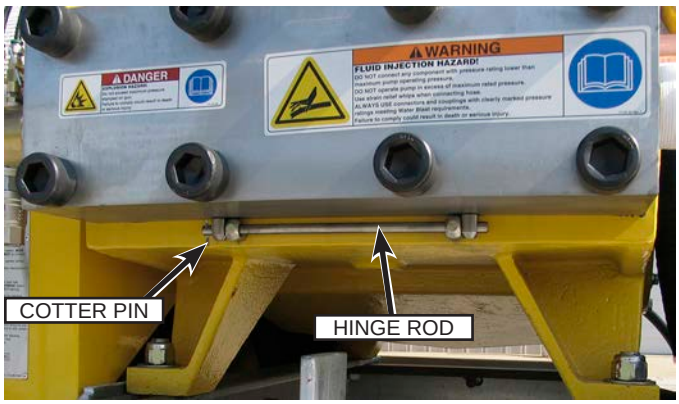


Fig. 44: Hinge Rod

6. Remove the top manifold bolts (Fig. 45) at each corner.

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

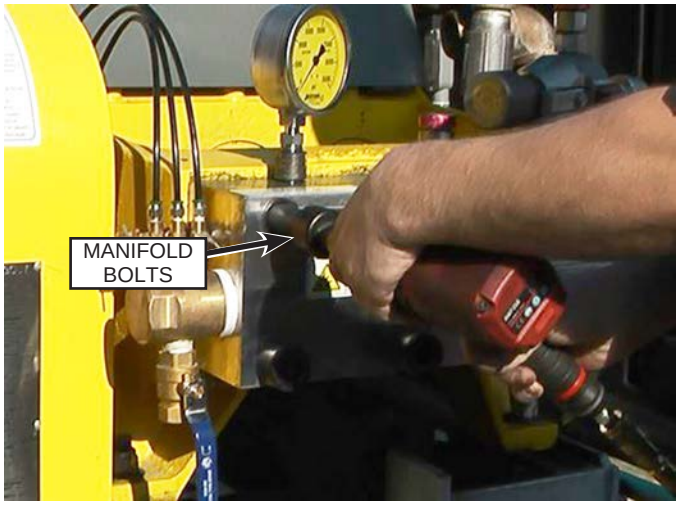


Fig. 45: Manifold Bolt Removal

7. Install manifold mounting studs (Fig. 46) into the two open holes to allow for easier installation of the new manifold.

Note: Manifold mounting studs can be purchased from Jetstream. (p/n 54261)

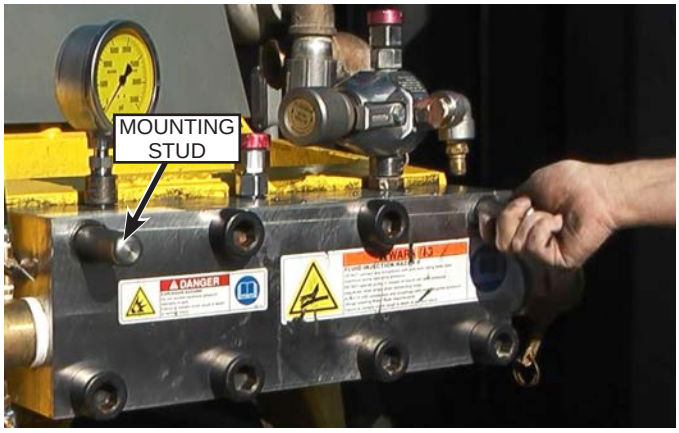


Fig. 46: Manifold Mounting Stud Installation

8. Continue removing the remaining manifold bolts.
9. Once all of the bolts are removed, lift the manifold off the pump using two people as shown in (Fig. 47). The weight of the manifold is approximately:

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

Fig. 47: Manifold Removal

10. Remove the water lubrication fitting (Fig. 48) from each stuffing box.

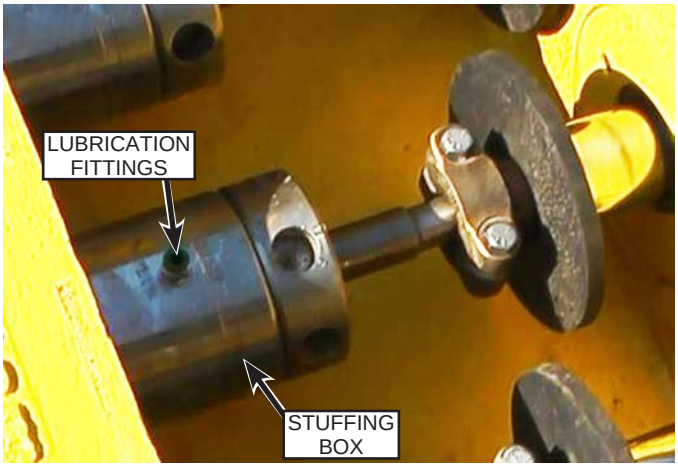


Fig. 48: Lubrication Fittings

11. Remove the two bolts that secure each plunger coupling (Fig. 49) to the plungers and remove the three couplings. The coupling halves are matched and must be kept together.

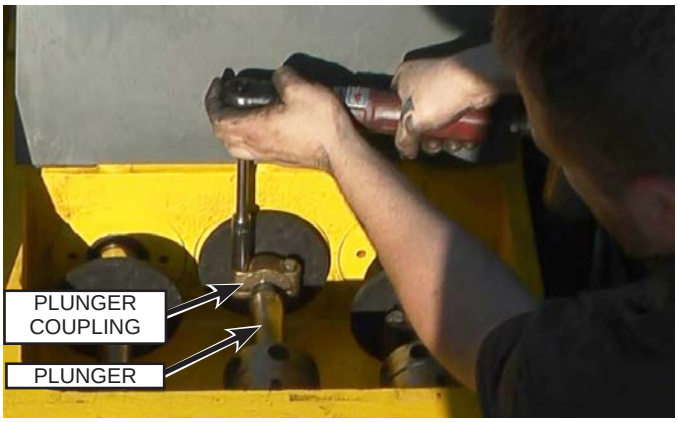


Fig. 49: Plunger Coupling Removal

12. Pull each stuffing box from the pump case. Refer to Fig. 50.

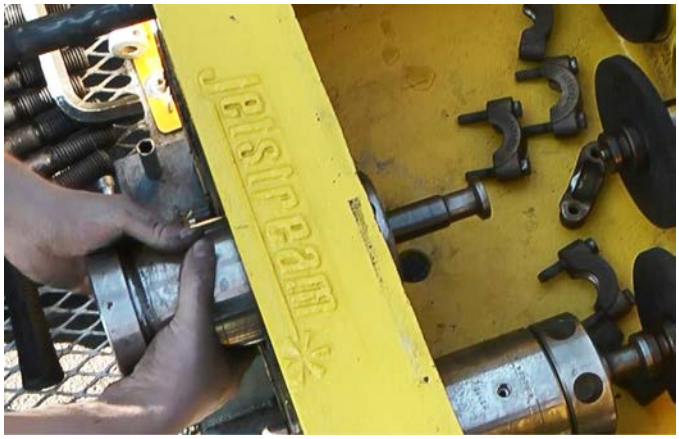


Fig. 50: Stuffing Box Removal

13. Clean the stuffing box bore thoroughly and apply petroleum jelly or Anti-Seize to the bores.

NOTICE

Apply petroleum jelly or Anti-Seize 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 (Fig. 51) on each plunger and secure with the two bolts. Tighten the bolts to 20 ft.-lb.(27 N·m).

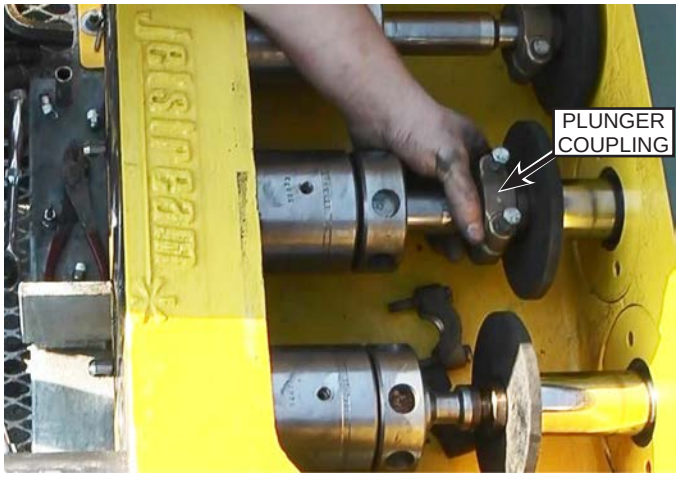


Fig. 51: Plunger Coupling Installation

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). Refer to Fig. 52. Hit the wrench about three times using moderate power. This should supply sufficient torque on the nut.

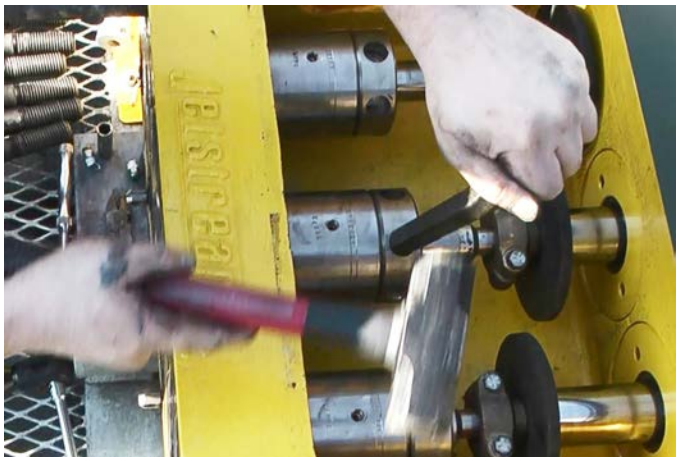


Fig. 52: Tightening the Gland Nuts

17. Apply Teflon tape to the threads of the lubrication line fittings (Fig. 53). Install the fittings onto the stuffing boxes.

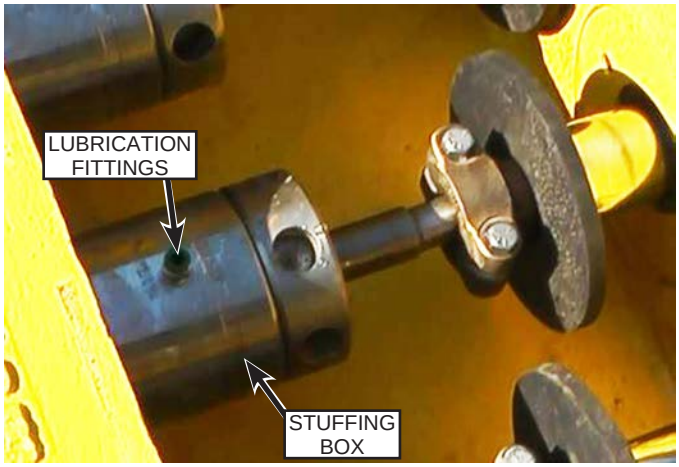


Fig. 53: Lubrication Line Fittings

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 (Fig. 54).

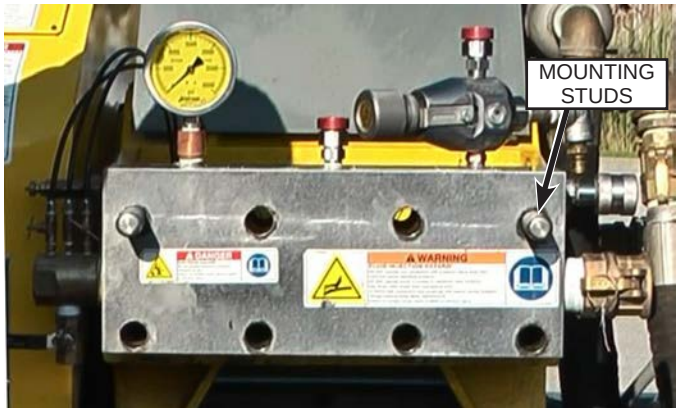


Fig. 54: Manifold on Mounting Studs

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. Slide the manifold away from the powerframe (or adapter plate) a few inches (Fig. 55). This will allow room to adjust the threaded trunnions in the bottom of the manifold.

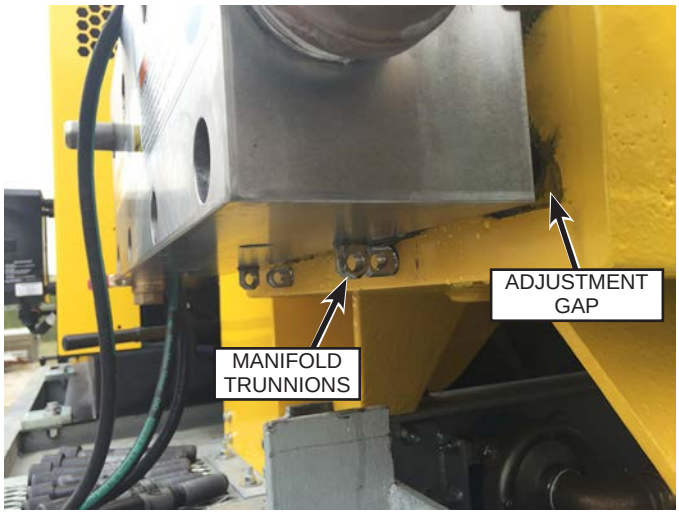


Fig. 55: Manifold in Adjustment Position

b. Screw both manifold trunnions (Fig. 55) in completely and then back both out 2½ turns. Slide the manifold back against the powerframe (or adapter plate).

c. To install the hinge rod (Fig. 56), 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.

Fig. 56: Hinge Rod Installation

d. 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 (Fig. 57) in the open holes and hand-tighten.

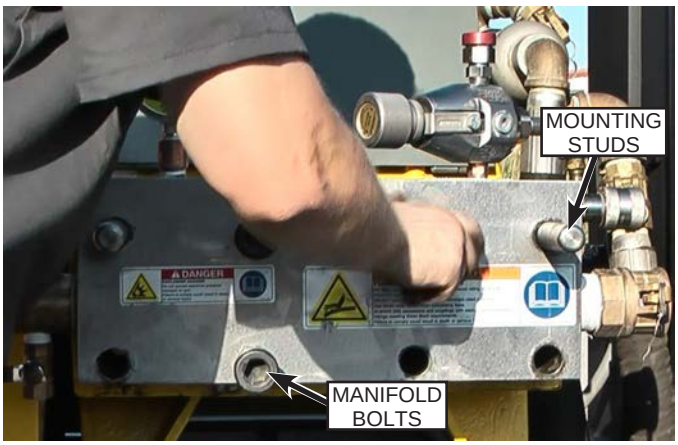


Fig. 57: Manifold Installation

22. Remove the manifold mounting studs and install the remaining two bolts. Tighten all of the bolts in a crisscross sequence starting with the center bolts as shown in (Fig. 58). Proper torque is 350 ft.-lb. (470 N·m).

Fig. 58: Tightening Sequence

23. Connect the water lubrication lines (Fig. 59) to the fittings on the stuffing boxes.

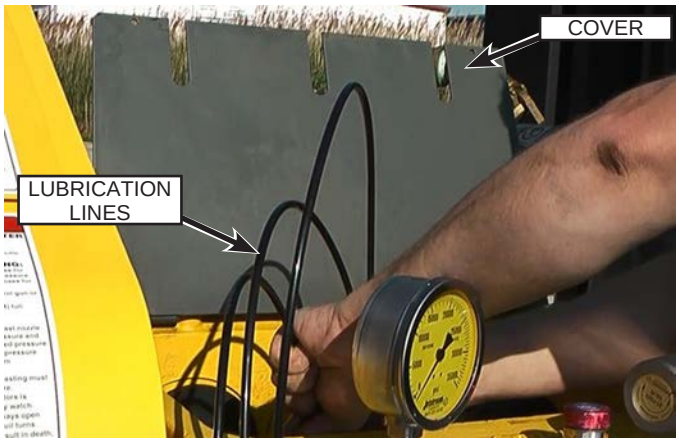


Fig. 59: Connecting Water Lubrication Lines

24. Connect the supply coupling (Fig. 60) and the bypass hose to the manifold.

NOTICE

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

Fig. 60: Hose Connections

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 25 for instructions.
27. If new packing was installed, break in the packing as outlined in “Breaking In New Packing” on page 26.

Jetstream®
Subsidiary of Federal Signal Corporation

FLUID END SERVICE

CHECKING MANIFOLD BOLT TORQUE

Verify the head bolts are properly tightened. Check the bolt torque in a crisscross sequence starting with the center bolts as shown in Fig. 61. Proper torque is 350 ft.-lb. (470 N·m) which can be achieved with a few hammer strikes on the pump wrench.

Fig. 61: Tightening Sequence

CHECKING GLAND NUT TORQUE

1. Open the rod box cover.
2. Place the long end of the pump wrench in one of the gland nut holes.
3. Use a 5 lb. (2 kg) hammer to hit the wrench in the direction as shown in (Fig. 62) to tighten the gland nuts. Hit the wrench about three times using moderate force. This will supply sufficient torque on the nut.

Fig. 62: Tightening Gland Nut

4. Repeat for the remaining nuts.
5. Close the rod box cover.

NOTICE

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

RUPTURE DISC INSPECTION

1. Use an adjustable wrench to remove the cap (Fig. 63) from the rupture disc assembly.

Fig. 63: Housing Removal (15K Manifold Shown)

2. Remove the rupture disc from the base and inspect.

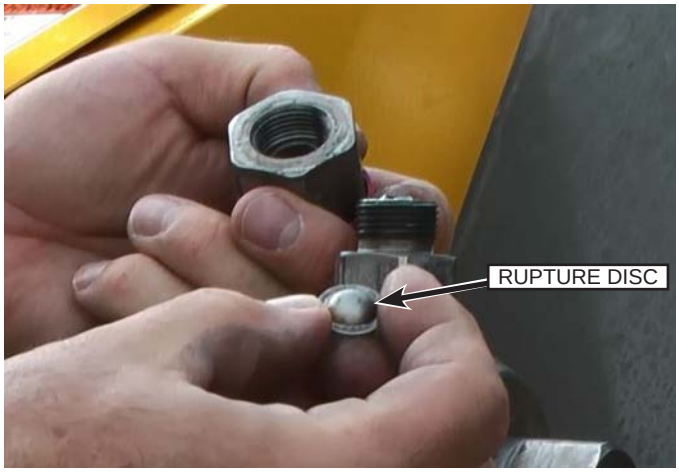


Fig. 64: Disc Removal

3. Verify a disc is installed and has not been damaged. Replace as necessary.

NOTICE

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

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

PACKING REPLACEMENT

Removal

1. Relieve pressure from the pump and turn off the electric motor.
2. Turn off the water supply and drain the water tank.
3. Open the rod box cover.
4. Disconnect the water lubrication lines.
5. Position the plunger to be serviced so that it is at bottom dead center (pony rod is fully retracted towards crankshaft). Pull the drive belts to rotate the pump as shown in Fig. 65.

⚠ WARNING

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

Fig. 65: Rotating the Belt Drive

6. Insert the rounded end of the pump wrench (Fig. 66) 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.

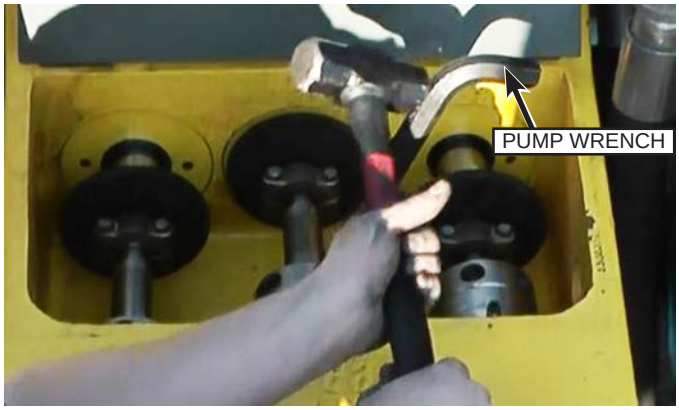


Fig. 66: Loosening Gland Nut

7. Remove the two bolts that secure the plunger coupling (Fig. 67) to the plunger and remove the coupling. Push the plunger into the stuffing box for clearance.

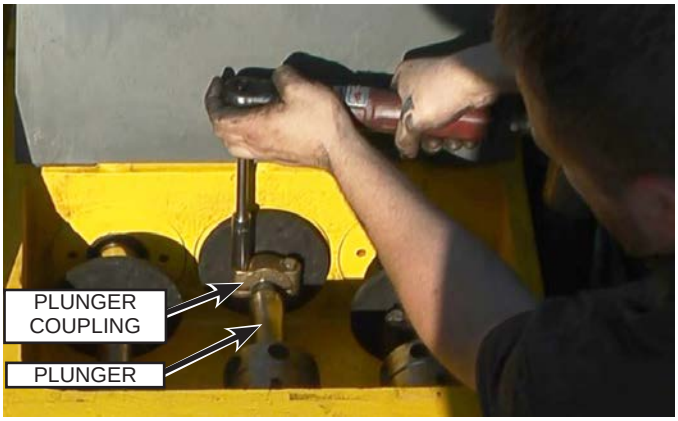


Fig. 67: Plunger Coupling Removal

8. Remove the gland nut and plunger from the stuffing box. It may require effort to wiggle the packing out by moving the plunger from side to side and up and down.

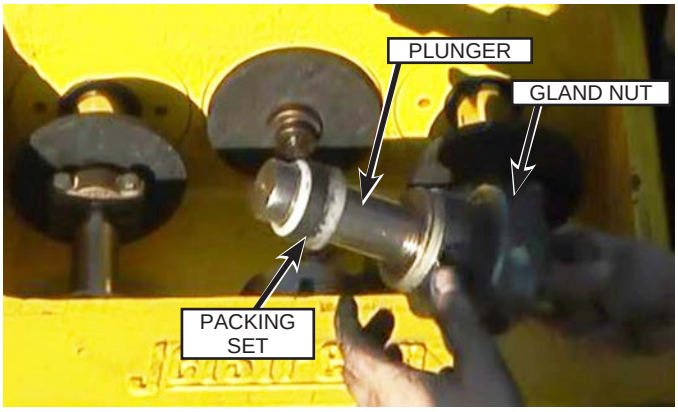


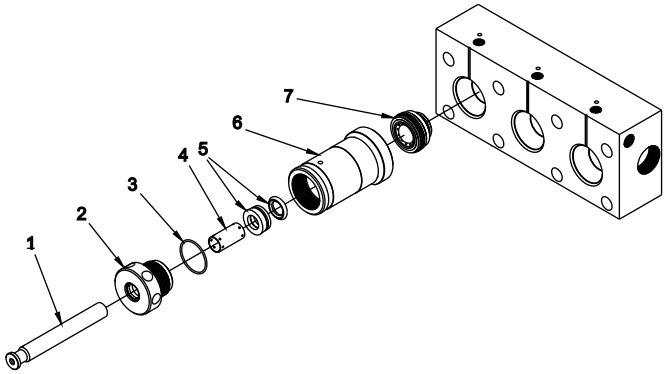
Fig. 68: Packing Removal

9. Remove the packing set (Fig. 68).
10. Remove the plunger and guide bushing (Fig. 69) from the gland nut and inspect. The guide bushing may be stuck and require some force to remove. Use a tool in the cutout (Fig. 70) to push the bushing out. Use caution to avoid damaging the gland nut.

Note: On 40K fluid ends, the brass sleeve (Fig. 72) inside the stuffing box does not need to be removed unless the plunger shows evidence of rubbing on the sleeve.

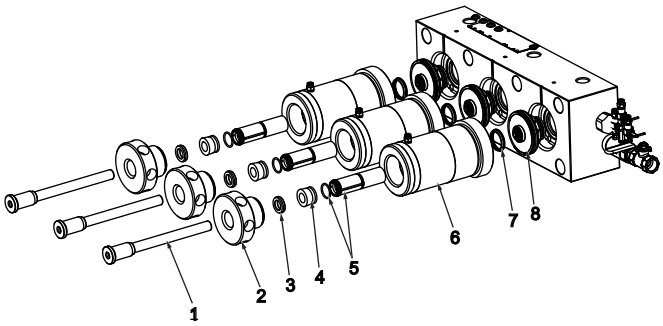
11. Remove the O-ring (Fig. 69) from the gland nut.
12. Repeat the previous steps for the remaining stuffing boxes if packing is to be replaced.

Fig. 69: Guide Bushing Removal (15K/20K Gland Nuts)



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

Fig. 71: 15K/20K Fluid End (Not All Components Shown)



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

Fig. 72: 40K Fluid End (Not All Components Shown)

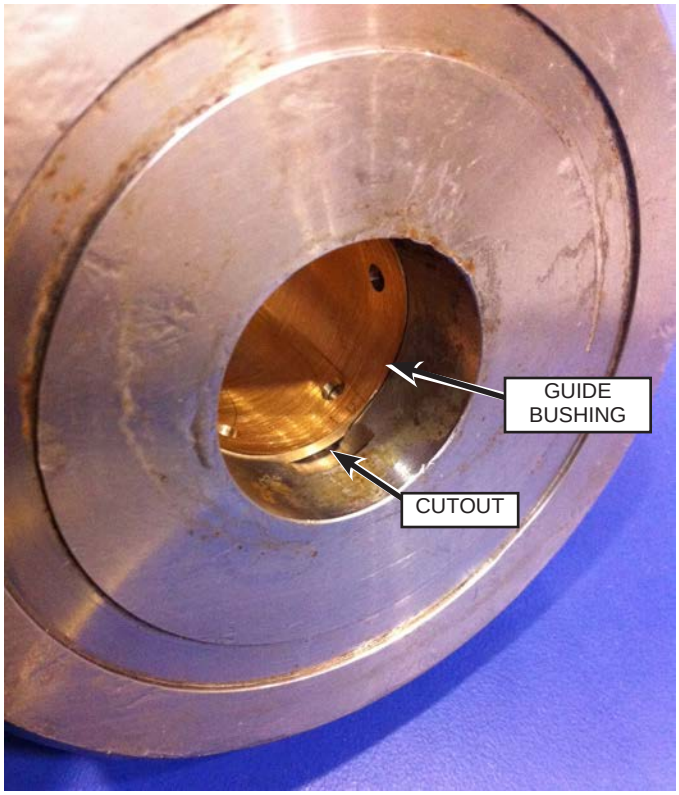


Fig. 70: Stuck Bushing

Inspection

1. Inspect the plunger for scratched or deep scores. Discard damaged plungers.
2. On 40K units, measure the diameter of the guide bushing. Refer to Dimension A in Fig. 73. If the diameter exceeds the Dimension A specification listed in “Table 1”, replace the bushing. If the bushing shows scoring or if the edge is chipped, replace the bushing.

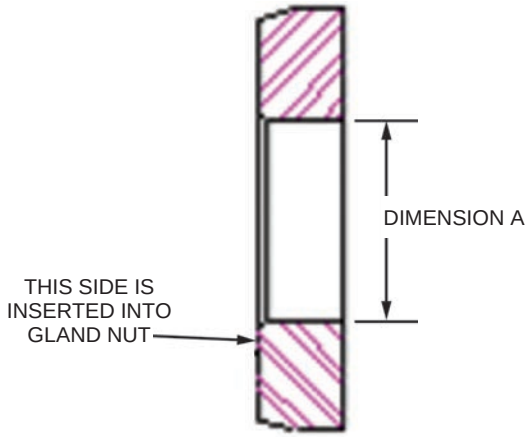


Fig. 73: Guide Bushing Check (40K Only)

Table 1

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

Installation

1. Install a new O-ring (Fig. 74) onto the gland nut.
2. Install the guide bushing (Fig. 74) and plunger into the gland nut.

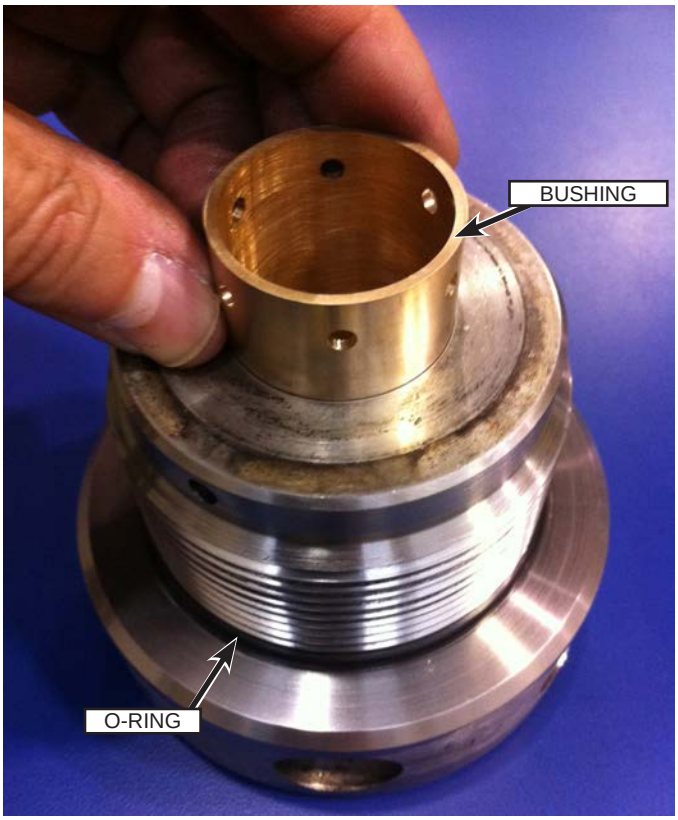


Fig. 74: Guide Bushing Installation

3. Place the new packing and guide bushing onto the plunger. Orient the packing as shown in (Fig. 71) for 15K/20K and (Fig. 72) for 40K.
4. Lubricate the gland nut with anti-seize compound. Apply the compound to the threads and on the small face that contacts the inside of the stuffing box as shown in Fig. 74. Place the assembly into the stuffing box. Hand-tighten the gland.

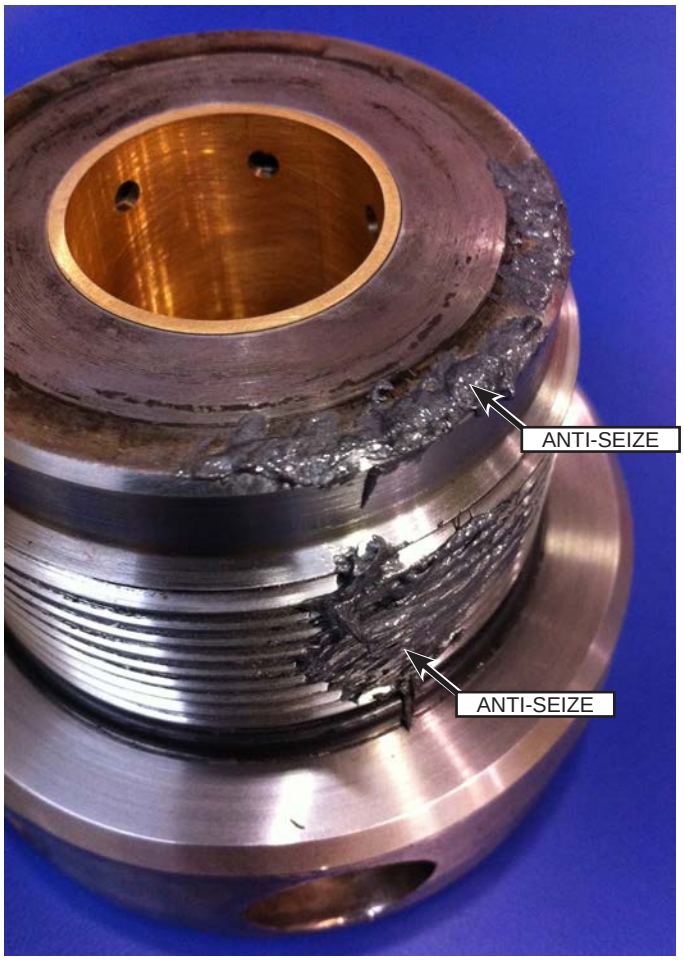


Fig. 75: Applying Anti-Seize

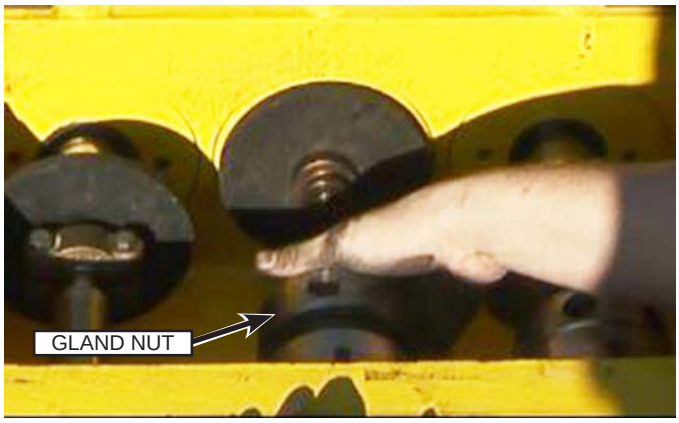


Fig. 76: Gland Installation

5. Pull the plunger (Fig. 77) 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. Place the plunger coupling into position and install the coupling bolts. Tighten the bolts to 20 ft.-lb. (27 N·m).

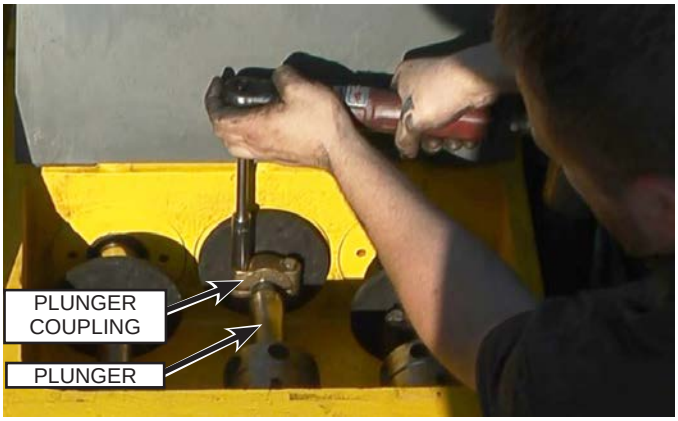


Fig. 77: Plunger Coupling Installation

6. 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.

Fig. 78: Tightening the Gland

7. Repeat the previous steps for the remaining stuffing boxes.
8. Connect the water lubrication lines and close the rod box cover.
9. 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 26 for the proper break-in procedure.

UNI-VALVE SERVICE

Removal

1. Relieve pressure from the pump and shut of the electric motor.
2. Turn off the water supply and drain the water tank.
3. Disconnect the bypass drain hose and the supply coupling from the manifold.

Fig. 79: Line Removal

4. Open the rod box cover (Fig. 80) and disconnect the lubrication lines from the stuffing box fittings.

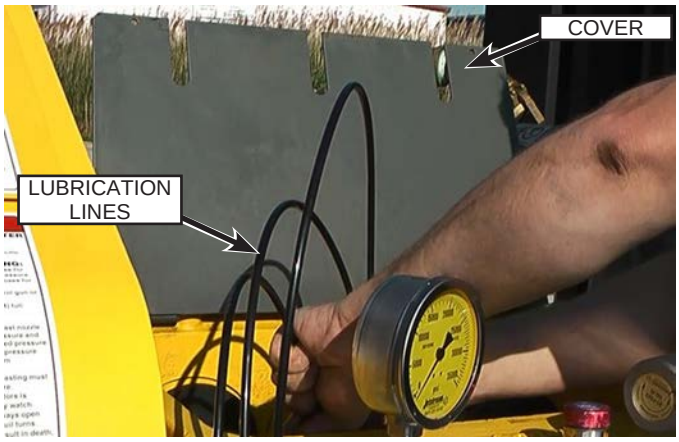


Fig. 80: Disconnecting Lubrication Lines

5. Remove the manifold bolts (Fig. 81). Ensure the trunnion rod (Fig. 82) is installed before removing the bolts.

⚠ WARNING

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

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

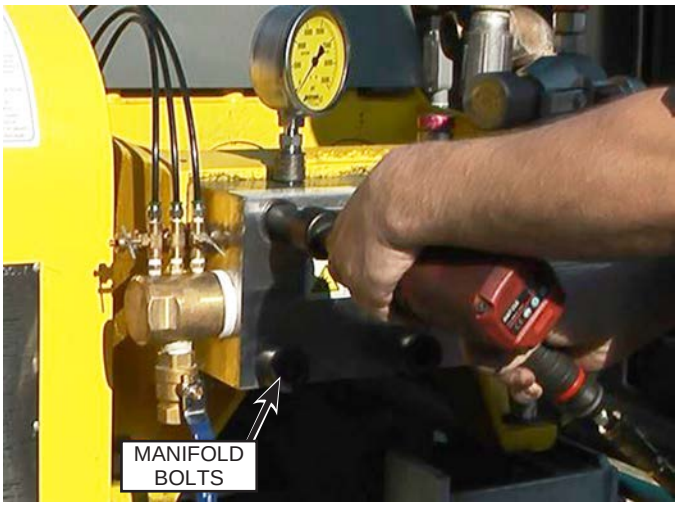


Fig. 81: Manifold Bolt Removal

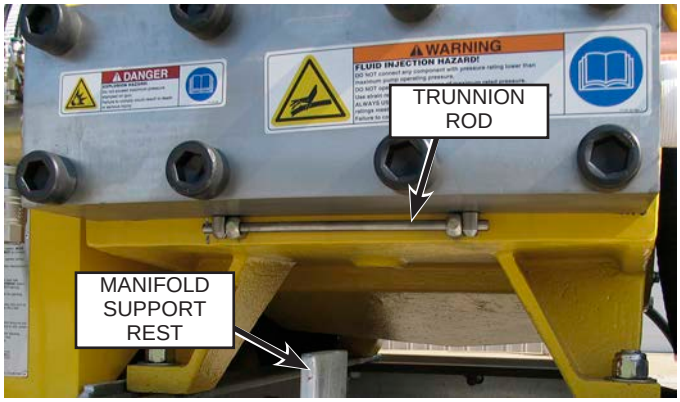


Fig. 82: Trunnion Rod

6. Slowly swing the manifold downward to the manifold support rest (Fig. 82). The weight of the manifold is approximately:

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

7. Use two small pry bars (Jetstream p/n 70179) to pry the valve out of the manifold as shown in (Fig. 83).

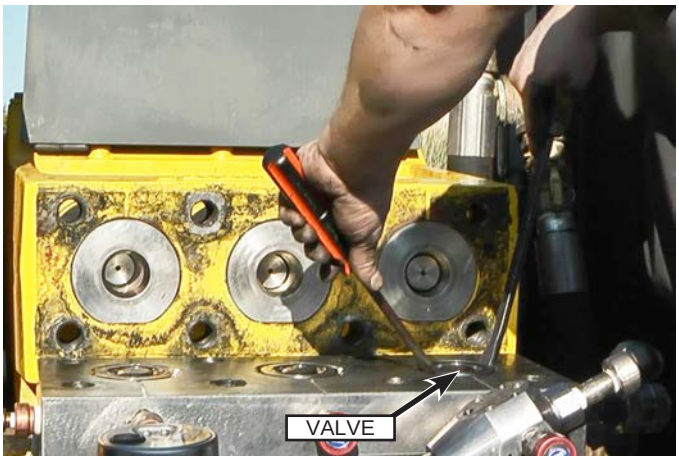


Fig. 83: Valve Removal

8. Remove the remaining valves. Refer to the topics on valve service later in this chapter for disassembly and maintenance instructions.

⚠ CAUTION

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

40K Face Seal Replacement

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

1. Press slightly behind the face seal using your finger and gently pull the seal out as shown in (Fig. 84).

⚠ 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.

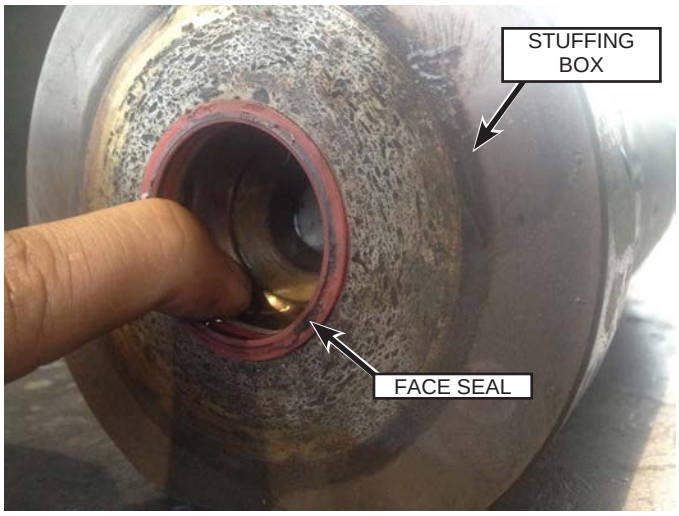


Fig. 84: Face Seal Removal

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

Installation

1. Place the valve into position on the manifold. Using the palms of your hands, press the valve into the manifold as shown in (Fig. 85).

Fig. 85: Valve Installation

2. Install the remaining valves.
3. Swing the manifold upward to install the bolts.
4. Install the manifold bolts and tighten in a crisscross sequence starting with the center bolts as shown in (Fig. 86). Proper torque is 350 ft.-lb. (470 N·m).

Fig. 86: Tightening Sequence

5. Connect the water lubrication lines (Fig. 87) to the stuffing boxes and close the rod box cover.

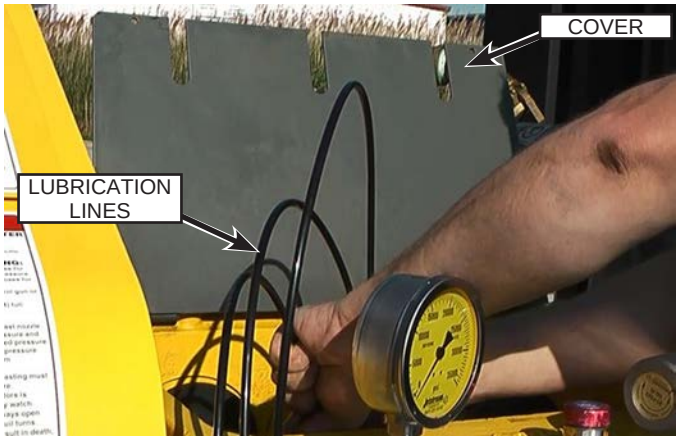


Fig. 87: Connecting Water Lubrication Lines

6. Connect the supply coupling (Fig. 88) and the bypass hose to the manifold.

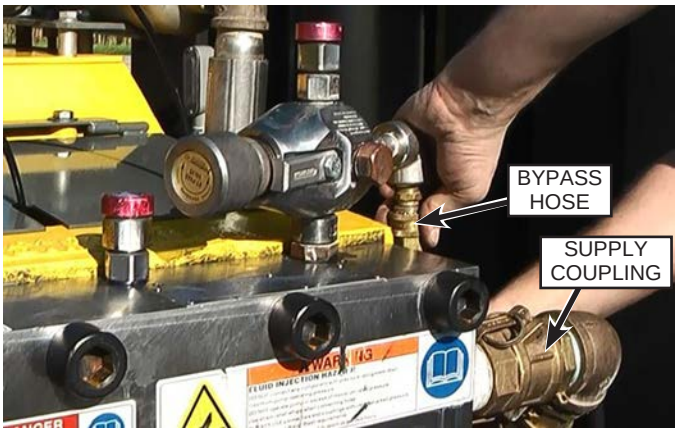


Fig. 88: Hose Connections

Disassembly

1. Remove the O-ring at each end of the valve as shown in Fig. 89. Discard the O-rings.

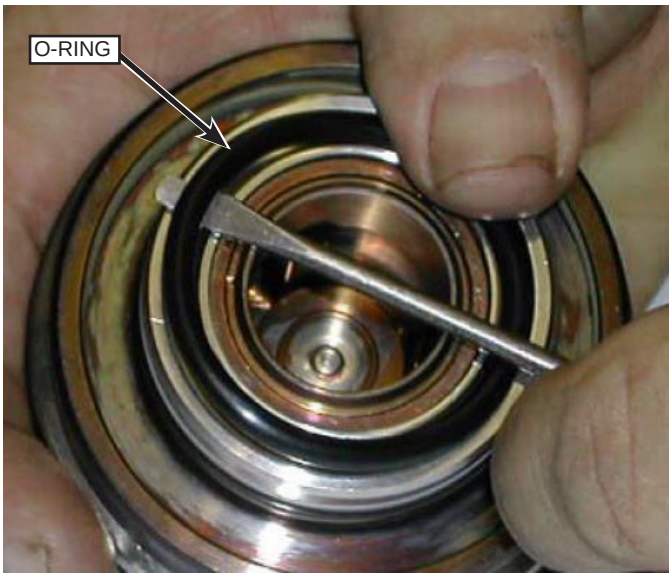


Fig. 89: O-ring Removal

2. Locate the slits in the two white backup rings and carefully remove the rings. Remove the companion O-rings, as well. Refer to Fig. 90. Discard the O-rings and backup rings.

Note: Note the orientation of the seals for installation.

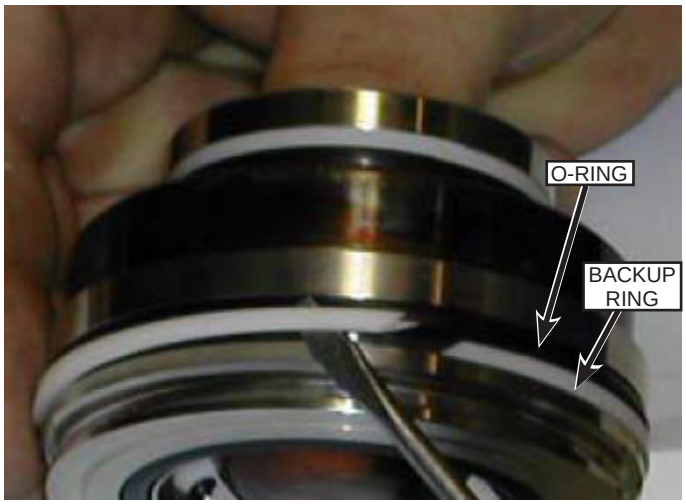


Fig. 90: Backup Ring and O-Ring Removal

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. Refer to Fig. 91.

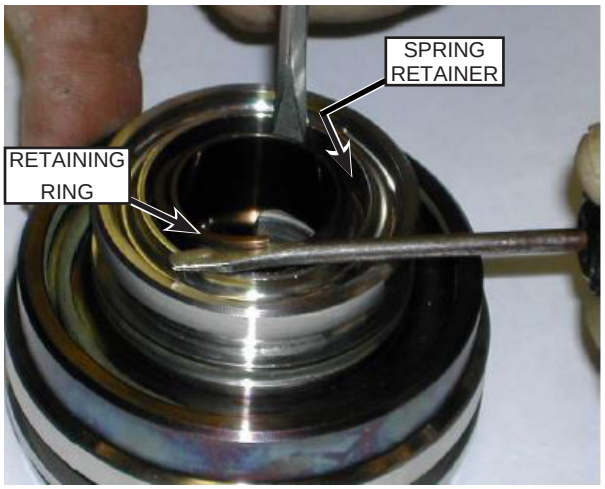


Fig. 91: Retaining Ring Removal

4. Remove the valve spring retainer and valve spring. Refer to Fig. 92.

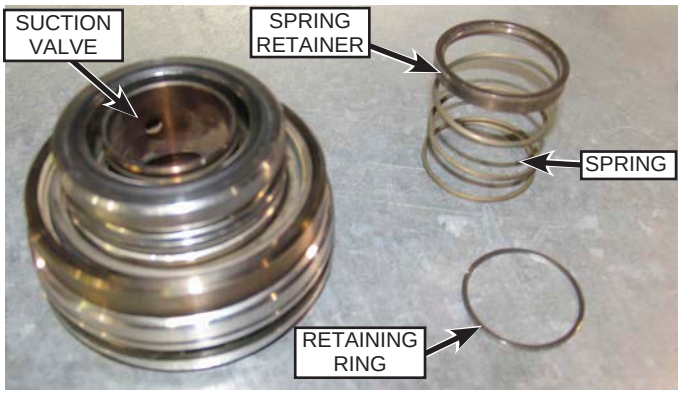


Fig. 92: Retainer and Spring Removal

5. Lift the assembly off of the suction valve and set the suction valve aside.
6. Insert a small screwdriver under the discharge spring (Fig. 93). 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. Refer to Fig. 94.

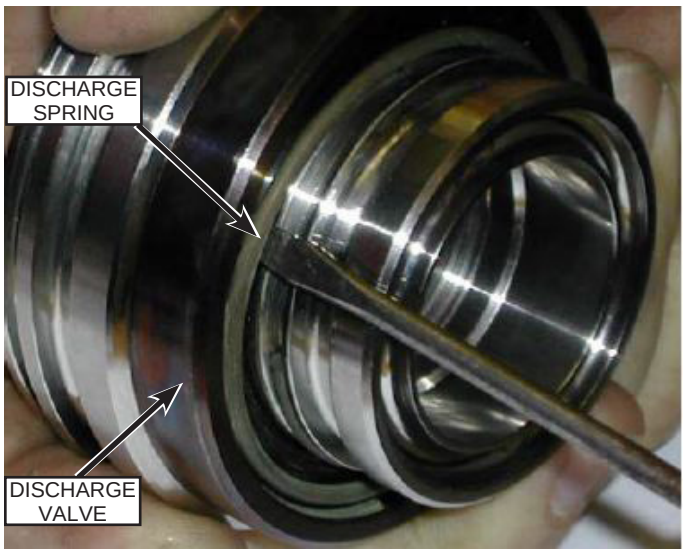
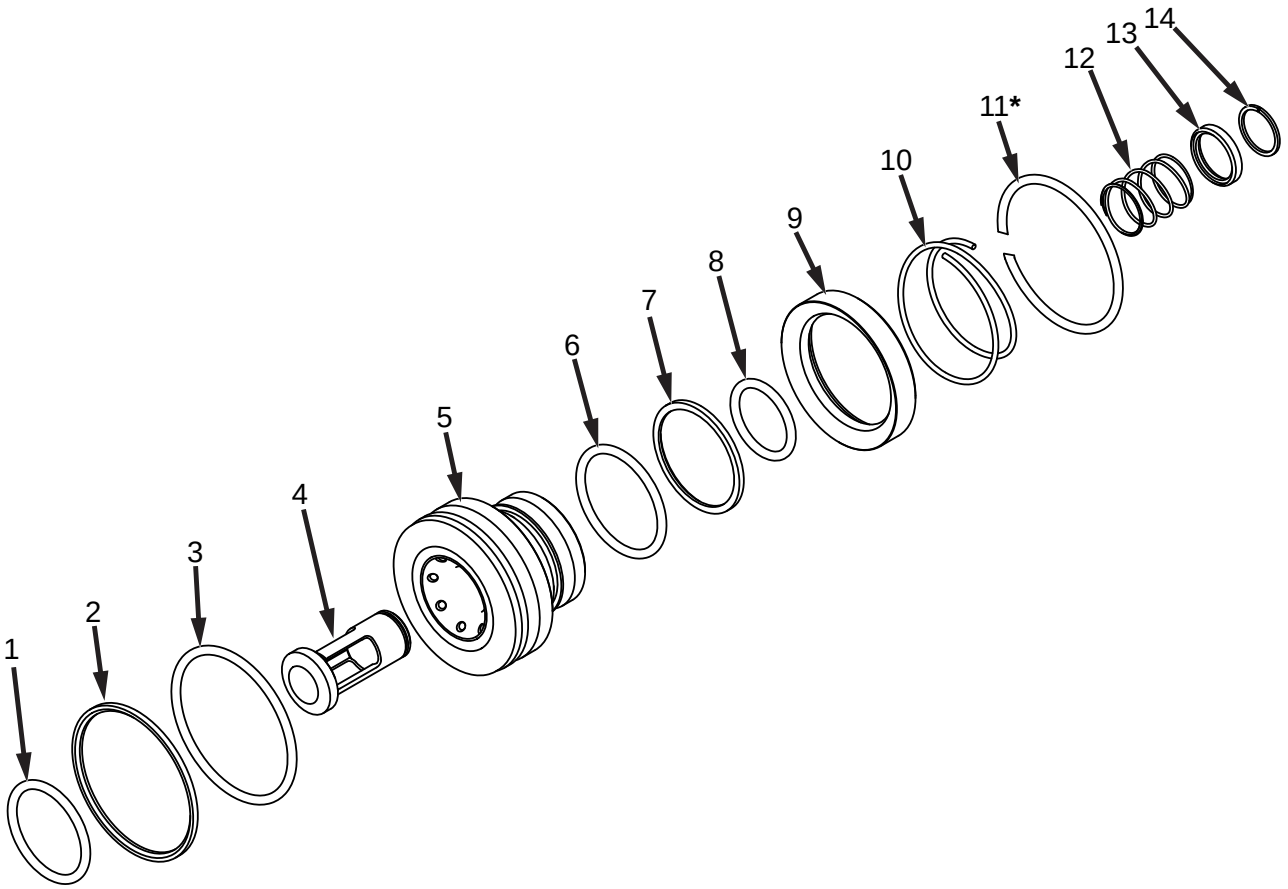


Fig. 93: Discharge Spring and Valve Removal

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



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

Fig. 94: 15/20K Uni-Valve Exploded View

Assembly

1. Install the discharge valve onto the valve body. The shiny mating surface faces the holes on the valve body. Place the discharge spring into position on the valve.

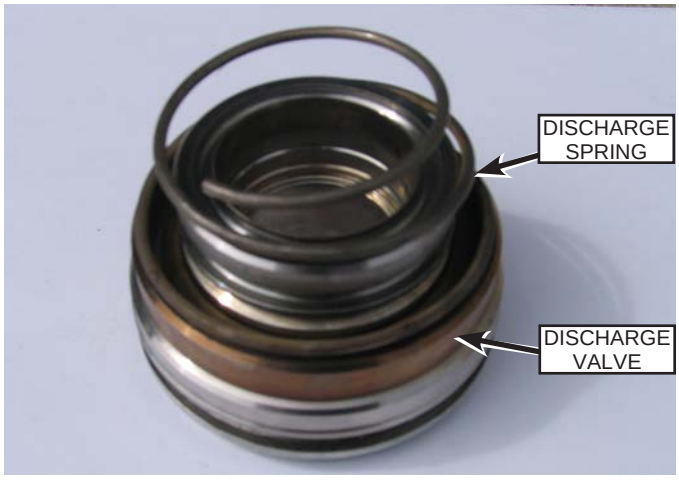


Fig. 95: Discharge Installation

2. Lock the spring in its retaining groove. Use a screwdriver to push the spring in place. Start at the base of the spring and follow along the coils to the top of the spring until it locks in its retaining groove.
3. Position the suction valve in the valve body as shown in Fig. 96.

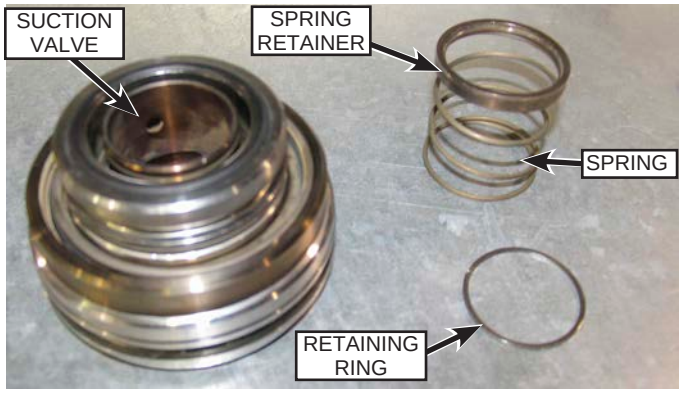


Fig. 96: Suction Valve Installation

4. Insert the suction valve spring and spring retainer into the valve body. Ensure the ledge the retaining ring sits on is positioned as shown in Fig. 97.

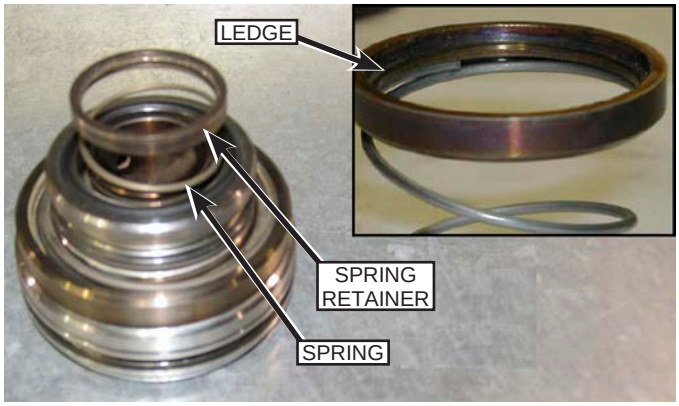


Fig. 97: Spring and Retainer Installation

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. Refer to Fig. 94.

Disassembly

1. Use a small screwdriver to remove the two black O-rings from the valve. Refer to Fig. 98.

Fig. 98: O-ring Removal

2. Use the screwdriver to remove the seal retaining ring. Insert the blade under the slit and rotate the ring out of the groove as shown in Fig. 99. Use caution to prevent bending or distorting the ring.

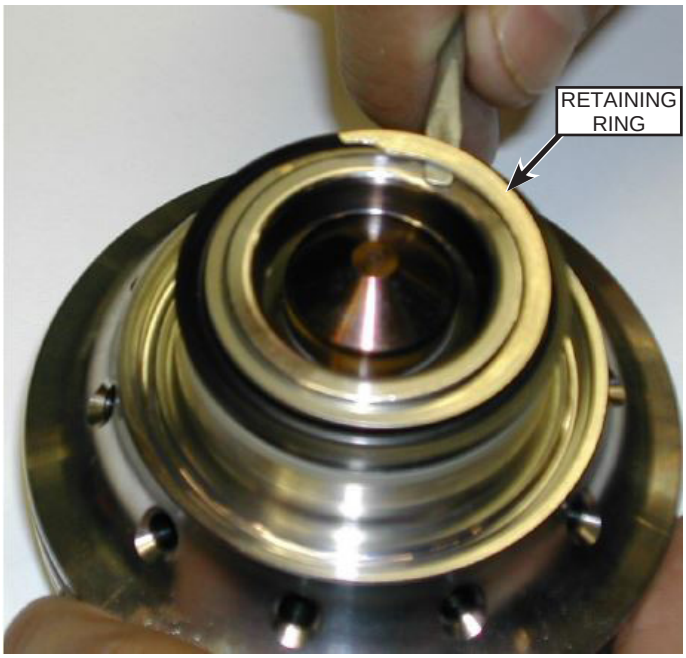


Fig. 99: Retaining Ring Removal

3. Use the screwdriver to remove the ring seal (Fig. 100) and seal support ring.

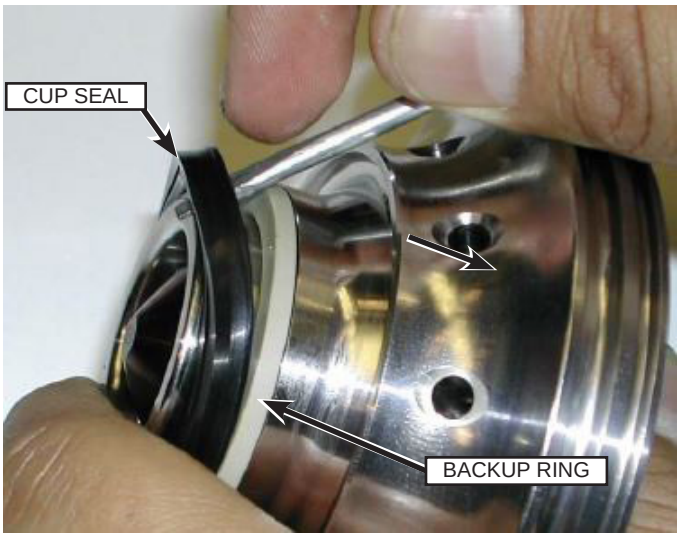


Fig. 100: Ring Seal Removal

4. Turn the valve over.
5. Press down on the valve spring retainer and slide the spring keepers out from the assembly.

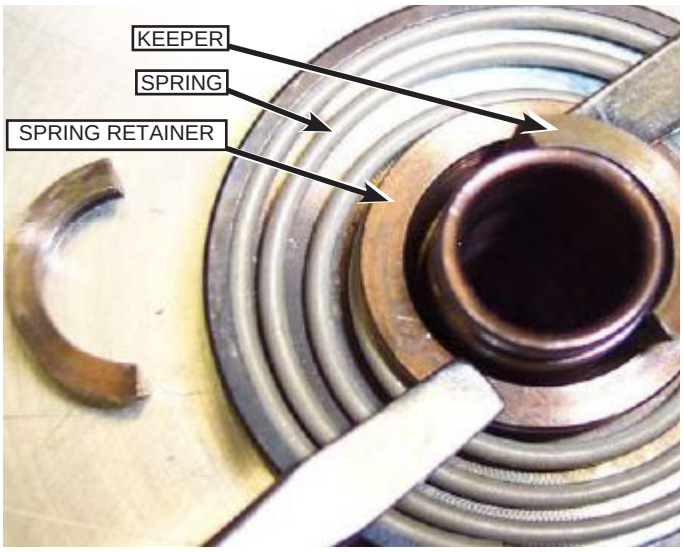


Fig. 101: Spring Retainer Removal

6. Remove the valve spring and valve spring retainer.

7. Remove the suction and discharge valves as shown in Fig. 102.

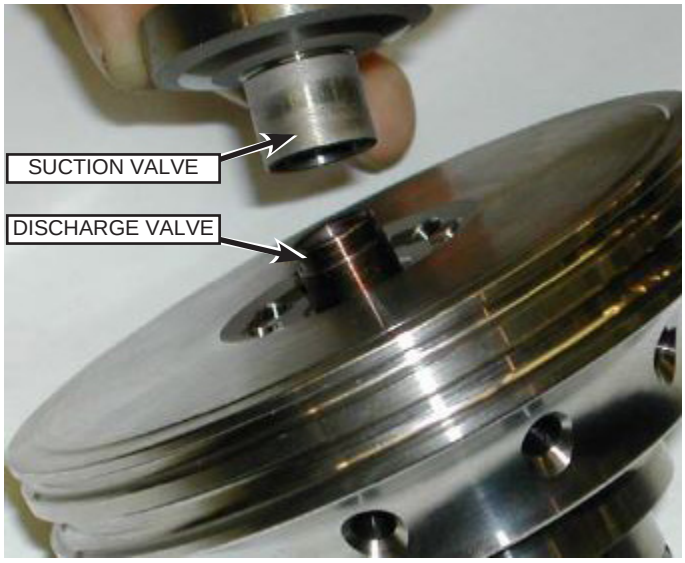


Fig. 102: Valve Removal

8. Inspect the valves. Refer to “Valve Inspection” on page 52 for inspection criteria.

Assembly

1. Install the discharge valve into the valve body as shown in Fig. 103.

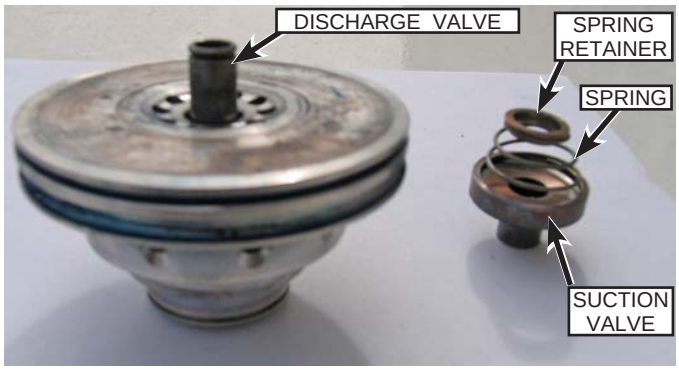


Fig. 103: Valve Installation

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. Refer to Fig. 104.

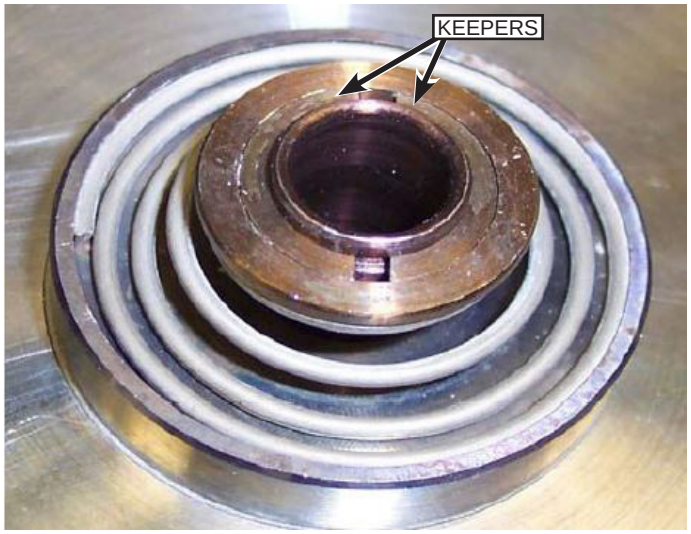


Fig. 104: Keeper Installation

3. Place the backup ring (Fig. 105) 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.

Fig. 105: Seal Ring Installation

4. Install the two O-rings.

Fig. 106: O-ring Installation

VALVE INSPECTION

1. Inspect all seals and discard as necessary.
2. Inspect the valve components. Discard excessively pitted or otherwise damaged components. Refer to Fig. 107.

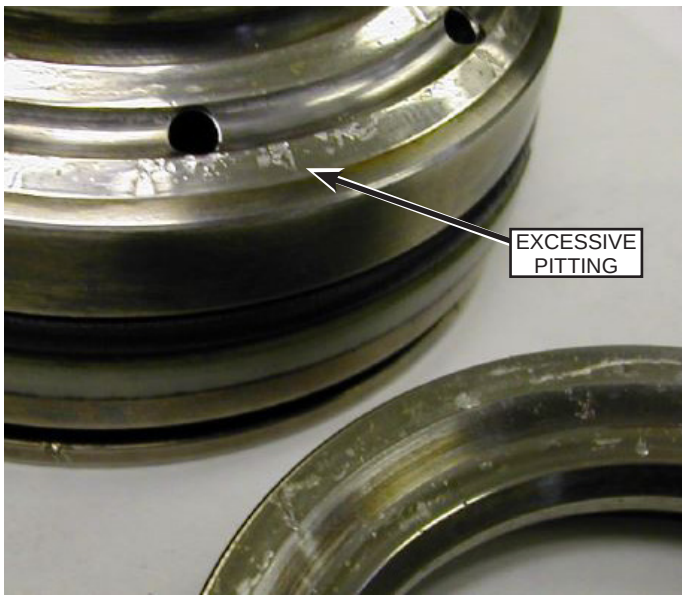


Fig. 107: Valve Pitting

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.

NOTICE

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. Refer to Fig. 108 for a typical example of lapping compound application.

Fig. 108: Lapping Compound Application

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 and then rotate the parts in the opposite direction approximately 90 degrees. Do this a few times during lapping. This will ensure that the lapping compound does not remain localized and it will distribute 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 as shown in Fig. 109.

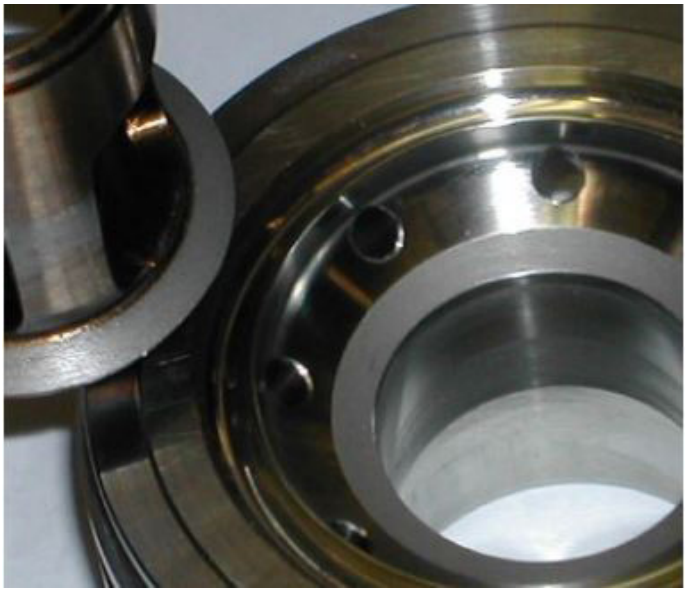


Fig. 109: Properly Lapped Valve Seats

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 in a mineral spirits solution. Submerge the parts in solution for a few minutes. Remove and air dry thoroughly with compressed air. Ensure that no compound or solution remains in the cross holes.

BYPASS VALVE CARTRIDGE REPLACEMENT

1. Remove the dump hose (Fig. 110) from the bypass valve.

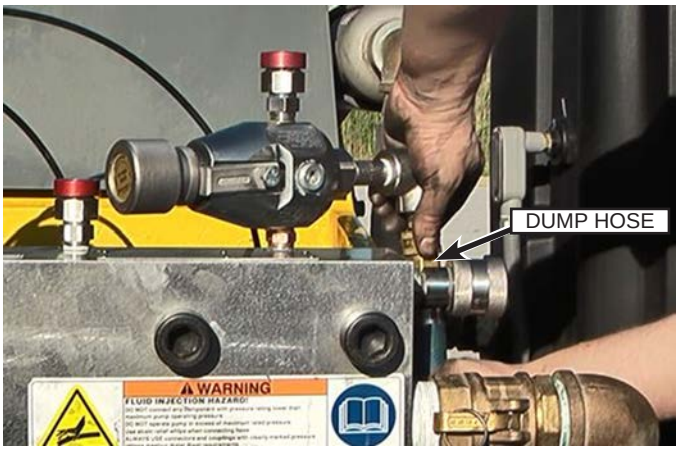


Fig. 110: Dump Hose Removal

2. Using an adjustable wrench, remove the cartridge housing (Fig. 111) from the valve.

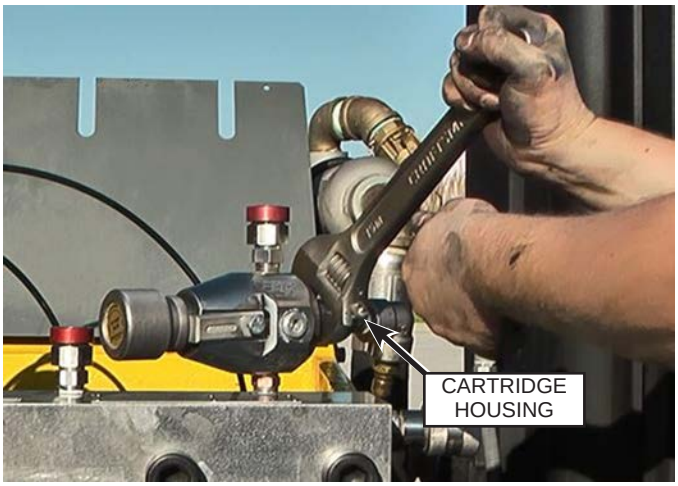


Fig. 111: Cartridge Housing Removal

3. Pull the cartridge (Fig. 112) from the housing.

Fig. 112: Cartridge Removal

4. Inspect the diffuser (Fig. 1133) for jetting damage. Replace if damage is extensive.

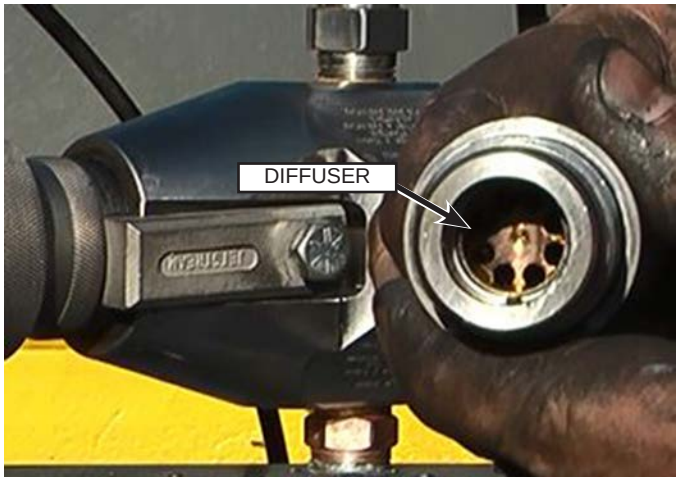


Fig. 113: Seating Surface Inspection

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.

POWER END SERVICE

CHECKING POWER END OIL LEVEL

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

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

1. Locate the sight gauge (Fig. 114) 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.

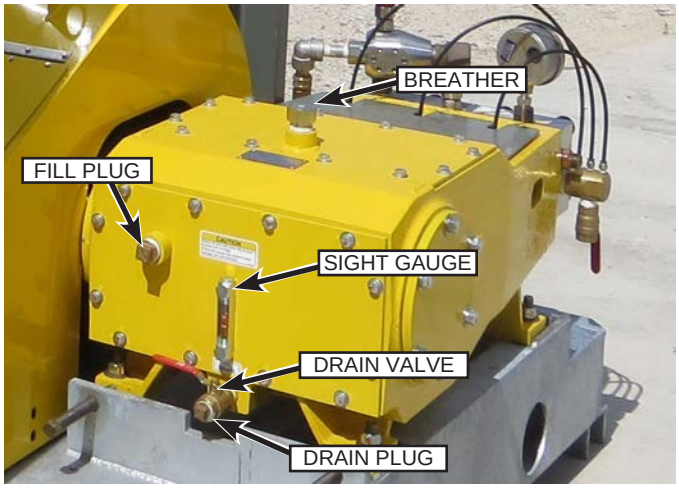


Fig. 114: Oil Check and Change

⚠ CAUTION

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

Alternate Oil Check Methods

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

Method 2: If the pump has been operating 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, run the motor at slow speed for 10-15 seconds. Check the oil level at the site gauge. If the oil level is still visible in the gauge, there is sufficient oil in the crankcase to run the pump. Optimally, the level should be halfway between the bottom of the site glass and the ADD line.

The typical oil level for a pump that has been operating and then brought to a stop is shown in (Fig. 115). The oil level will be at or near the full mark only after the pump has been at rest for 5 to 8 hours.

Fig. 115: Typical Oil Level for Recently Operated Pump

CHANGING THE POWER END OIL

1. With the motor off, remove the drain plug (Fig. 114) from the oil drain valve located on the back of the power end case.
2. Place a container below the valve large enough to capture the oil. Refer to the oil capacities listed below.
3. Install an extension hose/pipe to extend the drain past the trailer frame, if desired.
4. Open the ball valve to drain the oil.
5. After the oil has drained from the case, close the ball valve and install the plug.
6. Remove the back cover plate and inspect the magnets at the bottom of the pump for metal shavings or filings. Clean the magnet. If excessive shavings or filings were present, inspect the crankshaft journal bearings.
7. Install the back cover plate.
8. Add 80W/90 gear oil through the fill plug.
   - 3000 Series Pumps: 5 gal. (22 L)
   - 3600/4200 Series Pumps: 9 gal. (34 L)
9. Install the fill plug when done filling.

CHECKING BELT TENSION

⚠ CAUTION

Belts must be adjusted properly. Improper adjustment can lead to belt slippage and failure, or motor bearing damage caused by excessive belt tension.

1. Stop the motor.
2. Open the access cover on the belt guard.
3. Locate the decal on the cover to find the correct belt tension specification.
4. Adjust the deflection O-ring (Fig. 116) on a belt tension tool for the proper deflection as specified on the decal. Slide the force O-ring to the bottom of the scale. Use a five barrel tension tool if power bands are used on your unit. See Fig. 117.

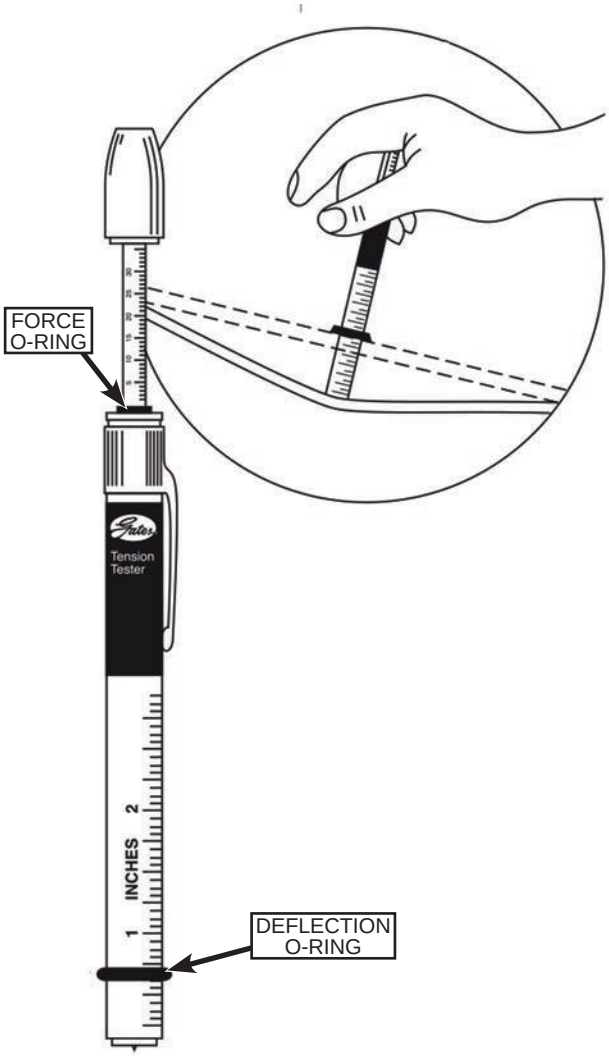


Fig. 116: Single Belt Tension Tester

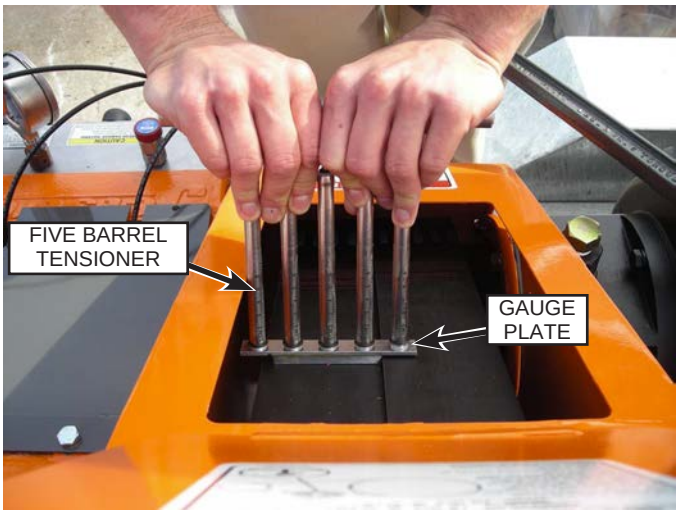


Fig. 117: Power Band Tensioning

5. Position the tension tool in the middle of one of the belts mid-way between belt pulleys. Press on the tool until the deflection O-ring is even with the adjacent belt. On five barrel tensioners, press until the gauge plate (Fig. 117) touches the adjacent belt.

Note: Power bands are five times the single belt force.

6. Release pressure and inspect the reading at the bottom edge of the force O-ring(s) (Fig. 116) on the tension tool . Adjust the belt if necessary. Refer to “Adjusting Belt Tension”.

ADJUSTING BELT TENSION

1. Loosen the four pump mounting bolts (Fig. 118). the bolts are located on each corner of the pump.

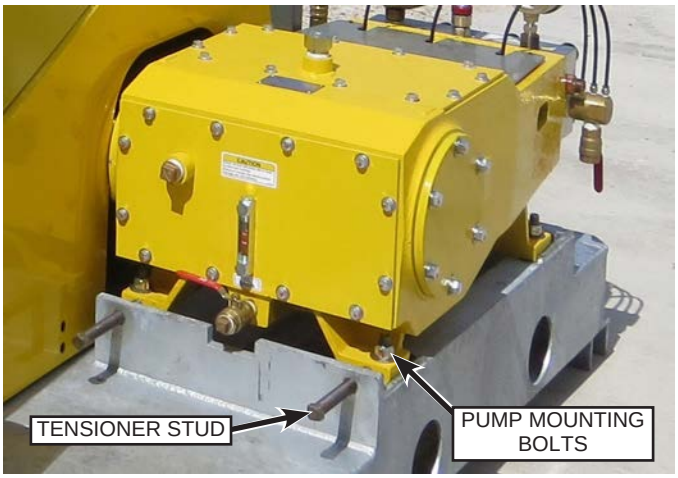


Fig. 118: Adjustment Hardware

2. Adjust the tension by equally turning the two tensioner studs. Turn clockwise to increase belt tension. Turn counter-clockwise to decrease belt tension.

3. Tighten the four pump mounting bolts to ensure a proper tension reading.
4. Recheck the belt tension as outlined in “Checking Belt Tension” on page 56.

NOTICE

If belt slippage occurs after tensioning, replace the belts. Check the tension after the first 20 minutes of operation with the new belts.

REPLACING THE BELTS

1. Remove the 16 capscrews and washers (Fig. 119) that secure the belt guard to the unit.

Fig. 119: Belt Guard Hardware

2. If a hoist is available, attach a hoist and appropriate lifting apparatus to the belt guard. Lift the belt guard from the unit. The weight of the belt guard is approximately 70 lb (32 kg). If a hoist is not available, use two people to carefully lift the guard from the unit.

Fig. 120: Belt Guard Removal

3. Loosen the four pump mounting bolts (Fig. 121).

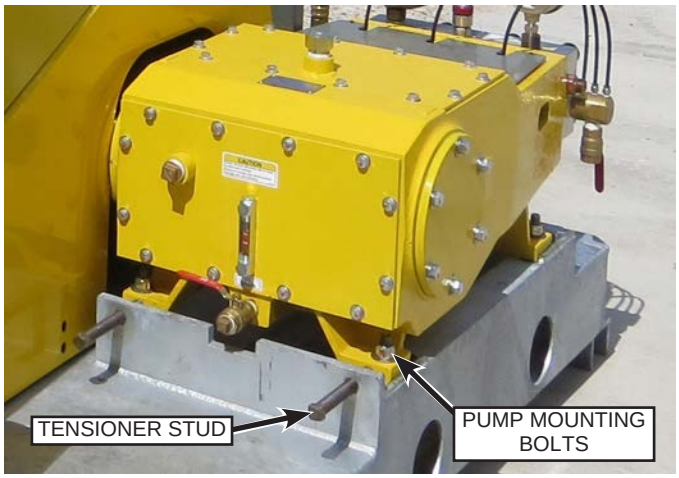


Fig. 121: Pump Mount

4. Equally turn the two tensioner studs (Fig. 121) counter-clockwise to move the pump and decrease the belt tension enough to allow belt removal.
5. Remove the belts and discard. Place the new belts into position.
6. Adjust the tension using the tensioner studs and then check the tension as outlined in “Checking Belt Tension” on page 56.
7. Lift the belt guard back onto the unit and install the 16 capscrews and washers (Fig. 119) that secures the guard to the unit.

CHARGE PUMP

Removal

1. Turn the main switch on the control panel to the OFF position.
2. Drain the water from the water tank.
3. Disconnect the wiring from the charge pump motor.
4. Remove the inlet and outlet hoses (Fig. 122) from the pump.

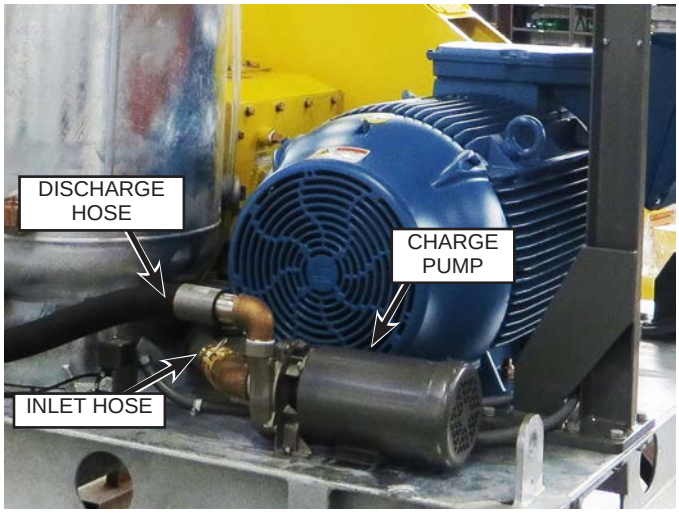


Fig. 122: Charge Pump

5. Remove the two capscrews that secure the charge pump assembly to the unit and remove the pump.

Installation

1. Place the charge pump assembly into position on the unit. Install the two capscrews that secure the charge pump to the unit and tighten the capscrews to 9 ft. lb (12 N·m).
2. Connect the inlet and outlet hoses to the pump.
3. Connect the wiring to the charge pump motor.

CROSSHEAD PONY ROD SEALS

Removal

1. Relieve pressure from the pump and turn the motor off.
2. Turn off the water supply and drain the water tank.
3. Drain the oil from the crankcase. Refer to “Changing The Power End Oil” on page 55 for instructions.
4. Open the rod box cover.
5. Disconnect the water lubrication lines if desired for easier access.
6. Position the pony rod to be serviced so that it is at top dead center (plunger fully extended towards the crankshaft). Pull on the drive belts to rotate the pump as shown in (Fig. 123).

Fig. 123: Rotating the Belt Drive

⚠ WARNING

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

7. Remove the two capscrews that secure the plunger coupling (Fig. 124) to the plunger and remove the coupling. Rotate the pump until the pony rod is fully retracted.

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

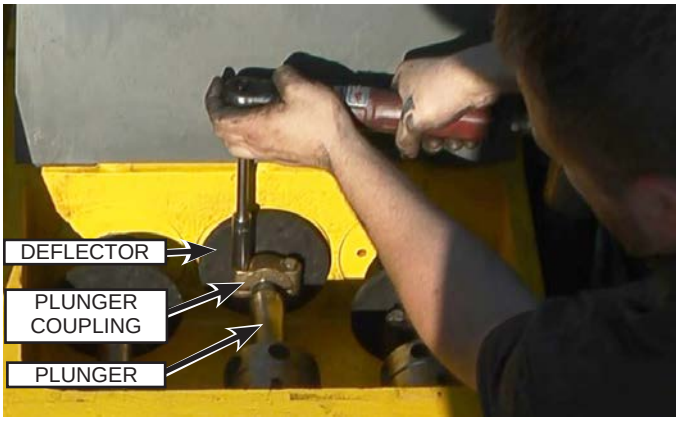


Fig. 124: Plunger Coupling Removal

8. Slide the rubber deflector (Fig. 124) off of the pony rod.
9. Remove the three capscrews and washers that secure the rod box cover to the frame. Remove the cover. Remove the rubber washers that sit below the mounting plate.

10. Using a 1/4” hex driver, loosen the set screw inside the bolt hole 2-3 full revolutions. Refer to Fig. 125.

Fig. 125: Set Screw Access

11. Install two 1/2”-13 UNC capscrews (Fig. 126) into the seal plate.
12. It may be necessary to use a long pry bar with the power frame as a lever to pry the back of the bolts. The seal plate should pop out from its bore. Remove the plate as shown in Fig. 126.

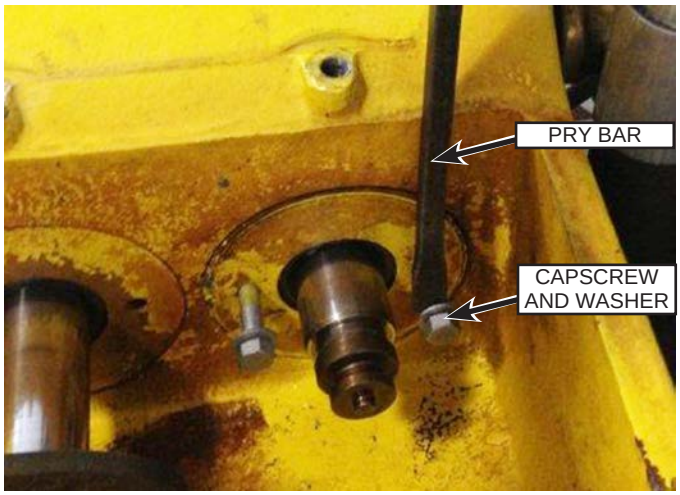


Fig. 126: Seal Plate Removal

13. Remove the O-ring and press the seals from the plate. Discard the O-ring and seals.
14. Repeat for the remaining crosshead seals, if necessary.

Installation

1. Place the seal plate in a hydraulic or arbor press with the inboard side facing up. Place the red outboard seal into position and orient the seal as shown in Fig. 127.

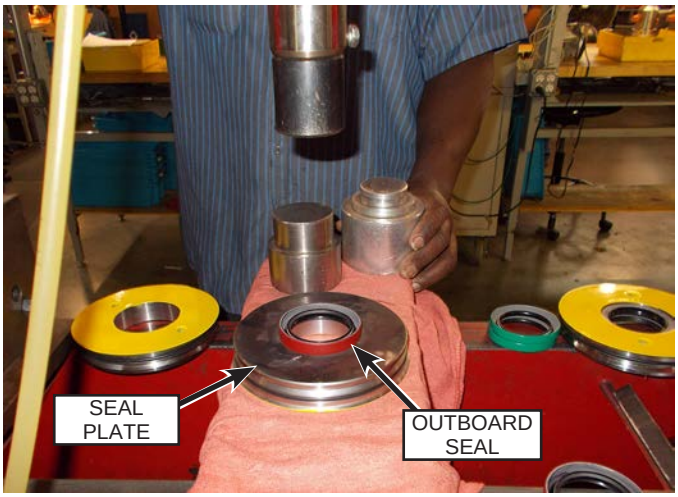


Fig. 127: Outboard Seal Installation

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.

Fig. 128: Pressing the Seal

3. Place the green inboard seal into position on top of the outboard seal and orient the seal as shown in Fig. 129. Press the seal into the plate until it is flush with the face of the plate. Use caution to avoid damaging the seal.

Fig. 129: Inboard Seal Installation

4. Install a new O-ring (Fig. 130) onto the seal plate. Lubricate the O-ring with O-ring lubricant.

Fig. 130: O-ring Installation

5. Lubricate the inner seals with clean oil.
6. Repeat the prior steps for the remaining seal plates, if necessary.
7. Clean the seal plate bore and chamfer with emery cloth. Smooth any rough edges that can cut or damage the O-ring.
8. Carefully install the seal plate onto the pony rod and into the bore using hand pressure only. Do not hammer the plate into place. The plates must be flush with the frame.
9. Using a 1/4” hex drive, tighten the set screw that secures the plate to 15 in.-lb. (1694 mN·m) inside the access holes.
10. Install the deflector (Fig. 131) 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).

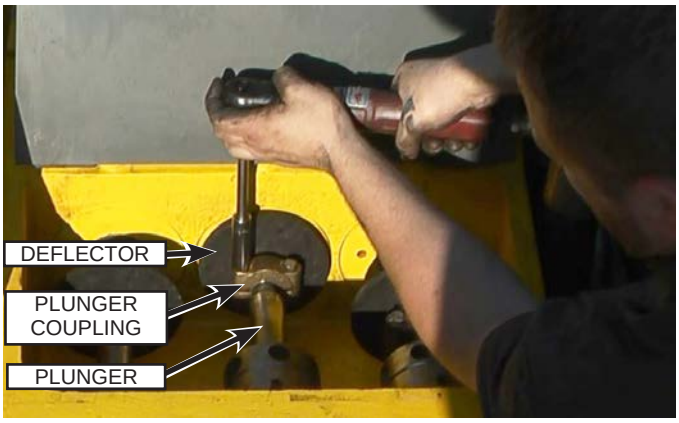


Fig. 131: Plunger Connection

13. Place the rubber washers into position on the frame and then place the cover into position. Install the three capscrews and washers that secure the cover.
14. Add oil to the crankcase as outlined in “Changing The Power End Oil” on page 55.

ROD JOURNAL BEARINGS

Removal

1. Drain the oil from the power end as outlined in “Changing The Power End Oil” on page 55.
2. Once drained, remove the capscrews, washers and lockwashers from the back plate (Fig. 132). Remove the plate and gasket. If the gasket is stuck to the frame, it can remain.

Fig. 132: Back Plate Removal

3. Remove the rod cap capscrews (Fig. 133) from each rod journal. Rotate the pump by pulling on the belts, as shown in Fig. 134, to gain access to the capscrews as needed.

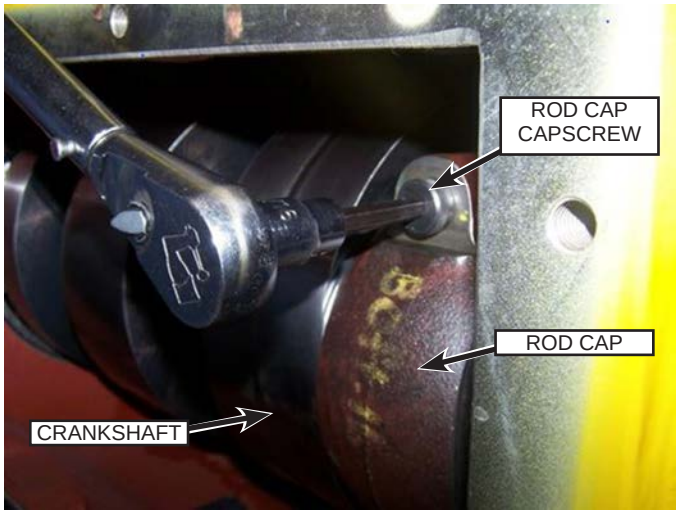


Fig. 133: Rod Cap Removal

Fig. 134: Rotating the Pump

⚠ WARNING

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

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

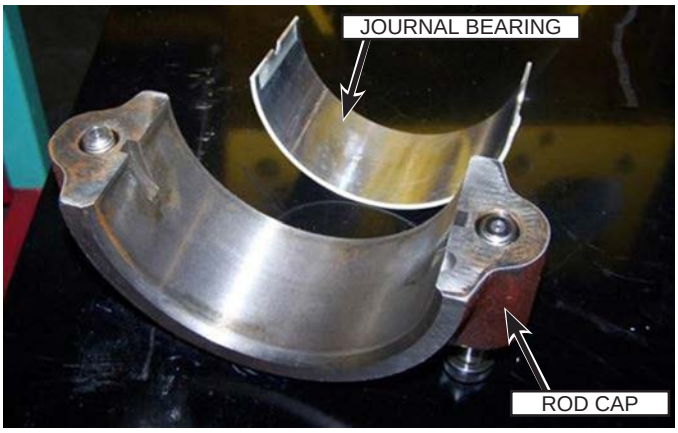


Fig. 135: Bearing Removal

7. To access the inner journal bearing (Fig. 136), push the connecting rod away from the crankshaft. Slide the bearing from the rod.

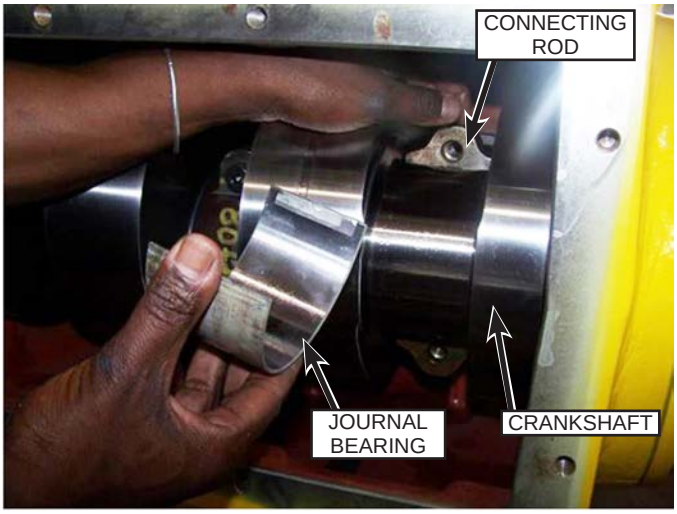


Fig. 136: Inner Bearing Removal

Inspection

1. Wipe the excess oil from the end cap bearings.
2. Install a small strip of plasti-gauge onto the end cap bearing (as shown in Fig. 137).

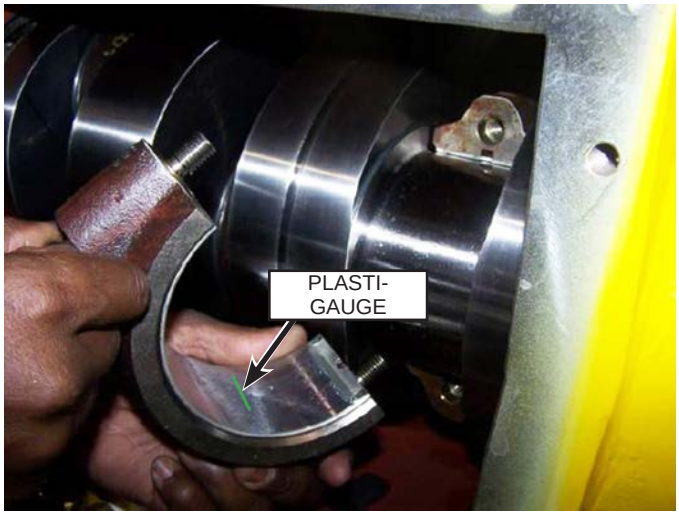


Fig. 137: Plasti-Gauge Installation

3. Position the end cap with capscrews back onto the matching connecting rod.
4. Screw in the capscrews by hand and then tighten to the proper torque:
   - 3000 Series Pumps: 45 ft.lb (61 N·m)
   - 3600/4200 Series Pumps: 80 ft.lb (108 N·m)
5. Remove the end cap.
6. Measure the flattened plasti-gauge using the gauge wrapper (as shown in Fig. 138).

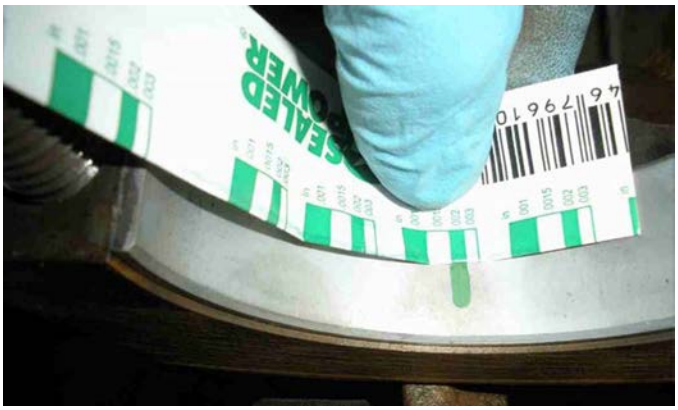


Fig. 138: Plasti-gauge Measurement

7. If the thickness of the plasti-gauge exceeds 0.012 in. (0.31 mm), replace the bearings. If the bearings do not exceed the criteria, the bearings can be reused.

Note: New part clearances are as follows:

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

Installation

1. Apply clean new oil to the new connecting rod journal bearing (inner diameter only). Refer to Fig. 139.

Fig. 139: Lubricating the Bearing

2. Slide the bearing (Fig. 140) into the connecting rod from below the crankshaft journal.

NOTICE

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. Refer to Fig. 141.

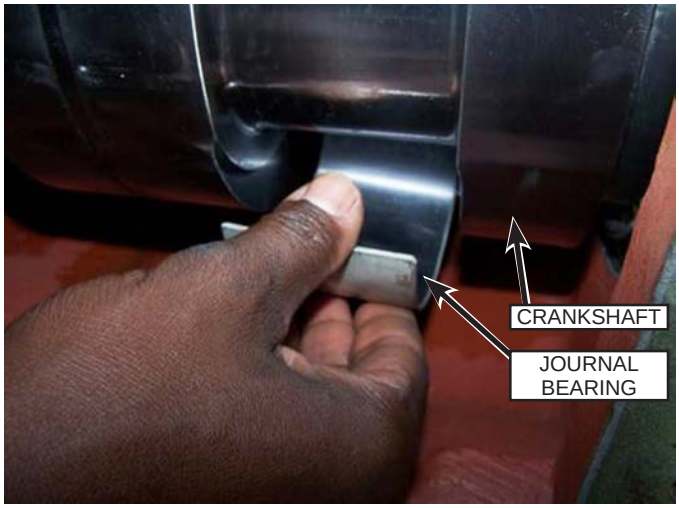


Fig. 140: Rod Bearing Installation

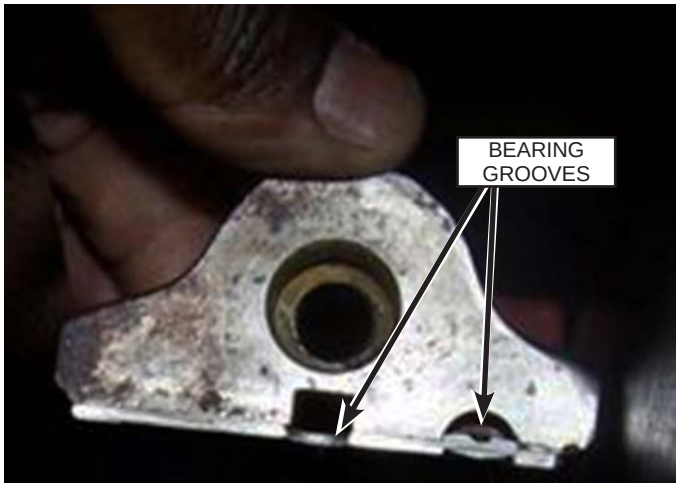


Fig. 141: Bearing Grooves

3. Apply oil to the inner surface of the cap end bearing.
4. Properly orient the grooves and install the bearing in the rod cap.
5. Place the two capscrews into the rod cap.
6. Pull the connecting rod (Fig. 142) onto the crankshaft and place the rod cap into position aligned with the connecting rod. Ensure the stampings (Fig. 143) on the cap and rod match.

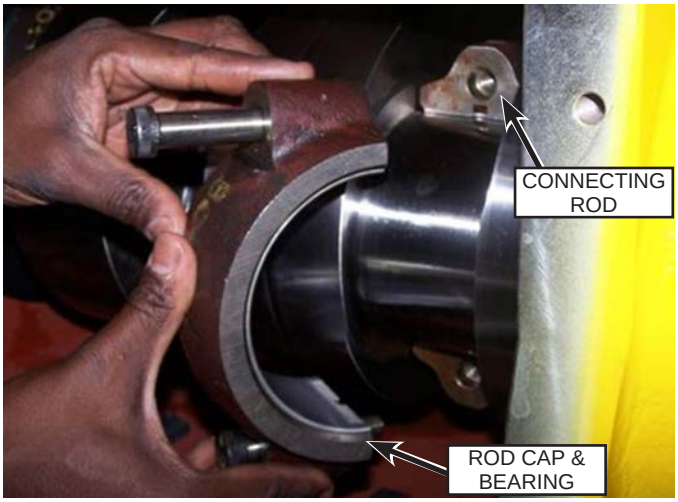


Fig. 142: Rod Cap Installation

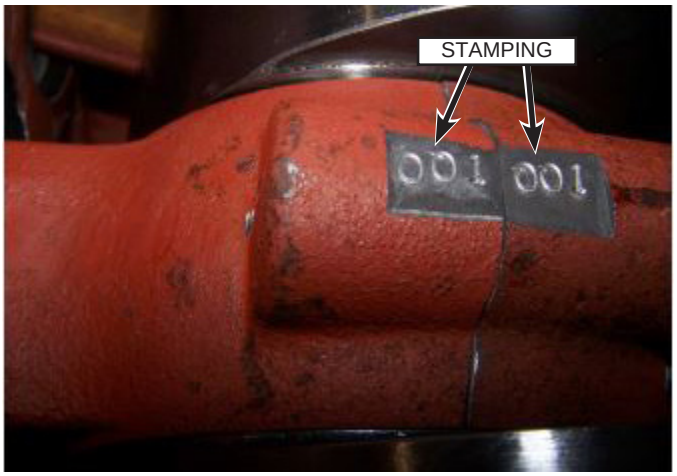


Fig. 143: Matched Parts Stampings

7. Screw in the capscrews by hand and then tighten to the proper torque:
   - 3000 Series Pumps: 45 ft.lb (61 N·m)
   - 3600/4200 Series Pumps: 80 ft.lb (108 N·m)
8. With the first rod connected, rotate the pump by pulling the belts. Allow the crankshaft to turn a few revolutions to ensure the rod was properly installed. If the crankshaft spins freely, the bearings were properly installed.
   If the crankshaft does not spin freely, remove the journal bearings and replace with another set.

9. Repeat the previous steps for installation of the remaining journal bearings.
10. Place the back plate (Fig. 144) and gasket into position on the frame.

Fig. 144: Cover Plate Installation

11. Install the capscrews, lock washers and flat washers. Tighten the capscrews to the proper torque.
    - 3000 Series Pumps: 20 ft.lb (27 N·m)
    - 3600/4200 Series Pumps: 35 ft.lb (47 N·m)
12. Fill the power end with oil as outlined in “Changing The Power End Oil” on page 55.

CROSSHEAD AND CONNECTING ROD ASSEMBLY

Removal

1. Remove the crankshaft from the pump as outlined in “Crankshaft” on page 68.
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. The set screws are installed on top of one another in the same hole.

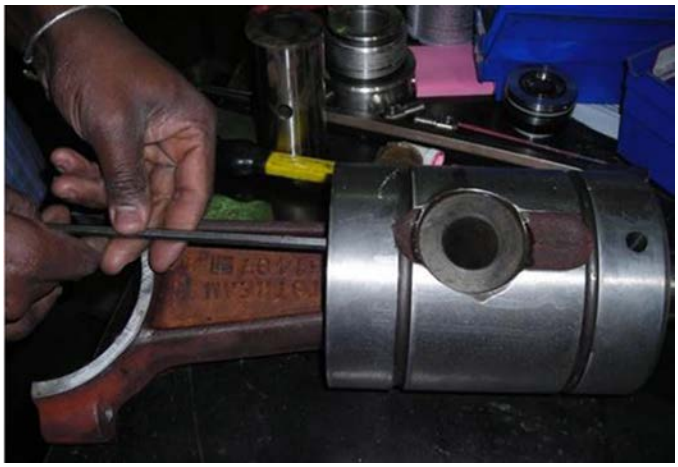


Fig. 145: Set Screw Removal

2. Slide the pin out from the assembly.

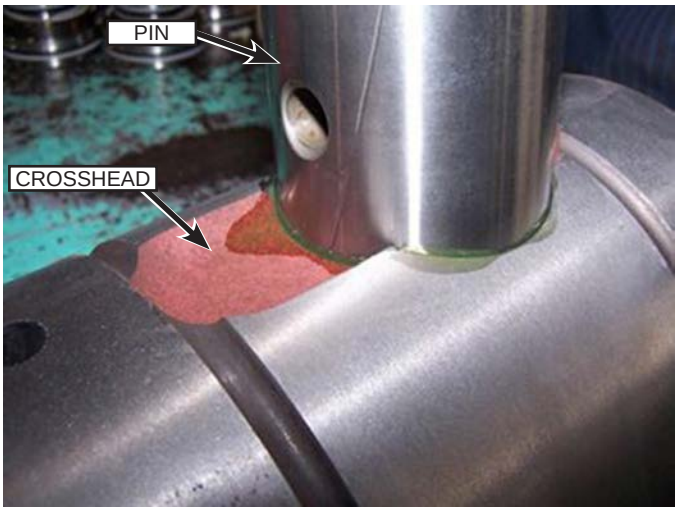


Fig. 146: Pin Removal

3. Remove the connecting rod from the crosshead.
4. Keep the components for each assembly together.
5. Disassemble the remaining assemblies.

Bushing Inspection

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

Note: New part clearances are as follows:

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

6. Repeat for the remaining assemblies.

Crosshead Inspection

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

Note: New part clearances are as follows:

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

6. Repeat for the remaining assemblies.

Assembly

1. Clean all surfaces of the crossheads, pins, and connecting rods using brake cleaner.
2. Inspect all surfaces of the crossheads, pins, and connecting rods for any signs of damage. Replace any suspect or damaged parts.
3. Inspect the long bore oil passage through the length of the connecting rod. Use a wire or a long handle brush to clear the passage if necessary.
4. Insert the connecting rod into the bottom of the crosshead and line up the bores.
5. Lubricate the pin (Fig. 147) with clean oil and insert the pin into the hole in the side of the crosshead.

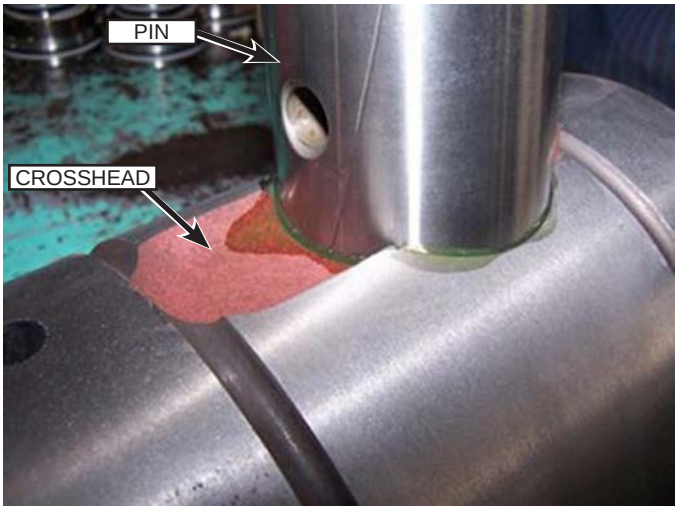


Fig. 147: Pin Placement

6. Align the hole in the connecting rod with the pin as it is slipped in.
7. Insert the first set screw into the crosshead hole and thread in until it touches the pin, then back off a 1/4 turn. Slide the wrist 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 the set screw to 36 ft lb (49 N·m).

Fig. 148: Second Set Screw Installation

The crosshead is now ready for installation in the pump.

Installation

1. Place the crosshead/connecting rod assemblies into position inside of the crankcase.
2. Install the crankshaft as outlined in “Installation” on page 69.

UNX PUMP

Removal

1. Drain the water tank.
2. Disconnect the bypass hose (Fig. 149) and supply hose from the manifold.

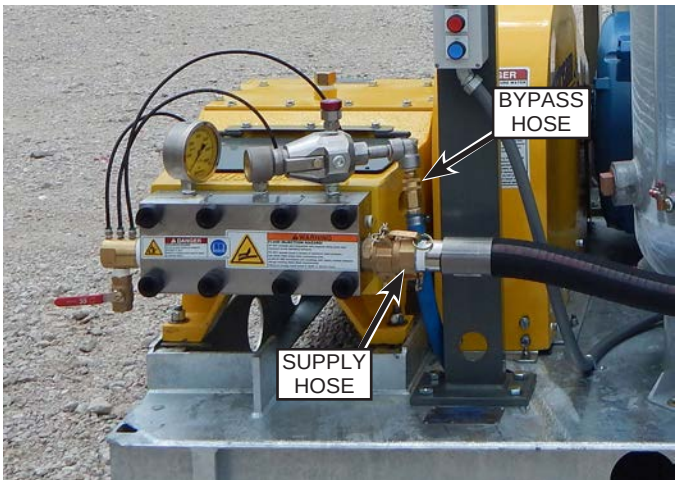


Fig. 149: Pump Removal Preparation

3. Remove the belts as outlined in “Replacing The Belts” on page 57.
4. Use a marker to mark the location of the pump footings for easier installation.
5. Remove the four pump mounting capscrews and nuts.
6. Attach a hoist and lifting apparatus to the pump as shown in (Fig. 150). The weight of the pump is approximately:
   - 3000 Series: 1200 lb. (544 kg)
   - 3600/4200 Series: 2200 lb. (998 kg)

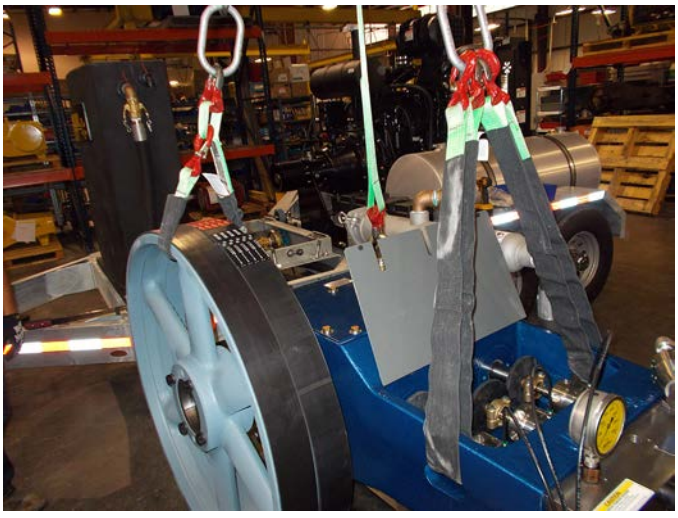


Fig. 150: Lifting the Pump

7. Lift the pump from the unit and place in a suitable location for servicing.
8. If shims were under the pump, keep the shims together and note their proper location.

Installation

1. If shims were under the pump, place the shims in their proper location.
2. Apply an anti-seize compound to the four pump mount channels.

Fig. 151: Lubricating Pump Channels

3. Attach a hoist and lifting apparatus to the pump as shown in (Fig. 150). The weight of the pump is approximately:
   - 3000 Series: 1200 lb. (544 kg)
   - 3600/4200 Series: 2200 lb. (998 kg)

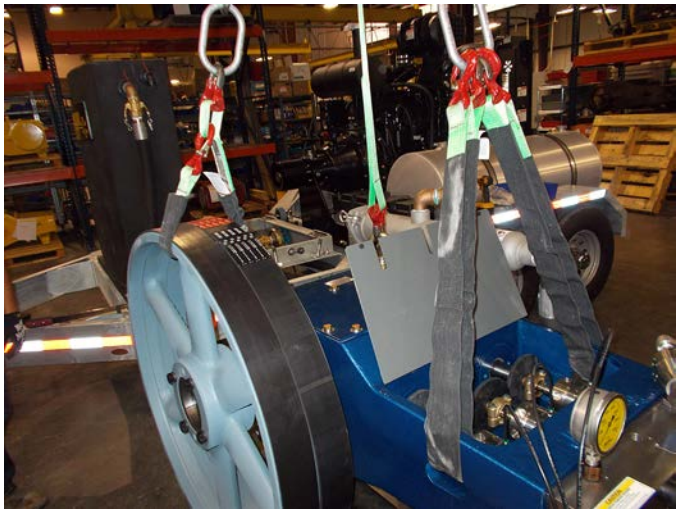


Fig. 152: Lifting the Pump

4. Lift the pump into position on the unit and position the pump near the position markings that were made during removal. Once in position, remove the lifting apparatus .
5. Loosely install the pump hardware.
6. Install the belts onto the pulleys. Adjust the belt tension as outlined in “Adjusting Belt Tension” on page 56.
7. Install the belt guard.
8. Install the bypass hose (Fig. 153) and supply hose.

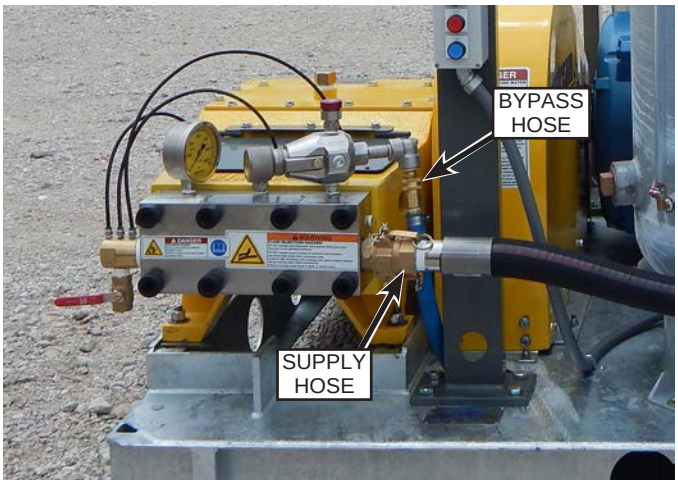


Fig. 153: Connect Switch and Hoses

CRANKSHAFT

Removal

1. Remove the pump from the unit. Refer to “Unx Pump” on page 66.
2. Open the rod box cover and remove the two capscrews that secure the plunger coupling (Fig. 154) to the plunger and remove the coupling.

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

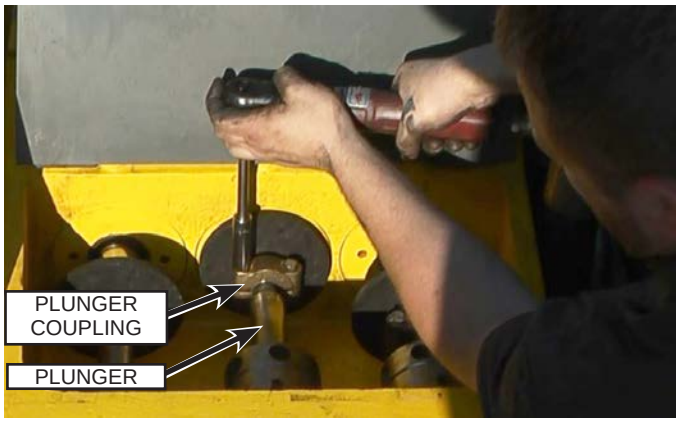
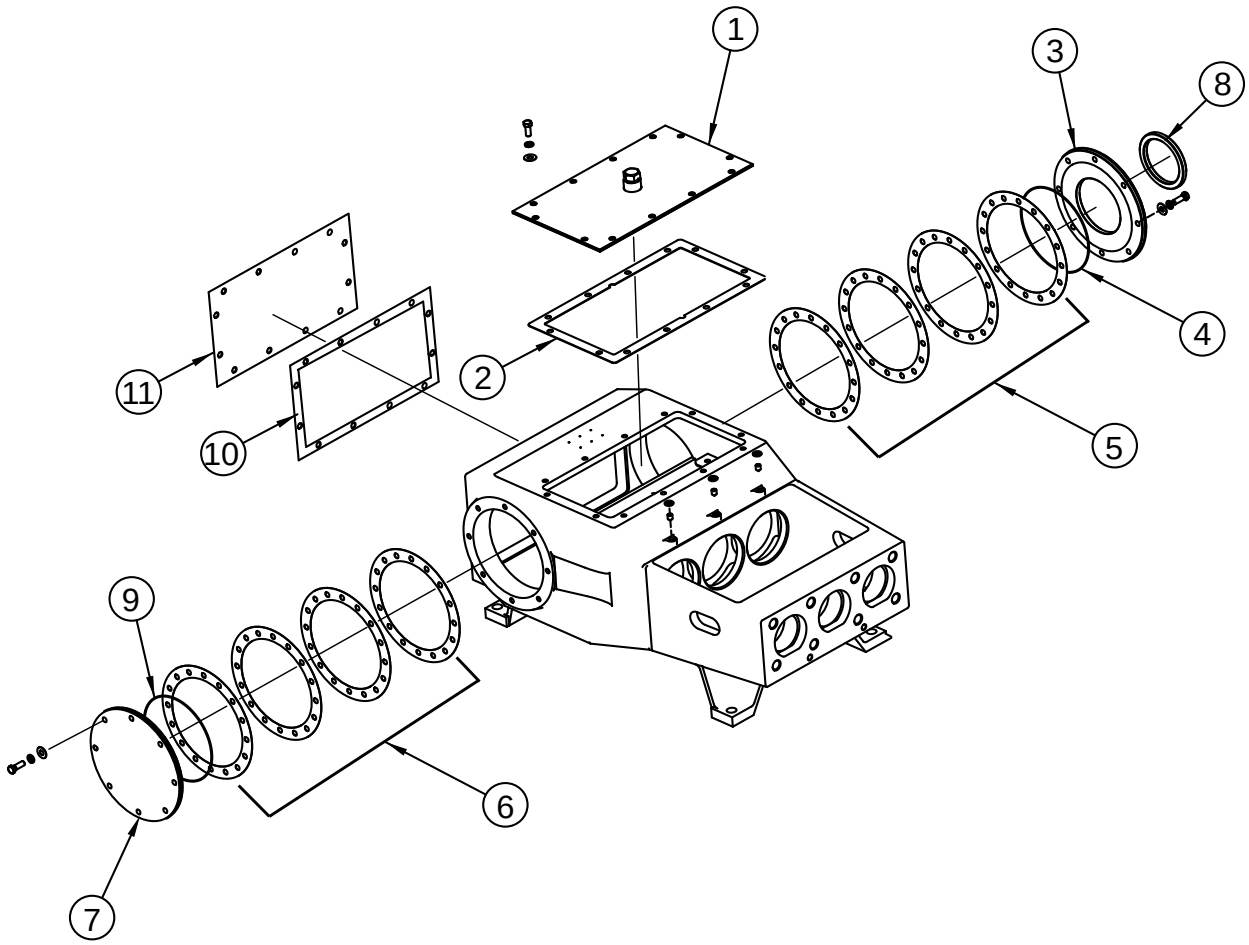


Fig. 154: Plunger Coupling Removal

3. Remove the connecting rod end caps as outlined in “Rod Journal Bearings” on page 61.
4. Remove the 12 capscrews and washers that secure the top cover (Fig. 155) to the power frame. Remove the cover and the gasket.
5. Remove the 12 capscrews and washers that secure the rear cover (Fig. 155) and belt guard to the power frame. Remove the cover, guard and gasket.
6. Pull the three connecting rod/crosshead assemblies towards the fluid end as far as possible.
7. Remove the eight capscrews and washers that secure the inboard side plate (Fig. 155) to the power frame.
8. Remove the side plate and shims. Keep the shims together.
9. Remove the eight capscrews and washers that secure the outboard side plate (Fig. 155) to the power frame.
10. Remove the side plate and shims while supporting the crankshaft. Keep the shims together.



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

Fig. 155: Power End Covers

11. Using a wood block and a hammer, hit either end of the crankshaft to unseat it from its bearing bores.

⚠ WARNING

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

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

Installation

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

⚠ CAUTION

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

2. When ready, slide the bearings onto each end of the crankshaft until they are fully seated.

Fig. 156: Bearing Installation

3. Verify that the bearing turns on the shaft.
4. Allow the crankshaft assembly to cool.
5. Install the outer bearing race (Fig. 157) onto the inboard bearing.

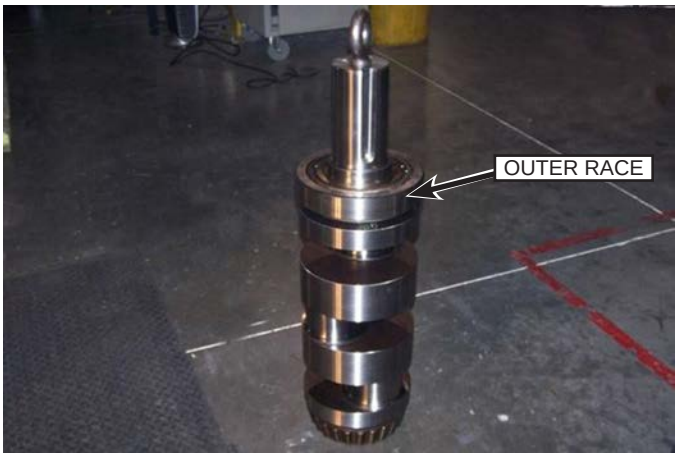


Fig. 157: Outer Race Installation

6. Install the outer bearing race (Fig. 158) into the power frame using a rubber mallet. Install the race so it is flush with the face of the case.

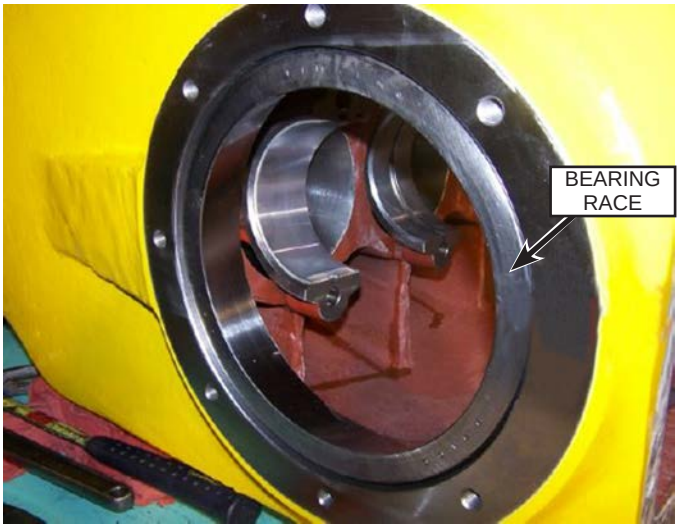


Fig. 158: Bearing Race Installation

7. Place the three crosshead/connecting rod assemblies into place. Allow clearance for the crankshaft by pushing them towards the fluid end.

Fig. 159: Connecting Rod Installation

8. Install two threaded rods (1 in.-8NC x 8 in.) into the ends of the crankshaft to aid in installation.
9. Using two people, lift the crankshaft into the power frame. The weight of the crankshaft is approximately:
   - 3000 Series: 125 lb. (57 kg)
   - 3600/4200 Series: 325 lb. (147 kg)
10. Using a wood block and a hammer, hit either end of the crankshaft to seat it in the bearing bore. Ensure the outer bearing race (Fig. 160) is inside the power frame case.

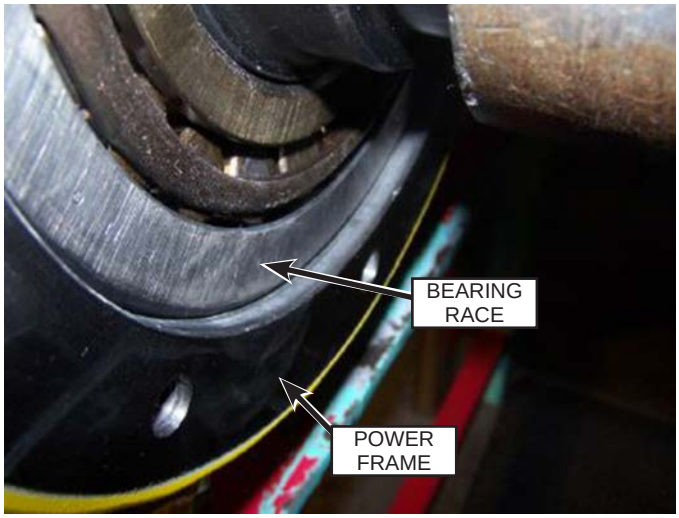


Fig. 160: Crankshaft Seating

11. Tap in the bearing race on the opposite end of the crankshaft if not already installed.
12. Install a new oil seal and O-ring onto the inboard side plate. Install the outboard and inboard side plates with the original shim packs. Ensure the thickness of each shim pack is equal on both ends. Install four equally spaced side plate capscrews and tighten to 50 ft.lb (68 N·m).

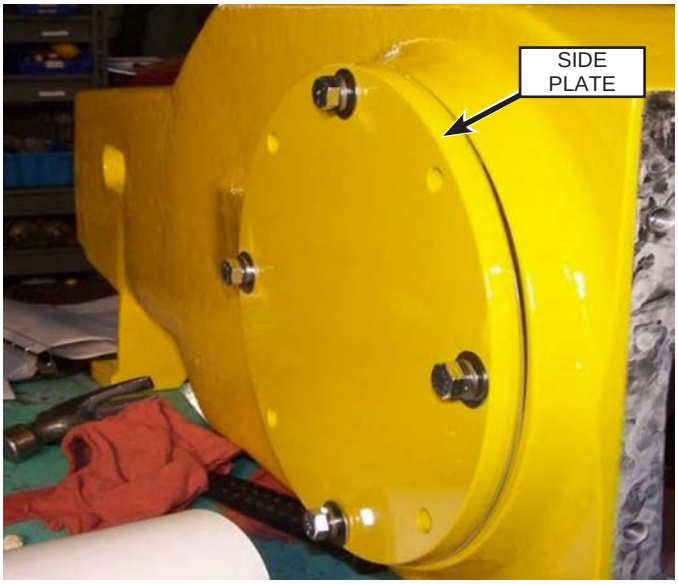


Fig. 161: Side Plate Installation

13. Mount a magnetic base dial indicator on the crankshaft with the indicator pin on the inside edge of the rear opening, as shown in Fig. 162.

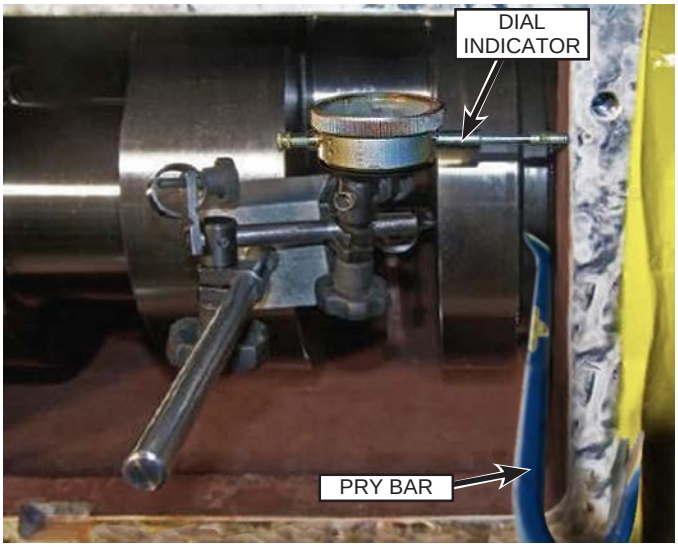


Fig. 162: Dial Indicator Mounting

14. With a firm, slow but not sudden pull in both directions the total end play should read within 0.001 inch (0.03 mm) - 0.004 inch (0.10 mm) tolerances.

15. Use a prybar (approx. 3 ft. (91 cm)) to move the crankshaft back and forth from left to right. Use firm, but not hard pressure. Record the movement of the indicator while prying in both directions. Add the measurements. Total indicator reading (sum of movement in both directions) should be 0.001 in. (0.0254 mm) - 0.004 in. (0.1016 mm). Check several times for consistency.
16. Add or remove shims as necessary to bring the endplay within the specified range. Keep the shim packs within 0.010 in. (0.254 mm) of each other.
17. Install the remaining capscrews onto the inboard and outboard side plates. Tighten the capscrews to 50 ft.lb (68 N·m).
18. Oil the bearings and install the connecting rods onto the crankshaft and install the crankcase cover as outlined in “Rod Journal Bearings” on page 61.
19. Install the three plunger couplings, connecting the plungers to the pony rods.

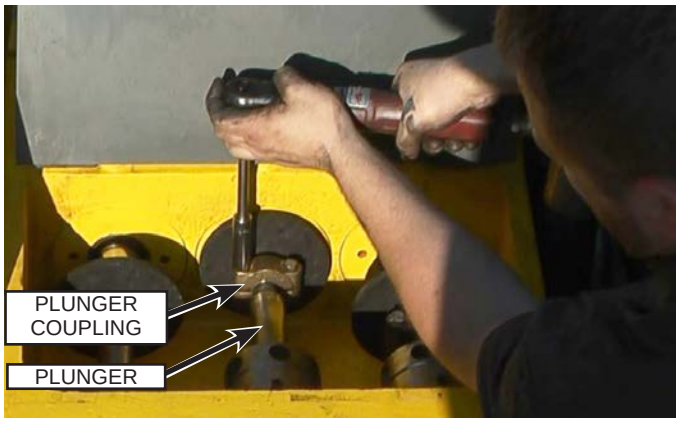


Fig. 163: Plunger Coupling Installation

20. Place the top cover and gasket into place. Install the 12 capscrews and washers that secure the top cover to the power frame. Tighten the capscrews to 50 ft.lb (68 N·m).
21. Position the rear cover, belt guard and gasket into place. Install the 12 capscrews and washers that secure the components to the power frame. Tighten the capscrews to 50 ft.lb (68 N·m).
22. Add oil to the crankcase. Refer to “Changing The Power End Oil” on page 55.

Jetstream®
Subsidiary of Federal Signal Corporation

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
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

PROBLEM	POSSIBLE CAUSE	REMEDY
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
Motor 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
Motor will not increase in speed when control gun first closes	Motor 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

TECHNICAL INFORMATION

A/C ELECTRIC MOTOR OPERATION

The speed of an A/C electric motor is dictated by the number of poles and the AC frequency or Hertz (Hz).

A 4 pole, 60 Hz motor will run at 1800 rpm with no load and draw about 30% of the full load amps (FLA) listed on the name plate of the motor. Jetstream normally uses 3 phase, 1800 rpm motors, but motors are available at 900, 1200 and 3600 rpm.

A motor will run slightly slower at full horsepower (hp). That speed is the nameplate rpm. An example of this is a nameplate rpm of 1785. The motor will draw full load amps at that speed. The full load amps is a measure of how much heat the motor can dissipate. If a motor is overloaded, it will not get to the name plate rpm and will draw more than full load amps. If this happens the motor will burn up. That is how you figure out if a motor is overloaded or not, read the amps and rpm. The rpm may not be a steady speed but the amps are a good measure.

The service factor (SF) of a motor was created to quantify how many times it can start each hour. It also means that the motor will run at that much over the rated horsepower if it is started and continuously run for hours at a time, with an hour or more before it is restarted. When you start a motor it is basically overloaded until it gets up to speed. However, the windings will cool down some as it runs, even at full load. For the most part, electric motor starters include a thermal overload protection module that senses the overload and shuts down before the motor burns up.

The motor will draw amps based on the voltage. A 250 hp motor with a 460 volt rating may draw 286 full load amps. If the voltage goes down to 455 volts it will draw 289 amps at full load. The motor will not run continuously at more than 20 volts below its rated voltage, under full load, without overheating and burning up. Electrical power is supplied at a slightly higher voltage than the nominal rating. A motor may be rated at 460 volts but the electrical service will be rated at 480 volts. As more and more load (amps) is added to a load center, the voltage goes down. If you need to diagnose a motor that trips the thermal overload regularly, check the voltage while the motor is running. If it goes well below the rated voltage and stays low, the problem is the power distribution going to the motor is overloaded.

A 75 hp motor may be rated for 208/230/460 volts and have a FLA rating of 184/167/83.4. 208 v =184 A / 230 v=167 A / 460 v = 83.4 A this is roughly equal to volts x amps=38,350.

Since motors come in nominal horsepower sizes, a specific application may not be running at full horsepower because the actual load is less. For example, the load may be 12 hp, but you have to put in a 15 hp motor because a 10 hp motor will be overloaded. A motor running at less than full load amps is not a problem.

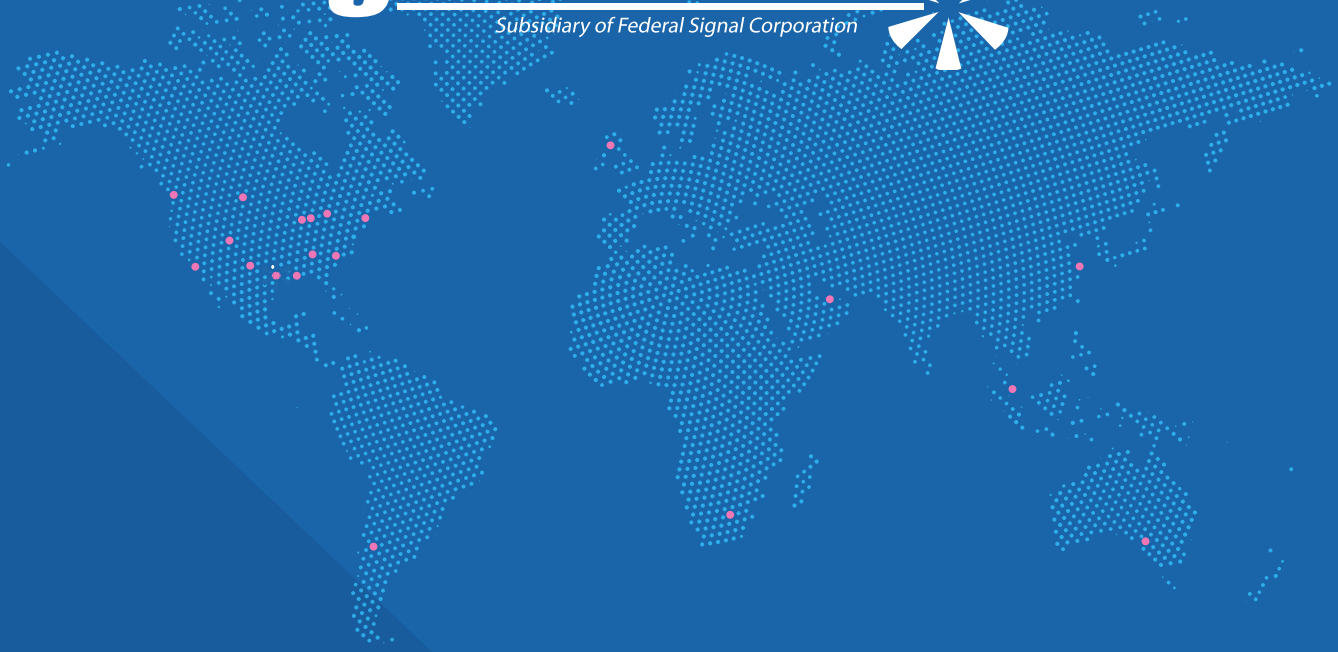
The starting amps are a function of the starter type. A soft start starter can be programmed to limit the amps during startup, typically, at about 1.5 times the FLA until it reaches full speed. The motor will start up slowly and take more time to get to full speed. An across the line starter does not limit the amps and the motor will draw about 3.0 to 6.0 times the FLA decreasing proportionally with speed to FLA when the motor gets up to full speed. Starting with the pump unloaded will reduce the start up amps on an across the line starter. With a soft start it will decrease the starting amps but increase the time required to get to full speed.

A motor running on a variable frequency drive will run at a speed based on the frequency programmed into the drive. It may be run faster or slower within the limits of the drive controller. However, you cannot run a motor above the name plate full load amps without damaging the motor. If you are using a variable frequency drive, set the required speed and then check the amps to be sure it is not overloaded

An AC motor designed to run on 60 Hz at 1800 rpm will run on 50 Hz at its designed voltage, but it will run at 1500 rpm and produce 5/6th the torque. Running the motor at 50 Hz is ok as long as the full load amps are not exceeded. Sometimes a manufacturer will provide a 460 v, 60 Hz motor to run on a 380 v, 50 Hz system that is de-rated to the next standard size that is below 5/6th of the original horsepower and simply change the name plate accordingly. This is a convenient way to get a 50 Hz in a hurry, but it will cost more. In some cases they will de-rate a 1.25 SF motor to 1.0 SF for use at 50 Hz at the same horsepower.

Jetstream®
Subsidiary of Federal Signal Corporation

Jetstream®
Subsidiary of Federal Signal Corporation



Streator, IL
(815) 672-6028

Toledo, OH
(888) 415-7368

New Brunswick, NJ
(732) 448-7830

Highland, IN
(219) 924-3180

Lexington, SC
(803) 996-0741

Leeds, AL
(800) 822-8785

Williston, ND
(701) 572-7421

La Porte, TX
(281) 674-8668

Gonzales, LA
(225) 647-0660

Midland, TX
(432) 563-4450

Salt Lake City, UT
(801) 808-4590

Long Beach, CA
(866) 515-9891

Lakewood, WA
(253) 584-0653

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

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

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

INTERNATIONAL DISTRIBUTORS

Orbitec
Santiago, Chile

Powerjet Rentals
Glasgow, Scotand

Asia Waterjet
Dubai, UAE

Total Blasting
Johannesburg, South Africa

Metco
Adelaide, Australia

FS Asia
Shanghai, China

Asia Waterjet
Singapore

JETSTREAM OF HOUSTON

5905 THOMAS ROAD
HOUSTON, TEXAS 77041

(832) 590-1300

(800) 231-8192

FS Solutions®

P/N 62201-C