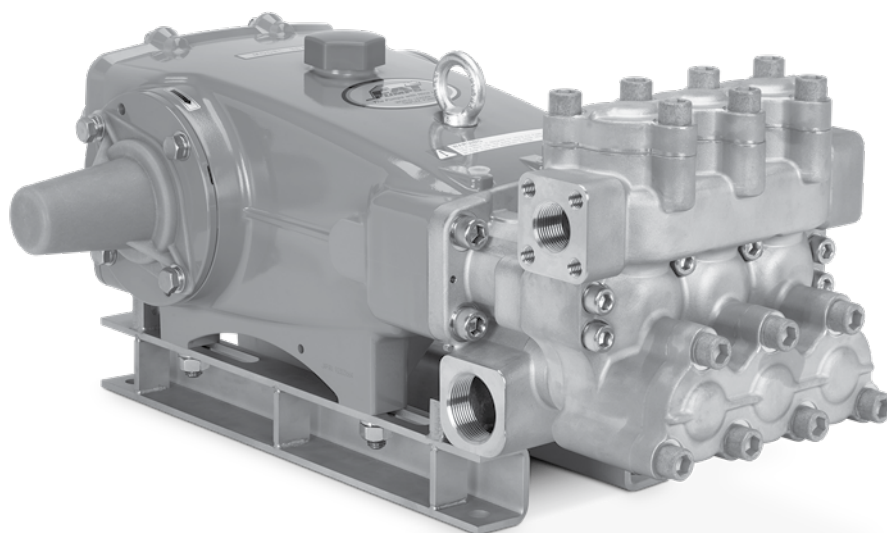


SERVICE MANUAL

36-FRAME SERIES PLUNGER PUMPS



PUMP MODELS INCLUDED

3621X	3622X	3631X	3632X	3641X	3642X
3621XD		3631XD		3641XD	

Product Quality, Reliability and Support You Expect

www.catpumps.com

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Safety Symbols

IMPORTANT SAFETY INSTRUCTIONS

It is the responsibility of the user to read and understand all instructions, important safeguards and safety precautions before operating or servicing any pump. Failure to do so may result in property damage, personal injury or death.

GENERAL SAFETY INFORMATION AND SYMBOLS

Pay special attention to the following signal words, safety alert symbols and statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or property damage.

NOTICE

Indicates a hazardous situation which, if not avoided, could result in property damage.



Indicates a potential personal injury hazard. Obey all safety messages that follow this symbol to avoid possible injury or death.

General Safety Information

DANGER

A. FLAMMABLE OR EXPLOSIVE LIQUID HAZARD

Do not operate pump with flammable or explosive liquids unless extraordinary safety precautions are observed. Leaks of flammable or explosive liquids, if exposed to elevated temperatures, static electricity, sparks or other hazards, will result in flame or possible explosion, causing serious personal injury, death or property damage.

1. Before operating pump with flammable or explosive liquids, ensure proper maintenance has been performed.
2. Do not operate pump with flammable or explosive liquids if leaks are detected.
3. Only pump flammable or explosive liquids that are compatible with pump component materials.
4. Do not operate pump with flammable or explosive liquids without safeguards or safety systems to detect leaks, elevated temperatures, spark prevention or any other hazards defined by the NFPA systems.
5. Do not remove Flammable Liquids Product Suitability Hang Tag to assure proper safety.
6. Follow ATEX guidelines for potentially-explosive atmospheres.

WARNING

A. ELECTRICAL SHOCK HAZARD

Do not service pump or electrical equipment while energized. Electricity can cause personal injury, death or property damage.

1. Adhere to "Lock Out" and "Tag Out" procedures for electrical equipment.
2. Before commencing pump service, turn power supply off.
3. Keep water away from electrical outlets and electrical devices.
4. Electrical components must be installed by a qualified electrician to avoid risk of electrocution.

B. ROTATING PARTS HAZARD

Do not service pump while energized. Moving, rotating or reciprocating parts can crush and cut, causing personal injury, death or property damage.

1. Adhere to "Lock Out" and "Tag Out" procedures for electrical equipment.
2. Before commencing pump service, turn power supply off, turn water supply off, squeeze trigger on gun to relieve system pressure.
3. For mobile equipment, be sure engines and hydraulics are turned off and secured to avoid accidental start.
4. Do not operate with safety guards removed.
5. Always use safety guards on all belt drives, couplings and shafts.

C. HOT SURFACE HAZARD

Do not touch pump, accessories or drive system while operating and until cool down is complete. Touching hot surface areas of the pump, accessories or drive system can cause severe burns or personal injury.

D. SKIN PUNCTURE HAZARD

Do not allow spray to contact any part of the body or animals. Pumped liquids under high pressure can pierce skin and underlying tissue or can deflect debris leading to serious personal injury or death.

1. Relieve all line pressure in the inlet line to the pump and discharge line from the pump before performing any maintenance on the pump.
2. When a high-pressure gun is not in use, set safety trigger lock (safety latch) to avoid accidental high-pressure operation and personal injury or property damage.
3. Do not check for leaks with hand. Use a piece of cardboard to check for leaks.
4. Review cleaning procedures to minimize heavy back blasting.
5. Wear adequate safety equipment and clothing when operating a high-pressure sprayer. Never use high-pressure spray with bare feet or exposed skin, and always wear safety glasses.

E. PUMPING LIQUIDS HAZARD

Do not operate pump with hot water, chemicals or other hazardous liquids unless extraordinary safety precautions are observed. Pumping hot water, chemicals or other hazardous liquids can expose personnel to serious injury.

1. Provide guards or shields around equipment to protect personnel.
2. Wear mask, goggles or eye protection while operating high-pressure equipment.
3. Obtain a Safety Data Sheet (SDS) and take appropriate safety measures for the liquid being handled.

General Safety Information

F. OVER PRESSURIZATION HAZARD **WARNING** CONTINUED

Do not operate high-pressure pumping system unless extraordinary safety precautions are observed. A high-pressure pumping system can deadhead or over pressurize causing serious personal injury and property damage.

1. All high-pressure systems require a primary pressure regulating device (e.g., regulator or unloader) and a secondary pressure safety relief device (e.g., pop-off valve, safety valve, rupture disc) to assure proper pressure setting and overpressure protection.
2. All high-pressure systems require a pressure gauge to monitor pressure settings and avoid overpressure of equipment or personal harm.
3. Install primary pressure relief device on the discharge side of the pump.
4. Install secondary pressure relief device between the primary device and pump.
5. Install pressure gauge onto the discharge manifold or in the discharge line near the manifold.
6. Open all valves on discharge side of plumbing before operation.

G. OXYGEN HAZARD

Do not charge pulsation dampeners with oxygen. Oxygen may cause an explosion causing personal injury, death or property damage.

1. Use nitrogen only when charging pulsation dampeners, **DO NOT USE OXYGEN**.
2. Use proper charging tools to charge pulsation dampeners.
3. Charge pulsation dampener within specifications stated on data sheet to assure proper pulsation dampening and prevent failure of bladder.

H. FALL HAZARD

Do not operate pressure washer while standing on slippery or unstable surface unless extraordinary safety precautions are observed. Pressure washing may create slippery surface on which a person may slip and fall causing personal injury or death.

1. Wear suitable footwear to maintain a good grip on wet surfaces.
2. Do not stand on ladders or scaffolding.
3. Do not over reach or stand on unstable supports.
4. Keep good footing and balance and hold gun with both hands to control kick back.

CAUTION

A. IMPROPER USE OF FITTINGS HAZARD

Do not operate the pump with improperly-connected, sized, worn or loose fittings, pipes or hoses. Operating the pump under these conditions could result in personal injury and property damage.

1. Ensure all fittings, pipes and hoses are properly rated for the maximum pressure rating and flow of the pump.
2. Check all fittings and pipes for cracks or damaged threads.
3. Check all hoses for cuts, wear, leaks, kinks or collapse before each use.
4. Ensure all connections are tight and secure.
5. Use PTFE thread tape or pipe thread sealant (sparingly) to reconnect plumbing. Do not wrap tape beyond the last thread, this will prevent loose tape from becoming lodged in the pump or accessories.
6. Apply proper sealants to assure secure fit or easy disassembly when servicing.

B. FROZEN LIQUID HAZARD

Do not operate the pump with frozen liquid. Operating the pump under this condition could over pressurize and jettison the manifold from the crankcase causing personal injury and property damage.

1. Store pump or pumping system in an environmentally-controlled room protected from freezing temperatures.
2. Follow procedures in *TECH BULLETIN 083* to winterize pump.

C. CLEANING PUMP HAZARD

Do not use solvents that are flammable and toxic to clean or degrease equipment. Use of these solvents could result in personal injury and property damage.

1. Follow safety instructions as found in SDS or on packaging of each liquid.
2. Clean equipment in a well-ventilated area.
3. Disposal of solvents to be in accordance with local, state and federal regulations.

D. OPERATING BEYOND SPECIFICATIONS HAZARD

Do not operate the pump outside the specifications of individual pump data sheet or service manual. Operating the pump under these conditions could result in personal injury and property damage.

1. Do not operate the pump faster than the maximum recommended RPM.
2. Do not operate the pump at pressures higher than the maximum recommended pressure.
3. Do not operate the pump at temperatures higher than the maximum recommended temperatures.
4. Do not use accessories that are not compatible or rated for the pump.

General Safety Information

E. LIFTING DEVICE HAZARD CONTINUED

Do not lift pump with unsuitable lifting devices. Use of unsuitable lifting devices may cause pump to fall, resulting in personal injury, damage to pump and/or pump with drive/base plate.

1. Lifting eyes installed on the pump must be used only to lift the pump.
2. Special lifting eyes should be installed on the base for lifting the pumping system (e.g. base, drive and accessories)
3. If slings or chains are used for lifting, they must be safely and securely attached to properly balance the weight of the unit.
4. Inspect slings and chains prior to use and replace worn and damaged slings and chains.

NOTICE

A. OIL HAZARD

Use only genuine Cat Pumps custom-blend, premium-grade, petroleum-based hydraulic oil. Use of other oil may not provide proper lubrication of drive-end components and may result in damage to the crankcase of the pump.

1. Fill pump crankcase to specific capacity indicated on data sheet or service manual prior to startup.
2. Cat Pumps premium custom-blend oil is available worldwide in 21-ounce bottles, (single and 12-pack cases), 2.5 gallon jugs (single and 2-pack) or 30 gallon drums. **Use of other oils may void the warranty.**

B. PUMP ROTATION DIRECTION HAZARD

Do not rotate pump crankshaft in reverse direction. Rotation of pump crankshaft in reverse direction may not provide proper lubrication and may result in damage to the drive-end components.

1. Forward rotation is the top of the crankshaft turning towards the manifold head of the pump.
2. Ensure oil is filled to the center red dot on sight gauge for forward rotation.
3. If reverse rotation is unavoidable, ensure oil is filled to slightly above center red dot on sight gauge.

C. BELT TENSION HAZARD

Do not operate pump with excessive belt tension. Excessive belt tension may damage the pump's bearings or reduce horsepower.

1. Rotate pump crankshaft before starting to ensure shaft and bearings are moving freely.
2. Ensure pulleys are properly sized.
3. Periodically replace belts to assure full horsepower transmission.
4. Ensure center distance dimensions between pulleys is correct.

D. BYPASS OPERATION HAZARD

Do not operate the pump in bypass for extended lengths of time. Operating the pump under this condition can quickly cause heat build-up resulting in damage to the pump.

1. Route bypass line to supply reservoir to dissipate heated bypass liquid into a large reservoir of cool water to reduce excessive temperature build-up.
2. Route bypass line to inlet of pump using a thermal valve in the bypass line or auto shut-off assembly that will sense temperature rise and either bypass or shut down system before damage occurs.

E. DRY OPERATION HAZARD

Do not operate the pump without water or liquid. Operating pump under these conditions could result in damage to the pump.

1. Open all valves on inlet side of pump before starting operation to prevent starving the pump.
2. Do not exceed inlet suction pressure limit specified in pump data sheet.
3. Ensure inlet feed exceeds the maximum flow being delivered by the pump.
4. Ensure all fittings, pipes and hoses are properly-sized for the pump to avoid restricted flow.
5. Review and implement all other recommendations appropriate for your system from the *Inlet Condition Check-List*.

Seal & Valve Kits

SERVICE INTERVALS

Typically, plunger pumps require only a very basic standard maintenance procedure of regular oil changes and seal and valve replacement. Seal and valve life are extremely dependent upon the type of pumped liquid, temperature, inlet conditions, system protective devices, filtration, duty-cycle and maintenance-cycle. Most system failures are not due to the pump, but fail because of other system components.

The Preventive Maintenance Schedule (on page 38) provides a summary of the various system maintenance concerns for all high-pressure systems.

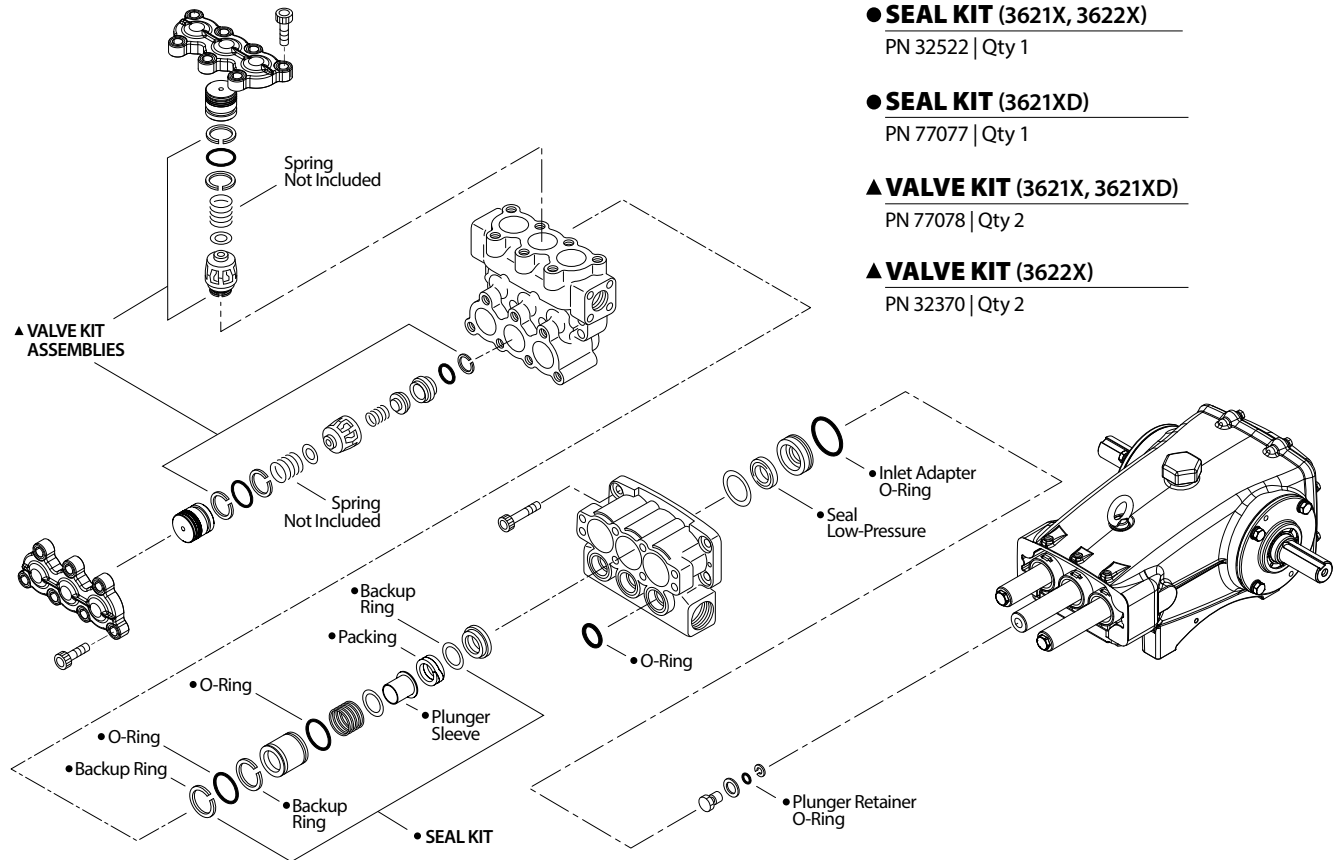
The seals on our pumps, operating under normal conditions, will perform for a minimum of 3,000 hours, with most lasting much longer. The valves typically perform for 3,000 hours, with many lasting much longer. Cat Pumps always recommends replacing these items as a kit since components usually wear at about the same rate.

TOOLS NEEDED

1. 10 mm Hex Wrench
2. 12 mm Hex Wrench
3. 2x Flat Tip Screwdrivers
4. Pick
5. Needle Nose Pliers
6. M10 x 1.5 Bolt
7. Adjustable Wrench
8. Reverse Pliers (PN 30696)
9. 21 mm Combination Wrench
10. Rubber Mallet
11. Oil Bubble Gauge Tool (PN 44050)
12. Lubricating Oil
13. Anti-Seize (PN 6139)
14. Liquid Thread Sealant



Seal & Valve Kit Pump Diagram – 20 Series



● SEAL KIT (3621X, 3622X)

PN 32522 | Qty 1

● SEAL KIT (3621XD)

PN 77077 | Qty 1

▲ VALVE KIT (3621X, 3621XD)

PN 77078 | Qty 2

▲ VALVE KIT (3622X)

PN 32370 | Qty 2

SEAL KIT

Models 3621X, 3622X | PN 32522 | Qty 1

SEAL KIT

Model 3621XD | PN 77077 | Qty 1

VALVE KITS

Models 3621X, 3621XD | PN 77078 | Qty 2
Model 3622X | PN 32370 | Qty 2



Seal & Valve Kit Pump Diagram – 30 Series

● SEAL KIT (3631X, 3632X)

PN 32532 | Qty 1

● SEAL KIT (3631XD)

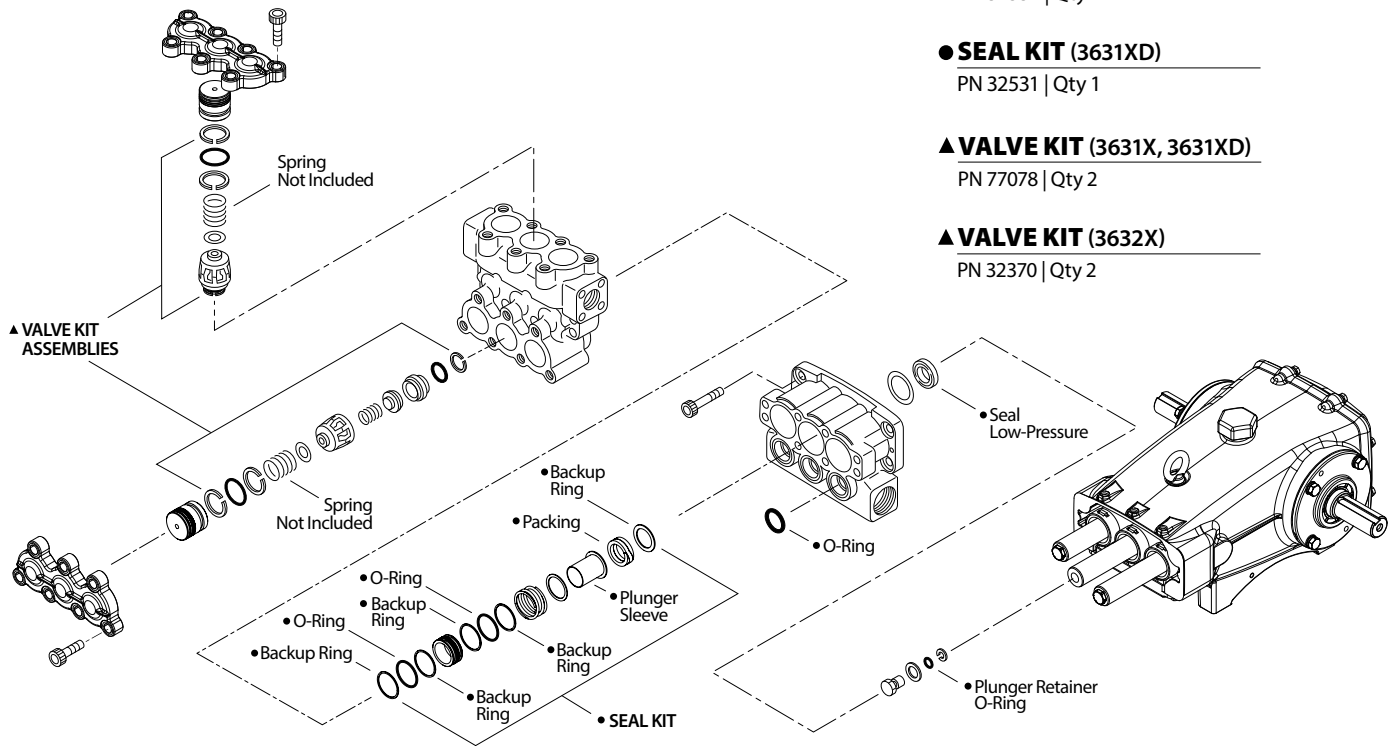
PN 32531 | Qty 1

▲ VALVE KIT (3631X, 3631XD)

PN 77078 | Qty 2

▲ VALVE KIT (3632X)

PN 32370 | Qty 2



SEAL KIT

Model 3631X | PN 32532 | Qty 1

SEAL KIT

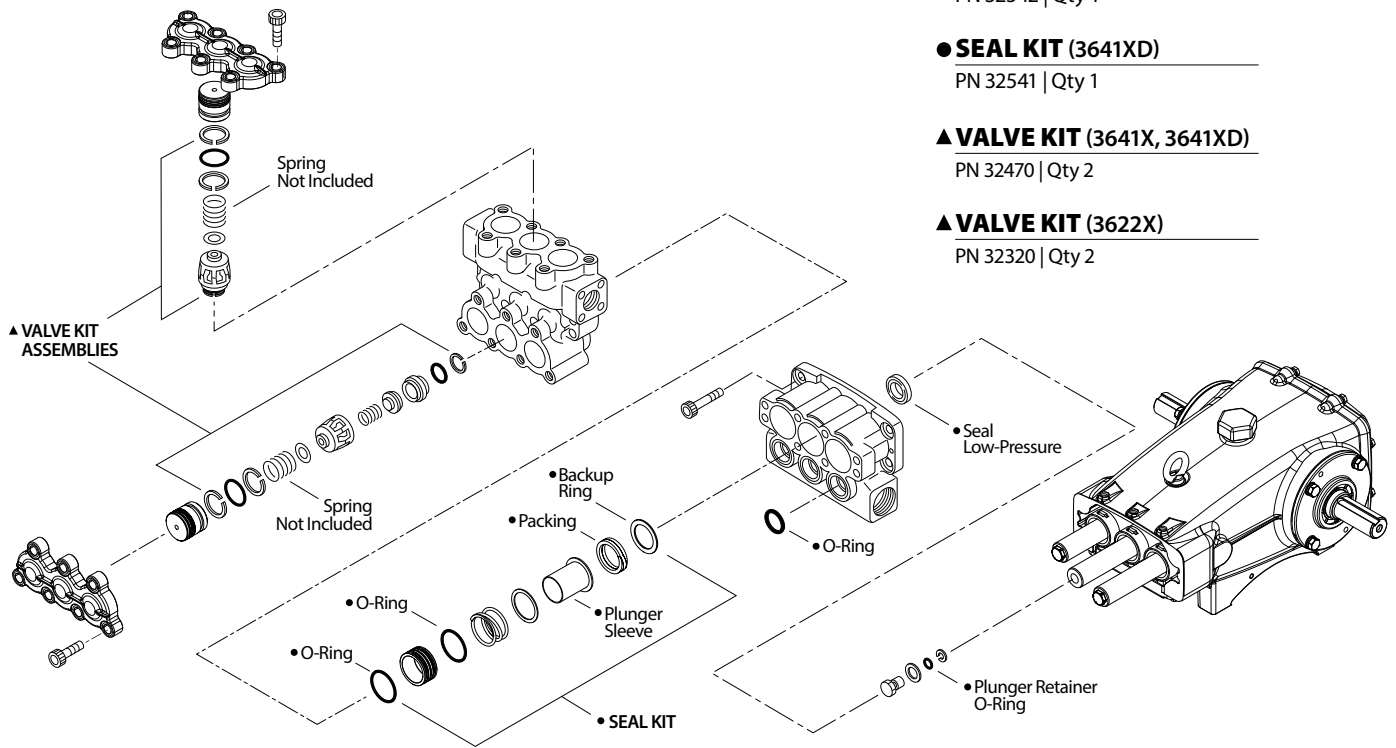
Model 3631XD | PN 32531 | Qty 1

VALVE KITS

Models 3631X, 3631XD | PN 77078 | Qty 2
Model 3632X | PN 32370 | Qty 2



Seal & Valve Kit Pump Diagram – 40 Series



● SEAL KIT (3641X, 3641X)

PN 32542 | Qty 1

● SEAL KIT (3641XD)

PN 32541 | Qty 1

▲ VALVE KIT (3641X, 3641XD)

PN 32470 | Qty 2

▲ VALVE KIT (3622X)

PN 32320 | Qty 2

SEAL KIT

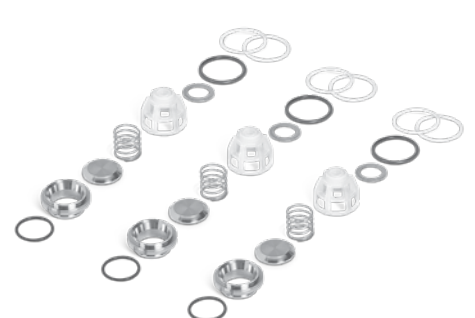
Models 3641X, 3642X | PN 32542 | Qty 1

SEAL KIT

Model 3641XD | PN 32541 | Qty 1

VALVE KITS

Models 3641X, 3641XD | PN 32470 | Qty 2
Model 3642X | PN 32320 | Qty 2

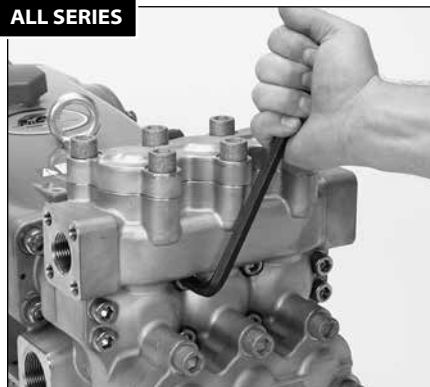


Servicing the Seals

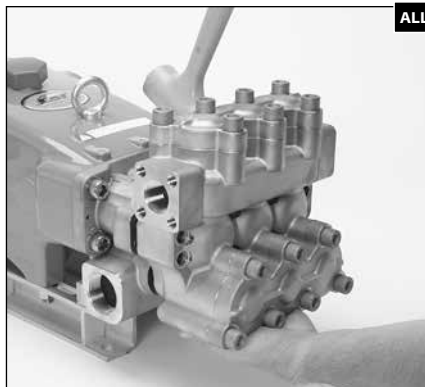
MANIFOLD AND SEAL REMOVAL

NOTE: One (1) seal kit is required to repair the pump

ALL SERIES



- 1.01 Use a 10 mm hex wrench to remove the eight (8) hex socket head screws (HSH) from the discharge manifold.



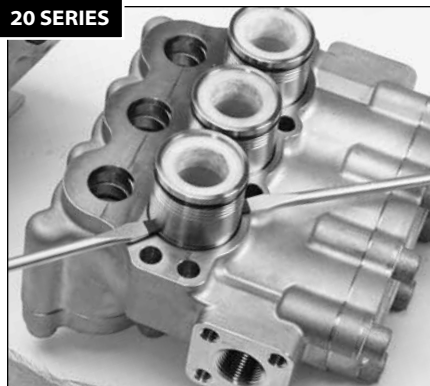
- 1.02 Support the manifold from underneath. Using a rubber mallet, tap the manifold to separate it from the inlet manifold and remove it completely.

NOTICE: The discharge manifold is very heavy, so use caution. To avoid injury, be sure to support the bottom of the manifold properly.



- 1.03 Place the discharge manifold on a flat surface with the packing cylinder or spacer bores facing up.

20 SERIES



- 1.04 Use two (2) flat tip screwdrivers on opposite sides to pry the cylinders loose from the manifold and remove them.



- 1.05 Set the packing cylinders on a flat surface with the smaller inside diameter facing upwards.



- 1.06 Using a socket with the same diameter as the small end of the packing cylinder bore, push the springs and packing assemblies out of the cylinders.



- 1.07 Inspect the packing backup ring for wear or damage.



- 1.08 Inspect the packings for wear or damage.



- 1.09 Inspect the spring for proper tension or any damage.

Servicing the Seals

MANIFOLD AND SEAL REMOVAL



1.10 Inspect the plunger sleeve for wear or damage.



1.11 Inspect the spring washer for wear or damage.



1.12 Inspect the packing cylinder bores to ensure sealing surfaces are smooth and corrosion-free.



1.13 Using a pick, remove the front packing cylinder O-rings and backup rings.



1.14 Inspect for cuts, nicks or damage.



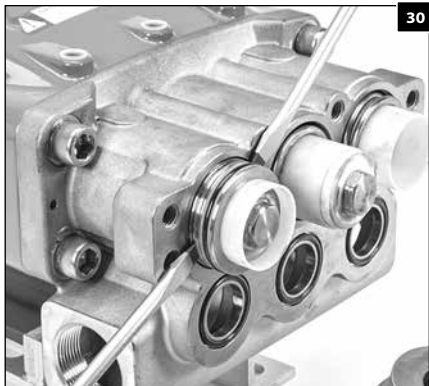
1.15 Using a pick, remove the rear packing cylinder O-ring.



1.16 Inspect for cuts, nicks or damage.



1.17 If the packing spacers remain in the discharge manifold, use two (2) flat tip screwdrivers on opposite sides to pry the cylinders loose from the manifold and remove.



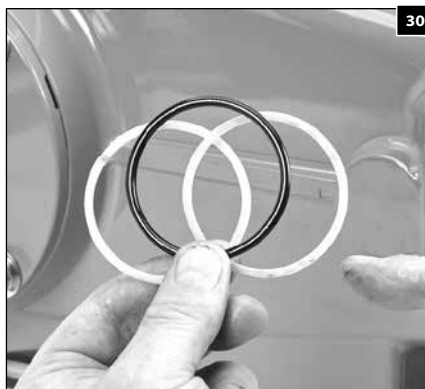
1.18 If the packing spacers remain in the inlet manifold, use two (2) flat tip screwdrivers on opposite sides to pry them loose from the manifold and remove.

Servicing the Seals

MANIFOLD AND SEAL REMOVAL



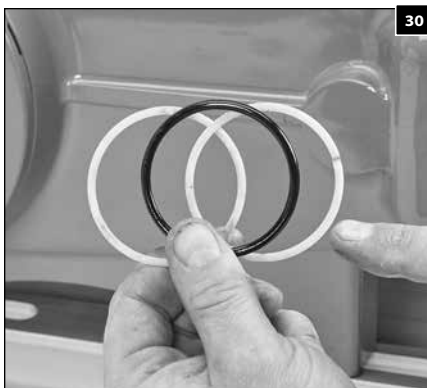
1.19 Using a pick, remove the front packing spacer O-ring and backup rings.



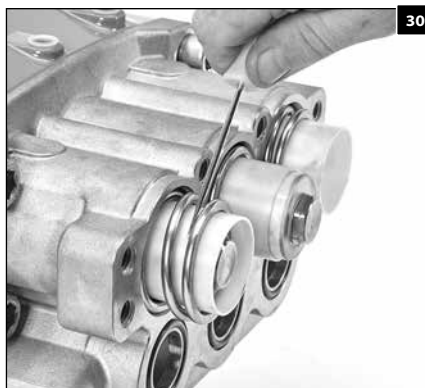
1.20 Inspect for cuts, nicks or damage.



1.21 Using a pick, remove the rear packing spacer O-ring and backup rings.



1.22 Inspect for cuts, nicks or damage.



1.23 Remove the coil springs from inlet manifold with a pick.

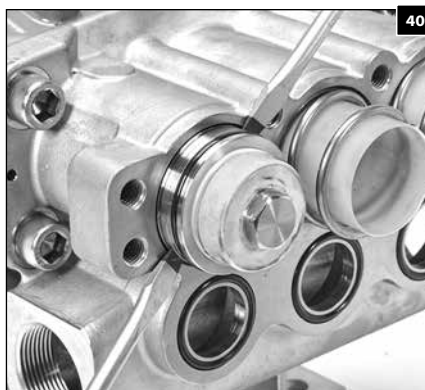


1.24 Inspect the spring for proper tension or any damage.

40 SERIES



1.25 If the packing spacers remain in the discharge manifold, use two (2) flat tip screwdrivers on opposite sides to pry the cylinders loose from the manifold and remove.



1.26 If the packing spacers remain in the inlet manifold, use two (2) flat tip screwdrivers on opposite sides to pry them loose from the manifold and remove.



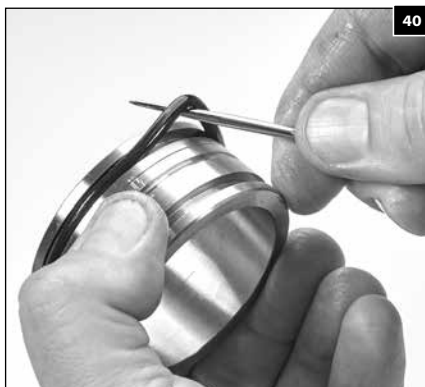
1.27 Using a pick, remove the front packing spacer O-ring.

Servicing the Seals

MANIFOLD AND SEAL REMOVAL



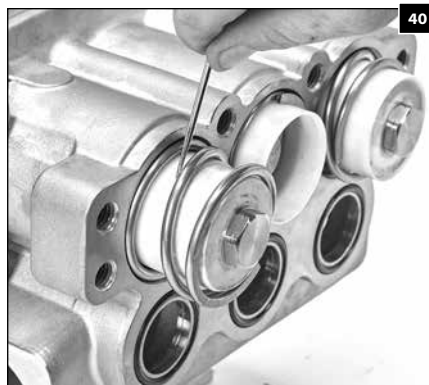
1.28 Inspect for cuts, nicks or damage.



1.29 Using a pick, remove the rear packing spacer O-ring.



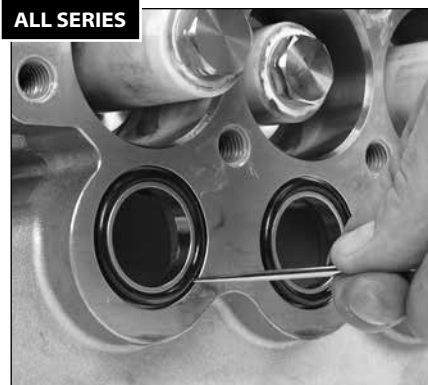
1.30 Inspect for cuts, nicks or damage.



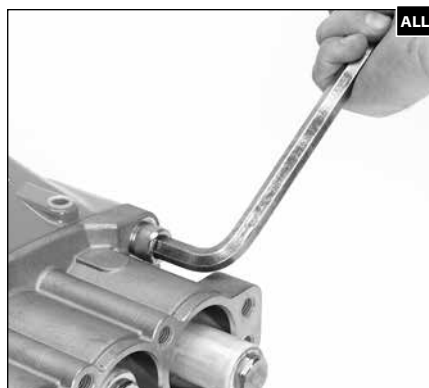
1.31 Remove the coil springs from inlet manifold with a pick.



1.32 Inspect the spring for proper tension or any damage.



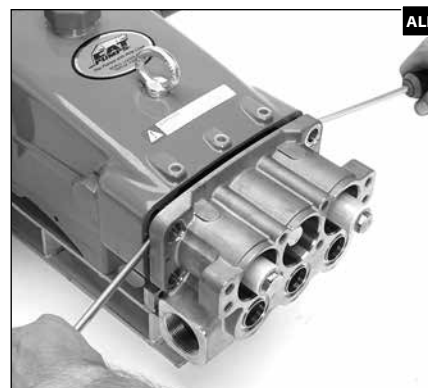
1.33 Using a pick, remove the inlet manifold O-rings.



1.34 Use a 12 mm hex wrench to remove the four (4) (HSH) screws from the inlet manifold.



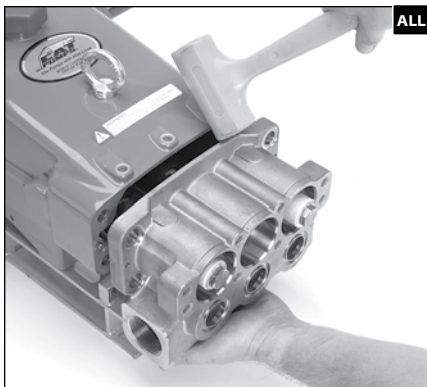
1.35 Rotate the crankshaft with an adjustable wrench to create separation between the manifold and crankcase.



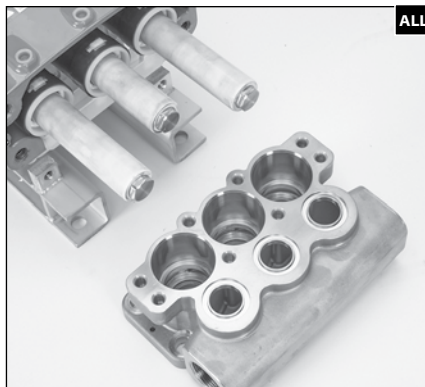
1.36 Insert two (2) flat tip screwdrivers on opposite sides to pry the manifold away from the crankcase.

Servicing the Seals

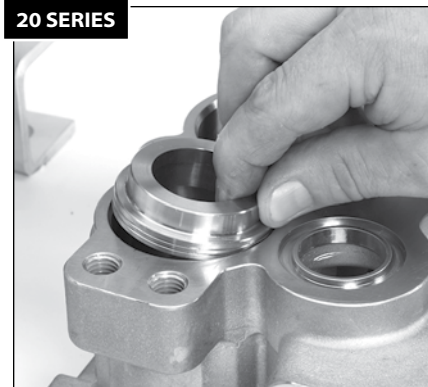
MANIFOLD AND SEAL REMOVAL



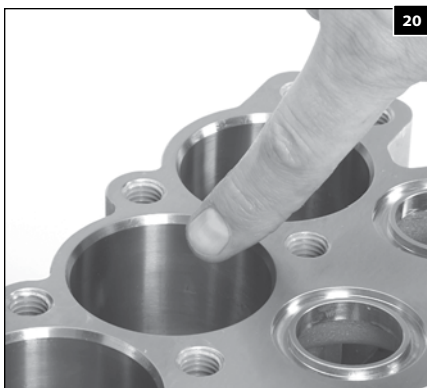
1.37 Support the manifold from underneath. Using a rubber mallet, tap the manifold to separate from the crankcase and remove completely.



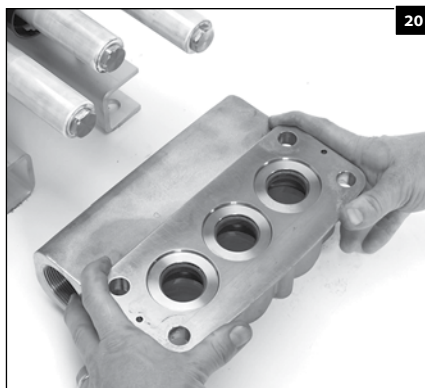
1.38 Place the inlet manifold on a flat surface with the packing cylinder or spacer bores facing up.



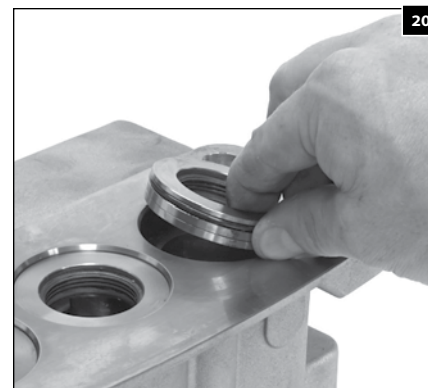
1.39 Remove the spacers. Inspect for wear or damage.



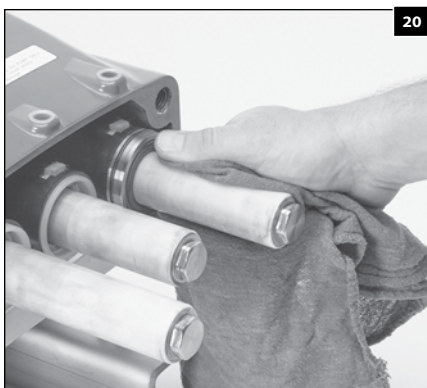
1.40 Inspect the manifold bores to ensure sealing surfaces are smooth and free from corrosion.



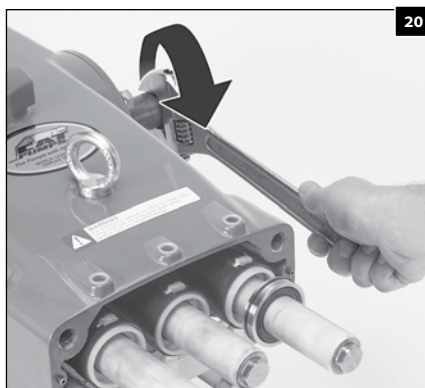
1.41 Flip the manifold over so the inlet adapters are facing upwards.



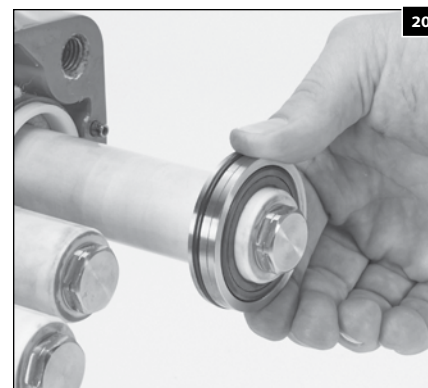
1.42 Remove the inlet adapters from the inlet manifold.



1.43 If the inlet adapters stay on the plungers, wipe them clean and apply a light oil.



1.44 Rotate the crankshaft with an adjustable wrench to create separation between the inlet adapters and the seal retainers.



1.45 Remove the inlet adapters from the plungers.

Servicing the Seals

MANIFOLD AND SEAL REMOVAL



1.46 Place the inlet adapters on top of the large bore end of the packing cylinders with the low-pressure seal facing down.



1.47 Using a socket that has the same diameter as the inlet adapter bore, push the low-pressure seals out of the adapters.



1.48 Inspect the inside diameter of the low-pressure seals for wear or damage.



1.49 Inspect the inside diameter of the inlet adapters to ensure sealing surfaces are smooth and free from corrosion.



1.50 Using a pick, remove the O-rings from the inlet adapters.



1.51 Inspect for cuts, nicks or damage.



1.52 Remove the low-pressure seal washers and inspect for wear or damage.



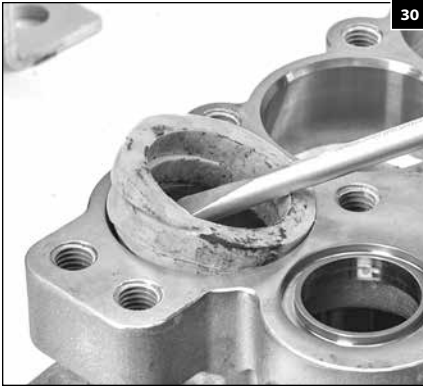
1.53 Inspect the manifold bores to ensure sealing surfaces are smooth and free from corrosion.



1.54 Remove the plunger sleeve and spring washer.

Servicing the Seals

MANIFOLD AND SEAL REMOVAL

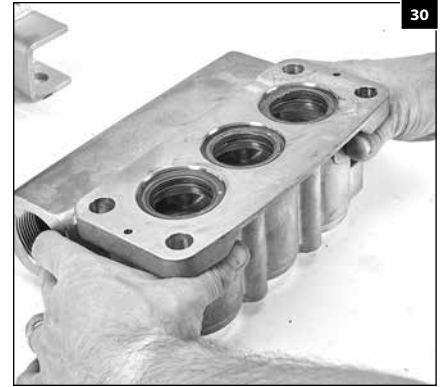


1.55 Use a flat tip screwdriver to pry the packing upward and remove.

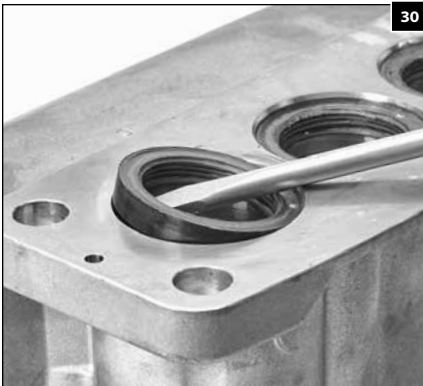
NOTICE: Be careful not to score the inside of the manifold.



1.56 Remove the packing backup ring and inspect for wear or damage



1.57 Flip the inlet manifold over so the low-pressure seals are facing upwards.



1.58 Use a flat tip screwdriver to pry the low-pressure seal upward and remove.

NOTICE: Be careful not to score the inside of the manifold.



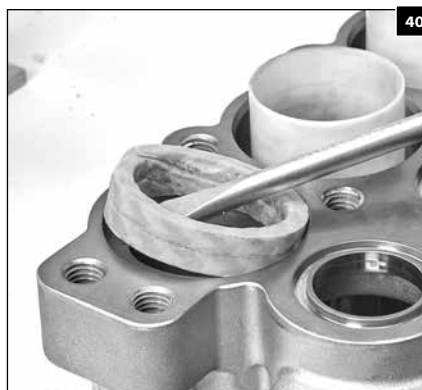
1.59 Remove the low-pressure seal spacers from the inlet manifold.



1.60 Inspect the manifold bores to ensure sealing surfaces are smooth and free from corrosion.



1.61 Remove the plunger sleeve and spring washer.



1.62 Use a flat tip screwdriver to pry the packing upward and remove.

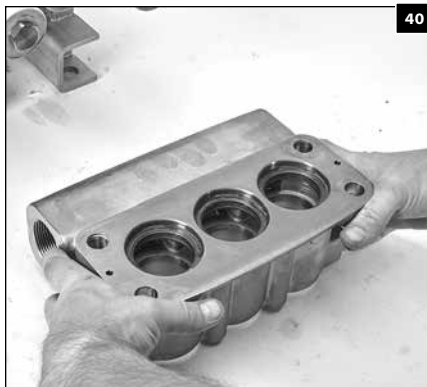
NOTICE: Be careful not to score the inside of the manifold.



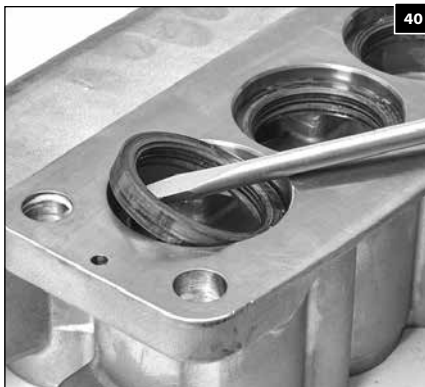
1.63 Remove the packing backup ring and inspect for wear or damage

Servicing the Seals

MANIFOLD AND SEAL REMOVAL

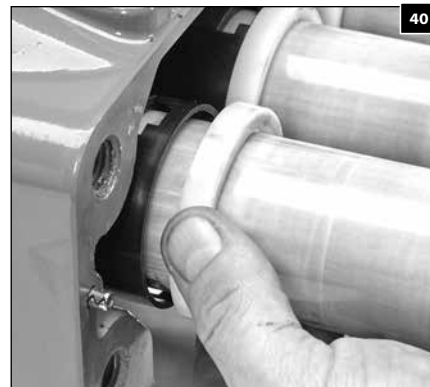


1.64 Flip the inlet manifold over so the low-pressure seals are facing upwards.



1.65 Use a flat tip screwdriver to pry the low-pressure seal upward and remove.

NOTICE: Be careful not to score the inside of the manifold.



1.66 Remove the low-pressure seal spacers from the seal retainers.

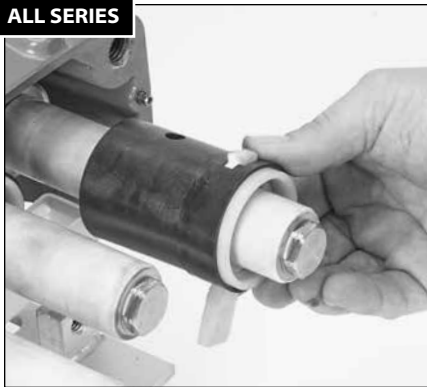


1.67 Inspect the manifold bores to ensure sealing surfaces are smooth and free from corrosion.

Servicing the Seals

PLUNGER REMOVAL

ALL SERIES



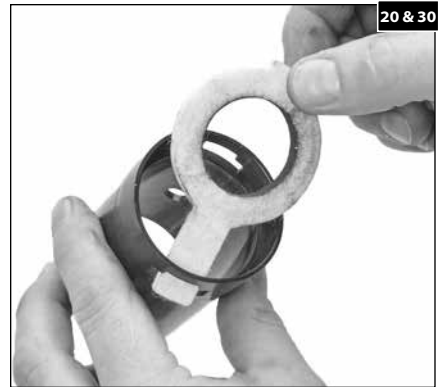
1.68 Remove the seal retainers from the crankcase housing.

20 & 30 SERIES



1.69 Remove the front piece of the seal retainer.

20 & 30



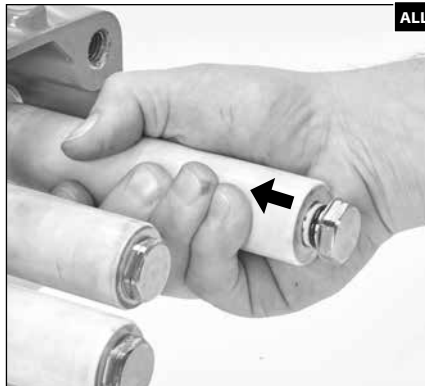
1.70 Remove and inspect the wicks. Replace as needed (wicks are not included in the seal kit).

ALL SERIES



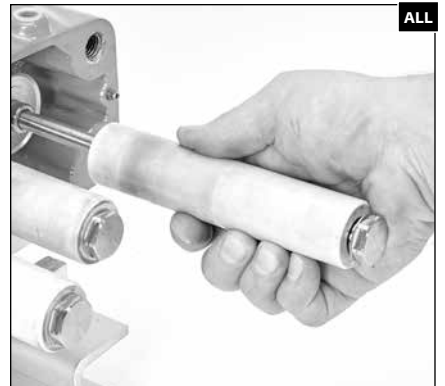
1.71 Using a 21 mm combination wrench, loosen the plunger retainer.

ALL



1.72 Before completely removing the plunger retainer, stop and push the plunger towards the drive end to break loose from the retainer.

ALL



1.73 Remove the plunger and retainer.

ALL



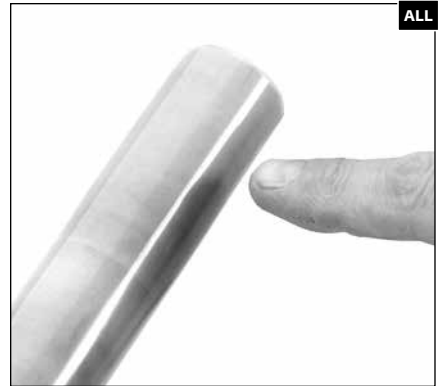
1.74 Remove the plunger retainer from the plunger and inspect the O-ring and backup ring for damage.

ALL



1.75 Using a pick, remove the plunger retainer O-ring from the plunger retainer.

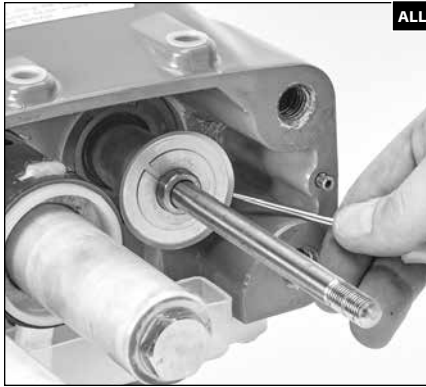
ALL



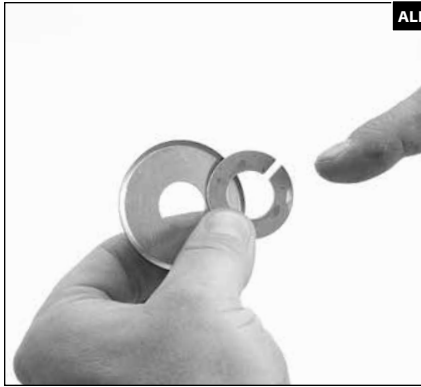
1.76 Inspect the ceramic plunger for cracks and scoring to the surface. Clean with a wire-wheel brush if necessary.

Servicing the Seals

PLUNGER REMOVAL



1.77 Use a pick to remove the keyhole washer and barrier slinger located behind the plunger.



1.78 Inspect for damage.

Servicing the Seals

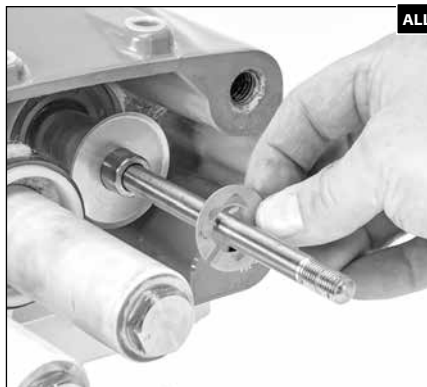
PLUNGER REASSEMBLY

ALL SERIES



1.79 Install the barrier slinger with the dish side facing away from the crankcase.

ALL



1.80 Install the keyhole washer. The slot can face any direction.

ALL



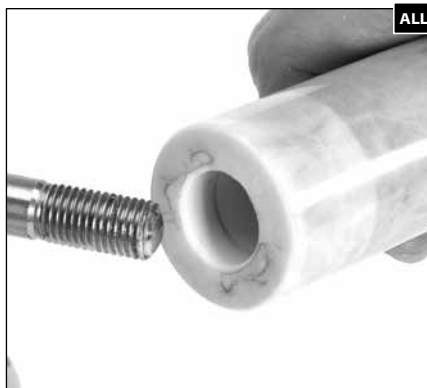
1.81 Install new plunger retainer O-rings between the backup rings and head of the retainer.

ALL



1.82 Apply a lubricant to the outside surfaces of the plunger retainer O-rings.

ALL



1.83 Look for the stepped side of the plunger. This side goes towards the pump crankcase.

ALL



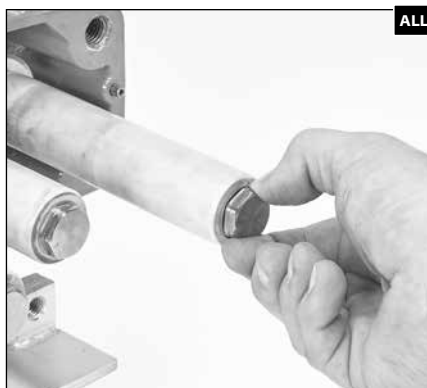
1.84 Insert the plunger retainer with O-ring and backup ring into the non-stepped side of the plunger.

ALL



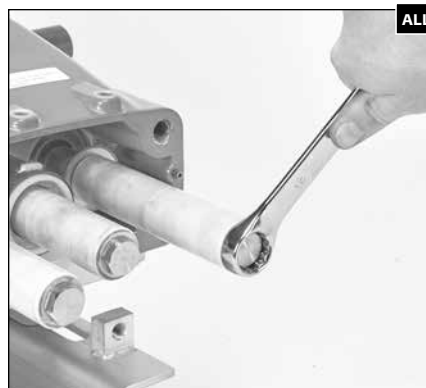
1.85 Place a drop of Loctite® 242® on the threaded end of the plunger rod.

ALL



1.86 Thread the plunger assembly onto the plunger rod by hand

ALL



1.87 Using a 21 mm combination wrench, torque to 220 in-lbs, 18 ft-lbs or 24 Nm.

Servicing the Seals

PLUNGER REASSEMBLY

20 & 30 SERIES



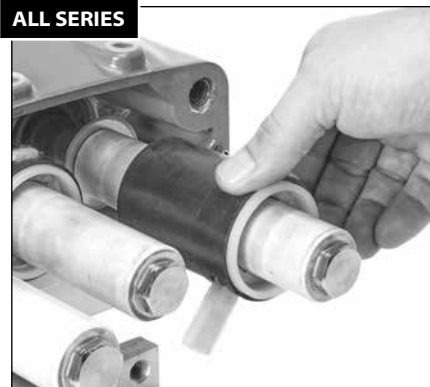
1.88 Install the wicks into the seal retainers.

20 & 30



1.89 Install the front piece of the seal retainer.

ALL SERIES



1.90 Install the seal retainer with wick tabs facing down and into the oil pan (20 and 30 Series), or with the holes facing down (40 Series).

Servicing the Seals

SEAL INSTALLATION

20 SERIES



1.91 Install the low-pressure seal washers into the inlet manifold.



1.92 Apply a lubricant to the outside surface of the low-pressure seals.



1.93 One side of the low-pressure seal has a groove and a spring. Install the grooved side facing upwards and press it into the low-pressure seal adapter by hand.



1.94 Set the low-pressure seal adapters on a flat surface with the grooved sides of the low-pressure seals facing upwards.



1.95 Using a socket with the same diameter as the low-pressure seals, tap the low-pressure seals all the way into the adapters.



1.96 Replace the O-rings on the low-pressure seal adapters.



1.97 Apply a lubricant to the outside surfaces of the low-pressure seal adapter O-rings.



1.98 Press the low-pressure seal adapters into the inlet manifold with the grooved sides of the low-pressure seals facing down.



1.99 Install the low-pressure seal spacers into the inlet manifold.

Loctite and 242 are registered trademarks of the Henkel Corporation.

Servicing the Seals

SEAL INSTALLATION



1.100 Apply a lubricant to the outside surface of the low-pressure seals.



1.101 One side of the low-pressure seal has a groove and a spring. Install the grooved side facing downwards and press it into the inlet manifold by hand.



1.102 Install the low-pressure seal spacers onto the seal retainers.



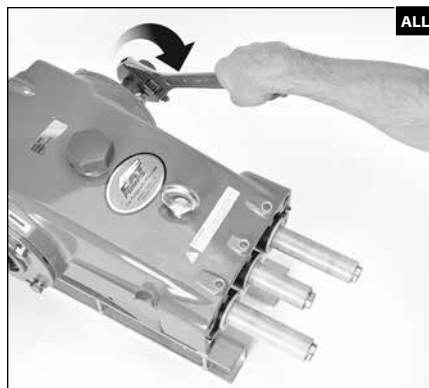
1.103 Apply a lubricant to the outside surface of the low-pressure seals.



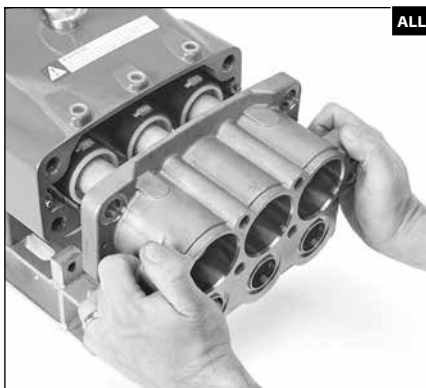
1.104 One side of the low-pressure seal has a groove. Install the groove side facing down and press into place.



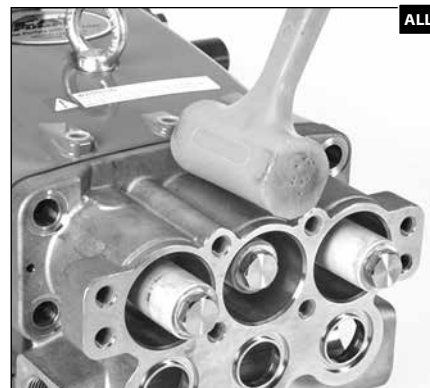
1.105 Flip the inlet manifold over so that the packing cylinder or spacer bores are facing up.



1.106 Rotate the crankshaft so that the outside two plungers are even at the furthest distance from the crankcase.



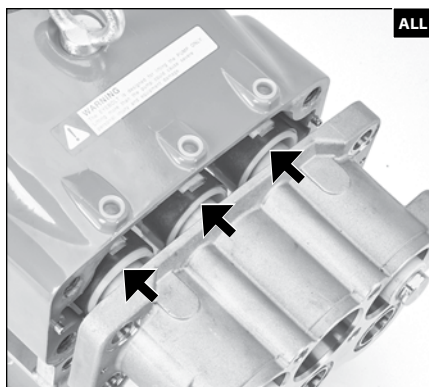
1.107 Install the inlet manifold by hand, ensuring even alignment.



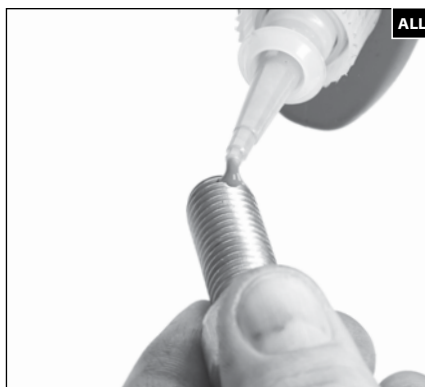
1.108 Use a rubber mallet to tap the manifold the rest of the way.

Servicing the Seals

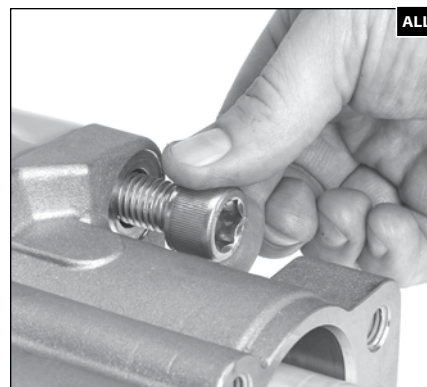
SEAL INSTALLATION



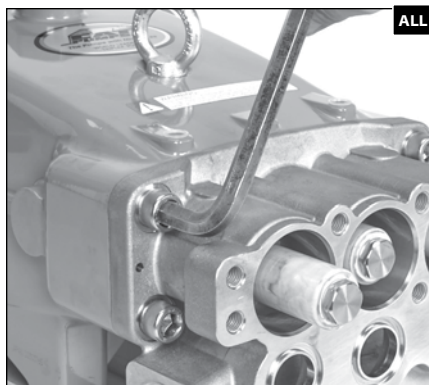
1.109 Check seal retainers to ensure they remain in place when installing the inlet manifold.



1.110 Place a drop of Loctite® 242® on the threads of inlet manifold screws.

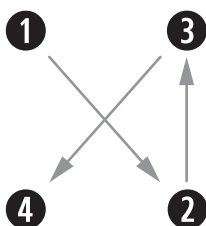


1.111 Install four (4) HSH screws by hand.



1.112 Using a 12 mm hex wrench, tighten hex head screws using the appropriate cross-pattern for even alignment. Torque to 480 in-lbs, 40 ft-lbs, or 54 Nm.

TORQUE SEQUENCE



Servicing the Seals

MANIFOLD REASSEMBLY

20 SERIES



1.113 Install backup rings into the larger groove on the end of the packing cylinder.



1.114 Install the thicker O-rings between the two backup rings.

NOTICE: There are two O-rings for each V-packing cylinder. The thicker O-rings go in the larger groove with the backup rings.



1.115 Install the O-ring into the smaller grooves on the other end of the packing spacers.



1.116 Install the coil springs into the packing cylinders.



1.117 Install the spring washer into the packing cylinder.



1.118 Install the plunger sleeve into the packing cylinder with the smaller diameter end facing down.



1.119 Apply a lubricant to the inside diameter of the packings.



1.120 Install the packings into the packing cylinder.



1.121 Install the packing backup ring into the packing cylinder.

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Servicing the Seals

MANIFOLD REASSEMBLY



1.122 Install the packing spacer with the smaller diameter side facing down and press it into place.



1.123 Lubricate both O-rings and backup rings on the packing cylinders.



1.124 Install the packing cylinder assemblies over the plungers with the backup ring ends facing outwards and twist them counter-clockwise to make them slide more easily.



1.125 Press the packing cylinder assemblies into the inlet manifold bores.



1.126 Install the packing backup rings into the manifold bores.



1.127 Install the plunger sleeves over the plungers with the larger diameter end facing the crankcase.



1.128 Lightly tap on the plunger sleeve with a mallet to drive the packing backup ring into the manifold bore.



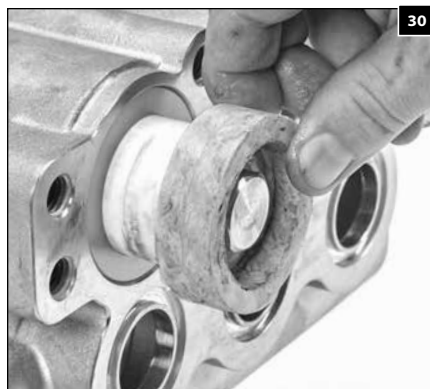
1.129 Remove the plunger sleeve.



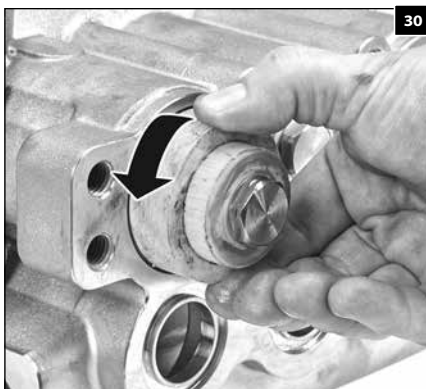
1.130 Apply a lubricant to the inside diameter of the packings.

Servicing the Seals

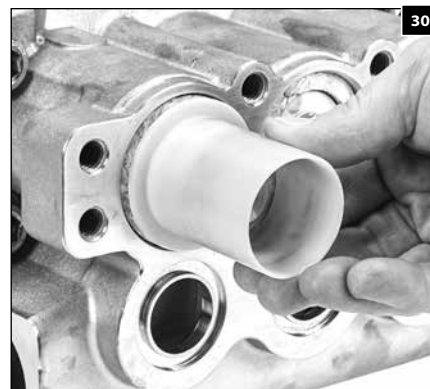
MANIFOLD REASSEMBLY



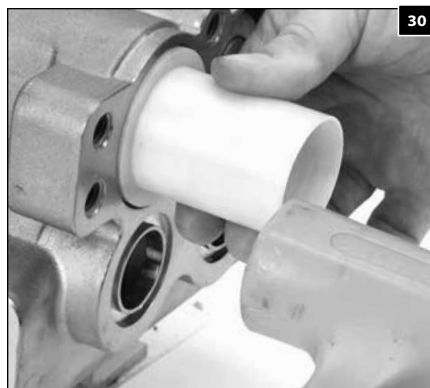
1.131 Install the packings over the plunger.



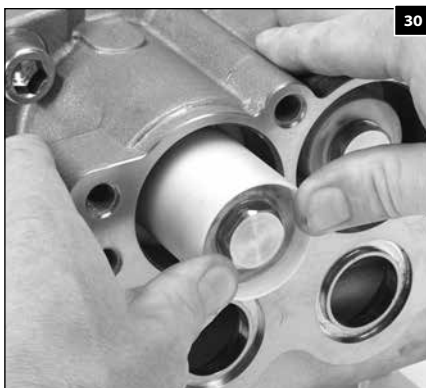
1.132 If the packing is tight around the plunger, twist it counter-clockwise to make it slide more easily.



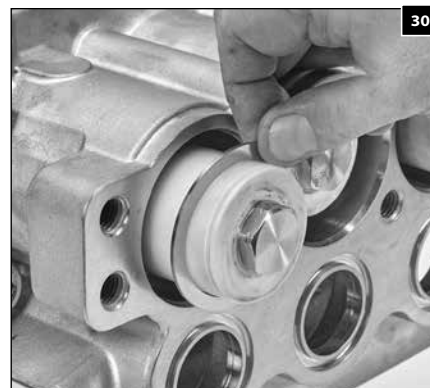
1.133 Install the plunger sleeve over the plunger with the larger diameter end facing the crankcase.



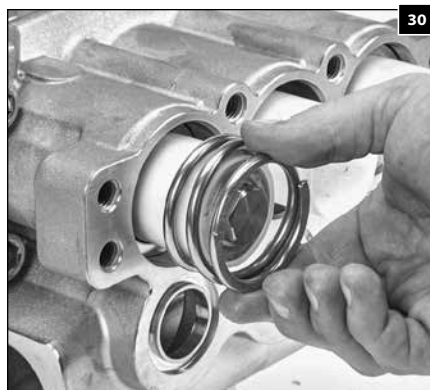
1.134 Lightly tap on the plunger sleeves with a mallet to drive the packings into the manifold bores.



1.135 Press the plunger sleeves into place by hand.



1.136 Install the spring washer over the plunger sleeve and into the manifold.



1.137 Install the large coil spring over the plunger sleeve and into the manifold.



1.138 Install backup rings into the grooves of the packing spacer.



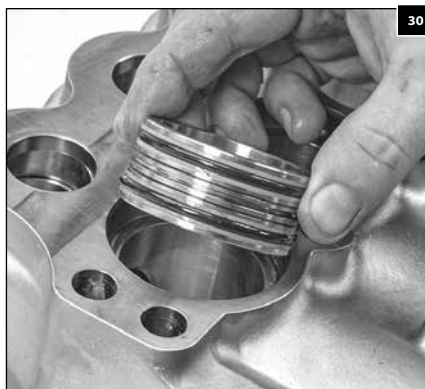
1.139 Install the O-rings between the two backup rings on both ends.

Servicing the Seals

MANIFOLD REASSEMBLY



1.140 Lubricate both O-rings and backup rings on the packing spacers.



1.141 Press the packing spacer assemblies into the discharge manifold bores.



1.142 Install the packing backup rings into the manifold bores.



1.143 Install the plunger sleeves over the plungers with the larger diameter end facing the crankcase.



1.144 Lightly tap on the plunger sleeve with a mallet to drive the packing backup ring into the manifold bore.



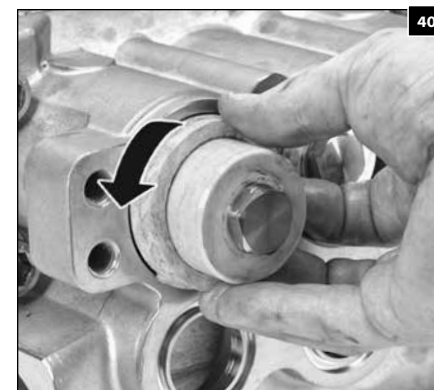
1.145 Remove the plunger sleeve.



1.146 Apply a lubricant to the inside diameter of the packings.



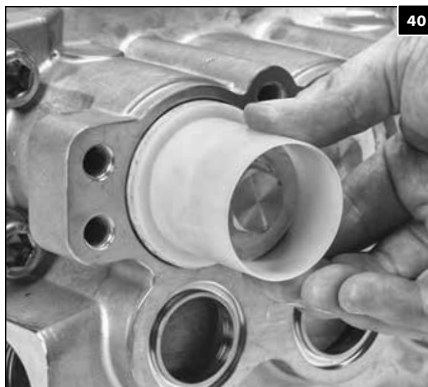
1.147 Install the packings over the plunger.



1.148 If the packing is tight around the plunger, twist it counter-clockwise to make it slide more easily.

Servicing the Seals

MANIFOLD REASSEMBLY



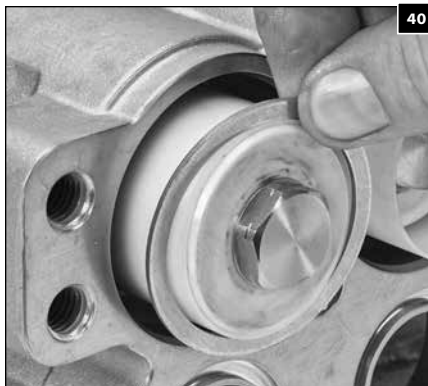
1.149 Install the plunger sleeve over the plunger with the larger diameter end facing the crankcase.



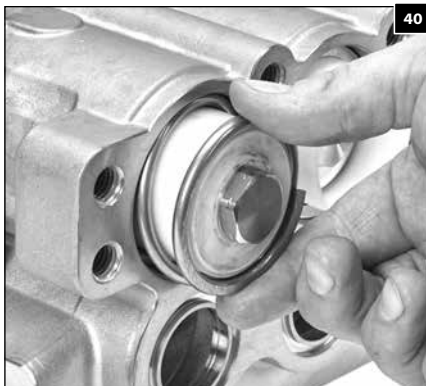
1.150 Lightly tap on the plunger sleeves with a mallet to drive the packings into the manifold bores.



1.151 Press the plunger sleeves into place by hand.



1.152 Install the spring washer over the plunger sleeve and into the manifold.



1.153 Install the large coil spring over the plunger sleeve and into the manifold.



1.154 Install the O-rings into the grooves of the packing spacers.



1.155 Lubricate both O-rings on the packing spacers.



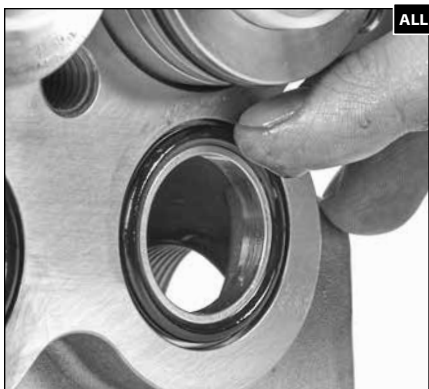
1.156 Press the packing spacer assemblies into the discharge manifold bores.



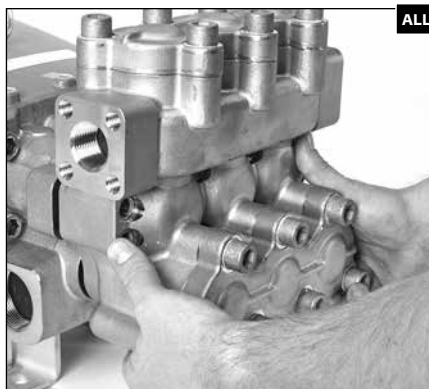
1.157 Install inlet manifold O-rings into the inlet manifold.

Servicing the Seals

MANIFOLD REASSEMBLY



1.158 Lubricate inlet manifold O-rings.



1.159 Install the discharge manifold by hand, ensuring even alignment.

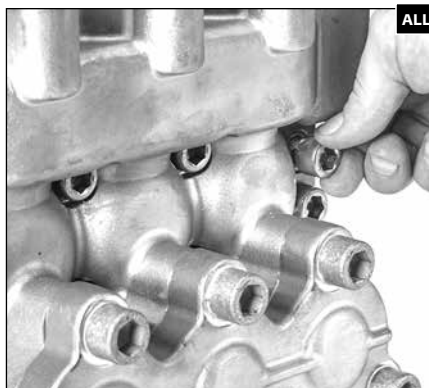


1.160 Lightly tap the manifold with a mallet until resistance from the springs is felt.

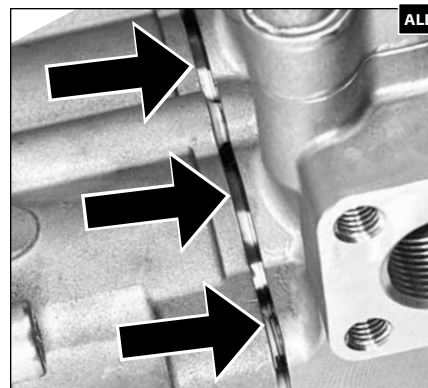
NOTICE: The manifolds will not be tight against each other until drawn into place with the screws in the following steps.



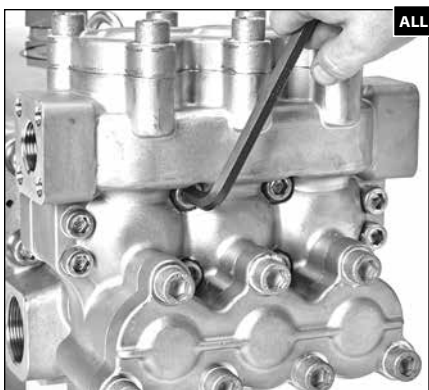
1.161 Apply anti-seize to the threads and underside of the heads of the discharge manifold HSH screws.



1.162 Install eight (8) HSH screws by hand.

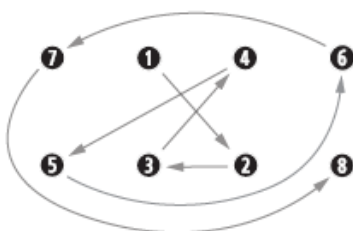


1.163 Watch backup rings on packing cylinders and spacers to ensure they do not come out of their grooves while tightening the discharge manifold into place.



1.164 Using a 10 mm hex wrench, tighten hex head screws using the appropriate cross-pattern for even alignment. Torque to 355 in-lbs, 30 ft-lbs, or 40 Nm.

TORQUE SEQUENCE



1.165 Rotate crankshaft with adjustable wrench to ensure proper movement of plunger rod assemblies and that seals are not binding.

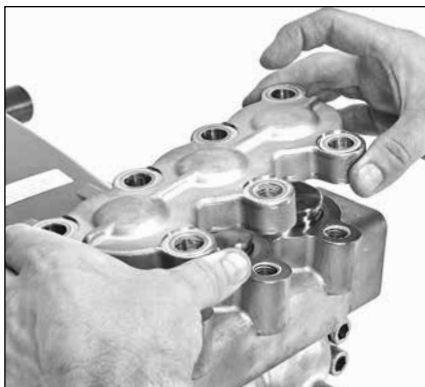
Servicing the Valves

VALVE REMOVAL

NOTE: Two (2) valve kits are required to repair the pump. Discharge and inlet valve assemblies are identical (use procedure below for disassembly and reassembly of discharge and inlet valves).



2.01 Use a 12 mm hex wrench to remove the seven (7) HSH screws from the valve plate.



2.02 Remove the valve plate by hand.



2.03 Insert two (2) flat tip screwdrivers into the grooves on the opposite sides of valve plug and pry upward to remove.



2.04 Using a pick, remove the valve plug O-ring and backup rings.



2.05 Inspect for cuts, nicks or damage.



2.06 Remove the coil springs from the manifold.



2.07 Remove the spring washers from the manifold.



2.08 Thread a 10 mm bolt into the top of the spring retainers.



2.09 Use needle-nosed pliers to grasp under the head of the bolt to pull the complete valve assemblies loose from the manifold. Lift up and straight out.

Servicing the Valves

VALVE REMOVAL



2.10 Remove the 10 mm bolt from the valve assembly.

NOTICE: If the spring retainer separates from the seat, remove the spring and valve by hand. Use reverse pliers to remove the valve seat with a turning motion while pulling away from the manifold.



WHITEBOARD SESSIONS TRAINING VIDEOS

Informative Whiteboard Sessions videos cover various technical topics, such as cavitation, line and nozzle sizing, pulsation and more, in short, easy-to-understand lessons conducted by Cat Pumps engineering.

www.catpumps.com/whiteboard-sessions

Servicing the Valves

VALVE DISASSEMBLY

NOTICE

Valve assemblies can be disassembled for inspection and servicing, and then reassembled.

If replacing complete valve kit assemblies, skip to Valve Installation step 2.25.



2.11 Insert two (2) flat tip screwdrivers through spring retainers just above the valves. Twist to create a small gap between the valve retainers and valve seats.



2.12 Place a flat tip screwdriver in the gap and twist to separate completely.



2.13 Inspect spring retainers for cracks, excessive wear or damage.



2.14 Inspect springs for proper tension or any damage.



2.15 Inspect tapered surfaces of the valves for wear, pitting or damage.



2.16 Inspect tapered surfaces of valve seats for wear, pitting or damage.

NOTICE: Pitting on the valve seat or valve is an indication of cavitation. Review our Cavitation Troubleshooting Support Document for assistance.

www.catpumps.com/cavitation-troubleshooting



2.17 Using a pick, remove O-rings and backup rings from valve seats.

NOTE: 40 Series pumps do not utilize backup rings on the valve seats.



2.18 Inspect valve seat O-rings and backup rings for cuts, nicks or damage.

Servicing the Valves

VALVE REASSEMBLY



2.19 Place valve seats on a flat surface with tapered surfaces facing up.



2.20 Place valves onto valve seats with tapered surfaces facing down.



2.21 Place springs onto the concave sides of valves.



2.22 Place spring retainers onto valve seats.



2.23 Using a rubber mallet, lightly tap spring retainers into place.



2.24 Replace valve seat O-rings at the top of the groove, then backup rings at the bottom.

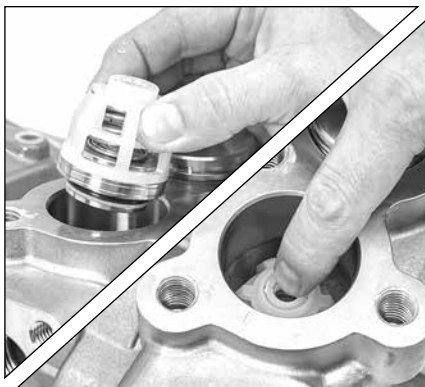
NOTE: 40 Series pumps do not utilize backup rings on the valve seats.

Servicing the Valves

VALVE INSTALLATION



2.25 Apply a lubricant to the outside surface of the valve seat O-rings.



2.26 Insert valve assemblies into the manifold and press them into place.



2.27 Install the spring washers on top of the valve assemblies.



2.28 Install the coil springs on top of the spring washers.



2.29 Replace the valve plug O-rings in the bottom groove of the valve plug.



2.30 Install backup rings on top of the O-rings.



2.31 Install other backup rings below the O-rings.



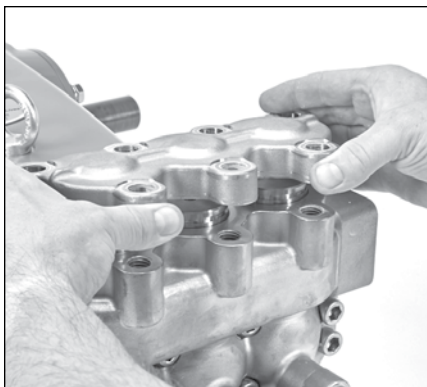
2.32 Apply a lubricant to the outside surfaces of the O-rings and backup rings.



2.33 Press the valve plugs into the manifold bores by hand.

Servicing the Valves

VALVE INSTALLATION



2.34 Install the valve plate by hand.



2.35 Apply anti-seize to the threads and underside of the heads of the valve plate HSH screws.

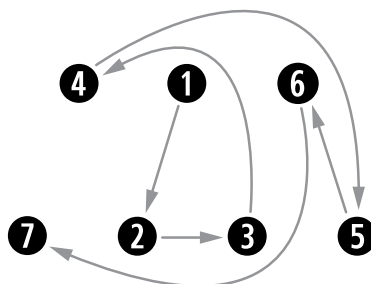


2.36 Install the seven (7) HSH screws by hand.

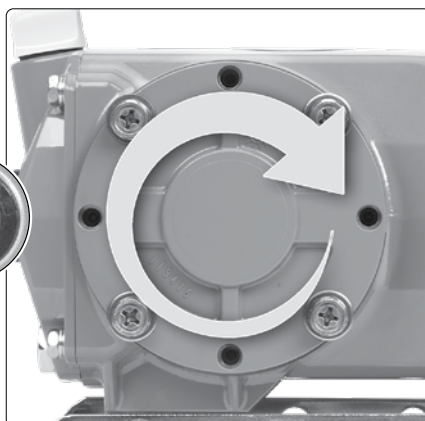
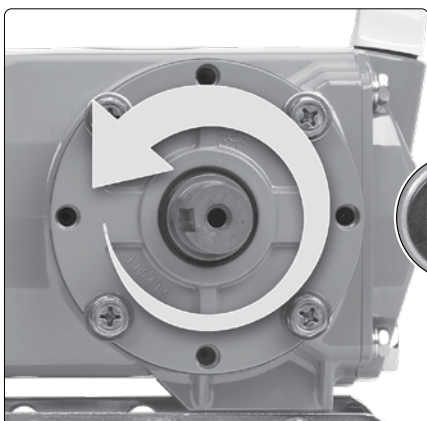


2.37 Using a 12 mm hex wrench, tighten HSH screws using the appropriate cross-pattern for even alignment. Torque to 960 in-lbs, 80 ft-lbs, or 108 Nm.

TORQUE SEQUENCE



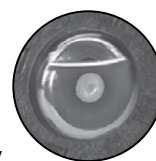
Pump Rotation Tech Tip



Pump Rotation: Forward rotation is recommended to allow optimum lubrication of the drive end.

Note:

If your installation does not allow forward rotation, reverse rotation is acceptable if the crankcase oil level is filled slightly above the red dot in the oil gauge, ensuring adequate lubrication.



www.youtube.com/watch?v=eL09-JanVoY

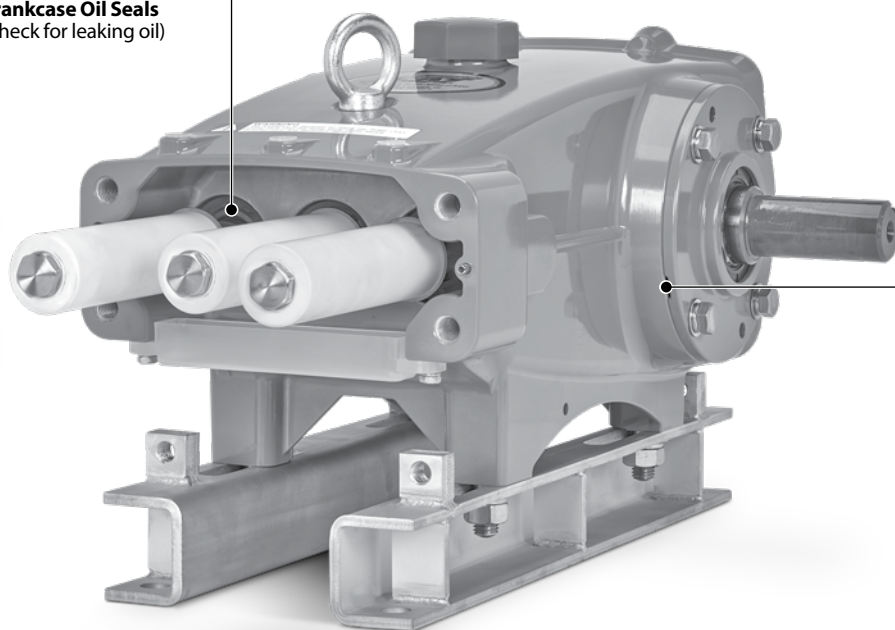
Crankcase Component Inspection

Inspection of the crankcase for leaks is an essential step in the preventive maintenance of a pump. Worn seals and O-rings not only can create a mess with leaking oil, but can lead to premature parts wear and damage due to low crankcase oil level.

Crankcase oil that appears cloudy or milky in the Oil Bubble Gauge indicates the presence of water in the crankcase. A water/oil mix does not provide enough lubrication to the components in the drive end and will cause damage. This damage can occur on the plunger rods or the crankshaft and connecting rods. Also, without a layer of oil on the drive end components, oxidation and rust will form on the bearings and crankshaft. If contamination is suspected, inspect and replace the seals in the pump manifold, then clean out the inside of the crankcase and change the oil.

Spot-check the following areas for signs of leaks and contact Cat Pumps or a local distributor for servicing crankcase if needed.

Crankcase Oil Seals
(Check for leaking oil)

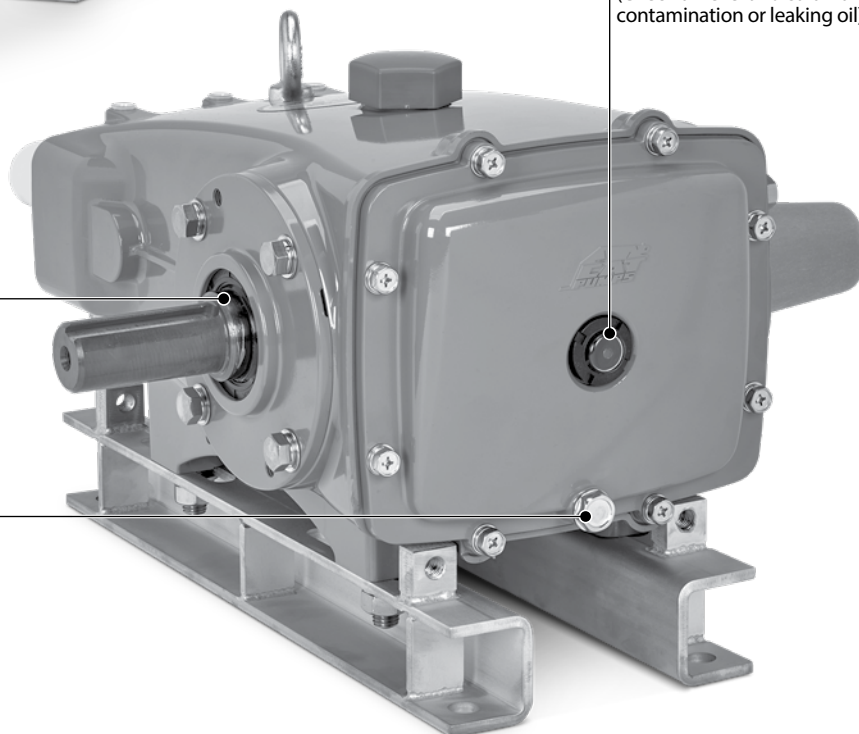


Bearing Covers
(Check for leaking oil)

Oil Bubble Gauge
(Check oil level and color for contamination or leaking oil)

Crankshaft Oil Seals
(Check for leaking oil)

Drain Plug
(Check for leaking oil)



Reference Information

PREVENTIVE MAINTENANCE SCHEDULE

Many application factors determine proper pump maintenance intervals. Variation in duty cycle, operating performance, fluid temperature, fluid type, inlet conditions and application environment can affect maintenance schedules. Every application should be evaluated and serviced based on its own requirements. The following checklist is intended as a reference guide only.

CHECK	DAILY	WEEKLY	50 HRS.	500 HRS.	1500 HRS.	3000 HRS.
Filters	• or •					
Oil Level/Quality	• or •		①	①		
Water Leaks	• or •					
Oil Leaks	•					
Plumbing		•				
Belts, Pulley		•				
Accessories					•	
Seals						②
Valves						③

Water leaks or loss of system performance can be an indicator of seal wear. Seal wear has many causes, including contaminated liquid or high-temperature/run dry operation. If the low-pressure seals show wear, the high-pressure seals most likely are in a similar condition. It is a good practice to replace both low and high-pressure seals and inspect plungers when leaks are present.

- ① Cat Pumps recommends using our custom-blend premium grade hydraulic oil formulated to meet Cat Pumps specifications. For best results, perform an initial oil change after the first 50 hours of operation and every 500 hours thereafter.
- ② Every system operates under different conditions. Past performance and maintenance history are the best indicators of future performance. If system performance degrades or changes, check seals and valves immediately. Service as required to restore system performance. Depending upon operating conditions, maintenance intervals for seal kits range between 3,000 and 16,000 hours.
- ③ Pump valves typically require changing every other seal change. If system performance degrades or changes, check valves immediately. Depending upon operating conditions, maintenance intervals for valve kits range between 3,000 and 16,000 hours.

Cat Pumps custom blend crankcase oil is exclusively designed, tested and proven to maximize the life of your pump. This special formulated premium-grade, petroleum-based, ISO 68 hydraulic oil contains the most advanced additive package to protect against wear, oxidation, rust and corrosion.

Cat Pumps premium custom-blend oil is available worldwide in 21-ounce bottles, (single and 12-pack cases), 2.5 gallon jugs (single and 2-pack) or 30 gallon drums. **Use of other oils may void the warranty.**

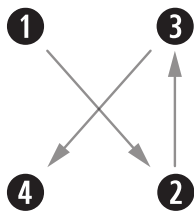


Reference Information

TORQUE CHART

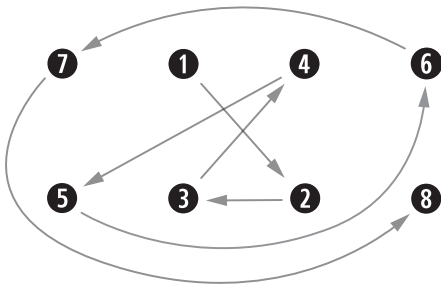
PUMP ITEM	THREAD	TOOL SIZE	TOOL PART NUMBER	TORQUE		
				IN-LBS	FT-LBS	Nm
Plunger Retainers	M10	21 mm Combination Wrench	—	220	18	24
Inlet Manifold Screws	M14	12 mm Hex Wrench	—	480	40	54
Discharge Manifold Screws	M12	10 mm Hex Wrench	—	355	30	40
Valve Plate Screws	M14	12 mm Hex Wrench	—	960	80	108
Rear Cover Screws	M8	13 mm Combination Wrench	—	115	9.58	13
Bearing Cover Screws	M10	17 mm Combination Wrench	—	220	18	24
Connecting Rod Screws	M10	17 mm Combination Wrench	—	220	18	24
Bubble Oil Gauge	M28	Oil Gauge Tool	44050	45	3.8	5

INLET MANIFOLD SCREWS TORQUE SEQUENCE



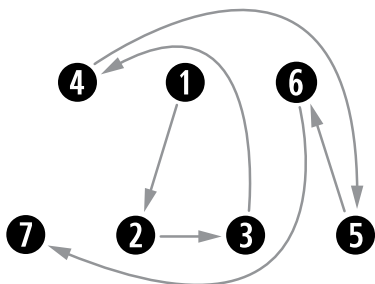
Torque to 480 in-lbs,
40 ft-lbs, or 54 Nm.

DISCHARGE MANIFOLD SCREWS TORQUE SEQUENCE



Torque to 355 in-lbs,
30 ft-lbs, or 40 Nm.

VALVE PLATE SCREWS TORQUE SEQUENCE



Torque to 960 in-lbs,
80 ft-lbs, or 108 Nm.

TECHNICAL BULLETIN REFERENCE CHART

NO.	SUBJECT	MODELS
002	Inlet Pressure vs. Water Temperature	All Models
024	Lubrication of Low-Pressure Seals	All Models
035	Servicing Crankcase Section – Roller Bearing Models	7CP, 7PFR–68PFR Plunger Pumps
036	Identifying Your Pump	All Models
074	Torque Chart	All Models
083	Winterizing a Pump	All Models
095	Galling Prevention	All Stainless Steel Models
134	Piston and Plunger Pump Crankcase Capacities	All Models

Diagnosis and Maintenance

This service manual is designed to assist you with the disassembly and reassembly of your pump. The following guide will assist in determining the cause and remedy to various operating conditions. You can also review our **FAQ** or **SERVICE & TRAINING** sections on our **WEB SITE** for more facts or contact Cat Pumps directly.

PROBLEM	PROBABLE CAUSE	SOLUTION
Low pressure	<ul style="list-style-type: none"> • Worn nozzle. • Air leak in inlet plumbing. • Pressure gauge inoperative or not registering accurately. • Relief valve stuck, partially plugged or improperly adjusted. • Inlet suction strainer (filter) clogged or improperly sized. • Abrasives in pumped liquid. • Leaky discharge hose. • Inadequate liquid supply. • Severe cavitation. • Worn seals. • Worn or dirty inlet/discharge valves. 	<ul style="list-style-type: none"> • Replace with proper size nozzle. • Tighten fittings and hoses. Use PTFE liquid or tape. • Check with new gauge. Replace worn or damaged gauge. • Clean/adjust relief valve. Replace worn seats/valves and O-rings. • Clean filter. Use adequate size filter. Check more frequently. • Install proper filter. • Replace discharge hose with proper rating for system. • Pressurize inlet. • Check inlet conditions. • Install new seal kit. Increase frequency of service. • Clean inlet/discharge valves or install new valve kit.
Pulsation	<ul style="list-style-type: none"> • Foreign material trapped in inlet/discharge valves. 	<ul style="list-style-type: none"> • Clean inlet/discharge valves or install new valve kit.
Water leak		
<ul style="list-style-type: none"> • Under the manifold • Into the crankcase 	<ul style="list-style-type: none"> • Worn high-pressure or low-pressure seals. • Humid air condensing into water inside the crankcase. • Excessive wear to high-pressure or low-pressure seals. 	<ul style="list-style-type: none"> • Install new seal kit. Increase frequency of service. • Install new oil cap protector. Change oil every 3 months or 500 hours. • Install new seal kit. Increase frequency of service.
Knocking noise		
<ul style="list-style-type: none"> • Inlet supply • Bearing 	<ul style="list-style-type: none"> • Inadequate inlet liquid supply. • Broken or worn bearing. 	<ul style="list-style-type: none"> • Check liquid supply. Increase line size or pressurize. • Replace bearing.
Oil leak		
<ul style="list-style-type: none"> • Crankcase oil seal • Crankshaft oil seal and O-ring • Drain plug • Bubble gauge • Bearing cover • Filler cap 	<ul style="list-style-type: none"> • Worn crankcase oil seal. • Worn crankshaft oil seal or O-ring on bearing cover. • Loose drain plug or worn drain plug O-ring. • Loose bubble gauge or worn bubble gauge gasket. • Loose bearing cover or worn bearing cover O-ring. • Loose filler cap or excessive oil in crankcase. 	<ul style="list-style-type: none"> • Replace crankcase oil seal. • Remove bearing cover and replace O-ring and/or oil seal. • Tighten drain plug or replace O-ring. • Tighten bubble gauge or replace gasket. • Tighten bearing cover or replace O-ring. • Tighten filler cap. Fill crankcase to specified capacity.
Pump runs extremely rough		
<ul style="list-style-type: none"> • Inlet conditions • Pump valves • Pump seals 	<ul style="list-style-type: none"> • Restricted inlet or air entering the inlet plumbing • Stuck inlet/discharge valves. • Leaking high-pressure or low-pressure seals. 	<ul style="list-style-type: none"> • Correct inlet size plumbing. Check for air tight seal. • Clean out foreign material or install new valve kit. • Install new seal kit. Increase frequency of service.
Premature seal failure		
	<ul style="list-style-type: none"> • Scored plunger. • Over pressure to inlet manifold. • Abrasive material in the liquid being pumped. • Excessive pressure and/or temperature of pumped liquid. • Running pump dry. • Starving pump of adequate liquid. • Eroded manifold. 	<ul style="list-style-type: none"> • Replace plunger. • Reduce inlet pressure per specifications. • Install proper filtration at pump inlet and clean regularly. • Check pressure and inlet liquid temperature. • DO NOT RUN PUMP WITHOUT LIQUID. Fill pump with oil. • Increase hose one size larger than inlet port size or pressurize. • Replace manifold. Check liquid compatibility.



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