

SERVICE MANUAL

67DX PLUNGER PUMP SERIES



PUMP MODEL	FLOW GPM (L/M)	PRESSURE PSI (BAR)	PUMP RPM	MOTOR RPM	TEMPERATURE Far. (Cent)	SHAFT DIA. INCH (MM)	OIL CAP Oz. (l)
67DX39G11	3.9 (14.8)	4000 (275)	3450	—	140° (60°)	1.00 (25.4)	13.5 (0.04)

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.

SERVICING THE 67DX SERIES PLUNGER PUMP

⚠ WARNING

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.

SERVICING THE VALVES

Disassembly

NOTE: Pump requires one (1) stacked valve kit to repair pump.

NOTE: Discharge and inlet valve assemblies may stay together or separate during removal. Spring retainer may also separate from the seat during removal.

1. Use a M24 hex tool to remove three (3) valve plugs.
2. Use reverse pliers to remove stacked valve assemblies from each valve chamber.
3. If the discharge assembly separates from the inlet valve assembly, use reverse pliers to remove the inlet valve seat.



NOTICE

Exercise caution as the reverse pliers may damage the threads in valve chamber or spring retainer.

4. Separate discharge valve assembly from inlet valve assembly.
5. Remove o-ring and backup-ring from discharge seat.
6. Using a small tipped screw driver, place end of screw driver through spring retainer and above the valve and pry upwards to separate spring retainer from valve seat.
7. Remove o-ring from inlet seat.
8. Repeat step 6 to disassemble inlet valve assembly.

Reassembly

NOTE: Reassemble by using either complete valve assembly and then go to step 11, or follow steps as outlined below for component piece parts.

1. Examine spring retainers for internal wear or breaks in the structure and replace as needed.
2. Examine springs for fatigue or breaks and replace as needed.
3. Examine valves and seats for grooves, pitting or wear and replace as needed.
4. Examine seat and valve plug o-rings for cuts or wear and replace as needed.

NOTE: Inlet valve seat, valve seat o-ring and inlet spring retainer are different than discharge valve seat, valve seat o-ring and discharge spring retainer.

5. Lubricate and install o-ring, then backup-ring onto each discharge seat.
6. Place discharge seat on work surface with tapered surface side up.
7. Place valve onto seat with concave side down.
8. Place spring onto valve.
9. Install tapered discharge spring retainer with deep stepped end over spring and snap onto seat. Ensure spring is positioned vertically with no twisting or binding.

NOTE: Repeat steps 5 to 9 for inlet valve assemblies (no backup-ring on inlet seat).

10. Snap discharge valve assembly onto the inlet valve assembly.
11. Press entire assembly into each valve chamber until completely seated.
12. Lubricate and install new o-ring onto each valve plug.
13. Apply Loctite®242® to threads of each valve plug. Thread in valve plug hand tight. Torque to 870 in/lbs or 72.5 ft/lbs (98.0Nm).

SERVICING THE SEAL

Disassembly

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

1. Using an M6 allen wrench, remove eight (8) Hex Socket Head (HSH) screws.
2. Insert flat head screwdrivers on each side between the crankcase and manifold head. Gently apply pressure to the head to begin separation.
3. Support the manifold head from the underside and pull the manifold head away from the crankcase.

NOTICE

Keep the manifold head properly aligned with the ceramic plungers when removing to avoid damage to the plungers.

4. Place manifold head on work surface with crankcase side up.
5. Use a screw driver to remove Lo-Pressure seal from each seal case.

NOTICE

Exercise caution as the screwdriver may damage seal during removal.

6. Remove seal cases either by using reverse pliers on second lip of seal case or insert sharp tipped flat head screw drivers on opposite sides of seal case and gently pry away from manifold.
7. Carefully insert a small pick under the o-ring and roll the o-ring off each seal case.



NOTICE

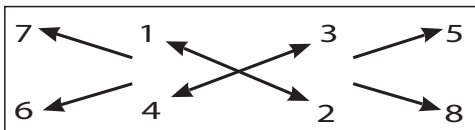
Exercise caution as the pick may score o-ring sealing surface.

8. Remove V-Packing and male adapter from each seal chamber by using a screw driver.

Reassembly

1. Examine the manifold chamber walls for scale buildup or damage and replace as needed.
2. Examine V-Packings for frayed edges or uneven wear and replace as needed.
3. Examine Lo-Pressure seals for wear to the internal ridges and outer surfaces or for broken springs and replace as needed.
4. Examine seal case o-rings for cuts or deterioration and replace as needed.
5. Examine seal cases and male adapters for deformation and replace as needed.
6. Install male adapter with notch side down into each seal chamber.
7. Lubricate and install V-Packing into each seal chamber with grooved side down.
8. Lubricate and install o-ring onto each seal case. Press small end of seal case into each seal chamber.
9. Lubricate and press Lo-Pressure seal into each seal case with the garter spring down.
10. Examine ceramic plungers for scoring, scale build up, chips or cracks and replace as needed (See **SERVICING THE PLUNGER** section if plungers are damaged).
11. Lightly lubricate ceramic plungers, and then carefully slide manifold head over the ceramic plungers supporting it from the underside to avoid damage to the plungers or seals. Press the manifold head flush with the crankcase.
12. Thread in eight (8) HSH screws in hand tight. Torque to 132 in/lbs or 11 ft/lbs (15.0 Nm) in the sequence as shown below.

TORQUE SEQUENCE



SERVICING THE PLUNGER

Disassembly

1. To service the ceramic plungers, it is necessary to remove the manifold head. See **SERVICING THE SEALS, Disassembly**, steps 1 to 3.
2. Remove seal retainer from each plunger rod.
3. Using a M10 hex tool, loosen the plunger retainer on each plunger rod approximately three to four turns.
4. Remove barrier slinger, ceramic plunger and seal washer from each plunger retainer.

Reassembly

1. Visually inspect the crankcase oil seals for deterioration or leaks. Contact Cat Pumps for assistance with replacement. See **SERVICING THE CRANKCASE**.
2. Examine seal washers and barrier slingers for damage or wear and replace as needed.
3. Examine plunger retainers for damaged threads and replace as needed.
4. Examine ceramic plungers for scoring, scale build up, chips or cracks and replace as needed. The ceramic plungers typically do not need to be replaced with every seal servicing.
5. Install seal washer onto each plunger retainer.
6. Slide plunger retainer with seal washer into flat end of ceramic plunger. Place barrier slinger onto plunger retainer.

NOTE: Ceramic plungers can only be installed in one direction. Counter bore end of ceramic plunger should face toward crankcase.



7. Apply Loctite®242® to exposed threaded end of plunger retainer.
8. Install ceramic plunger with plunger retainer, seal washer and barrier slinger over each plunger rod shoulder and thread hand tight. Torque to 55 in/lbs or 4.6 ft/lbs (6.2 Nm).
9. Slide seal retainer over each ceramic plunger with the openings to the top and bottom, small tab down and larger face surface towards seal. Press into crankcase.
10. Lightly lubricate ceramic plungers, and then carefully slide manifold head over the ceramic plungers supporting it from the underside to avoid damage to the plungers or seals. Press the manifold head flush with the crankcase.
11. Thread in eight (8) HSH screws in hand tight. Torque to 132 in/lbs or 11 ft/lbs (15.0 Nm) as found in the **TORQUE SEQUENCE**.

SERVICING THE CRANKCASE

1. While manifold, ceramic plungers and seal retainers are removed, examine crankcase oil seals for leaking and wear.
2. Check for any signs of leaking at adapter bearing cover, drain plug or bubble gauge.
3. Check oil level and evidence of water in oil. Change crankcase oil on a regular schedule.
4. Rotate crankshaft by hand to feel for smooth bearing movement.
5. Examine crankshaft oil seal externally for drying, cracking or leaking.
6. Contact Cat Pumps or your local distributor if crankcase service is needed.

SERVICING THE UNLOADER/CHEMICAL INJECTOR

Disassembly

1. Remove chemical injector with o-ring.
2. Remove check valve spring, check valve and check valve seat.
3. Remove black adjusting handle (if equipped).
4. Remove adjusting cap by turning in a counterclockwise direction.
5. Loosen setscrew and remove locking nut.
6. Remove exposed pressure spring and flat spring retainer.
7. Use a wrench to remove piston retainer by turning in counterclockwise direction.

NOTE: The piston assembly may fall out when the piston retainer is removed. If so, proceed to step 9. If not, continue with step 8.

8. Use needle nose pliers to remove piston assembly.
9. Separate piston stem from valve/ball assembly by securing the flat surface of the valve/ball assembly. Insert a screwdriver into slotted head of piston stem and unthread from valve/ball assembly. Inspect all parts for wear and damage.

NOTICE

Exercise caution to avoid contact and damage to the tapered surface of the valve/ball assembly.

10. Examine seat at bottom of the unloader chamber for grooves, pitting or wear and replace only as needed. Use reverse pliers for removal of seat.

NOTICE

Seat will be damaged when removed.

Reassembly

NOTE: Prior to reassembly, assess wear or damage to internal components of integral unloader. Use either one (1) o-ring kit, one (1) repair kit or one (1) piston assembly to repair integral unloader.

1. If seat is damaged replace with new seat. Lubricate and install new o-ring onto seat. Press seat into unloader chamber with flat side up, bevel side down, until squarely seated.
2. If only o-rings are worn, replace with o-ring kit, proceed to step 5.
3. If all internal components are worn or damaged, replace with repair kit, proceed to step 5.
4. If valve/ball assembly surface is damaged or eroded, replace with a piston assembly, proceed to step 9.
5. Lubricate and install o-ring over slotted head of piston stem, then position backup-ring on top of o-ring.
6. Lubricate and install backup-ring and o-rings on valve retainer.
7. Install washer and valve retainer onto piston stem.
8. Apply Loctite®609 to threads of piston stem and screw valve/ball assembly onto piston stem.
9. Lower piston assembly into unloader chamber with valve/ball assembly facing down.
10. Examine piston retainer for damaged threads or wear and replace as needed. Examine o-rings for cuts or wear and replace as needed.
11. Apply Loctite®242® to threads of piston retainer. Hand thread piston retainer into unloader by turning in a clockwise direction, and then tighten with wrench.
12. Examine spring retainer and pressure spring for fatigue or breaks and replace as needed.
13. Place spring retainer into piston retainer, followed by pressure spring.
14. Thread locking nut onto piston retainer. Do not tighten setscrew until unloader is set for proper pressure, then tighten.
15. Thread adjusting cap onto piston retainer by turning in a clockwise direction.
16. If equipped, slide black adjusting handle over brass adjusting cap.

NOTE: Examine and install the following components into the chemical injector.

17. Examine chemical injector for damaged threads and replace as needed.
18. Examine check valve spring, check valve and check valve seat for damage or wear and replace as needed.
Examine o-rings for cuts or wear and replace as needed.
19. Install check valve spring into inlet port of chemical injector.
20. Install check valve with o-ring on spring in chemical injector with o-ring facing out away from spring.
21. Install check valve seat with o-ring into unloader.
22. Apply Loctite®242® to threads of chemical injector. Hand thread in chemical injector into unloader by turning in a clockwise direction, and then tighten with wrench.

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PREVENTATIVE MAINTENANCE CHECK-LIST					
Check	Daily	Weekly	50 hrs.	500 hrs. *	1,000 hrs. **
Clean Filters	X				
Oil Level/Quaility	X				
Oil Leaks	X				
Water Leaks	X				
Plumbing		X			
Initial Oil Change			X		
Oil Change				X	
Seal Change					X
Valve Change					X
Accessories					X

* If other than Cat Pumps special custom blend, ISO 68 hydraulic oil is used, change cycle should be every 300 hours.

** Each system's maintenance cycle will be exclusive. If system performance decreases, check immediately. If no wear at 1000 hours, check again at 1500 hours and each 500 hours until wear is observed. Valves typically require changing every other seal change.

Duty cycle, temperature, quality of pumped liquid and inlet feed conditions all effect the life of pump wear parts and service cycle.

** Remember to service the regulator at each seal servicing and check all system accessories and connections before resuming operation.

GENERAL SAFETY INFORMATION AND SYMBOLS

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 safe guards 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 high pressure gun is not in use, set safety trigger lock (safetylatch) 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 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 material safety data sheet (MSDS) and take appropriate safety measures for the liquid being handled.

F. OVER PRESSURIZATION HAZARD

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 (i.e., regulator or unloader) and a secondary pressure safety relief device (i.e., 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 Prrrr-O-Lators (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 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 MSDS 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.

E. LIFTING DEVICE HAZARD

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 (i.e. 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. Cat Pumps custom-blend oil is available worldwide in 21 oz. bottles, cases, or 5-gallon twin packs. Use of other oils may void the warranty.
2. Fill pump crankcase to specific capacity indicated on data sheet or service manual prior to startup.

B. ROTATION OF PUMP 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. Ensure oil is filled to slightly above center red dot on sight gauge for reverse rotation.

C. BELT TENSION HAZARD

Do not operate pump with excessive belt tension. Excessive belt tension may damage the pumps 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. BY-PASS OPERATION HAZARD

Do not operate the pump in by-pass 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 by-pass line to supply reservoir to dissipate heated by-pass liquid into a large reservoir of cool water to reduce excessive temperature build-up.
2. Route by-pass line to inlet of pump using a thermo valve in the by-passline or auto shut-off assembly that will sense temperature rise and either by-pass 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.

DIAGNOSIS AND MAINTENANCE

One of the most important steps in a high pressure system is to establish a regular maintenance program. This will vary slightly with each system and is determined by various elements such as the duty cycle, the liquid being pumped, the actual specifications vs rated specifications of the pump, the ambient conditions, the inlet conditions and the accessories in the system. A careful review of the necessary inlet conditions and protection devices required before the system is installed will eliminate many potential problems.

Cat Pumps are very easy pumps to service and require far less frequent service than most pumps. Typically, only common tools are required, making in-field service convenient, however, there are a few custom tools, special to certain models, that do simplify the process. 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** 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 V-Packing or Lo-Pressure Seals. • Humid air condensing into water inside the crankcase. • Excessive wear to Lo Pressure and High Pressure seals.
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.
Oil leak	<ul style="list-style-type: none"> • Crankcase oil seal • Crankshaft oil seal and o-ring 	<ul style="list-style-type: none"> • Worn crankcase oil seal. • Worn crankshaft oil seal or o-ring on bearing cover.
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 V-Packing or Lo-Pressure seals.
Premature seal failure	<ul style="list-style-type: none"> • Drain plug • Bubble gauge • Adapter Bearing cover • Filler cap 	<ul style="list-style-type: none"> • Loose drain plug or worn drain plug o-ring. • Loose bubble gauge or worn bubble gauge gasket. • Loose or worn adapter bearing cover o-ring. • Loose filler cap or excessive oil in crankcase.
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 V-Packing or Lo-Pressure seals.
Premature seal failure	<ul style="list-style-type: none"> • Scored plunger. • Over pressure to inlet manifold. • Abrasive material in the liquid being pumped. 	<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.
Premature seal failure	<ul style="list-style-type: none"> • Excessive pressure and/or temperature of pumped liquid. • Running pump dry. • Starving pump of adequate liquid. • Eroded manifold. 	<ul style="list-style-type: none"> • DO NOT RUN PUMP WITHOUT LIQUID. • Increase hose one size larger than inlet port size. • Replace manifold. Check liquid compatibility.



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