



927xx TYPE 1 OWNERS MANUAL

G12-590

06/02/2017



SAFETY INSTRUCTIONS

This is an industrial component. Only a qualified systems integrator should be allowed to design it into a system. The integrator must determine proper plumbing, mounting, driveline and guard components.

Improper installation or use could lead to a serious, even fatal, accident. The system integrator must communicate all safe operation procedures to the end user(s).

Before operation, fully understand and follow the instructions shown in this manual and any instructions communicated by the system integrator. No one should be allowed to operate or maintain this pump that has not been fully trained to work safely according to the configuration of the pump system and in accordance with all applicable government and industry regulations.

DO NOT paint over nameplates, ID tags or warning tags.

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RECORD INFORMATION FROM PUMP NAMEPLATE HERE:

MODEL:

SPEC:

TYPE:

SERIAL:

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1. WARNINGS & GENERAL GUIDELINES



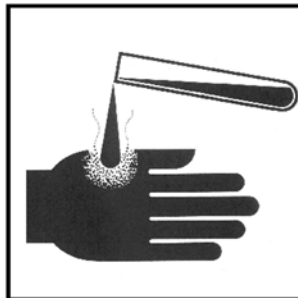
! WARNING

Over-pressure may burst pump or system components. Always include a relief valve in installation. Do not over pressurize pump or block discharge line while operating.



! WARNING

Injection Hazard: Do not try to stop a leak with your hand! Avoid any close contact with hydraulic fluid jets. Escaping fluid can penetrate skin, causing serious injury. In case of accident, seek medical attention immediately for removal of fluid.



! WARNING

Hazardous or Toxic fluids can cause serious injury.

WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

NOTICE: These are general guidelines and do not cover all possible situations. It is the responsibility of the system integrator to apply this product properly.

- **System Pressure & Hazardous Fluids**

1. Disconnecting fluid or pressure containment components during pump operation can cause property damage, serious personal injury, or death.
2. Failure to relieve system pressure prior to performing pump service or maintenance can cause property damage, serious personal injury, or death.
3. If pumping hazardous or toxic fluids, system must be flushed and decontaminated, inside and out, prior to performing service or maintenance.

- **Plumbing**

1. The inlet pipe should be as short and straight as possible to minimize suction pressure losses. Excessive restrictions at the inlet can cause cavitation resulting in poor performance, noise, vibration, and pump damage.
2. Slope the inlet plumbing appropriately to avoid air pockets.
3. Plumbing weight, misalignment with the ports or thermal expansion can exert excessive forces on the pump body. Plumbing must be properly supported and aligned with expansion joints, if required, to minimize these forces.
4. To prevent over pressure situations, install a properly sized relief valve as close to the pump outlet as possible. Install the relief valve in line between the pump discharge and any shut-off valves.

DO NOT use Thread Seal (Teflon®) tape on pump port threads.

Teflon® is a registered trademark of E.I. DuPont de Nemours Co., Inc.



WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

WARNING: Failure to stop the pump before adjusting the shaft packing can cause serious injury or death.

- **Mounting Base**

1. Mount the unit on a rigid, heavy base to provide support and absorb shock. Bases should be designed for high rigidity; not just strength.
2. The pump feet were not designed for mounting to concrete and do not have enough contact area to prevent concrete from failing. When mounting to cement or concrete, use a steel baseplate to distribute the mounting stress over an area large enough to prevent the cement from failing. Grout it in place.

- **Pump and Drive Assemblies**

1. Assure adequate guards have been installed to prevent personnel contacting moving components.
2. Follow all OSHA, Federal, State, and local codes.

- **Check Alignment of Pump to Driveline**

Excessive misalignment can overload the pump input shaft and cause premature failure. The figures below show parallel and angular misalignments which must be avoided.

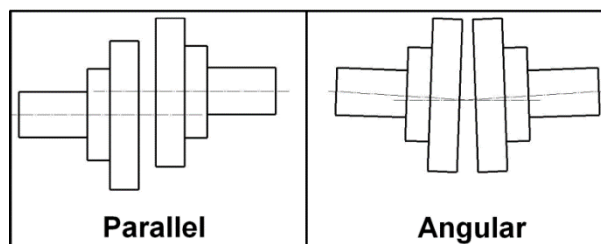


Figure 1-1: Coupling Alignment

- **Roper Pump Company Close Coupled Drives**

The hydraulic or gearmotor units mount directly to the pump.

- o Alignment between pump and driveline is maintained by the assembly.

Because the adapter bracket absorbs the reaction forces of the driveline, the mounting base does not need to be as robust. Piping loads are the major source of stress and strain in the pump body in this configuration.

- **Guarding PTO Drive Shafts**

PTO drive systems can be dangerous. Safety precautions, including guarding, are required and must be provided by the drive system installer. Roper Pump Company does not manufacture guards for the PTO drives. It is the responsibility of the pump and drive system installer to incorporate safe guarding and the operator to use, maintain and not defeat them.

NOTICE: The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who knows the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application, installation, and operation is the user's.*

WARNING: Failure to stop the pump before adjusting the shaft packing can cause serious injury or death. Never attempt to adjust packing while a pump is running.



WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

- **Hopper Feed Pumps**

In order to avoid an unsafe or hazardous condition, it is recommended that hopper feed pumps be installed with the following minimum provisions in addition to the other recommendations contained in this manual.

- o Hopper feed pumps should not be operated unless the hopper body and inlet piping completely enclose the auger-moving elements and power transmission guards are in place. If the hopper body is to be opened for inspection, cleaning, or observation, the driver must be locked out in such a manner that it cannot be restarted by anyone, either in the vicinity or remotely, unless the hopper body has been closed and all other guards are in place.
- o If the pump must have an open hopper body as a condition of its use and application, the entire pump is then to be guarded by a railing or fence and warning signs posted.
- o Feed openings for shovel, front end loader, or other manual or mechanical equipment must be constructed in such a way that the hopper body opening is covered by grating. If the nature of the material is such that a grating cannot be used, then the exposed hopper body opening must be guarded by a railing or fence and warning signs posted.

WARNING:

- o **DO NOT** walk on hopper gratings or power transmission guards.
- o **DO NOT** poke or prod material in the hopper body with a bar or stick.
- o **DO NOT** place hands feet, head, or any other part of the body in any hopper opening.

2. NAMEPLATE DATA

Roper Pump Company identifies each pump by a metal nameplate attached to the pump. The nameplate describes the pump as built at the factory. Copy the nameplate data from your pump into the area provided on the front page of this manual. Use this for ready reference when ordering repair parts or when consulting with a Roper distributor or Roper Pump Company about this pump.

WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

PUMP NOMENCLATURE

MODEL 92724*GHH **SPEC** xxxxxx **TYPE** 1 **SERIAL NO.** xxxxxx

- * **The letter “M” may be used in this space to indicate that the pump was originally supplied by the Roper factory mounted on a base (with or without the motor).**

- The Model Number consists of a five-digit number followed by a three or four letter material code.
 - The first digit (9) indicates the Xeric progressing cavity pump series.
 - The second digit (2) indicates the number of stages of pumping elements.
 - The third digit (7) indicates the drive size or configuration.
7 = Hopper feed (foot mounted motor), pin joint construction
 - The fourth, fifth, and (where appropriate) sixth digits (24) indicate the approximate theoretical displacement in U.S. gallons per 100 revolutions.

4 th , 5 th , 6 th digits	06	13	24	49	96	105		
Gal./100 Rev.	6	13	24	49	96	105		

- The three letters (GHH) indicate the materials of construction. The first letter (G) indicates the pump body. The second letter (H) indicates the internals. The third letter (H) indicates the stator.

Item	Letter	Material
Pump Body	G	Alloy steel
Internals	H	Alloy steel, hard chrome plated rotor
Stator	H	High strength Alloy steel tube and profile

NOTE: The preceding description of the figure number is to assist in identifying your Roper progressing cavity pump only. **DO NOT** attempt to derive any ratings or performance from the figure number. **DO NOT** use the explanation of the figure number to construct your own pump. Not all combinations are possible. For assistance in pump selection, it is recommended that you consult Roper Pump Company or an authorized distributor.

- Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are denoted by a SPECification Number. Identification of any items different than a standard pump can be made by consulting Roper Pump Company or an authorized distributor.
- The TYPE number is a number used by Roper Pump Company for in-house identification of construction and hydraulics. Always include the TYPE number in any references to the pump.
- The SERIAL number is a unique number assigned to each pump built by Roper Pump Company.

In any communication concerning this pump, always be sure to include the Figure, Spec, Type, and Serial numbers so proper identification of the pump can be made.

3. MAXIMUM PRESSURE RATINGS

Figure 3.1 shows the maximum allowable differential pressure (the amount of pressure difference between the inlet and discharge of the pump) for various stages of the pump. These values are the maximum allowable and are not recommended for every application. Abrasive fluids should not be pumped at these maximum values as it will shorten the life of the rotor and stator. Refer to Roper Pump Company's progressing cavity pump technical literature for additional information on recommended pressure limitations for pumping abrasive products.

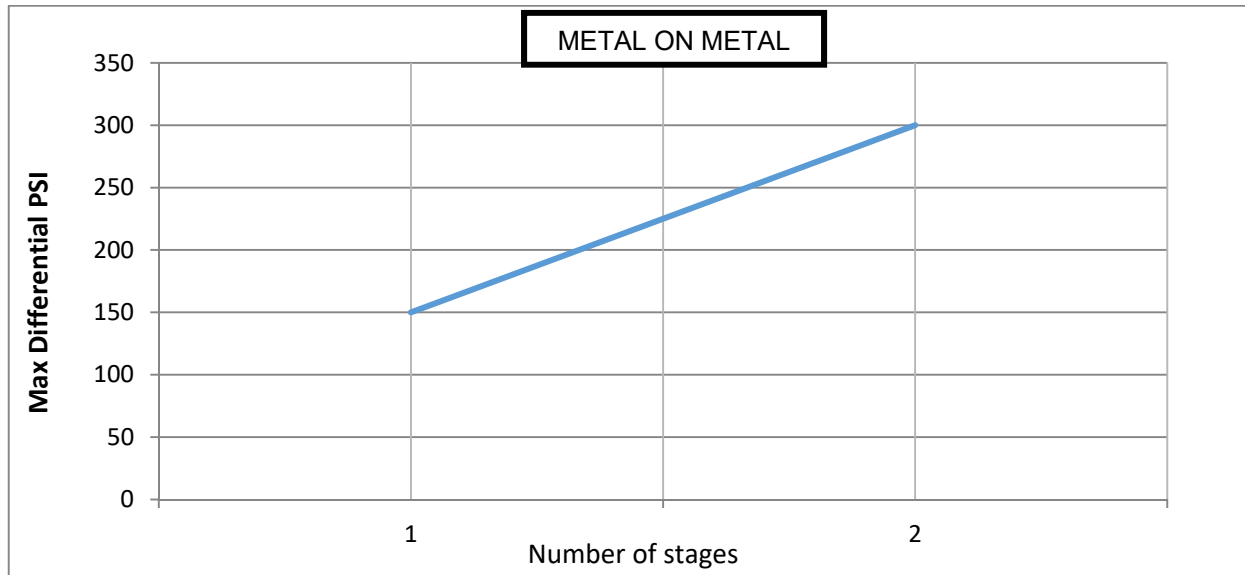


Figure 3.1

4. PREOPERATION CHECKS

Read and understand the instructions and recommendations contained in this manual.

De-energize or lock out the drive motor.

Disconnect the coupling between the driver and pump.

Be aware that the pump was tested at the factory with hydraulic oil and can have a residual amount left inside the stator.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Normal rotation is indicated on the pump drive end. The driver rotation test must be done with the driver and pump disconnected. **DO NOT run pump dry for long periods. Dry operation could be harmful to the pump and drive shaft if not equipped with a special cartridge seal.**

Before the initial startup, some of the fluid to be pumped should be introduced into the inlet body to insure wetting of the pumping elements. (On subsequent startups, if the pump does not discharge fluid after it has been operating for one minute, it should be re-primed.) Turn on the flush liquid to the packing, if applicable.

Before starting, make sure all guards are in place and the inlet and discharge valves are opened.

After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and correct the problem. Once the pump starts delivering liquid, check the unit for excessive vibration, localized heating, and excessive shaft seal leakage. Check the pressure and vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure and/or vacuum conform to specifications.

5. INSTRUCTIONS FOR PUMP DISASSEMBLY

Refer to Section 7. **PUMP SECTIONAL DRAWING.**

1. Read and understand all safety instructions and warnings before starting to disassemble pump. While disassembling pump, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required.
2. Turn off pump and lockout energy source to driver.
DO NOT proceed further with disassembly of pump if there is the slightest possibility the driver may be started.
3. If used, turn off and disconnect fluid flush to packing or cartridge seal.
4. Close inlet and discharge valves.
5. Remove guard and disconnect driver from pump.
6. Drain inlet and discharge lines. Disconnect piping from the pump inlet and discharge.
7. Remove pipe plug [502] from inlet body [505]. Drain inlet body. Place a temporary support, such as a block of wood, under inlet body.
8. Remove hex nuts [609] from tie rods [611].
9. Remove discharge flange housing [504] and stator gasket [403] from the discharge end of pump.
10. Remove screws [631] from top of stator support [612]. Remove tie rods [611] and slide stator support off end of stator [402].
11. Remove stator [402] from rotor [401]. Using a twisting motion (similar to unthreading parts) may help ease removal. Remove remaining stator gasket [403] on other end of stator.
NOTE: Any fluid trapped in cavities formed by rotor and stator will spill from these parts during disassembly. Full precautions should be taken to avoid any hazards.
12. Remove screws [606] from inlet body [505]. Slide inlet body [505] carefully over rotor end of pump, ensuring that the rotor [401] is not damaged. Remove inlet body gasket [501].
13. Cut clamp bands [306] from cover sleeve [308] and roll cover sleeve toward rotor [401] to expose rotor band [304].
NOTE: In case of oil-filled joints, fluid will spill from these parts during disassembly. Full precautions should be taken to avoid any hazards.
14. Use a brass punch or dowel to tap rotor band [304] toward connecting rod [307]. Take care not to tap or press on free end of connecting rod as this may cause damage.
15. Remove pin [301] and rotor [401]. Remove cover sleeve [308] from rotor head.
16. Repeat process steps 13. thru 15. above for the other end of the connecting rod [307].
17. Remove pin [301]. Push each pin bushing [303] halfway out from within drive shaft [118] bore by moving connecting rod [307] back and forth to access the bushing. Remove connecting rod.
18. Remove key [101] from drive shaft [118].
19. Remove all coverplate screws [139], coverplate [131] and coverplate gasket [132]. Remove lip seal [133] from coverplate. Remove retaining ring [116].
20. If a cartridge seal is used, loosen seal set screws that retain rotating collar to drive shaft [118].
21. Slide drive shaft [118] from rear of bearing housing [110]. Be careful not to damage bearings or shaft.
22. Remove ball bearing [103] and bearing spacer [102].

DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.

NOTE: In case of oil-filled cavities, fluid will spill from these parts during disassembly. Full precautions should be taken to avoid any hazards.

23. A. If pump has cartridge seal [219] installed (not shown on Pump Sectional Drawing), remove packing housing [204] with cartridge seal. Remove screws [201] holding seal in housing.

Warning: some cartridge seal components can be easily damaged.

B. If pump has packing rings [207] installed, remove the following parts as a complete unit and disassemble: packing housing [204], packing gland [203], packing rings [207] and screws [201]. Packing hooks are commercially available to assist in removing packing.

24. Remove flinger [114], retaining ring [127].
25. Remove bearing retainer [128] with the following components intact and disassemble: o-ring [115] and lip seal [112].
26. Remove spacer ring [113] and remaining ball bearing [104].

DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.

NOTE: In case of oil-filled cavities, fluid will spill from these parts during disassembly. Full precautions should be taken to avoid any hazards.

27. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that a new packing set [207], lip seals [112, 133], and gaskets [132, 501, 403] be installed each time pump is disassembled and reassembled. It is recommended the o-rings in the cartridge seal be replaced. Because clamp bands [306] are cut, they must be replaced at each disassembly.

6. INSTRUCTIONS FOR PUMP ASSEMBLY

Refer to Section 7. **PUMP SECTIONAL DRAWING.**

1. Read Sections 10, 11, and 12 on **SHAFT SEALING, BEARING LUBRICATION, and JOINT LUBRICATION** before assembling pump. Visually inspect all parts during assembly. Replace all worn or damaged parts. Although they may appear reusable, it is recommended that a new packing set [207], lip seals [112, 133], and gaskets [132, 501, 403] be installed each time pump is disassembled and reassembled. It is recommended the o-rings in the cartridge seal be replaced.
2. Clean all bores in bearing housing [110]. Lightly pack ball bearing [104] full of grease and coat spacer ring [113] with grease to hold in place. Install spacer ring [113] and ball bearing in bearing housing. Refer to Section 11. **BEARING LUBRICATION**, for additional information.

DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.

3. Lubricate lip seal bore [112] and o-ring [115] with light oil. Install both into bearing retainer [128]. Install assembled unit into bearing housing [110] using retaining ring [127] and flinger [114].
4. Clean bore in packing housing [204].

A. If packing is being used, lightly lubricate packing rings [207] and install in packing housing. Stagger joints of adjacent packing rings 180° apart. Insert packing gland [203] and FINGER tighten screws [201]. **Final tightening and packing adjustment should be done after pump has been completely assembled and installed. DO NOT TIGHTEN WHILE PUMP IS IN OPERATION.** Slide complete unit into bearing housing [110]. Refer to Section 10. **SHAFT SEALING**, for additional information.

B. If a cartridge seal [219] (not shown in PUMP SECTIONAL DRAWING) is being used, insure the rotating collar set screws will not interfere with the drive shaft installation. Apply a light film of grease to o-rings on the ID of the seal. Install seal into packing housing [204] and tighten screws [201]. Slide complete unit in bearing housing [110]. Rotate shipping clips out of operating area.

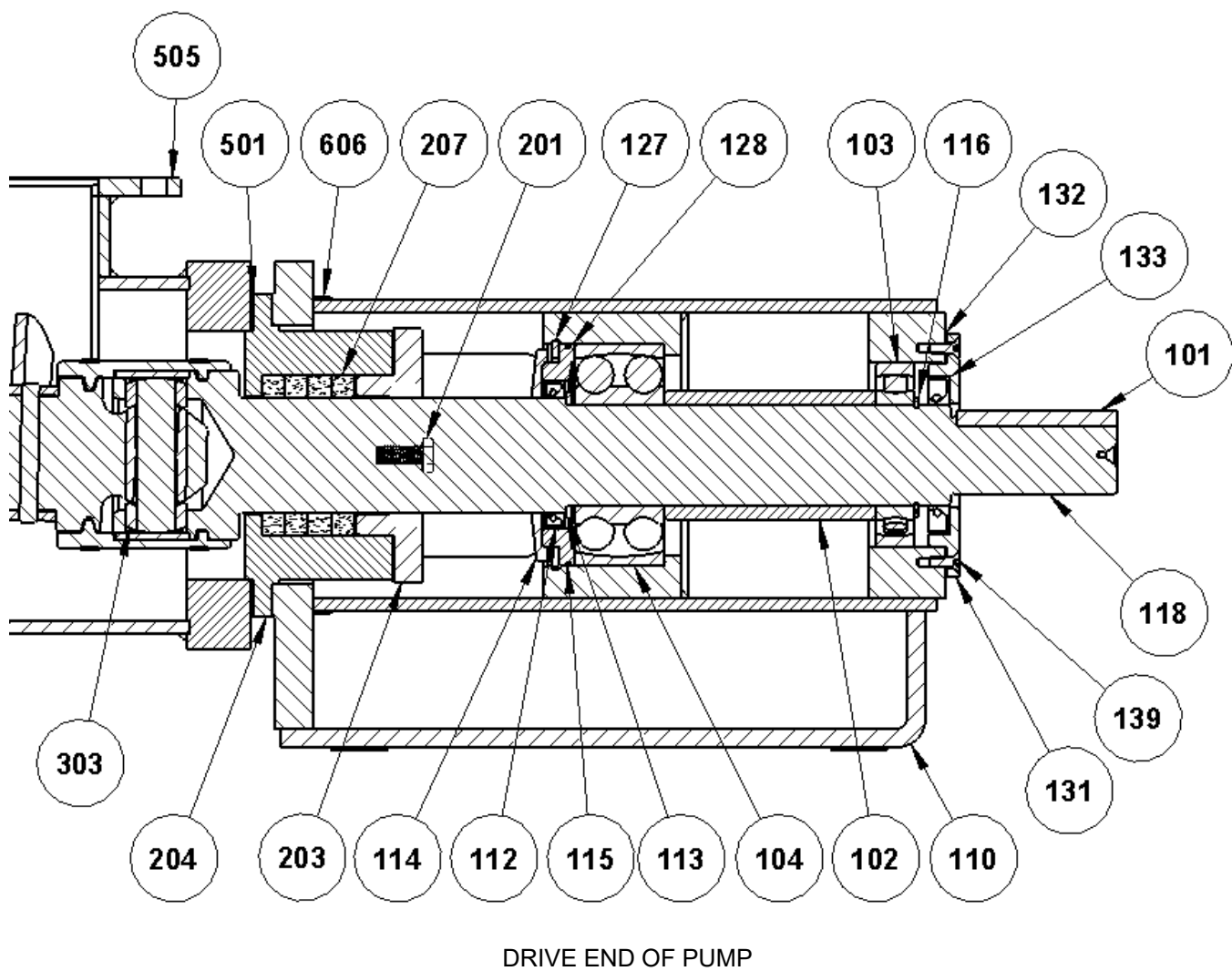
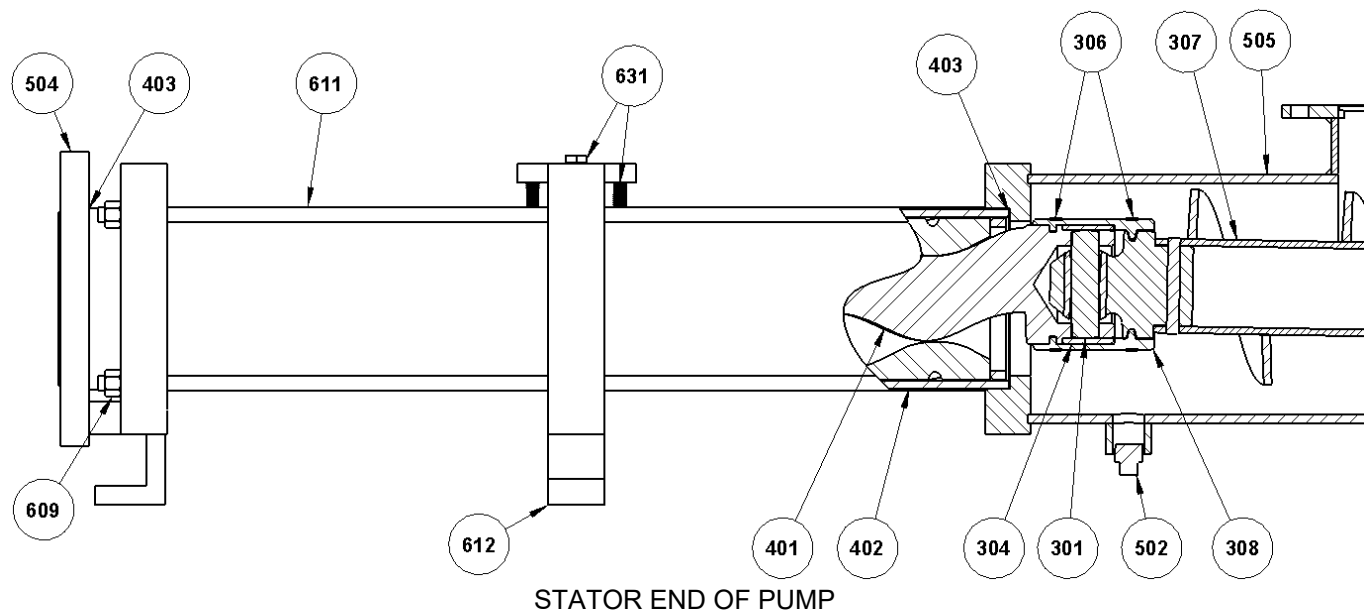
5. Cover drive shaft [118] keyway and retaining ring groove with tape to avoid damage to lip seals or o-rings. Slide drive shaft all the way into bearing housing [110] from rear. Be careful not to damage bearings or shaft. It may be necessary to lightly tap end of drive shaft with a rubber or plastic mallet to seat outer bearing. **DO NOT** use a metallic-faced striking instrument. Remove tape from retaining ring groove and keyway.
6. Install bearing spacer [102]. Fill cavity half full of grease in area around bearing spacer. Lightly pack ball bearing [103] full of grease and install into bearing housing [110] until flush with bearing spacer. Install retaining ring [116]. Refer to Section 11. **BEARING LUBRICATION**, for additional information.

DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.

7. Lubricate bore of lip seal [133] with light oil and install into coverplate [131]. Install coverplate gasket [132] and coverplate onto bearing housing using screws [139].
8. If a cartridge seal is used, tighten seal set screws evenly. This will center the cartridge seal rotating collar to the drive shaft [118].
9. Install key [101] onto drive shaft [118].
10. Slide rotor band [304] and cover sleeve [308] over head of connecting rod [307]. Apply a generous amount of grease compatible with pumped fluid to that head of connecting rod. Refer to Section 12. **JOINT LUBRICATION**, for additional information.
11. Slide connecting rod head [307] into rear of drive shaft [118] and install pin [301]. Tap each pin bushing [303] until outside of bushing is flush with the ends of the pin. Tap rotor band [304] over pin to secure in place. Roll cover sleeve [308] in place and secure with clamp bands [306].
12. Slide rotor band [304] and cover sleeve [308] over head at other end of connecting rod [307]. Apply a generous amount of grease compatible with pumped fluid to that head of connecting rod. Refer to Section 12. **JOINT LUBRICATION**, for additional information.
13. Slide connecting rod head into head of rotor [401] and install pin [301]. Tap rotor band [304] over pin to secure in place. Roll cover sleeve [308] in place and secure with clamp bands [306].
14. Slide inlet body gasket [501] and inlet body [505] over rotor [401] and connecting rod [307]. Attach with screws [606]. Take care not to damage rotor or connecting rod. Place a temporary support, such as a block of wood under inlet body. Install pipe plug [502].
15. Place stator gasket [403] in bore of inlet body [505]. Lubricate inside of stator [402] and profile of rotor [401] with glycerin, waterless hand cleaner or very soapy water. Grease or oil may also be used for this purpose when compatible with the pumped fluid. **Proceed with caution as both rotor and stator will be slippery and possibly difficult to hold.** Slide rotor into stator. Using a twisting motion (similar to threading parts) may help ease assembly. Immediately clean up any material used for lubricating parts that may have spilled.
16. Install tie rods [611] and slide stator support over end of stator [402] and tie rods. Tighten screws [631].
17. Install stator gasket [403] inside bore of discharge flange housing [504] and slide entire unit over end of stator [402] and tie rods [611]. Tighten hex nuts [609] to the following torque (based on pump model):

72706 = 16 lbf-ft;	72713 & 72724 = 29 lbf-ft;	72749 & 72796 = 70 lbf-ft
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18. Read and understand all safety instructions and warnings, Section 1. **WARNINGS & GENERAL GUIDELINES**, Section 4. **PREOPERATION CHECKS**, Section 10. **SHAFT SEALING**, and make sure to follow Section 3. **MAXIMUM PRESSURE RATINGS** before installing and operating pump.

7. PUMP SECTIONAL DRAWING



8. PARTS & REPAIR KITS

Refer to the drawing in Section 7.

XERIC rotors and stators are only sold as a kit. The stator is not interchangeable with any other rotor.

KEY NO.	DESCRIPTION	QTY
101	Key	1
102	Bearing Spacer	1
103	Bearing	1
104	Bearing	1
110	Bearing Housing	1
112*	Lip Seal	1
113	Spacer Ring	1
114	Flinger	1
115*	O-Ring	1
116	Retaining Ring	1
118	Drive Shaft	1
127	Retaining Ring	1
128	Bearing Retainer	1
131	Coverplate	1
132*	Coverplate Gasket	1
133*	Lip Seal	1
139	Screw	2
201	Screw	2
203	Packing Gland	1
204	Packing Housing	1
207*	Packing Rings	4
219*	Cartridge Seal	1
301*	Pin	2
303*	Pin Bushing	1
304	Rotor Band	2
306*	Clamp Band	4
307*	Connecting Rod	1
308*	Cover Sleeve	2
401**	Rotor	1
402**	Stator	1
403*	Stator Gasket	2
501*	Inlet Body Gasket	1
502	Pipe Plug	1
504	Discharge Flange Housing	1
505	Inlet Body	1
606	Screw	4
609	Hex Nut	4
611	Tie Rod	4
612	Stator Support	1-2
631	Screw	3-6

*REPAIR KITS INCLUDE COMPONENTS MARKED ABOVE.
(DOES NOT INCLUDE ROTOR & STATOR KIT).
[KEY 207 **OR** KEY 219; NOT BOTH]

**ROTOR & STATOR KITS INCLUDE COMPONENTS MARKED ABOVE.
(CANNOT BE PURCHASED AS SEPARATE PARTS).

9. STORAGE

If you do not intend to install this Roper pump immediately after purchase, the following recommendations are offered and should be followed to insure the best possible chances of a successful startup when the pump is installed.

STORAGE RECOMMENDATIONS:

- Protect the pump from the elements. Store the pump indoors whenever possible away from sources of ozone-generating equipment such as motors or generators. If indoor storage is not possible, cover the pump with a protective covering. Do not allow moisture to collect in or around the pump.
- Remove the drain plug from the inlet housing and allow the pump to dry completely.
- Relieve the compression on the packing by loosening the packing gland. If you intend to grease lubricate the packing after installing the pump, inject a liberal amount of grease into the stuffing box through the lube fitting. If a water flush is to be used, do not inject grease into the stuffing box; instead, place a small amount of light oil into the stuffing box.
- Read and understand this manual thoroughly before installing or starting pump.
- If applicable, remove the drive belts from belt-driven units or disconnect the coupling on direct-connected units.
- Apply a clean vapor phase, rust inhibitor to the pump. Since the stator is metal, it is subject to rust. Applying oil can prevent corrosion and increase longevity of pump life. Approximately every two weeks, rotate the drive shaft of the pump manually.

If other equipment included with the pump, such as drivers, seals, flow monitors, etc., are to be stored also, refer to the respective manufacturer's recommendations for storage.

10. SHAFT SEALING

PACKING

The standard shaft sealing method used in these pumps is die-formed ring packing.

If the packing is to be grease-lubricated during initial installation or during replacement, a good grade of bearing grease should generally be used. Should bearing grease be unacceptable or incompatible with the fluid being pumped, another paste-type lubricant may be used. Lubrication of the packing must be performed with the pump stopped. **DO NOT** lubricate or adjust packing with the pump operating.



WHERE LIQUID BEING HANDLED IS HAZARDOUS OR VOLATILE, FULL PRECAUTIONS SHOULD BE TAKEN AT ALL TIMES.

DO NOT work on a pump while it is operating.

CARE OF PACKING

Packing hooks are commercially available to help in removing packing rings from the packing housing. It is generally not recommended to reuse old packing rings. When installing packing, use formed packing rings. **DO NOT** use a one-piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the packing housing and against the shaft, then backed off until finger-tight. After the pump is started, note the amount of leakage from the packing housing. If the packing leakage exceeds ten drops per minute, stop the pump and tighten the gland nuts. The gland nuts should be tightened evenly in 1/6 to 1/3 turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers, and generate excessive heat.

The pump should be stopped and the packing gland adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

MECHANICAL SEALS

Certain applications may not permit the necessary leakage required for the proper operation of packing. These applications may require the use of an end-face type of mechanical seal. Various types of mechanical seals may be available to fit most pumps. Due to the various seal types and styles available, the seal manufacturer's instructions for installation and setting should be followed.

CARTRIDGE SEALS

Certain applications may not permit the necessary leakage required for the proper operation of packing or mechanical seals. Applications where the pumping fluid contains particles that are abrasive and/or operates at high temperatures (250°F to 400°F) may require cartridge seals. Follow the seal manufacturer's instructions for installation and setting.

NOTE: Not all seals will fit or function in all pumps. Modification to the pump and/or seal may be required, or it may be necessary to change to a different type of seal. Consult with both the pump and seal manufacturers if a change in shaft sealing method is necessary.

11. BEARING LUBRICATION

The pump bearings are antifriction bearings, either ball bearings or tapered roller bearings, and are grease lubricated. The bearings installed in pumps are lubricated at the factory and, under normal operating conditions, should not need additional lubrication or re-lubrication for the first 10,000 hours of operation. When the pump is operated in dusty or humid environments, the lubrication intervals should be shortened.

A good grade of NLGI Grade 2 EP (extreme pressure) grease, suitable for the operating temperatures encountered, should be used. Pumps are lubricated at the factory.

It is recommended that the bearing seals be replaced each time the bearing housing is disassembled. Add a few drops of oil to the bore of the bearing seals before reassembling.

PREFERRED RE-LUBRICATION METHOD

When re-lubricating the bearings, the shaft-bearing assembly should be removed from the pump and cleaned of old lubricant. See Section 5. **INSTRUCTIONS FOR PUMP DISASSEMBLY**. Carefully inspect the bearings for signs of wear or contamination and replace them if necessary. **DO NOT** contaminate the bearings while they are out of the pump. Pack each bearing full of grease and fill the space between the bearings approximately one-half full.

NOTE: In a new or re-lubricated pump, the bearings may run warmer than normal for a few hours before the temperature levels to normal operating temperature. This is a normal condition of bearings freshly lubricated and is no cause for alarm. Higher than normal bearing temperature, occurring for several days after re-lubricating the bearings, may indicate a problem. This problem could be an excessive amount of lubricant, a contaminated bearing, or it could possibly indicate a bearing about to fail. Should bearing temperatures run higher than normal for several days, it is recommended that the shaft-bearing assembly be removed, inspected, and re-lubricated as outlined in the preferred re-lubrication method.



WARNING

DO NOT spin bearings with compressed air. This is highly dangerous and will cause the bearing to spin at dangerously high speed. This can cause the bearing to fragment with explosive force possibly causing serious personal injury or death.

To insure that antifriction bearings are capable of achieving long life and that they perform without objectionable noise, temperature rise, or shaft excursions, the following precautions are recommended:

- Handle bearings with care.
- Work with clean tools, clean dry hands, and in clean surroundings.
- **DO NOT** wash or wipe new bearings prior to installation.
- Place unwrapped bearings on clean paper and keep them similarly covered, if they are not in the original container.
- **DO NOT** use wooden mallets, brittle or chipped tools, or dirty fixtures and tools in mounting bearings.
- **DO NOT** spin bearings that have not been cleaned. **NEVER** spin any bearing with compressed air.
- **DO NOT** scratch or nick bearings.
- Insure that races are started onto shafts and into housings evenly so as to prevent cocking.
- Inspect shafts and housings before mounting bearings.
- When removing bearings, clean housings, covers, and shafts before exposing the bearings. All dirt can be considered an abrasive – dangerous to the reuse of any bearing.
- Treat used bearings, which may be reused, as new ones.
- Protect dismantled bearings from dirt and moisture. Wrap bearings in clean oil-proof paper when not in use.
- In assembling bearings onto shafts, **NEVER** strike the outer race. Apply force only to the race that is being pressed onto a shaft or into a bore. Never apply force to a race that will transmit a load through the rolling elements to the other race during installation. In disassembling, follow the same precautions.

The general classifications of failures and deficiencies requiring bearing removal are listed below. These classifications are associated with numerous causes, some of which are outlined as follows.

PROBLEM	POSSIBLE CAUSES
OVERHEATING	Bearing contamination
	Excessive lubrication
	Inadequate lubrication
	Housing distortion
	Cage wear
VIBRATION	Bearing contamination
	Fatigued bearing elements
	Race misalignment
	Shaft out-of-round
	Flats on bearing elements
NOISE	Inadequate lubrication
	Bearing contamination
	Brinelling due to handling abuse
	Loss of bearing clearance
	Bearing slipping on shaft
BINDING	Lubricant breakdown
	Bearing contamination
	Thermal expansion
	Race misalignment
	Cage failure
LUBRICANT LEAKAGE	Excessive lubrication
	Seal wear or failure
	Lubricant deteriorating due to high temperature
	Lubricant churning

12. JOINT LUBRICATION

This pump is provided with two universal joints which allow the rotor to rotate through an eccentric path necessary for proper functioning of the pump. The joints may be of a pin type or crowned gear type depending upon the model of the pump. Proper lubrication of the joints is important and will help extend the service life of the joint components.

When assembling the pump, make sure that all components of the joint are coated with lubricant. Also, fill the spaces between joint components full of lubricant. This is particularly important because joint lubrication can be performed only when the pump is disassembled, and the lubricant must perform its job until the next time maintenance is performed on the pump.

In pin joint pumps, use a grease that is compatible with the fluid being pumped and that will not react with the fluid. A good grade of EP (extreme pressure) grease containing molybdenum disulfide additives should be used.