

## TLP Series

SANITARY POSITIVE DISPLACEMENT PUMP

FORM NO.: 95-03095 REVISION: 11/2017

ORIGINAL INSTRUCTIONS

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



SPX Flow Technology

[www.spxflow.com](http://www.spxflow.com)

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# EC-Declaration of conformity

Machinery Directive 2006/42/EC, Annex IIA

## Manufacturer

SPX Flow Technology Poland Sp. z o.o.  
Hermana Frankego, 9  
85-862 Bydgoszcz Poland

We hereby declare that **TopLobePlus rotary lobe pumps**

|        |                 |                 |
|--------|-----------------|-----------------|
| types: | <b>TLP 0040</b> | <b>TLP 0300</b> |
|        | <b>TLP 0100</b> | <b>TLP 0670</b> |
|        | <b>TLP 0140</b> | <b>TLP 0940</b> |
|        | <b>TLP 0230</b> | <b>TLP 2290</b> |

whether delivered without drive or delivered as an assembly with drive, are in conformity with the relevant provisions of the Machinery Directive 2006/42/EC, Annex I.

## Manufacturer Declaration

Machinery Directive 2006/42/EC, Annex IIB

The product must not be put into service until the machinery into which it has to be incorporated has been declared to conform with the provisions of the Directive.

Bydgoszcz (Poland), 6 November 2017



Alberto Scotti  
Product Engineering Director – Industrial Pumps

# Declaration of compliance for food contact materials

## Manufacturer

SPX Flow Technology Poland Sp. z o.o.  
Hermana Frankego, 9  
85-862 Bydgoszcz Poland

We hereby certify the compliance of the materials coming into contact with food during the intended use with the general requirements as of the date of this Declaration of compliance to:

**Regulation (EC) No 1935/2004 of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC.**

This Declaration applies to the following products:

Product: **TopLobePlus rotary lobe pumps**

|        |                 |                 |
|--------|-----------------|-----------------|
| Types: | <b>TLP 0040</b> | <b>TLP 0300</b> |
|        | <b>TLP 0100</b> | <b>TLP 0670</b> |
|        | <b>TLP 0140</b> | <b>TLP 0940</b> |
|        | <b>TLP 0230</b> | <b>TLP 2290</b> |

We certify that the processed foodstuffs are not harmfully influenced by the materials used in our pumps if used as intended. They don't emit substances which could be hazardous to health or harmful to foodstuffs.

The material surfaces in contact with foodstuffs consist of stainless steel materials; seals are made of EPDM, FPM, ceramic and carbon graphite. The polymer seal materials are FDA approved. Lubricants if used are "Food Grade" approved.

The traceability of the pumps with food contact supplied is provided in respect of the Art. 17, Regulation (EC) No 1935/2004.

We manufacture our products on the basis of Good Manufacturing Practice according to Regulation (EC) No 2023/2006.

Bydgoszcz (Poland), 6 November 2017



Alberto Scotti  
Product Engineering Director – Industrial Pumps

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## 1.0 Warranty

Seller warrants its products to be free from defect in materials and workmanship for a period of one (1) year from the date of shipment. This warranty shall not apply to products which require repair or replacement due to normal wear and tear or to products which are subjected to accident, misuse or improper maintenance. This warranty extends only to the original Buyer. Products manufactured by others but furnished by Seller are exempted from this warranty and are limited to the original manufacturer's warranty.

Seller's sole obligation under this warranty shall be to repair or replace any products that Seller determines, in its discretion, to be defective. Seller reserves the right either to inspect the products in the field or to request their prepaid return to Seller. Seller shall not be responsible for any transportation charges, duty, taxes, freight, labor or other costs. The cost of removing and/or installing products which have been repaired or replaced shall be at Buyer's expense.

Seller expressly disclaims all other warranties, express or implied, including without limitation any warranty of merchantability of fitness for a particular purpose. The foregoing sets forth Seller's entire and exclusive liability, and Buyer's exclusive and sole remedy, for any claim of damages in connection with the sale of products. In no event shall Seller be liable for any special consequential incidental or indirect damages (including without limitation attorney's fees and expenses), nor shall Seller be liable for any loss of profit or material arising out of or relating to the sale or operation of the products based on contract, tort (including negligence), strict liability or otherwise.

### 1.1 Shipping Damage or Loss

If equipment is damaged or lost in transit, file a claim at once with the delivering carrier. The carrier has signed the Bill of Lading acknowledging that the shipment has been received from the seller in good condition. Seller is not responsible for the collection of claims or replacement of materials due to transit shortages or damages.

### 1.2 Warranty Claim

Warranty claims must have a **Returned Goods Authorization (RGA)** from the Seller before returns will be accepted. Claims for shortages or other errors, exclusive of transit shortages or damages, must be made in writing to Seller within ten (10) days after delivery. Failure to give such notice shall constitute acceptance and waiver of all such claims by Buyer.

## 2.0 Safety

### **READ AND UNDERSTAND THIS MANUAL PRIOR TO INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT**

We recommend users of our equipment and designs follow the latest Industrial Safety Standards. At a minimum, these should include the industrial safety requirements established by:

1. Occupational Safety and Health Administration (OSHA), Title 29 of the CFR.  
Section 1910.212- General Requirements for all Machines
2. National Fire Protection Association, ANSI/NFPA 79.  
ANSI/NFPA 79- Electrical Standards for Industrial Machinery
3. National Electrical Code, ANSI/NFPA 70  
ANSI/NFPA 70- National Electrical Code  
ANSI/NFPA 70E- Electrical Safety Requirement for Employee Workplaces
4. American National Standards Institute, Section B11

**Attention:** Servicing energized industrial equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout industrial equipment from power sources, and release stored energy, if present. Refer to the National Fire Protection Association Standard No. NFPA70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (Lockout-Tagout) and OSHA Electrical Safety Related Work Practices, including procedural requirements for:

- Lockout-tagout
- Personnel qualifications and training requirements
- When it is not feasible to de-energize and lockout-tagout electrical circuits and equipment before working on or near exposed circuit parts

**Locking and Interlocking Devices:** These devices should be checked for proper working condition and capability of performing their intended functions. Make replacements only with the original manufacturer's renewal parts or kits. Adjust or repair in accordance with the manufacturer's instructions.

**Periodic Inspection:** Industrial equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions and adjusted as indicated by experience. At a minimum, an initial inspection within 3 to 4 months after installation is recommended. Inspection of the electrical control systems should meet the recommendations as specified in the National Electrical Manufacturers Association (NEMA) Standard No. ICS 1.3, Preventative Maintenance of Industrial Control and Systems Equipment, for the general guidelines for setting-up a periodic maintenance program.

**Replacement Equipment:** Use only replacement parts and devices recommended by the manufacturer to maintain the integrity of the equipment. Make sure the parts are properly matched to the equipment series, model, serial number, and revision level of the equipment.

Warnings and cautions are provided in this manual to help avoid serious injury and/or possible damage to equipment:



**DANGER:** marked with a stop sign.

Immediate hazards which **WILL** result in severe personal injury or death.



**WARNING:** marked with a warning triangle.

Hazards or unsafe practices which **COULD** result in severe personal injury or death.



**CAUTION:** marked with a warning triangle.

Hazards or unsafe practices which **COULD** result in minor personal injury or product or property damage.

### 3.0 Replacement Labels

 **WARNING:** The following labels are installed on your equipment. If these labels are removed or become unreadable, refer to “Parts Lists” on page 48 for replacement part numbers.

### 3.1 Application Instructions

Apply to a clean, dry surface. Remove the backing from the label, place it in proper position, protect it with a cover sheet and burnish it. (A soft rubber roller also may be used to press the label into place). Apply all labels to be readable from the front of the pump.

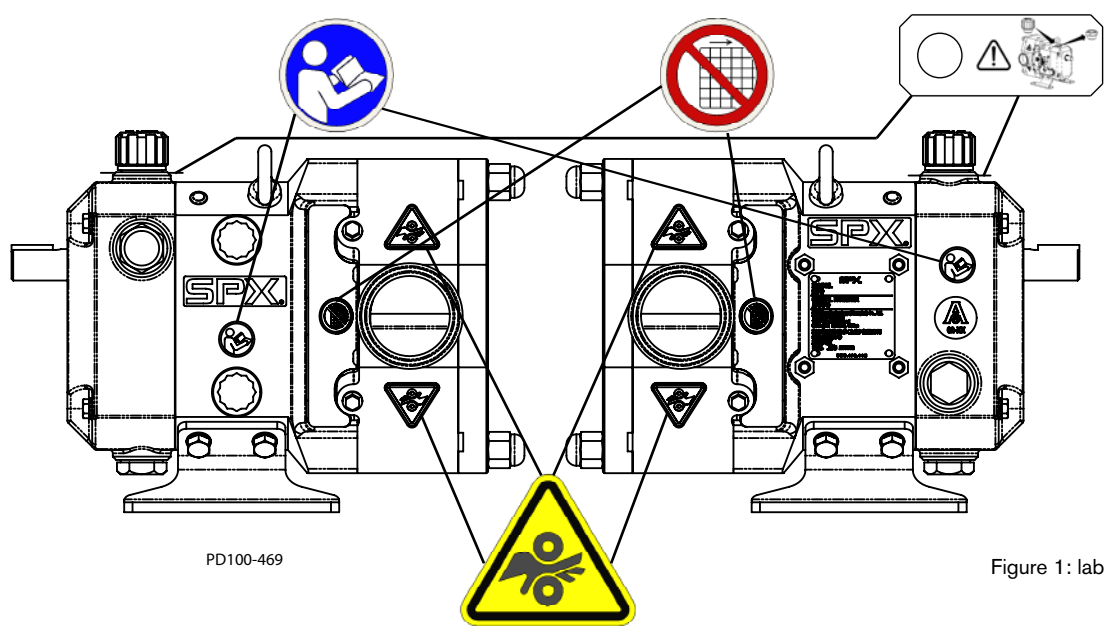
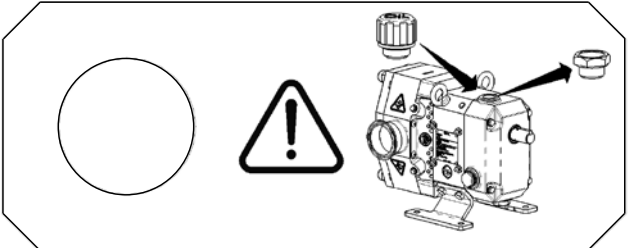


Figure 1: label locations

| Label                                                                               | Definition                        |
|-------------------------------------------------------------------------------------|-----------------------------------|
|  | Consult operation manual          |
|  | Do not operate with guard removed |
|  | Entanglement hazard               |
|  | Replace plug with breather plug   |

## 4.0 Care of Stainless Steel

**NOTE:** SPX recommends the use of an FDA-approved anti-seize compound on all threaded connections.

### 4.1 Care of Stainless Steel

Corrosion resistance is greatest when a layer of oxide film is formed on the surface of stainless steel. If film is disturbed or destroyed, stainless steel becomes much less resistant to corrosion and may rust, pit or crack. Corrosion pitting, rusting and stress cracks may occur due to chemical attack. Use only cleaning chemicals specified by a reputable chemical manufacturer for use with 300 series stainless steel. Do not use excessive concentrations, temperatures or exposure times. Avoid contact with highly corrosive acids such as hydrofluoric, hydrochloric or sulfuric. Also avoid prolonged contact with chloride-containing chemicals, especially in presence of acid. If chlorine-based sanitizers are used, such as sodium hypochlorite (bleach), do not exceed concentrations of 150 ppm available chlorine, do not exceed contact time of 20 minutes, and do not exceed temperatures of 104°F (40°C). Corrosion discoloration, deposits or pitting may occur under product deposits or under gaskets. Keep surfaces clean, including those under gaskets or in grooves or tight corners. Clean immediately after use. Do not allow equipment to set idle, exposed to air with accumulated foreign material on the surface. Corrosion pitting may occur when stray electrical currents come in contact with moist stainless steel. Ensure all electrical devices connected to the equipment are correctly grounded.

### 4.2 Elastomer Seal Replacement Following Passivation

Passivation chemicals can damage product contact areas of equipment. Elastomers (rubber components) are most likely to be affected. Always inspect all elastomer seals after passivation is completed. Replace any seals showing signs of chemical attack. Indications may include swelling, cracks, loss of elasticity or any other noticeable changes when compared with new components.

## 5.0 Introduction



**DANGER:** The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out.

### 5.1 Pump Model Designation

| TL | - | 0100 | - | 01 | - | 01 | - | 01 | - | 02 | - | 01 | - | 02 |
|----|---|------|---|----|---|----|---|----|---|----|---|----|---|----|
| 1  |   | 2    |   | 3  |   | 4  |   | 5  |   | 6  |   | 7  |   | 8  |

1. Model Series: TL – Johnson Pump TLP Series
2. Pump Model Size: 0040, 0100, 0140, 0230, 0300, 0670, 0940, 2290
3. Port Connection Type:
  - 01 – ISO 2852 S-Clamp
  - 02 – DIN 11851 Fittings
  - 03 – DIN 2633 Flanges
  - 04 – SMS 1145 Fittings
4. Rotor: 01 – Stainless Steel Tri-Lobe
5. Cover: 01 – Standard
6. Product Seal Material:
  - 01 – Carbon vs. Hardened Stainless Steel
  - 02 – Silicon Carbide vs. Silicon Carbide
7. Double Mechanical Seal:
  - 01 – No
  - 02 – Yes – adds carbon outer seal
8. Product Contact O-Ring Material:
  - 01 – FKM
  - 02 – EPDM

The TLP Series pump meets the 3-A standard for sanitation, design, and style.

### 5.2 Intended Use



**CAUTION:**

*Improper use of the pumps leads to:*

- Damage
- Leakage
- Destruction
- Possible failures in the production process

The TLP Rotary Pump is exclusively intended for pumping liquids, especially in beverage and food installations as well as in comparable applications of the chemical, pharmaceutical and health care industries. Its use is permissible only within the admissible pressure and temperature margins and under consideration of chemical and corrosive influences. Any use exceeding the margins and specifications set forth is considered to be not intended. Any damage resulting therefrom is not within the responsibility of the manufacturer. The user will bear the full risk.

### 5.3 Pump Receiving

**NOTE:** Each pump is shipped from the factory with the gearbox sealed. Prior to operation, check the oil level and replace the uppermost oil drain plug with the supplied oil fill breather. See "Lubrication" on page 21 for oil type and quantity.

All ports are covered at the factory to keep out foreign objects during transit. If covers are missing or damaged, remove the pump cover for a thorough inspection of the fluid head. Be sure that the pumping head is clean and free of foreign material before rotating the shaft.

### 5.4 Pump Characteristics

These positive displacement, low-slip, stainless steel pumps are designed with larger diameter shafts for greater strength and stiffness, and are mounted on a heavy-duty cast iron bearing frame with double tapered roller bearings.

- Designed for continuous operation.
- Rotor connections are sealed from the product zone.
- Rotors are secured to the shafts using rotor nuts.
- Single mechanical seals are standard.
- CIP capability.

### 5.5 Equipment Serial Number

All pumps are identified by a serial number on the gear case nameplate. The serial number is also stamped on the pump body.

**NOTE:** The gear case and body must be kept together to maintain proper rotor clearance. Failure to do so will damage the pump.

### 5.6 Pump Shaft Location

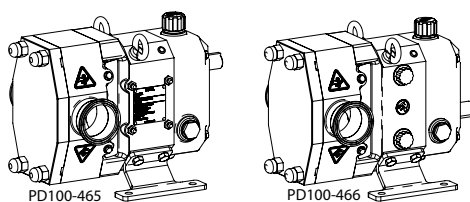


Figure 2: Upper and Lower Shaft Mount

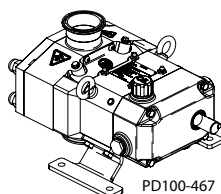
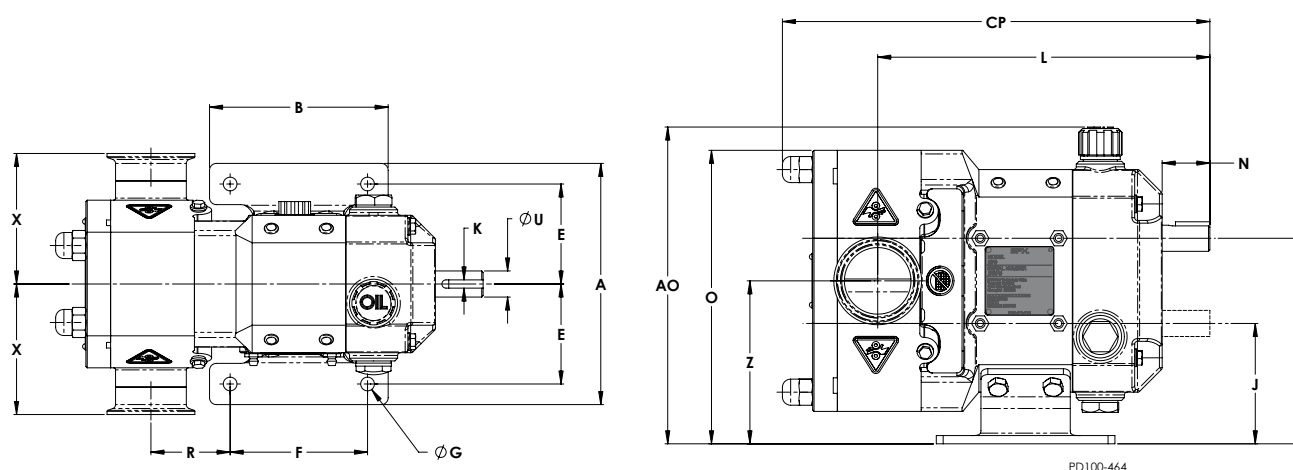


Figure 3: Sidemount Left Hand (as viewed from pump cover)

There are two pump drive shaft locations, as shown in Figure 2 and Figure 3. When side-mounted, left-hand as viewed from the pump cover (Figure 3), rotation may be reversed for up or down vertical flows. See also Figure 24 and Figure 25. The mounting position may be easily reconfigured by changing the location of the mounting feet. The breather plug must be moved to the uppermost port and the level indicator should be in the lowest, side port in the gear cover.

## 5.7 Pump Dimensions



### 5.7.1 Mounting Dimensions

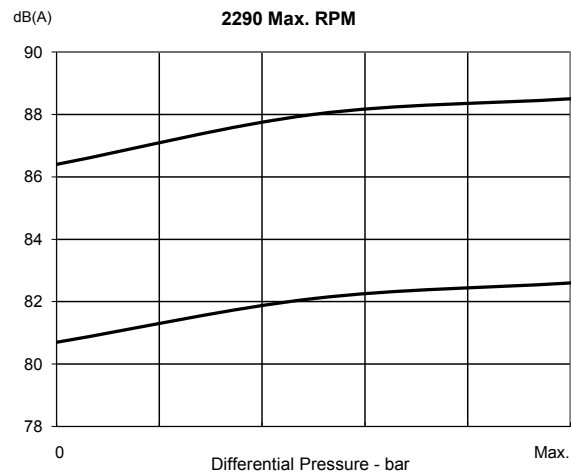
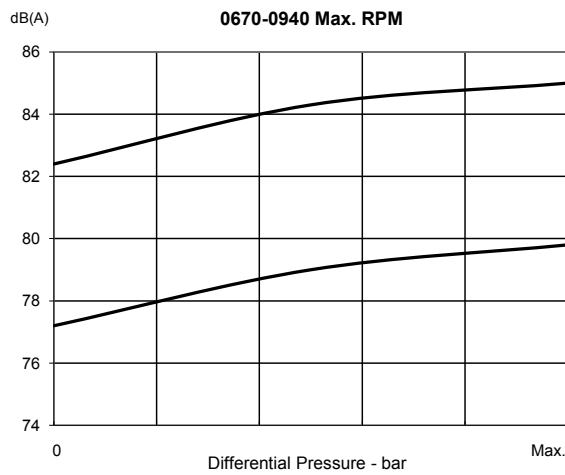
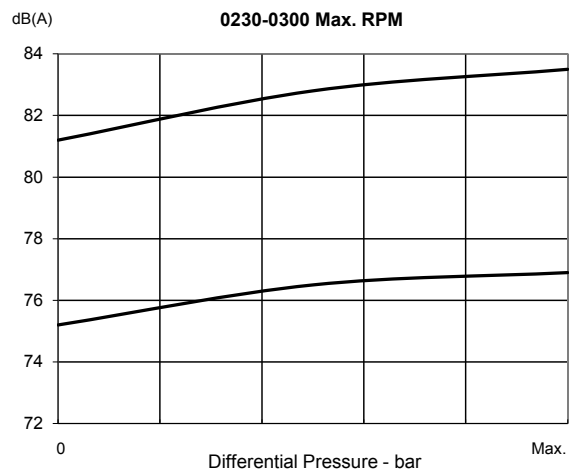
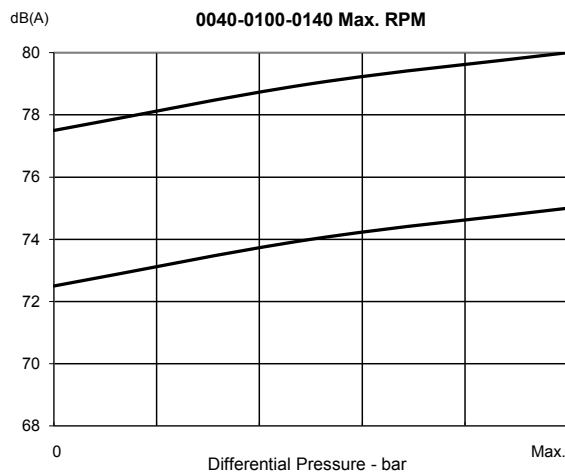
|       |       |       |       |       |       |       |       |    |       |       |       |      |       |      |    | ISO 2852<br>DIN 11851<br>SMS 1145 | DIN 2633 |       |
|-------|-------|-------|-------|-------|-------|-------|-------|----|-------|-------|-------|------|-------|------|----|-----------------------------------|----------|-------|
| Model | A     | AO    | B     | CP    | D     | E     | F     | G  | J     | K     | L     | N    | O     | R    | U  | X                                 |          | Z     |
| 0040  | 175.5 | 230.5 | 130.0 | 281.4 | 149.6 | 72.8  | 100.0 | 10 | 87.6  | 6x6   | 227.6 | 34.7 | 231.6 | 43.5 | 19 | 98.0                              | 130.0    | 118.6 |
| 0100  | 175.5 | 230.5 | 130.0 | 286.8 | 149.6 | 72.8  | 100.0 | 10 | 87.6  | 6x6   | 229.0 | 34.7 | 231.6 | 44.9 | 19 | 98.0                              | 130.0    | 118.6 |
| 0140  | 175.5 | 230.5 | 130.0 | 298.7 | 149.6 | 72.8  | 100.0 | 10 | 87.6  | 6x6   | 235.8 | 34.7 | 231.6 | 51.7 | 19 | 98.0                              | 130.0    | 118.6 |
| 0230  | 175.5 | 230.5 | 130.0 | 299.1 | 149.6 | 72.8  | 100.0 | 10 | 87.6  | 6x6   | 235.9 | 34.7 | 231.6 | 51.8 | 19 | 98.0                              | 130.0    | 118.6 |
| 0300  | 175.5 | 230.5 | 130.0 | 311.1 | 149.6 | 72.8  | 100.0 | 10 | 87.6  | 6x6   | 241.8 | 34.7 | 231.6 | 57.7 | 19 | 98.0                              | 130.0    | 118.6 |
| 0670  | 239.1 | 310.6 | 160.0 | 396.4 | 205.9 | 99.5  | 120.0 | 13 | 112.9 | 10x8  | 321.0 | 57.6 | 292.9 | 75.5 | 38 | 124.0                             | 156.0    | 159.4 |
| 0940  | 239.1 | 310.6 | 160.0 | 423.9 | 205.9 | 99.5  | 120.0 | 13 | 112.9 | 10x8  | 332.6 | 57.6 | 292.9 | 87.1 | 38 | 134.0                             | 166.0    | 159.4 |
| 2290  | 301.1 | 384.6 | 250.0 | 553.6 | 263.7 | 130.5 | 210.0 | 13 | 138.7 | 16x10 | 437.0 | 85.6 | 368.2 | 81.5 | 55 | 159.0                             | 189.0    | 201.2 |

### 5.7.2 Technical Data

| Model | Displacement<br>liter/rev | Nominal<br>Connection<br>Size | Differential<br>Pressure<br>Rating<br>bar | Max.<br>Pump<br>Speed<br>RPM | Input<br>Shaft<br>Diameter | Max.<br>Torque<br>N-m | Max.<br>Temp.<br>°C | Horizontal<br>Mount<br>Pump<br>Weight | Vertical<br>Mount<br>Pump<br>Weight |
|-------|---------------------------|-------------------------------|-------------------------------------------|------------------------------|----------------------------|-----------------------|---------------------|---------------------------------------|-------------------------------------|
| 0040  | 0.04                      | 25 (1")                       | 10                                        | 1200                         | 19                         | 108                   | 100                 | 22                                    | 22                                  |
| 0100  | 0.10                      | 25 (1")                       | 10                                        | 900                          | 19                         | 108                   | 100                 | 22                                    | 22                                  |
| 0140  | 0.14                      | 38 (1.5")                     | 10                                        | 900                          | 19                         | 108                   | 100                 | 24                                    | 24                                  |
| 0230  | 0.23                      | 38 (1.5")                     | 10                                        | 900                          | 19                         | 108                   | 100                 | 24                                    | 24                                  |
| 0300  | 0.30                      | 50 (2")                       | 10                                        | 900                          | 19                         | 108                   | 100                 | 25                                    | 25                                  |
| 0670  | 0.67                      | 50 (2")                       | 10                                        | 700                          | 38                         | 400                   | 100                 | 65                                    | 65                                  |
| 0940  | 0.94                      | 75 (3")                       | 10                                        | 700                          | 38                         | 400                   | 100                 | 70                                    | 70                                  |
| 2290  | 2.29                      | 100 (4")                      | 10                                        | 600                          | 55                         | 1200                  | 100                 | 148                                   | 148                                 |

**NOTE:** All weights in daN, mass in Kg.

## 5.7.3 Sound Level



## 5.7.4 Maximum Particle Size

| Model | Port Connection<br>Inside Diameter<br>(mm) | Max. Theoretical<br>Particle Size<br>(mm) | Recommended Max.<br>Particle Size<br>(mm) |
|-------|--------------------------------------------|-------------------------------------------|-------------------------------------------|
| 0040  | 20                                         | 7.6                                       | 3                                         |
| 0100  | 26                                         | 15.6                                      | 5                                         |
| 0140  | 38                                         | 15.6                                      | 5                                         |
| 0230  | 38                                         | 25.6                                      | 9                                         |
| 0300  | 50                                         | 25.6                                      | 9                                         |
| 0670  | 50                                         | 38.5                                      | 13                                        |
| 0940  | 81                                         | 38.5                                      | 13                                        |
| 2290  | 100                                        | 45.6                                      | 15                                        |

## 6.0 Installation

The installation of the pump and piping system should be in accordance with local codes and restrictions. Practices described in this manual are recommended for optimum performance. All system equipment, such as motors, sheaves, drive couplings, speed reducers, etc., must be properly sized to ensure satisfactory operation of your pump within its limits.

**CAUTION:** These pumps are positive displacement, low slip design and will be severely damaged if operated with closed valves in discharge or inlet lines. The pump warranty is not valid for damages caused by a hydraulic overload from operation or start-up with a closed valve in the system.

### 6.1 Install Pump and Drive Unit

**WARNING:** Full guards must be installed to isolate operators and maintenance personnel from rotating components.

In a typical installation configuration, the pump and drive unit are mounted on a common base plate. The unit can be installed in any of the arrangements shown in Figure 4 through Figure 7 (the shaded area indicates the guard location).

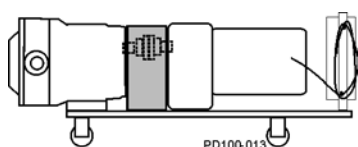


Figure 4 - Portable Base

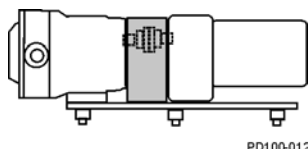


Figure 5 - Adjustable Leg Base

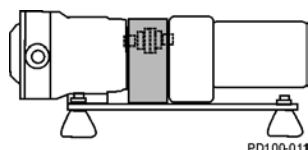


Figure 6 - Leveling and/or Vibration Isolation Pads

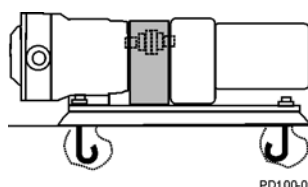


Figure 7 - Permanent Installation on Foundation

**NOTE:** When installing unit as shown in Figure 7, level the unit before installing the bolts.

## 6.2 Install Connections and Piping

### 6.2.1 Piping Support

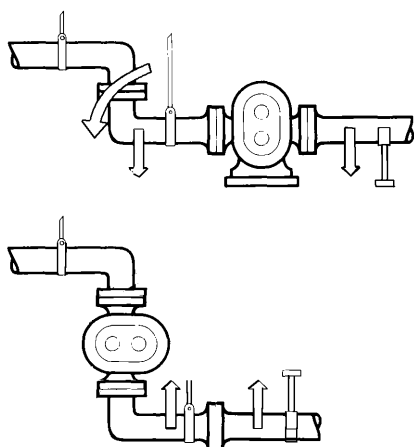


Figure 8 - Piping Support

To minimize forces exerted on the pump, support all piping to the pump independently with hangers or pedestals. Such forces can cause misalignment of the pump parts and lead to excessive wear of rotors, bearings, and shafts. Figure 8 shows typical supporting methods used to independently support each pipe, reducing the weight effect of piping and fluid on the pump.

### 6.2.2 Expansion Joints

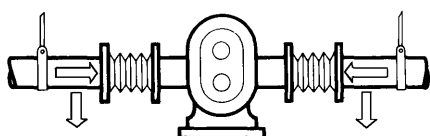


Figure 9 - Flexible Connections and Supports

Thermal expansion of piping can cause tremendous forces. Use thermal expansion joints to minimize these forces on the pump. Flexible joints can be used to limit transmission of mechanical vibration. Ensure that the free ends of any flexible connections in the system are anchored.

### 6.2.3 Inlet Piping

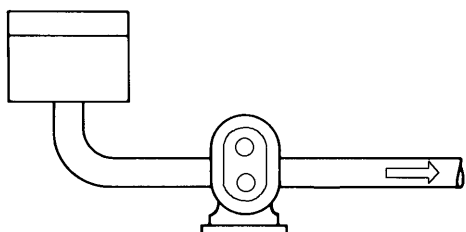
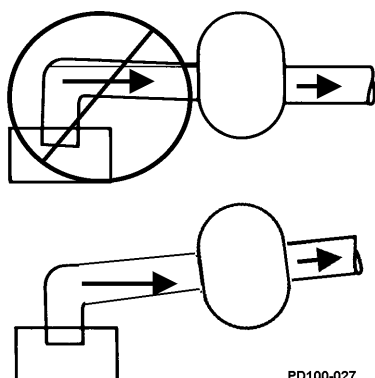


Figure 10 - Pump Below Supply

Install the pump below the supply liquid level to reduce the air in the system by flooded suction (Figure 10).



PD100-027

Figure 11 - Corect Piping to Prevent Inlet Air Pockets

If the pump is installed above the supply liquid level, the piping on inlet side must slope up toward the pump, preventing air pockets in the pipes (Figure 11).

## 6.3 Install Check Valves

### 6.3.1 Inlet Side on Lift Applications

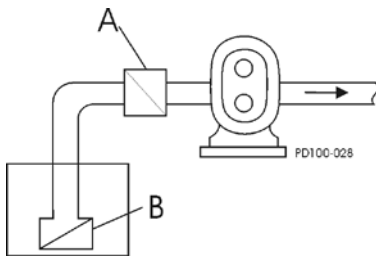


Figure 12 - Inlet Check Valve

Use check valves to keep the inlet line full, particularly with low-viscosity fluids (Figure 12).

- A. Inlet Check Valve
- B. Foot Check Valve

### 6.3.2 Discharge Side

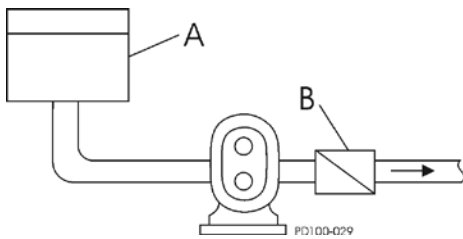


Figure 13 - Discharge Check Valve

For systems with liquid under a vacuum, we recommend installing a check valve on the discharge side of the pump. The check valve prevents backflow (air or fluid) to aid in the initial start-up by minimizing the required differential pressure supplied by the pump to start the flow (Figure 13).

- A. Closed Tank - produces a vacuum on liquid (Low Absolute Pressure)
- B. Check Valve (outlet)

## 6.4 Install Isolation Valves

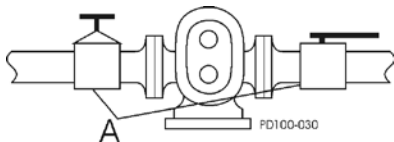


Figure 14 - Isolation Valves

Isolation valves permit pump maintenance and safe pump removal without draining the system (Figure 14, item A).

## 6.5 Install Relief Valves

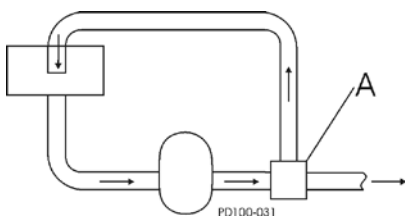


Figure 15 - Relief Valves

Install relief valves to protect the pump and piping system against excessive pressure. We recommend installing an external relief valve designed to bypass fluid from the pump outlet to the inlet side of the system (Figure 15, item A).

## 6.6 Inlet Side Strainers and Traps

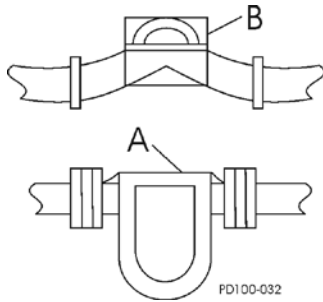


Figure 16 - Inline Strainers and Traps

Inlet side strainers and traps (Figure 16, items A and B) can be used to prevent foreign matter from damaging the pump. Make the selection carefully to prevent cavitation caused by the restriction of the inlet. If the inlet strainers are used, they must be serviced regularly to prevent clogging and flow stoppage.

- A. Strainer
- B. Magnetic Tap

## 6.7 Install Pressure Gauges

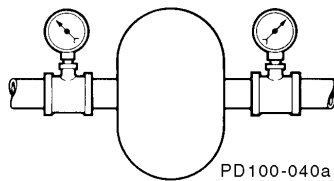


Figure 17 - Pressure and Vacuum Gauges

Pressure and vacuum gauges provide valuable information about pump operation (Figure 17). Wherever possible, install the gauges to help provide information on the following:

- Normal or abnormal pressures
- Indication of flow
- Changes in pump condition
- Changes in system conditions
- Changes in fluid viscosity

## 6.8 Seal Flush Connections

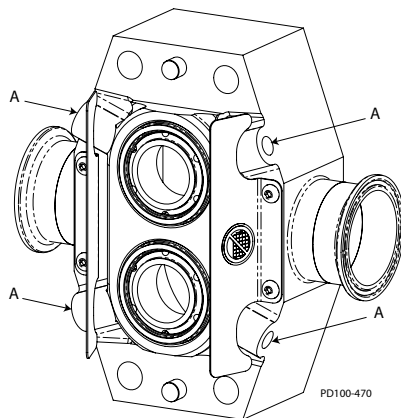


Figure 18 - Flush Piping Setup

Pumps with double seals require flushing. The flush media (typically water) must be connected and flowing whenever pump is operated.

**WARNING:** Operating the pump without flush will damage the seal and pump parts due to excess heat from dry running.

Pump bodies have four G 1/8 BSPT flush connections located near the bottom and top of the body (Figure 18, item A).

1. Flushing media may be piped into either side for both shaft seals and discharged to drain on opposite side.
2. Both inlets may be manifolded to simplify piping. Be sure flush water is flowing out both discharge lines.
3. Use cool, filtered flush media to obtain maximum service life of seal components. If the pumped product is sticky or solidifies at room temperature, use warm or hot media.
4. Install a pressure reducing valve and flow control valve (needle valve) on the flush supply line. Set the supply pressure at a maximum of 2 bar (30 psi) and adjust the flow rate to approximately 0.9 lpm (1/4 gpm) (more for high temperature applications).

5. A solenoid valve also should be installed in the flush supply and wired in series with the motor starter to provide automatic start/stop of the flush media flow before the motor turns on and after motor turns off.

## 6.9 CIP (Clean-In-Place) Guidelines

These optional CIP (Clean-In-Place) guidelines are designed to provide complete access of CIP solutions to all product contact surfaces:

- Ensure that the velocity rate of CIP solutions is adequate to clean the entire circuit. For most applications, a velocity of 1.5 m/sec (5 ft./sec) is sufficient. For the CIP solution to achieve the proper velocity, the pump drive must have enough speed range and horsepower. The required inlet pressure also must be satisfied. If the pump does not supply enough CIP solution velocity, a separate CIP supply pump with an installed bypass may be used. To determine the appropriate bypass arrangement, contact Application Engineering.
- Ensure that a differential pressure is created across the pump. Differential pressure will push CIP solutions through close-clearance areas of the pump, resulting in better cleaning action. The high pressure side may be either the inlet or outlet side. 2 bar (30 psi) differential pressure is adequate for most applications.
- The pump must be operated during CIP to increase turbulence and cleaning action within the pump. If complete draining is required, the pump must be in the side mount position.

## 6.10 Check Coupling Alignment

Pump and drive coupling alignment **must** be rechecked after the complete unit has been installed and piping completed. Periodic rechecking is advisable during the pump service life.

- We recommend using a flexible coupling to connect the drive to the pump. Several different types are available, including couplings with slip or overload provision. Flexible couplings can be used to compensate for end play and small differences in alignment.
- Align the pump and drive shaft as closely as possible.

## 6.11 Check Angular Alignment

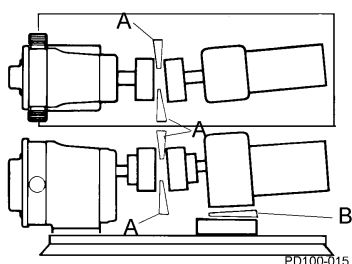


Figure 19 - Check Angular Alignment

1. Using feeler gauges or taper gauges (Figure 19, items A and B), check the alignment at four points every 90 degrees around the coupling; **adjust to equal dimension at all points.**
2. Set the space between the coupling halves to the manufacturer's recommended distance.
3. Install shims to bring the system into alignment.

## 6.12 Check Parallel Alignment

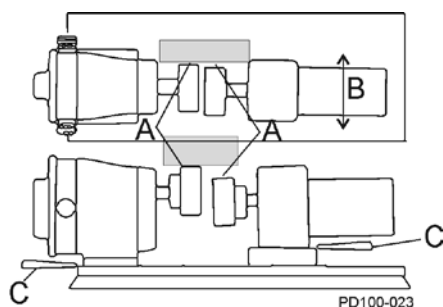


Figure 20 - Check Parallel Alignment

1. Check both the horizontal and vertical alignment of the pump and drive using a straight edge.
2. Using a feeler gauge at location "A" in Figure 20, determine the direction and amount of movement needed (Figure 20, item B).
3. If necessary, shim at location "C" and/or move drive as needed.

## 6.13 Check Belt and Chain Alignment

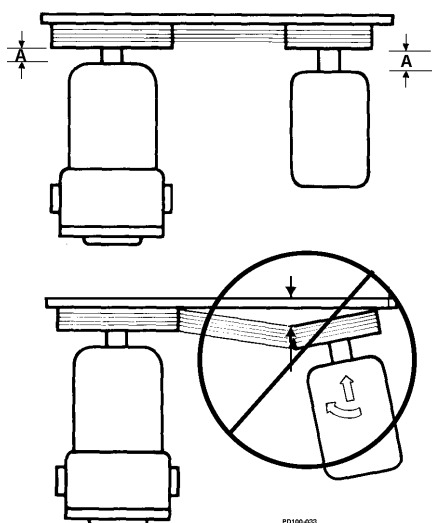


Figure 21 - Alignment Belt and Chain Drives

Use a straight edge to visually check the belt or chain alignment. Keep the shaft distance to a minimum (Figure 21, item A). After the piping is complete and before the belts are installed, manually turn the pump shaft to ensure that it turns freely.

## 6.14 Check Pump Rotation

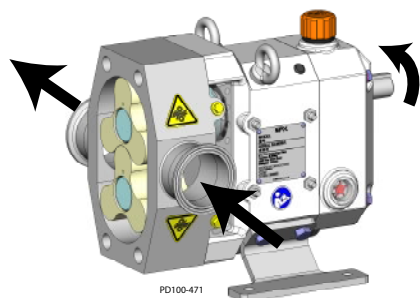


Figure 22 - Upper Shaft Drive Flow

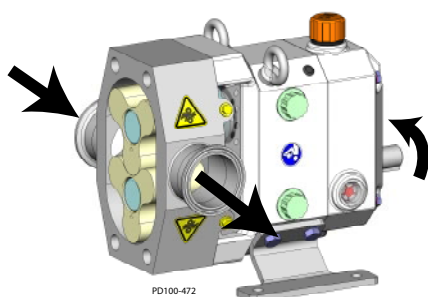


Figure 23 - Lower Shaft Drive Flow

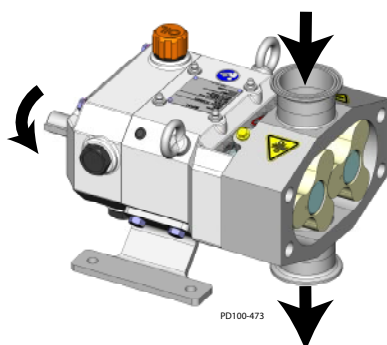


Figure 24 - Vertical Porting Flow

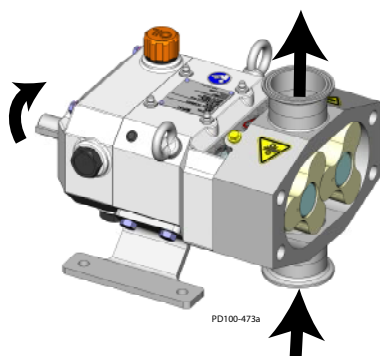


Figure 25 - Pump Rotation

Check the rotation direction of the drive to determine the rotation direction of pump (Figure 22 through Figure 25). After verifying the correct drive rotation, connect the coupling and assemble the pump and coupling guards.

**NOTE:** The pump covers in the following figures have been removed to view the rotor rotation. Never operate the pump with the covers removed.

## 7.0 Operation



**DANGER:** The pump contains internal moving parts. **DO NOT** put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, **DO NOT** install, clean, service, or repair the pump unless all power is off and locked out.



**CAUTION:** These pumps are positive displacement, low slip design and will be severely damaged if operated with closed valves in the discharge or inlet lines. The pump warranty is not valid for damages caused by a hydraulic overload from operation or start-up with a closed valve in the system.

### 7.1 Pre-Startup Checklist



**CAUTION:** Do not use this pump to flush a newly- installed system. Severe damage may occur to the pump and system if the pump is used to flush the system. **Remove the rotors during system flushing.**



**WARNING:** Full guards must be installed to isolate the operators and maintenance personnel from the rotating components. Guards are provided with TLP pumps as part of a complete pump and drive package.



**WARNING:** Do not start a pump with seal flush unless the seal flush is installed and on.

1. Ensure that the pump is correctly installed as described in “Installation” par. 6.0. Review “Install Relief Valves” par. 6.5 and install relief valves as needed.
2. Check the coupling alignment. See “Check Coupling Alignment” par. 6.10.
3. Ensure that the pump and piping are clean and free of foreign material such as welding slag, gaskets, etc.
4. Ensure that all piping connections are tight and leak-free. Where possible, check the system with non-hazardous fluid.
5. Ensure that the pump and drive are lubricated. See “Lubrication” starting par. 8.2.
6. Ensure that all guards are in place and secure.
7. Double mechanical seals require adequate supply and flow of clean flushing fluids.
8. Ensure that all valves are open on the discharge side and a free flow path is open to the destination.
9. Ensure that all valves are open on the inlet side and fluid can fill the pump. A flooded suction installation is recommended.
10. Check the direction of pump and drive rotation to ensure that the pump will rotate in the proper direction. See “Check Pump Rotation” par. 6.14.

### 7.2 Startup Procedure

1. Start the pump drive. Where possible, start at a slow speed or jog.
2. Ensure that the liquid is reaching the pump within 60 seconds. If pumping does not begin and stabilize, check “Troubleshooting” par. 9.0.

### 7.3 Shutdown Procedure

1. Shut off the power to the pump drive.
2. Shut off the supply and discharge lines.

### 7.4 Emergency Shutdown Procedure

Emergency Shutdown Procedures should be documented by plant personnel after assessing system-wide requirements.

## 8.0 Maintenance

### 8.1 Important Safety Information

STOP

**DANGER:** The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out.

Before detaching port connections to the pump:

- Close suction and discharge valves.
- Drain pump and clean or rinse, if necessary.
- Disconnect or shut off the electrical supply and lock out all power.

### 8.2 Lubrication

Table 1: Callout table for Figure 26

- |     |                                  |
|-----|----------------------------------|
| 30. | Oil Fill Breather                |
| 31. | Oil Level Check Plug, Sightglass |
| 32. | Oil Drain Plug                   |
| 33. | Grease Fittings                  |
| 39. | Grease Cleanout Plug             |

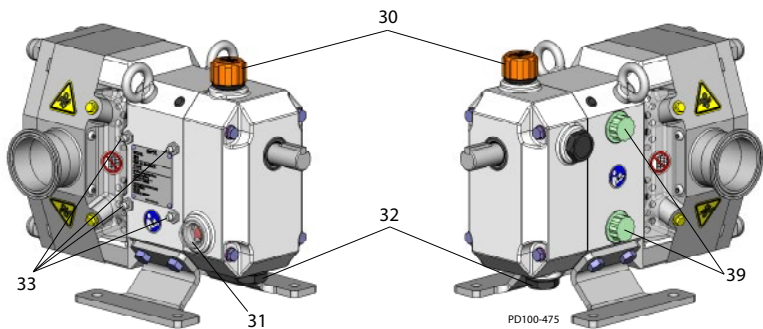


Figure 26 - Lubrication Points

#### 8.2.1 Drive Lubrication

Refer to the manufacturer’s manual shipped with the drive for proper drive lubrication and frequency.

#### 8.2.2 Gear Oil

!

**CAUTION:** Each pump is shipped from the factory with the gearbox sealed. Prior to operation, check the oil level and replace the uppermost oil drain plug with the supplied oil fill breather, at the location of item 30 in Figure 26.

Refer to the table below for the required capacity per pump model as shown.

**Change the oil every 1000 hours.**

#### Gear Oil Specification

ISO Grade 320, SAE 140 or AGMA Number 6EP

| Model                          | Gear Oil Volume  |                |
|--------------------------------|------------------|----------------|
|                                | Horizontal Ports | Vertical Ports |
| 0040, 0100, 0140<br>0230, 0300 | 100 ml           | 170 ml         |
| 0670, 0940                     | 325 ml           | 490 ml         |
| 2290                           | 625 ml           | 1125 ml        |

Table 2: Gear Oil Volume

### 8.2.3 Bearing Lubrication

Bearings are factory-lubricated with grease. Table 3 provides approximate volumes for adequate re-greasing. Grease the bearings every 250 hours.

Excess grease will accumulate in the gear case. Remove it through the cleanout hole covered with a plastic plug (Figure 26, item D).

#### Bearing Lubricant Grease

NLGI Grade No. 2, EP, Lithium-based lubricant

| <b>Model</b>                   | <b>Grease Quantity per Bearing</b> |              |
|--------------------------------|------------------------------------|--------------|
|                                | Front Bearing                      | Rear Bearing |
| 0040, 0100, 0140<br>0230, 0300 | 5 ml                               | 4 ml         |
| 0670, 0940                     | 10 ml                              | 9 ml         |
| 2290                           | 17 ml                              | 14 ml        |

**Table 3: Grease Quantity**

## 8.3 Maintenance Inspections

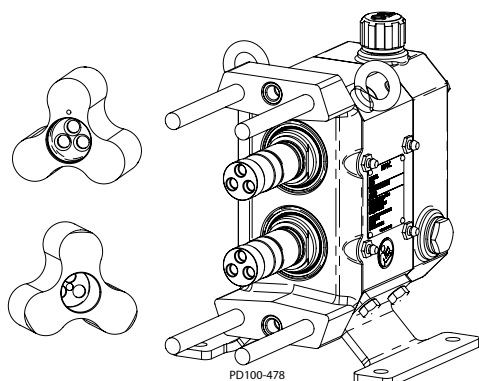


Figure 27 - Check for Wear



**DANGER:** The pump contains internal moving parts. **DO NOT** put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, **DO NOT** install, clean, service, or repair pump unless all power is off and locked out.

Detecting wear in the early stages can reduce repair costs and down time. A simple "look-feel" inspection of the pump during breakdown cleaning is recommended to detect signs of trouble at an early stage.

### 8.3.1 Inspection of Shaft

Visually inspect the shaft for twists or bends; replace it as necessary.

### 8.3.2 Inspection of Hub End

Visually inspect the rotor hub end for excessive wear; replace it as necessary. Each time the rotors are removed, replace the o-rings on the hub.

### 8.3.3 Inspection of Shaft Shoulder

Visually inspect the shaft shoulder for excessive wear and replace it as necessary. If the shaft shoulder has a sharp edge, remove the edge with a file to prevent cutting the shaft o-ring on installation.

### 8.3.4 Inspection of Gears and Bearings

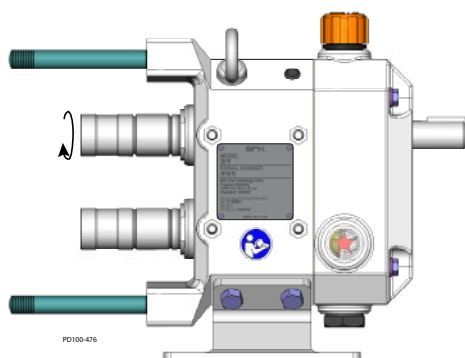


Figure 28 - Backlash Check

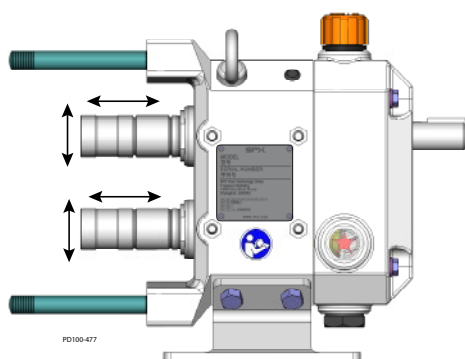


Figure 29 - Bearing Deflection Check

**NOTE:** The rotor hub and shaft shoulder wear are caused by operating with a loose rotor lug screw(s) for extended periods.

#### Gear backlash

With the fluid head and seals removed, feel for gear backlash by rotating either shaft by hand. The other shaft must engage immediately. Perform this check three times at 60-degree intervals. If play (backlash) is evident, remove the gear case cover, check the gear teeth for wear and ensure that the gear is not loose on the shaft. If the gear teeth are worn, replace the gears. If the gear is loose on the shaft, inspect the shaft key and keyway; replace as necessary.

#### Check bearing condition

With the fluid head and seals removed, check the bearing condition by applying (by hand) an up or down force of approximately 30 lbs (14 kg). If movement is detected, the bearing may be failing. Check the shaft movement forward or backward. When the bearing is determined to be failing, replace the bearing and review the lubrication schedule.

### 8.3.5 Recommended Maintenance Schedule

| <b>Item</b>      | <b>Maintenance Interval</b>                                               |
|------------------|---------------------------------------------------------------------------|
| Replace Gear Oil | Every 1000 hours.<br>See <b>“Gear Oil” par. 8.2.2.</b>                    |
| Grease Bearings  | Every 250 hours.<br>See <b>“Bearing Lubrication” starting par. 8.2.3.</b> |
| Replace O-Rings  | Every time o-rings are removed.                                           |

**NOTE:** For seals and rotors, component life varies widely between different applications. Inspect for wear and replace as needed. See **“Maintenance Inspection Chart” par. 8.4.**

## 8.4 Maintenance Inspection Chart

| PROBLEM                                                    | POSSIBLE CAUSE                                                                                                | POSSIBLE SOLUTIONS                                                                                                                                 |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Rotor to rotor contact or uneven rotor to rotor clearance. | Hard object jammed into rotors and twisted shafts.                                                            | Replace shafts.<br>Install strainers if necessary.<br>Check and replace gears if necessary.                                                        |
| Worn rotor hub end or shaft shoulder.                      | Loose rotor lug screw(s).<br>Rotors slammed against shoulder when installed.                                  | Torque rotor lug screw(s). See "Torque Reference" par. 8.8.14.<br>Replace rotors and shafts or shim shafts to maintain proper backface clearances. |
| Sharp edged shaft shoulder.                                | Loose rotor lug screw(s).<br>Rotors slammed against shoulder when installed.<br>Backface clearances not even. | Remove sharp edge with file to prevent cutting shaft o-ring.<br>Verify backface clearances are even.                                               |
| Gear backlash.                                             | Lack of lubrication.<br>Excessive hydraulic loads.                                                            | Check lubrication level and frequency.<br>Reduce hydraulic loads.<br>Check and replace gears if necessary.                                         |
| Worn or broken gear teeth.                                 | Lack of lubrication.<br>Excessive hydraulic loads.                                                            | Check lubrication level and frequency.<br>Reduce hydraulic loads.<br>Check and replace gears if necessary.                                         |
| Loose bearings, axially or radially.                       | Lack of lubrication.<br>Lack of lubrication.<br>Excessive hydraulic loads.<br>Product or water contamination. | Check lubrication level and frequency.<br>Reduce hydraulic loads.<br>Ensure no excess grease build-up.<br>Replace bearings if necessary.           |
| Damaged front grease seals.                                | Seal may be old and worn.<br>No grease on lips to lubricate.                                                  | Replace seals.<br>Properly lubricate with grease when installing.<br>Inspect shaft surface under seals.                                            |
| Damaged rear oil seals.                                    | Shaft worn under seals.<br>Seal may be old and worn.                                                          | Replace seals.<br>Properly lubricate with grease when installing.<br>Inspect shaft surface under seals.                                            |

## 8.5 Cleaning

The pump cleaning schedule should be determined on-site for the materials being processed and the plant maintenance schedule. For CIP cleaning, see "CIP (Clean-In-Place) Guidelines" par. 6.9.

To disassemble the fluid head, see "Pump Disassembly - Hydraulic Components" par. 8.6. Remove and clean the cover o-ring, pump seals, and the rotor lug screws. Inspect and replace them as necessary.

In applications where material can harden in the pump during shutdown, a CIP cleaning, flush, or disassembly of the fluid head and manual cleaning is strongly recommended.

**NOTE:** Always replace the rotor cap o-rings and rotor hub o-rings when reassembling the pump. If the area behind these seals becomes soiled, contact Application Engineering for a specific cleaning and sanitizing procedure validated to remove bacteria.

## 8.6 Pump Disassembly - Hydraulic Components



**DANGER:** The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair pump unless all power is off and locked out.



**DANGER:** To avoid serious injury, shut off and drain product from the pump prior to disconnecting the piping.

**Table 4: Callout table for Figure 30**

|     |                          |
|-----|--------------------------|
| 2.  | Cover                    |
| 3.  | Rotor                    |
| 4.  | Rotor Nut                |
| 5.  | Rotor Screw Cap          |
| 35. | Acorn Nut                |
| 51. | Cover o-ring             |
| 55. | Rotor Screw Cover o-ring |

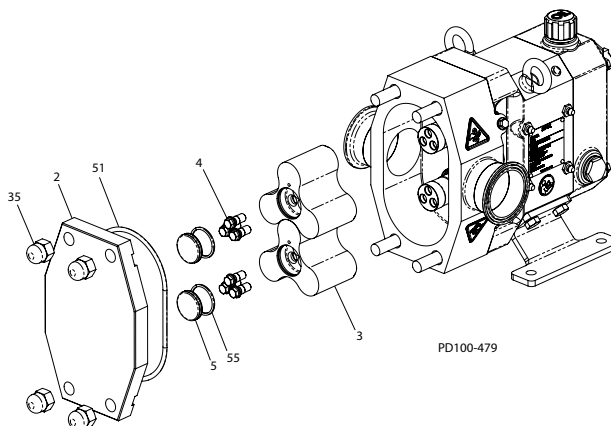


Figure 30 - Pump Cover and Rotor Removal

### 8.6.1 Pump Cover Removal

1. Remove the cover acorn nuts (Figure 30, item 35).
2. Remove the cover (item 2). Cavities are provided on the mounting surface of the cover to permit removing the cover with the aid of a screwdriver.
3. Remove and inspect the o-ring (item 51).

### 8.6.2 Rotor Removal

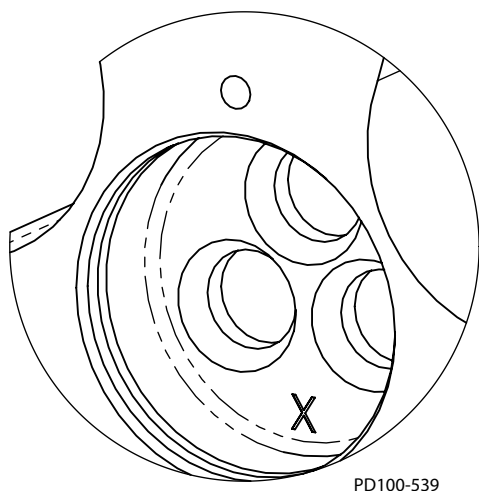


Figure 31 - Counterbore Detail

1. Remove the screw caps (Figure 30, item 5) from the rotors (item 3). Remove and inspect the o-rings (item 55).
2. Remove the rotor lug screws (item 4). To prevent the rotors from turning while loosening (or tightening) the rotor lug screws, block the rotors following the guidelines provided in the "Rotor Blocking" section par. 8.6.3.
3. Remove the rotors (Figure 30, item 3). If the rotors cannot be removed by hand, use a twisting motion to break them free. If unsuccessful, tap the body forward using a mallet to loosen the rotors.

**NOTE:** The rotor mounted on the drive shaft is marked with an "X" in the lug screw counterbore (see Figure 31). The marked rotor must always be installed on the drive shaft to maintain proper rotor clearance and prevent pump damage.

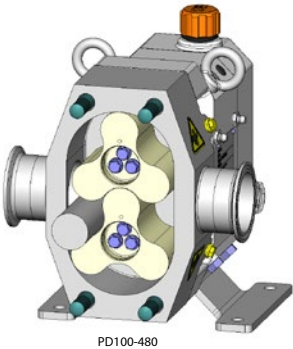
8.6.3 Rotor Blocking

Use a rod made of a non-marring material to block the rotors and prevent them from turning. A plastic rod works well for this purpose. Table 5 lists rod diameters by model for rotor blocking. Always block the rotor against the body, not against the opposite rotor. See Figure 32.

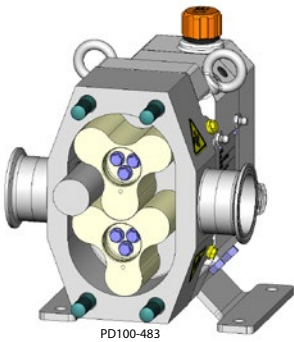
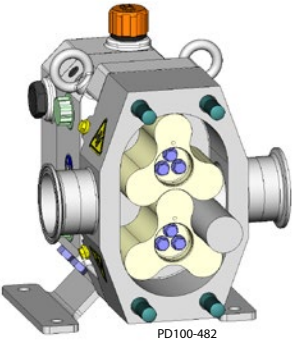
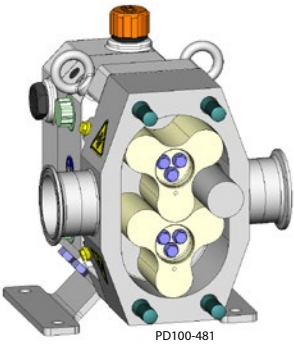
Table 5: Rod diameters

|            |      |
|------------|------|
| 0040       | 15mm |
| 0100, 0140 | 20mm |
| 0230, 0300 | 30mm |
| 0670, 0940 | 45mm |
| 2290       | 60mm |

Loosen Bottom Rotor



Loosen Top Rotor



Tighten Bottom Rotor

Tighten Top Rotor

Figure 32 - Rod Position for Blocking

8.6.4 Pump Body Removal

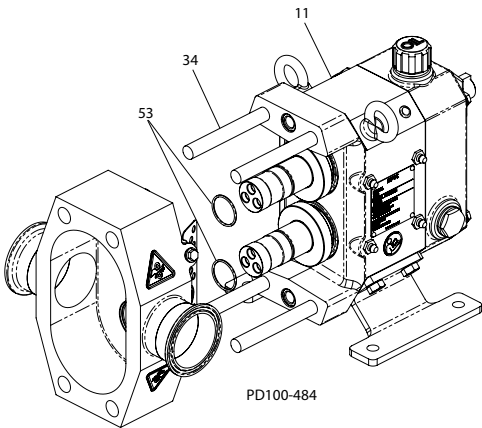


Figure 33 - Pump Body Removal

1. Using a mallet, tap the body forward until the dowels are free of the gear case (Figure 33, item 11).
2. Carefully slide the body off of the studs (item 34) to prevent damaging the mechanical seal components.
3. Place the body on a protected surface with the seals facing up.
4. Remove and inspect the rotor hub o-rings (item 53).

## 8.6.5 Mechanical Seal Removal

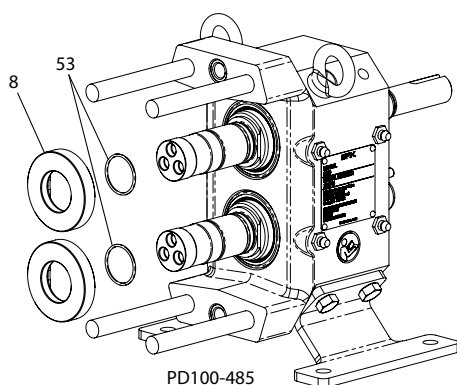


Figure 34 - Remove Seal Seats

1. Remove the seal seats (Figure 34, item 8) from the shafts. Take care to prevent damage to the seats or shafts.
2. Remove and inspect the o-rings (item 53).

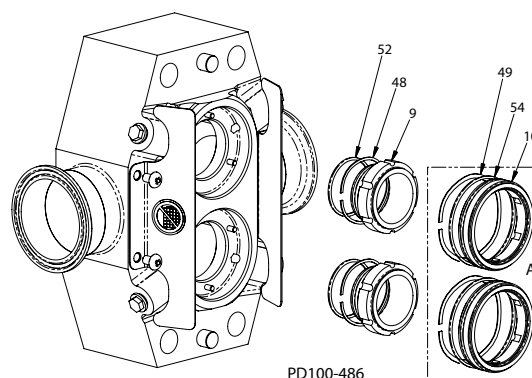


Figure 35 - Remove Seals

3. Remove the inner seal (Figure 35, item 9) and wave spring (item 48). Remove the o-ring (item 52) from the inner seal and inspect it. Replace as necessary.
4. On pumps equipped with double mechanical seals (Figure 35, inset A), remove the outer seal (item 10) and wave spring (item 49). Remove the o-ring (item 54) from the outer seal and inspect it. Replace as necessary.

## 8.7 Gearbox Disassembly



**DANGER:** To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out.



**DANGER:** To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.

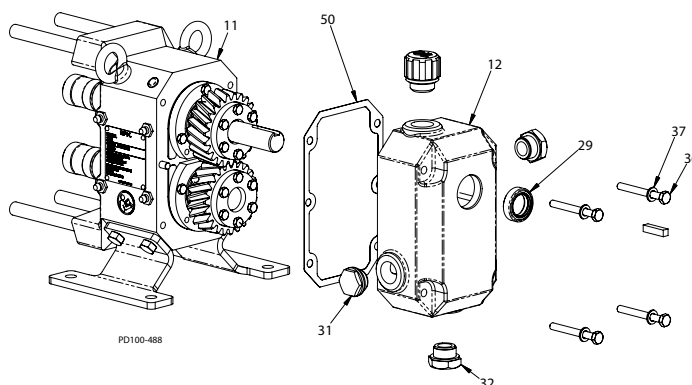


Figure 36 - Remove Gear Case Cover

### 8.7.1 Gear Cover Removal

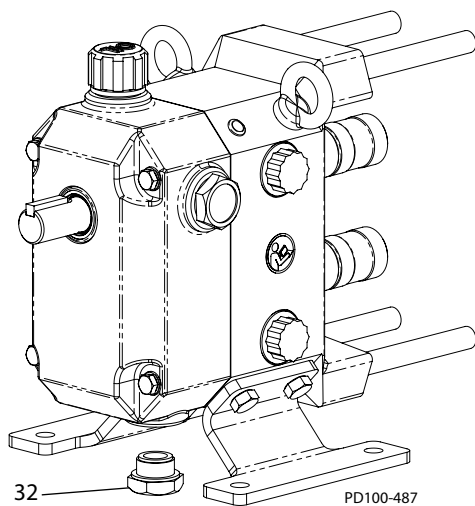


Figure 37 - Remove Oil Drain Plug

1. Remove the bottom drain plug (Figure 37, item 32) and drain the oil into an appropriate container. Dispose of the used oil in accordance with local requirements.
2. Remove the input shaft key (if present) and remove any burrs or sharp edges from the input shaft.
3. Remove the cap screws (Figure 36, item 36) and washers (item 37) and remove the cover (item 12).
4. Remove the input shaft seal (item 29) from the gear cover and discard it.
5. Inspect the level indicator plug (item 31) and replace it if it appears cloudy or stained.
6. Remove the gasket (Figure 36, item 50) and discard it. Carefully scrape any gasket residue from the mating surfaces of the gear cover (item 12) or gear case (item 11).

## 8.7.2 Gear and Shaft Removal

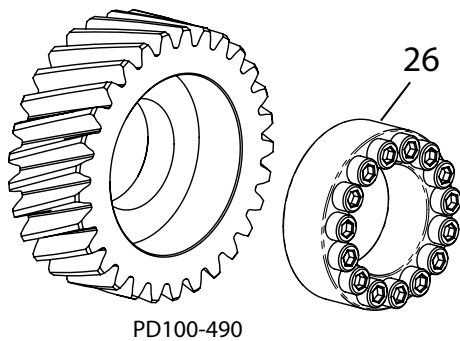


Figure 38 - Locking Assembly

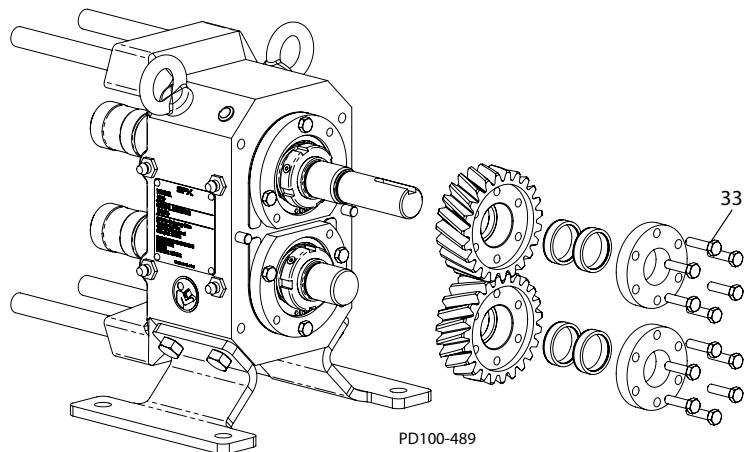


Figure 39 - Remove Gear and Locking Assembly

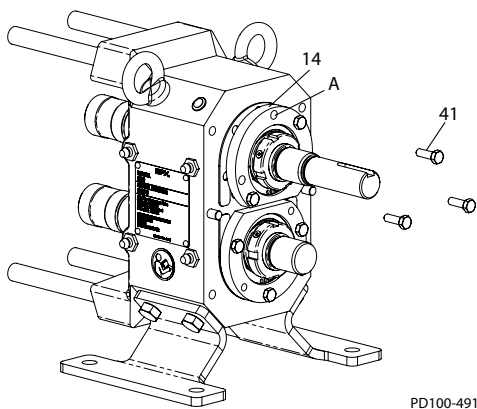


Figure 40 - Remove Screws

1. Loosen the clamp ring screws (Figure 39, item 24) or locking screws in the locking assembly (Figure 38, item 26) to release the gear from the shaft.
2. Remove the gear and locking assembly from the shaft.
3. Repeat steps 1-2 for the other shaft.
4. Remove the bearing case screws (Figure 40, item 41).
5. Install 2 screws in the tapped holes (Figure 40, item A) in the bearing case (item 14). Tighten the screws to pull the bearing case from the gear case. (Figure 41).

- 
6. Repeat steps 4-5 for the other shaft.

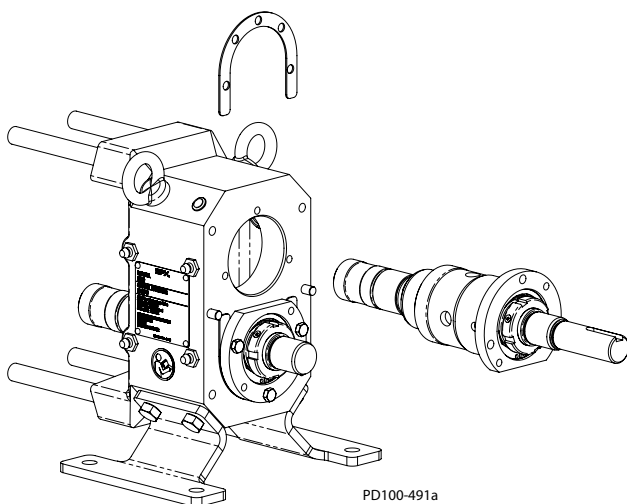


Figure 41 - Remove Shaft

## 8.7.3 Bearing Removal

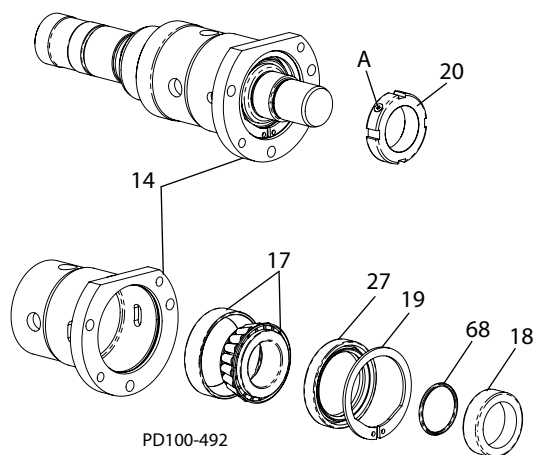


Figure 42 - Remove Bearings

1. Loosen the locking setscrew(s) (Figure 42, item A) in the bearing adjustment nuts (item 20) and remove the bearing adjustment nuts.
2. With the bearing case supported as shown in Figure 43, press the shaft free of the rear bearing (item 17), bearing case (item 14), seal sleeve o-ring (item 68), and seal sleeve (item 18).
3. Remove the retaining ring (item 19) from the bearing case and press the rear bearing cup and rear bearing seal (item 27) out of the bearing case.
4. Press the front bearing cone off of the shaft.

-----

5. Repeat the steps above for the other shaft.

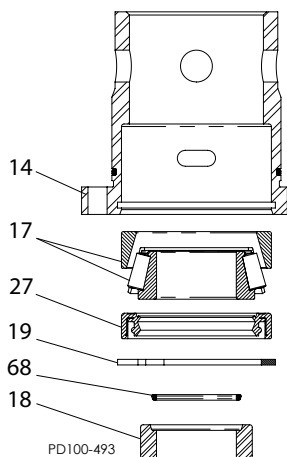


Figure 43 - Press Shaft Free of Rear Bearing

## 8.8 Pump Assembly

**NOTE:** Use care at all times to prevent damage to critical machined surfaces.

**NOTE:** Check the components for sharp edges or burrs. Remove them as required.

### 8.8.1 Install Front Seals

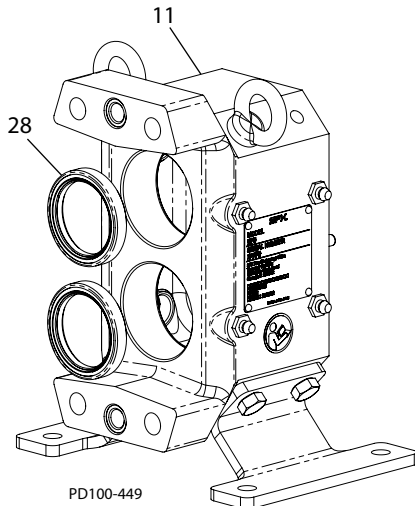


Figure 44 - Install Front Seals

Install new front bearing seals (Figure 44, item 28) into the gear case (item 11) with the primary lip facing toward the inside of the gear case. The seals should be flush with the face of gear case.

### 8.8.2 Bearing Assembly

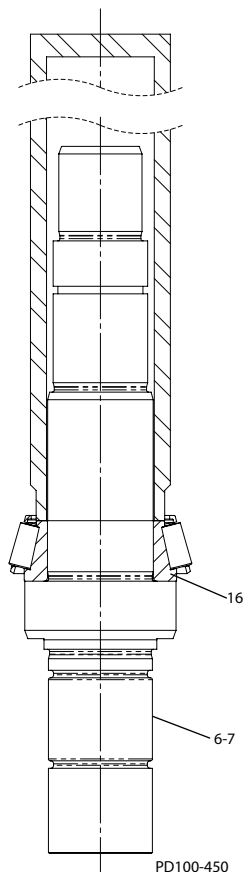


Figure 45 - Press Bearing Cone onto Shaft

1. Press the rear bearing cup (Figure 46, item 17) into the bearing case (item 14) using a pusher tool (item A).

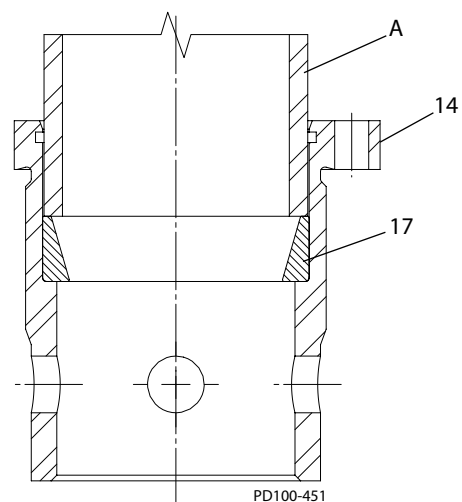


Figure 46 - Press Rear Bearing Cup

2. Heat the bearing cone to 120°C and place it on the shaft.

Alternate method: Press the front bearing cone (Figure 45, item 16) onto the shafts (items 6-7). The bearing cone must seat squarely against the shaft shoulder.

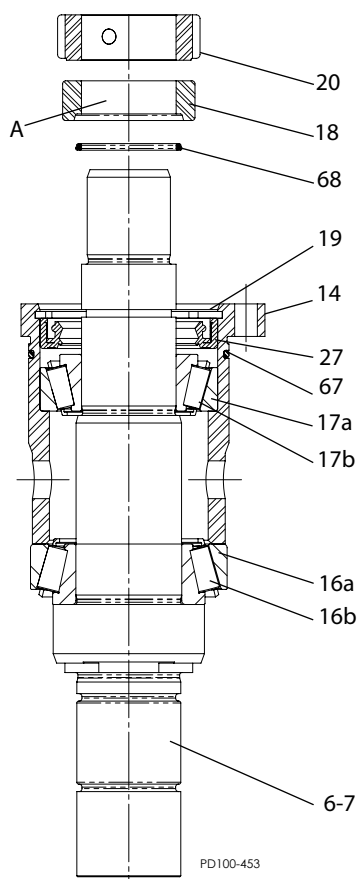


Figure 47 - Bearing Assembly

3. Install the front bearing cup (Figure 47, item 16a) onto the mounted cone (item 16b), followed by the bearing case (item 14).
4. Press the rear bearing cone (item 17b) onto the shaft and into the cone.
5. Press the rear seal (item 27) into the bearing case (item 14) with the primary lip facing away from the bearing, and install the retaining ring (item 19). Orient the seal as shown and make sure it does not interfere with the bearing.
6. Install the o-ring (item 68) and seal sleeve (item 18) onto the shaft as shown in Figure 47. Orient the seal sleeve with the groove toward the bearing.
7. Install the bearing adjustment nut (item 20) and tighten "hand tight." Do not tighten the locking setscrews at this time.
8. Install the o-ring (item 67) into the groove of the bearing case (item 14).

### 8.8.3 Bearing Adjustment

1. See Figure 48. Apply a coating of bearing grease to the inside diameter (item A) of the front lip seals (item 29).

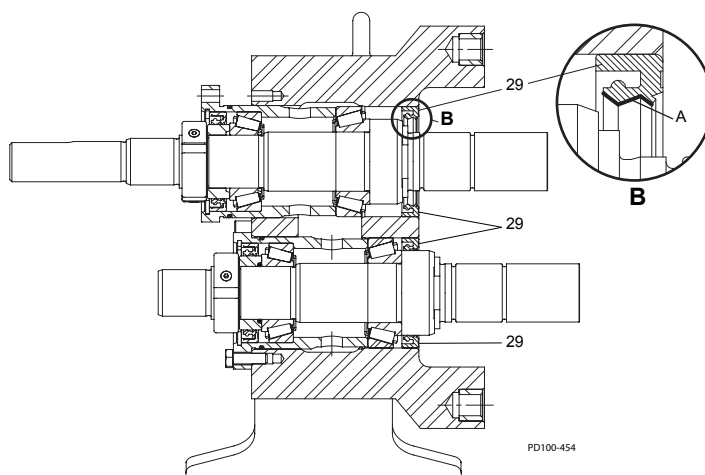


Figure 48 - Apply Bearing Grease

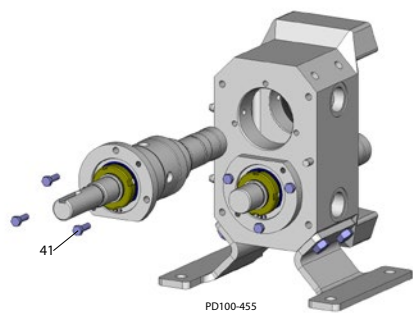


Figure 49 - Secure with Cap Screw

- 2. Install the shaft assemblies into the gear case and secure them with cap screws (Figure 49, item 41). Apply a light film of bearing grease to the bores and bearing cups to ease installation. Use care to prevent damage to the lip seals (Figure 48, item 29) during assembly.
- 3. Install one lug screw (Figure 50, item 4) into one of the tapped holes in each of the shafts and check the rolling torque of each shaft assembly with a torque wrench.

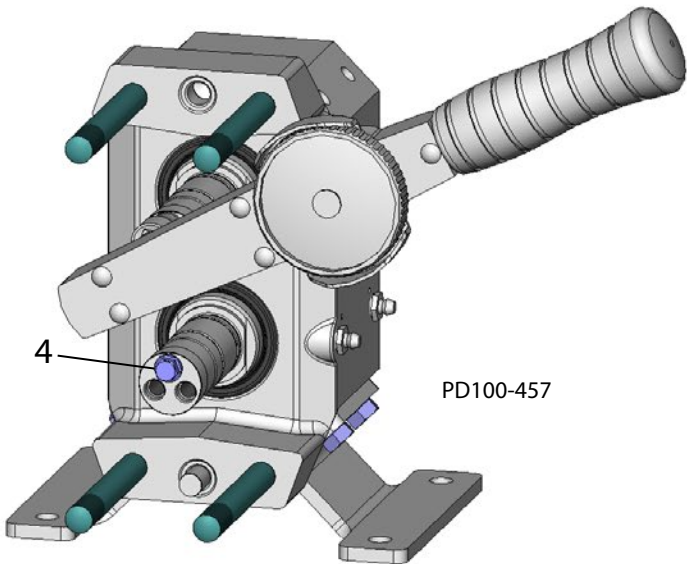


Figure 50 - Check Rolling Torque

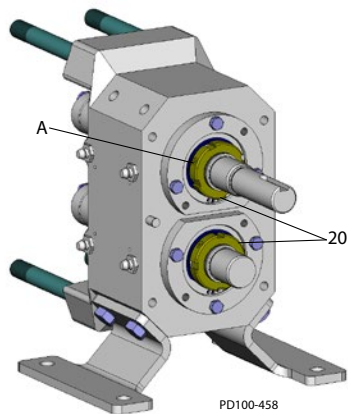


Figure 51 - Tighten Setscrews

- 4. Tighten or loosen the bearing lock nut (Figure 51, item 20) to achieve a torque value as shown in Table 6.

| Pump                           | Torque        |
|--------------------------------|---------------|
| 0040, 0100, 0140<br>0230, 0300 | 1.6 - 1.8 N-m |
| 0670, 0940                     | 3.2 - 3.4 N-m |
| 2290                           | 4.5 - 4.7 N-m |

Table 6: Bearing Rolling Torque

- 5. Tighten the locking setscrew(s) (Figure 51, item A) in the bearing lock nuts (item 20).

## 8.8.4 Shaft Seal Installation

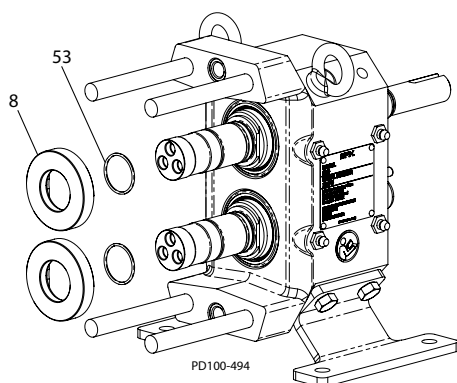


Figure 52 - Shaft Seal Installation

1. Install the seat o-rings (Figure 52, item 53) into the rear groove in the shaft.
2. Apply a compatible lubricant to the o-rings and install the seal seats (Figure 52, item 8). Align the flats in the seal seats with the flats on the shafts and seat them firmly against the shaft shoulder.

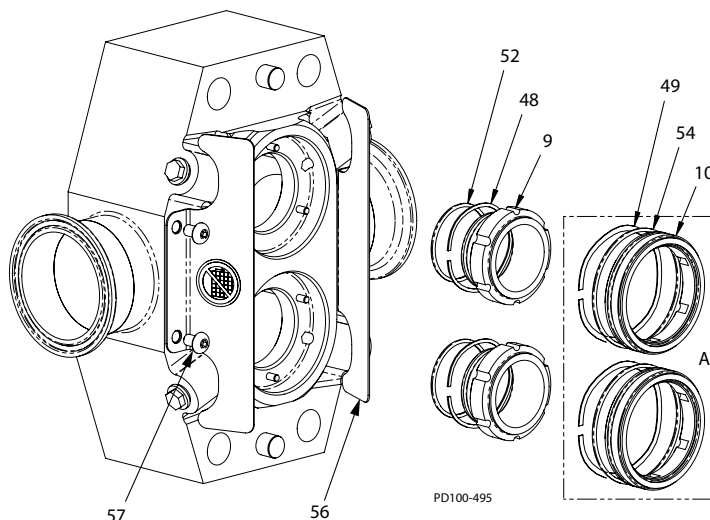


Figure 53 - Shaft Seal Installation

3. Install the inner seal o-ring (Figure 53, item 52) into the inner seal groove and install the wave spring (item 48) onto the body of the inner seals (item 9).
4. Apply a compatible lubricant to the o-rings and install the seal, o-ring, and wave spring into the body. Align the slots in the seal with pins in the body. Repeat for the second seal.
5. Fasten the guards (Figure 53, item 56) to the body with button head screws (item 57).
6. For pumps equipped with double seals (Figure 53, inset A):

Install the outer seal o-ring (Figure 53, item 54) into the groove in the outer seal (item 10).

Place the wave spring (item 49) into the bore, then apply a compatible lubricant to the o-ring and install the seal into the body. Repeat for the second seal.

## 8.8.5 Mechanical Seal Guidelines/Notes

1. The lapped faces of mechanical seal components are extremely flat and smooth. Use great care when handling these components to prevent damage and reduced seal performance.
2. Although it is impossible to prevent touching the seal faces during assembly, use clean hands and try to minimize contact with the lapped faces.
3. Keep the work area clean to prevent contamination of the seal faces.
4. O-ring lubrication is important to ease assembly of the components, prevent o-ring damage, and provide proper seal function. The lubricant chosen must be non-toxic and compatible with the o-ring material.
5. Clean water can be used as an assembly lubricant for the o-rings if no other lubricant is available.
6. Seal seats should sit squarely against the shaft shoulder.
7. The inner and outer seals should not bind in their respective bores. When pushed by hand, the wave springs should return the seals to their starting position.

## 8.8.6 Body Installation

| <b>Pump</b>                          | <b>I.D.<br/>(mm)</b> | <b>O.D.<br/>(mm)</b> | <b>Length<br/>(mm)</b> |
|--------------------------------------|----------------------|----------------------|------------------------|
| 0040<br>0100<br>0140<br>0230<br>0300 | 14                   | 25                   | 18                     |
| 0670<br>0940                         | 18                   | 25                   | 18                     |
| 2290                                 | 21                   | 30                   | 30                     |

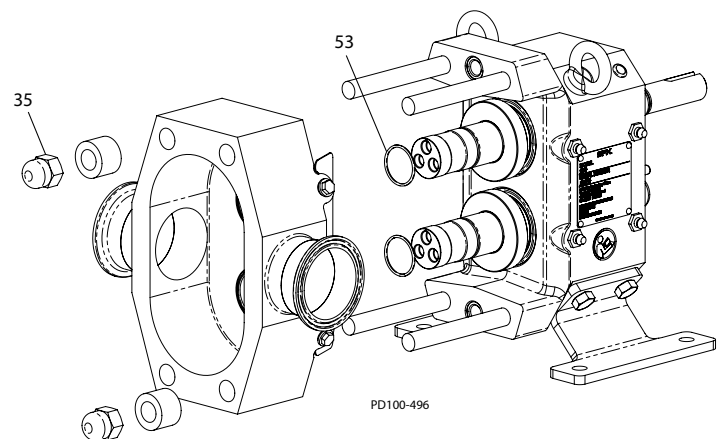
**Table 7: Cover Spacer Dimensions**

Figure 54 - Body Installation

1. Install the rotor hub seal o-rings (Figure 54, item 53) into the groove of each shaft.
2. Guide the body with seals installed over the studs and seat it firmly to the gear case. Use care to prevent damage to the seals.
3. Fix the body to the gear case using two spacers and acorn nuts (item 35) at opposite corners of the body. See Table 7 for nominal dimensions required for spacers.

8.8.7 Rotor Positioning

**NOTE:** The screw holes in the rotors are designed to match the screw holes in the shafts in only one orientation. To aid assembly, reference marks are provided on each rotor and the end of the shaft.

8.8.8 Rotor Installation

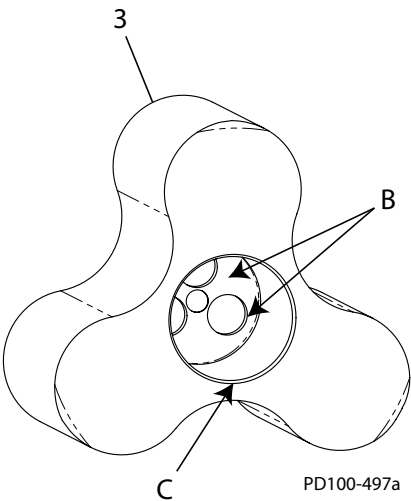


Figure 55 - Rotor Detail

Rotor clearances and synchronization require that each rotor must always be installed on a specific shaft to maintain these clearances and prevent pump damage. The drive shaft rotor, therefore, is marked with an 'X' in the lug screw counterbore. The marked rotor must always be installed on the drive shaft.

- 1. The shaft bore of the rotors (Figure 55, item 3) must be clean and free of burrs and debris (Figure 55, item B). The edge chamfer (item C) must be free of burrs to prevent damage to the o-rings.
- 2. The face of the shaft must be free of raised edges or burrs (see Figure 56, Detail G, item D).
- 3. **Re-using rotors:** Apply a compatible lubricant to the o-rings and install the marked rotor onto the drive shaft and the unmarked rotor onto the short shaft, making note of the alignment reference mark on the shafts for rotor positioning. (See item A in Figure 56, Detail F and G.)

**Installing new rotors:** Apply a compatible lubricant to the o-rings and install the rotors onto the shafts, making note of the alignment reference mark on the shafts for rotor positioning. (See item A in Figure 56, Detail F and G.) Stamp an "X" approximately 3mm high in the face of the counterbore opposite the alignment reference mark. See Figure 56, Detail F; also see Figure 31 for a larger view.

- 4. Install one lug screw (Figure 56, item 4) into the hole nearest the reference mark in each rotor.
- 5. Install the remaining screws and torque all screws to the value listed in Table 8.

| Pump                                 | Hex   | Torque  |
|--------------------------------------|-------|---------|
| 0040<br>0100<br>0140<br>0230<br>0300 | 9 mm  | 24 N-m  |
| 0670<br>0940                         | 13 mm | 70 N-m  |
| 2290                                 | 18 mm | 160 N-m |

Table 8: Lug Screw Torque

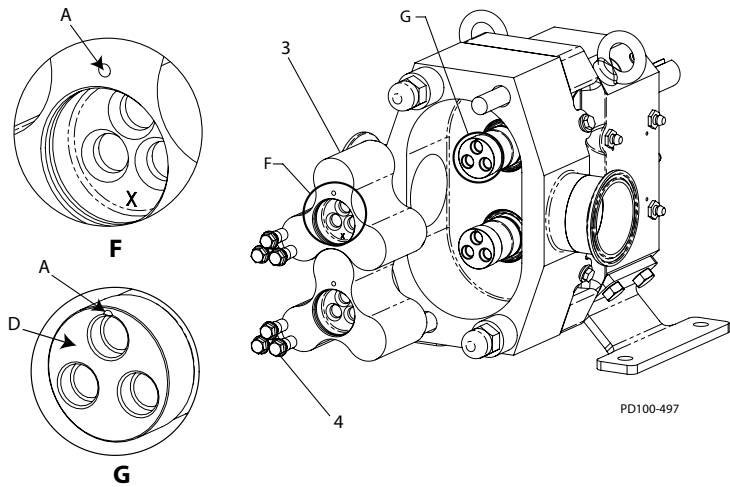


Figure 56 - Rotor Installation

## 8.8.9 Setting Rotor Clearance

| Pump Model           | Clearance Target | Acceptable Range |                |
|----------------------|------------------|------------------|----------------|
|                      |                  | Back Face        | Front Face     |
| 0040<br>0100<br>0140 | 0.100            | 0.125<br>0.100   | 0.260<br>0.155 |
| 0230                 | 0.125            | 0.150<br>0.125   | 0.265<br>0.160 |
| 0300                 | 0.125            | 0.150<br>0.125   | 0.315<br>0.210 |
| 0670<br>0940         | 0.150            | 0.175<br>0.150   | 0.340<br>0.235 |
| 2290                 | 0.200            | 0.225<br>0.200   | 0.440<br>0.335 |

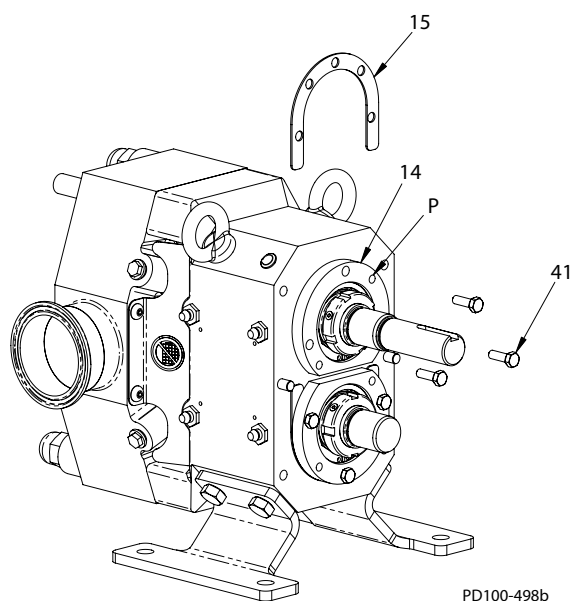
**Table 9: Back Face and Front Face Clearance**

Figure 58 - Install Shims

1. Measure the clearance between the rotor and body as shown in Detail E, item A in Figure 57. Record this number.

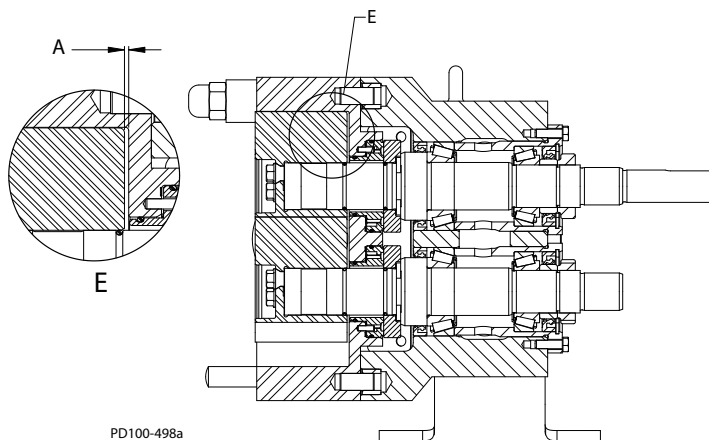


Figure 57 - Rotor to Body Clearance

2. Refer to Table 9. Subtract the "Clearance Target" for the appropriate model from the clearance measurement. The resulting value is the total shim thickness that must be installed behind the flange of the bearing case.
3. Choose a combination of shims (Figure 58, item 15) to achieve a thickness as close as possible to the calculated amount. Do not exceed the calculated amount.
4. Remove the bearing case screws (Figure 58, item 41), install the shims selected in Step 3, and re-install the screws. To provide clearance for the shims, move the shaft toward the rear by tapping gently on the rotor with a soft-faced mallet or by installing two screws in the jacking holes (item P) in the bearing case flange (item 14).
5. Check the resulting backface and front face clearance (items M and N in Figure 59). Adjust the shims as necessary.

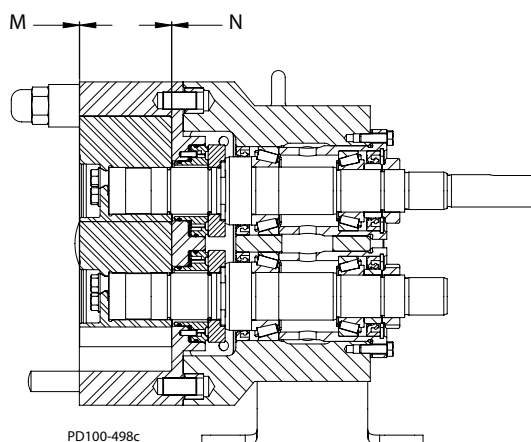


Figure 59 - Measure Clearance

6. Repeat steps 1-5 for the other shaft.

### 8.8.10 Gear Mounting and Rotor Synchronization

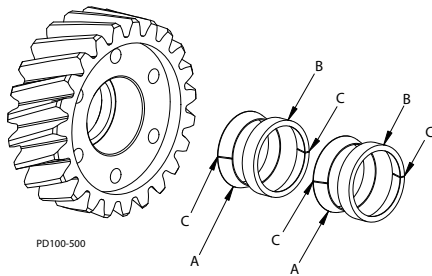


Figure 60 - Locking Element Assembly

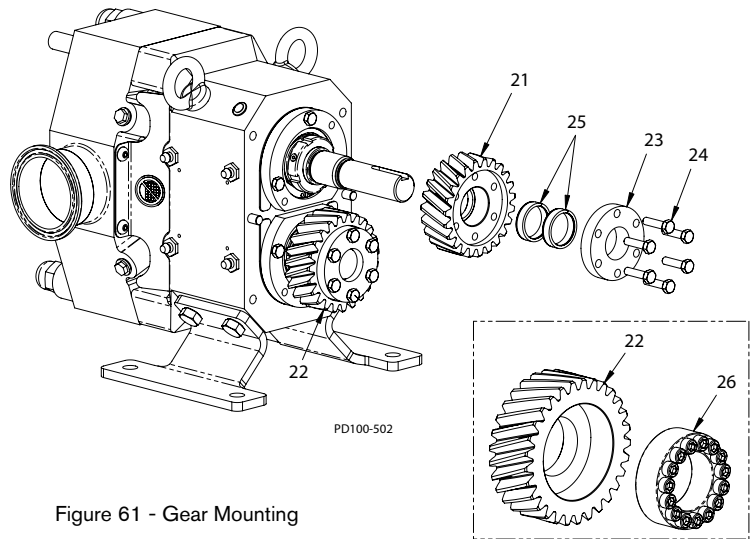
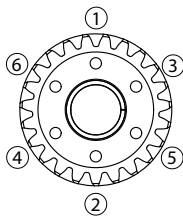
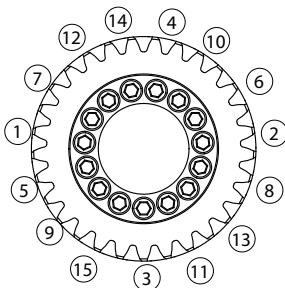


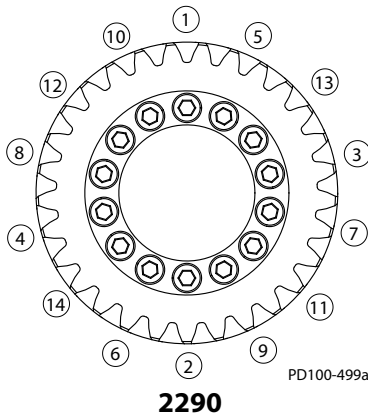
Figure 61 - Gear Mounting



**0040-0300**



**0670-0940**



**2290**

PD100-499a

Figure 62 - Screw Tightening Patterns

1. All contact surfaces of the screws, locking elements, gears, and shafts must be clean and slightly oiled with a light lubricant. Do not use oils containing molybdenum disulfide (MoS<sub>2</sub>).
2. Assemble the gear (Figure 61, item 22) and locking components onto the lay shaft.
  - For models 0040 - 0300, this refers to the locking elements (Figure 61, item 25), clamp ring (item 23), and screws (item 24).
  - For models 0670 - 2290, this refers to the locking assembly (Figure 61, item 26 (inset)).
3. The locking elements (Figure 61, item 25, detailed in Figure 60) consist of a slit inner ring and a slit outer ring. For proper performance, the elements must be assembled in the following order: inner ring (A), outer ring (B), inner ring (A), outer ring (B); with the slits in the rings (item C) staggered 180° apart as shown in Figure 60.
4. Tighten the screws evenly by hand.
5. Following a diametrically opposite sequence, tighten the screws to the value shown in Table 10 for "Step 1." Do not turn any screw more than 1/4 turn at a time, to ensure that the clamp load is applied evenly. Suggested patterns are provided in Figure 62, listed by model number.
6. Following the same sequence as in Step 4, tighten the screws to the value shown in Table 10 under the heading "Final."

| <b>Pump Model</b>                    | <b>Screw Torque</b> |              |
|--------------------------------------|---------------------|--------------|
|                                      | <b>Step 1</b>       | <b>Final</b> |
| 0040<br>0100<br>0140<br>0230<br>0300 | 3 N-m               | 6 N-m        |
| 0670<br>0940                         | 5 N-m               | 10 N-m       |
| 2290                                 | 13 N-m              | 25 N-m       |

**Table 10: Screw Torque**

| <b>Pump Model</b> | <b>Clearance A and B (mm)</b> |             |
|-------------------|-------------------------------|-------------|
|                   | <b>Max.</b>                   | <b>Min.</b> |
| 0040              | 0.30                          | 0.18        |
| 0100<br>0140      | 0.33                          | 0.21        |
| 0230<br>0300      | 0.45                          | 0.25        |
| 0670<br>0940      | 0.59                          | 0.35        |
| 2290              | 0.71                          | 0.51        |

**Table 11: Rotor Clearances**

7. Re-check each screw one-by-one to ensure that the specified torque value has been reached. The process is complete when no screw moves when torque is applied.
8. Assemble the gear (Figure 61, item 21) and locking components onto the drive shaft.
9. Tighten the screws evenly by hand so that the locking components begin to grip the shaft.
10. Check the rotor-to-rotor clearance at the positions shown in Figure 63.

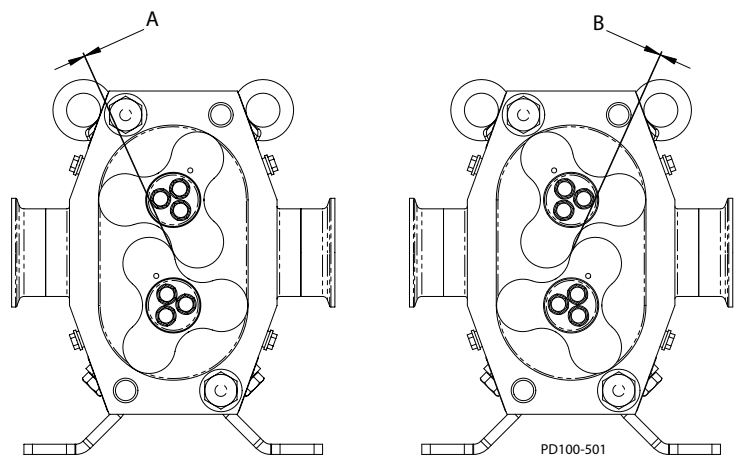


Figure 63 - Rotor Clearance

11. The "A" and "B" clearance dimensions shown in Figure 63 must be within the ranges specified in Table 11 at all positions. Adjust the gear position on the drive shaft as required.
12. Following a diametrically opposite sequence, tighten the screws to the value shown in Table 10 for "Step 1." Do not turn any screw more than a 1/4 turn at a time to ensure that the clamp load is applied evenly.
13. Following the same sequence as in step 4, tighten the screws to the value shown in Table 10 under the heading "Final."
14. Re-check each screw one-by-one to ensure that the specified torque value has been reached. The process is complete when no screw moves when torque is applied.

## 8.8.11 Verify Rotor Clearance

| <b>Pump Model</b>    | <b>Radial Clearance (mm)</b> |             |
|----------------------|------------------------------|-------------|
|                      | <b>Max.</b>                  | <b>Min.</b> |
| 0040<br>0100<br>0140 | 0.18                         | 0.11        |
| 0230<br>0300         | 0.27                         | 0.15        |
| 0670<br>0940         | 0.39                         | 0.23        |
| 2290                 | 0.42                         | 0.25        |

**Table 12: Radial Clearances**

1. With the rotors synchronized, measure the radial clearance of each lobe (Figure 64, item A) and verify that the clearance falls within the range shown in Table 12.
2. Check clearance at all six points in the body as shown. See Figure 64, item B.

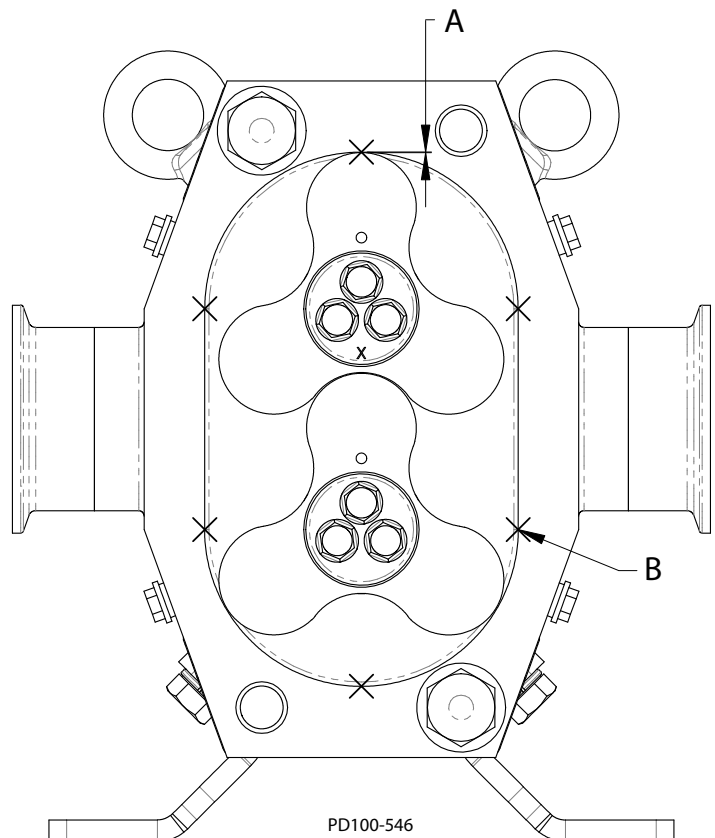


Figure 64 - Radial Clearance Check

## 8.8.12 Gear Cover Installation

| <b>Pump Model</b>                    | <b>Oil Volume (ml)</b>  |                       |
|--------------------------------------|-------------------------|-----------------------|
|                                      | <b>Horizontal Ports</b> | <b>Vertical Ports</b> |
| 0040<br>0100<br>0140<br>0230<br>0300 | 100                     | 170                   |
| 0670<br>0940                         | 325                     | 490                   |
| 2290                                 | 625                     | 1125                  |

**Table 13: Oil Volume**

| <b>Pump Model</b>                    | <b>Grease Volume (ml)</b> |                     |
|--------------------------------------|---------------------------|---------------------|
|                                      | <b>Front Bearing</b>      | <b>Rear Bearing</b> |
| 0040<br>0100<br>0140<br>0230<br>0300 | 8.7                       | 8.2                 |
| 0670<br>0940                         | 16.6                      | 17.1                |
| 2290                                 | 43.2                      | 39.6                |

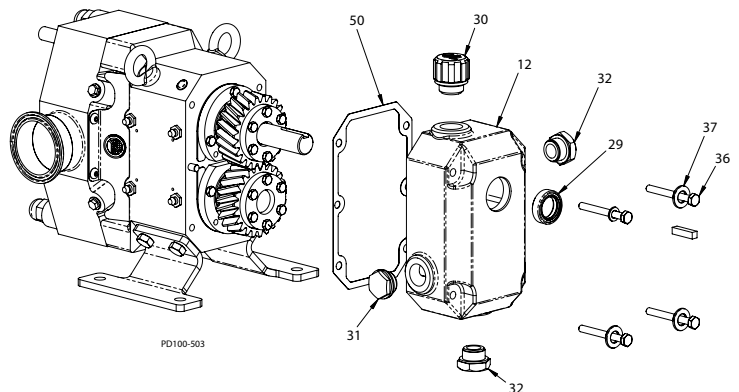
**Table 14: Grease Volume**

Figure 65 - Gear Cover Installation

1. Press the input shaft seal (Figure 65, item 29) into the bore of the gear cover (item 12).
2. Place the gasket (item 50) over the dowel pins in the gear case.
3. Lubricate the inside diameter of the seal with bearing grease and install the gear cover. Use care to prevent damage to the lip seal when installing the cover.
4. Install the cap screws (item 36) and washers (item 37) and tighten them evenly.
5. Install the oil plugs (item 32) and level indicator plug (item 31) into the appropriate locations for the pump mounting position.
6. Fill with oil and install the breather plug (item 30). Table 13 provides oil capacity by pump size and mounting position. The oil level should reach the center of the level indicator.
7. Grease the bearings. See Table 14 for the approximate volume of grease required for the initial charge. For re-greasing a pump in service, see Table 3.

## 8.8.13 Cover Installation

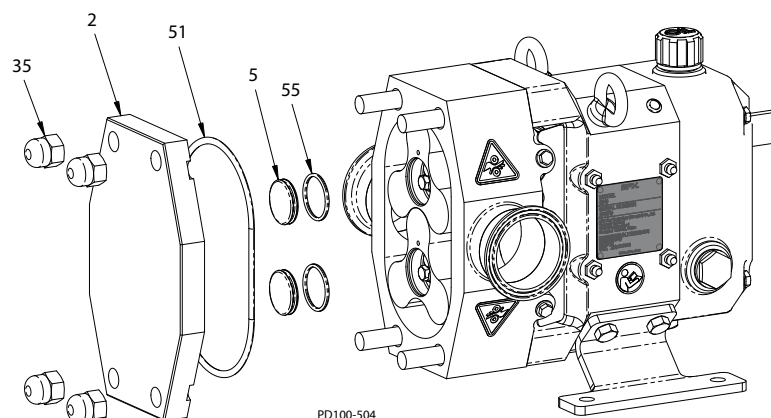


Figure 66 - Cover Installation

1. Install the screw cap o-ring (Figure 66, item 55) into the groove in the screw cap (item 5) and install it in the rotor bore. The o-ring snaps into the groove in the rotor bore.
2. Install the cover o-ring (item 51) into the groove in the cover.
3. Remove the acorn nuts and spacers used to secure the pump body.
4. Install the cover (item 2) over the studs and fasten it securely with acorn nuts (item 35). The pump should rotate freely by hand with no binding or dragging.
5. Check that all labels are in place and legible. See "Replacement Labels" par. 3.0.

## Torque Reference

| <b>Pump Model</b>                    | <b>Rotor Lug Screw</b> |               | <b>Cover Nut</b> |               | <b>Bearing Nut Lock Screw</b> |               | <b>Gear Locking Assembly</b> |               |
|--------------------------------------|------------------------|---------------|------------------|---------------|-------------------------------|---------------|------------------------------|---------------|
|                                      | <b>Hex</b>             | <b>Torque</b> | <b>Hex</b>       | <b>Torque</b> | <b>Hex</b>                    | <b>Torque</b> | <b>Hex</b>                   | <b>Torque</b> |
| 0040<br>0100<br>0140<br>0230<br>0300 | 9 mm                   | 24 N-m        | 19 mm            | 71 N-m        | 2.5 mm                        | 4 N-m         | 8 mm                         | 6 N-m         |
| 0670<br>0940                         | 13 mm                  | 70 N-m        | 24 mm            | 172 N-m       | 3 mm                          | 8 N-m         | 5 mm                         | 10 N-m        |
| 2290                                 | 18 mm                  | 160 N-m       | 30 mm            | 347 N-m       | 3 mm                          | 8 N-m         | 6 mm                         | 25 N-m        |

**Table 15: Nut and Screw Torque Reference**

## 9.0 Troubleshooting

| PROBLEM                                      | POSSIBLE CAUSE                                                                                                                                      | SUGGESTED ACTION                                                                                                                                         |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>No flow, pump rotors are not turning.</b> | Drive motor not running.                                                                                                                            | Check resets, fuses, circuit breakers.                                                                                                                   |
|                                              | Keys sheared or missing.                                                                                                                            | Replace.                                                                                                                                                 |
|                                              | Drive belts, power transmission components slipping or broken.                                                                                      | Replace or adjust.                                                                                                                                       |
|                                              | Pump shaft, keys, or gears sheared.                                                                                                                 | Inspect: and replace parts as necessary.                                                                                                                 |
|                                              |                                                                                                                                                     |                                                                                                                                                          |
| <b>No flow, pump rotors are turning.</b>     | Rotors turn in the wrong direction.                                                                                                                 | Check motor hookup to reverse motor rotation.                                                                                                            |
|                                              | Relief valve not properly adjusted, or held open by foreign material.                                                                               | Adjust or clear valve.                                                                                                                                   |
|                                              |                                                                                                                                                     |                                                                                                                                                          |
| <b>No flow, pump not priming.</b>            | Valve closed in inlet line.                                                                                                                         | Open valve.                                                                                                                                              |
|                                              | Inlet line clogged or restricted.                                                                                                                   | Clear line, clean filters, etc.                                                                                                                          |
|                                              | Air leaks due to bad gaskets or pipe connections.                                                                                                   | Replace gaskets; check lines for leakage (can be done by air, by pressure or by filling with liquid and pressurizing with air).                          |
|                                              | Pump speed too slow.                                                                                                                                | Increase pump speed.                                                                                                                                     |
|                                              | Liquid drains or siphons from system during off periods.                                                                                            | Use foot valve or check valves.<br><br>Filling inlet lines with material before startup may solve startup priming problems due to no material in system. |
|                                              | "Air" lock caused by fluids which "gas off", or vaporize, or allow gas to come out of solution during off periods.                                  | Install and use a manual or automatic air bleed from pump or lines near pump.                                                                            |
|                                              | Extra clearance rotors, worn pump.                                                                                                                  | Increase pump speed, use foot valve to improve priming.                                                                                                  |
|                                              | Net inlet pressure available too low.                                                                                                               | Check Net Inlet Pressure Available & Net Inlet Pressure Required. Change inlet system as needed.                                                         |
|                                              | On "Vacuum" inlet system:<br>On initial start-up, atmospheric "blow back" prevents pump from developing enough differential pressure to start flow. | Install check valve in discharge line.                                                                                                                   |

| PROBLEM                                                  | POSSIBLE CAUSE                                                                                                | SUGGESTED ACTION                                                                                                                                                                                                                                                    |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Insufficient flow.</b>                                | Speed too low to obtain desired flow.                                                                         | Check flow-speed curve (available from customer service) and adjust as necessary.                                                                                                                                                                                   |
|                                                          | Air leak due to bad seals, gadgets or pipe connections.                                                       | Replace seals, check inlet fittings.                                                                                                                                                                                                                                |
|                                                          |                                                                                                               |                                                                                                                                                                                                                                                                     |
| <b>Noisy operation caused by mechanical problems.</b>    |                                                                                                               |                                                                                                                                                                                                                                                                     |
|                                                          | Strainers, foot valves, inlet fittings or lines clogged.                                                      | Clear lines. If problem continues, inlet system may require changing.                                                                                                                                                                                               |
|                                                          | Inlet line size too small, inlet line too long. Too many fittings or valves. Foot valve, strainers too small. | Increase inlet line size. Reduce length, minimize direction and size changes, reduce number of fittings.                                                                                                                                                            |
|                                                          | NIPA - Net Inlet Pressure Available at Pump is too low.                                                       | Raise liquid level in source tank to increase Net Inlet Pressure (NIPA).<br><br>Increase Net Inlet Pressure Available at Pump by raising or pressurizing source tank.<br><br>Select larger pump size with ("starved" pump inlet) lower Net Inlet Pressure Required. |
|                                                          | Fluid viscosity greater than expected.                                                                        | Reduce pump speed and accept lower flow, or change system to reduce line losses.<br><br>Increase temperature of product to reduce viscosity.                                                                                                                        |
|                                                          | Fluid temperature higher than expected (vapor pressure higher).                                               | Reduce temperature, reduce speed and accept lower flow or change system to increase Net Inlet Pressure Available.                                                                                                                                                   |
| <b>Insufficient flow. Flow being bypassed somewhere.</b> |                                                                                                               |                                                                                                                                                                                                                                                                     |
|                                                          | Flow diverted in branch line, open valve, etc.                                                                | Check system and controls                                                                                                                                                                                                                                           |
|                                                          | Relief valve not adjusted or jammed.                                                                          | Clear or adjust valve.                                                                                                                                                                                                                                              |
| <b>Insufficient flow. High slip.</b>                     |                                                                                                               |                                                                                                                                                                                                                                                                     |
|                                                          | Hot (HC) or extra clearance rotors on "cold" fluid, and/or low viscosity fluid.                               | Replace with standard clearance rotors.                                                                                                                                                                                                                             |
|                                                          | Worn pump.                                                                                                    | Increase pump speed (within limits). Replace rotors, have pump remanufactured.                                                                                                                                                                                      |
|                                                          | High pressure.                                                                                                | Reduce pressure by adjusting system settings or hardware.                                                                                                                                                                                                           |

| PROBLEM                                               | POSSIBLE CAUSE                                                                                                       | SUGGESTED ACTION                                                                                                                 |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Noisy operation caused by fluid.</b>               | Cavitation due to high fluid viscosity.<br>High vapor pressure fluid.<br>High temperature.                           | Slow down pump, reduce temperature, change system setup.                                                                         |
|                                                       | Cavitation due to Net Inlet Pressure Available less than Net Inlet Pressure Required<br>Net Inlet Pressure Required. | Increase NIPA - Net Inlet Pressure Required or reduce NIPR - Net Inlet Pressure Required. Contact customer service if necessary. |
|                                                       | Air or gas in fluid caused by leaks in the piping.                                                                   | Check system and fix any leaks.                                                                                                  |
|                                                       | Air or gas in fluid caused by dissolved gas or naturally aerated products.                                           | Minimize discharge pressure (also see Cavitation).                                                                               |
|                                                       |                                                                                                                      |                                                                                                                                  |
| <b>Noisy operation caused by mechanical problems.</b> | Rotor to body contact due to improper assembly of pump.                                                              | Check clearances and adjust shimming.                                                                                            |
|                                                       | Rotor to body contact caused by distortion of pump due to improper piping installation.                              | Change piping installation to eliminate piping stress and distortion on body.                                                    |
|                                                       | Pressures required higher than the pump is rated for.                                                                | Reduce discharge pressure required.                                                                                              |
|                                                       | Rotor to body contact caused by worn bearings.                                                                       | Rebuild with new bearings and lubricate regularly.                                                                               |
|                                                       | Rotor to Rotor Contact caused by loose or not timed correctly gears.                                                 | This has caused severe damage to components - rebuild with new parts.                                                            |
|                                                       | Rotor to Rotor Contact caused by sheared keys.                                                                       | This has caused severe damage to components - rebuild with new parts.                                                            |
|                                                       | Rotor to Rotor Contact caused by worn gear splines.                                                                  | This has caused severe damage to components - rebuild with new parts.                                                            |
|                                                       | Drive noise caused by gear trains, chains, couplings, bearings.                                                      | Repair or replace drive parts. Check bearings for damage and replace as necessary.                                               |

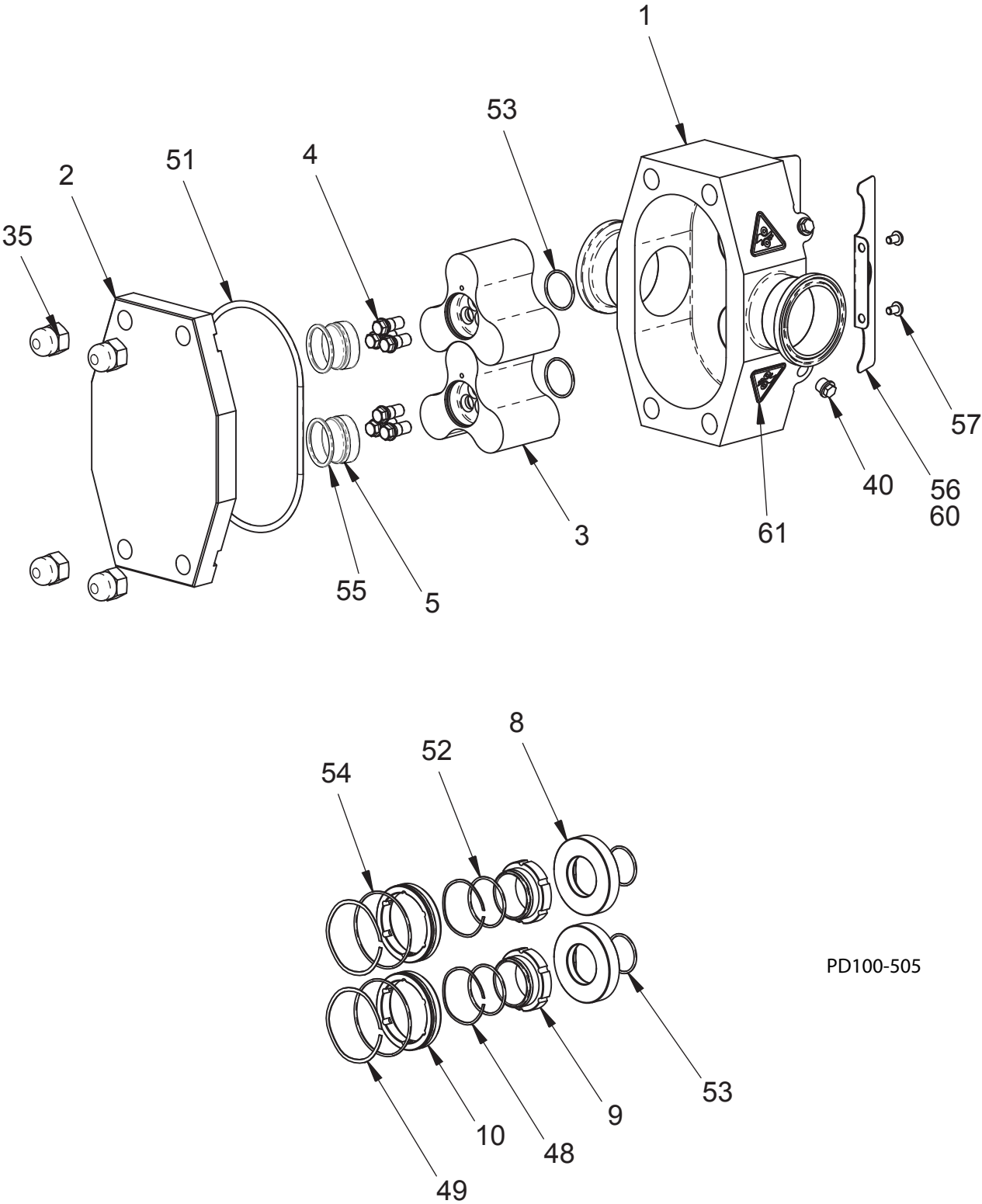
| PROBLEM                                                                                      | POSSIBLE CAUSE                                                                       | SUGGESTED ACTION                                                                                                                                                |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Pump requires excessive power (over heats, stalls, high current draw, breakers trip).</b> | Higher than expected viscosity losses.                                               | If within pump rating, increase drive size.                                                                                                                     |
|                                                                                              | Higher than expected pressures.                                                      | Reduce pump speed.<br>Increase line sizes.                                                                                                                      |
|                                                                                              | Fluid is colder with a higher viscosity than expected.                               | Heat fluid, insulate lines or heat trace lines.<br>Increase line sizes.                                                                                         |
|                                                                                              | Fluid sets in line and pump during shutdown.                                         | Insulate lines or heat trace lines.<br>Install a "soft start" drive.<br><br>Install a recirculating bypass system.<br><br>Flush system with a nonsetting fluid. |
|                                                                                              | Fluid builds up on pump surfaces.                                                    | Replace the pump with more running clearances.                                                                                                                  |
|                                                                                              |                                                                                      |                                                                                                                                                                 |
|                                                                                              |                                                                                      |                                                                                                                                                                 |
| <b>Short pump service life.</b>                                                              | Pumping abrasives                                                                    | Larger pumps at slower speeds.                                                                                                                                  |
|                                                                                              | Speeds and pressures higher than rated.                                              | Reduce speeds and pressures by making changes in the system.<br><br>Replace pump with a large model with higher pressure ratings.                               |
|                                                                                              | Worn bearings and gears due to lack of lubrication.                                  | Check and replace bearing and gears as necessary. Adjust lubrication schedule to decrease time between lubrication.                                             |
|                                                                                              | Misalignment of drive and piping (Excessive over hung load or misaligned couplings). | Check alignment of piping and drive.<br>Adjust as necessary.                                                                                                    |

## NOTES

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

10.0 Parts Lists

10.1 Model 0040-0300 Pump Parts (-A- exploded view)



## 10.2 Model 0040-0300 Pump Parts (-A- BOM Items)

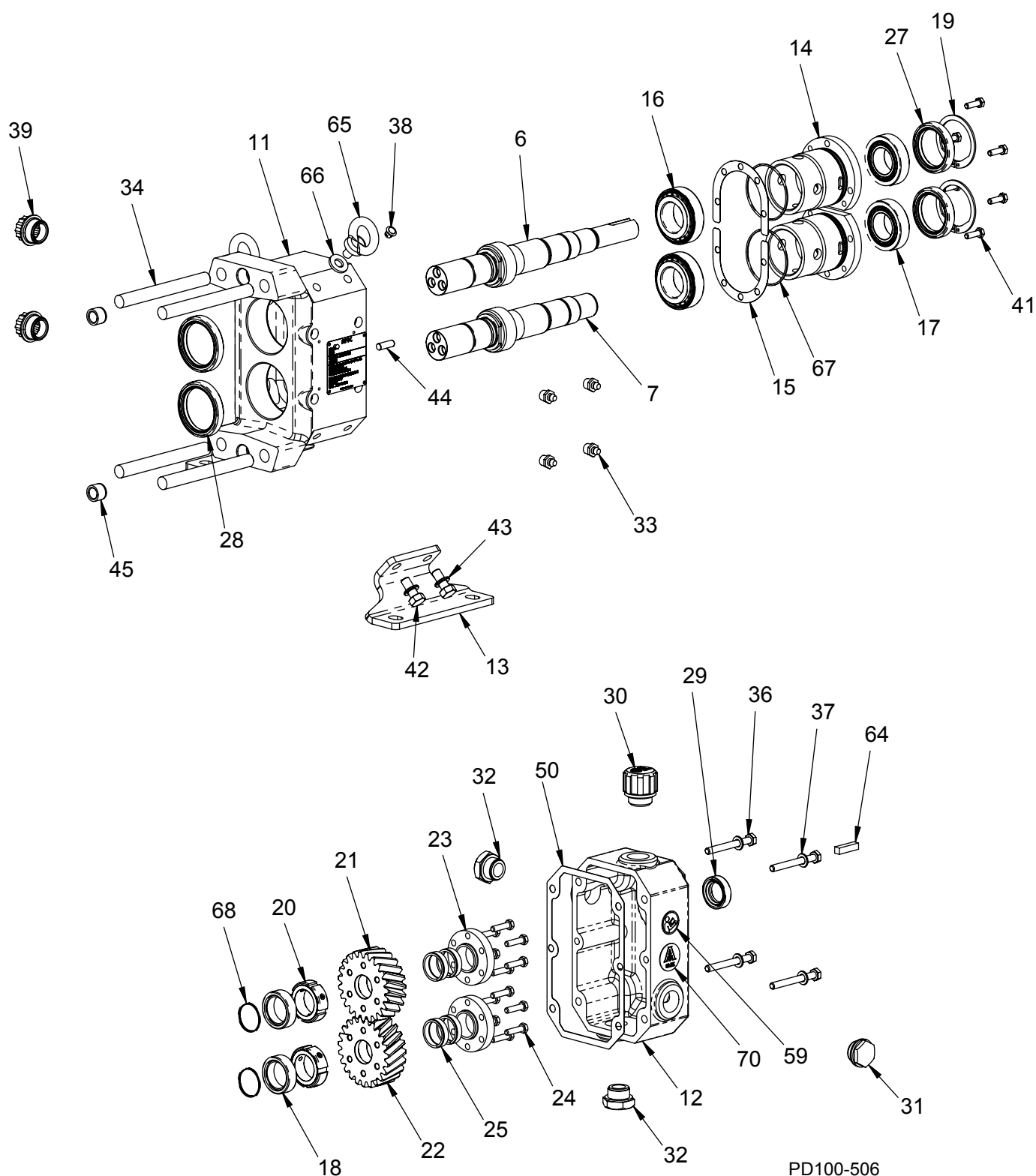
| ITEM | DESCRIPTION                        | QTY | PART NUMBER BY MODEL |           |           |           |           | NOTES |
|------|------------------------------------|-----|----------------------|-----------|-----------|-----------|-----------|-------|
|      |                                    |     | 0040                 | 0100      | 0140      | 0230      | 0300      |       |
| 1    | FINISHED BODY ASSEMBLY - ISO 2852  | 1   | CNG127255            | CNG127256 | CNG127257 | CNG127258 | CNG127259 |       |
|      | FINISHED BODY ASSEMBLY - DIN 11851 |     | CNG127264            | CNG127265 | CNG127266 | CNG127267 | CNG127268 |       |
|      | FINISHED BODY ASSEMBLY - DIN 2633  |     | CNG127933            | CNG127934 | CNG127935 | CNG127936 | CNG127937 |       |
|      | FINISHED BODY ASSEMBLY - SMS 1145  |     | CNG138030            | CNG138031 | CNG138032 | CNG138033 | CNG138034 |       |
| 2    | COVER                              | 1   | CNG127172            | CNG127173 | CNG127173 | CNG127174 | CNG127174 |       |
| 3    | ROTOR                              | 2   | CNG127407            | CNG127408 | CNG127409 | CNG127410 | CNG127411 |       |
| 4    | ROTOR LUG SCREW                    | 6   | CNG127416            | CNG127416 | CNG127416 | CNG127416 | CNG127416 |       |
| 5    | COVER-ROTOR SCREW                  | 2   | CNG127944            | CNG127944 | CNG127944 | CNG127944 | CNG127944 |       |
| 8    | SEAL SEAT - STAINLESS STEEL        | 2   | CNG127207            | CNG127207 | CNG127207 | CNG127207 | CNG127207 |       |
|      | SEAL SEAT - SILICON CARBIDE        | 2   | CNG127210            | CNG127210 | CNG127210 | CNG127210 | CNG127210 |       |
| 9    | INNER SEAL - CARBON                | 2   | CNG127610            | CNG127610 | CNG127610 | CNG127610 | CNG127610 |       |
|      | INNER SEAL - SILICON CARBIDE       | 2   | CNG127216            | CNG127216 | CNG127216 | CNG127216 | CNG127216 |       |
| 10   | OUTER SEAL - CARBON                | 2   | CNG127613            | CNG127613 | CNG127613 | CNG127613 | CNG127613 |       |
| 35   | ACORN NUT                          | 4   | CNG127285            | CNG127285 | CNG127285 | CNG127285 | CNG127285 |       |
| 40   | PLUG 1/8 BSP POLY (FLUSH PORTS)    | 4   | CNG127484            | CNG127484 | CNG127484 | CNG127484 | CNG127484 |       |
| 48   | WAVE SPRING - INNER SEAL           | 2   | CNG127222            | CNG127222 | CNG127222 | CNG127222 | CNG127222 |       |
| 49   | WAVE SPRING - OUTER SEAL           | 2   | CNG127225            | CNG127225 | CNG127225 | CNG127225 | CNG127225 |       |
| 51   | O-RING - COVER FKM                 | 1   | CNG127432            | CNG127434 | CNG127434 | CNG127436 | CNG127436 | 1     |
|      | O-RING - COVER EPDM                | 1   | CNG127433            | CNG127435 | CNG127435 | CNG127437 | CNG127437 | 1     |
| 52   | O-RING - INNER SEAL FKM            | 2   | CNG127454            | CNG127454 | CNG127454 | CNG127454 | CNG127454 | 1     |
|      | O-RING - INNER SEAL EPDM           | 2   | CNG127455            | CNG127455 | CNG127455 | CNG127455 | CNG127455 | 1     |
| 53   | O-RING - SEAL SEAT/ROTOR HUB FKM   | 4   | CNG127448            | CNG127448 | CNG127448 | CNG127448 | CNG127448 | 1     |
|      | O-RING - SEAL SEAT/ROTOR HUB EPDM  | 4   | CNG127449            | CNG127449 | CNG127449 | CNG127449 | CNG127449 | 1     |
| 54   | O-RING - OUTER SEAL FKM            | 2   | CNG127456            | CNG127456 | CNG127456 | CNG127456 | CNG127456 | 1     |
|      | O-RING - OUTER SEAL EPDM           | 2   | CNG127457            | CNG127457 | CNG127457 | CNG127457 | CNG127457 | 1     |
| 55   | O-RING - ROTOR SCREW COVER FKM     | 2   | CNG127442            | CNG127442 | CNG127442 | CNG127442 | CNG127442 | 1     |
|      | O-RING - ROTOR SCREW COVER EPDM    | 2   | CNG127443            | CNG127443 | CNG127443 | CNG127443 | CNG127443 | 1     |
| 56   | GUARD - SHAFT SEAL                 | 2   | CNG127381            | CNG127381 | CNG127381 | CNG127381 | CNG127381 |       |
| 57   | BHCS-M5X8 18-8 SS                  | 4   | CNG127384            | CNG127384 | CNG127384 | CNG127384 | CNG127384 |       |
| 60   | LABEL - ISO GUARD                  | 2   | CNG127388            | CNG127388 | CNG127388 | CNG127388 | CNG127388 |       |
| 61   | LABEL - ISO ENTANGLEMENT HAZARD    | 4   | CNG127387            | CNG127387 | CNG127387 | CNG127387 | CNG127387 |       |

## Notes

- FKM is standard; EPDM is optional

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### 10.3 Model 0040-0300 Pump Parts (-B- exploded view)

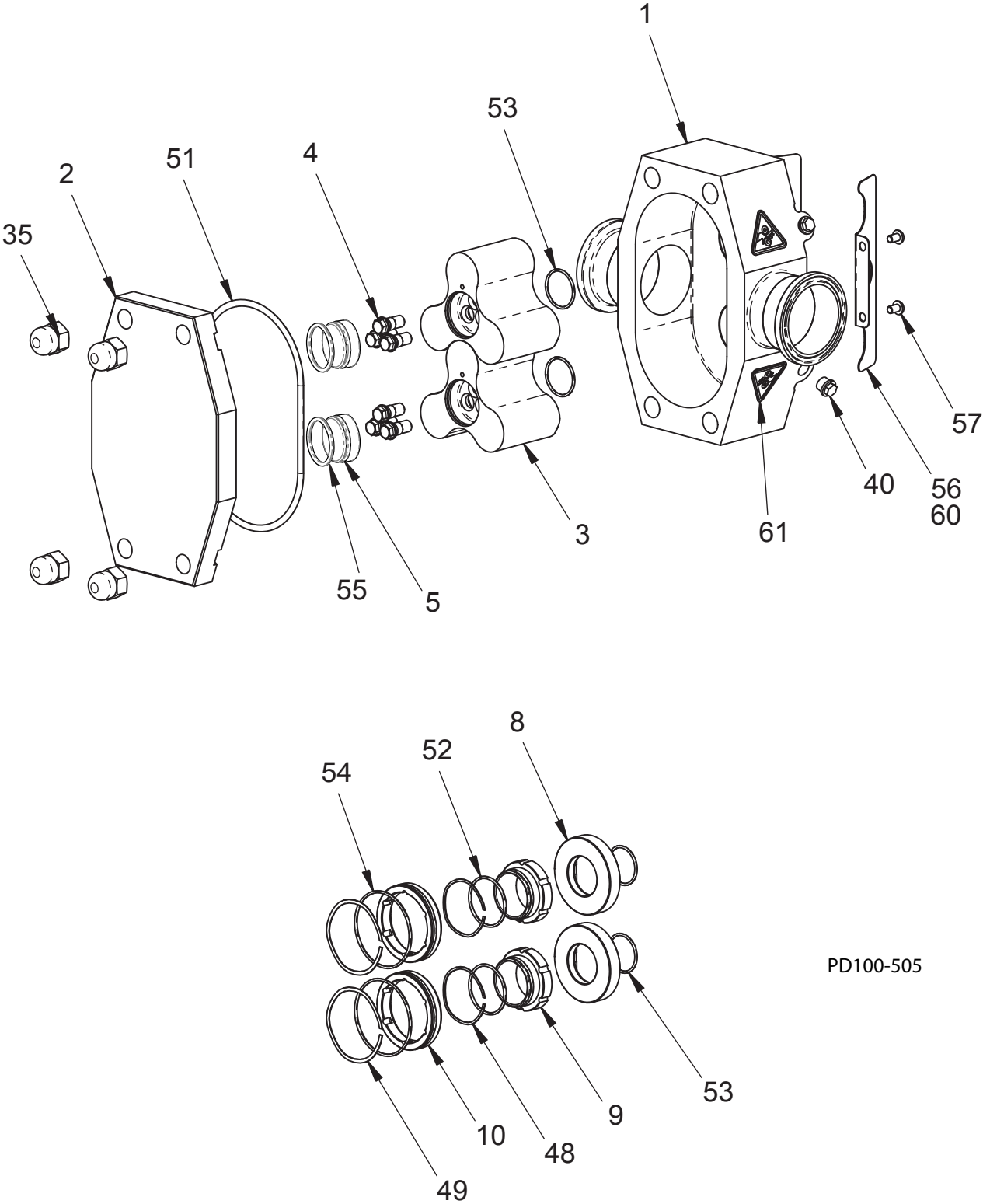


## 10.4 Model 0040-0300 Pump Parts (-B- BOM Items)

| ITEM | DESCRIPTION                             | QTY | PART NUMBER BY MODEL |           |           |           |           | NOTES |
|------|-----------------------------------------|-----|----------------------|-----------|-----------|-----------|-----------|-------|
|      |                                         |     | 0040                 | 0100      | 0140      | 0230      | 0300      |       |
| 6    | DRIVE SHAFT                             | 1   | CNG127389            | CNG127391 | CNG127393 | CNG127395 | CNG127397 |       |
| 7    | LAY SHAFT                               | 1   | CNG127390            | CNG127392 | CNG127394 | CNG127396 | CNG127398 |       |
| 11   | BEARING HOUSING (GEARCASE)              | 1   | CNG127160            | CNG127160 | CNG127160 | CNG127160 | CNG127160 |       |
| 12   | GEAR COVER                              | 1   | CNG127166            | CNG127166 | CNG127166 | CNG127166 | CNG127166 |       |
| 13   | MOUNTING FOOT                           | 2   | CNG127201            | CNG127201 | CNG127201 | CNG127201 | CNG127201 |       |
| 14   | BEARING CASE                            | 2   | CNG127180            | CNG127180 | CNG127180 | CNG127180 | CNG127180 |       |
| 15   | SHIM-AXIAL POSITIONING-0.025            | A/R | CNG127504            | CNG127504 | CNG127504 | CNG127504 | CNG127504 |       |
|      | SHIM-AXIAL POSITIONING-0.05             |     | CNG127426            | CNG127426 | CNG127426 | CNG127426 | CNG127426 |       |
|      | SHIM-AXIAL POSITIONING-0.10             |     | CNG127427            | CNG127427 | CNG127427 | CNG127427 | CNG127427 |       |
|      | SHIM-AXIAL POSITIONING-1.0              |     | CNG127505            | CNG127505 | CNG127505 | CNG127505 | CNG127505 |       |
| 16   | FRONT BEARING                           | 2   | CNG127288            | CNG127288 | CNG127288 | CNG127288 | CNG127288 |       |
| 17   | REAR BEARING                            | 2   | CNG127291            | CNG127291 | CNG127291 | CNG127291 | CNG127291 |       |
| 18   | SEAL SLEEVE                             | 2   | CNG127198            | CNG127198 | CNG127198 | CNG127198 | CNG127198 |       |
| 19   | RETAINING RING - REAR BEARING SEAL      | 2   | CNG127319            | CNG127319 | CNG127319 | CNG127319 | CNG127319 |       |
| 20   | BEARING LOCK NUT                        | 2   | CNG127586            | CNG127586 | CNG127586 | CNG127586 | CNG127586 |       |
| 21   | HELICAL GEAR RH                         | 1   | CNG127137            | CNG127137 | CNG127137 | CNG127137 | CNG127137 |       |
| 22   | HELICAL GEAR LH                         | 1   | CNG127138            | CNG127138 | CNG127138 | CNG127138 | CNG127138 |       |
| 23   | CLAMP RING - GEAR                       | 2   | CNG127526            | CNG127526 | CNG127526 | CNG127526 | CNG127526 |       |
| 24   | HHCS - CLAMP PLATE                      | 12  | CNG127528            | CNG127528 | CNG127528 | CNG127528 | CNG127528 |       |
| 25   | LOCKING ELEMENT                         | 4   | CNG127527            | CNG127527 | CNG127527 | CNG127527 | CNG127527 |       |
| 27   | SEAL - REAR BEARING                     | 2   | CNG127306            | CNG127306 | CNG127306 | CNG127306 | CNG127306 |       |
| 28   | SEAL - FRONT BEARING                    | 2   | CNG127303            | CNG127303 | CNG127303 | CNG127303 | CNG127303 |       |
| 29   | SEAL - INPUT SHAFT                      | 1   | CNG127309            | CNG127309 | CNG127309 | CNG127309 | CNG127309 |       |
| 30   | BREATHER PLUG                           | 1   | CNG127314            | CNG127314 | CNG127314 | CNG127314 | CNG127314 |       |
| 31   | LEVEL INDICATOR PLUG                    | 1   | CNG127315            | CNG127315 | CNG127315 | CNG127315 | CNG127315 |       |
| 32   | OIL PLUG                                | 2   | CNG127313            | CNG127313 | CNG127313 | CNG127313 | CNG127313 |       |
| 33   | GREASE FITTING-G1/8 BSPT                | 4   | CNG127312            | CNG127312 | CNG127312 | CNG127312 | CNG127312 |       |
| 34   | COVER STUD                              | 4   | CNG127183            | CNG127184 | CNG127185 | CNG127185 | CNG127186 |       |
| 36   | HHCS - GEAR COVER                       | 4   | CNG127475            | CNG127475 | CNG127475 | CNG127475 | CNG127475 |       |
| 37   | WASHER - GEAR COVER                     | 4   | CNG127480            | CNG127480 | CNG127480 | CNG127480 | CNG127480 |       |
| 38   | PLUG - TAPPED HOLE                      | 4   | CNG127379            | CNG127379 | CNG127379 | CNG127379 | CNG127379 |       |
| 39   | PLASTIC PLUG - GREASE CLEANOUT          | 2   | CNG127483            | CNG127483 | CNG127483 | CNG127483 | CNG127483 |       |
| 41   | HHCS - BEARING CASE                     | 6   | CNG127472            | CNG127472 | CNG127472 | CNG127472 | CNG127472 |       |
| 42   | HHCS - MOUNTING FOOT                    | 4   | CNG127478            | CNG127478 | CNG127478 | CNG127478 | CNG127478 |       |
| 44   | DOWEL PIN-M6X18                         | 2   | CNG127377            | CNG127377 | CNG127377 | CNG127377 | CNG127377 |       |
| 45   | DOWEL BUSHING - G SERIES                | 2   | CNG127376            | CNG127376 | CNG127376 | CNG127376 | CNG127376 |       |
| 46   | DOWEL PIN-M10X20 (not shown)            | 2   | CNG127378            | CNG127378 | CNG127378 | CNG127378 | CNG127378 |       |
| 47   | DOWEL PIN - (SEAL STOP PIN) (not shown) | 6   | CNG127282            | CNG127282 | CNG127282 | CNG127282 | CNG127282 |       |
| 50   | GEAR COVER GASKET                       | 1   | CNG127204            | CNG127204 | CNG127204 | CNG127204 | CNG127204 |       |
| 59   | LABEL - ISO READ MANUAL                 | 1   | CNG127385            | CNG127385 | CNG127385 | CNG127385 | CNG127385 |       |
| 64   | KEY- INPUT SHAFT                        | 1   | CNG127316            | CNG127316 | CNG127316 | CNG127316 | CNG127316 |       |
| 65   | EYEBOLT                                 | 2   | CNG127487            | CNG127487 | CNG127487 | CNG127487 | CNG127487 |       |
| 66   | EYEBOLT WASHER - RUBBER                 | 2   | CNG127510            | CNG127510 | CNG127510 | CNG127510 | CNG127510 |       |
| 67   | O-RING - BEARING CASE BUNA N            | 2   | CNG127580            | CNG127580 | CNG127580 | CNG127580 | CNG127580 |       |
| 68   | O-RING - SEAL SLEEVE BUNA N             | 2   | CNG127583            | CNG127583 | CNG127583 | CNG127583 | CNG127583 |       |
| 70   | LABEL - 3-A                             | 1   | 125096+              | 125096+   | 125096+   | 125096+   | 125096+   |       |

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10.5 Model 0670-2290 Pump Parts (-A- exploded view)



PD100-505

## 10.6 Model 0670-2290 Pump Parts (-A- BOM Items)

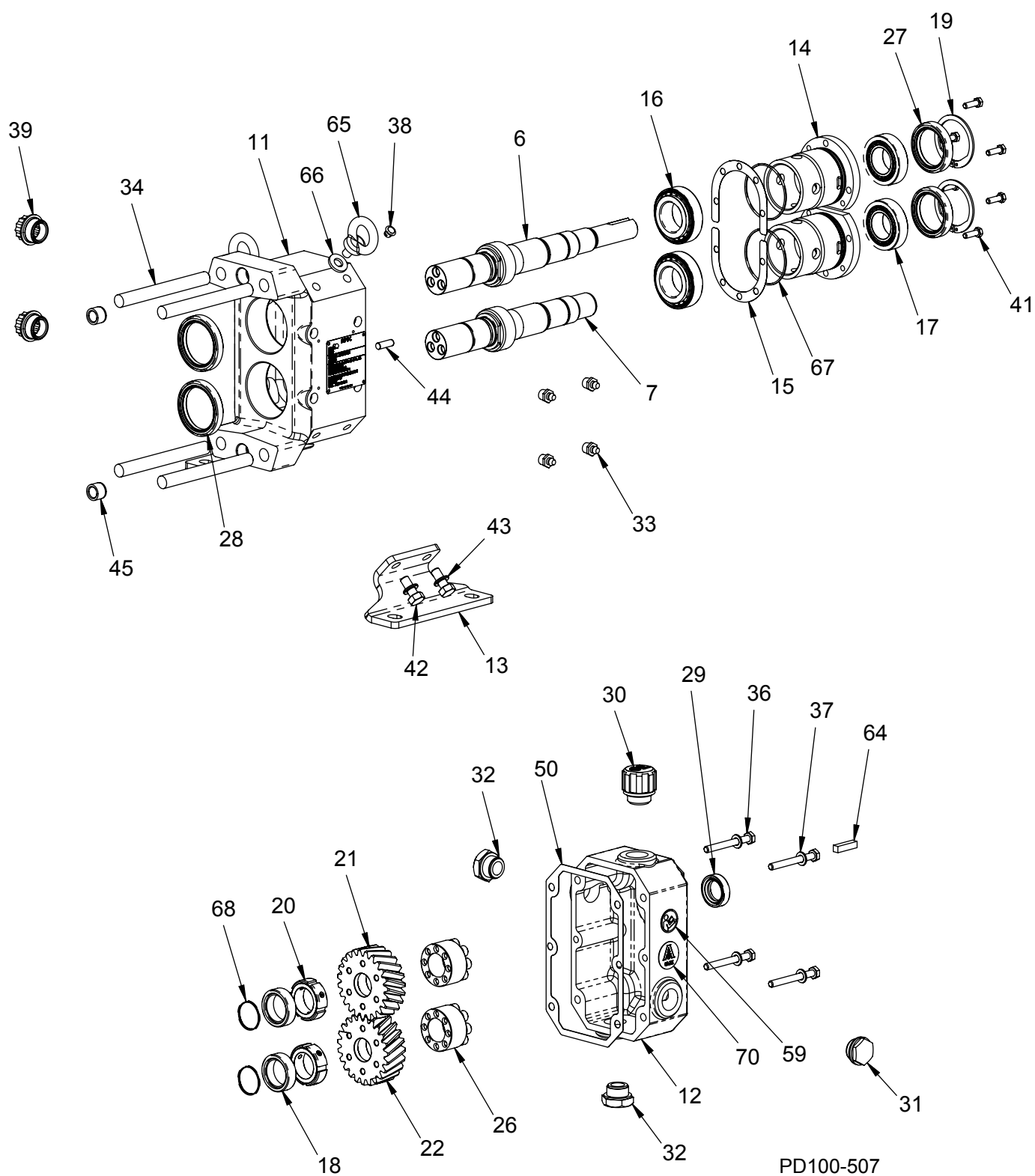
| ITEM | DESCRIPTION                        | QTY | PART NUMBER BY MODEL |           |           | NOTES |
|------|------------------------------------|-----|----------------------|-----------|-----------|-------|
|      |                                    |     | 0670                 | 0940      | 2290      |       |
| 1    | FINISHED BODY ASSEMBLY - ISO 2852  | 1   | CNG127260            | CNG127261 | CNG127262 |       |
|      | FINISHED BODY ASSEMBLY - DIN 11851 |     | CNG127269            | CNG127270 | CNG127271 |       |
|      | FINISHED BODY ASSEMBLY - DIN 2633  |     | CNG127938            | CNG127939 | CNG127940 |       |
|      | FINISHED BODY ASSEMBLY - SMS 1145  |     | CNG138035            | CNG138036 | CNG138037 |       |
| 2    | COVER                              | 1   | CNG127175            | CNG127175 | CNG127176 |       |
| 3    | ROTOR                              | 2   | CNG127412            | CNG127413 | CNG127414 |       |
| 4    | ROTOR LUG SCREW                    | 6   | CNG127417            | CNG127417 | CNG127418 |       |
| 5    | COVER-ROTOR SCREW                  | 2   | CNG127945            | CNG127945 | CNG127946 |       |
| 8    | SEAL SEAT - STAINLESS STEEL        | 2   | CNG127208            | CNG127208 | CNG127209 |       |
|      | SEAL SEAT - SILICON CARBIDE        | 2   | CNG127211            | CNG127211 | CNG127212 |       |
| 9    | INNER SEAL - CARBON                | 2   | CNG127611            | CNG127611 | CNG127612 |       |
|      | INNER SEAL - SILICON CARBIDE       | 2   | CNG127217            | CNG127217 | CNG127218 |       |
| 10   | OUTER SEAL - CARBON                | 2   | CNG127614            | CNG127614 | CNG127615 |       |
| 35   | ACORN NUT                          | 4   | CNG127286            | CNG127286 | CNG127287 |       |
| 40   | PLUG 1/8 BSP POLY (FLUSH PORTS)    | 4   | CNG127484            | CNG127484 | CNG127484 |       |
| 48   | WAVE SPRING - INNER SEAL           | 2   | CNG127223            | CNG127223 | CNG127224 |       |
| 49   | WAVE SPRING - OUTER SEAL           | 2   | CNG127226            | CNG127226 | CNG127227 |       |
| 51   | O-RING - COVER FKM                 | 1   | CNG127438            | CNG127438 | CNG127440 | 1     |
|      | O-RING - COVER EPDM                | 1   | CNG127439            | CNG127439 | CNG127441 | 1     |
| 52   | O-RING - INNER SEAL FKM            | 2   | CNG127460            | CNG127460 | CNG127458 | 1     |
|      | O-RING - INNER SEAL EPDM           | 2   | CNG127461            | CNG127461 | CNG127459 | 1     |
| 53   | O-RING - SEAL SEAT/ROTOR HUB FKM   | 4   | CNG127450            | CNG127450 | CNG127452 | 1     |
|      | O-RING - SEAL SEAT/ROTOR HUB EPDM  | 4   | CNG127451            | CNG127451 | CNG127453 | 1     |
| 54   | O-RING - OUTER SEAL FKM            | 2   | CNG127462            | CNG127462 | CNG127464 | 1     |
|      | O-RING - OUTER SEAL EPDM           | 2   | CNG127463            | CNG127463 | CNG127465 | 1     |
| 55   | O-RING - ROTOR SCREW COVER FKM     | 2   | CNG127450            | CNG127450 | CNG127446 | 1     |
|      | O-RING - ROTOR SCREW COVER EPDM    | 2   | CNG127451            | CNG127451 | CNG127447 | 1     |
| 56   | GUARD - SHAFT SEAL                 | 2   | CNG127382            | CNG127382 | CNG127383 |       |
| 57   | BHCS-M5X8 18-8 SS                  | 4   | CNG127384            | CNG127384 | CNG127384 |       |
| 60   | LABEL - ISO GUARD                  | 2   | CNG127388            | CNG127388 | CNG127388 |       |
| 61   | LABEL - ISO ENTANGLEMENT HAZARD    | 4   | CNG127387            | CNG127387 | CNG127387 |       |

## Notes

1. FKM is standard; EPDM is optional

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## 10.7 Model 0670-2290 Pump Parts (-B- exploded view)

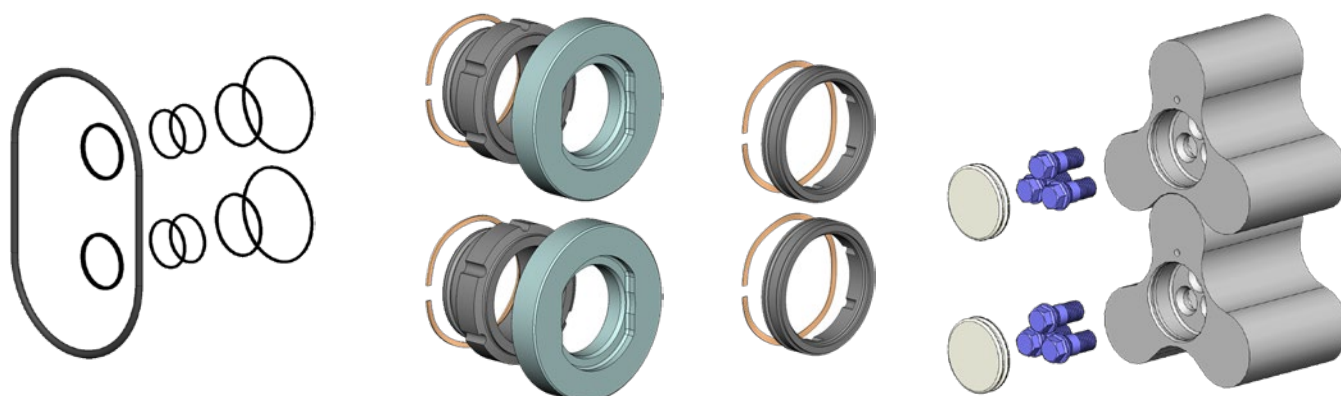


## 10.8 Model 0670-2290 Pump Parts (-B- BOM Items)

| ITEM | DESCRIPTION                             | QTY | PART NUMBER BY MODEL |           |           | NOTES |
|------|-----------------------------------------|-----|----------------------|-----------|-----------|-------|
|      |                                         |     | 0670                 | 0940      | 2290      |       |
| 6    | DRIVE SHAFT                             | 1   | CNG127399            | CNG127401 | CNG127403 |       |
| 7    | LAY SHAFT                               | 1   | CNG127400            | CNG127402 | CNG127404 |       |
| 11   | BEARING HOUSING (GEARCASE)              | 1   | CNG127161            | CNG127161 | CNG127162 |       |
| 12   | GEAR COVER                              | 1   | CNG127167            | CNG127167 | CNG127168 |       |
| 13   | MOUNTING FOOT                           | 2   | CNG127202            | CNG127202 | CNG127203 |       |
| 14   | BEARING CASE                            | 2   | CNG127181            | CNG127181 | CNG127182 |       |
| 15   | SHIM-AXIAL POSITIONING-0.025            | A/R | CNG127506            | CNG127506 | CNG127508 |       |
|      | SHIM-AXIAL POSITIONING-0.05             |     | CNG127428            | CNG127428 | CNG127430 |       |
|      | SHIM-AXIAL POSITIONING-0.10             |     | CNG127429            | CNG127429 | CNG127431 |       |
|      | SHIM-AXIAL POSITIONING-1.0              |     | CNG127507            | CNG127507 | CNG127509 |       |
| 16   | FRONT BEARING                           | 2   | CNG127289            | CNG127289 | CNG127290 |       |
| 17   | REAR BEARING                            | 2   | CNG127292            | CNG127292 | CNG127293 |       |
| 18   | SEAL SLEEVE                             | 2   | CNG127199            | CNG127199 | CNG127200 |       |
| 19   | RETAINING RING - REAR BEARING SEAL      | 2   | CNG127320            | CNG127320 | CNG127321 |       |
| 20   | BEARING LOCK NUT                        | 2   | CNG127587            | CNG127587 | CNG127588 |       |
| 21   | HELICAL GEAR RH                         | 1   | CNG127139            | CNG127139 | CNG127141 |       |
| 22   | HELICAL GEAR LH                         | 1   | CNG127140            | CNG127140 | CNG127142 |       |
| 26   | LOCKING ASSEMBLY                        | 2   | CNG127529            | CNG127529 | CNG127530 |       |
| 27   | SEAL - REAR BEARING                     | 2   | CNG127947            | CNG127947 | CNG127305 |       |
| 28   | SEAL - FRONT BEARING                    | 2   | CNG127304            | CNG127304 | CNG127305 |       |
| 29   | SEAL - INPUT SHAFT                      | 1   | CNG127310            | CNG127310 | CNG127307 |       |
| 30   | BREATHER PLUG                           | 1   | CNG127314            | CNG127314 | CNG127314 |       |
| 31   | LEVEL INDICATOR PLUG                    | 1   | CNG127315            | CNG127315 | CNG127315 |       |
| 32   | OIL PLUG                                | 2   | CNG127313            | CNG127313 | CNG127313 |       |
| 33   | GREASE FITTING-G1/8 BSPT                | 4   | CNG127312            | CNG127312 | CNG127312 |       |
| 34   | COVER STUD                              | 4   | CNG127187            | CNG127188 | CNG127189 |       |
| 36   | HHCS - GEAR COVER                       | 4   | CNG127476            | CNG127476 | CNG127477 |       |
| 37   | WASHER - GEAR COVER                     | 4   | CNG127481            | CNG127481 | CNG127482 |       |
| 38   | PLUG - TAPPED HOLE                      | 4   | CNG127380            | CNG127380 | CNG127380 |       |
| 39   | PLASTIC PLUG - GREASE CLEANOUT          | 2   | CNG127483            | CNG127483 | CNG127483 |       |
| 41   | HHCS - BEARING CASE                     | 6   | CNG127473            | CNG127473 | CNG127474 |       |
| 42   | HHCS - MOUNTING FOOT                    | 4   | CNG127479            | CNG127479 | CNG127479 |       |
| 44   | DOWEL PIN-M6X18                         | 2   | CNG127377            | CNG127377 | CNG127377 |       |
| 45   | DOWEL BUSHING - G SERIES                | 2   | CNG127376            | CNG127376 | CNG127376 |       |
| 46   | DOWEL PIN-M10X20 (not shown)            | 2   | CNG127378            | CNG127378 | CNG127378 |       |
| 47   | DOWEL PIN - (SEAL STOP PIN) (not shown) | 6   | CNG127283            | CNG127283 | CNG127284 |       |
| 50   | GEAR COVER GASKET                       | 1   | CNG127205            | CNG127205 | CNG127206 |       |
| 59   | LABEL - ISO READ MANUAL                 | 1   | CNG127386            | CNG127386 | CNG127386 |       |
| 64   | KEY- INPUT SHAFT                        | 1   | CNG127317            | CNG127317 | CNG127318 |       |
| 65   | EYEBOLT                                 | 2   | CNG127488            | CNG127488 | CNG127488 |       |
| 66   | EYEBOLT WASHER - RUBBER                 | 2   | CNG127511            | CNG127511 | CNG127511 |       |
| 67   | O-RING - BEARING CASE BUNA N            | 2   | CNG127581            | CNG127581 | CNG127582 |       |
| 68   | O-RING - SEAL SLEEVE BUNA N             | 2   | CNG127584            | CNG127584 | CNG127585 |       |
| 70   | LABEL - 3-A                             | 1   | 125096+              | 125096+   | 125096+   |       |

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## 10.9 Maintenance Kits



O-Ring Kit

Product Seal Kit

Double Seal Kit

Rotor Replacement Kit

| MAINTENANCE KIT INDEX |           |           |              |           |             |                   |
|-----------------------|-----------|-----------|--------------|-----------|-------------|-------------------|
| MODEL                 | O-RING    |           | PRODUCT SEAL |           | DOUBLE SEAL | ROTOR REPLACEMENT |
|                       | FKM       | EPDM      | STANDARD     | SC vs. SC |             |                   |
| 0040                  | CNG127334 | CNG127335 | CNG127498    | CNG127495 | CNG127492   | CNG127364         |
| 0100                  | CNG127336 | CNG127337 |              |           |             | CNG127365         |
| 0140                  |           |           |              |           |             | CNG127366         |
| 0230                  | CNG127338 | CNG127339 |              |           |             | CNG127367         |
| 0300                  |           |           |              |           |             | CNG127368         |
| 0670                  | CNG127340 | CNG127341 | CNG127499    | CNG127496 | CNG127493   | CNG127369         |
| 0940                  |           |           |              |           |             | CNG127370         |
| 2290                  | CNG127342 | CNG127343 | CNG127500    | CNG127497 | CNG127494   | CNG127371         |

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| Item             | Maintenance Interval                                          |
|------------------|---------------------------------------------------------------|
| Replace Gear Oil | Every 1000 hours. See <b>"Gear Oil"</b> par. 8.2.2.           |
| Grease Bearings  | Every 250 hours. See <b>"Bearing Lubrication"</b> par. 8.2.3. |
| Replace O-Rings  | Every time o-rings are removed.                               |

**Table 16 - Recommended Maintenance Schedule****NOTE:**

- 1) An o-ring kit and a product seal kit shall be used in conjunction with a relevant double seal kit to assemble a complete double mechanical seal.
- 2) For seals and rotors, component life varies widely between different applications. Inspect for wear and replace as needed. See "Maintenance Inspection Chart" par. 8.4.



## TLP Series

SANITARY POSITIVE DISPLACEMENT PUMP

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