

## Universal 3 Series

ROTARY POSITIVE DISPLACEMENT PUMP



**The Williams - Carver Co., Inc.**

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FORM NO.: 95-03103  
REVISION: 12/2017

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





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## Warranty

LIMITED WARRANTY: Unless otherwise negotiated at the time of sale, SPX FLOW US, LLC (SPX FLOW) goods, auxiliaries and parts thereof are warranted to the original purchaser against defective workmanship and material for a period of twelve (12) months from date of installation or eighteen (18) months from date of shipment from factory, whichever expires first. If the goods or services do not conform to the warranty stated above, then as Buyer's sole remedy, SPX FLOW shall, at SPX FLOW's option, either repair or replace the defective goods or re-perform defective services. Third party goods furnished by SPX FLOW will be repaired or replaced as Buyer's sole remedy, but only to the extent provided in and honored by the original manufacturer's warranty. Unless otherwise agreed to in writing, SPX FLOW shall not be liable for breach of warranty or otherwise in any manner whatsoever for: (i) normal wear and tear; (ii) corrosion, abrasion or erosion; (iii) any good or services which, following delivery or performance by SPX FLOW, has been subjected to accident, abuse, misapplication, improper repair, alteration, improper installation or maintenance, neglect, or excessive operating conditions; (iv) defects resulting from Buyer's specifications or designs or those of Buyer's contractors or subcontractors other than SPX FLOW; or (v) defects resulting from the manufacture, distribution, promotion or sale of Buyer's products.

THE WARRANTIES CONTAINED HEREIN ARE THE SOLE AND EXCLUSIVE WARRANTIES AVAILABLE TO BUYER AND SPX FLOW HEREBY DISCLAIMS ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING REPAIR, REPLACEMENT AND RE-PERFORMANCE OBLIGATIONS STATE SPX FLOW'S ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM IN CONNECTION WITH THE SALE AND FURNISHING OF SERVICES, GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATIONS.

## Shipping Damage or Loss

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

## Warranty Claim

Warranty claims must have a **Returned Material Authorization (RMA)** from the Seller or returns will not be accepted. Contact 800-252-5200 or 262-728-1900.

Claims for shortages or other errors must be made in writing to Seller within ten (10) days after delivery. This does not include transit shortage or damages. Failure to give such notice shall constitute acceptance and waiver of all such claims by Buyer.

## Safety

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

SPX FLOW recommends 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)
2. National Fire Protection Association (NFPA)
3. National Electrical Code (NEC)
4. American National Standards Institute (ANSI)

#### **WARNING**

*Severe injury or death can result from electrical shock, burn, or unintended actuation of 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

Before putting SPX FLOW equipment into operation, the operator shall analyze the application for all foreseeable risks, their likelihood to occur and the potential consequences of the identified risks as per ISO 31000 and ISO/IEC 31010 in their actual current version.

**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 equipment manufacturer's OEM renewal parts or kits. Adjust or repair in accordance with the manufacturer's instructions.

**Periodic Inspection:** 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**

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

#### **WARNING**

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

#### **CAUTION**

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



## Warnings

1. Read the instructions before installing the pump and starting it up. Always follow the guidelines for assembly in order to achieve optimum operational reliability.
2. Always check that the specifications of the motor and the motor control unit are correct, particularly in operating environments where there may be a risk of explosion.
3. Pumps should only be installed, disassembled, repaired and assembled by personnel trained in servicing pumps.
4. Always ensure that all electrical installation is carried out by qualified staff.
5. Never hose down or clean the electric motor directly with water or cleaning fluid. If the motor will be used in a washdown environment a washdown designed motor must be used.
6. Never dismantle the pump before the motor has been disconnected from the power supply. Remove the fuses and disconnect the cable from the motor terminal box.
7. Never dismantle the pump until the isolating valves on the suction and discharge side have been closed and the immediate pipe system has been drained. If the pump is used for hot and/or hazardous fluids, special precautions must be taken. In such cases follow the local regulations for personal safety when working with these products.
8. Always ensure that all pipe connections have been fitted and tightened properly before the pump is started. If the pump is used for hot and/or hazardous liquids, take special care: follow the local regulations for personal safety when working with these products.
9. Always wear personal protective equipment according to the requirements established by OSHA, NFPA, NEC (See page 7).
10. Always remove all assembly and auxiliary tools from the pump before starting it up.
11. Make sure product lines and power cables are laid in suitable guides/trays.
12. Always ensure that no debris of any kind is present in the pump.
13. Always ensure that the pump and the motor shafts are properly aligned.
14. Always ensure that the suction and discharge valves isolating the pump are fully open before starting the pump.
15. Never close or obstruct the outlet of the pump as the pressure in the system will increase above the specified maximum pressure of the pump and cause damage to the pump.
16. There are rotating parts in the pump. Never put hands or fingers into a pump while it is in operation.
17. The pump components and piping may contain sharp edges. Handle the rotors carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.
18. Never touch the gear case during operation. The surface temperature may exceed 110°F (43°C). The pump cover and body may be cold or hot depending on the product (CIP at 190°F (88°C) or 300°F (149°C) product, for example).
19. Never touch the motor or motor shroud (if supplied) during operation, as it can become very hot.
20. When moving the pump, use appropriate lifting devices. Attach lifting devices to the eye bolts on the gear case; the gear case has holes for attaching lifting eye bolts. Always use securely fitted lifting straps when lifting with a crane or similar lifting gear. See "Lifting" on page 15.
21. Never drop parts on the floor.
22. Never exceed the maximum temperature or operating pressure specified under "Operating Parameters" on page 12.
23. Guards should be used when applicable. See page 16, page 24, and page 99.
24. Make sure to keep the work area clear of machine parts, tools, product lines, foreign materials, and power cables to avoid potential hazards.



## Care of Component Materials

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

### WARNING

Failure to comply with the Care of Component Materials could lead to bodily injury.

## Stainless Steel Corrosion

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.

## Alloy 88

Waukesha Alloy 88 is the standard rotor material for Universal 1, Universal 2, Universal 3, Universal TS, Universal Lobe, Universal 420/520, and 5000 Series Rotary PD pumps. This alloy was developed specifically for corrosion resistance and close operating clearance requirements of high performance rotary positive displacement pumps. Alloy 88 is a nickel based, corrosion-resistant, non-galling or seizing material. The ASTM designation is A494 Grade CY5SnBiM (UNS N26055), and the material is listed in the 3-A Sanitary Standards as acceptable for product contact surfaces.

The corrosion resistance of Alloy 88 is approximately equal to AISI 300 Series Stainless Steel. However, Alloy 88 has limited resistance to certain aggressive chemicals that may be commonly used in contact with AISI 300 Series Stainless Steel.

Do not use Alloy 88 in contact with nitric acid. Nitric acid is commonly used to passivate new installations of stainless steel equipment. Do not allow nitric acid based passivation chemicals to contact Alloy 88 rotors. Remove the rotors during passivation and use a separate pump to circulate the passivation chemicals. Also, if nitric acid-based CIP cleaning chemicals are used, remove the rotors prior to CIP cleaning and clean them separately by hand in a mild detergent. If you have questions regarding other aggressive chemicals, please contact SPX FLOW Application Engineering for assistance.

## Elastomer Seal Replacement Following Passivation

Passivation chemicals can damage product contact areas of this 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.

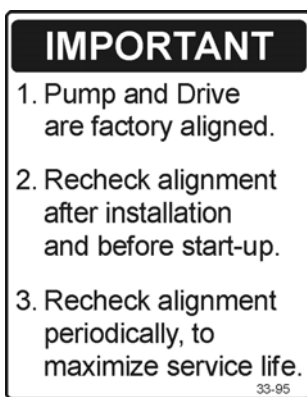
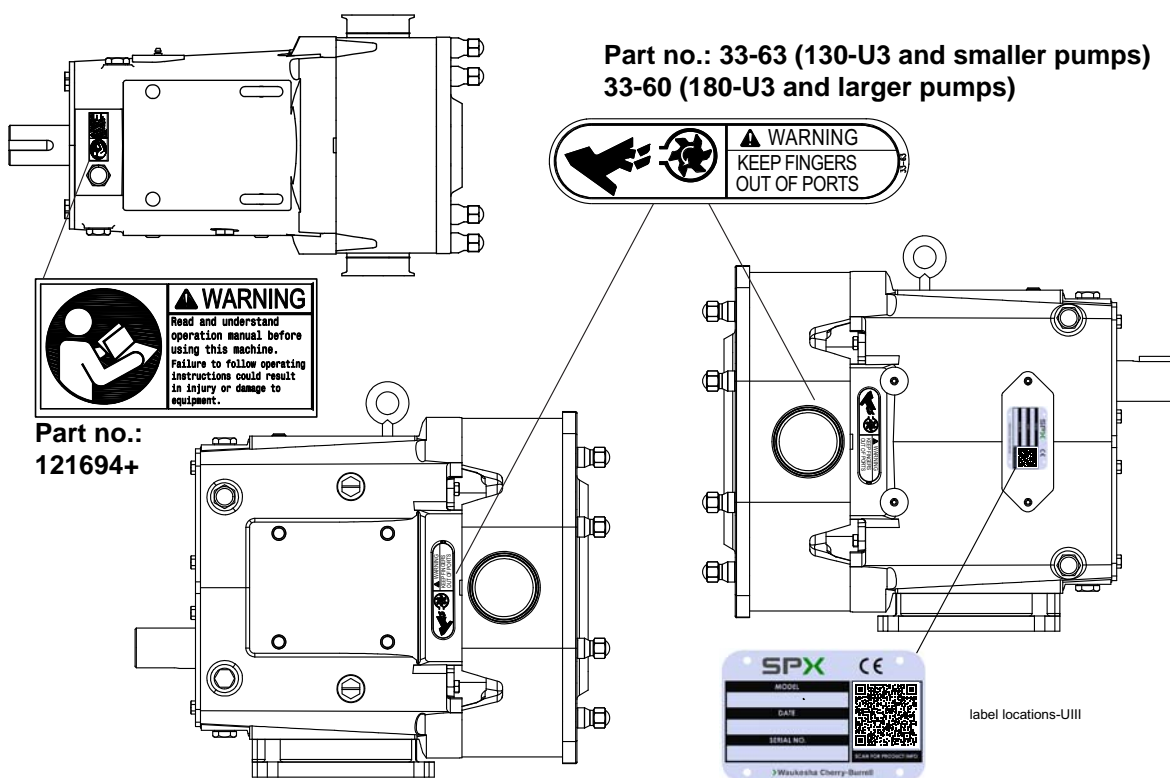
## Replacement Labels

### ⚠ WARNING

The following labels are installed on your equipment. If these labels are removed or become unreadable, contact SPX FLOW customer service at 1-800-252-5200 or 262-728-1900, and refer to the part numbers below for replacement labels. See also items 65 and 66 in the parts list section starting on page 100.

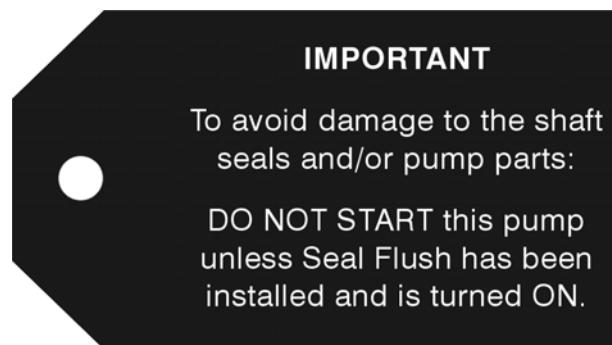
## Application Instructions

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. The labels below are affixed to the pumps as shown.



### Part no: 33-95

This label is supplied on base packages, on the side of the gear case.



### Part no: 112446+

This label is supplied with pumps with double mechanical seals and single mechanical flush. It is attached to the eye bolt.

## Introduction

### Pump Receiving

#### **⚠ 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.*

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

Each standard Waukesha Cherry-Burrell brand pump is shipped completely assembled and lubricated. Review "Operation" on page 24 before operating the pump.

### Intended Use

The Universal 3 Series Rotary Positive Displacement Pump is exclusively intended for pumping liquids, especially in food and beverage installations.

Refrain from using the pump in a manner which exceeds the scope and specifications stated in this manual.

Any use exceeding the margins and specifications set forth is considered to be not intended.

SPX FLOW is not liable for any damage resulting from such activities. The user bears the full risk.

#### **⚠ WARNING**

*Improper use of the pump leads to:*

- damage
- leakage
- destruction
- potential failures in the production process

### Equipment Serial Number

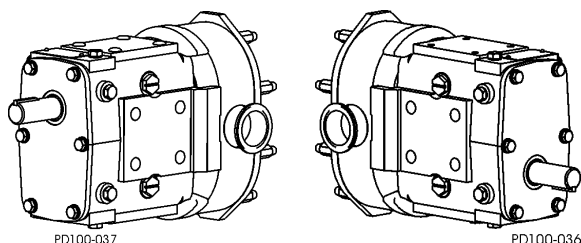
All Waukesha Cherry-Burrell brand pumps are identified by a serial number on the gear case nameplate, which is stamped on the pump body and cover.

#### **⚠ CAUTION**

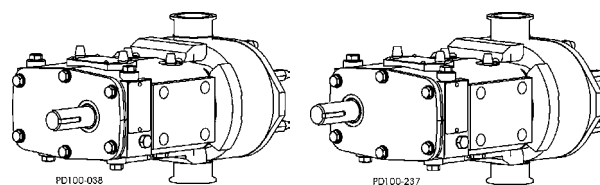
*The gear case, body, and cover must be kept together as a unit due to backface, rotor, and cover clearances. Failure to do so will damage the pump.*

### Pump Shaft Location

There are two pump drive shaft locations:



**Figure 1 - Upper and Lower Shaft Mount**



**Figure 2 - Sidemount Left Hand and Right Hand  
(as viewed from pump cover)**

## Operating Parameters

U3 Model	Nominal Displacement per revolution	Maximum Nominal Capacity	Inlet/Outlet	Optional Inlet/Outlet	Maximum Pressure Range	Max. RPM	Temp Range*
006	.0082 gal (.031 liter)	8 gpm (1.8 m <sup>3</sup> /hr.)	1"	1-1/2"	300 psi (20.7 bar)	1000	LV: -40°F (-40°C) to 180°F (82°C);  Std: -40°F (-40°C) to 300°F (149°C)
015	.0142 gal (.054 liter)	11 gpm (2.5 m <sup>3</sup> /hr.)	1-1/2"	-	250 psi (17.2 bar)	800	
018	.029 gal (.110 liter)	20 gpm (4.5 m <sup>3</sup> /hr.)	1-1/2"	2"	200 psi (13.8 bar)	700	
030	.060 gal (.227 liter)	36 gpm (8.2 m <sup>3</sup> /hr.)	1-1/2"	2"	250 psi (17.2 bar)	600	
040	.076 gal (.288 liter)	46 gpm (1.4 m <sup>3</sup> /hr.)	2"	-	150 psi (10.3 bar)	600	
045	.098 gal (.371 liter)	58 gpm (13.2 m <sup>3</sup> /hr.)	2"	-	450 psi (31.0 bar)	600	
060	.153 gal (.579 liter)	90 gpm (2.4 m <sup>3</sup> /hr.)	2-1/2"	3"	300 psi (20.7 bar)	600	
130	.253 gal (.958 liter)	150 gpm (34.1 m <sup>3</sup> /hr.)	3"	-	200 psi (13.8 bar)	600	
180	.380 gal (1.438 liter)	230 gpm (52.2 m <sup>3</sup> /hr.)	3"	-	450 psi (31.0 bar)	600	
210	.502 gal (1.900 liter)	300 gpm (68.1 m <sup>3</sup> /hr.)	4"	-	500 psi (34.5 bar)	600	
220	.521 gal (1.972 liter)	310 gpm (7.4 m <sup>3</sup> /hr.)	4"	-	300 psi (20.7 bar)	600	
320	.752 gal (2.847 liter)	450 gpm (102 m <sup>3</sup> /hr.)	6"	-	300 psi (20.7 bar)	600	

LV = Low Viscosity Rotors; Std = Standard Clearance Rotors

Other inlet/outlet sizes are available. Contact SPX FLOW Application Engineering.

\* Contact SPX FLOW Application Engineering for higher pressures or higher temperature applications. Pump max temperature is 300°F (149°C).

### **⚠ DANGER**

*Operating the pump outside the stated operating parameters may result in severe personal injury or death.*

**"Low Viscosity" rotors** may be used with liquid temperatures up to 180°F (82°C). However, between 160° (71°C) and 200°F (93°C), consider other application factors such as; speed of operation, differential pressure, lubricating properties of liquid being pumped, and product viscosity. If these factors trend toward a difficult application (high speed, high pressure, non-lubricating) then "Standard" clearance rotors are recommended.

**"Standard" clearance rotors** are recommended for use with liquid temperatures between -40°F (-40°C) and 300°F (149°C). They provide additional clearance in the front face area plus rotor to body areas. Because of this additional clearance there is more slip (inefficiency) with low viscosity liquids, which the pump must overcome with higher operating speed (rpm.) VHP (viscous horsepower) is slightly lower when using standard clearance rotors. Standard clearance rotors are also used when the product viscosity is above 200 CPS.

**"316SS" clearance rotors** are made from 316 stainless steel material (in place of standard non-galling alloy 88) and recommended for use at temperatures up to 200°F (93°C). These rotors provide additional clearance all around (more than Standard clearance alloy 88 rotors) to ensure no running contact between the 316 SS rotors and other 316 SS pump components. Because of this additional clearance, there is more slip (inefficiency) with low viscosity liquids, which the pump must overcome with higher operating speed (rpm.) VHP (viscous horsepower) is slightly lower when using "316SS" clearance rotors.

**NOTE:** Consult SPX FLOW Technical Services for applications near 300°F (149°C) or above 200°F (93°C) with 316SS rotors. For clearance data, see Table 18, "Rotor Clearances," on page 89.

## Certifications

### ***EHEDG***

Only pumps containing the elastomers and seals listed on the EHEDG certificate are EHEDG-certified.

### ***3-A***

See the 3-A website for current certificates: [www.3-a.org/3-A-Symbol/Search-Database-of-Current-Certificates](http://www.3-a.org/3-A-Symbol/Search-Database-of-Current-Certificates).

Certificate Number 29 covers all SPX FLOW Centrifugal and Rotary Pumps. You can search using: Certificate Number 29, Company Name "SPX Flow US, LLC," or Standard Number 02-\_\_\_. The 3-A Standard for fittings is 63-\_\_\_ ("\_\_\_" indicates the current revision.)

Only designs meeting 3-A Standards are 3-A certified.

## Pumps For Life program

Waukesha Cherry-Burrell brand Universal 3 pumps are not designed to be factory remanufactured. In place of a remanufacture program, customers may participate in a pump exchange program. The Universal 3 pump exchange program offers a brand new pump at the traditional remanufactured pump discount as long as the end user has maintained the pump with SPX FLOW genuine parts for all wear parts (seals, shafts, etc.) and returns the original pump to SPX FLOW for inspection and recycling.

Contact your SPX FLOW Customer Service Representative at 1-800-252-5200 or 262-728-1900 and provide the three serial numbers (serial tag, pump body, and cover) of any pump being considered for the pump exchange program.

## Qualification Guidelines for Operating Staff

### **Definitions**

#### ***Operator***

A person who is capable of handling the installation, interior, operation, warnings, cleaning, repair or transportation of the machine.

#### ***Trained person***

A person who is instructed in the tasks given and the possible dangerous situation that may occur. The person is also aware of the protection installations and measures.

#### ***Skilled worker***

A person who based upon his or her background and due to his or her knowledge, is able to perform the tasks, and has an appropriate knowledge of the provisions given.

See Table 1, "Qualification Guidelines for Operating Staff," on page 14.

**Table 1: Qualification Guidelines for Operating Staff**

Phase of Life	Task Example	Prerequisite for the operating staff	
		Trained person	Skilled worker
Transport	Lift	x	
	Loading	x	
	Unloading	x	
Assembly and Installation/ Commissioning	Assembly/fastening of the machine		x
	Connection to the electric grid		x
	Filling of lubricant to drive motors	x	
Operation	Startup	x	
	Controlling	x	
	Surveillance	x	
	Shutdown	x	
Cleaning, Maintenance	Cleaning	x	
	Refilling of lubricants	x	
	Disconnection from energy supply	x	
	Assembly/Disassembly of parts	x	
Troubleshooting	Disconnection from energy supply	x	
	Troubleshooting	x	
	Assembly/Disassembly of parts	x	
	Repair	x	
Dismounting/Unplugging from plant	Removal of energy supply	x	
	Dismount		x
	Lift		x
	Loading		x
	Unloading		x

## Installation

### Important Safety Information

#### **⚠ 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 and the pump is de-pressurized.

#### **⚠ WARNING**

The pump components and piping may contain sharp edges. Handle the rotors carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.

#### **⚠ CAUTION**

Maintenance should be performed only by trained personnel. See "Qualification Guidelines for Operating Staff" on page 13.

### Lifting



**Figure 3 - Lifting location**

#### **⚠ CAUTION**

When moving the pump, use appropriate lifting devices. Always use securely fitted lifting straps/chains when lifting with a crane or similar lifting gear.

#### **⚠ DANGER**

Do not stand underneath the pump while it is being lifted.

As shown in Figure 3, attach lifting straps/chains to the two eye bolts on the top of the gear case.

Table 2: Pump Weights (less motor or base)			
U3 Model	Weight, lb (kg)	U3 Model	Weight, lb (kg)
006	60 (27)	060	290 (132)
015	62 (28)	130	310 (141)
018	65 (29)	180	498 (226)
030	114 (52)	210	510 (231)
040	117 (53)	220	748 (339)
045	284 (129)	320	817 (371)

#### **⚠ CAUTION**

To lift the cover on a 210 or 320-U3, attach an eye bolt to the threaded hole in the cover and attach lifting straps or chains to the eye bolt.

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.

To lift the gear case assembly on pumps larger than 018-U3, attach lifting straps/chains to the two eye bolts on the top of the gear case.

For Unit orders (a pump and motor mounted on a common baseplate (not pictured)), use straps to lift the unit by the baseframe at either end. Do not lift by the eye bolts on the pump or motor. Due to the wide range of pump sizes and motors, SPX FLOW cannot give lifting instructions here for all configurations. Contact SPX FLOW or an authorized lifting expert if questions arise.



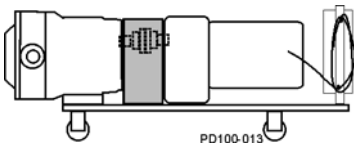
## Install Pump and Drive Unit

### ⚠ CAUTION

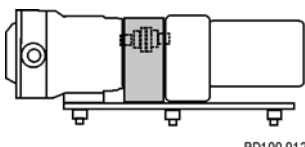
Install the pump and piping system in accordance with local codes and restrictions. Practices described in this manual are recommended for optimum performance.

### ⚠ CAUTION

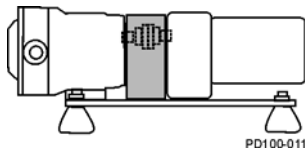
The motor must be installed by qualified personnel, e.g., a licensed electrician.



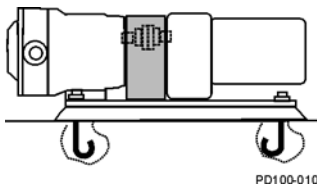
**Figure 4 - Portable Base**



**Figure 5 - Adjustable Leg Base**



**Figure 6 - Leveling and/or Vibration Isolation Pads**



**Figure 7 - Permanent Installation on Foundation**

All system equipment, such as motors, sheaves, drive couplings, speed reducers, etc., must be properly sized to ensure satisfactory operation of your Waukesha Cherry-Burrell brand pump within its limits. Customer-supplied motors should have a basic level of safety to prevent electrical hazards, and should be dealt with in accordance with the manufacturer's instructions.

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.

**NOTE:** The gap between the pump body and gearcase is required for 3-A sanitary standards.

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

The shaded area in Figure 4 through Figure 7 indicates the guard location.

See "Pump Shaft Guards" on page 99.

### ⚠ WARNING

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

Guards are provided as part of a complete pump and drive package and are selected by SPX FLOW Engineering for the pump, base, and motor ordered. Do not modify the guard provided by SPX FLOW. If the guard provided by SPX FLOW is lost, contact SPX FLOW Customer Service and provide your order number or PO number of the pump to order a correctly-sized replacement guard.

If the pump was not purchased as a unit, it is the responsibility of the customer to ensure proper guarding. Refer to your local regulations for guidance.

## Install Connections and Piping

### ⚠ CAUTION

These pumps are positive displacement 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.

### 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.

### ⚠ WARNING

Do not exceed 50 lb (22.7 kg) load on pump inlet or discharge ports. Exceeding this limit may cause damage to the pump.

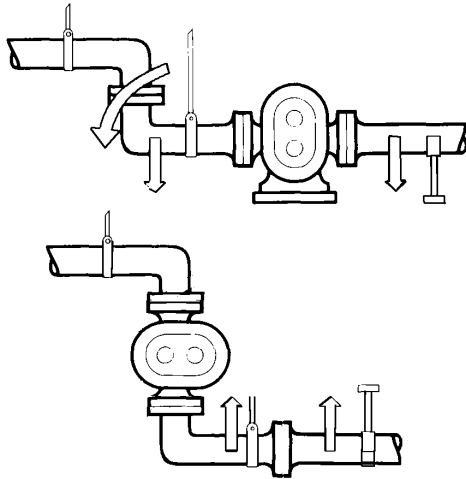


Figure 8 - Piping Support

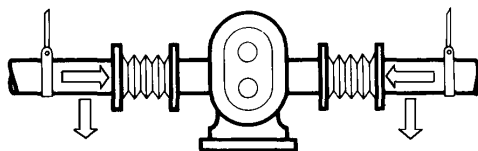


Figure 9 - Flexible Connections and Supports

### Expansion Joints

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.

### Inlet Piping

Install the pump below the supply liquid level to reduce the air in the system by flooded suction, to prevent the pump from becoming air-bound (Figure 10).

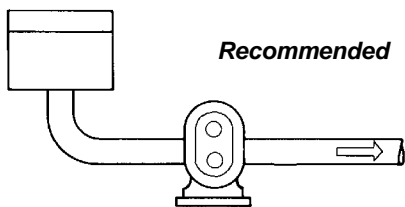


Figure 10 - Pump Below Supply

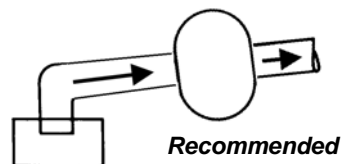
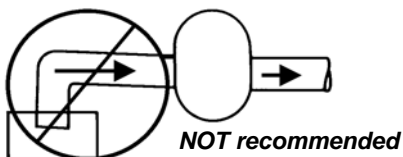
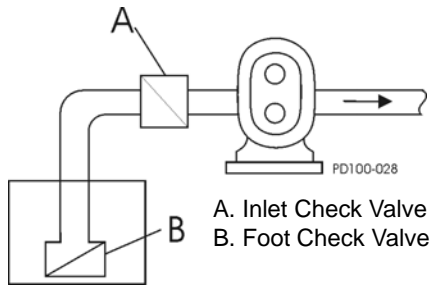


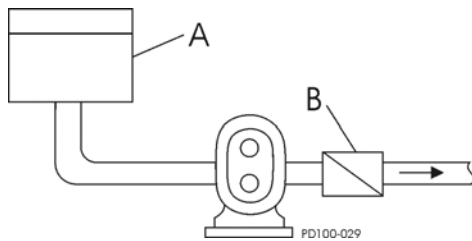
Figure 11 - Piping Slope

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

## Install Check Valves



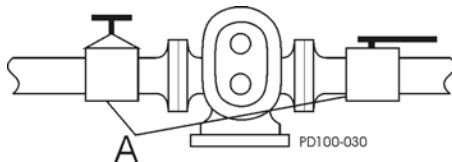
**Figure 12 - Inlet Check Valve**



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

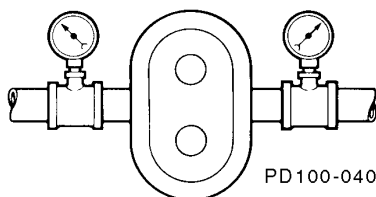
**Figure 13 - Discharge Check Valve**

## Install Isolation Valves



**Figure 14 - Isolation Valves**

## Install Pressure Gauges



**Figure 15 - Pressure and Vacuum Gauges**

## Inlet Side on Lift Applications

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

## Discharge Side

For systems with liquid under a vacuum, install a check valve on the discharge side of the pump. The check valve prevents back-flow (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).

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

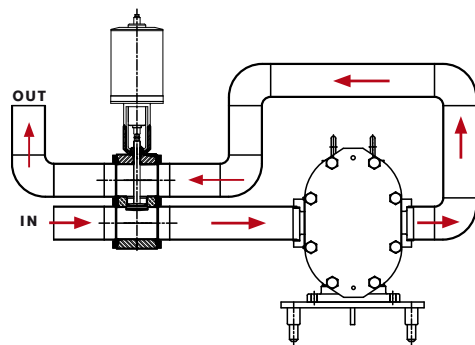
**NOTE:** Make sure the inlet flow is not restricted. Don't start the pump deadheaded, e.g., operated with no flow through it.

Pressure and vacuum gauges provide valuable information about pump operation (Figure 15). Wherever possible, install the gauges to help provide information on the following:

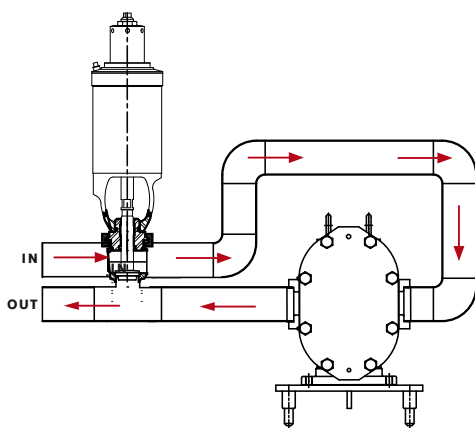
- Normal or abnormal pressures
- Indication of flow
- Changes in pump condition
- Changes in system conditions
- Changes in fluid viscosity

## Install Relief Valves

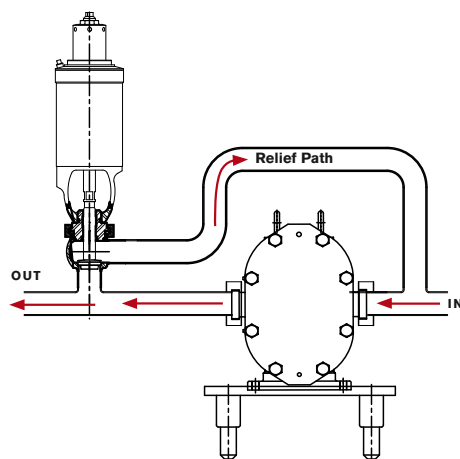
Install relief valves to protect the pump and piping system against excessive pressure. SPX FLOW recommends installing an external relief valve designed to bypass fluid from the pump outlet to the inlet side of the system (See Figure 16, Figure 17, and Figure 18).



**Figure 16 - WR63 Reverse-Acting Over-Pressure Relief Valve**

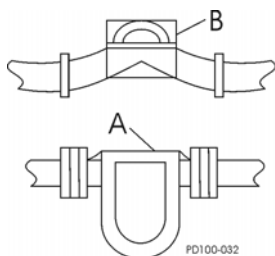


**Figure 17 - WR61C Air-to-Raise Valve with Adjustable-Spring Actuator**



**Figure 18 - WR61T 4RHAR Valve**

## Inlet Side Strainers and Traps



A. Strainer B. Magnetic Trap

**Figure 19 - Inline Strainers and Traps**

## CIP (Clean-In-Place) Design

### ⚠ CAUTION

*In order to avoid temperature shock after the introduction of hot CIP fluid, stop the pump before filling the pumphead with hot CIP fluid. Once the hot CIP fluid has filled the pumphead, allow up to 15 minutes for the pump fluid components to thermally expand, then re-start the pump.*

Inlet side strainers and traps (Figure 19, items A and B, respectively) can be used to prevent foreign matter from damaging the pump.

Select carefully to prevent cavitation caused by the restriction of the inlet. If inlet strainers are used, they must be serviced regularly to prevent clogging and flow stoppage.

The design of the Universal 3 provides complete access of the CIP solution to all product contact surfaces:

- The flat body profile (minimum requirement for standard CIP installations) allows complete draining of the side-mounted pump, and provides the CIP solution access to the entire profiled cover gasket groove.
- Flats on the rotor hubs provide solution access to the cover hub/shaft seal areas for difficult cleaning applications.

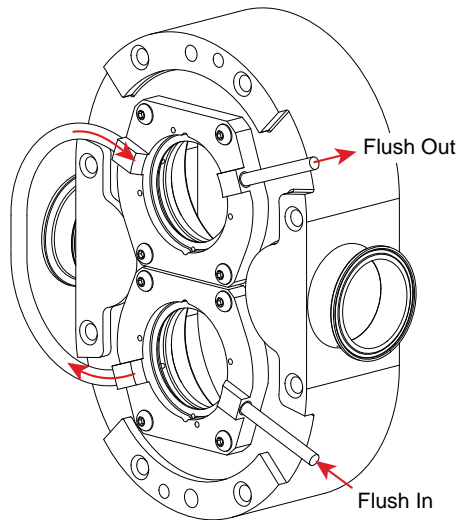
## Guidelines

Use the following guidelines when designing and installing the CIP system to ensure successful cleaning:

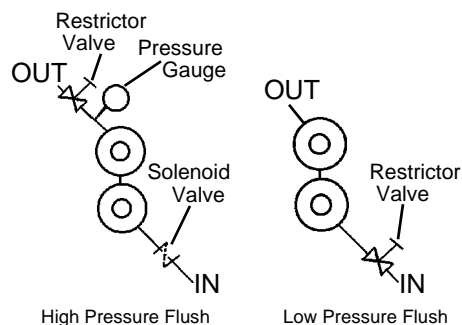
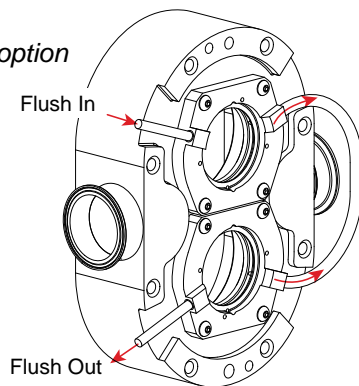
- Ensure that the velocity rate of CIP solutions is adequate to clean the entire circuit. For most applications, a velocity of 5 ft/sec is sufficient. For the CIP solution to achieve the proper velocity, the pump drive must have enough speed range and horsepower. The required inlet pressure also must 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 SPX FLOW Application Engineering.
- Make sure 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. 30 psi (2 bar) is the minimum required differential pressure for most applications. For difficult cleaning applications, higher pressure or longer cleaning cycles may be required.
- 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.

*Make sure to jog the rotors during draining to ensure that all fluid drains from the seal area.*

## Seal Flush Connections



*Flush option*



**Figure 20 - Flush Piping Setup**

Pumps with double seals require flushing.

The flush media (water or lubricating fluid compatible with the product) must be connected and flowing whenever the pump is operated.

### **⚠ WARNING**

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

### **⚠ CAUTION**

*Check for buildup or restrictions (kinking) in the flush lines or fittings at regular intervals. SPX FLOW recommends using clear (transparent) flush lines for easier observation.*

Two 1/8-inch female pipe thread (NPT) flush connections are located in the seal housing pieces.

1. Connect the flush inlet to the lower connection, and the outlet to the upper connection, to flood the flush area completely. Alternately, connect the flush inlet to the upper connection, and the outlet to the lower connection. See "Flush option" in Figure 20.

2. Connect the flush outlet for unrestricted flow to the drain.

**NOTE:** *If steam is used as a flush media, connect the inlet at the upper connection, and the outlet at the lower connection to ensure condensation removal.*

*If steam condensate is used as a flush media, connect the inlet at the lower connection, and the outlet at the upper connection.*

3. Use cool, filtered flush media to obtain maximum service life of the seal components. If the pumped product is sticky or solidifies at room temperature, use warm or hot flush 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 220 psi (15 bar). The required flow rate is 0.5-0.8 gpm (1.9-3.0 l/m).

**NOTE:** *The difference between the product-side pressure and the flushing pressure must not exceed 102 psi (7 bar).*

5. Also install a solenoid valve in the flush supply and wire it in series with the motor starter to provide an automatic start/stop of the flush media flow before the motor turns on and after the motor turns off.

## Check Coupling Alignment



Figure 21 - Lovejoy Coupling



Figure 22 - T.B. Woods® Coupling

Pumps and drives ordered from the factory and mounted on a common base plate are aligned before shipment. Alignment **must** be re-checked after the complete unit has been installed and piping completed. Periodic re-checking is advisable during the pump service life.

- SPX FLOW recommends using a flexible coupling to connect the drive to the pump. Several different types are available, including couplings with slip or overload provisions. SPX FLOW provides Lovejoy (Figure 21) or T.B. Woods® (Figure 22) couplings unless otherwise specified when ordering. 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:
  - Pump and Drive are factory aligned.
  - Re-check alignment after installation and before start-up.
  - Re-check alignment periodically, to maximize service life.

## Check Angular Alignment

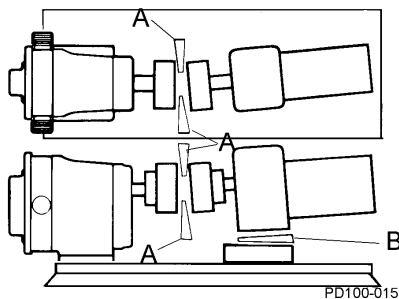


Figure 23 - Check Angular Alignment

1. Using feeler gauges or taper gauges (Figure 23, 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.

## Check Parallel Alignment

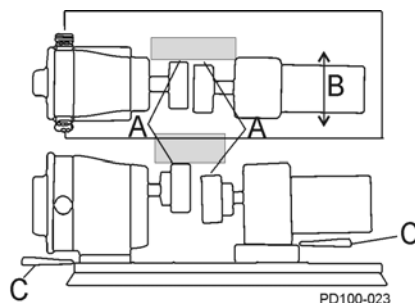
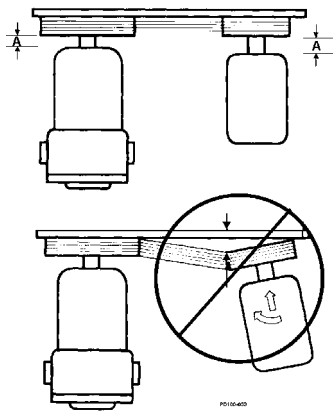


Figure 24 - Check Parallel Alignment

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 24, determine the direction and amount of movement needed (Figure 24, item B).
3. If necessary, shim at location "C" and/or move drive as needed.



## Check Belt and Chain Drive Alignment



**Figure 25 - Aligning Belt and Chain Drives**

Use a straight edge to visually check the belt or chain alignment. Keep the shaft distance to a minimum (Figure 25, item A).

After the piping is complete and before the belts are installed, manually turn the pump shaft to ensure it turns freely.

## Check Pump Rotation

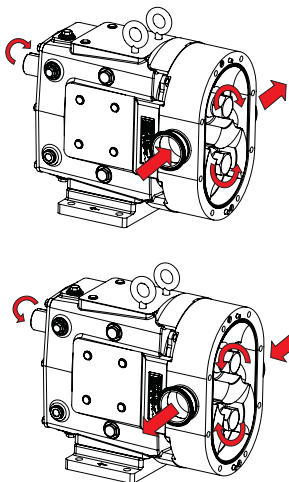
Check the direction of the drive rotation to determine the rotation direction of pump (Figure 26). After the correct drive rotation is verified, connect the coupling and assemble the pump and coupling guards.

**NOTE:** The pump is bidirectional.

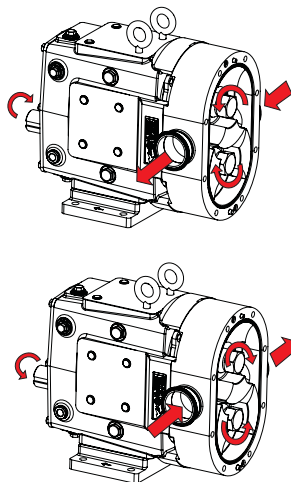
### ⚠ CAUTION

The pump covers in the figures below have been removed to view the rotor rotation. Never operate the pump with the covers removed.

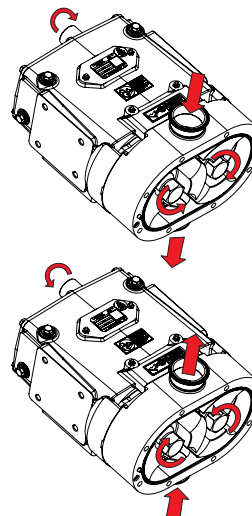
**Upper Shaft Drive Flow,  
Horizontal Porting,  
Vertical mount**



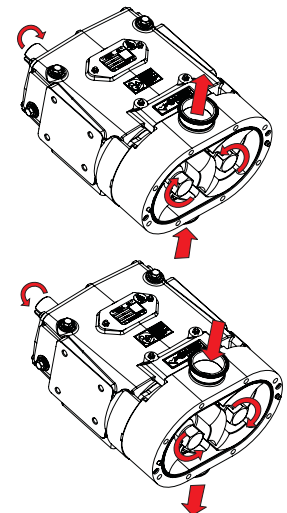
**Lower Shaft Drive Flow,  
Horizontal Porting,  
Vertical mount**



**Upper Shaft Drive  
Flow, Vertical Porting,  
Horizontal mount**



**Lower Shaft Drive  
Flow, Vertical Porting,  
Horizontal mount**



**Figure 26 - Pump Rotation (Liquid End Shown)**

## Operation

### Important Safety Information

**⚠ 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 and the pump is de-pressurized.*

**⚠ WARNING**

*Handle the pump components carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*

**⚠ CAUTION**

*Maintenance should be performed only by trained personnel. See “Qualification Guidelines for Operating Staff” on page 13.*

**⚠ 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.*

### Pre-Startup Checklist

**⚠ CAUTION**

*The motor must be installed by qualified personnel, e.g., a licensed electrician.*

**⚠ CAUTION**

*Consult the motor or VFD manufacturer's manual for setup, operation, disassembly, and troubleshooting of the motor or VFD, or contact the manufacturer.*

**⚠ 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, to prevent debris from being trapped between the rotors and the pump body. This debris may damage the pump upon startup.***

**⚠ WARNING**

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

1. Ensure that the pump is correctly installed as described in “Installation” on page 15. Review “Install Relief Valves” on page 19 and install relief valves as needed.
2. Check the coupling alignment. See “Check Coupling Alignment” on page 22.
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” on page 27.
6. Ensure that all valves are open on the discharge side and a free flow path is open to the destination.
7. Ensure that all guards are in place and secure.

**⚠ CAUTION**

*Full guards must be installed to isolate the operators and maintenance personnel from the rotating components. Guards are provided as part of a complete pump and drive package. See page 16 and page 99.*

8. Double mechanical seals require adequate supply and flow of clean flushing fluids.
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" on page 23.

## Starting the Pump

### **⚠ WARNING**

*Keep a safe distance (1.6 ft/.5 m) away from the pump during startup.*

### **⚠ CAUTION**

*The motor must be installed by qualified personnel, e.g., a licensed electrician.*

### **⚠ WARNING**

*In order to avoid temperature shock after the introduction of hot or cold product, stop the pump before filling the pumphead with product. Once the product has filled the pumphead, allow up to 15 minutes for the pump's fluid components to thermally adjust, then re-start the pump.*

1. Start the pump drive. Where possible, start at a slow speed or jog.
2. For sanitary applications, sanitize the pump per customer requirements before putting the pump into service.
3. Check to make sure that the liquid is reaching the pump. If pumping does not begin and stabilize, check "Troubleshooting" on page 92.

## Stopping the Pump

### **⚠ WARNING**

*Keep a safe distance (1.6 ft/.5 m) away from the pump during shutdown.*

### **⚠ CAUTION**

*The motor must be installed by qualified personnel, e.g., a licensed electrician.*

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

## Maintenance

### Important Safety Information

**⚠ 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 and the pump is de-pressurized. Shut off and drain product from the pump prior to disconnecting the piping.*

**⚠ WARNING**

*The pump components and piping may contain sharp edges. Handle the rotors carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*

**⚠ WARNING**

*Never touch the gear case during operation. The surface temperature may exceed 110°F (43°C). The pump cover and body may be cold or hot depending on the product (CIP at 190°F (88°C) or 300°F (149°C) product, for example).*

**⚠ CAUTION**

*Maintenance should be performed only by trained personnel. See “Qualification Guidelines for Operating Staff” on page 13.*

**⚠ CAUTION**

*Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.*

**⚠ CAUTION**

*Make sure to keep the work area clear of machine parts, tools, product lines, foreign materials, and power cables to avoid potential hazards.*

**⚠ CAUTION**

*Make sure appropriate lighting is available: at least 1000 lux, independent of daylight and weather conditions.*

**⚠ CAUTION**

*Before carrying out any maintenance and repair work on cold components, ensure that the machine parts in question are sufficiently heated. The contact temperature of accessible machine parts must not be lower than those in the EN ISO 13732-1.*

**⚠ CAUTION**

*To lift the cover on a 210 or 320-U3, attach an eye bolt to the threaded hole in the cover and attach lifting straps or chains to the eye bolt.*

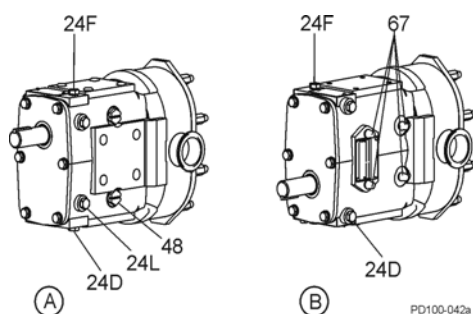
*To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.*

*To lift the gear case assembly on pumps larger than 018-U3, attach lifting straps/chains to the two eye bolts on the top of the gear case.*

Before detaching port connections to the pump:

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

## Lubrication



**Figure 27 - Lubrication Points**

- A. Upper Shaft Drive Pump (Standard)  
 B. Lower Shaft Drive Pump (Optional)  
 24D. Oil Drain Plug  
 24F. Oil Fill Plug  
 24L. Oil Level Check Plug, Sight glass  
 48. Grease Clean-out Plug  
 67. Grease Fittings

### Gear Oil Specification

Standard: ISO Grade 320, SAE 140 or AGMA Number 6EP, part no. 118402+.  
 Food-grade: part no. 000140003+.

### Bearing Lubricant Grease

Standard: NLGI Grade No. 2, EP, Lithium-based lubricant, part no. 118401+.  
 Food-grade: part no. 000140002+.

## Drive Lubrication

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

## Gears

Gears are factory-lubricated with gear oil at the quantity shown in Table 3 on page 27. **Change the oil every 750 hours.** Aggressive washdown or extreme running conditions may require more frequent lubrication intervals.

When the pump is not running, the gear oil level is correct when the oil level is visible in the sight glass. Check the oil level regularly.

When the pump is running, the oil level may be difficult to see and may appear cloudy.

Universal 3 pumps are shipped with the oil level at or slightly above the sight glass.

## Bearings

Bearings are factory-lubricated with grease. Re-lubricate them at the quantity shown in Table 3 on page 27. **Grease the bearings every 750 hours.** Aggressive washdown or extreme running conditions may require more frequent lubrication intervals.

Excess grease will accumulate in the gear case and must be removed through the cleanout hole covered with a plastic plug (Figure 27, item 48). Check the cleanout plugs for any collection of gear oil.

Best practice is to clean out this area every time you grease the pump. Water can accumulate in the gearcase from condensation or from aggressive washdown. If water is found in the gearcase, clean out this area more frequently.

**Table 3: Lubrication Quantities**

Universal 3 Model	Oil Capacity (Gears)		Grease Quantity (per Bearing)	
	Top or Bottom	Side Mount	Front	Rear
006, 015, 018	1.3 oz (40 ml)	3.3 oz (100 ml)	.37 oz (11 ml)	.13 oz (4 ml)
030, 040	2.0 oz (60 ml)	4 oz (120 ml)	.60 oz (18 ml)	.21 oz (6 ml)
045, 060, 130	6.0 oz (170 ml)	9.5 oz (280 ml)	.84 oz (25 ml)	.76 oz (22 ml)
180, 220	11 oz (320 ml)	20 oz (600 ml)	1.33 oz (39 ml)	1.03 oz (30 ml)
210, 320	17 oz (500 ml)	44 oz (1300 ml)	1.96 oz (58 ml)	1.16 oz (34 ml)

## Maintenance Inspections

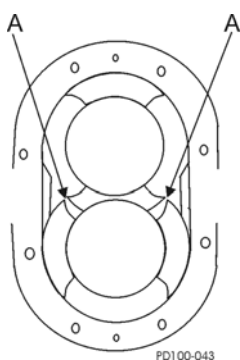
### **⚠ DANGER**

*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 and the pump is de-pressurized. Shut off and drain product from the pump prior to disconnecting the piping.*

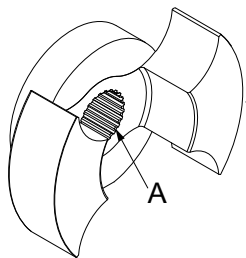
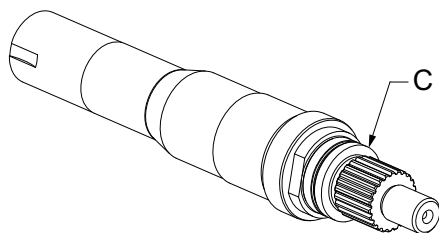
Detecting wear in the early stages can reduce repair costs and down time. A simple “look-feel” inspection of the pump during breakdown cleaning is recommended to detect signs of trouble at an early stage.

A detailed maintenance inspection should be scheduled annually. See “Annual Maintenance” on page 29.

Refer to the “Maintenance Inspection Chart” on page 30 for possible causes and solutions to common issues discovered during inspection.



**Figure 28 - Rotor to Rotor Tip Clearance**



**Figure 29 - Shaft and Rotor Inspection**

### Inspection of Rotor Tips

Remove the cover (see “Remove Cover” on page 32) and check for metal-to-metal contact between the rotor wings. When contact is detected, repair or replace the pump.

Visually inspect the rotors for rotor tip to rotor tip contact and rotor tip to rotor hub contact. Manually rotate the pump drive shaft and ensure that the rotor tip clearance is equal on both sides as indicated in Figure 28.

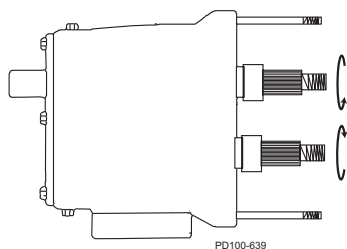
### Inspection of Shaft and Shaft Shoulder

Visually inspect the shaft for twists or bends; replace it as necessary. Visually inspect the shaft shoulder (Figure 29, item C) for excessive wear; 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.

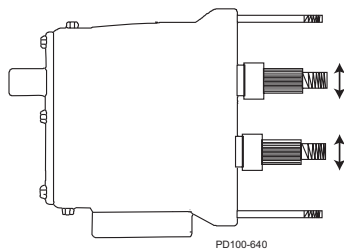
### Inspection of Rotor

Visually inspect the rotors for worn splines (Figure 29, item A) and hub wear at the rotor stress points (see arrows in Figure 33 on page 29). Each time the rotors are removed, replace the product side seal O-rings.

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



**Figure 30 - Backlash Check**



**Figure 31 - Bearing Deflection Check**

## Annual Maintenance

### Inspection of Gears and Bearings

#### **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. Also check the shaft movement forward or backward. If the bearing is failing, replace the bearing and review the lubrication section starting on page 27.

#### **⚠ DANGER**

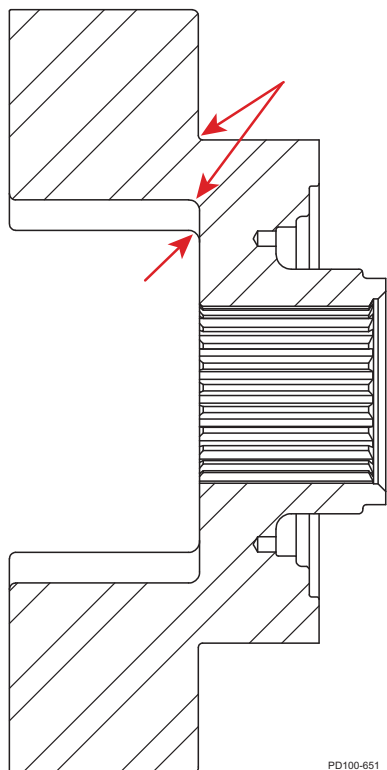
*The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized. Shut off and drain product from the pump prior to disconnecting the piping.*

At least annually, perform the procedures and corrective measures outlined in "Maintenance Inspections" on page 28, in addition to the following preventive maintenance:

- Check the bearings with a dial indicator for shaft radial play. If the deflection is equal to or greater than the rotor-to-body diametrical clearance (see "Checking for Proper Clearance" on page 88), replace the bearings.
- Remove the gear case cover and inspect the gears for wear, backlash and looseness. Loosen and torque the gear retaining nuts to the proper torque.
- Thoroughly inspect the rotors for worn splines, hub wear and stress cracks (see arrows in Figure 32). Use the dye check method to detect any fatigue-type cracks at rotor stress points.
- Review the performance record on the pump, and check the radial and backface clearances to determine wear and effect on performance. Adjustment to the operating speed can compensate for wear in some applications.

#### **⚠ CAUTION**

*When bearings or shafts are replaced in the field, take care to correctly position the shaft by shimming it to maintain sufficient running clearances between the rotor wing faces and the pump body faces (backface and cover face). It is important to hold the same backface dimension for both rotors, within 0.0005" (0.0127 mm), to avoid crossover interference.*



**Figure 32 - Rotor Stress Points**



## Maintenance Inspection Chart

Problem	Possible Causes	Possible Solutions
Rotor tip to rotor tip contact or uneven rotor tip to rotor tip clearance.	Hard object jammed into rotors and twisted shafts. Worn gear teeth. Worn gear keyway.	Replace shafts. Install strainers if necessary. Check and replace gears if necessary.
Rotor tip to rotor hub contact.	Loose rotor nut(s). Backface clearances not even. Bearings need replacing.	Torque rotor nut(s) properly. Verify backface clearances are even. Check and replace bearings.
Rotor-to-body or rotor-to-cover contact	Loose rotor nut(s) Excessive hydraulic loads Incorrect front face/backface clearances Bearings need replacing.	Torque rotor nut(s) properly. Review pressure rating on page 12. Verify front face/backface clearances are within the values listed on page 89. Check and replace bearings.
Worn rotor or shaft splines.	Loose rotor nut(s).	Replace rotors and shafts. Torque rotor nut(s). See "Torque Values" on page 91.
Worn rotor hub end or shaft shoulder.	Loose rotor nut(s). Rotors slammed against shoulder when installed.	Torque rotor nut(s). See "Torque Values" on page 91. Replace rotors and shafts or shim front bearing(s) to maintain proper backface clearances.
Sharp edged shaft shoulder.	Loose rotor nut(s). Rotors slammed against shoulder when installed. Backface clearances not even.	Torque rotor nut(s). See "Torque Values" on page 91. Remove sharp edge with file to prevent cutting shaft O-ring. Verify backface clearances are even.
Gear backlash.	Lack of lubrication. Excessive hydraulic loads. Loose gear locknuts. Worn gear teeth.	Check lubrication level and frequency. Reduce hydraulic loads. Torque locknuts to specified torque values. See "Torque Values" on page 91. Check and replace gears if necessary.
Worn or broken gear teeth.	Lack of lubrication. Excessive hydraulic loads. Loose gear locknuts.	Check lubrication level and frequency. Reduce hydraulic loads. Torque locknuts to specified torque values. See "Torque Values" on page 91. Check and replace gears if necessary.
Loose gears.	Gear locknuts not torqued properly. Locking assembly not torqued properly. Worn gear key.	Torque gear nut to specified torque value. See "Torque Values" on page 91. Check and replace gears if necessary. Inspect gear key, shaft keyway and shaft, replace if necessary.
Loose bearings, axially or radially.	Lack of lubrication. Excessive hydraulic loads. Product or water contamination.	Check lubrication level and frequency. Reduce hydraulic loads. Ensure no excess grease build-up. Replace bearings if necessary.
Damaged front grease seals.	Seal may be old and worn. No grease on lips to lubricate. Shaft worn under seals. Worn bearings.	Replace seals. Properly lubricate with grease when installing. Inspect shaft surface under seals. Replace bearings.
Damaged rear oil seals.	Seal may be old and worn. No grease on lips to lubricate. Shaft worn under seals. Not centered on shaft when installed. Worn bearings.	Replace seals. Properly lubricate with grease when installing. Inspect shaft surface under seals. Replace bearings.

## Cleaning

Determine the pump cleaning schedule on-site for materials being processed and plant maintenance schedule.

To disassemble the fluid head, see “Fluid Head Disassembly - Cover and Rotors” on page 32. Remove and clean the cover O-ring, pump seals, and the rotor nut assembly. Inspect and replace them as necessary.

**NOTE:** *Always replace the rotor nut O-rings and product-side seal O-rings when reassembling the pump. If the area behind these seals becomes soiled, contact SPX FLOW Application Engineering for a specific cleaning and sanitizing procedure validated to remove bacteria. If a chlorine solution (200 ppm available chlorine) is used, it should leave no residual deposits which would remain in the pump.*

### CAUTION

*Acid cleaners have a much higher metal corrosion rate and pump parts should remain in acid cleaning solutions no longer than necessary. Any strong inorganic mineral-based acids that are harmful to your hands would be harmful to pump parts. See “Stainless Steel Corrosion” on page 9.*

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. See “CIP (Clean-In-Place) Design” on page 20.

## Fluid Head Disassembly - Cover and Rotors

**NOTE:** SPX FLOW recommends replacing elastomers every time the pump is serviced.

**Table 4: Cover Nuts Wrench Size**

Model U3	Wrench Size
006, 015, 018, 030, 040	5/8"
045, 060, 130, 180, 220	7/8"
210, 320	1"



**Figure 33 - Remove cover**



**Figure 34 - Remove cover gasket**

### **⚠ 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 and the pump is de-pressurized. Shut off and drain product from the pump prior to disconnecting the piping.

### **⚠ WARNING**

The pump components and piping may contain sharp edges. Handle the rotors carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.

### **⚠ CAUTION**

Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.

## Remove Cover

1. Remove the cover nuts from the cover. Using a soft hammer, tap the cover off the body studs and dowel pins.
2. Place the cover on a protected surface with the finished surfaces facing up.

### **⚠ CAUTION**

To lift the cover on a 210 or 320-U3, attach an eye bolt to the threaded hole in the cover and attach lifting straps or chains to the eye bolt.

3. Remove and inspect the cover gasket.



**Figure 35 - Remove Rotor Nut**

**Table 5: Rotor Nut Wrench Size and Socket Tool**

U3 Model	Wrench Size	Socket Tool
006, 015, 018	15/16"	126533+
030, 040	1-1/4"	139795+
045, 060, 130	1-5/8"	139796+
180, 220	2-1/4"	139797+
210, 320	2-3/8"	126536+



**Figure 36 - Remove O-ring**



**Figure 37 - Remove rotor**

## Remove Rotor Nuts

1. Use the rotor blocking tool (part number 139794+) to keep the rotors from turning when removing the rotor nuts.

**NOTE:** When working on a rotor, always block the rotor against the body, not against the other rotor. See Figure 35.

**NOTE:** SPX FLOW recommends using the Non-Marring Socket Tool for Rotor Nuts to protect the rotor nut. See Table 5 and page 126.

2. Remove the rotor nuts.

3. Remove the rotor nut O-rings from each rotor nut.

**NOTE:** Discard the O-rings from the rotor nut; these are intended for one-time use only.

## Remove Rotors

### ⚠ WARNING

The pump components and piping may contain sharp edges. Handle the rotors carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.

Remove the rotors by hand. Place the rotors on a protected surface to prevent damage to close-tolerance parts.

**NOTE:** Mechanical seal is shown in Figure 37.

For mechanical seals, continue.

📖 For O-ring seals, skip to page 65.

## Single and Double Mechanical Seal

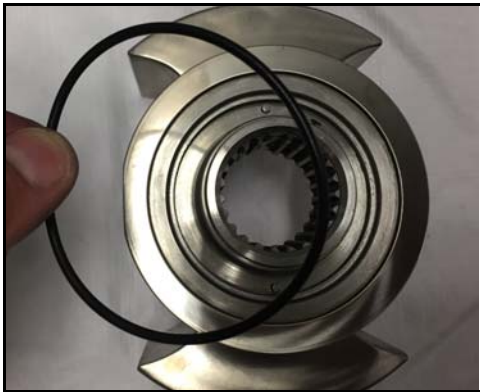
### Remove Product-Side Rotary and Stationary Seal

1. Remove the rotary seal from the rotor.



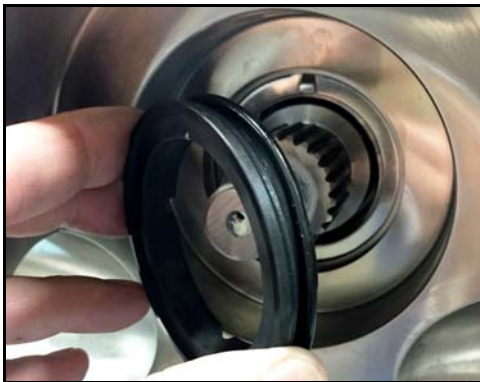
**Figure 38 - Remove rotary seal**

2. Remove the rotary seal O-ring from the rotor.



**Figure 39 - Remove seal O-ring**

3. Remove the stationary seal from the pump body.



**Figure 40 - Remove stationary seal**

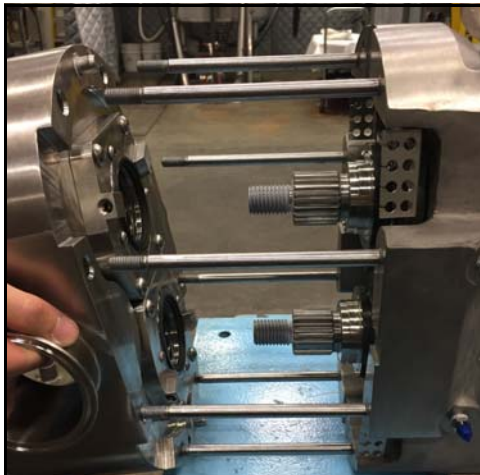




**Figure 41 - Stationary Seal O-ring**



**Figure 42 - Remove body retaining screws**



**Figure 43 - Remove pump body**

4. Remove the stationary seal O-ring from the stationary seal.

**NOTE:** The O-ring usually comes off with the seal in step 3.



The product-side seals and O-rings in a U3 mechanical seal can be replaced without removing the pump body. To replace or service these components only, skip to "Install Product-Side Rotary and Stationary Seal" on page 62.

## Remove Pump Body

1. Remove the two body retaining cap screws.

**Table 6: Body Retaining Screws Wrench Size**

Model	Wrench Size
006, 015, 018, 030, 040	3/16"
045, 060, 130	1/4"
180, 220, 210, 320	5/16"

2. Remove the body from the gear case. If needed, use a plastic mallet to tap the body away from the gear case, until the dowel pins are dislodged from the bushings.
3. Slide the body straight off the body studs to prevent damaging the mechanical seal parts.

### **⚠ CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.

4. Place the body on a protected surface with the seals facing up to protect the seals.

**NOTE:** For single mechanical seal, continue. For double mechanical seal, see page 43.

## Single Mechanical Seal

### Remove Seal Components

**NOTE:** For double mechanical seal, see page 43.

1. Remove the seal housing bolts.



**Figure 44 - Remove seal housing bolts**



**Figure 45 - Remove seal housing**

2. Remove the seal housing. Figure 45 shows the design for 130-U3 and smaller sizes. See Figure 46 for 180-U3 and larger sizes.



**Figure 46 - Remove seal housing**

3. Figure 46 shows the design for 180-U3 and larger sizes. See Figure 45 for 130-U3 and smaller sizes.





**Figure 47 - Remove wave spring**

4. Remove the wave spring (040-U3 pictured).



**Figure 48 - Remove drive ring**

5. Remove the drive ring (040-U3 pictured).



**Figure 49 - Remove shaft ring**

6. 130-U3 and smaller pumps only: Remove the shaft ring.  
(180-U3 and larger sizes do not have a shaft ring.)

**NOTE:** To assemble a single mechanical seal for 130-U3 and smaller pumps, continue. For 180-U3 and larger pumps, see page 41.

**NOTE:** SPX FLOW recommends replacing elastomers every time the pump is serviced.



**Figure 50 - Single Mechanical Seal (040-U3 shown)**



**Figure 51 - Install shaft ring**



**Figure 52 - Ring installed**

### 130-U3 and smaller pumps: Install Seal Components (single mechanical seal)

**NOTE:** For single mechanical seal on 180-U3 and larger pumps, see page 41. For double mechanical seal, see page 43.

1. Lay out the required parts for each seal (040-U3 shown).

**⚠ CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.

2. Install the shaft ring with the notch openings facing toward you as shown in Figure 51.

**NOTE:** Make sure the notch openings in the shaft ring are perpendicular to the ports, and in line with the bores. See Figure 57 on page 40.

3. Figure 52 shows the shaft ring installed.



**Figure 53 - Install drive ring**

4. Install the drive ring with the tab protrusions facing the pump body.

**NOTE:** The side of the drive ring tab that protrudes, faces the body; the flat side of the tab faces up. (The flat side of the tab is facing the camera in Figure 53 and Figure 54.)



**Figure 54 - drive ring installed (130-U3 and smaller)**

5. Figure 54 shows the drive ring installed.



**Figure 55 - Install wave spring**

6. Install the wave spring, centering it on the drive ring.



**Figure 56 - Wave spring installed**

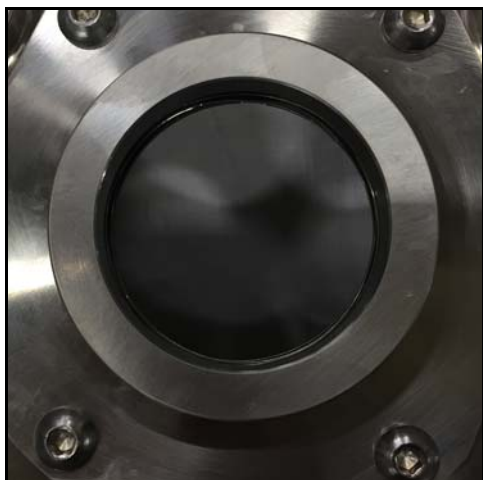
7. Figure 56 shows the wave spring installed.



**Figure 57 - Install seal housing**



**Figure 58 - Install seal housing bolts**



**Figure 59 - Seal housing installed**

8. Install the seal housing, as shown in Figure 57.

**NOTE:** Note the alignment of the drive ring tabs and shaft ring.

9. Lubricate the threads of the seal housing bolts with food grade anti-seize. Push down on the seal housing to compress the seal spring, and install the 4 seal housing bolts.
10. Torque the bolts to the specified torque value:

**Table 7: Seal Housing Bolt Torque**

U3 Model	Seal Housing Bolt Torque
006, 015, 018	7.4 ft-lb / 10 N·m
030, 040, 045, 060, 130, 180, 220, 210, 320	14.8 ft-lb / 20 N·m

11. Figure 59 shows the seal housing installed.

12. Repeat these steps for the second seal.



Skip to “Install Pump Body” on page 61.



**NOTE:** SPX FLOW recommends replacing elastomers every time the pump is serviced.

### 180-U3 and larger pumps: Install Seal Components (single mechanical seal)

**NOTE:** For single mechanical seal on 130-U3 and smaller pumps, see page 38. For double mechanical seal, see page 55.

1. Lay out the required parts for each seal.

#### **⚠ CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.

2. Install the drive ring as shown in Figure 60. The side of the drive ring tab that protrudes, faces the body; the flat side of the tab faces up. (The flat side of the tab is facing the camera in Figure 60 and Figure 61.)

**NOTE:** See also the exploded-view drawing of the seals on page 120

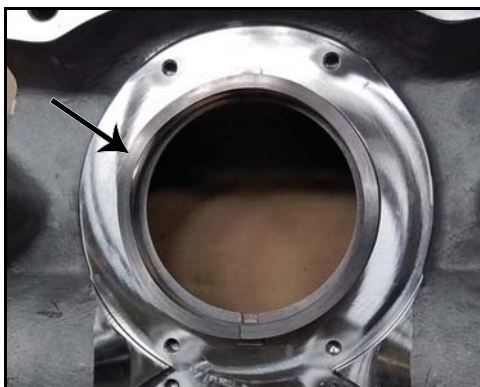


**Figure 60 - Install drive ring**



**Figure 61 - Drive ring installed**

3. Figure 61 shows the drive ring installed.



**Figure 62 - Wave spring installed**

4. Install the wave spring, centering it on the drive ring. Figure 62 shows the wave spring installed.



Figure 63 - Install seal housing



Figure 64 - Install seal housing bolts




Figure 65 - Seal housing installed

5. Install the seal housing as shown in Figure 63. Align the notches in the seal housing with the tabs on the drive ring (installed in step 3 on page 41). Make sure the flat side of the seal housing is positioned between the bores (shown installed in Figure 65).
6. Lubricate the threads of the seal housing bolts with food grade anti-seize. Push down on the seal housing to compress the seal spring, and install the 4 seal housing bolts.
7. Torque the bolts to the specified torque value:

Table 8: Seal Housing Bolt Torque

U3 Model	Seal Housing Bolt Torque
006, 015, 018	7.4 ft-lb / 10 N·m
030, 040, 045, 060, 130, 180, 220, 210, 320	14.8 ft-lb / 20 N·m

8. Figure 65 shows the seal housing installed.
9. Repeat these steps for the second seal.

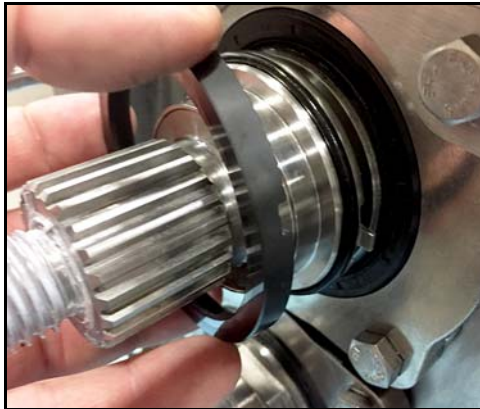
 Skip to “Install Pump Body” on page 61.

## Double Mechanical Seal

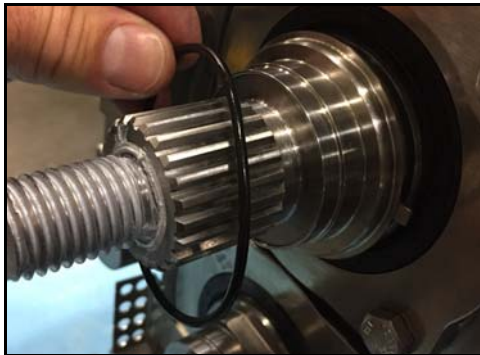
### Remove Flush-Side Seal Components

**NOTE:** For single mechanical seal, see page 36. For O-ring seals, see page 67.

1. Remove the flush-side rotary seal from each shaft. Use caution not to damage the seals during removal.



**Figure 66 - Remove flush-side rotary seal**



**Figure 67 - Remove O-ring**

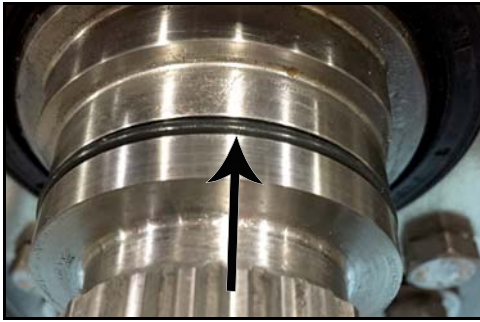
2. Remove the flush-side rotary seal O-ring from each shaft.



**Figure 68 - Remove adjusting ring**

3. Remove the adjusting ring from each pump shaft.





**Figure 69 - Adjusting ring O-ring**

4. Remove the adjusting ring O-ring from the shaft groove on each shaft.

**NOTE:** Before installing the new O-rings, inspect the shaft O-ring groove(s) for damage, and repair or replace the shafts if required.

**NOTE:** Inspect the flats on the shaft shoulder and repair or replace the shafts if required.



**Figure 70 - Remove seal retaining bolts**

5. Remove the 3 stationary seal retaining bolts from each seal housing (040-U3 pictured).

**NOTE:** The seal may be removed by loosening 2 screws and removing the 3rd screw.



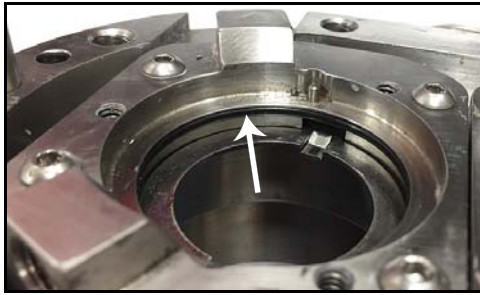
**Figure 71 - Remove stationary seal**

6. Remove the flush-side stationary seal (040-U3 pictured).
7. Inspect the seal housing pins for damage, and repair or replace them as necessary. If the pins are loose, replace them with new ones.



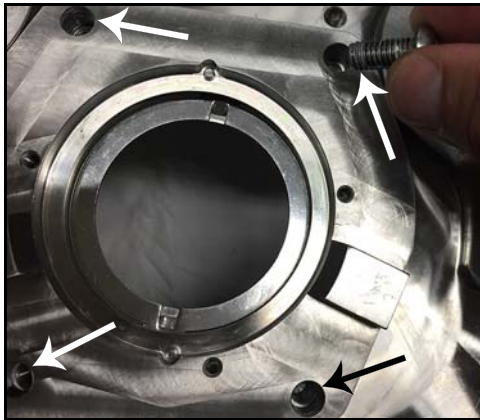
**Figure 72 - Remove wave spring**

8. Remove the wave spring (040-U3 pictured).



**Figure 73 - Seal O-ring location**

9. Remove the stationary seal O-ring (040-U3 pictured).



**Figure 74 - Seal housing bolts**

10. Remove the 4 seal housing bolts (040-U3 pictured).



**Figure 75 - Remove seal housing**

11. Remove the seal housing (040-U3 pictured). The arrow in Figure 75 shows the seal housing O-ring location on 130-U3 pumps and smaller.



**Figure 76 - Remove seal housing O-ring**

12. (130-U3 pumps and smaller) Remove the seal housing O-ring from around the shaft ring. See Figure 75 for the seal housing O-ring location.



**Figure 77 - Remove seal housing O-ring**

13. (180-U3 pumps and larger) Remove the seal housing O-ring from the seal housing.

**NOTE:** On the 180-U3 pumps and larger, the seal housing O-ring is installed on the seal housing.



**Figure 78 - Remove drive ring**

14. Remove the drive ring. (040-U3 pictured.)



**Figure 79 - Remove shaft ring**

Remove the shaft ring. (Applies to 130-U3 pumps and smaller only. 180-U3 pumps and larger do not have a shaft ring.)

1. Repeat for the second seal.

**NOTE:** To assemble a double mechanical seal for 130-U3 pumps and smaller, continue. For 180-U3 pumps and larger, see page 55.

### 130-U3 and smaller pumps: Install Seal Components (double mechanical seal)

**NOTE:** For double mechanical seal on 180-U3 and larger pumps, see page 55. For single mechanical seal, see page 38.

1. Lay out the required parts for each seal (Figure 80 shows parts for one seal, on a 040-U3 size pump).

**⚠ CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.



**Figure 80 - Double Mechanical Seal (040-U3 shown)**



**Figure 81 - Install shaft ring**

2. Install the shaft ring with the notch openings facing toward you as shown in Figure 81.

**NOTE:** Make sure the notch openings in the shaft ring are perpendicular to the ports, and in line with the bores. See Figure 87 on page 49.



**Figure 82 - Shaft ring installed**

3. Figure 82 shows the shaft ring installed.





**Figure 83 - Install drive ring**



**Figure 84 - Drive ring installed**



**Figure 85 - Install seal housing O-ring**



**Figure 86 - Seal housing O-ring installed**

4. Install the drive ring as shown in Figure 83. The side of the drive ring tab that protrudes, faces the body; the flat side of the tab faces up. (The flat side of the tab is facing the camera in Figure 83 and Figure 84.)
5. Note the orientation of the tabs; for pumps 130-U3 and smaller, the tabs of the drive ring are perpendicular to the side ports of the body. See Figure 87 on page 49 for the orientation as installed.
6. Figure 84 shows the drive ring installed.
7. Install the seal housing O-ring. The O-ring fits in the body, around the shaft ring. See Figure 86.
8. Figure 86 shows the seal housing O-ring installed.

9. Install the seal housing.



**Figure 87 - Install seal housing**

10. Install the 4 seal housing bolts. Torque the bolts to the specified torque value:

**Table 9: Seal Housing Bolt Torque**

U3 Model	Seal Housing Bolt Torque
006, 015, 018	7.4 ft-lb / 10 N·m
030, 040, 045, 060, 130, 180, 220, 210, 320	14.8 ft-lb / 20 N·m



**Figure 88 - Seal housing bolts**

11. Figure 89 shows the seal housing installed. Note the orientation of the flush ports (arrows).



**Figure 89 - Seal housing installed**



**Figure 90 - Install seal O-ring**

12. Install the lubricated stationary seal O-ring as shown in Figure 90.



**Figure 91 - Seal O-ring location**

13. The stationary seal O-ring is located between the seal housing and the drive ring.



**Figure 92 - Install wave spring**

14. Install the wave spring.



**Figure 93 - Wave spring installed**

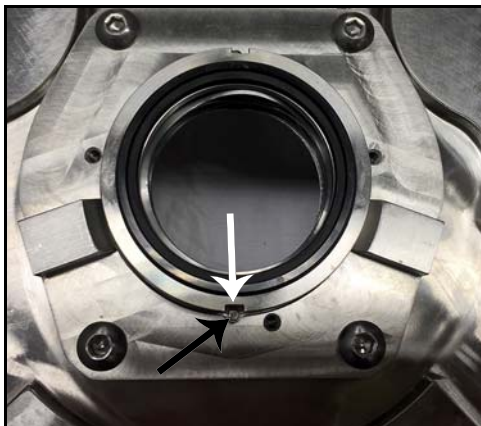
15. Figure 93 shows the wave spring installed.





**Figure 94 - Install flush-side stationary seal**

16. Install the flush-side stationary seal, making sure to line up the notches on the seal to the seal housing pins.



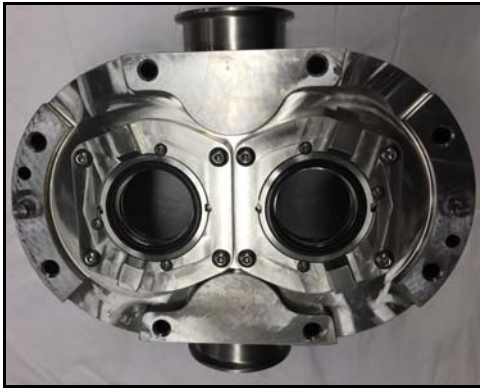
**Figure 95 - Flush-side stationary seal installed**

17. Figure 95 shows the flush-side stationary seal installed. Note the notches (white arrow) lined up with the seal housing pins (black arrow).



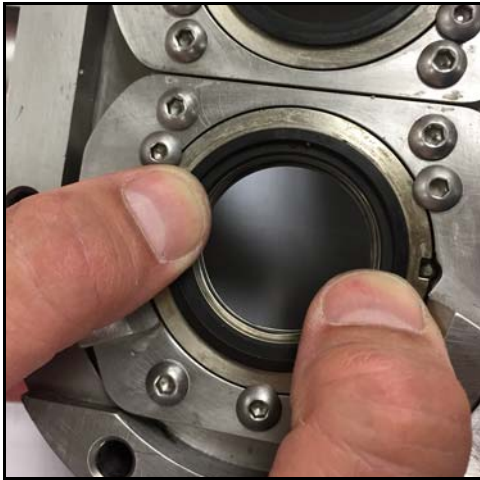
**Figure 96 - Install seal retaining bolts**

18. Install the 3 seal retaining bolts. Hand-tighten the bolts until snug.
19. Repeat these steps to install the second seal.



**Figure 97 - Seals installed**

20. Figure 97 shows both seals installed.



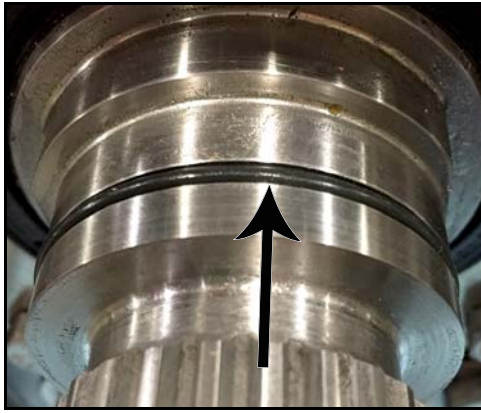
**Figure 98 - Apply finger pressure**

21. Confirm that each seal moves easily in and out by applying finger pressure to the seal. If the seal does not move, reassemble the seal and re-confirm.



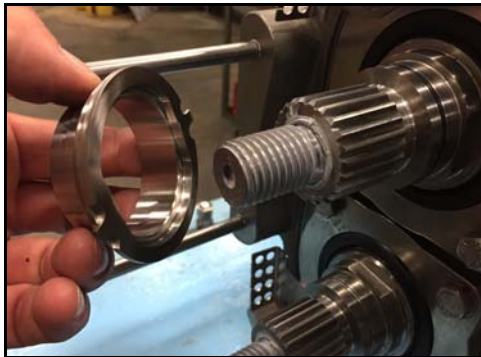
**Figure 99 - Install O-ring**

22. Install the lubricated adjusting ring O-ring onto the shaft groove.



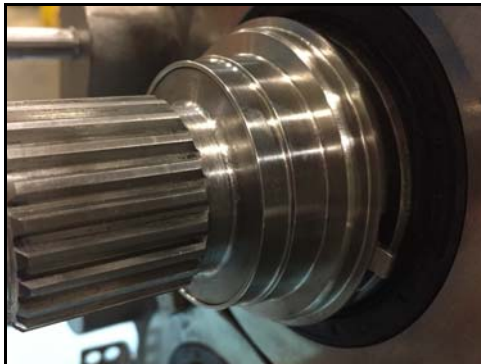
**Figure 100 - O-ring installed**

23. Figure 100 shows the O-ring installed in the shaft groove.



**Figure 101 - Install adjusting ring**

24. Install the adjusting ring onto each pump shaft. Make sure to align the flats on the adjusting ring to the flats on the drive shafts.



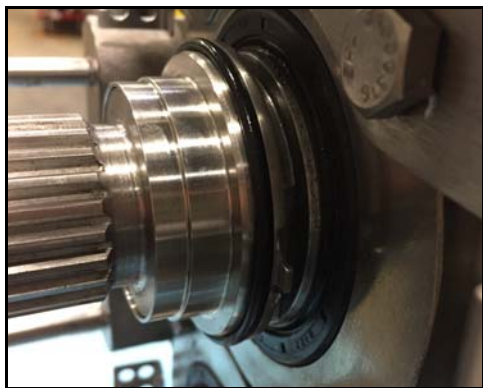
**Figure 102 - Adjusting ring installed**

25. Figure 102 shows the adjusting ring installed.



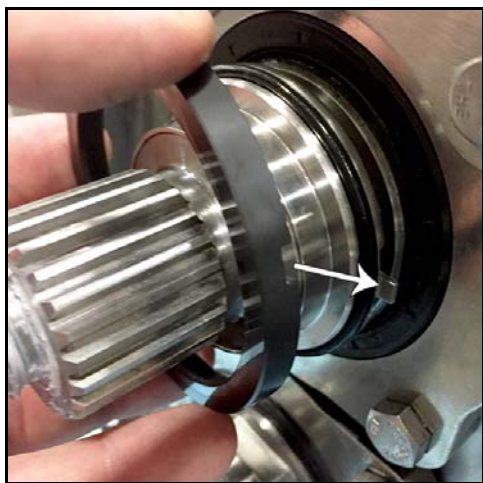
**Figure 103 - Install O-ring**

26. Install the rotary seal O-ring on each shaft.



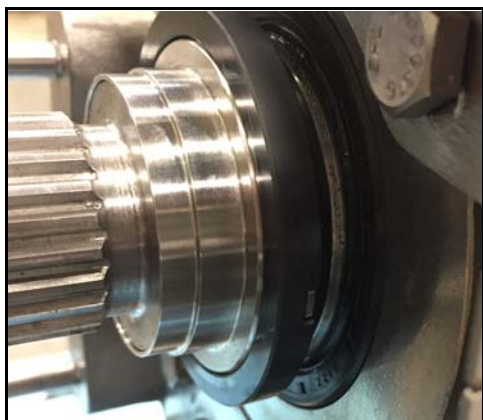
**Figure 104 - O-ring installed**

27. Figure 104 shows the rotary seal O-ring installed on the shaft.



**Figure 105 - Install flush-side rotary seal**

28. Install the flush-side rotary seal onto the shaft, aligning the tab with the notch on the seal.



**Figure 106 - Rotary seal installed**

29. Figure 106 shows the seal installed.



Skip to “Install Pump Body” on page 61.



### 180-U3 and larger pumps: Install Seal Components (double mechanical seal)

**NOTE:** For 130-U3 and smaller pumps, see page 47. For single mechanical seal, see page 41.

1. Lay out the required parts for each seal.

**⚠ CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.



**Figure 107 - Install drive ring**



**Figure 108 - Drive ring installed**



**Figure 109 - Install seal housing O-ring**

2. Install the drive ring as shown in Figure 107. The side of the drive ring tab that protrudes, faces the body; the flat side of the tab faces up. (The flat side of the tab is facing the camera in Figure 107 and Figure 108.)
3. Note the orientation of the tabs; for pumps 180-U3 and larger, the tabs of the drive ring are parallel to the side ports of the body as shown in Figure 107 and Figure 108.

4. Figure 108 shows the drive ring installed.

5. Install the seal housing O-ring on the seal housing.



**Figure 110 - Seal housing O-ring installed**



**Figure 111 - Seal housing in place**



**Figure 112 - Seal housing bolts**

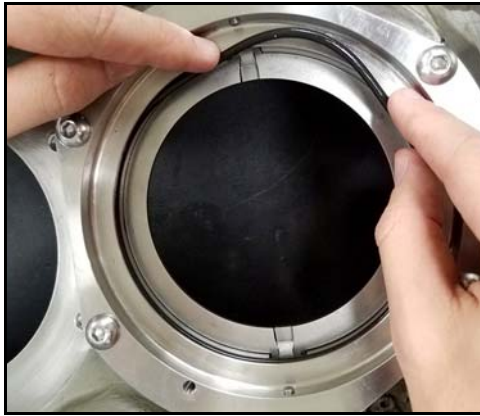
6. Install the seal housing. Align the drive ring tabs with the notches in the seal housing.

7. Figure 111 shows the 180-U3 seal housing in place. Note the orientation of the flat (arrow), facing the center of the pump body.

8. Install the 4 seal housing bolts. Torque the bolts to the specified torque value:

**Table 10: Seal Housing Bolt Torque**

U3 Model	Seal Housing Bolt Torque
006, 015, 018	7.4 ft-lb / 10 N·m
030, 040, 045, 060, 130, 180, 220, 210, 320	14.8 ft-lb / 20 N·m



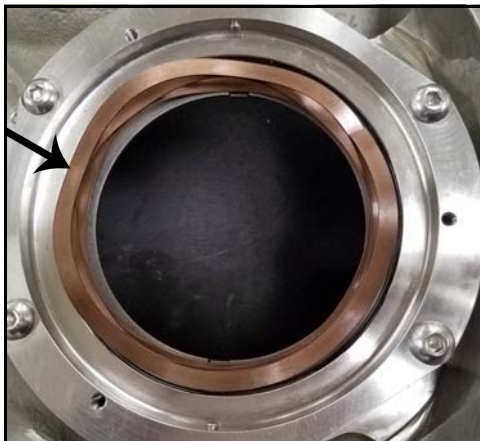
**Figure 113 - Install seal O-ring**

9. Install the lubricated stationary seal O-ring as shown in Figure 113.



**Figure 114 - Seal O-ring location**

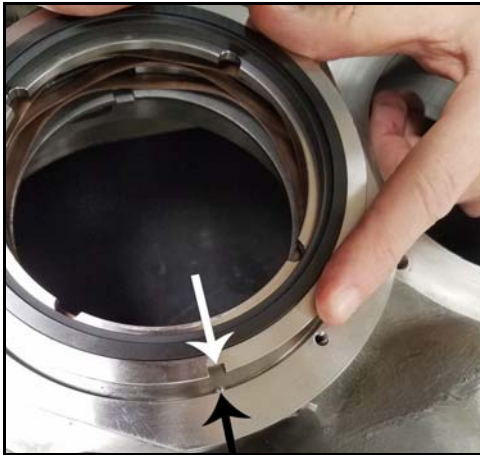
10. The stationary seal O-ring is located between the seal housing and the drive ring.



**Figure 115 - Wave spring installed**

11. Install the wave spring.





**Figure 116 - Install flush-side stationary seal**

12. Install the flush-side stationary seal, making sure to line up the notches on the seal (white arrow) to the seal housing pins (black arrow).



**Figure 117 - Install seal retaining bolts**

13. Install the 3 seal retaining bolts. Hand-tighten the bolts until snug.



**Figure 118 - Apply finger pressure**

14. Confirm that the seal moves easily in and out by applying finger pressure to the seal. If the seal does not move, reassemble the seal and re-confirm.
15. Repeat these steps to install the second seal.



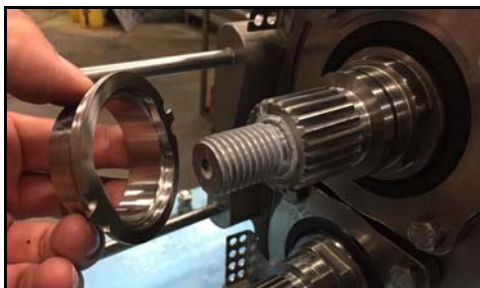
**Figure 119 - Install O-ring**

16. Install the lubricated adjusting ring O-ring onto the shaft groove.



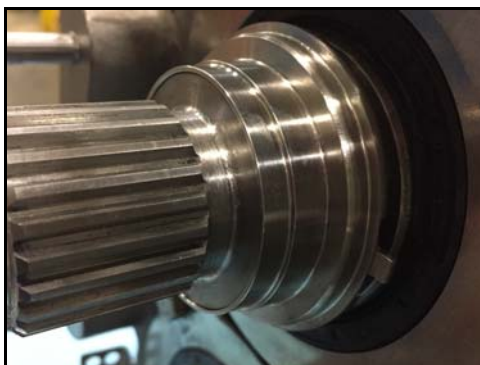
**Figure 120 - O-ring installed**

17. Figure 120 shows the O-ring installed in the shaft groove.



**Figure 121 - Install adjusting ring**

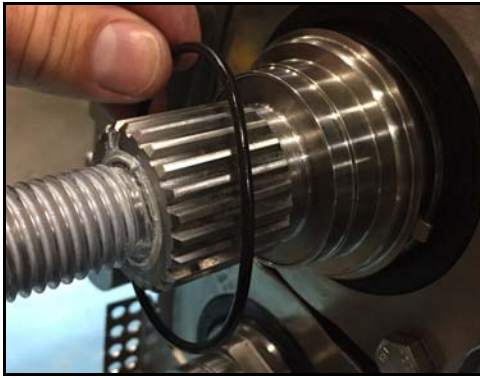
18. Install the adjusting ring onto each pump shaft. Make sure to align the flats on the adjusting ring to the flats on the drive shafts.



**Figure 122 - Adjusting ring installed**

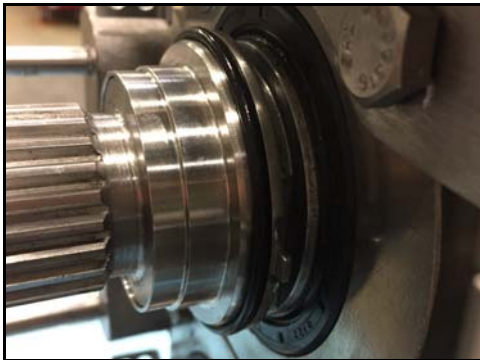
19. Figure 122 shows the adjusting ring installed.

20. Install the rotary seal O-ring on each shaft.



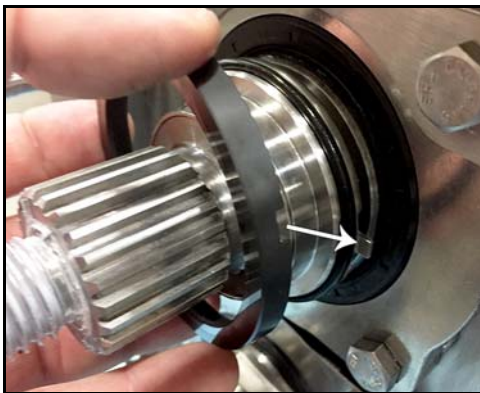
**Figure 123 - Install O-ring**

21. Figure 124 shows the rotary seal O-ring installed on the shaft.



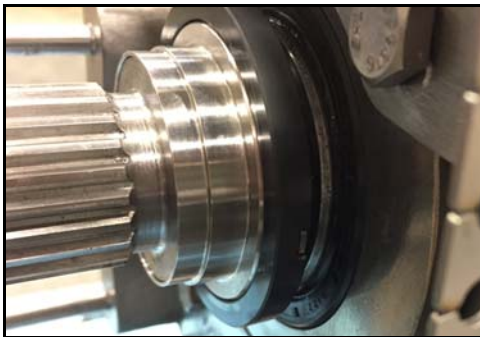
**Figure 124 - O-ring installed**

22. Install the flush-side rotary seal onto the shaft, aligning the tab with the notch on the seal.



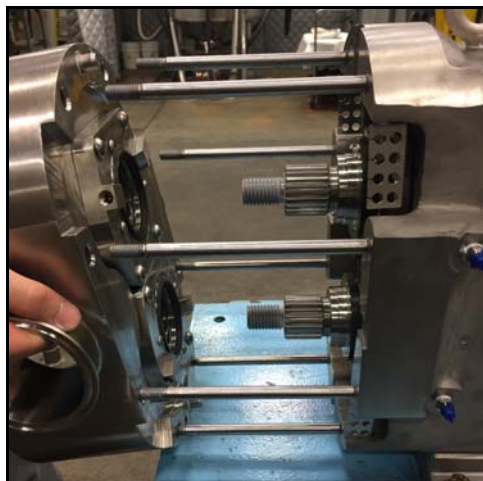
**Figure 125 - Install flush-side rotary seal**

23. Figure 126 shows the seal installed.

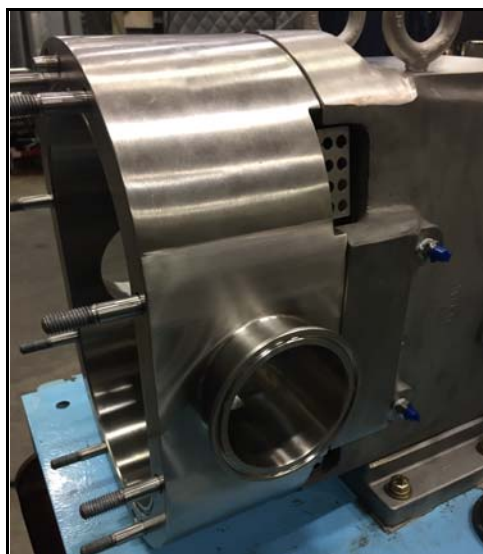


**Figure 126 - Rotary seal installed**

## Single and Double Mechanical Seal



**Figure 127 - Install pump body**



**Figure 128 - Pump body installed**



**Figure 129 - Install body retaining screws**

### Install Pump Body

#### ⚠ CAUTION

*Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.*

#### ⚠ CAUTION

*To lift the body of a 130, 180, 210, 220, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.*

1. Install the pump body onto the gear case. Confirm that the pump body dowel pins align with the correct size bushing on the gear case.

**NOTE:** Double mechanical seal shown.

2. Figure 128 shows the pump body installed on the gear case.

3. Install the body retaining screws. Lubricate the thread with food-grade anti-seize. Lightly hand-tighten the screws, so the pump body is securely seated against the gear case.

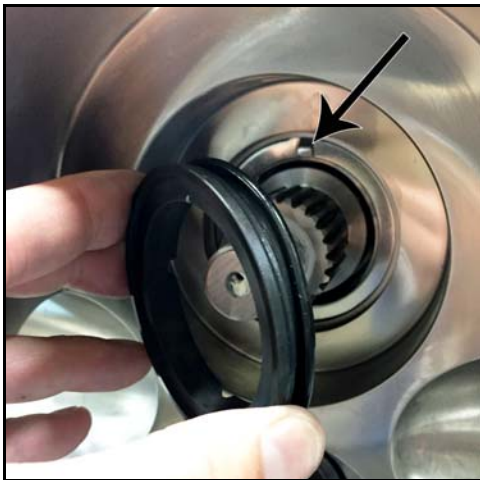




**Figure 130 - Install seal O-ring**



**Figure 131 - Seal O-ring installed**



**Figure 132 - Install stationary seal**



**Figure 133 - Push on stationary seal**

## Install Product-Side Rotary and Stationary Seal

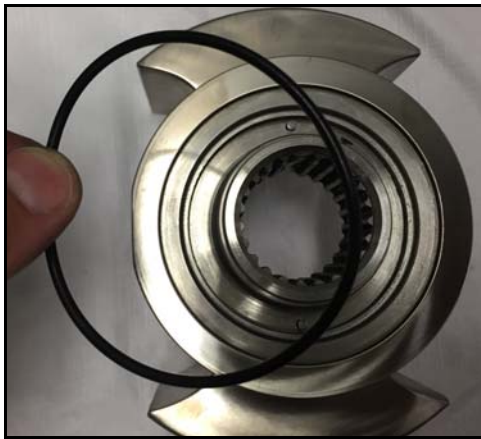
**NOTE:** Applies to both single and double mechanical seal.

1. Install the lubricated stationary seal O-ring onto the stationary seal.
2. Figure 131 shows the O-ring installed on the stationary seal.
3. Install the stationary seal into the pump body. Align the notches in the seal with the tabs on the drive ring (see arrow in Figure 132). Push the seal into the pump so that the O-ring can seat in the bore and hold the seal in place.
4. After installing the stationary seal, push on it and it should spring back freely. If it does not spring back, check the seal installation.



**Figure 134 - Stationary seal installed**

5. Figure 134 shows the stationary seal installed.



**Figure 135 - Install seal O-ring**

6. Install the lubricated rotary seal O-ring into the rotor.



**Figure 136 - Seal O-ring installed**

7. Figure 136 shows the O-ring installed.



**Figure 137 - Install rotary seal**



**Figure 138 - Rotary seal installed**



**Figure 139 - Seal O-ring pinched**




**Figure 140 - Push in O-ring**

8. Install the rotary seal into the rotor. Align the notches in the seal to the drive pins on the rotor.

9. After installing the rotary seal, it should fit solidly in the rotor as shown in Figure 138.

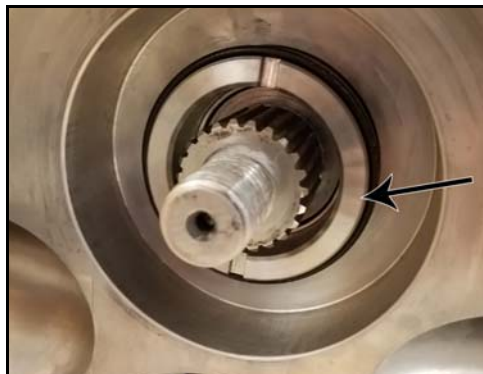
10. Make sure the seal O-ring is not pinched.

11. If the O-ring is pinched as shown in Figure 139, push in the O-ring with the O-ring removal tool while inserting the seal. (For part number, see "O-ring Removal Tools" on page 126.)

 Skip to "Install Rotors" on page 74.



## O-ring Seal



**Figure 141 - Sleeve remaining after rotor removal**



**Figure 142 - Remove sleeve, O-ring**



**Figure 143 - Remove O-ring**



**Figure 144 - Remove O-ring**

## Remove Product-Side Seal Components

**NOTE:** Removing the rotor normally does not remove the sleeve; the sleeve must be removed separately. Figure 141 shows the sleeve remaining after the rotor has been removed.

1. Grasp the sleeve with your fingers and pull it out of the seal housing.
2. Remove the sleeve front O-ring (indicated by the arrow in Figure 142) from the sleeve and discard it.

### **Removing a single O-ring or the front O-ring of a double O-ring seal**

1. Remove the front O-ring using either the Standard O-ring removal tool (part no. AD0096001, shown) or U3 Double O-Ring Seal Removal Tool (part no. 140062+, pictured in Figure 144).
2. Discard the used O-ring.

### **Removing the back O-ring of a double O-ring seal**

1. Use the U3 Double O-Ring Seal Removal Tool, part no. 140062+.



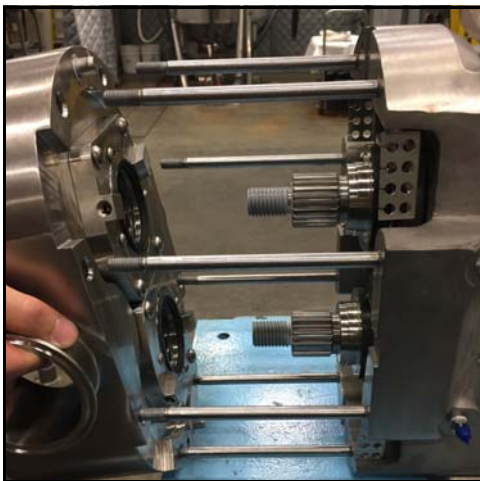
**Figure 145 - Remove O-ring**



**Figure 146 - Remove O-ring**



**Figure 147 - Remove body retaining screws**



**Figure 148 - Remove pump body**

2. The O-ring fits into a groove on the seal housing. With the hook on the tool facing down (facing the groove), slide the tool between the O-ring and the groove to dislodge the O-ring.

3. Then twist the tool so the hook faces the opposite direction (toward the shaft), and pull the O-ring out of the seal housing.
4. Discard the used O-ring.



The seal sleeve and O-rings in a U3 O-ring seal can be replaced without removing the pump body. To replace or service these components only, skip to "Install Seal O-ring" on page 72.

## Remove Pump Body

1. Remove the two body retaining cap screws.

**Table 11: Body Retaining Screws Wrench Size**

Model	Wrench Size
006, 015, 018, 030, 040	3/16"
045, 060, 130	1/4"
180, 220, 210, 320	5/16"

2. Remove the body from the gear case. If needed, use a plastic mallet to tap the body away from the gear case, until the dowel pins are dislodged from the bushings.
3. Slide the body straight off the body studs to prevent damaging the mechanical seal parts.

### **CAUTION**

To lift the body of a 130, 180, 210, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.

4. Place the body on a protected surface with the seals facing up to protect the seals.



**Figure 149 - Remove bolts**

### **Remove Flush-Side Seal Components**

1. Using an Allen wrench, remove the bolts.



**Figure 150 - Remove seal housing**

2. Remove the seal housing.



**Figure 151 - Remove O-ring**

3. Remove the seal housing O-ring and discard it.



**Figure 152 - Remove wave spring**

4. Remove the wave spring from the shaft.

5. Remove the seal seat from the shaft.



**Figure 153 - Remove seal seat**

6. Remove the sleeve back O-ring from the groove on the shaft and discard it.



**Figure 154 - Remove O-ring**

### Install Body Seal Components

1. Place the body on a protected surface. Lubricate and install the seal housing O-ring. Figure 155 shows the seal housing O-ring installed.

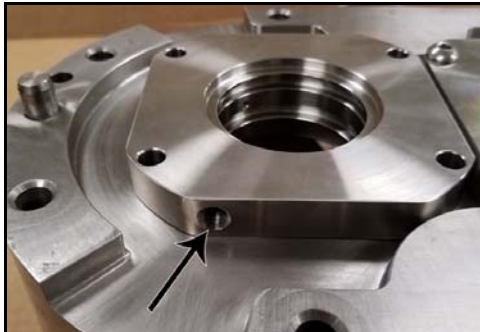


**Figure 155 - Seal housing O-ring installed**

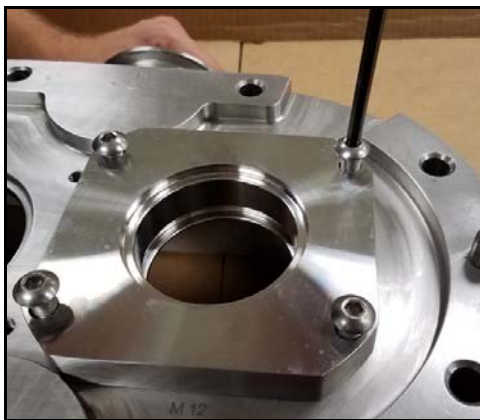




**Figure 156 - Line up bolt holes**



**Figure 157 - Flush hole location**



**Figure 158 - Install bolts**



**Figure 159 - Seal housings installed**

2. Line up the bolt holes of the O-ring seal housing with the holes on the body.
3. For a double O-ring seal, position the housing so that the flush holes are located toward the outer edge of the body, not toward the middle.
4. Lubricate the threads of the seal housing bolts with food grade anti-seize. Using an Allen wrench, install the 4 seal housing bolts.
5. Torque the bolts to the specified torque value:

**Table 12: Seal Housing Bolt Torque**

U3 Model	Seal Housing Bolt Torque
006, 015, 018	7.4 ft-lb / 10 N·m
030, 040, 045, 060, 130, 180, 220, 210, 320	14.8 ft-lb / 20 N·m

6. Repeat for the second seal housing. Figure 159 shows the seal housings installed.



### Install O-ring Seal

1. Lubricate the sleeve back O-ring and install it in the groove on the shaft.



**Figure 160 - Lubricate and install O-ring**

2. Figure 161 shows the O-ring installed on the shaft.



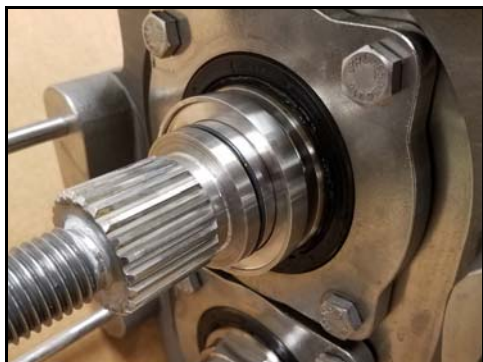
**Figure 161 - O-ring installed**

3. Make sure the flats of the seal seat are aligned with the flats on the shaft and place the seal seat on the shaft.



**Figure 162 - Install seal seat**

4. Figure 163 shows the seal seat installed on the shaft.

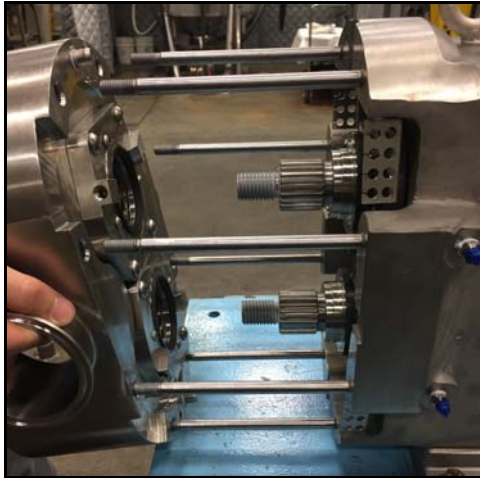


**Figure 163 - Seal seat installed**



**Figure 164 - Install wave spring**

5. Install the wave spring on the shaft.



**Figure 165 - Install pump body**

### Install Pump Body

**⚠ CAUTION**

*Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.*

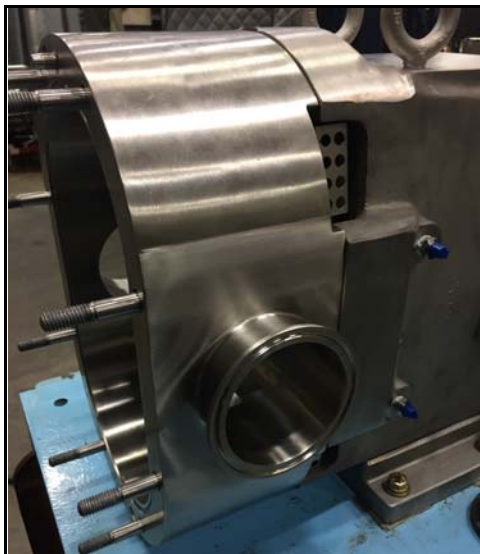
**⚠ CAUTION**

*To lift the body of a 130, 180, 210, 220, 220, or 320-U3, use a lifting strap threaded through the ports on either side of the body.*

1. Install the pump body onto the gear case. Confirm that the pump body dowel pins align with the correct size bushing on the gear case.

**NOTE:** Double mechanical seal shown.

2. Figure 166 shows the pump body installed on the gear case.



**Figure 166 - Pump body installed**



**Figure 167 - Install body retaining screws**

3. Install the body retaining screws. Lubricate the thread with food-grade anti-seize. Lightly hand-tighten the screws, so the pump body is securely seated against the gear case.

### Install Seal O-ring

**NOTE:** Do not lubricate the seal O-ring.

1. For a single O-ring seal, install the seal O-ring in the front groove in the seal housing.
2. For a double O-ring seal, install the back O-ring first, then install the front O-ring. The O-rings fit into the grooves in the seal housing.



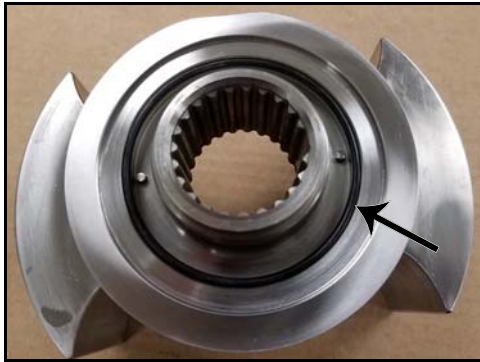
**Figure 168 - Install seal O-ring**

### Install Rotary Seal Components

1. Lubricate and install the sleeve front O-ring on the rotor.

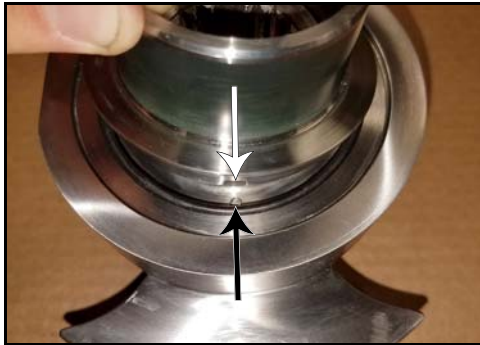


**Figure 169 - Install sleeve front O-ring**



**Figure 170 - Sleeve front O-ring installed**

2. Figure 170 shows the sleeve front O-ring installed.



**Figure 171 - Line up notch and pin**

3. Line up the notch (white arrow) in the O-ring seal sleeve with the pin (black arrow) on the rotor.



**Figure 172 - Press sleeve into place**

4. Press the sleeve into place on the rotor.



**Figure 173 - Seal sleeve installed**

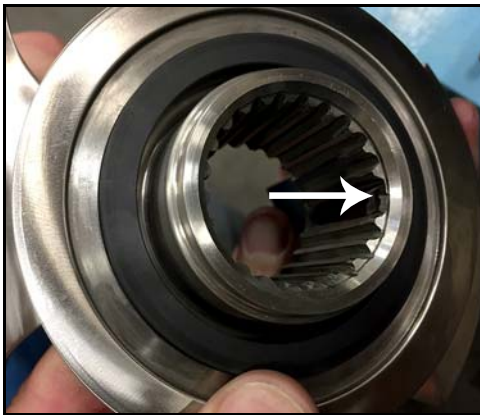
5. Figure 173 shows the seal sleeve installed on the rotor.



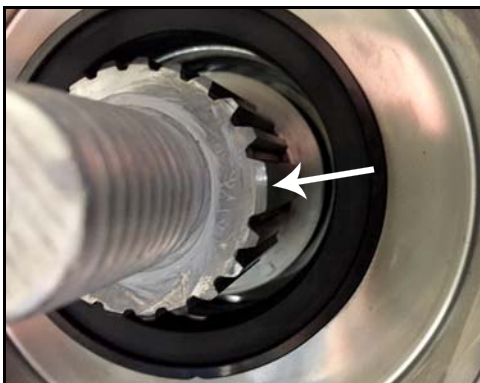


**Figure 174 - Lubricate seal sleeve**

## Fluid Head Assembly - Rotors and Cover



**Figure 175 - Timing spline of rotor**



**Figure 176 - Timing spline of shaft**

6. Lubricate the outer surface of the seal sleeve.
7. Continue to install the rotors.

**NOTE:** Mechanical seals are shown in the "Install Rotors" section, but the instructions apply to the O-ring seal as well.

## Install Rotors

**NOTE:** Mechanical seals are shown in this section, but the instructions apply to the O-ring seal as well.

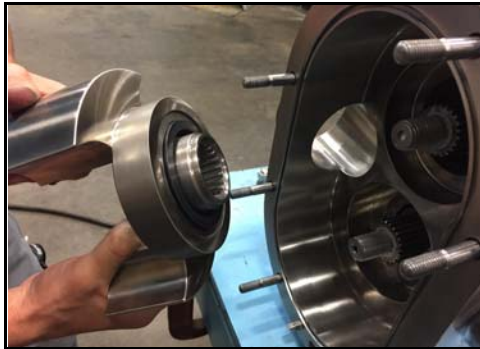
1. Align the timing spline of the rotor and the pump shaft.

**NOTE:** Mechanical seal shown.

2. Figure 176 shows the timing spline of the shaft.

**NOTE:** Mechanical seal shown.





**Figure 177 - Push rotor on shaft**

3. Push the rotor onto the shaft.

**NOTE:** When you push on the rotor, you should feel pressure from the seal spring. (With the O-ring seal, you should feel a little pressure from the spring, but not as much as from the mechanical seal.)

**NOTE:** Mechanical seal shown.



**Figure 178 - Rotor installed**

4. Figure 178 shows the rotor installed. Repeat these steps to install the second rotor.



**Figure 179 - Install O-ring**

### Install Rotor Nuts

1. Install the lubricated rotor nut O-ring onto the rotor nut.



**Figure 180 - O-ring installed**



**Figure 181 - Install rotor nut**



**Figure 182 - Torque rotor nut**

2. Figure 180 shows the rotor nut O-ring installed.

3. Apply a small amount of anti-seize to the shaft threads, then install the rotor nut.
4. Repeat these steps for the second rotor.

5. Insert the rotor blocking tool (part number 139794+) to keep the rotors from turning when installing the rotor nuts.

**NOTE:** When working on a rotor, always block the rotor against the body, not against the other rotor. See Figure 182.

**NOTE:** SPX FLOW recommends using the Non-Marring Socket Tool for Rotor Nuts (see below) to protect the rotor nut when torquing.

**Table 13: Rotor Nut Wrench Size and Socket Tool**

U3 Model	Wrench Size	Socket Tool
006, 015, 018	15/16"	126533+
030, 040	1-1/4"	139795+
045, 060, 130	1-5/8"	139796+
180, 220	2-1/4"	139797+
210, 320	2-3/8"	126536+

**Table 14: Rotor Nut Torque**

U3 Model	Rotor Nut Torque
006, 015, 018	50 ft-lb (68 N·m)
030, 040	120 ft-lb (163 N·m)
045, 060, 130	250 ft-lb (339 N·m)
180, 220	325 ft-lb (441 N·m)
210, 320	375 ft-lb (508 N·m)

6. Torque the rotor nuts to the specified torque (see Table 14). Remove the rotor blocking tool after torquing.

**⚠ CAUTION**

*Use a torque wrench to tighten the rotor nuts to the proper torque. Failure to tighten the nuts properly could result in the nuts loosening during operation, causing damage to the pump.*

**Figure 183 - Rotors installed**

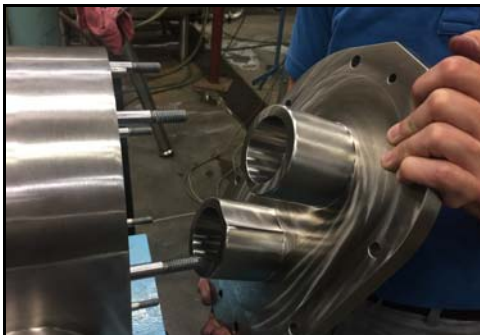
7. Figure 184 shows the rotors installed.
8. Double Mechanical Seal only: Turn on the flush and make sure there are no leaks. If there are leaks, check for pinched O-rings or cracked seals.

**Figure 184 - Install cover gasket****Install Cover**

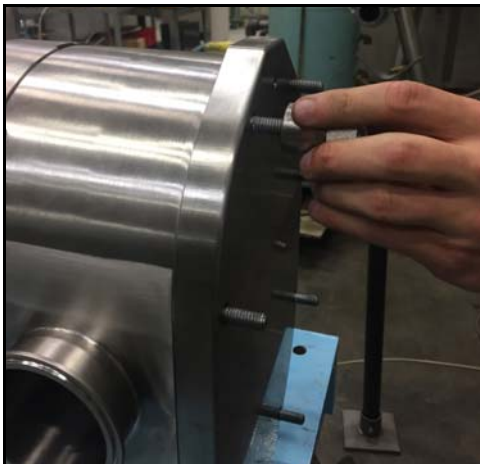
1. Install the cover gasket into the groove on the pump body.



**Figure 185 - Cover gasket installed**



**Figure 186 - Install cover**



**Figure 187 - Install cover nuts**

2. Figure 185 shows the cover gasket installed. Apply an anti-seize compound compatible with the product to the threads of the body studs.

3. Align the pump body studs with the cover holes and install the cover on the pump body.

**⚠ CAUTION**

To lift the cover on a 210 or 320-U3, attach an eye bolt to the threaded hole in the cover and attach lifting straps or chains to the eye bolt.

4. Install the cover nuts by hand, then torque the cover nuts to the correct torque.

**⚠ CAUTION**

Failure to tighten the cover nuts to the proper torque could cause the body studs to fail prematurely under high pressure.

**Table 15: Cover Nut Torque**

U3 Model	Cover Nut Torque
006, 015, 018	7 ft-lb / 10 N·m
030, 040	11 ft-lb / 15 N·m
045, 060	56 ft-lb / 76 N·m
130	25 ft-lb / 34 N·m
180, 220	110 ft-lb / 149 N·m
210, 320	158 ft-lb / 214 N·m



**Figure 188 - Cover installed**

5. Figure 188 shows the cover installed.

**⚠ CAUTION**

*If a double seal arrangement is used, the seals must be provided with a clean, compatible barrier fluid. Make certain that the flush ports in the pump body are clean and clear.*

**⚠ WARNING**

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



## Gear Case

### **⚠ 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 and the pump is de-pressurized.

### **⚠ DANGER**

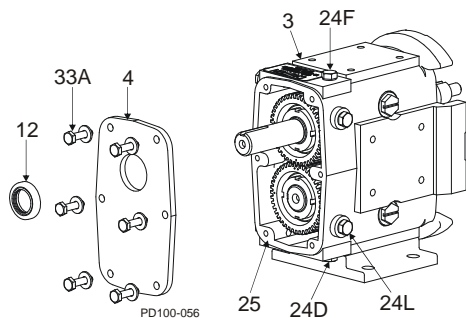
To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.

### **⚠ CAUTION**

To lift the gear case assembly on pumps larger than 018-U3, attach lifting straps/chains to the two eye bolts on the top of the gear case.

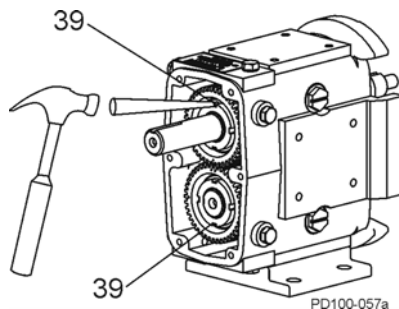
### **⚠ CAUTION**

Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.



**Figure 189 - Remove Gear Case Cover**

- 3. Gear Case
- 4. Gear Case Cover
- 12. Oil Seal
- 24D. Oil Drain Plug
- 24F. Oil Fill Plug
- 24L. Oil Level Check Plug, Sight glass
- 25. Silicone Sealant
- 33A. Cap Screw



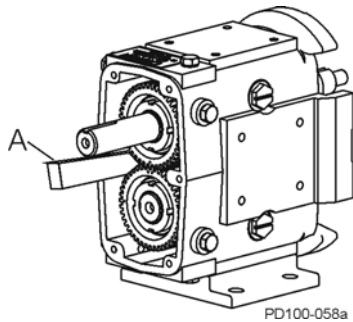
**Figure 190 - Straighten Lock Tab on Lock Washers**

### Remove Gear Case Cover

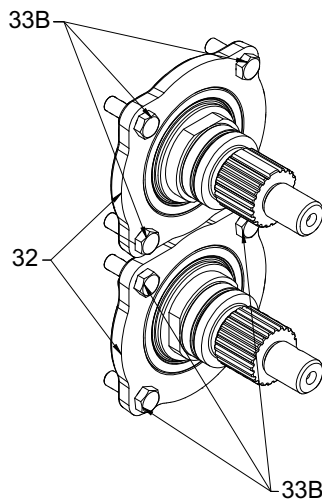
1. Remove the oil drain plug (Figure 189, item 24D); drain the oil.
2. Remove the cap screws from the gear case (Figure 189, item 33A).
3. Pull the cover (item 4) off the shaft extension. If the cover sticks, use a soft hammer to loosen it.
4. Remove the silicone sealant (item 25) from the gear case and cover.
5. Using an arbor press, remove the oil seal (item 12) from the cover. Discard the used oil seal.

### Remove Shaft

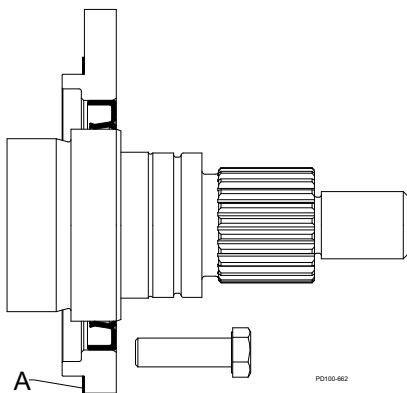
1. Straighten the tab on the lock washers (Figure 190, item 39).



**Figure 191 - Block Shaft Rotation**



**Figure 192 - Remove Bearing Retainers**



**Figure 193 - Remove Sealant from Retainer**

- Prevent the shafts from turning by placing a wedge or soft dowel between the gears (Figure 191, item A). Use a gear nut driver tool (see below) to remove the gear locknut. The gears will be removed later.

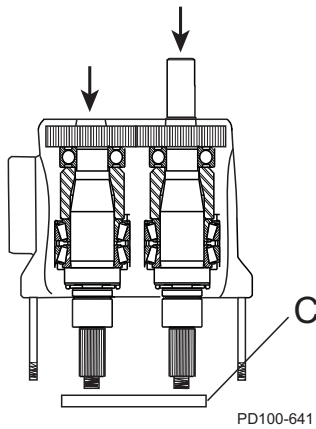
**Table 16: Gear Nut Driver Tool**

Model U3 Pumps	Part Number
006, 015, 018	109281+
030, 040	109282+
045, 060, 130	109283+
180, 220	110304+
210, 320	114702+

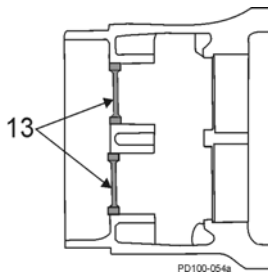
- Remove the front bearing retainer screws (Figure 192, item 33B) and pull off the bearing retainers (item 32). (If a retainer is stuck, leave it in place; it will press out when the shaft is removed.)

- Remove the silicone sealant (Figure 193, item A) from the bearing retainer and gear case.

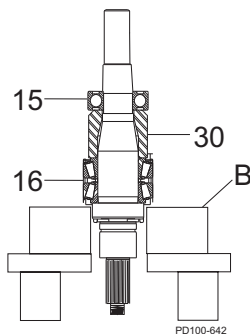
**NOTE:** Protect the liquid end of the shafts by wrapping them with tape.



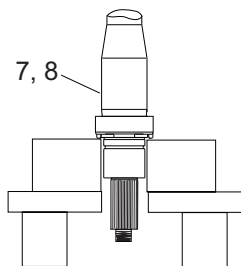
**Figure 194 - Press Shafts from Gear Case**



**Figure 195 - Remove Rear Oil Seals**



**Figure 196 - Remove Bearings From Shaft**



**Figure 197 - Grease Shaft**

#### **CAUTION**

To lift the gear case assembly on pumps larger than 018-U3, attach lifting straps/chains to the two eye bolts on the top of the gear case.

5. Place the gear case on an arbor press with the liquid end facing down. Protect the shaft ends with a wood or plastic block (Figure 194, item C) and press the shafts out of the gear case.
6. Remove the gear spacers and gear keys from the shafts.
7. Remove the gears from the gear case.
8. Press out and discard the front bearing seals from the front bearing retainers. Clean and reuse the bearing isolators, if installed.
9. Remove the shims. If the shafts and bearings will be reused, identify the shims and bearings that belong with each shaft.
10. Press out and discard both rear oil seals in the gear case (Figure 195, item 13).

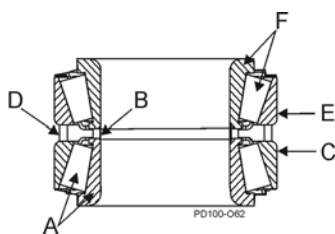
11. Use a hydraulic press and V-blocks (Figure 196, item B) to remove the bearings (items 15 and 16) and spacer (item 30)

**NOTE:** Make sure both ends of the shaft are protected when removing the shaft.

### **Front Bearing Assembly**

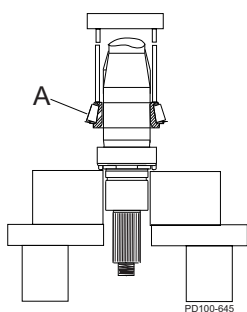
SPX FLOW PD Precision Pumps require bearing assemblies with very tight internal tolerances. In fact, the internal tolerances of “off-the-shelf” bearings can be many times larger than required. Although they are considered in-spec in the bearing industry, they can cause internal damage within an SPX FLOW PD Pump.

SPX FLOW’s proprietary bearing “MATCHING” process starts with top quality bearing assemblies, then sorts, measures, pairs, grinds and adds spacers to them to ensure the matched bearing sets meet the required tight internal tolerances.

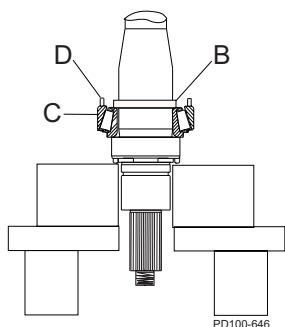


**Figure 198 - Bearing assembly**

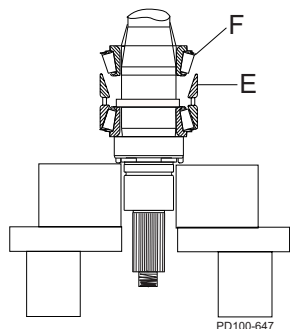
- A. Lower Cone / Roller Assembly
- B. Inner Spacer
- C. Lower Cup
- D. Outer Spacer
- E. Upper Cup
- F. Upper Cone / Roller Assembly



**Figure 199 - Press Lower Cone onto Shaft**



**Figure 200 - Install Inner & Outer Spacer and Lower Cup**



**Figure 201 - Install Upper Cup & Upper Cone**

SPX FLOW bearings can be cross-referenced and appear to be the same, but competitive bearings are omitting the Matching process, which is imperative to achieve the required internal tolerances. Once a bearing set is matched, it must remain together as a set for the life of the pump, in order to maintain the tight internal tolerances.

**NOTE:** The following instructions cover the assembly of a six-piece front bearing assembly. For a four-piece assembly, only one spacer and cup is used.

1. Lubricate the front bearing area of the shaft (Figure 197, item 7, 8) with anti-seize. Place it upright in a hydraulic press with the liquid end down.
2. Unwrap the front bearing assembly.

**NOTE: DO NOT** interchange the parts of one bearing assembly with another. The parts are precisely matched during manufacturing and must be installed as a matched assembly. See Figure 198.

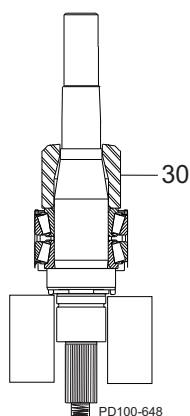
3. Lift the lower cone and roller assembly (Figure 199, item A) out of the bearing stack and place it on the shaft with the radius facing down. Press it onto the shaft until it is seated against the shaft shoulder. **Press only on the inner cone.**

4. Place the inner spacer (Figure 200, item B) over the shaft onto the lower cone and roller assembly.
5. Place the lower cup (item C) over the lower cone and roller assembly, keeping the cup opening toward the assembly.
6. Place the outer spacer (item D) over the shaft and onto the lower cup.

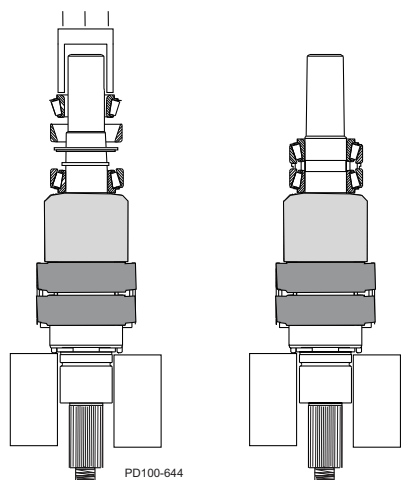
7. Place the upper cup (Figure 201, item E) on top of the outer spacer.
8. Lubricate the front bearing area of the shaft with anti-seize, and slip the bearing over the shaft with the roller radius facing up (Figure 201, item F). Press it onto the shaft and into the upper cup (Figure 201, item E).

**NOTE:** Make sure all components are aligned before pressing. **Press only on the inner cone.**

9. Install the bearing spacer (Figure 202, item 30).



**Figure 202 - Install Bearing Spacer**



**Figure 203 - Rear Tapered Roller Bearing Assembly**

## Rear Bearing Assembly

Models 006, 015, 018, 030, and 040 use a single ball bearing assembly for the rear bearing. All other models use a tapered roller bearing assembly similar to the front bearings.

1. Unwrap the rear bearing assembly.

**NOTE:** *DO NOT interchange the parts of one bearing assembly with another. These parts are precisely matched during manufacturing and must be installed as a matched assembly.*

- **For models with ball bearing assemblies:**  
Lubricate the shaft bearing area with anti-seize, then press the bearing into place. The shielded side of the bearing fits against the bearing spacer. Press only on the inner race.
- **For models with tapered roller bearing assemblies:**  
Lubricate the shaft bearing area with anti-seize. Follow the "Front Bearing Assembly" procedures starting on page 82.

**NOTE:** *Heating the bearings is **NOT** recommended. If bearings are heated, do not exceed 300°F (149°C).*

### **⚠ 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 and the pump is de-pressurized. Shut off and drain product from the pump prior to disconnecting the piping.*



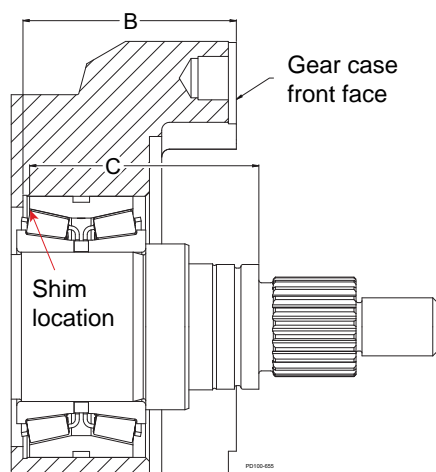


Figure 204 - Measure B &amp; C

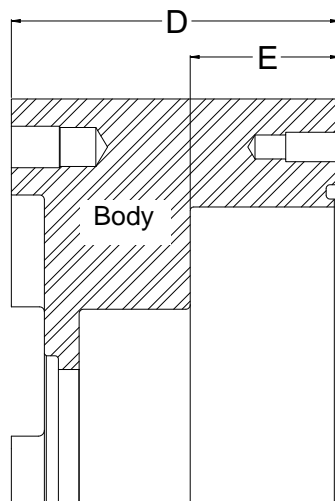


Figure 205 - Measure D &amp; E

- B. Front face of gear case to back of bearing bore
- C. Shaft shoulder to back of bearing race
- D. Body thickness
- E. Depth of rotor cavity

**NOTE:** Arrange with thicker shims on outside of the shim pack.

### ⚠ CAUTION

Make sure the pump is securely bolted or clamped down prior to performing any maintenance work. The pump center of gravity changes as parts are added or removed, and could result in tipping of an unsecured pump.

### Shimming

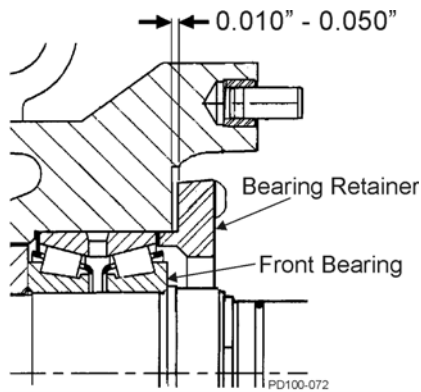
- When installing the shafts in the gear case, shim behind the front bearing to achieve the proper backface clearance between the back of the rotors and the body. (See Figure 204.) The backface clearance must be equal for both rotors to prevent the rotors from hitting each other during operation.

#### Suggested Shims

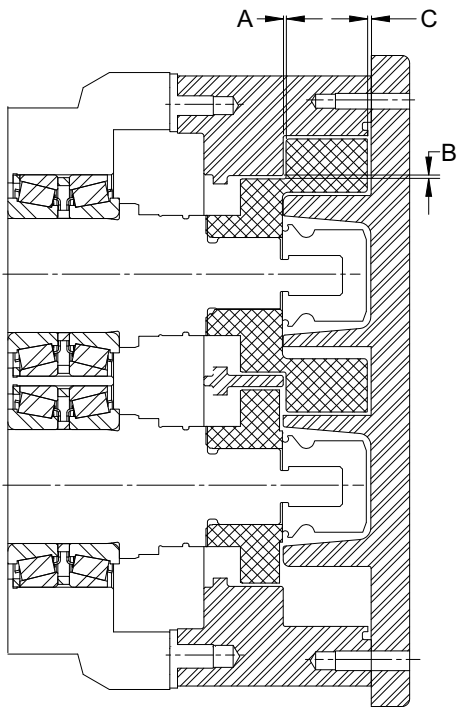
U3 Model	Standard Shaft	Replacement Shaft	Shim kit
006, 015, 018	.113 in (2.87 mm)	.110 in (2.79 mm)	117889+
030, 040	.105 in (2.27 mm)	.102 in (2.59 mm)	117890+
045, 060, 130	.093 in (2.36 mm)	.088 in (2.24 mm)	117891+
180, 220	.115 in (2.92 mm)	.110 in (2.79 mm)	117892+
210, 320	.125 in (3.18 mm)	.120 in (3.05 mm)	117893+

**NOTE:** Do not install bearing retainer sealant, gears, or gear locknuts until the correct shimming has been verified.

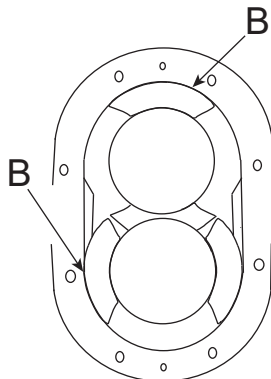
- If the shafts and/or bearings do not need to be replaced and the shims are marked indicating the shaft and bearing they are matched with, a shim adjustment probably will not be necessary. Reuse the existing tagged shims, shafts and bearings in the same gear case bores.
- If existing shims are lost and/or a standard shaft is used, determine the required shims from the chart.
- If it is necessary to calculate the required shims for replacement shafts, bearings or both, refer to Figure 204 and Figure 205; carry measurements and calculations to three decimal places (e.g. 0.059).
- Determine the shim thickness required for the front bearing:
  - Measure "B" in the gear case and "C" on the shaft (Figure 204).
  - Measure "D" and "E" on the body (Figure 205).
  - Determine the proper backface clearance. Refer to Table 18, "Rotor Clearances," on page 89.
  - Required Shims = Backface clearance - C + B + D - E.
- Place the shims in the gear case, resting against the shoulder in the front bearing bore. (See Figure 204.)



**Figure 206 - Bearing Retainer Clearance**



**Figure 207 - Measure Clearance**



**Figure 208 - Measure Clearance**

## Install Shaft

1. With the shims in place, install the shaft assembly in the front bearing bore with the fluid end facing up. Ensure that the shaft is installed in its original location.

**NOTE:** The shafts may need to be removed for a final shim adjustment.

2. Lubricate the outside diameter of the bearing.
3. Press the shaft into place until it is seated against the shim pack. **Press only against the outer race of the bearing.**

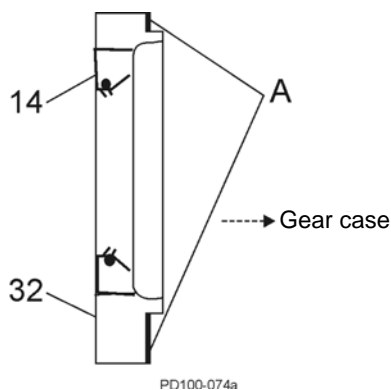
**NOTE:** A tube of the same diameter as the outer race of the bearing also can be used to press the shaft into place.

4. Temporarily secure the shaft/bearing in place with bearing retainers to aid in checking the clearances. **DO NOT** install silicone sealant at this time.
5. The bearing retainer must rest firmly against the bearing. Leave a 0.010 to 0.050 in (0.25 to 1.25 mm) clearance between the back of the bearing retainer and the front of the gear case (Figure 206). If this clearance is not met, place shims between the bearing and retainer.
6. Temporarily mount the body on the gear case.
7. Secure the body to the gear case using the body retaining screws.
8. Install the rotors and rotor nuts. Rotor nut O-rings and retainer O-rings are not required at this time.
9. Measure the rotor backface clearance (Figure 207, item A) through the port or from the front. The backface clearance for both rotors must be the same to prevent rotor crossover contact and must be  $\pm 0.0005$ " of the value found in Table 18, "Rotor Clearances," on page 89.
10. Check the rotor front face clearance (Figure 207, item C).
11. Check the rotor to body clearance (Figure 207 and Figure 208, item B).
12. Check the clearances against Table 18, "Rotor Clearances," on page 89. For other non-standard rotors, check with customer service.

**NOTE:** If the process uses special clearance rotors, contact customer service with the serial number of the pump for clearance tolerance values.

**NOTE:** "B" dimension is below the face of the casing.

13. If the backface clearance is not met, disassemble the pump and adjust the shimming to achieve the correct backface clearance.
14. If the rotor to body clearance is not met or is uneven, contact SPX FLOW Application Engineering for proper adjustment procedures.
15. After obtaining proper clearance, remove the rotor nuts, rotors, body, and bearing retainers.

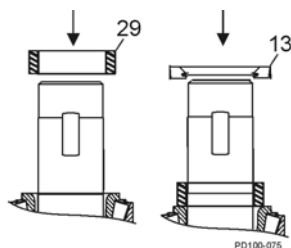


**Figure 209 - Install Bearing Retainer**

16. Grease the front and rear bearing through the grease fittings until grease is visible around the bearing assemblies. The amount of grease required is listed in "Grease Quantity (per Bearing)" on page 27. Rotate the shafts while greasing to disperse the grease.
17. Lubricate the seal lips and install the grease seals in the bearing retainers (compression spring on inside).
18. Coat the retainer flanges with silicone sealant (Figure 209, item A). (Gore-Tex® sealing tape can be used on silicone free models.) The grease seal (item 14) will be flush with the front of the bearing retainer. On 030 models, the grease seal will be against the step on the inside diameter of the retainer.
19. Install the bearing retainers (Figure 209, item 32).

### Install Rear Seal Assembly

**NOTE:** Place tape or other material over the shaft end to prevent cutting the seal during installation.



**Figure 210 - Install Rear Seal**

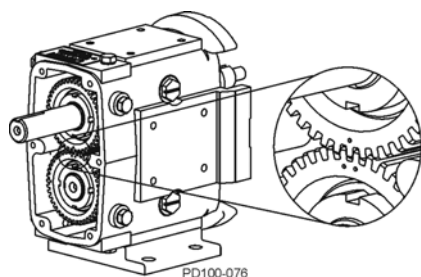
1. Install the gear spacers (Figure 210, item 29).
2. Lubricate the inside and outside diameters of the oil seals with oil or grease.
3. Install the oil seals with the spring facing out (Figure 210, item 13).

### Install Timing Gears

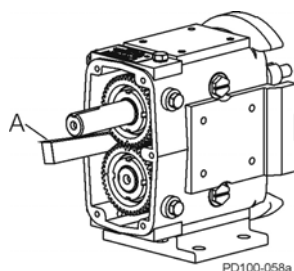
1. Place the gear keys into the shaft key slots. Angle the keys out for easier installation of the gears.

**NOTE:** To aid in timing setup, rotate the rotors until they are at right angles to each other before installing the gears.

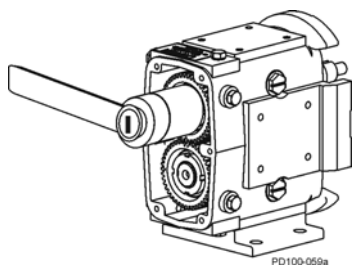
2. Slide the spur drive gear onto the drive shaft. The spur drive gear has one punch mark on the gear.
3. Slide the short shaft gear onto the short shaft. The short shaft gear has two punch marks on the gear. Straddle the single punch mark of the spur drive gear with the two punch marks on the short shaft gear (Figure 211).
4. Use a wood or nylon block (Figure 212, item A) to keep the shafts from turning. If a block is not available, use rags to block the gears, or with one rotor on the shaft, block the rotor with a nylon dowel.
5. Slide the lock washers onto the shaft. Lubricate the threaded area on the shafts and face of the locknuts with oil or grease.



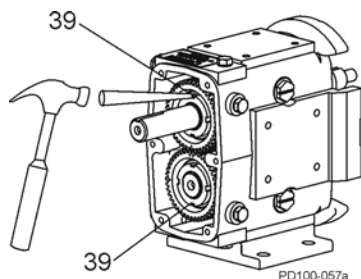
**Figure 211 - Timing Gear Marks**



**Figure 212 - Block Shaft Rotation**



**Figure 213 - Install Gear Locknuts**

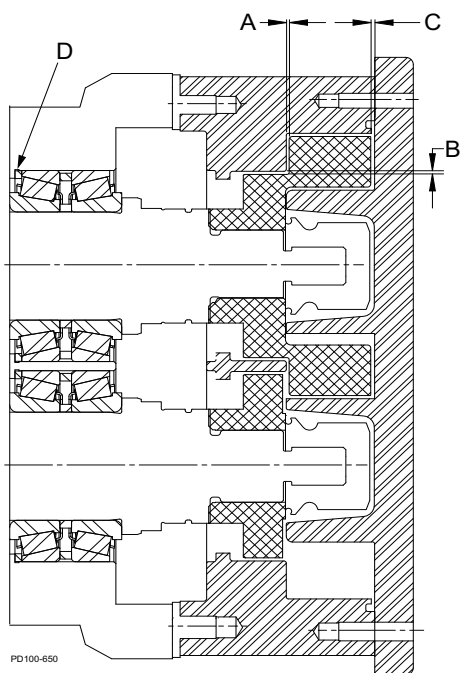


**Figure 214 - Bend Locking Tab**

**NOTE:** It is generally best to keep backface clearance to a minimum.

**CAUTION**

Backface clearance for both rotors must be equal to avoid crossover interference with the adjacent rotor hub.



**Figure 215 - Clearance Measurements**

6. Tighten the gear locknuts to the specified torque, using a gear nut driver tool.

**Table 17: Torque Values and Gear Nut Driver Tool**

Model U3 Pumps	Gear Nut Torque	Tool Part Number
006, 015, 018	120 ft-lb (163 N·m)	109281+
030, 040		109282+
045, 060, 130	140 ft-lb (190 N·m)	109283+
180, 220	230 ft-lb (312 N·m)	110304+
210, 320	320 ft-lb (434 N·m)	114702+

7. Bend the locking tab on the lock washers into the locking nut slots, securing the gear locknut into place (Figure 214).

## Checking for Proper Clearance

Waukesha Cherry-Burrell brand pumps are designed with close running clearances. Backface clearances are set with shims during assembly.

Shafts are positioned with shims behind the front bearing and locked into gear case with the bearing retainers. Rotors lock against the shaft shoulder. Clearance between the body backface and the back of the rotor wing is called backface clearance.

1. To check backface clearance, first mount the body (less seals) onto the housing. Assemble the rotors and secure them with rotor jam nuts.
2. With feeler gauges, measure the rotor backface clearance (Figure 215, item A), through the port or from the front.
3. Measure the rotor front face clearance (Figure 215, item C).
4. Measure the rotor to body clearance (Figure 215, item B).
5. Check the measured clearances against Table 18, "Rotor Clearances," on page 89.
6. Make corrections as required and follow examples in Table 19, "Backface Clearance Corrections," on page 89, to determine the exact adjustment to make and to avoid unnecessary assembly/disassembly.
7. To make shim adjustments, first remove the rotors, body and shafts. Make the required shim adjustment and reassemble. (Figure 215, item D is the front bearing rear shim.)
8. Re-check the backface clearances. Be sure both rotors have the same clearance to avoid crossover interference with the adjacent rotor hub.

Table 18: Rotor Clearances

Universal 3 Model	A - Back Face in (mm)		B - Rotor to Body in (mm)		C - Front Face in (mm)	
	Low Viscosity	Standard	Low Viscosity	Standard	Low Viscosity	Standard
006	0.0025 - 0.004 (0.06 - 0.10)	0.0035 - 0.005 (0.09 - 0.13)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0045 - 0.0055 (0.11 - 0.14)
015, 018	0.0025 - 0.0045 (0.06 - 0.11)	0.003 - 0.005 (0.08 - 0.013)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0055 - 0.0065 (0.14 - 0.17)
030, 040	0.002 - 0.004 (0.05 - 0.10)	0.0035 - 0.0055 (0.09 - 0.14)	0.001 - 0.005 (0.03 - 0.13)	0.0025 - 0.006 (0.06 - 0.15)	0.0045 - 0.0055 (0.11 - 0.14)	0.006 - 0.007 (0.15 - 0.18)
045, 060	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.003 - 0.0075 (0.08 - 0.19)	0.005 - 0.010 (0.13 - 0.25)	0.0055 - 0.0075 (0.14 - 0.19)	0.0085 - 0.0105 (0.22 - 0.27)
130	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.0035 - 0.0075 (0.09 - 0.19)	0.0055 - 0.0095 (0.14 - 0.24)	0.006 - 0.007 (0.15 - 0.18)	0.009 - 0.0115 (0.23 - 0.29)
180, 220	0.004 - 0.008 (0.10 - 0.20)	0.005 - 0.009 (0.13 - 0.23)	0.0055 - 0.0095 (0.14 - 0.24)	0.009 - 0.013 (0.23 - 0.33)	0.006 - 0.008 (0.15 - 0.20)	0.010 - 0.012 (0.25 - 0.30)
210, 320	0.005 - 0.009 (0.13 - 0.23)	0.007 - 0.011 (0.18 - 0.28)	0.008 - 0.012 (0.20 - 0.30)	0.010 - 0.014 (0.25 - 0.36)	0.008 - 0.010 (0.20 - 0.25)	0.012 - 0.014 (0.30 - 0.36)

Low Viscosity Rotors: -40°F (-40°C) to 180°F (82°C); Standard Clearance Rotors: -40°F (-40°C) to 300°F (149°C). Contact SPX FLOW Application Engineering if alternate rotors are needed.

**NOTE:** The assembly clearances stated in Table 18 are for reference only. Actual pump clearances may vary based on pump performance testing.

Table 19: Backface Clearance Corrections

Problem	Condition	Correction
Too Much Backface Clearance (A)	Dimension A is greater than the value in Table 18.	A (measured) minus Column A (Table 18) = shims to remove from the rear outer race of the front bearing
	Rotor wing face projects past the body front face	C (measured with depth micrometer) plus C (Table 18) = shims to remove from the rear of the front bearing
Not Enough Backface Clearance (A)	Dimension A is less than the value in Table 18.	Column A (Table 18) minus A (measured) = shims to add to the rear outer race of the front bearing

**NOTE:** If the clearance corrections in Table 19 have been performed and desired performance is not achieved, contact SPX FLOW technical services for guidance.



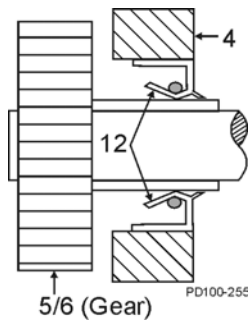


Figure 216 - Orientation of Oil Seal

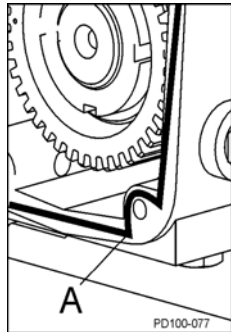


Figure 217 Sealant Placement

Install Gear Case Cover

- 1. Lubricate the inside diameter of a new oil seal.
- 2. Press the new oil seal (Figure 216, item 12) into the gear case cover (item 4) flush with the outside face, with the spring facing in.

- 3. Apply silicone sealant to the back of the gear case. (Gore-Tex® sealing tape can be used on silicone-free models.) Place tape on the inside of the screw holes. (Figure 217, item A).
- 4. Tape the shaft end to prevent cutting the seal on the keyway. Mount the cover assembly on the gear case. Secure it with cap screws and washers.
- 5. Remove the tape from the shaft end.

**NOTE:** Make sure that the shaft is centered in the lip seal before securing the cap screws.

- 6. Install the oil drain plug.
- 7. Fill gear case with gear oil to proper level. Refer to “Lubrication” on page 27.

Table 20: Standard O-Ring Selections, Descriptions and Color Codes for U3 Pumps

Ethylene Propylene Diene Rubber (EPDM) Compound Color: Black or Purple Color Code: Green FDA Compliant to 21CFR177.2600		Perfluoroelastomer (FFKM) Compound Color: Black Color Code: None Individually packaged with size and material noted.	
Fluorocarbon Rubber (FKM) Compound Color: Rust, Brown or Black Color Code: White FDA Compliant to 21CFR177.2600 3A Sanitary			

## Reference Tables

Table 21: Universal 3 Wrench Size				Gear Nut Driver Tool
Model	Rotor Nut	Body Retaining Cap Screw	Cover Nut	
006, 015, 018	15/16"	3/16"	5/8"	109281+
030, 040	1-1/4"			109282+
045, 060, 130	1-5/8"	1/4"	7/8"	109283+
180, 220	2-1/4"	5/16"		110304+
210, 320	2-3/8"		1"	114702+

Table 22: Torque Values				
Model	Gear Nut	Rotor Nut	Cover Nut	Seal Housing Bolt
006, 015, 018	120 ft-lb 163 N·m	50 ft-lb 68 N·m	7 ft-lb 10 N·m	7.4 ft-lb 10 N·m
030, 040		120 ft-lb 163 N·m	11 ft-lb 15 N·m	14.8 ft-lb 20 N·m
045, 060	140 ft-lb 190 N·m	250 ft-lb 339 N·m	56 ft-lb 76 N·m	
130			25 ft-lb 34 N·m	
180, 220	230 ft-lb 312 N·m	325 ft-lb 441 N·m	110 ft-lb 149 N·m	
210, 320	320 ft-lb 434 N·m	375 ft-lb 508 N·m	158 ft-lb 214 N·m	

Table 23: Arbor or Hydraulic Press Tonnage (Approximate)						
Model	Shaft		Front Bearing		Rear Bearing	
	IN	OUT	ON	OFF	ON	OFF
006, 015, 018	.25	.50	.50	1.00	.50	1.00
030, 040	.25	1.00	.50	1.00	.50	1.00
045, 060, 130	.50	1.00	2.00	5.00	3.00	5.00
180, 220	.50	1.00	5.00	15.00	5.00	15.00
210, 320	.50	1.00	5.00	2.00	5.00	2.00

## 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 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.
	Suction port is blocked, not allowing flow to the pump.	Check all inlet valves, strainers, tank outlet ports.
<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 pressure or by filling with liquid and pressurizing with air).
	Pump speed too slow.	Increase pump speed.
	Pump speed too fast for high-viscosity liquid.	Decrease pump speed.
	Liquid drains or siphons from system during off periods.	Use foot valve or check valves. 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 on rotors, worn pump.	Increase pump speed, use foot valve to improve priming. Replace worn rotors.
	Net inlet pressure available too low.	Check Net Inlet Pressure Available & Net Inlet Pressure Required. Change inlet system as needed.
	On "Vacuum" inlet system: 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 or too high to obtain desired flow.	Check flow-speed curve (available from SPX FLOW website) and adjust as necessary.
	Air leak due to bad seals, pipe connections, or other equipment.	Replace seals, check inlet fittings.
<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>	Standard clearance rotors on "cold" fluid and/or low viscosity fluid.	Replace with low viscosity rotors.
	Worn pump.	Increase pump speed (within limits). Replace rotors
	High pressure.	Reduce pressure by adjusting system settings or hardware.
<b>Fluid vaporization ("starved" pump inlet)</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).  Increase Net Inlet Pressure Available at Pump by raising or pressurizing source tank.  Select larger pump size with lower Net Inlet Pressure Required.
	Fluid viscosity greater than expected.	Reduce pump speed and accept lower flow, or change system to reduce line losses.  Change 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.

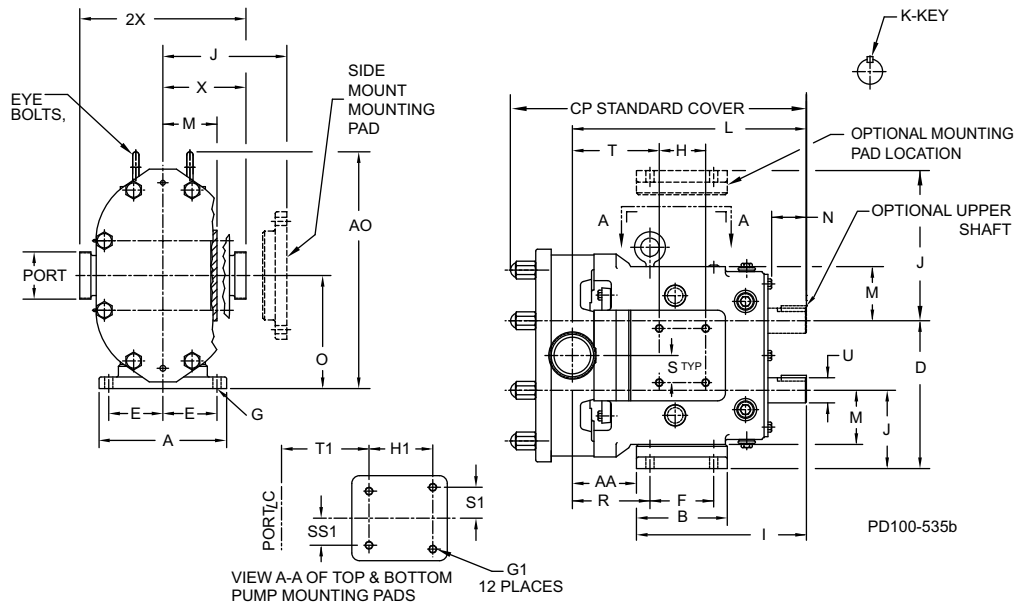
PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
<b>Noisy operation</b>	Cavitation	
	High fluid viscosity. High vapor pressure fluid. High temperature.	Slow down pump, reduce temperature, change system setup.
	Net Inlet Pressure Available less than Net Inlet Pressure Required.	Increase NIPA - Net Inlet Pressure Available or reduce NIPR - Net Inlet Pressure Required. Contact SPX FLOW if necessary.
	Air or gas in fluid	
	Leaks in the pump or piping.  Dissolved gas or naturally aerated products.	Correct leaks.  Minimize discharge pressure (also see "Cavitation," above).
<b>Noisy operation caused by mechanical problems</b>	Rotor to body contact	
	Improper assembly of pump.	Check clearances and adjust shimming.
	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.
	Worn bearings.	Rebuild with new bearings and lubricate regularly.
	Rotor to Rotor Contact	
	Loose or incorrectly-timed gears.  Worn gear splines.	This has caused severe damage to components - rebuild with new parts.  This has caused severe damage to components - rebuild with new parts.
<b>Pump requires excessive power (overheats, stalls, high current draw, breakers trip)</b>	Drive noise caused by gear trains, chains, couplings, bearings.	Repair or replace drive parts. Check bearings for damage and replace as necessary.
	Higher than expected viscosity losses.	If within pump rating, increase drive size.
	Higher than expected pressures.	Reduce pump speed. Increase line sizes.
	Fluid is colder with a higher viscosity than expected.	Heat fluid, insulate lines or heat trace lines.  Increase line sizes.



PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
<b>Pump requires excessive power (overheats, stalls, high current draw, breakers trip)</b>	Fluid sets in line and pump during shutdown.	Insulate lines or heat trace lines. Install a "soft start" drive. Install a recirculating bypass system. 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. Replace pump with a larger 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. Modify external wash down method to reduce water entering into gear case.
	Misalignment of drive and piping. (Excessive overhung load or misaligned couplings.)	Check alignment of piping and drive. Adjust as necessary.

# Pump Dimensions

## Universal 3 PD Pump Dimensions



U3 Model		A	AA	AO	B	CP	D	E	F	G	G1	H	H1
006	inch	4.71	2.41	8.3	3.66	12.42	5.50	1.97	2.31	0.50	5/16-18x.62	2.50	2.50
	mm	120	61	211	93	315	140	50	59	13	--	64	64
015	inch	4.71	2.41	8.3	3.66	12.69	5.50	1.97	2.31	0.50	5/16-18x.62	2.50	2.50
	mm	120	61	211	93	322	140	50	59	13	--	64	64
018	inch	4.71	2.65	8.3	3.66	13.35	5.50	1.97	2.31	0.50	5/16-18x.62	2.50	2.50
	mm	120	67	211	93	339	140	50	59	13	--	64	64
030	inch	6.19	3.22	10.29	4.15	15.16	6.86	2.42	2.56	.41, slot	3/8-16x.62	1.81	2.75
	mm	157	82	261	105	385	174	61	65	10, slot	--	46	70
040	inch	6.19	3.39	10.29	4.15	15.54	6.86	2.42	2.56	.41, slot	3/8-16x.62	1.81	2.75
	mm	157	86	261	105	395	174	61	65	10, slot	--	46	70
045	inch	8.25	3.85	15.31	5.88	19.11	9.56	3.5	4.12	0.53	1/2-13x.88	3.00	4.13
	mm	210	98	389	149	485	243	89	105	13	--	76	105
060	inch	8.25	4.13	15.31	5.88	19.66	9.56	3.5	4.12	0.53	1/2-13x.88	3.00	4.13
	mm	210	105	389	149	499	243	89	105	13	--	76	105
130	inch	8.25	4.77	15.31	5.88	20.68	9.56	3.5	4.12	0.53	1/2-13x.88	3.00	4.13
	mm	210	121	389	149	525	243	89	105	13	--	76	105
180	inch	8.5	3.46	19.13	9.00	23.48	12.38	3.75	7.25	.53, slot	1/2-13x.88	5.38	5.38
	mm	216	88	486	229	596	314	95	184	13, slot	--	137	137
210	inch	12	4.14	23.84	11.63	27.07	13.87	5.25	8.00	.66, slot	1/2-13x.88	5.38	5.38
	mm	305	105	606	295	688	352	133	203	17, slot	--	137	137
220	inch	8.5	3.70	19.13	9.00	24.22	12.38	3.75	7.25	.53, slot	1/2-13x.88	5.38	5.38
	mm	216	94	486	229	615	314	95	184	13, slot	--	137	137
270	inch	8.5	4.33	19.13	9.00	24.85	12.38	3.75	7.25	.53, slot	1/2-13x.88	5.38	5.38
	mm	216	110	486	229	631	314	95	184	13, slot	--	137	137
320	inch	12	4.52	23.84	11.63	27.66	13.87	5.25	8.00	.66, slot	1/2-13x.88	5.38	5.38
	mm	305	115	606	295	703	352	133	203	17, slot	--	137	137

### Universal 3 PD Pump Dimensions

U3 Model	I	J	K	L	M	N	O	Port Size	R	S	S1	SS1	T	T1	U	X	2X
006	7.61	2.93	0.19	10.04	2.43	1.92	4.21	1"	3.23	1.00	1.00	1.00	2.95	2.95	0.88	3.49	6.97
	193	74	5	255	62	49	107	--	82	25	25	25	75	75	22	89	177
015	7.61	2.93	0.19	10.04	2.43	1.92	4.21	1-1/2"	3.23	1.00	1.00	1.00	2.95	2.95	0.88	3.49	6.97
	193	74	5	255	62	49	107	--	82	25	25	25	75	75	22	89	177
018	7.61	2.93	0.19	10.28	2.43	1.92	4.21	1/1/2"	3.47	1.00	1.00	1.00	3.18	3.18	0.88	3.55	7.09
	193	74	5	261	62	49	107	--	88	25	25	25	81	81	22	90	180
030	8.80	3.56	0.25	12.05	2.62	2.26	5.21	1-1/2"	4.26	1.12	1.12	1.12	4.42	4.01	1.25	4.25	8.50
	224	90	6	306	67	57	132	--	108	28	28	28	112	102	32	108	216
040	8.80	3.56	0.25	12.21	2.62	2.26	5.21	2"	4.43	1.12	1.12	1.12	4.59	4.18	1.25	4.32	8.64
	224	90	6	310	67	57	132	--	113	28	28	28	117	106	32	110	219
045	11.00	5.06	0.38	14.84	3.50	2.18	7.31	2"	4.72	1.75	2.00	1.75	5.32	4.72	1.63	5.38	10.75
	279	129	10	377	89	55	186	--	120	44	51	44	135	120	41	137	273
060	11.00	5.06	0.38	15.13	3.50	2.18	7.31	2-1/2"	5.01	1.75	2.00	1.75	5.61	5.01	1.63	5.38	10.75
	279	129	10	384	89	55	186	--	127	44	51	44	142	127	41	137	273
130	11.00	5.06	0.38	15.76	3.50	2.18	7.31	3"	5.64	1.75	2.00	1.75	6.24	5.64	4.63	5.38	10.75
	279	129	10	400	89	55	186	--	143	44	51	44	158	143	118	137	273
180	14.80	6.38	0.50	19.03	4.50	2.67	9.38	3"	4.21	2.69	2.69	2.69	5.77	5.77	2.00	6.53	13.06
	376	162	13	483	114	68	238	--	107	68	68	68	147	147	51	166	332
210	17.72	6.87	0.63	21.85	5.06	4.02	10.38	4"	5.64	2.69	2.69	2.69	8.39	8.39	2.38	7.37	14.73
	450	174	16	555	129	102	264	--	143	68	68	68	213	213	60	187	374
220	14.80	6.38	0.50	18.49	4.50	2.67	9.38	4"	4.45	2.69	2.69	2.69	6.01	6.01	2.00	6.63	13.25
	376	162	13	470	114	68	238	--	113	68	68	68	153	153	51	168	337
270	14.80	6.38	0.50	19.13	4.50	2.67	9.38	4"	5.08	2.69	2.69	2.69	6.65	6.65	2.00	6.63	13.25
	376	162	13	486	114	68	238	--	129	68	68	68	169	169	51	168	337
320	17.72	6.87	0.63	22.34	5.06	4.02	10.38	6" 150# FLG	6.02	2.69	2.69	2.69	8.77	8.77	2.38	8.00	16.00
	450	174	16	567	129	102	264		153	68	68	68	223	223	60	203	406

Note: Dimensions "X" and "2X" apply for bevel seat, "S" Clamp, "Q" Clamp, 15I, and 14I fittings (except 320-U3).

## Tru-Fit™ Universal 3 PD Pump Dimensions

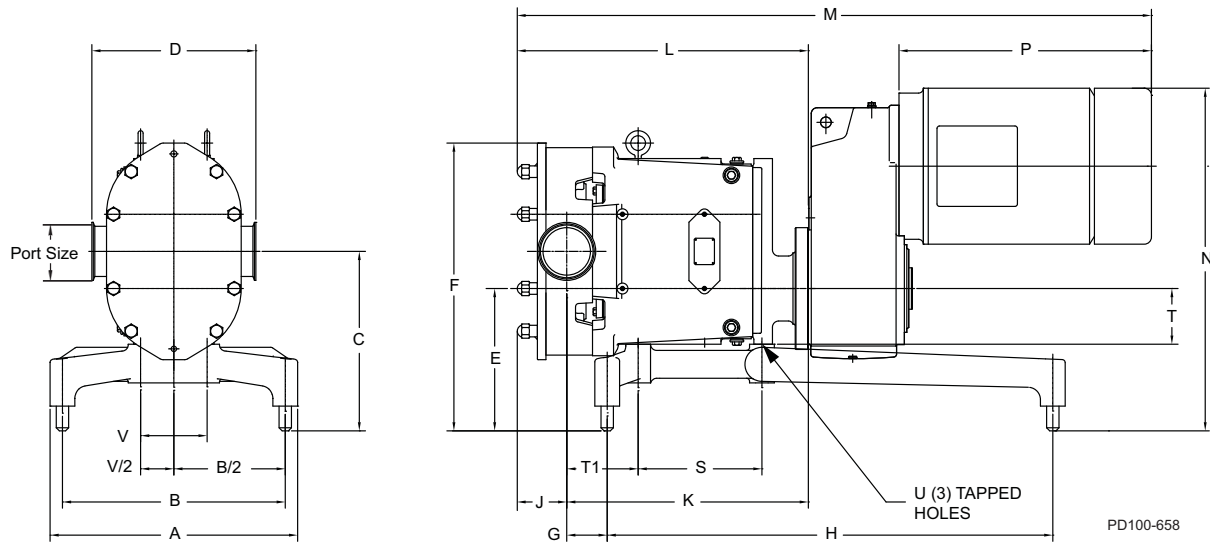


Table of Dimensions

U3 Model		A	B	C	D <sup>2</sup>	E	F	G	H	J	K	L	M <sup>1</sup>	N <sup>1</sup>	P <sup>1</sup>	S	T	T1	Port Size	U	V
006	inch	12.00	10.00	9.15	6.97	7.87	13.25	2.45	18.00	1.89	10.52	12.90	28.02	15.56	10.92	5.44	2.12	2.95	1"	5/16-16 x .62	2.00
	mm	305	254	232	177	200	337	62	457	48	267	328	712	395	227	138	54	75	--	--	51
015	inch	12.00	10.00	9.15	6.97	7.87	13.25	2.45	18.00	1.90	10.52	13.17	28.29	15.56	10.92	5.44	2.12	2.95	1-1/2"	5/16-16 x .62	2.00
	mm	304	254	232	177	200	337	62	457	48	267	335	719	395	227	138	54	75	--	--	51
018	inch	12.00	10.00	9.15	7.10	7.87	13.25	2.72	18.00	1.95	10.78	13.83	28.29	15.56	10.92	5.44	2.12	2.98	1-1/2"	5/16-16 x .62	2.00
	mm	304	254	232	180	200	337	69	457	50	274	351	719	395	227	138	54	76	--	--	51
030	inch	14.00	12.00	10.00	8.51	8.37	15.11	3.01	20.00	1.99	12.89	16.01	34.24	18.65	13.74	5.81	2.62	4.01	1-1/2"	3/8-16 x .62	2.25
	mm	356	304	255	216	213	384	76.454	508	51	327	407	870	474	349	148	67	102	--	--	57
040	inch	14.00	12.00	10.00	8.62	8.37	15.11	3.18	20.00	2.20	13.05	16.38	34.61	18.65	13.74	5.81	2.62	4.18	2"	3/8-16 x .62	2.25
	mm	356	305	255	219	213	384	80.772	508	56	331	416	879	474	349	148	67	106	--	--	57
045	inch	18.00	16.00	12.00	10.74	9.75	20.00	2.71	28.00	3.27	17.09	21.63	44.24	22.02	17.16	8.13	3.50	4.99	2"	1/2-13 x .88	3.50
	mm	457	406	305	273	248	508	69	711	83	434	549	1124	559	436	207	89	127	--	--	89
060	inch	18.00	16.00	12.00	10.74	9.75	20.00	3.00	28.00	2.91	17.38	21.91	44.52	22.02	17.16	8.13	3.50	5.00	2-1/2"	1/2-13 x .88	3.50
	mm	457	406	305	273	248	508	76	711	74	441	557	1131	559	436	208	89	127	--	--	89
130	inch	18.00	16.00	12.00	10.74	9.75	20.00	3.63	28.00	3.29	18.01	22.93	45.54	22.02	17.16	8.13	3.50	5.65	3"	1/2-13 x .88	3.50
	mm	457	406	305	273	218	508	92	711	84	457	582	1157	559	436	207	89	144	--	--	89
180	inch	20.00	18.00	14.50	13.06	11.50	23.25	3.28	36.00	4.16	19.53	24.73	50.24	25.91	18.82	10.00	4.50	6.01	3"	1/2-13 x 1.0	5.38
	mm	508	457	368	332	292	591	83.312	914	106	496	628	1276	658	478	254	114	153	--	--	137
220	inch	20.00	18.00	14.50	13.25	11.50	23.25	3.52	36.00	4.10	19.77	25.47	50.98	25.91	18.82	10.00	4.50	6.01	4"	1/2-13 x 1.0	5.38
	mm	508	457	368	337	292	591	89.408	914	104	502	647	1295	658	478	254	114	153	--	--	137

<sup>1</sup> Dimensions affected by motor frame size

<sup>2</sup> Dimensions affected by connection type

## Pump Shaft Guards

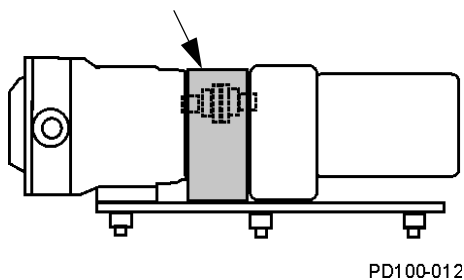
### ⚠ WARNING

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

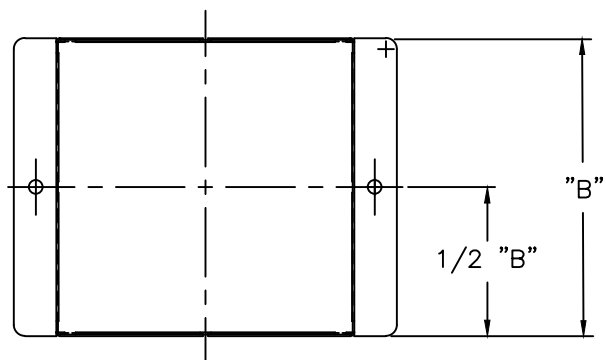
Guards are provided as part of a complete pump and drive package and are selected by SPX FLOW Engineering for the pump, base, and motor ordered. Do not modify the guard provided by SPX FLOW. If the guard provided by SPX FLOW is lost, contact SPX FLOW Customer Service and provide your order number or PO number of the pump to order a correctly-sized replacement guard.

If the pump was not purchased as a unit, it is the responsibility of the customer to ensure proper guarding. Refer to your local regulations for guidance.

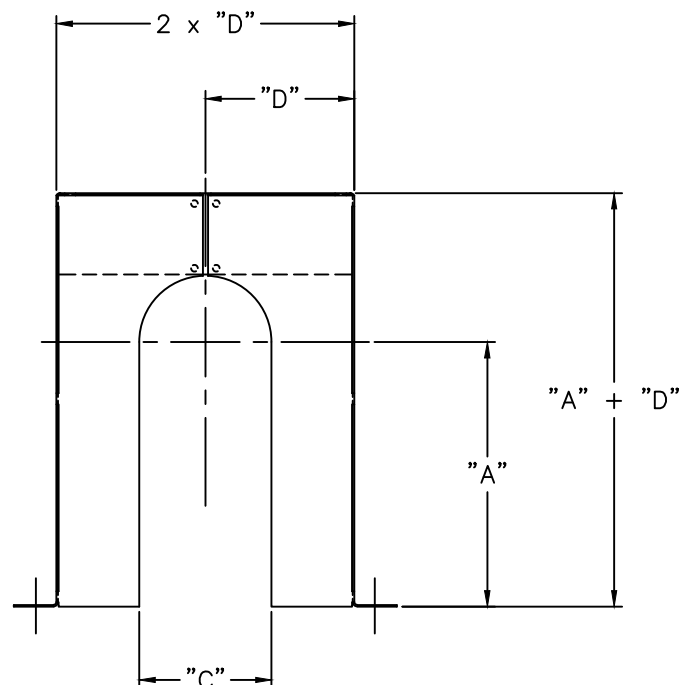
Guard (side view) shown as supplied with an SPX FLOW base package



Top view



Front view

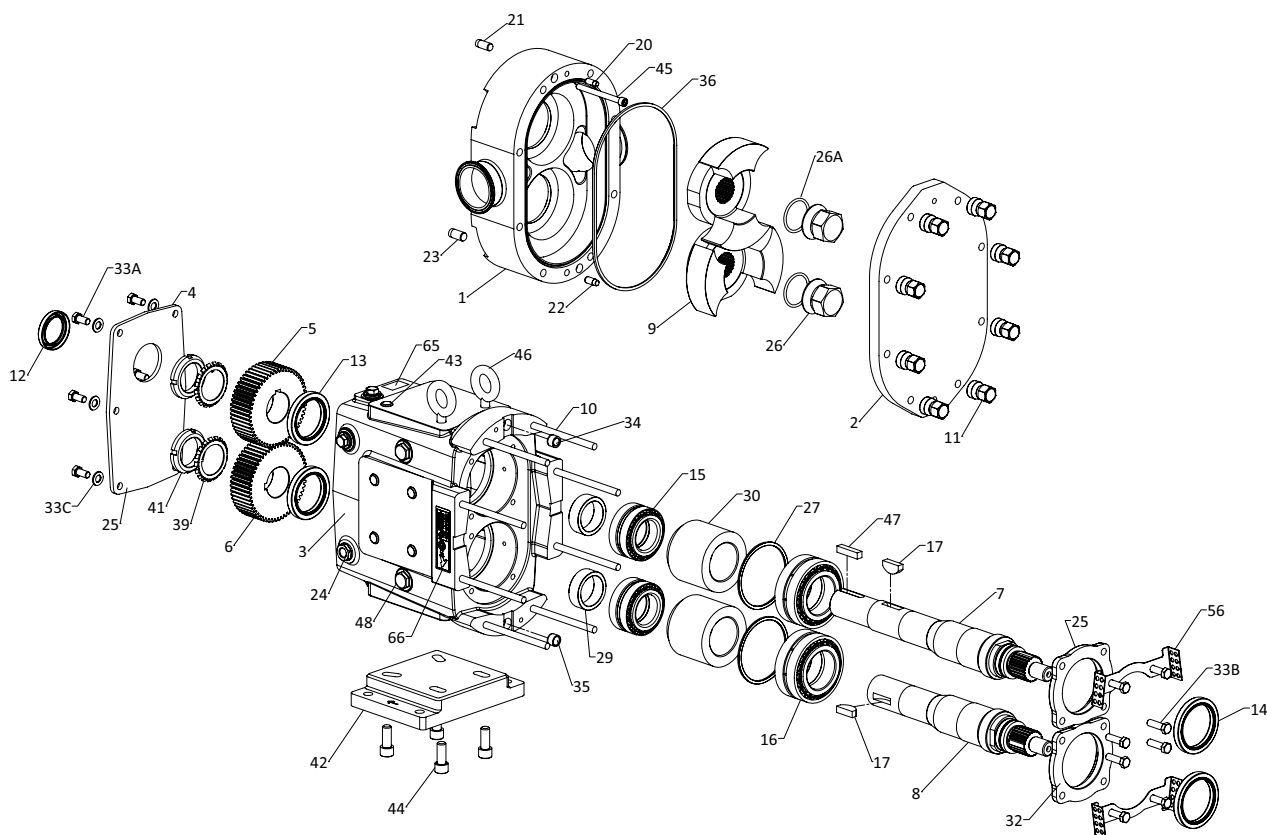


**NOTE:** Dimensions A, B, C, and D depend on the specific pump unit configuration.



## Parts List

### 006, 015, 018-U3 Parts



**006, 015, 018-U3 Parts**

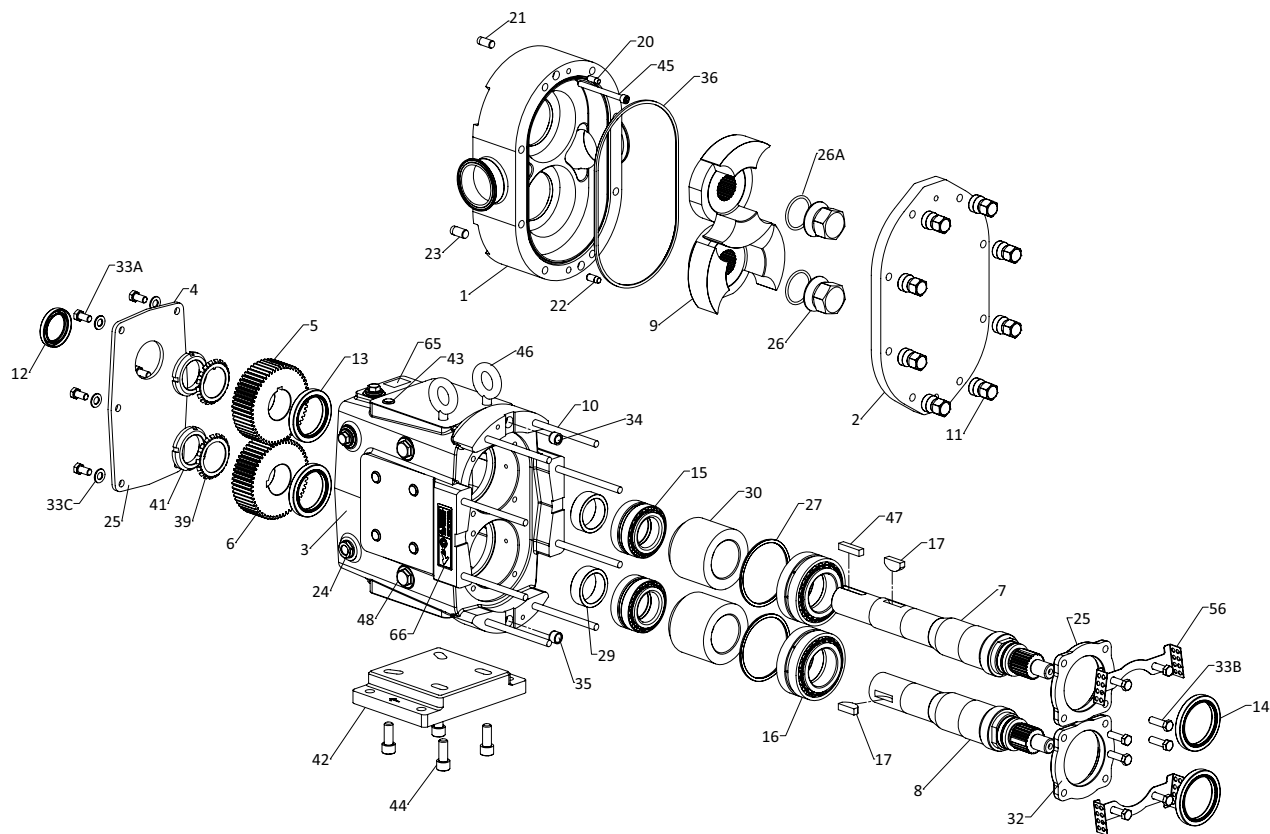
ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
1	Pump Body	1	See Note 1	1
2	006-U3 Pump Cover	1	138283+	
	015-U3 Pump Cover	1	138242+	
	018-U3 Pump Cover	1	138284+	
3	Gear Case, SS, Model 006, 015, 018	1	138116+	
4	Gear Case Cover, SS	1	102280+	
5	Gear, Drive Shaft, Spur	1	107997+	
6	Gear, Short Shaft, Spur	1	107997+	
7	006-015-018-U3 Drive Shaft	1	138240+	43
8	006-015-018-U3 Short Shaft	1	138239+	43
9	006-U3 Rotor, Twin Wing, Alloy 88	2	138253+	2
	006-U3 Rotor, Twin Wing, 316SS	2	138257+	2
	015-U3 Rotor, Twin Wing, Alloy 88	2	138263+	2
	015-U3 Rotor, Twin Wing, 316SS	2	138267+	2
	018-U3 Rotor, Twin Wing, Alloy 88	2	138273+	2
	018-U3 Rotor, Twin Wing, 316SS	2	138277+	2
9A	Rotor drive pin (not shown)	2	138646+	2
10	006-U3 Stud	8	138290+	
	015-U3 Stud	8	138291+	
	018-U3 Stud	8	138292+	
11	Hex Nut	8	108369+	
12	Oil Seal, Gear Case Cover	1	000030016+	
13	Oil Seal, Gear Case Rear	2	000030017+	
14	Grease Seal, Bearing Retainer	2	121679+	
15	Bearing, Rear	2	015035000+	
16	Bearing, Front	2	101714+	
17	Key, Gear	2	015037000+	
20	Dowel Pin, Upper Cover Side	1	137001+	
21	Dowel Pin, Upper Gear Case Side	1	124581+	
22	Dowel Pin, Lower Cover Side	1	137002+	
23	Dowel Pin, Lower Gear Case Side	1	124582+	
* 24	Oil Plug, M20 x 1.5"	5	137169+	4
	<b>O-Ring, Buna (for oil plug)</b>	5	N70114	
	Oil Level Indicator, M20 x 1.5"	1	137435+	
25	Silicone Sealant	1	000142301+	
26	Nut, Rotor	2	138243+	
* 26A	<b>O-Ring, Rotor Nut, EPDM</b>	2	E70121	
	<b>O-Ring, Rotor Nut, FKM</b>	2	V70121	
	<b>O-Ring, Rotor Nut, FFKM</b>	2	K70121	

PL5060-CH152

**Notes:****\* Recommended spare parts**

- Contact customer service with Serial Number of pump for Part Number.
  - Standard clearances and finishes for rotor part numbers shown. Contact customer service for optional clearances and finishes. All rotors include rotor drive pins installed. For replacement pin, see item 9A (not shown).
  - The oil plug requires O-ring N70114.
  - Tru-Fit drive shaft is longer than the standard drive shaft listed here. See page 125.
- For seals, see page 120 and 122.

006, 015, 018-U3 Parts



**006, 015, 018-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
27	Shim Kit	2	117889+	
29	Spacer, Gear to Rear Bearing	2	015055000+	
30	Bearing Spacer	2	101814+	
32	Bearing Retainer, Front	2	120332+	
33A, 33B	1/4-20 x 3/4" HHCS, SS	8	30-58	
33C	1/4" Flat Washer	8	43-27	
34	Dowel Bushing, Upper	1	AD0116000	
35	Dowel Bushing, Lower	1	AD0116100	
*	006-015-018-U3 Cover Gasket, FKM	1	137422+	
	006-015-018-U3 Cover Gasket, FFKM	1	137423+	
	006-015-018-U3 Cover Gasket, EPDM	1	137424+	
39	Lockwasher, Gear	2	STD136005	
41	Locknut, Gear	2	STD236005	
42	Mounting Foot 006-015-018-U3 SS	1	102284+	
43	Plastic Cap Plug	6	000121003+	
44	5/16-18 x 1" SHCS, SS	4	30-525	
45	006-U3 Body Retaining Screw	2	30-211	
	015-U3 Body Retaining Screw	2	30-543	
	018-U3 Body Retaining Screw	2	30-613	
46	Eye Bolt, 5/16-18 x 1/2" SS	2	30-719	
47	Key, Coupling - 3/16 x 3/16 x 1-1/8"	1	000037001+	
	Key, Coupling - Tru-Fit	1	119714+	
48	Cleanout Plug, SS	2	102298+	
56	006-015-018-U3 Seal Guard	2	138896+	
61	Name Plate, Sanitary	1	135623+	
62	#2 x .187" RHDS	4	30-355	
65	Caution Plate	2	121694+	
66	Warning Label	2	33-63	
67	Grease Fitting, 1/8"	4	LL118404	
68	Plastic Cap, Grease Fitting	4	BD0093000	

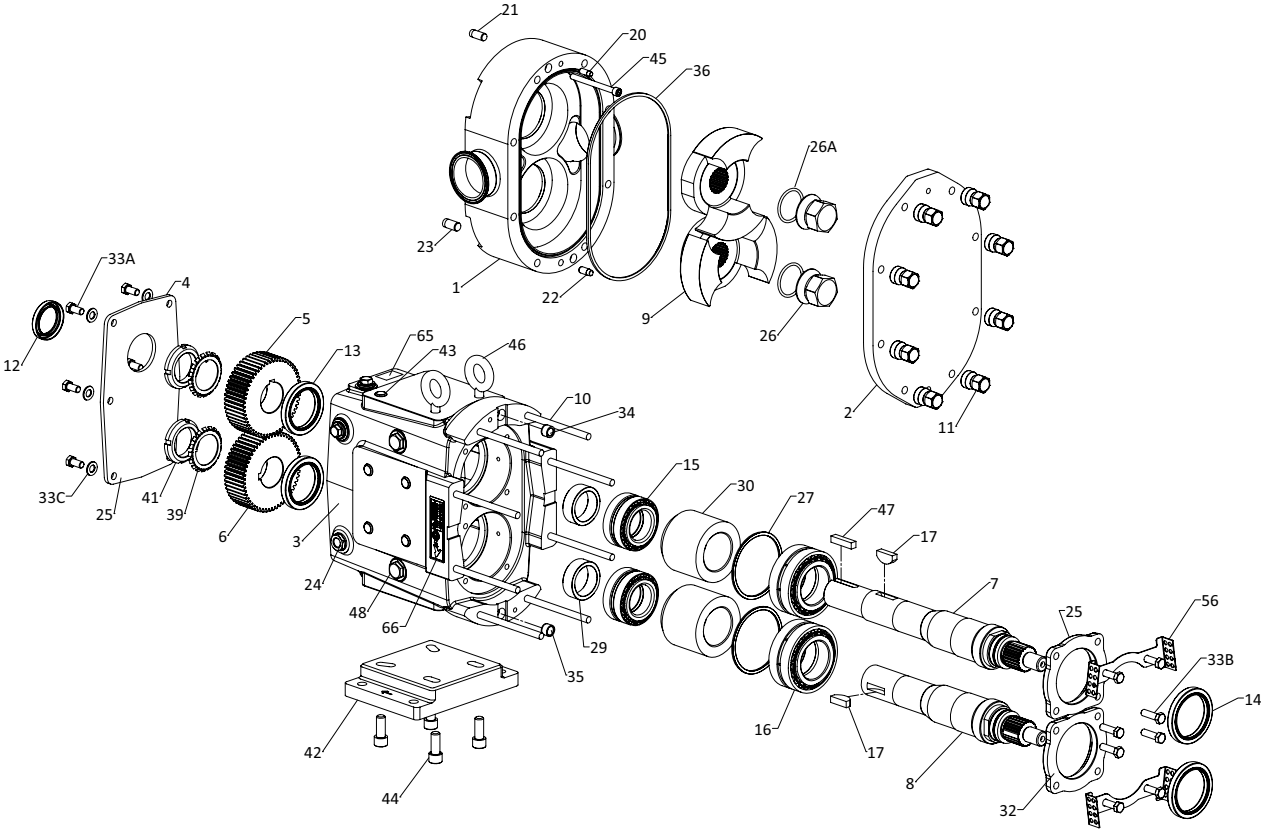
PL5060-CH153

**Notes:****\* Recommended spare parts**

For seals, see page 120 and 122.

3. See "Replacement Labels" on page 10 for detail.

030, 040-U3 Parts



**030, 040-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
1	Pump Body	1	See Note 1	1
2	030-U3 Pump Cover	1	133424+	
	040-U3 Pump Cover	1	137948+	
3	Gear Case, SS, Model 030, 040	1	138122+	
4	Gear Case Cover, SS	1	102281+	
5	Gear, Drive Shaft, Spur	1	107999+	
6	Gear, Short Shaft, Spur	1	107999+	
7	030-040-U3 Drive Shaft	1	133419+	43
8	030-040-U3 Short Shaft	1	133420+	43
9	030-U3 Rotor, Twin Wing, Alloy 88	2	133421+	2
	030-U3 Rotor, Twin Wing, 316SS	2	137963+	2
	040-U3 Rotor, Twin Wing, Alloy 88	2	137966+	2
	040-U3 Rotor, Twin Wing, 316SS	2	137972+	2
9A	Rotor drive pin (not shown)	2	137985+	2
10	030-U3 Stud	8	109865+	
	040-U3 Stud	8	138604+	
11	Hex Nut	8	108370+	
12	Oil Seal, Gear Case Cover	1	000030013+	
13	Oil Seal, Gear Case Rear	2	000030014+	
14	Grease Seal, Bearing Retainer	2	121680+	
15	Bearing, Rear	2	030035000+	
16	Bearing, Front	2	101715+	
17	Key, Gear	2	BD0037000	
20	Dowel Pin, Upper Cover Side	1	137001+	
21	Dowel Pin, Upper Gear Case Side	1	124582+	
22	Dowel Pin, Lower Cover Side	1	137002+	
23	Dowel Pin, Lower Gear Case Side	1	124583+	
* 24	Oil Plug, M20 x 1.5"	5	137169+	4
	<b>O-Ring, Buna (for oil plug)</b>	5	N70114	
	Oil Level Indicator, M20 x 1.5"	1	137435+	
25	Silicone Sealant	1	000142301+	
26	Nut, Rotor	2	137947+	
* 26A	<b>O-Ring, Rotor Nut, EPDM</b>	2	E70126	
	<b>O-Ring, Rotor Nut, FKM</b>	2	V70126	
	<b>O-Ring, Rotor Nut, FFKM</b>	2	K70126	

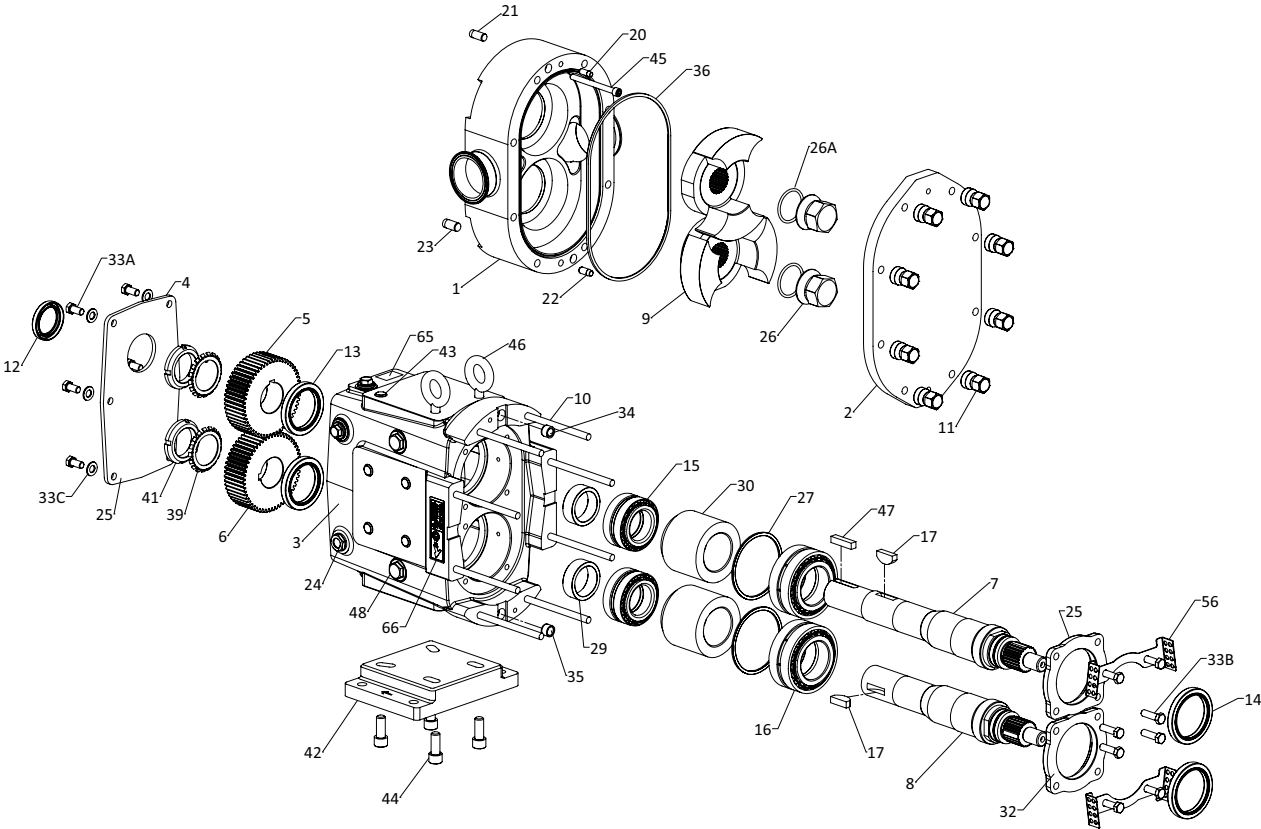
PL5060-CH154

**Notes:****\* Recommended spare parts**

- Contact customer service with Serial Number of pump for Part Number.
  - Standard clearances and finishes for rotor part numbers shown. Contact customer service for optional clearances and finishes. All rotors include rotor drive pins installed. For replacement pin, see item 9A (not shown).
  - The oil plug requires O-ring N70114.
  - Tru-Fit drive shaft is longer than the standard drive shaft listed here. See page 125.
- For seals, see page 120 and 122.



030, 040-U3 Parts



**030, 040-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
27	Shim Kit	2	117890+	
29	Spacer, Gear to Rear Bearing	2	030055000+	
30	Bearing Spacer	2	101815+	
32	Bearing Retainer, Front	2	120333+	
33A	5/16-18 X 3/4" HHCS, SS	8	30-623	
33B	5/16-18 X 3/4" SHCS, SS	8	30-296	
33C	5/16" Flat Washer	8	43-246	
34	Dowel Bushing, Upper	1	BD0116000	
35	Dowel Bushing, Lower	1	BD0116100	
*	030-040-U3 Cover Gasket, FKM	1	130296+	
	030-040-U3 Cover Gasket, FFKM	1	137240+	
	030-040-U3 Cover Gasket, EPDM	1	137245+	
39	Lockwasher, Gear	2	CD0036W00	
41	Locknut, Gear	2	CD0036N00	
42	Mounting Foot 030-040-U3 SS	1	102285+	
43	Plastic Cap Plug	6	000121002+	
44	3/8-16 x 1" SHCS	4	30-189	
45	030-U3 Body Retaining Screw	2	30-613	
	040-U3 Body Retaining Screw	2	30-740	
46	Eye Bolt, 3/8-16 x 9/16" SS	2	30-720	
47	Key, Coupling - 1/4 x 1/4 x 1-3/4"	1	000037002+	
	Key, Coupling - Tru-Fit	1	119715+	
48	Cleanout Plug, SS	2	102297+	
56	030-040-U3 Seal Guard	2	138897+	
61	Name Plate, Sanitary	1	135624+	
62	#2 x .187" RHDS	4	30-355	
65	Caution Plate	2	121694+	
66	Warning Label	2	33-63	
67	Grease Fitting, 1/8"	4	LL118404	
68	Plastic Cap, Grease Fitting	4	BD0093000	

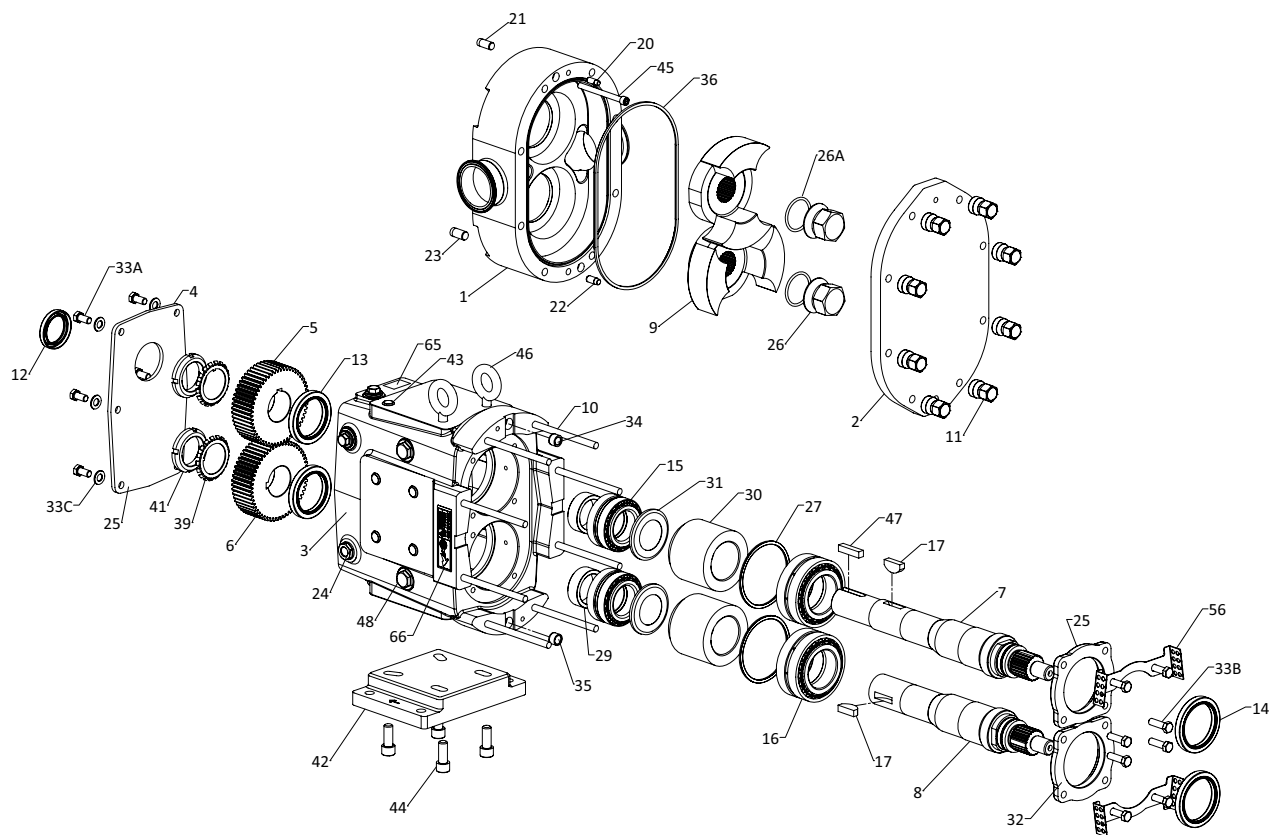
PL5060-CH155

**Notes:****\* Recommended spare parts**

For seals, see page 120 and 122.

3. See "Replacement Labels" on page 10 for detail.

045, 060, 130-U3 Parts



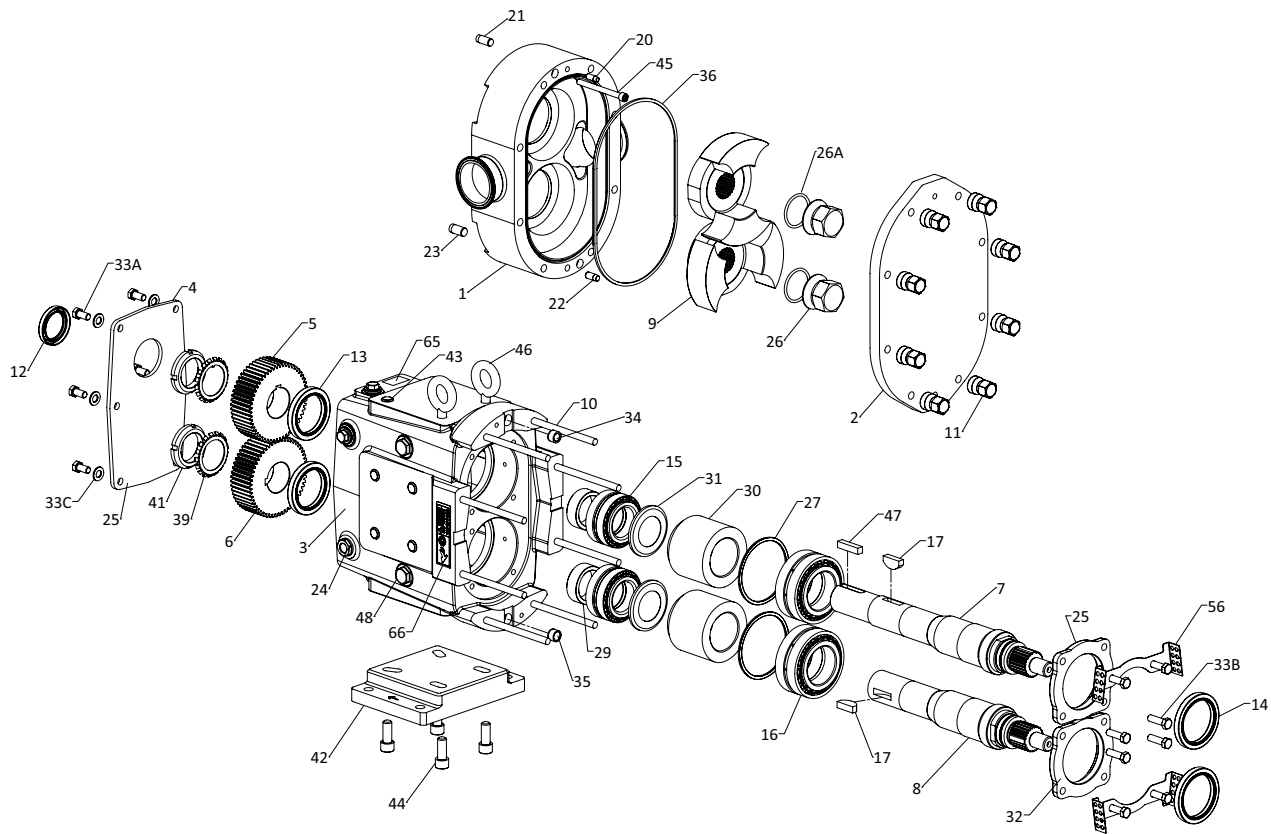
**045, 060, 130-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
1	Pump Body	1	See Note 1	1
2	045-U3 Pump Cover	1	138048+	
	060-U3 Pump Cover	1	138049+	
	130-U3 Pump Cover	1	138031+	
3	Gear Case, SS, Model 045, 060, 130	1	138131+	
4	Gear Case Cover, SS	1	102282+	
5	Gear, Drive Shaft, Spur	1	107404+	
6	Gear, Short Shaft, Spur	1	107404+	
7	045-060-130-U3 Drive Shaft	1	138042+	43
8	045-060-130-U3 Short Shaft	1	138043+	43
9	045-U3 Rotor, Twin Wing, Alloy 88	2	138035+	2
	045-U3 Rotor, Twin Wing, 316SS	2	138055+	2
	060-U3 Rotor, Twin Wing, Alloy 88	2	138036+	2
	060-U3 Rotor, Twin Wing, 316SS	2	138063+	2
	130-U3 Rotor, Twin Wing, Alloy 88	2	138037+	2
	130-U3 Rotor, Twin Wing, 316SS	2	138070+	2
9A	Rotor drive pin (not shown)	2	137985+	2
10	045-U3 Stud	8	138611+	
	060-U3 Stud	8	108843+	
	130-U3 Stud	8	138612+	
11	Hex Nut	8	108371+	
12	Oil Seal, Gear Case Cover	1	000030012+	
13	Oil Seal, Gear Case Rear	2	000030011+	
14	Grease Seal, Bearing Retainer	2	101829+	
15	Bearing, Rear	2	107186+	
16	Bearing, Front	2	060036000+	
17	Key, Gear	2	060037000+	
20	Dowel Pin, Upper Cover Side	1	124586+	
21	Dowel Pin, Upper Gear Case Side	1	124584+	
22	Dowel Pin, Lower Cover Side	1	137003+	
23	Dowel Pin, Lower Gear Case Side	1	137002+	
* 24	Oil Plug, M20 x 1.5"	5	137169+	4
	<b>O-Ring, Buna (for oil plug)</b>	5	N70114	
	Oil Level Indicator, M20 x 1.5"	1	137435+	
25	Silicone Sealant	1	000142301+	
26	Nut, Rotor	2	138044+	
* 26A	<b>O-Ring, Rotor Nut, EPDM</b>	2	E70224	
	<b>O-Ring, Rotor Nut, FKM</b>	2	V70224	
	<b>O-Ring, Rotor Nut, FFKM</b>	2	K70224	

PL5060-CH156

**Notes:****\* Recommended spare parts**

1. Contact customer service with Serial Number of pump for Part Number.
  2. Standard clearances and finishes for rotor part numbers shown. Contact customer service for optional clearances and finishes. All rotors include rotor drive pins installed. For replacement pin, see item 9A (not shown).
  4. The oil plug requires O-ring N70114.
  43. Tru-Fit drive shaft is longer than the standard drive shaft listed here. See page 125.
- For seals, see page 120 and 122.

**045, 060, 130-U3 Parts**

**045, 060, 130-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
27	Shim Kit	2	117891+	
29	Spacer, Gear to Rear Bearing	2	107187+	
30	Bearing Spacer	2	060055003+	
31	Retainer, Grease	2	STD091000	
32	Bearing Retainer, Front	2	121828+	
33A	3/8-16 x 3/4" HHCS Gear Case Cover	8	30-50	
33B	3/8-16 x 1-1/4" HHCS, SS Bearing Retainer	8	30-60	
33C	3/8" Flat Washer, Gear Case Cover	8	43-30	
34	Dowel Bushing, Upper	1	CD0116000	
35	Dowel Bushing, Lower	1	CD0116100	
*	045-060-130-U3 Cover Gasket, FKM	1	133633+	
	045-060-130-U3 Cover Gasket, FFKM	1	137241+	
	045-060-130-U3 Cover Gasket, EPDM	1	137246+	
39	Lockwasher, Gear	2	STD136009	
41	Locknut, Gear	2	STD236009	
42	Mounting Foot 045-060-130-U3 SS	1	102286+	
43	Plastic Cap Plug	6	000121001+	
44	1/2-13 x 1-1/4" SS SHCS	4	30-503	
45	045-U3 Body Retaining Screw	2	30-319	
	060-U3 Body Retaining Screw	2	30-760	
	130-U3 Body Retaining Screw	2	30-761	
46	Eye Bolt, 1/2-13 x 3/4"	2	30-721	
47	Key, Coupling - 3/8 x 3/8 x 1-5/8"	1	000037003+	
	Key, Coupling - Tru-Fit	1	119716+	
48	Cleanout Plug, SS	2	102297+	
56	045-060-130-U3 Seal Guard	2	138898+	
61	Name Plate, Sanitary	1	135624+	
62	#2 x .187" RHDS	4	30-355	
65	Caution Plate	2	121694+	
66	Warning Label	2	33-60	
67	Grease Fitting, 1/8"	4	LL118404	
68	Plastic Cap, Grease Fitting	4	BD0093000	

PL5060-CH157

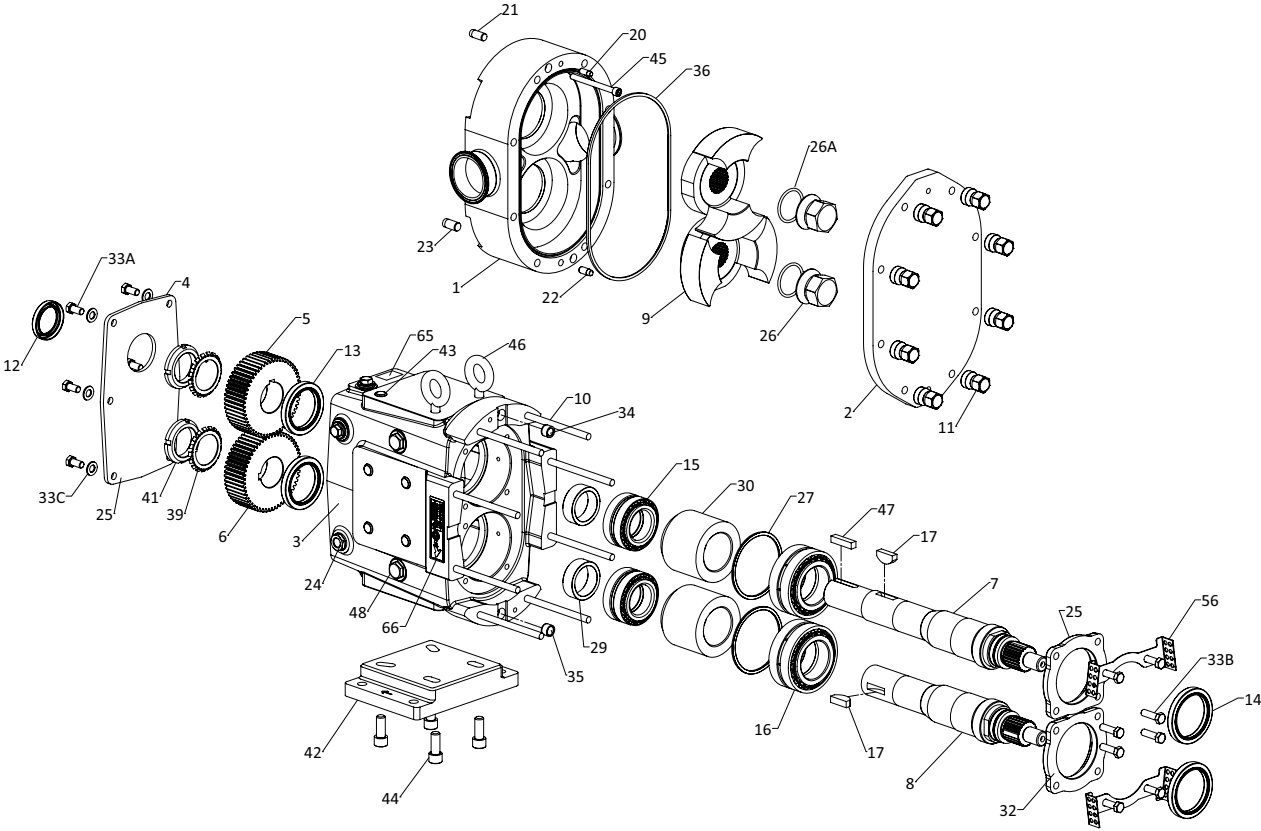
**Notes:****\* Recommended spare parts**

For seals, see page 120 and 122.

3. See "Replacement Labels" on page 10 for detail.



180, 220-U3 Parts



**180, 220-U3 Parts**

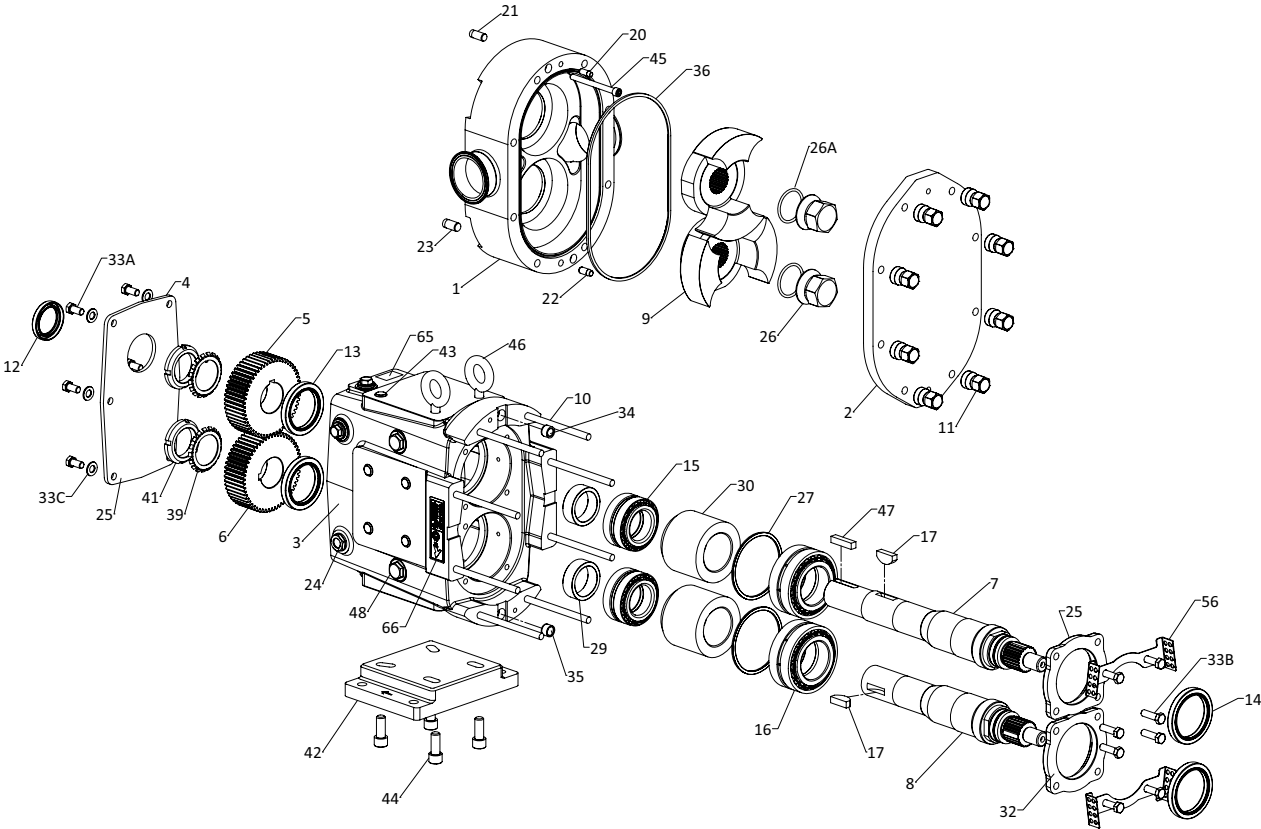
ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
1	Pump Body	1	See Note 1	1
2	180-U3 Pump Cover	1	138189+	
	220-U3 Pump Cover	1	138190+	
3	Gear Case, SS, Model 180, 220	1	138143+	
4	Gear Case Cover, SS	1	102283+	
5	Gear, Drive Shaft, Spur	1	110932+	
6	Gear, Short Shaft, Spur	1	110932+	
7	180-220U3 Drive Shaft	1	138107+	43
8	180-220U3 Short Shaft	1	138108+	43
9	180-U3 Rotor, Twin Wing, Alloy 88	2	138159+	2
	180-U3 Rotor, Twin Wing, 316SS	2	138163+	2
	220-U3 Rotor, Twin Wing, Alloy 88	2	138170+	2
	220-U3 Rotor, Twin Wing, 316SS	2	138174+	2
9A	Rotor drive pin (not shown)	2	M525S1670X	2
10	180-U3 Stud	8	138340+	
	220-U3 Stud	8	138626+	
11	Hex Nut	8	108372+	
12	Oil Seal, Gear Case Cover	1	STD030006	
13	Oil Seal, Gear Case Rear	2	STD119002	
14	Grease Seal, Bearing Retainer	2	121681+	
15	Bearing, Rear	2	300035000+	
16	Bearing, Front	2	200036000+	
17	Key, Gear	2	200037000+	
20	Dowel Pin, Upper Cover Side	1	124586+	
21	Dowel Pin, Upper Gear Case Side	1	124584+	
22	Dowel Pin, Lower Cover Side	1	137005+	
23	Dowel Pin, Lower Gear Case Side	1	137004+	
* 24	Oil Plug, M20 x 1.5"	5	137169+	4
	<b>O-Ring, Buna (for oil plug)</b>	5	N70114	
	Oil Level Indicator, M20 x 1.5"	1	137435+	
25	Silicone Sealant	1	000142301+	
26	Nut, Rotor	2	138112+	
* 26A	<b>O-Ring, Rotor Nut, EPDM</b>	2	E70228	
	<b>O-Ring, Rotor Nut, FKM</b>	2	V70228	
	<b>O-Ring, Rotor Nut, FFKM</b>	2	K70228	

PL5060-CH158

**Notes:****\* Recommended spare parts**

1. Contact customer service with Serial Number of pump for Part Number.
  2. Standard clearances and finishes for rotor part numbers shown. Contact customer service for optional clearances and finishes. All rotors include rotor drive pins installed. For replacement pin, see item 9A (not shown).
  4. The oil plug requires O-ring N70114.
  43. Tru-Fit drive shaft is longer than the standard drive shaft listed here. See page 125.
- For seals, see page 120 and 122.

180, 220-U3 Parts



**180, 220-U3 Parts**

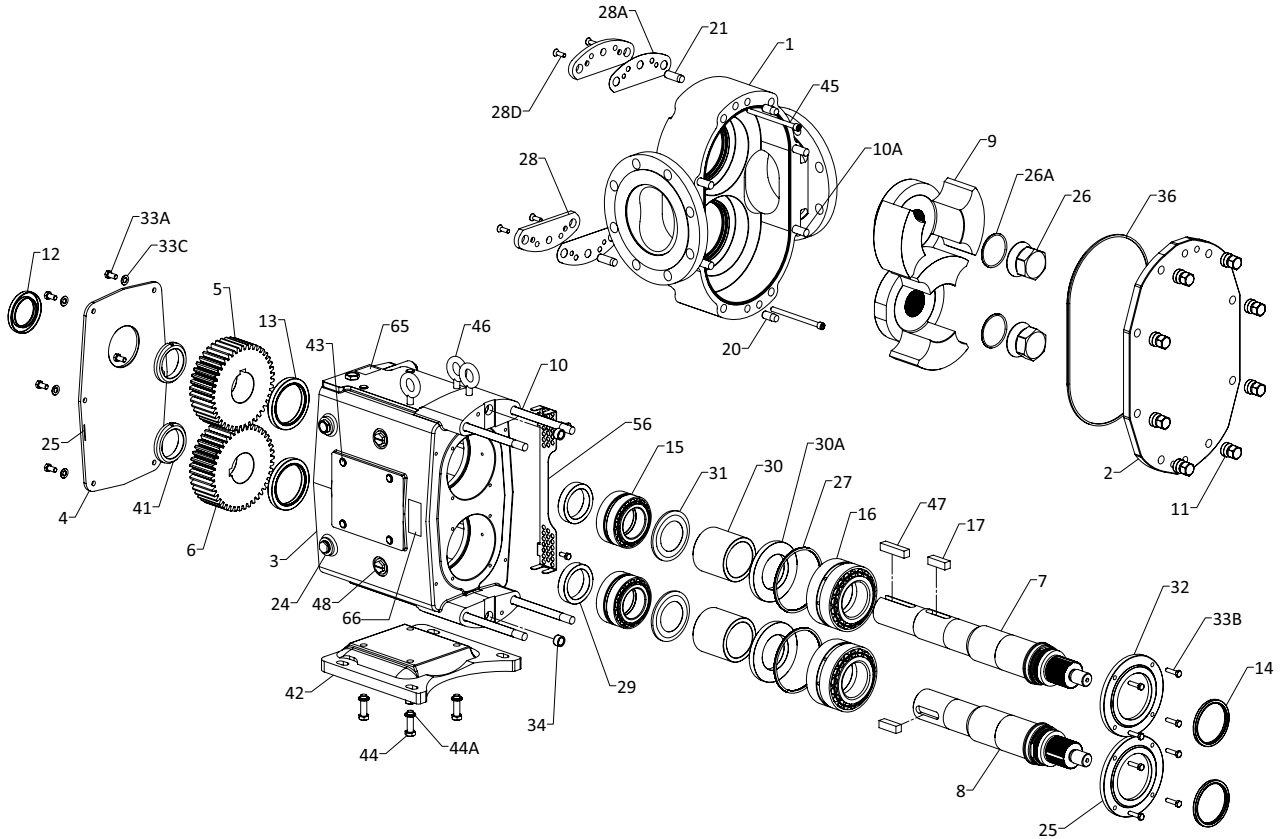
ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
27	Shim Kit	2	117892+	
29	Spacer, Gear to Rear Bearing	2	40878+	
30	Bearing Spacer	2	40752+	
32	Bearing Retainer, Front	2	121829+	
33A	3/8-16 x 3/4" HHCS, SS Gear Case Cover	8	30-50	
33B	3/8-16 x 1-1/4" HHCS, SS Bearing Retainer	8	30-60	
33C	3/8" Flat Washer, Gear Case Cover	8	43-30	
34	Dowel Bushing, Upper	1	CD0116000	
35	Dowel Bushing, Lower	1	CD0116100	
*	180-220-U3 Cover Gasket, FKM	1	137431+	
	180-220-U3 Cover Gasket, FFKM	1	137432+	
	180-220-U3 Cover Gasket, EPDM	1	137433+	
39	Lockwasher, Gear	2	STD136011	
41	Locknut, Gear	2	STD236011	
42	Mounting Foot 180-220-U3 SS	1	102287+	
43	Plastic Cap Plug	6	000121001+	
44	1/2-13 x 1-1/4" SS SHCS	4	30-503	
45	180-U3 Body Retaining Screw	2	30-766	
	220-U3 Body Retaining Screw	2	30-717	
46	Eye Bolt, 1/2-13 x 3/4"	2	30-721	
47	Key, Coupling - 1/2 x 1/2 x 1-7/8"	1	000037004+	
	Key, Coupling - Tru-Fit	1	119717+	
48	Cleanout Plug, SS	2	102297+	
56	180-220-U3 Seal Guard	2	138899+	
61	Name Plate, Sanitary	1	135624+	
62	#2 x .187" RHDS	4	30-355	
65	Caution Plate	2	121694+	
66	Warning Label	2	33-60	
67	Grease Fitting, 1/8"	4	LL118404	
68	Plastic Cap, Grease Fitting	4	BD0093000	

PL5060-CH159

**Notes:****\* Recommended spare parts**

For seals, see page 120 and 122.

3. See "Replacement Labels" on page 10 for detail.

**210, 320-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
<b>1</b>	Pump Body	1	See Note 1	1
<b>3</b>	Gear Case, SS, Model 210-320	1	138149+	
<b>2</b>	210-U3 Pump Cover	1	138286+	
	320-U3 Pump Cover	1	138285+	
<b>4</b>	Gear Case Cover, SS	1	135851+	
<b>5</b>	Gear, Drive Shaft, Spur	1	102470+	
<b>6</b>	Gear, Short Shaft, Sput	1	102470+	
<b>7</b>	210-320-U3 Drive Shaft	1	138281+	43
<b>8</b>	210-320-U3 Short Shaft	1	138282+	43
<b>9</b>	210-U3 Rotor, Twin Wing, Alloy 88	2	138332+	2
	210-U3 Rotor, Twin Wing, 316SS	2	138336+	2
	320-U3 Rotor, Twin Wing, Alloy 88	2	138300+	2
	320-U3 Rotor, Twin Wing, 316SS	2	138304+	2
<b>9A</b>	Rotor drive pin (not shown)	2	M525S1670X	2
<b>10</b>	210-U3 Stud, Long	4	138340+	
	320-U3 Stud, Long	4	138341+	
<b>10A</b>	210-320 Stud, Short	4	111292+	
<b>11</b>	Hex Nut	8	108373+	
<b>12</b>	Oil Seal, Gear Case Cover	1	STD030004	
<b>13</b>	Oil Seal, Gear Case Rear	2	102475+	

PL5060-CH160

See notes on page 117.

**210, 320-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
14	Grease Seal, Bearing Retainer	2	121681+	
15	Bearing, Rear	2	0H1036000	
16	Bearing, Front	2	0H1036003	
17	Key, Gear	2	0H1037000	
20	Dowel Pins, Cover Side	2	0H1040000	
21	Dowel Pins, Gear Case Side	2	105871+	
*	Oil Plug, M20 x 1.5"	5	137169+	4
	<b>O-Ring, Buna (for oil plug)</b>	5	N70114	
	Oil Level Indicator, M20 x 1.5"	1	137435+	
25	Silicone Sealant	1	000142301+	
26	Nut, Rotor	2	138288+	
*	<b>O-Ring, Rotor Nut, EPDM</b>	2	E70231	
	<b>O-Ring, Rotor Nut, FKM</b>	2	V70231	
	<b>O-Ring, Rotor Nut, FFKM</b>	2	K70231	
27	Shim Kit	2	117893+	
28	Shim Plate	2	134506+	
28A	Shims, Body, .002	AR	134507+	
	Shims, Body, .003	AR	134508+	
	Shims, Body, .005	AR	134509+	
	Shims, Body, .010	AR	134510+	
	Shims, Body, .020	AR	134511+	
28D	5/16-18 x 1" FHSCS	4	30-612	
29	Spacer, Gear to Rear Bearing	2	102474+	
30	Bearing Spacer	2	102472+	
30A	Spacer Seal	2	102473+	
31	Retainer, Grease	2	STD091000	
32	Bearing Retainer, Front	2	123533+	
33A	3/8-16 x .75" HHCS	6	30-50	
33B	5/16-18 x 1.125" BSHCS	8	30-742	
33C	3/8" Flat Washer	6	43-30	
34	Dowel Bushings	2	0H1116000	
*	<b>210-U3 Cover Gasket, FKM</b>	1	139750+	
	<b>210-U3 Cover Gasket, FFKM</b>	1	139751+	
	<b>210-U3 Cover Gasket, EPDM</b>	1	139752+	
	<b>320-U3 Cover Gasket, FKM</b>	1	133636+	
	<b>320-U3 Cover Gasket, FFKM</b>	1	137243+	
	<b>320-U3 Cover Gasket, EPDM</b>	1	137248+	
41	Locknut, Gear	2	105697+	

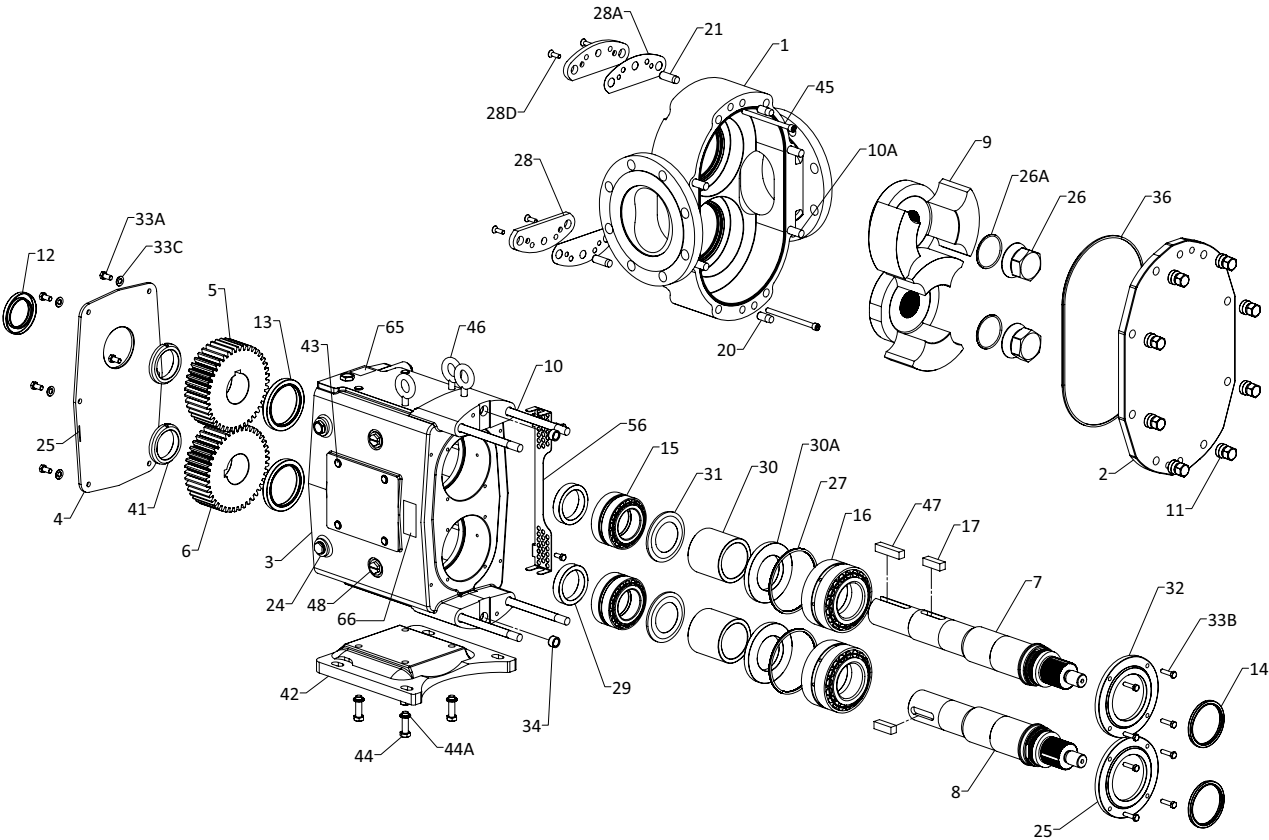
PL5060-CH160a

**Notes:****\* Recommended spare parts**

1. Contact customer service with Serial Number of pump for Part Number.
  2. Standard clearances and finishes for rotor part numbers shown. Contact customer service for optional clearances and finishes. All rotors include rotor drive pins installed. For replacement pin, see item 9A (not shown).
  4. The oil plug requires O-ring N70114.
  43. Tru-Fit drive shaft is longer than the standard drive shaft listed here. See page 125.
- For seals, see page 120 and 122.



210, 320-U3 Parts



**210, 320-U3 Parts**

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.	NOTES
42	Mounting Foot 210-320-U3 SS	1	130748+	
43	Plastic Cap Plug	8	000121001+	
44	1/2-13 x 1-3/4" HHCS	4	30-127X	
44A	Lock Washer, 1/2"	4	43-16	
45	210-U3 Body Retaining Screws	2	30-766	
	320-U3 Body Retaining Screws	2	30-766	
46	Eye Bolt	3	30-721	
47	Key, Coupling - 5/8 x 5/8 x 2-3/4"	1	000037005+	
	Key, Coupling - Tru-Fit	1	119718+	
48	Cleanout Plug, SS	2	102297+	
56	210-320-U3 Seal Guard	2	113504+	
56A	5/16-18 x .75" HHCS	4	30-623	
60A	1/8-27 Aseptic Connection Pipe Plugs	10	STD128500	
61	Name Plate, Sanitary	1	135624+	
62	#2 x .187" RHDS	4	30-355	
65	Caution Plate	2	121694+	
66	Warning Label	2	33-60	
67	Grease Fitting, 1/8"	4	LL118404	
68	Plastic Cap, Grease Fitting	4	BD0093000	

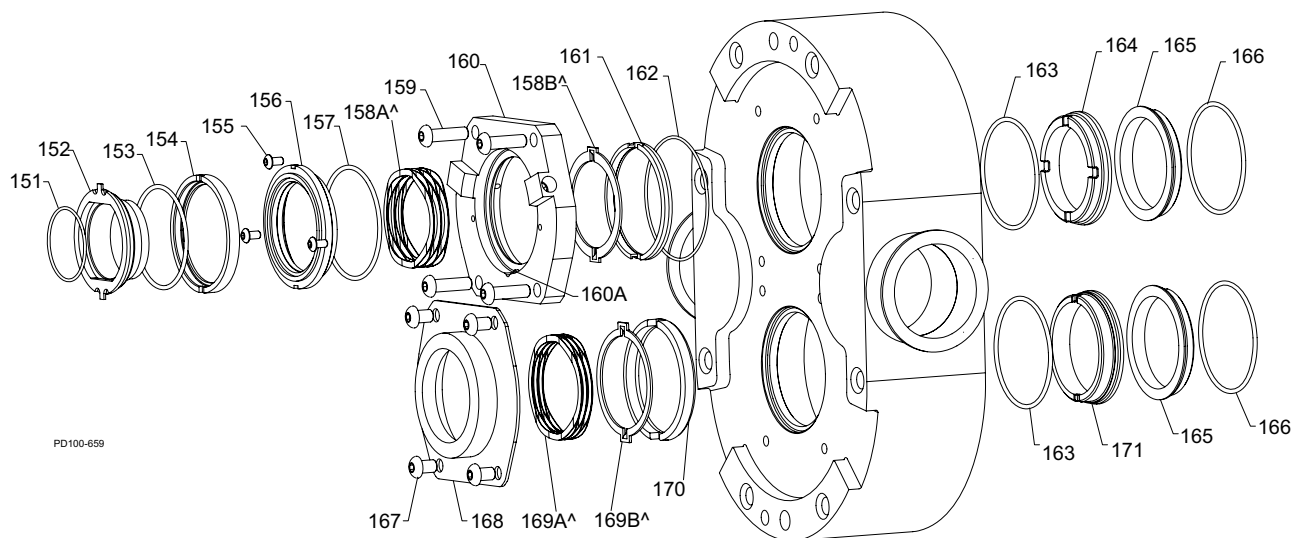
PL5060-CH161

**Notes:****\* Recommended spare parts**

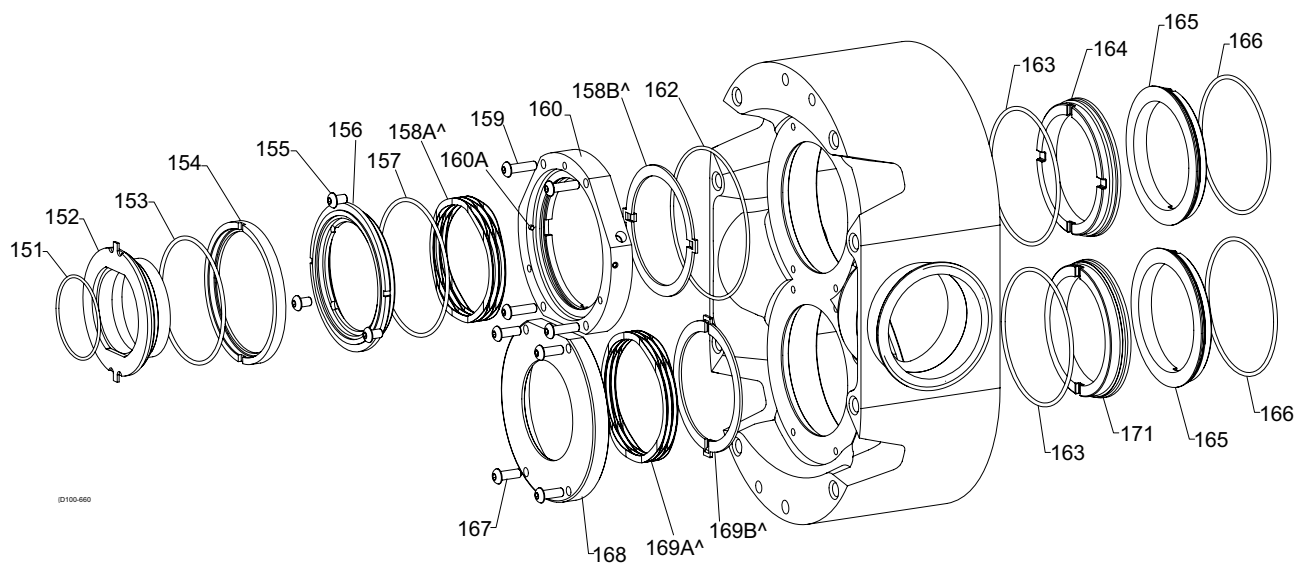
For seals, see page 120 and 122.

3. See "Replacement Labels" on page 10 for detail.

## Universal 3 Standard Seals



***Double (Top) and Single (Bottom) Mechanical Seal, U3 pumps 130-U3 and smaller***



***Double (Top) and Single (Bottom) Mechanical Seal, U3 pumps 180-U3 and larger***

^ Kit contains 1 wave spring and 1 drive ring.

## Universal 3 Standard Seals

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.					NOTES
			006, 015, 018-U3	030, 040-U3	045, 060, 130-U3	180, 220-U3	210, 320-U3	
* 151	O-Ring, Adjusting Ring	EPDM	2	E70024	E70031	E70150		
		FKM	2	V70024	V70031	V70150		
152	Adjusting Ring		2	138246+	137980+	138212+		
* 153	O-Ring, Flush Rotary Seal	EPDM	2	E70130	E70145	E70245		
		FKM	2	V70130	V70145	V70245		
154	Flush-Side Rotary Seal	SC	2	138371+	138372+	138373+		
155	Seal Retaining Bolt		6	30-546	30-546	30-741		
156	Flush-Side Stationary Seal	C	2	139787+	139788+	139789+		
* 157	O-Ring, Flush Stationary Seal	EPDM	2	E70134	E70147	E70248		
		FKM	2	V70134	V70147	V70248		
158A	Wave Spring (sold as a kit with 158B)		2	139890+	139892+	139894+		2
158B	Drive Ring (sold as a kit with 158A)							
159	Seal Housing Bolt		8	30-765	30-725   30-742	30-742		
160	Seal Housing - DM, includes stop pin		2	138245+	137979+   138074+	138192+   138289+		3
160A	Stop Pin, Seal		4	137124+	137985+	138451+		3
161	Shaft Ring - DM		2	LA1215200	LA1215400	N/A   N/A		1
* 162	O-Ring, Seal Housing	EPDM	2	E70036	E70041	L25071004		
		FKM	2	V70036	V70041	L25071002		
* 163	O-Ring, Product Stationary Seal	EPDM	2	E70135	E70147	E70248		
		FKM	2	V70135	V70147	V70248		
		FFKM	2	K70135	K70147	K70248		
164	Product-side stationary seal	SC	2	138368+	138369+	138370+		
		C	2	138385+	138386+	138387+		
		TC	2	138400+	138401+	138402+		
		SC NF	2	139592+	139596+	N/A		
		TC NF	2	139593+	139597+	N/A		
165	Product-side rotary seal	SC	2	138362+	138363+	138364+   138364+		
		TC	2	138394+	138395+	138396+   138396+		
* 166	O-Ring, Product Rotary Seal	EPDM	2	E70135	E70147	E70248   E70248		
		FKM	2	V70135	V70147	V70248   V70248		
		FFKM	2	K70135	K70147	K70248   K70248		
167	Seal Housing Bolt		8	30-546	30-741	30-745   30-745		
168	Seal Housing - SM		2	138244+	137946+   138076+	138195+   138343+		
169A	Wave Spring (sold as a kit with 169B)		2	139891+	139893+	139895+		2
169B	Drive Ring (sold as a kit with 169A)							
170	Shaft Ring - SM		2	LA2363201		N/A   N/A		1
171	Stationary Seal	SC	2	138365+	138366+	138367+   138367+		
		C	2	138382+	138383+	138384+   138384+		
		TC	2	138397+	138393+	138399+   138399+		
		SC NF	2	139590+	139594+	N/A   N/A		
		TC NF	2	139591+	139595+	N/A   N/A		

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## Notes:

\* Recommended spare part

- Does not apply to U3 pumps 180-U3 and larger
- Seal Service Kit (indicated with ^ on page 120) contains 1 wave spring and 1 drive ring.
- Seal Housing - DM includes stop pin installed. For a replacement pin, see item 160A.

## Seal Description Key:

DM Double Mechanical

SM Single Mechanical

SC Silicon Carbide

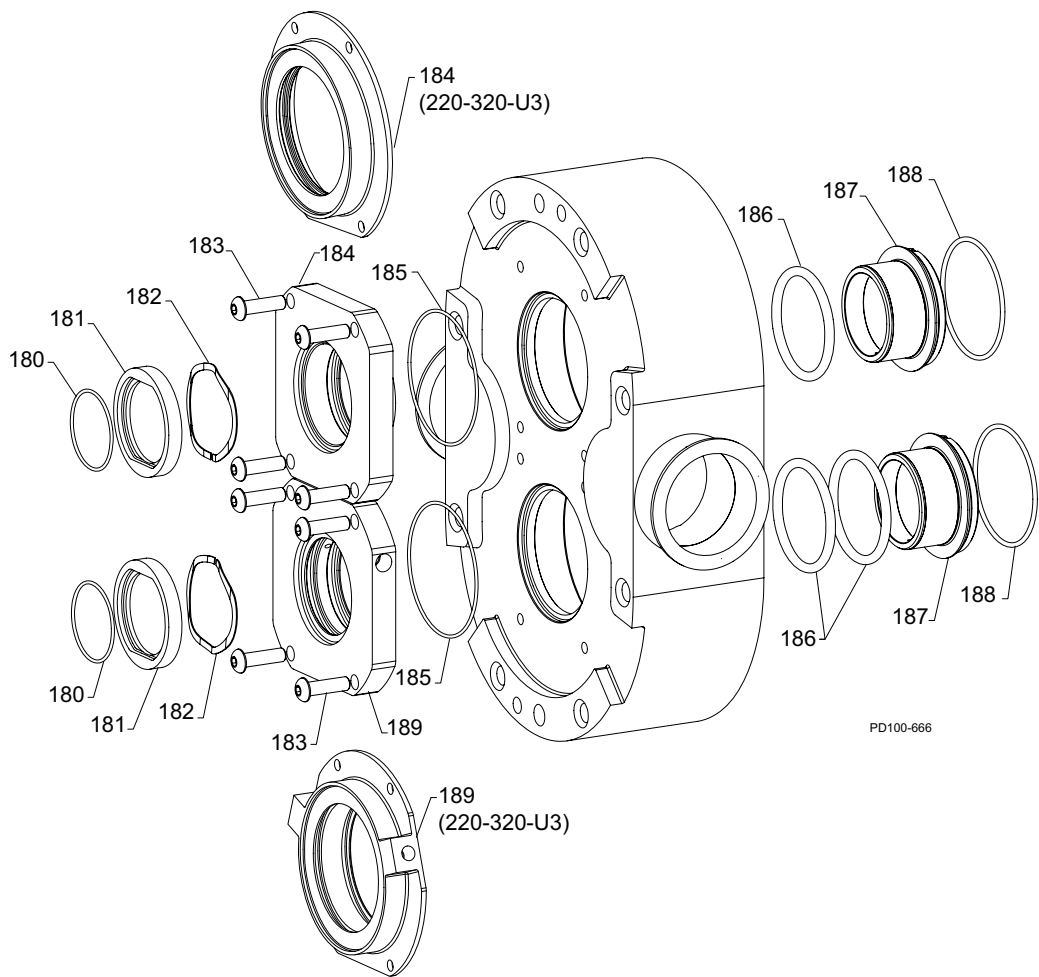
C Carbon

TC Tungsten Carbide

NF Narrow Face

For specialty seals, see page 123.

Universal 3 Specialty Seals



Single (Top) and Double (Bottom) O-Ring Seal

## Universal 3 Specialty Seals

ITEM NO.	DESCRIPTION	QTY. PER PUMP	PART NO.					NOTES	
			006, 015, 018-U3	030, 040-U3	045, 060, 130-U3	180, 220-U3	210, 320-U3		
O-ring Seal									
180	O-Ring, Sleeve Back	EPDM	2	E70024	E70031		E70150		
		FKM		V70024	V70031		V70150		
		FFKM		K70024	K70031		K70150		
181	Spring Seat, O-Ring Seal	2	138467+	138442+		139115+			
182	Wave Spring	2	139799+	101685+		101688+			
183	Button Socket Head Cap Screw (BSHCS)	8	30-546	30-742		30-741			
184	Housing, Single O-Ring Seal	2	138470+	138424+	138425+	139098+	139099+	2	
185	O-Ring, Seal Housing	EPDM	2	E70036	E70041		L25071004		
		FKM		V70036	V70041		L25071002		
		FFKM		K70036	K70041		N/A		
186	O-Ring, Seal	EPDM	2/4	E70326	E70331		E70343		1
	O-Ring, Seal	FKM		V70326	V70331		V70343		
	O-Ring, Seal	FFKM		K70326	K70331		K70343		
187	Sleeve, O-Ring Seal	2	138465+	138428+		139116+			
188	O-Ring, Sleeve Front	EPDM	2	E70135	E70146		E70248		
		FKM		V70135	V70146		V70248		
		FFKM		K70135	K70146		K70248		
189	Housing, Double O-Ring Seal	2	138466+	138426+	138427+	139095+	139097+	3	

PL5060-CH168

## Notes:

\* Recommended spare part

- Quantity 2 for Single O-Ring Seal; Quantity 4 for Double O-Ring Seal
- Applies to Single O-Ring Seal Design only; does not apply to Double O-Ring Seal Design
- Applies to Double O-Ring Seal Design only; does not apply to Single O-Ring Seal Design



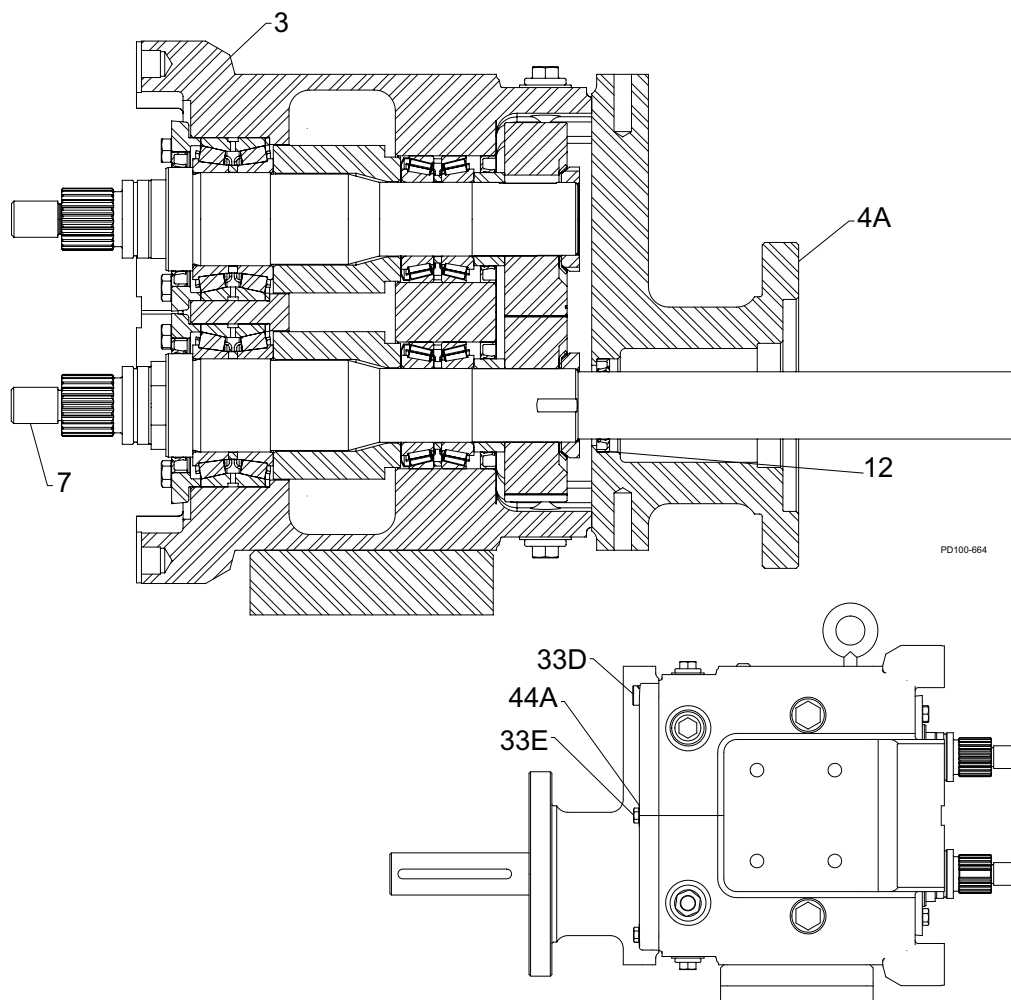
**U3 Shaft and Bearing Assemblies**

DESCRIPTION	QTY. PER PUMP	PART NO.
006-015-018-U3 Drive Shaft & Bearing Assy.	1	139809+
006-015-018-U3 Short Shaft & Bearing Assy.	1	139810+
030-040-U3 Drive Shaft & Bearing Assy.	1	139811+
030-040-U3 Short Shaft & Bearing Assy.	1	139812+
045-060-130-U3 Drive Shaft & Bearing Assy.	1	139813+
045-060-130-U3 Short Shaft & Bearing Assy.	1	139814+
180-220-U3 Drive Shaft & Bearing Assy.	1	139815+
180-220-U3 Short Shaft & Bearing Assy.	1	139816+
210-320-U3 Drive Shaft & Bearing Assy.	1	139817+
210-320-U3 Short Shaft & Bearing Assy.	1	139818+

PL5060-CH165

## Note:

Assembly includes items 7 or 8 (Drive or Short Shaft), 15 (Rear Bearing), 16 (Front Bearing), 17 (gear key), and 29 (gear to rear bearing spacer). See model-specific parts list page for drawing.

**Tru-Fit™ Universal 3 PD Pump Parts**

Item No.	Description	U3 Pump Size					Notes
		006, 015, 018	030, 040	045, 060, 130	180, 220	210, 320	
3	Gear Case, SS	125414+	121201+	125355+	124663+	134290+	
4A	Gear Case Cover, Adapter, SS	136577+	Serial # Required				1
7	Drive Shaft	139062+	139063+	139064+	139065+	139066+	
12	Oil Seal, Gear Case Cover	000030016+	000030013+	000030012+	STD030006	STD030004	2
33D	1/4-20 x 1" HHCS	30-93	—	—	—	—	
	5/16-18 x 1-1/8" HHCS	—	30-237	—	—	—	
	3/8 - 16x1-1/2" HHCS	—	—	30-50	—	—	
	1/2-13 x 1-1/2" HHCS	—	—	—	—	30-103	
33E	5/16" x 3/4" lg. SHSB	30-690	—	—	—	—	
	3/8" x 3/4" lg. SHSB	—	30-691	—	—	—	
	1/2" x 1" lg. SHSB	—	—	30-692	—	—	
	5/8" x 1" lg. SHSB	—	—	—	—	30-693	
44A	Flat Washer, 5/16"	43-246	—	—	—	—	
	Flat Washer, 3/8"	—	43-30	—	—	—	
	Flat Washer, 1/2"	—	—	—	43-31	—	

PL5060-CH163

## Note:

1. Depends on the Nord motor, material, paint. Contact customer service with serial number for part number.
2. Item 12, Oil seal, gear case cover, is the same seal that is used on non-Tru-Fit pumps. It is not included with item 4A.

## Special Tools for U3 Pumps

### Non-Marring Socket Tool for Rotor Nuts

U3 Model	Part Number
006, 015, 018	140074+
030, 040	139795+
045, 060, 130	139796+
180, 220	139767+
210, 320	126536+



PL5060-CH149

### O-ring Removal Tools

Description	Part Number
Standard O-ring removal tool	AD0096001
U3 Double O-Ring Seal Removal Tool	140062+

PL5060-CH170

### Rotor Blocking Tool

Description	Part Number
Rotor Blocking Tool	139794+

PL5060-CH164

### Gear Nut Driver, Gear End Shaft Thread Chaser

Description	Model U3 Pumps	Part Number
Gear Nut Driver	006, 015, 018	109281+
	030, 040	109282+
	045, 060, 130	109283+
	180, 220	110304+
	210, 320	114702+
Gear End Shaft Thread Chaser	006, 015, 018	109287+
	030, 040	109288+
	045, 060, 130	109289+
	180, 220	110305+
	210, 320	POA

PL5060-CH150

## Long Term Storage

Long-term storage (greater than six months) of Waukesha Cherry-Burrell brand pumps:

### Before Storage

1. Lubricate all bearings and seals, including:
  - Rubber o-rings and mechanical seal faces (new pump bearings installed from the factory are already lubricated).
  - Motors and drives (see manufacturer's instructions)
2. Be sure the pump contains no water. Make sure to disassemble the wet end and wipe it dry if necessary.
3. Use rust inhibitor on any exposed metal surfaces:
  - Any unpainted surfaces
  - Shafts, nuts/bolts
4. Cover the inlet/outlet connections of the pumps to keep out foreign materials.
5. Put all related instruction manuals in a separate water-tight envelope or container and store them with the equipment.
6. Completely enclose the equipment to prevent contamination from moisture, dust and other possible contaminants. Certain types of plastic wrap materials, when properly used, make excellent storage enclosures.
7. Rotate the pump and drive shafts several turns every 3 months.

### Storage

1. Store in a dry location. Indoor storage is preferred. If stored outdoors, the equipment must be in a weather-tight enclosure and shielded from direct sunlight.
2. Maintain even temperatures to prevent condensation.

### After Storage

**NOTE:** Do not start the motor if there is any indication of water contamination. Have the motor checked by a qualified electrician before starting.

1. Remove the equipment from the enclosure and repair or replace any damaged items before using equipment.
2. Check the electric motor (if applicable) per the manufacturer's instructions.
3. Pumps:
  - Completely disassemble the product contact liquid end per the instruction manual.
  - Clean and inspect all parts, including seals and o-rings.
  - Replace rubber parts with any sign of age or damage, such as cracks, taking a set, or loss of elasticity.
4. Lubricate the seal and o-rings and reassemble the liquid end per the instruction manual.
5. Lubricate the motor/drive (if applicable) per the manufacturer's instructions.
6. If the pump has been in storage longer than 1 year, change the oil in the pump and drive.

## Universal 3 Maintenance Summary Reference Sheet

Universal 3 Model	Change oil every 750 hours* ISO Grade 320, SAE 140 or AGMA Number 6EP		Grease bearings every 750 hours* NLGI Grade No. 2, EP, Lithium-based grease.	
	Oil Capacity (Gears)		Grease Quantity (per Bearing)	
	Top or Bottom	Side Mount	Front	Rear
006, 015, 018	1.3 oz (40 ml)	3.3 oz (100 ml)	.37 oz (11 ml)	.13 oz (4 ml)
030, 040	2.0 oz (60 ml)	4 oz (120 ml)	.60 oz (18 ml)	.21 oz (6 ml)
045, 060, 130	6.0 oz (170 ml)	9.5 oz (280 ml)	.84 oz (25 ml)	.76 oz (22 ml)
180, 220	11 oz (320 ml)	20 oz (600 ml)	1.33 oz (39 ml)	1.03 oz (30 ml)
210, 320	17 oz (500 ml)	44 oz (1300 ml)	1.96 oz (58 ml)	1.16 oz (34 ml)

\* Aggressive washdown or extreme running conditions may require more frequent lubrication intervals.

Universal 3 Model	Torque Values - Locknuts		Universal 3 Wrench Size		
	Rotor	Cover	Rotor Nut	Body Retaining Cap Screw	Cover Nut
006, 015, 018	50 ft-lb (68 N·m)	7 ft-lb (10 N·m)	15/16"	3/16"	5/8"
030, 040	120 ft-lb (163 N·m)	11 ft-lb (15 N·m)	1-1/4"		
045, 060	250 ft-lb (339 N·m)	56 ft-lb (76 N·m)	1-5/8"	1/4"	7/8"
130		25 ft-lb (34 N·m)			
180, 220	325 ft-lb (441 N·m)	110 ft-lb (149 N·m)	2-1/4"	5/16"	1"
210, 320	375 ft-lb (508 N·m)	158 ft-lb (214 N·m)	2-3/8"		

Universal 3 Model	A - Back Face in (mm)		B - Rotor to Body in (mm)		C - Front Face in (mm)	
	Low Viscosity	Standard	Low Viscosity	Standard	Low Viscosity	Standard
006	0.0025 - 0.004 (0.06 - 0.10)	0.0035 - 0.005 (0.09 - 0.13)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0045 - 0.0055 (0.11 - 0.14)
015, 018	0.0025 - 0.0045 (0.06 - 0.11)	0.003 - 0.005 (0.08 - 0.013)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0055 - 0.0065 (0.14 - 0.17)
030, 040	0.002 - 0.004 (0.05 - 0.10)	0.0035 - 0.0055 (0.09 - 0.14)	0.001 - 0.005 (0.03 - 0.13)	0.0025 - 0.006 (0.06 - 0.15)	0.0045 - 0.0055 (0.11 - 0.14)	0.006 - 0.007 (0.15 - 0.18)
045, 060	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.003 - 0.0075 (0.08 - 0.19)	0.005 - 0.010 (0.13 - 0.25)	0.0055 - 0.0075 (0.14 - 0.19)	0.0085 - 0.0105 (0.22 - 0.27)
130	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.0035 - 0.0075 (0.09 - 0.19)	0.0055 - 0.0095 (0.14 - 0.24)	0.006 - 0.007 (0.15 - 0.18)	0.009 - 0.0115 (0.23 - 0.29)
180, 220	0.004 - 0.008 (0.10 - 0.20)	0.005 - 0.009 (0.13 - 0.23)	0.0055 - 0.0095 (0.14 - 0.24)	0.009 - 0.013 (0.23 - 0.33)	0.006 - 0.008 (0.15 - 0.20)	0.010 - 0.012 (0.25 - 0.30)
210, 320	0.005 - 0.009 (0.13 - 0.23)	0.007 - 0.011 (0.18 - 0.28)	0.008 - 0.012 (0.20 - 0.30)	0.010 - 0.014 (0.25 - 0.36)	0.008 - 0.010 (0.20 - 0.25)	0.012 - 0.014 (0.30 - 0.36)

Low Viscosity Rotors: -40°F (-40°C) to 180°F (82°C); Standard Clearance Rotors: -40°F (-40°C) to 300°F (149°C). Contact SPX FLOW Application Engineering if alternate rotors are needed.

**NOTE:** The assembly clearances stated above are for reference only. Actual pump clearances may vary based on pump performance testing.

## Universal 3 Maintenance Summary Reference Sheet - Copy for optional removal

Universal 3 Model	Change oil every 750 hours* ISO Grade 320, SAE 140 or AGMA Number 6EP		Grease bearings every 750 hours* NLGI Grade No. 2, EP, Lithium-based grease.	
	* Aggressive washdown or extreme running conditions may require more frequent lubrication intervals.			
	Oil Capacity (Gears)		Grease Quantity (per Bearing)	
	Top or Bottom	Side Mount	Front	Rear
006, 015, 018	1.3 oz (40 ml)	3.3 oz (100 ml)	.37 oz (11 ml)	.13 oz (4 ml)
030, 040	2.0 oz (60 ml)	4 oz (120 ml)	.60 oz (18 ml)	.21 oz (6 ml)
045, 060, 130	6.0 oz (170 ml)	9.5 oz (280 ml)	.84 oz (25 ml)	.76 oz (22 ml)
180, 220	11 oz (320 ml)	20 oz (600 ml)	1.33 oz (39 ml)	1.03 oz (30 ml)
210, 320	17 oz (500 ml)	44 oz (1300 ml)	1.96 oz (58 ml)	1.16 oz (34 ml)

Universal 3 Model	Torque Values - Locknuts		Universal 3 Wrench Size		
	Rotor	Cover	Rotor Nut	Body Retaining Cap Screw	Cover Nut
006, 015, 018	50 ft-lb (68 N·m)	7 ft-lb (10 N·m)	15/16"	3/16"	5/8"
030, 040	120 ft-lb (163 N·m)	11 ft-lb (15 N·m)	1-1/4"		
045, 060	250 ft-lb (339 N·m)	56 ft-lb (76 N·m)	1-5/8"	1/4"	7/8"
130		25 ft-lb (34 N·m)			
180, 220	325 ft-lb (441 N·m)	110 ft-lb (149 N·m)	2-1/4"	5/16"	1"
210, 320	375 ft-lb (508 N·m)	158 ft-lb (214 N·m)	2-3/8"		

Universal 3 Model	A - Back Face in (mm)		B - Rotor to Body in (mm)		C - Front Face in (mm)	
	Low Viscosity	Standard	Low Viscosity	Standard	Low Viscosity	Standard
006	0.0025 - 0.004 (0.06 - 0.10)	0.0035 - 0.005 (0.09 - 0.13)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0045 - 0.0055 (0.11 - 0.14)
015, 018	0.0025 - 0.0045 (0.06 - 0.11)	0.003 - 0.005 (0.08 - 0.013)	0.001 - 0.004 (0.03 - 0.10)	0.0025 - 0.0055 (0.06 - 0.14)	0.004 - 0.005 (0.10 - 0.13)	0.0055 - 0.0065 (0.14 - 0.17)
030, 040	0.002 - 0.004 (0.05 - 0.10)	0.0035 - 0.0055 (0.09 - 0.14)	0.001 - 0.005 (0.03 - 0.13)	0.0025 - 0.006 (0.06 - 0.15)	0.0045 - 0.0055 (0.11 - 0.14)	0.006 - 0.007 (0.15 - 0.18)
045, 060	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.003 - 0.0075 (0.08 - 0.19)	0.005 - 0.010 (0.13 - 0.25)	0.0055 - 0.0075 (0.14 - 0.19)	0.0085 - 0.0105 (0.22 - 0.27)
130	0.003 - 0.007 (0.08 - 0.18)	0.004 - 0.008 (0.10 - 0.20)	0.0035 - 0.0075 (0.09 - 0.19)	0.0055 - 0.0095 (0.14 - 0.24)	0.006 - 0.007 (0.15 - 0.18)	0.009 - 0.0115 (0.23 - 0.29)
180, 220	0.004 - 0.008 (0.10 - 0.20)	0.005 - 0.009 (0.13 - 0.23)	0.0055 - 0.0095 (0.14 - 0.24)	0.009 - 0.013 (0.23 - 0.33)	0.006 - 0.008 (0.15 - 0.20)	0.010 - 0.012 (0.25 - 0.30)
210, 320	0.005 - 0.009 (0.13 - 0.23)	0.007 - 0.011 (0.18 - 0.28)	0.008 - 0.012 (0.20 - 0.30)	0.010 - 0.014 (0.25 - 0.36)	0.008 - 0.010 (0.20 - 0.25)	0.012 - 0.014 (0.30 - 0.36)

Low Viscosity Rotors: -40°F (-40°C) to 180°F (82°C); Standard Clearance Rotors: -40°F (-40°C) to 300°F (149°C). Contact SPX FLOW Application Engineering if alternate rotors are needed.

**NOTE:** The assembly clearances stated above are for reference only. Actual pump clearances may vary based on pump performance testing.

Notes







## Universal 3 Series

ROTARY POSITIVE DISPLACEMENT PUMP

# SPX<sup>®</sup>FLOW



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