



INSTRUCTION AND MAINTENANCE MANUAL:

FKL 15 AND 20 STYLE PUMP



Sanitary Positive Displacement Pump

DESCRIPTION

This manual contains installation, operation and repair instructions for the Fristam FKL 15 & 20 Series balanced circular piston pump.

The FKL pump is a positive displacement pump characterized by its balanced rotor design. The rotors travel through a precisely machined, close clearance channel in the housing and cover allowing the product to be pumped very efficiently.

The FKL 15 & 20 series pump features a unique balanced rotor design with heavy-duty shafts allowing the pump to maintain its efficiency at differential pressures up to 200 psi. The pump also features rotors made from “non-galling” stainless steel, which allows the pump to continue to run even under extreme conditions. The FKL series pump is ideal for pumping products that are shear sensitive, have a high viscosity and/or contain large particulate. The FKL series pump excels in applications with high differential pressure and/or low inlet pressures and its high efficiency, low slip performance makes it an excellent pump for metering applications for consistent flow control.

The FKL series pump is available with any connection type desired and may be mounted with the inlet/outlet connections in a horizontal or vertical orientation. The pump should be coupled to a motor/drive assembly properly specified to give the desired performance for the required application.

CAUTION: BEGIN ALL PUMP MAINTENANCE OPERATIONS BY DISCONNECTING THE ENERGY SOURCE TO THE PUMP. OBSERVE ALL LOCK OUT/TAG OUT PROCEDURES AS OUTLINED BY ANSI Z244.1-1982 AND OSHA 1910.147 TO PREVENT ACCIDENTAL START-UP AND INJURY.

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TECHNICAL INFORMATION

SPECIFICATIONS

Maximum Pressure Rating.....	200 PSIG
Normal Speed Range: Model 15	0 to 1000 RPM
Normal Speed Range: Model 20	0 to 800 RPM
Normal Temperature Differential (Standard Rotors).....	D140°F
Normal Temperature Differential (High Temperature Rotors)	D210°F

STANDARD MATERIALS OF CONSTRUCTION (NOTE: OTHER OPTIONS AVAILABLE)

Product Contact Components	AISI 316L Stainless Steel
Rotors	Non-galling Stainless Steel
Seal Components	
Stationary Seal	Carbon
Rotating Seal Material.....	Chrome Oxide Coated 316L Stainless Steel
Product Contact Surfaces	32µin Ra finish
Cover O-ring.....	Buna
Seal O-rings.....	Viton

SEAL OPTIONS

Mechanical Seal Type	Single or Double
O-ring Seal Type.....	Single or Double

RECOMMENDED TORQUE VALUES

Cover Nut	65 in-lbs (7.3 N-m)
Housing Screw	45 in-lbs (5 N-m)
Rotor Bolt.....	25 ft-lbs (34 N-m)
Bearing Lock Nut	50 ft-lbs (68 N-m)
Bearing Retainer	45 in-lbs (5 N-m)
Gearbox Nuts	45 in-lbs (5 N-m)
Strap Screw	10 ft-lbs (13.5 N-m)

TOOLS FOR ASSEMBLY & DISASSEMBLY

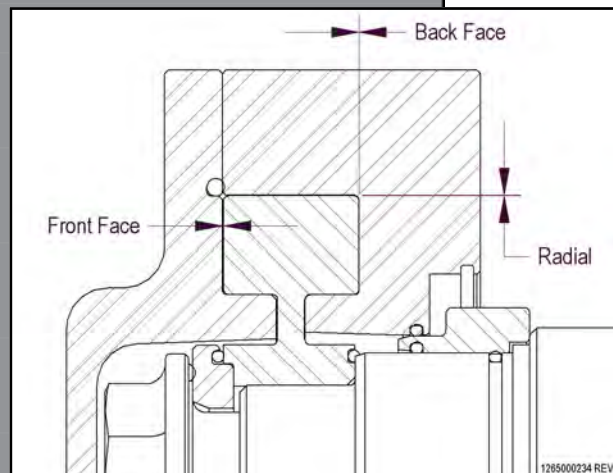
6mm Socket	Strap Screws
8mm Socket	Gearbox Cover Nuts
	Gearbox Forcing Screws
10mm Socket	Pump Cover Nuts
19mm Socket	Rotor Bolts
4mm Allen Wrench Socket	Housing Screws
	Bearing Cover Bolts
Ratchet.....	For Loosening Bolts
Standard Screwdriver.....	Bearing Lockwasher
M22 Spanner Wrench.....	Bearing Locknut
Torque Wrench.....	For Proper Bolt Tightening
Adjustable Pliers.....	Removing & Installing Water Pipes
Soft-faced Hammer	For Removing Shafts
1/2" Diameter Wooden Dowel.....	Removing & Installing Rotor Bolts
Food Grade Lubricant.....	For Lubricating O-rings & Gaskets

LUBRICATION

Oil Grade.....	SAE 15W40
Oil Capacity	
Horizontal	0.6 liters / 0.63 US quarts

Dimensions are in millimeters (inches).						
Model	Rotor Material: Non-Galling Stainless Steel			Rotor Material: 316L & 17-4 Stainless Steel, Hastelloy, AL6XN		
	Rotor Clearances: Standard			Rotor Clearances: Standard		
	Back Face	Front Face	Radial	Back Face	Front Face	Radial
15	0.06 - 0.08 (0.0025" - 0.0030")	0.07 - 0.17 (0.0030" - 0.0065")	0.05 - 0.09 (0.0020" - 0.0035")	0.13 - 0.17 (0.0050" - 0.0065")	0.13 - 0.25 (0.0050" - 0.0100")	0.11 - 0.15 (0.0045" - 0.0060")
20	0.06 - 0.08 (0.0025" - 0.0030")	0.07 - 0.17 (0.0030" - 0.0065")	0.05 - 0.09 (0.0020" - 0.0035")	0.13 - 0.17 (0.0050" - 0.0065")	0.13 - 0.25 (0.0050" - 0.0100")	0.11 - 0.15 (0.0045" - 0.0060")
25	0.06 - 0.08 (0.0025" - 0.0030")	0.07 - 0.17 (0.0030" - 0.0065")	0.05 - 0.09 (0.0020" - 0.0035")	0.13 - 0.17 (0.0050" - 0.0065")	0.13 - 0.25 (0.0050" - 0.0100")	0.11 - 0.15 (0.0045" - 0.0060")
50	0.07 - 0.11 (0.0030" - 0.0045")	0.08 - 0.20 (0.0030" - 0.0080")	0.05 - 0.11 (0.0020" - 0.0045")	0.14 - 0.20 (0.0055" - 0.0080")	0.15 - 0.29 (0.0060" - 0.0115")	0.12 - 0.17 (0.0045" - 0.0065")
75	0.08 - 0.12 (0.0030" - 0.0045")	0.10 - 0.22 (0.0040" - 0.0085")	0.07 - 0.13 (0.0030" - 0.0050")	0.15 - 0.21 (0.0060" - 0.0085")	0.18 - 0.32 (0.0070" - 0.0125")	0.15 - 0.20 (0.0060" - 0.0080")
150	0.08 - 0.12 (0.0030" - 0.0045")	0.13 - 0.25 (0.0050" - 0.0100")	0.08 - 0.14 (0.0030" - 0.0055")	0.15 - 0.21 (0.0060" - 0.0085")	0.23 - 0.37 (0.0090" - 0.0145")	0.16 - 0.21 (0.0065" - 0.0085")
205	0.09 - 0.13 (0.0035" - 0.0050")	0.16 - 0.28 (0.0065" - 0.0110")	0.11 - 0.17 (0.0045" - 0.0065")	0.16 - 0.22 (0.0065" - 0.0085")	0.28 - 0.42 (0.0110" - 0.0165")	0.20 - 0.27 (0.0080" - 0.0105")
250	0.09 - 0.13 (0.0035" - 0.0050")	0.16 - 0.28 (0.0065" - 0.0110")	0.11 - 0.17 (0.0045" - 0.0065")	0.16 - 0.22 (0.0065" - 0.0085")	0.28 - 0.42 (0.0110" - 0.0165")	0.20 - 0.27 (0.0080" - 0.0105")
400	0.10 - 0.14 (0.0040" - 0.0055")	0.16 - 0.30 (0.0065" - 0.0120")	0.12 - 0.18 (0.0045" - 0.0070")	0.17 - 0.23 (0.0065" - 0.0090")	0.30 - 0.45 (0.0120" - 0.0175")	0.23 - 0.29 (0.0090" - 0.0115")
580/600	0.11 - 0.16 (0.0045" - 0.0065")	0.17 - 0.32 (0.0065" - 0.0125")	0.14 - 0.19 (0.0055" - 0.0075")	TBD	TBD	TBD
	Rotor Clearances: High Temperature			Rotor Clearances: High Temperature		
	Back Face	Front Face	Radial	Back Face	Front Face	Radial
15	0.11 - 0.14 (0.0045" - 0.0055")	0.11 - 0.23 (0.0045" - 0.0090")	0.08 - 0.12 (0.0030" - 0.0045")	0.18 - 0.22 (0.0070" - 0.0085")	0.18 - 0.30 (0.0070" - 0.0120")	0.15 - 0.19 (0.0060" - 0.0075")
20	0.11 - 0.14 (0.0045" - 0.0055")	0.11 - 0.23 (0.0045" - 0.0090")	0.08 - 0.12 (0.0030" - 0.0045")	0.18 - 0.22 (0.0070" - 0.0085")	0.18 - 0.30 (0.0070" - 0.0120")	0.15 - 0.19 (0.0060" - 0.0075")
25	0.11 - 0.14 (0.0045" - 0.0055")	0.11 - 0.23 (0.0045" - 0.0090")	0.08 - 0.12 (0.0030" - 0.0045")	0.18 - 0.22 (0.0070" - 0.0085")	0.18 - 0.30 (0.0070" - 0.0120")	0.15 - 0.19 (0.0060" - 0.0075")
50	0.12 - 0.17 (0.0045" - 0.0065")	0.13 - 0.27 (0.0050" - 0.0105")	0.09 - 0.15 (0.0035" - 0.0060")	0.19 - 0.25 (0.0075" - 0.0100")	0.21 - 0.34 (0.0085" - 0.0135")	0.15 - 0.20 (0.0060" - 0.0080")
75	0.13 - 0.18 (0.0050" - 0.0070")	0.16 - 0.30 (0.0065" - 0.0120")	0.12 - 0.18 (0.0045" - 0.0070")	0.20 - 0.26 (0.0080" - 0.0100")	0.25 - 0.39 (0.0100" - 0.0155")	0.20 - 0.25 (0.0080" - 0.0100")
150	0.13 - 0.18 (0.0050" - 0.0070")	0.21 - 0.35 (0.0085" - 0.0140")	0.13 - 0.19 (0.0050" - 0.0075")	0.20 - 0.26 (0.0080" - 0.0100")	0.32 - 0.46 (0.0125" - 0.0180")	0.21 - 0.26 (0.0085" - 0.0100")
205	0.14 - 0.19 (0.0055" - 0.0075")	0.26 - 0.40 (0.0100" - 0.0155")	0.18 - 0.24 (0.0070" - 0.0095")	0.21 - 0.27 (0.0085" - 0.0105")	0.38 - 0.51 (0.0150" - 0.0200")	0.25 - 0.31 (0.0100" - 0.0120")
250	0.14 - 0.19 (0.0055" - 0.0075")	0.26 - 0.40 (0.0100" - 0.0155")	0.18 - 0.24 (0.0070" - 0.0095")	0.21 - 0.27 (0.0085" - 0.0105")	0.38 - 0.51 (0.0150" - 0.0200")	0.25 - 0.31 (0.0100" - 0.0120")
400	0.15 - 0.20 (0.0060" - 0.0080")	0.27 - 0.43 (0.0105" - 0.0170")	0.20 - 0.26 (0.0080" - 0.0100")	0.22 - 0.28 (0.0085" - 0.0110")	0.40 - 0.55 (0.0155" - 0.0215")	0.27 - 0.33 (0.0105" - 0.0130")
580/600	0.17 - 0.23 (0.0065" - 0.0090")	0.30 - 0.44 (0.0120" - 0.0175")	0.22 - 0.28 (0.0085" - 0.0110")	TBD	TBD	TBD
	Rotor Clearances: Chocolate *					
	Back Face	Front Face	Radial			
15	0.26 - 0.38 (0.0100" - 0.0150")	0.21 - 0.49 (0.0085" - 0.0195")	0.22 - 0.30 (0.0085" - 0.0120")			
20	0.26 - 0.38 (0.0100" - 0.0150")	0.21 - 0.49 (0.0085" - 0.0195")	0.22 - 0.30 (0.0085" - 0.0120")			
25	0.26 - 0.38 (0.0100" - 0.0150")	0.21 - 0.49 (0.0085" - 0.0195")	0.22 - 0.30 (0.0085" - 0.0120")			
50	0.27 - 0.41 (0.0105" - 0.0160")	0.22 - 0.52 (0.0085" - 0.0205")	0.25 - 0.33 (0.0100" - 0.0130")			
75	0.28 - 0.42 (0.0110" - 0.0165")	0.23 - 0.53 (0.0090" - 0.0210")	0.28 - 0.36 (0.0110" - 0.0140")			
150	0.28 - 0.42 (0.0110" - 0.0165")	0.23 - 0.53 (0.0090" - 0.0210")	0.29 - 0.37 (0.0115" - 0.0145")			
205	0.29 - 0.43 (0.0115" - 0.0170")	0.27 - 0.57 (0.0105" - 0.0225")	0.37 - 0.46 (0.0145" - 0.0180")			
250	0.29 - 0.43 (0.0115" - 0.0170")	0.27 - 0.57 (0.0105" - 0.0225")	0.37 - 0.46 (0.0145" - 0.0180")			
400	0.30 - 0.44 (0.0120" - 0.0175")	0.30 - 0.62 (0.0120" - 0.0245")	0.44 - 0.53 (0.0175" - 0.0210")			
580/600	TBD	TBD	TBD			

*Chocolate rotor clearances apply to all rotor materials.



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INSTALLATION

UNPACKING

Check the contents and all wrapping when unpacking the pump. Inspect the pump carefully for any damage that may have occurred during shipping. Immediately report any damage to the carrier. Keep the protective caps over the pump inlet and outlet in place until you are ready to install the pump.

INSTALLING

Prior to actually installing the pump, ensure that:

- The pump will be readily accessible for maintenance, inspection and cleaning.
- Adequate ventilation is provided for motor cooling.
- The drive and motor type is suitable for the environment where it is to be operated. Pumps intended for use in hazardous environments e.g., explosive, corrosive, etc., must use a motor and drive with the appropriate enclosure characteristics. Failure to use an appropriate motor type may result in serious damage and/or injury.
- When switching the pump mounting to vertical, the sight glass and vent cap will need to be switched.

PIPING

CAUTION: Because the FKL pump is a highly efficient positive displacement pump, the user needs to ensure that the pump will not be over-pressurized during operation as this can cause severe damage to the pump. (Over-pressurization can occur if a valve is closed on the discharge of the pump and the pump continues to run beyond its maximum pressure rating.) The pump warranty is void for damage caused by over-pressurization. The pressure can be determined by putting a pressure gauge at the discharge side of the pump.

Follow good piping practices when installing your FKL series pump:

- Support all piping independently to minimize the forces exerted on the pump (figure 1).
- Ensure that the piping can accommodate thermal expansion without stressing the pump.

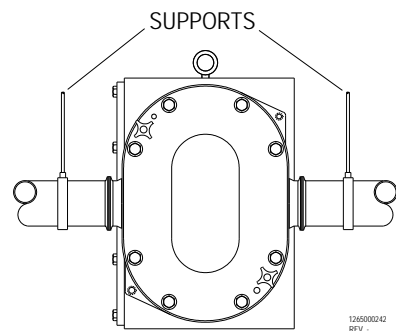


FIGURE 1

- Slope inlet piping up to pump to avoid air pockets (figure 2).

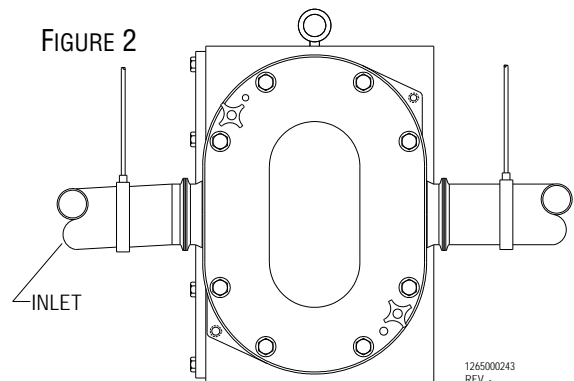
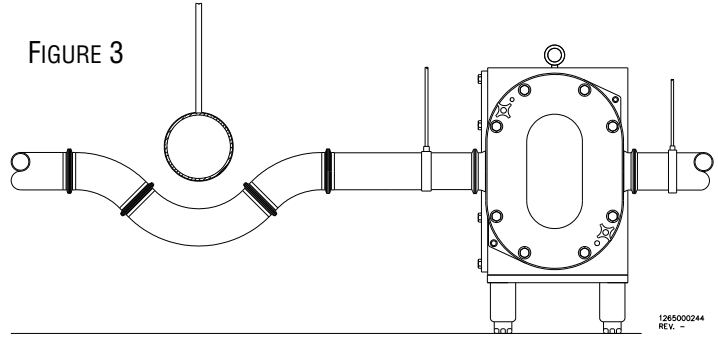


FIGURE 2

- Avoid sump areas where sediment may collect (figure 3).
- Use a check or “foot” valve on the inlet side of the pump in lift applications to keep the suction piping flooded.
- Avoid throttling valves in the suction piping.
- Keep suction lines as short and direct as possible.

FIGURE 3



- Avoid abrupt transitions in the piping systems (figure 4).

INCORRECT

CORRECT

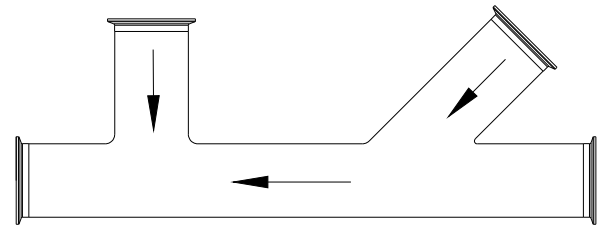
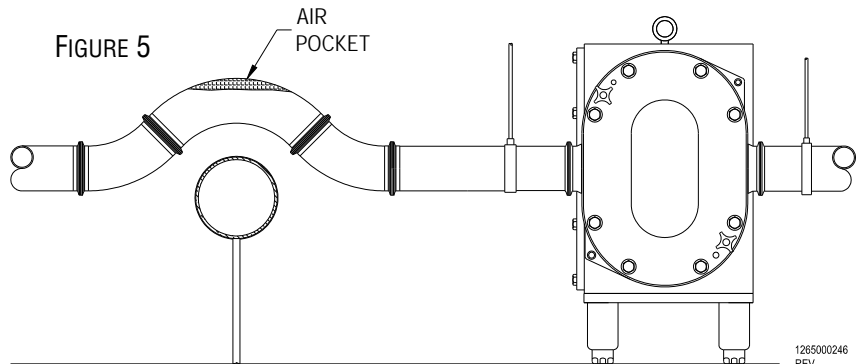


FIGURE 4

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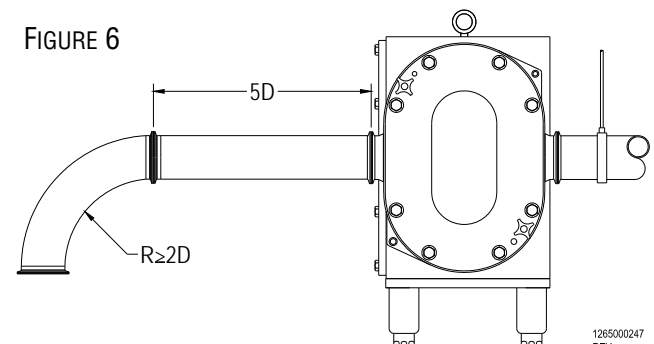
- Avoid the formation of air pockets in the piping (figure 5).
- Ensure that the NPSH available in the system is greater than NPSH required by the pump.
- Avoid abrupt closure of shut-off valves, this may cause hydraulic shock which can cause severe damage to the pump and system.

FIGURE 5



- Avoid elbows in the suction line if possible. When necessary they should be located 5 pipe diameters away from the pump inlet and have a bend radius greater than 2 pipe diameters (figure 6).
- Install a relief valve on the discharge side of the pump with a bypass loop back to the suction side to ensure that the pump cannot be over-pressurized.

FIGURE 6



ALIGNMENT

In most cases, the pump will be shipped with a drive unit mounted on a baseplate. The drive and pump are aligned at the factory; however, this alignment should be checked after installation (Figure 7). Misalignment between the pump and drive can result in premature bearing failure or other damage. If the pump is not shipped with a drive unit, use a flexible coupling between the pump and drive unit. Align the pump and drive unit according to the coupling requirements.

To check the alignment:

- Remove the wire ring from the coupling sleeve and let it hang between the sleeve and one of the flanges.
- To check the parallel alignment place a straight edge across the two coupling flanges and measure the maximum offset at various points around the periphery of the coupling without rotating the coupling. If the maximum offset ("A") exceeds the figure shown under "Parallel" in the table below, realign the shafts.
- Check the angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other ("Y") at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions without rotating the coupling. The difference between the maximum and minimum must not exceed the figure given under "Angular" in the table below. If a correction is necessary, be sure to recheck the parallel alignment.
- Reinstall the wire ring on the O.D. of the coupling sleeve.

WOODS SURE-FLEX COUPLING ALIGNMENT

Sleeve Size	Type E			Type H		
	Parallel A	Angular Y max. - Y min.	Y*	Parallel A	Angular Y max. - Y min.	Y*
5	0.015"	0.056"	1.938"	N/A	N/A	N/A
6	0.015"	0.070"	2.375"	0.010"	0.016"	2.375"

* The "Y" dimension is shown for reference.

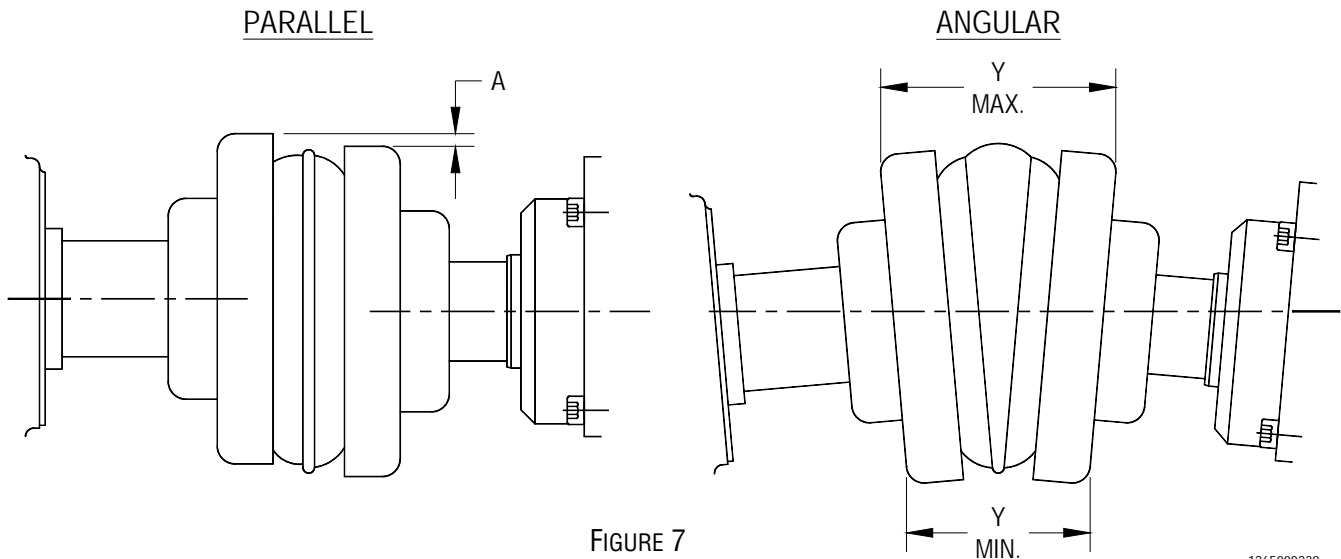


FIGURE 7

ELECTRICAL CONNECTIONS

Have an electrician connect the drive motor using sound electrical practices. Ensure that proper motor overload protection is provided. The size of the drive selected should meet the requirements of the operating conditions. A change in conditions (for example, higher viscosity product, higher product specific gravity) can overload the motor. For technical assistance regarding operating condition changes, please contact Fristam Pumps. Make sure that the pump is rotating in the correct direction.

WATER FLUSH CONNECTIONS

If your pump is equipped with a double mechanical or double o-ring product seal, water must be supplied to provide cooling and lubrication (Figure 8). Connect supply and return lines to the water pipes supplied with the product seal on your pump. The water pipes have a 1/16" NPT thread.

Note: Water should flow from bottom to top and steam should travel top to bottom. Use about 3-12 gallons per hour of water at 1-2 psi. Excessive seal pressure and/or flow rate through the product seal cavity may cause increased seal wear and shorten seal life.

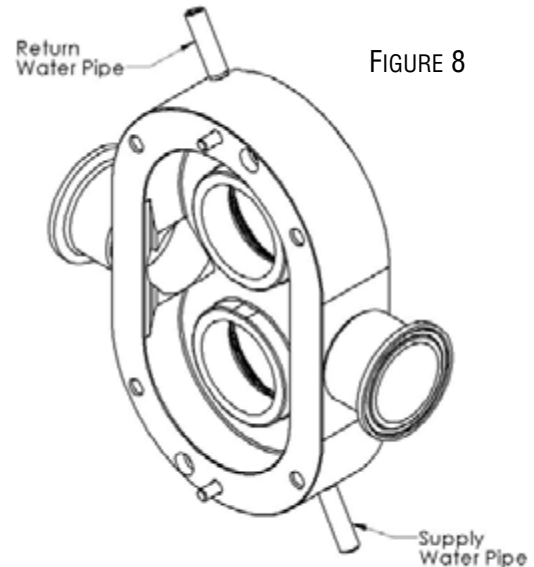


FIGURE 8

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START-UP CHECK-LIST

- Make sure that the pump and piping system are clear of any foreign matter. Do not use the pump to flush the system.
- Make sure that the pump and drive are properly lubricated (page 4). See instructions from the manufacturer for the drive.
- Check to make sure that all guards are in place and secure.
- Check for proper pump and drive rotation (Figures 9 & 10). Make sure that the pump is flooded with product when checking the rotation. Running the pump dry even momentarily can cause seal damage.
- Check that all valves on the discharge side are open to prevent over-pressurizing the pump.
- Place an inline screen before the pump inlet to ensure no foreign objects run through the pump and alter critical clearances.

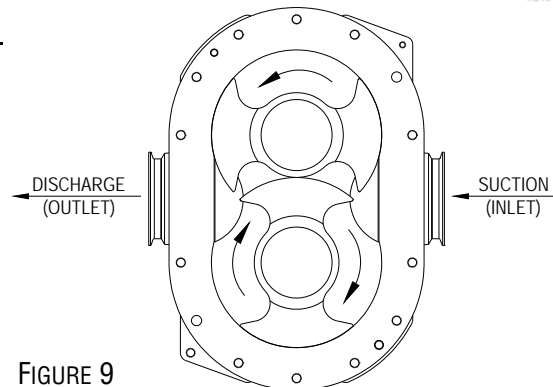


FIGURE 9

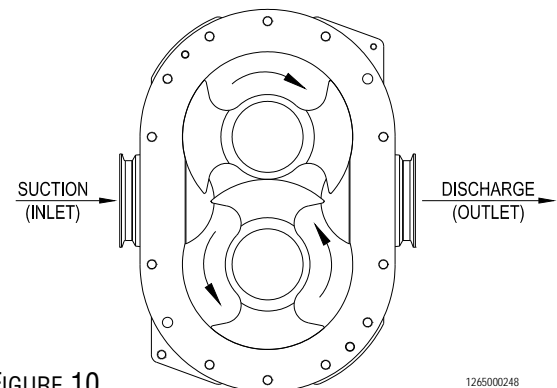


FIGURE 10

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RECOMMENDED PREVENTIVE MAINTENANCE

RECOMMENDED SEAL MAINTENANCE

- Visually inspect mechanical seal daily for leakage.
- Replace mechanical seal annually under normal duty.
- Replace mechanical seal as often as required under heavy duty.

ELASTOMER INSPECTION

Inspect all elastomers (o-rings and gaskets) when performing pump maintenance. We recommend replacing elastomers during seal, pump shaft and/or motor replacement or sooner depending on the application.

LUBRICATION

The oil level should be maintained in the center of the sight glass on the side of the gearbox. The oil should be changed every 4,000 hours under normal conditions and every 2,000 hours under severe conditions such as washdown applications.

PERIODIC MAINTENANCE

Periodically inspect the pump housing, cover and rotors for any signs of wear or damage. If wear is present this could be a sign of over-pressurization, incorrect rotor gap or bearing wear.

CLEANING RECOMMENDATIONS

The FKL pump is designed for CIP (clean-in place) cleaning. It is not necessary to disassemble the pump for cleaning in most applications.

Temperature

Note that the FKL pump has tight clearances between the rotors and the housing which attributes to its high efficiency. When you are running products or cleaning solutions with different temperatures, allow enough time for all of the wetted components inside the pump to reach a steady-state temperature before running the pump.

If your process does not allow you to stop the pump during this transition, you should install rotors that provide larger clearances.

Flow Rate

To ensure that you have the proper flow rate to clean the entire circuit and adequate turbulence inside the FKL pump, Fristam strongly recommends using a separate CIP supply pump and a bypass loop around the FKL.

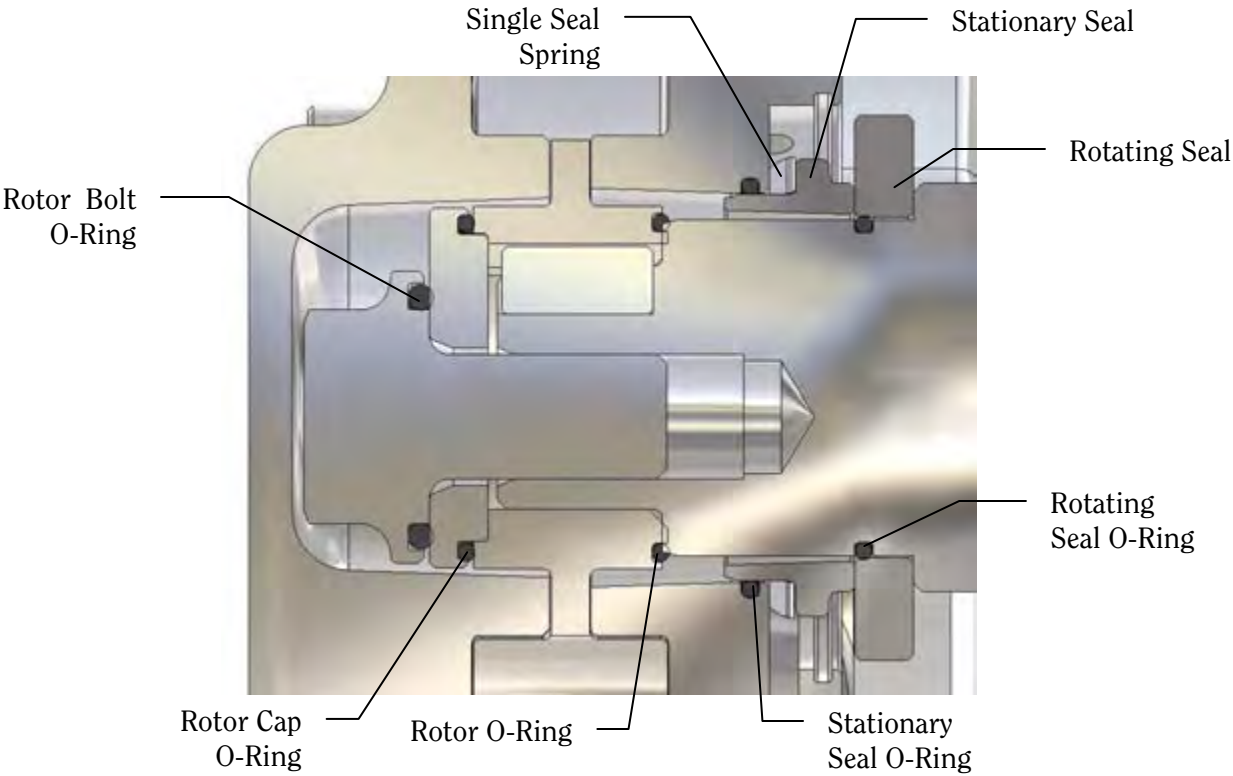
Pump Speed

During CIP, the FKL should operate at approximately 100 RPM. A slower rotation promotes turbulence and cleaning.

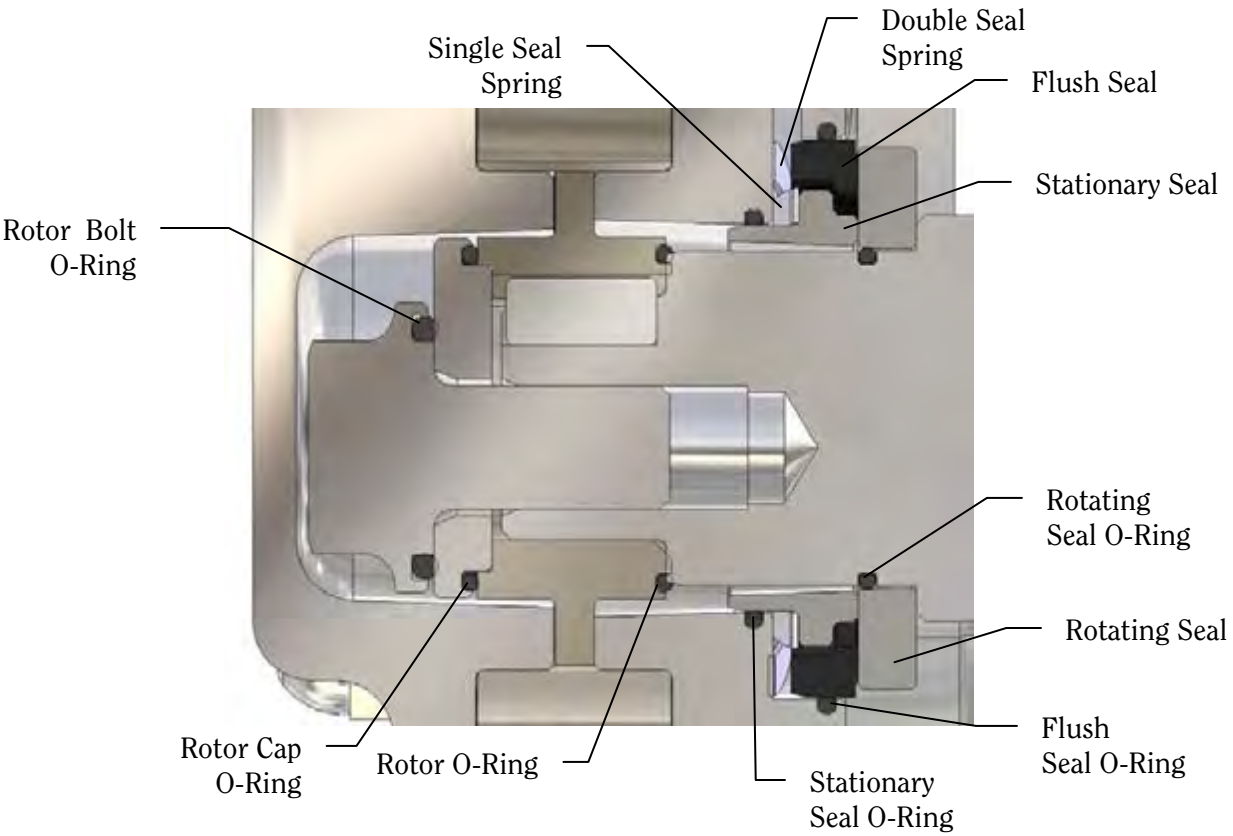
Differential Pressure

For less viscous products, differential pressure within the pump (inlet to outlet) should be at least 10 PSI to promote the resonance time of CIP solution in the pump. For higher product viscosity, the required differential pressure may need to be increased to 30-50 PSI.

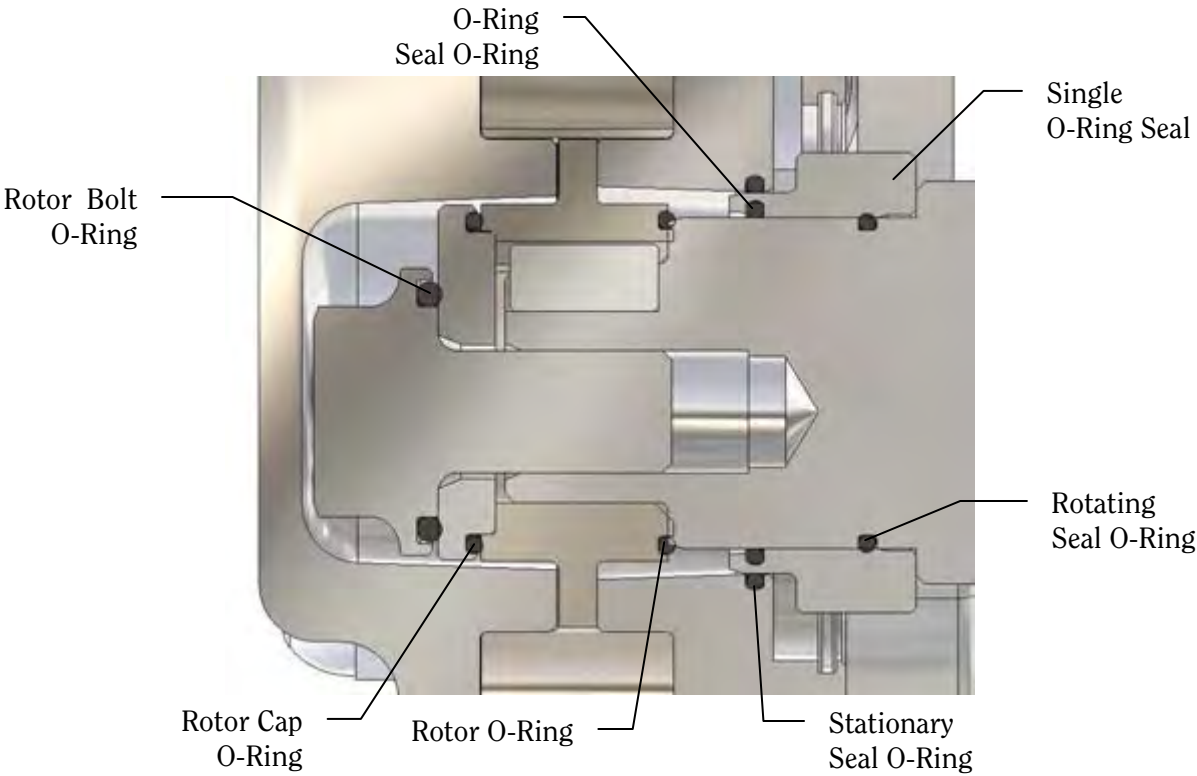
SINGLE MECHANICAL SEAL ASSEMBLY



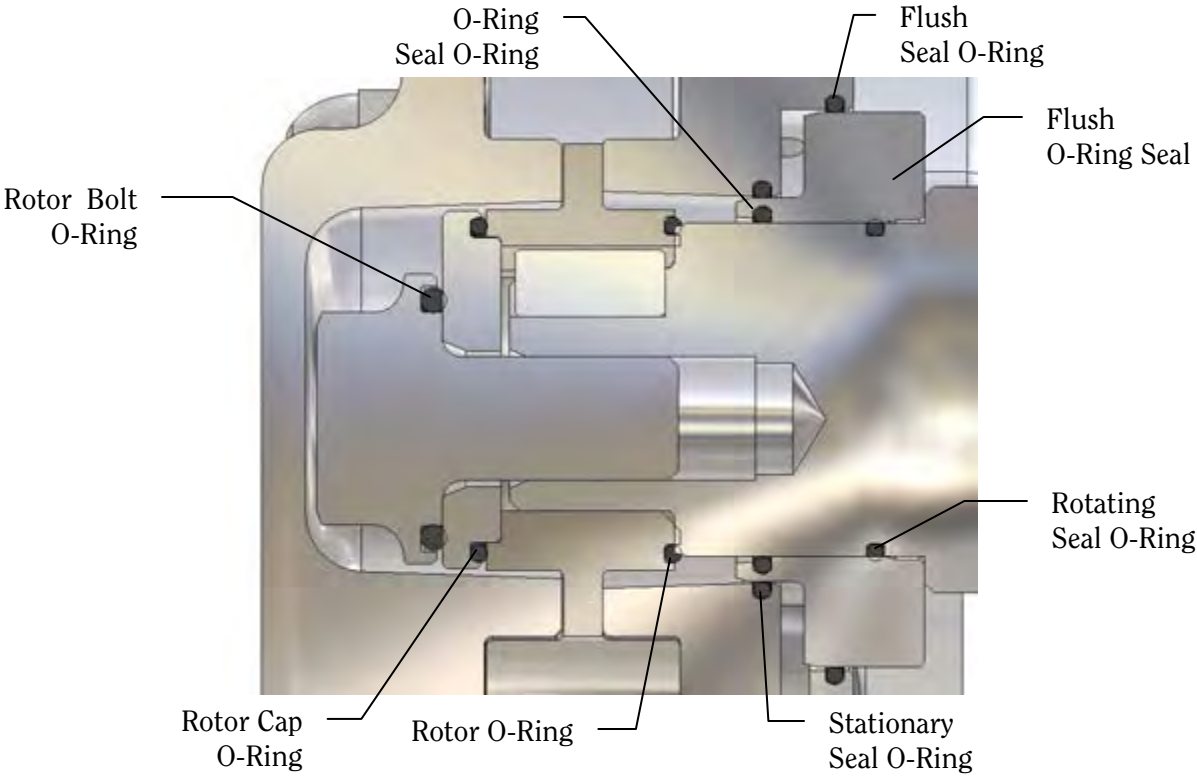
DOUBLE MECHANICAL SEAL ASSEMBLY



SINGLE O-RING SEAL ASSEMBLY



DOUBLE O-RING SEAL ASSEMBLY



Single Mechanical Seal

Description	Material	Qty	Part No.
Rotor Bolt O-Ring	Viton	2	1180000085
	EPDM		1180000188
Rotor Cap O-Ring	Viton	2	1180000700
	EPDM		1180000706
Rotor O-Ring	Viton	2	1180000700
	EPDM		1180000706
Single Seal Spring	-	2	1820000041
Stationary Seal	Carbon	2	1815600115
	Silicon Carbide		1815600116
Stationary Seal O-Ring	Viton	2	1180000261
	EPDM		1180000262
Rotating Seal	Chrome Oxide/SS	2	1810600112
	Silicon Carbide		1810600113
Rotating Seal O-Ring	Viton	2	1180000700
	EPDM		1180000706

Double Mechanical Seal

Description	Material	Qty	Part No.
Rotor Bolt O-Ring	Viton	2	1180000085
	EPDM		1180000188
Rotor Cap O-Ring	Viton	2	1180000700
	EPDM		1180000706
Rotor O-Ring	Viton	2	1180000700
	EPDM		1180000706
Single Seal Spring	-	2	1820000041
Stationary Seal	Carbon	2	1815600115
	Silicon Carbide		1815600116
Stationary Seal O-Ring	Viton	2	1180000261
	EPDM		1180000262
Double Seal Spring	-	2	1820000063
Flush Seal	Carbon	2	1815600117
Flush Seal O-Ring	Viton	2	1180000701
	EPDM		1180000707
Rotating Seal	Chrome Oxide/SS	2	1810600112
	Silicon Carbide		1810600113
Rotating Seal O-Ring	Viton	2	1180000700
	EPDM		1180000706

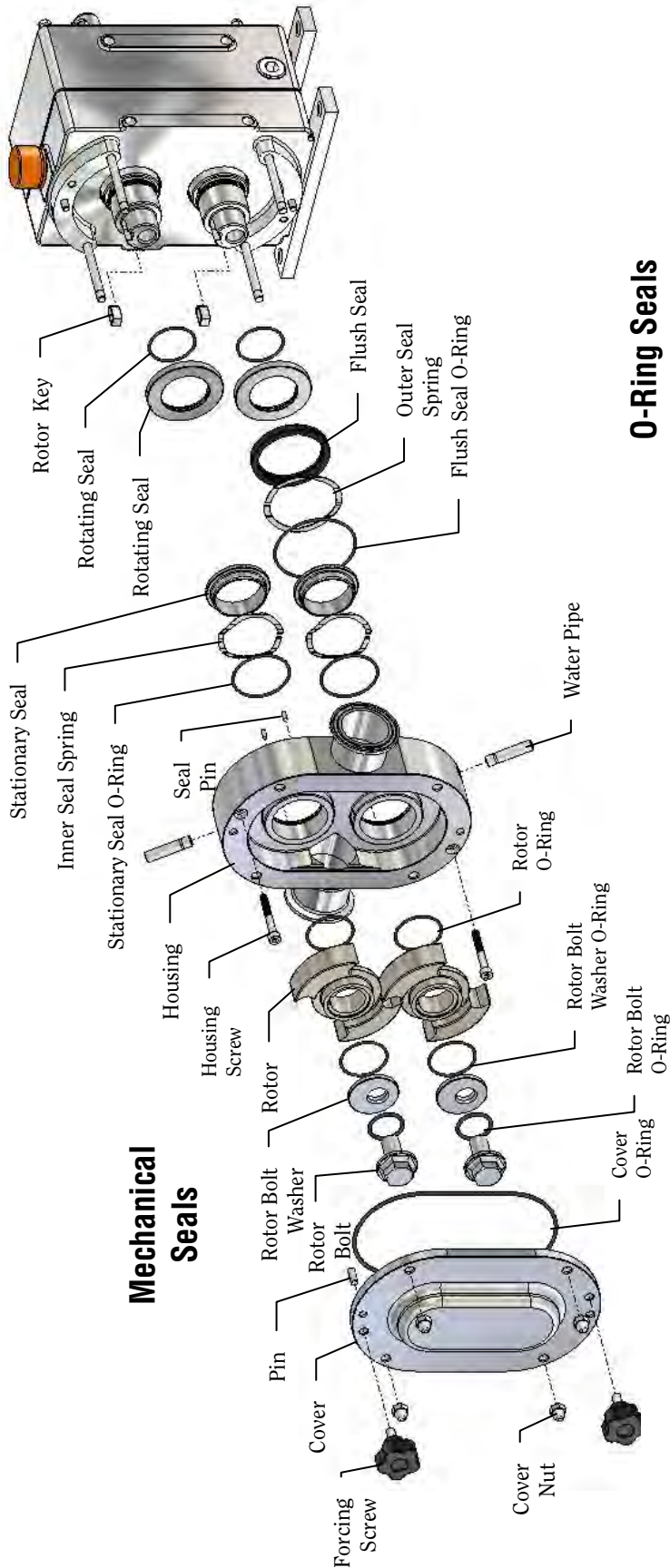
Single O-Ring Seal

Description	Material	Qty	Part No.
Rotor Bolt O-Ring	Viton	2	1180000085
	EPDM		1180000188
Rotor Cap O-Ring	Viton	2	1180000700
	EPDM		1180000706
Rotor O-Ring	Viton	2	1180000700
	EPDM		1180000706
O-Ring Seal O-Ring	Viton	2	1180000350
	EPDM		1180000076
Stationary Seal O-Ring	Viton	2	1180000261
	EPDM		1180000077
Single O-Ring Seal	SS	2	1224000104
Rotating Seal O-Ring	Viton	2	1180000700
	EPDM		1180000706

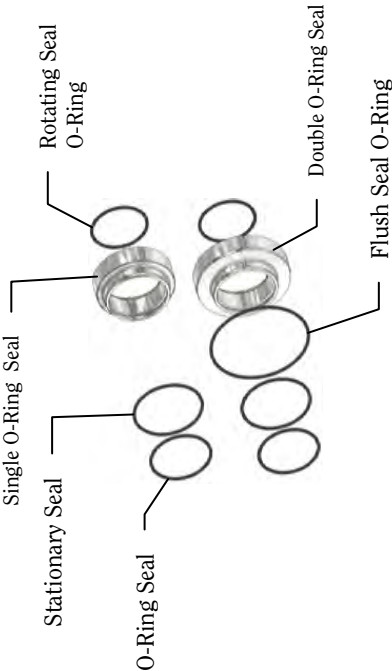
Double O-Ring Seal

Description	Material	Qty	Part No.
Rotor Bolt O-Ring	Viton	2	1180000085
	EPDM		1180000188
Rotor Cap O-Ring	Viton	2	1180000700
	EPDM		1180000706
Rotor O-Ring	Viton	2	1180000700
	EPDM		1180000706
O-Ring Seal O-Ring	Viton	2	1180000350
	EPDM		1180000076
Stationary Seal O-Ring	Viton	2	1180000261
	EPDM		1180000262
Double O-Ring Seal	SS	2	1224000105
Flush Seal O-Ring	Viton	2	1180000701
	EPDM		1180000707
Rotating Seal O-Ring	Viton	2	1180000700
	EPDM		1180000706

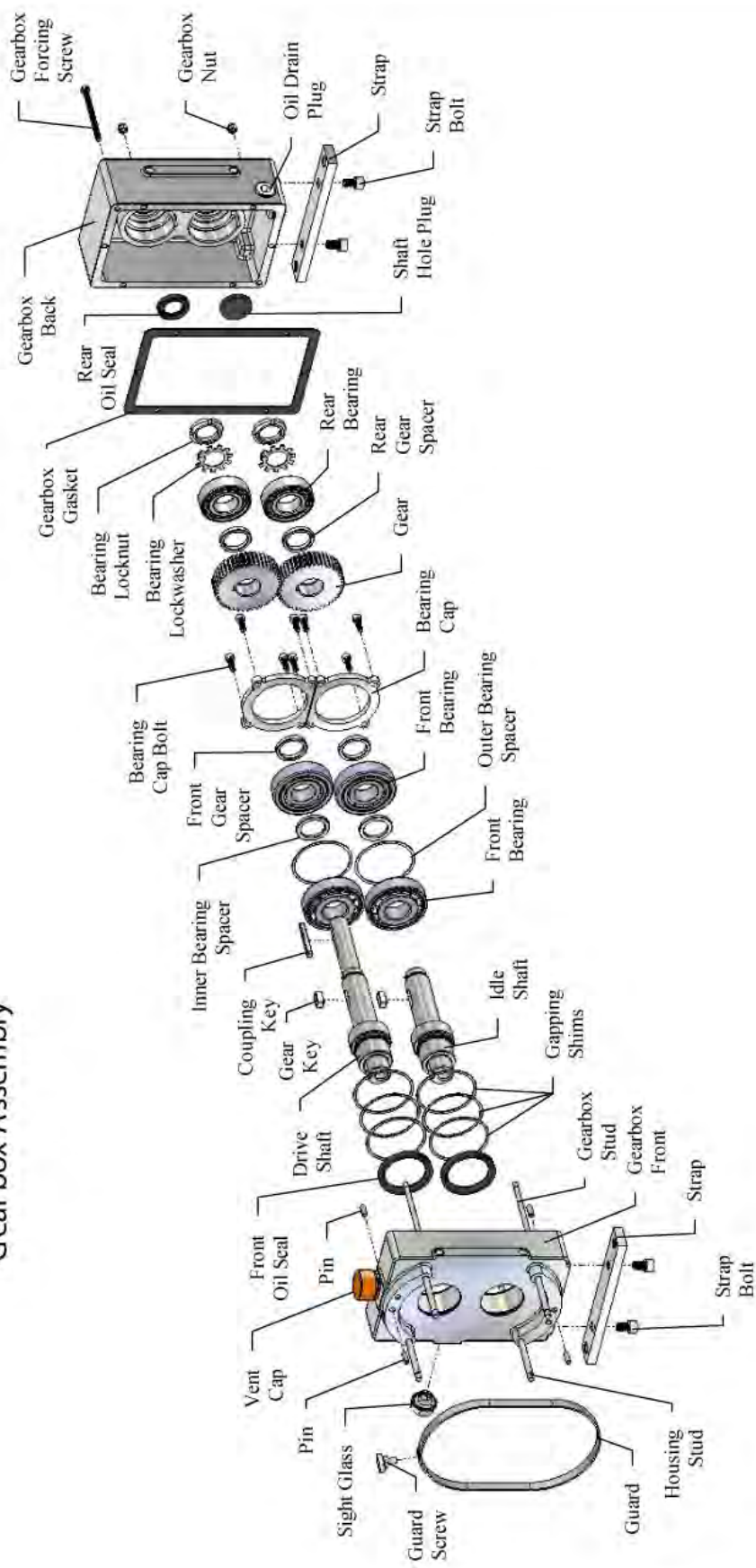
Exploded Pump Head Assembly



O-Ring Seals



Exploded Pump
Gear box Assembly



Description	Material	Qty	Part No.	
			15	20
Forcing Screw	-	2	1018000074	
Cover Nut	-	4	1103004836	
Cover	-	1	1652620000	1654620000
Cover O-Ring	Buna	1	1180000000	1180000716
	Viton		1180000149	1180000215
	EPDM		1180000299	1180000300
Pin	-	6	1891000080	
Rotor Bolt	-	2	1102000001	
Rotor Bolt O-Ring	Viton	2	1180000085	
	EPDM		1180000188	
Rotor Cap	-	2	1104000068	
Rotor Cap O-Ring	Viton	2	1180000700	
	EPDM		1180000706	
Rotor (standard)	-	2	1653630000	1655630000
Rotor O-Ring	Viton	2	1180000700	
	EPDM		1180000706	
Housing Screw	-	2	1101000209	
Housing	-	1	1652610000	1654610000
Seal Pin	-	4*	1891000051	
Water Pipe	-	2	1910000002	
Rotor Key	-	2	1315000040	1315000038
Guard	-	1	1936000137	
Guard Screw	-	1	1102000000	
Housing Stud	-	4	1103000115	1103000079
Vent Cap	-	1	1248000023	
Strap	-	2	1925000009	
Strap Bolt	-	4	1101000210	

**Quantities may vary

Description	Qty	Part No.	
		15	20
Oil Sight Glass	1	1248000029	
Gearbox Front	1	1310600149	
Front Oil Seal	2	1812000040	
Gapping Shim (1mm)	4**	1373000067	
Gapping Shim (0.5mm)	2**	1373000068	
Gapping Shim (0.25mm)	0**	1373000069	
Gapping Shim (0.05mm)	0**	1373000070	
Drive Shaft	1	1372600028	1372600026
Idle Shaft	1	1372600029	1372600027
Gear Key	2	1315000037	
Coupling Key	1	1315000039	
Front Bearing Assembly	2	1173000041	
Front Gear Spacer	2	1224000119	
Bearing Cover	2	1304000017	
Bearing Cover Bolt	8	1101000208	
Gear	2	1365000012	
Rear Gear Spacer	2	1224000118	
Rear Bearing	2	1173000039	
Bearing Lockwasher	2	1104000069	
Bearing Locknut	2	1306000083	
Gearbox Gasket	1	1181000152	
Rear Oil Seal	1	1812000041	
Shaft Hole Plug	1	1812000042	
Gearbox Back	1	1310600150	
Gearbox Forcing Screw	1	1101000218	
Gearbox Nut	1	1103000080	
Oil Drain Plug	1	1248000012	

PUMP HEAD DISASSEMBLY

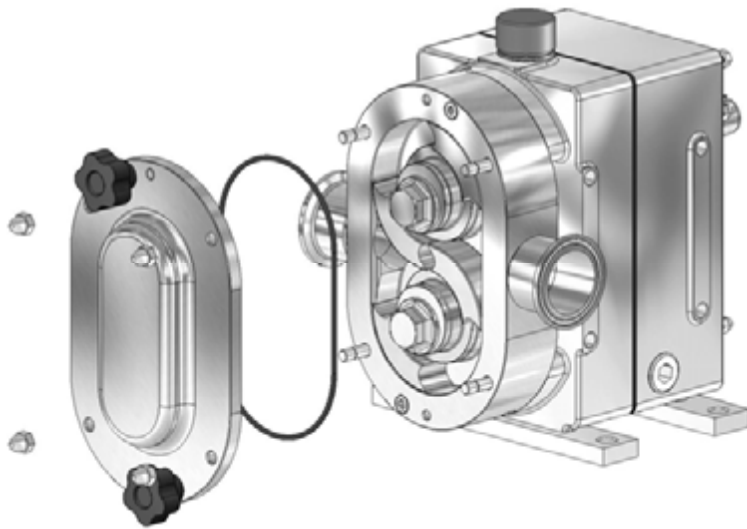


FIGURE 11

Remove the cover nuts.

Remove the cover by turning the forcing screws clockwise.

Remove the cover and discard the cover o-ring.

Jacket Cover Only: Remove cover nuts, then remove jacketed cover and jacketed cover o-ring. Remove cover and discard cover o-ring.

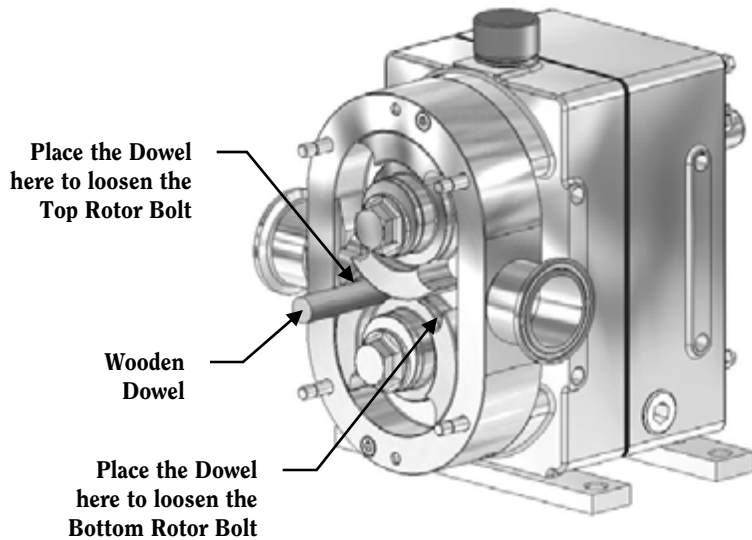


FIGURE 12

Place a 1/2" diameter wooden dowel between the rotors.

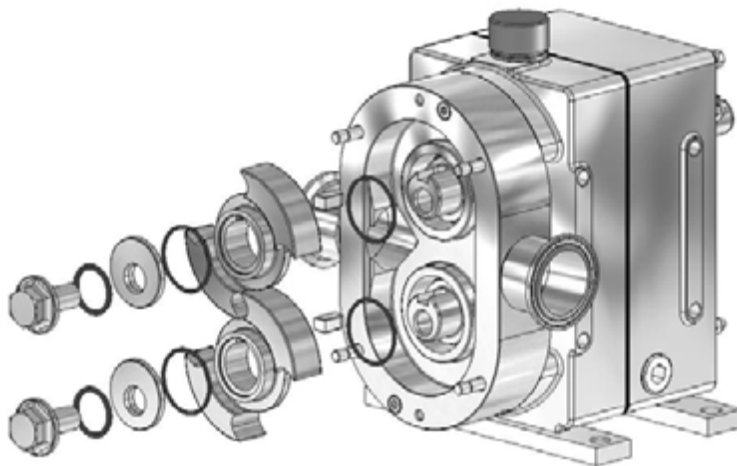


FIGURE 13

Remove the rotor bolts.

Discard the rotor bolt o-rings.

Remove the rotor caps and discard the rotor cap o-rings.

Remove the rotors. **Note: Keep rotors free from damage (i.e. nicks, dings) to ensure high efficiency the pump was designed for.**

Discard the rotor o-rings.

Remove the rotor keys.

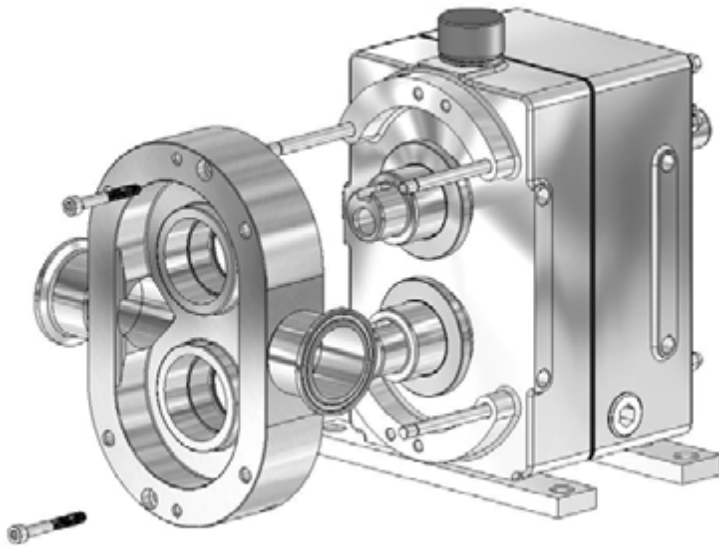


FIGURE 14

Remove the housing screws .

Carefully slide the housing forward and remove.

Note: Keep housing free from damage, e.g., nicks and dings, to ensure high efficiency the pump was designed for.

MECHANICAL SEAL DISASSEMBLY

For O-Ring Seal disassembly - skip to Figures 17.

FIGURE 15

Place the housing face down.

Remove and discard the Stationary seals, o-rings and springs.

Double Seal Only: Remove and discard the Flush seals, o-rings and springs.

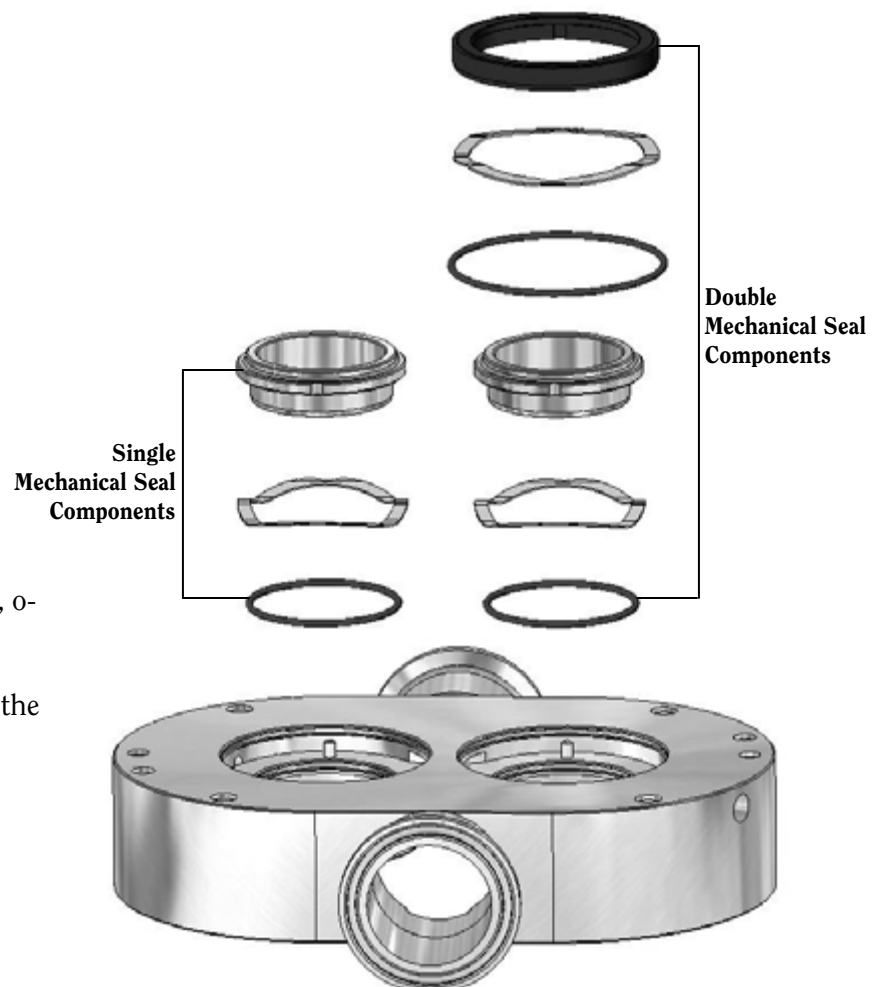
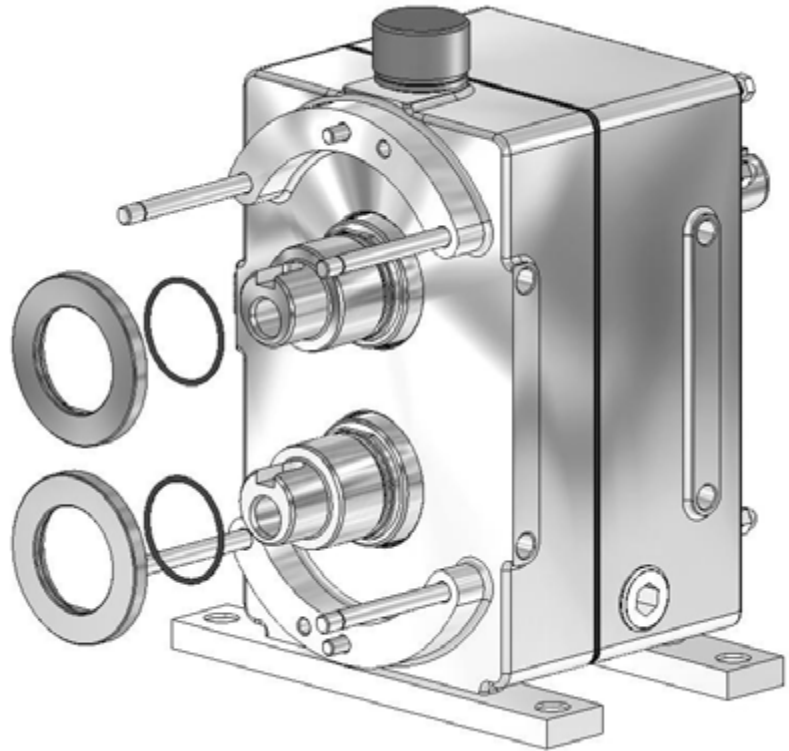


FIGURE 16

Remove and discard the rotating seals and o-rings.



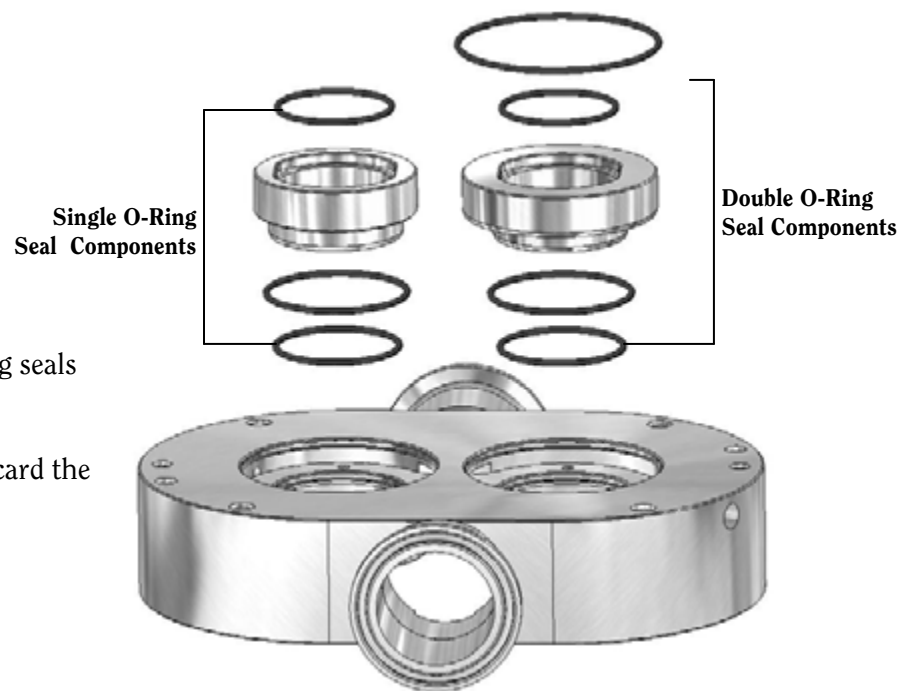
O-RING SEAL DISASSEMBLY

FIGURE 17

Place the housing face down.

Remove and discard the single o-ring seals and o-rings.

Double Seal Only: Remove and discard the double o-ring seals and o-rings.



Note: The housing, rotors and cover should be cleaned before reassembly.

MECHANICAL SEAL ASSEMBLY

For O-Ring Seal assembly - skip to Figures 23-24.

FIGURE 18

Install the Stationary seal o-rings.

Install the single seal springs making sure to align the seal pins on the housing with the cut-outs on the springs.



FIGURE 19

Install the Stationary seals making sure to align the seal pins on the housing with the cut-outs on the seals.

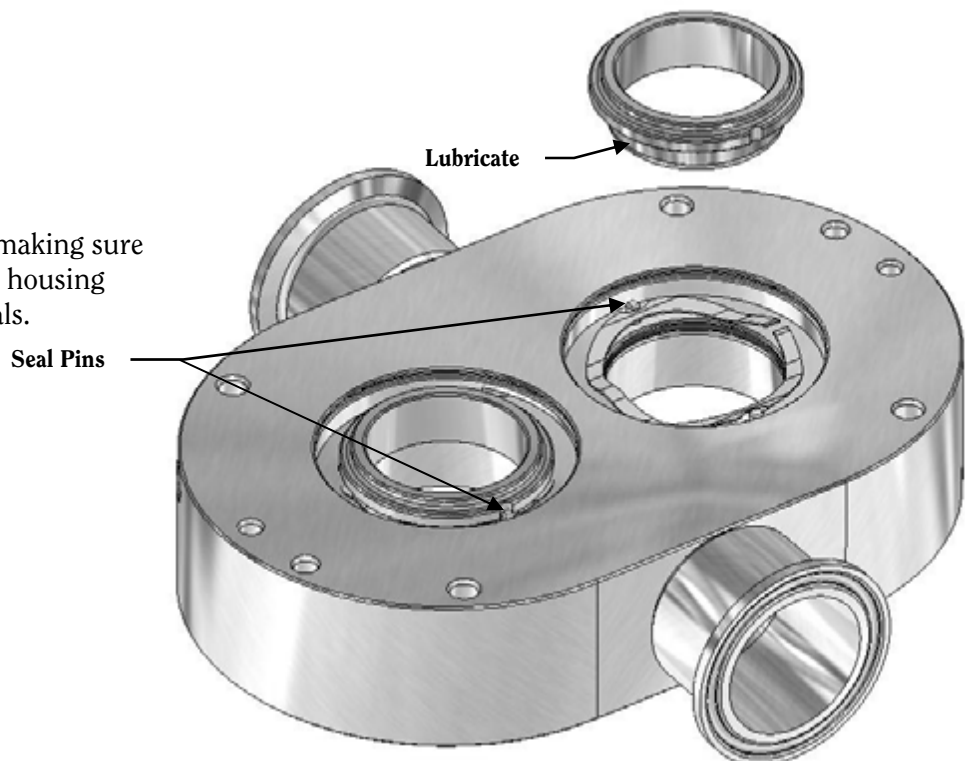


FIGURE 20

Double Seal Only: Install the Flush seal o-rings.

Install the double seal springs making sure to align the seal pins on the housing with the cut-outs on the springs.

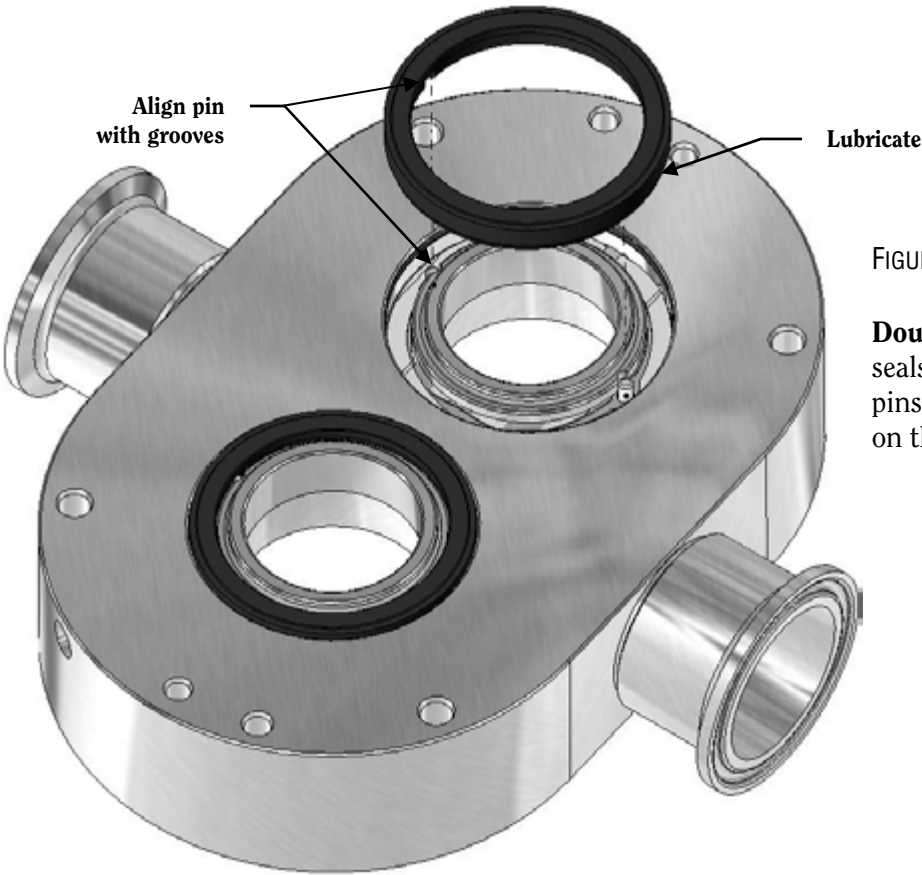


FIGURE 21

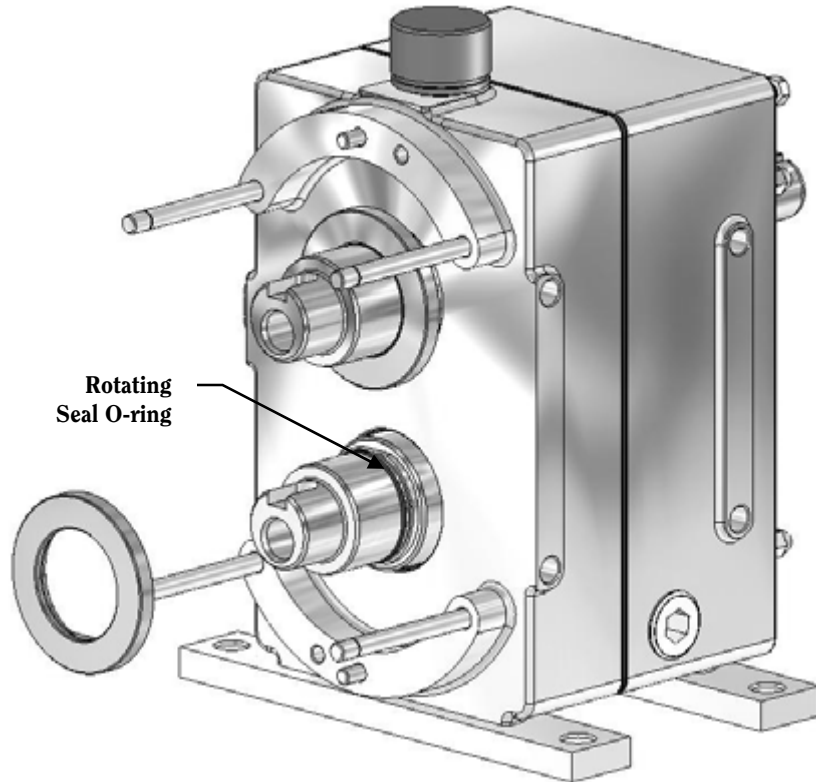
Double Seal Only: Install the Flush seals making sure to align the seal pins on the housing with the cut-outs on the seals.

ROTATING SEAL ASSEMBLY

FIGURE 22

Install the rotating seal o-rings.

Install the rotating seals making sure to align the flats on the seals with the flats on the shaft.



O-RING SEAL ASSEMBLY

FIGURE 23

Install the Stationary seal o-rings.

Double Seal Only: Install the Flush seal o-rings.

Note: If the pump is changing from mechanical seals to o-ring seals, the seal pins must be removed from the housing prior to installing the o-ring seals.

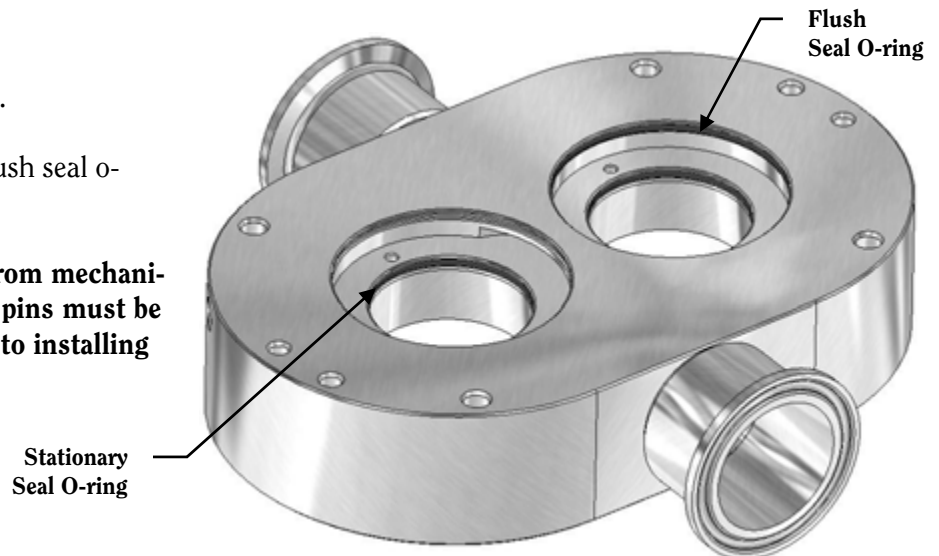
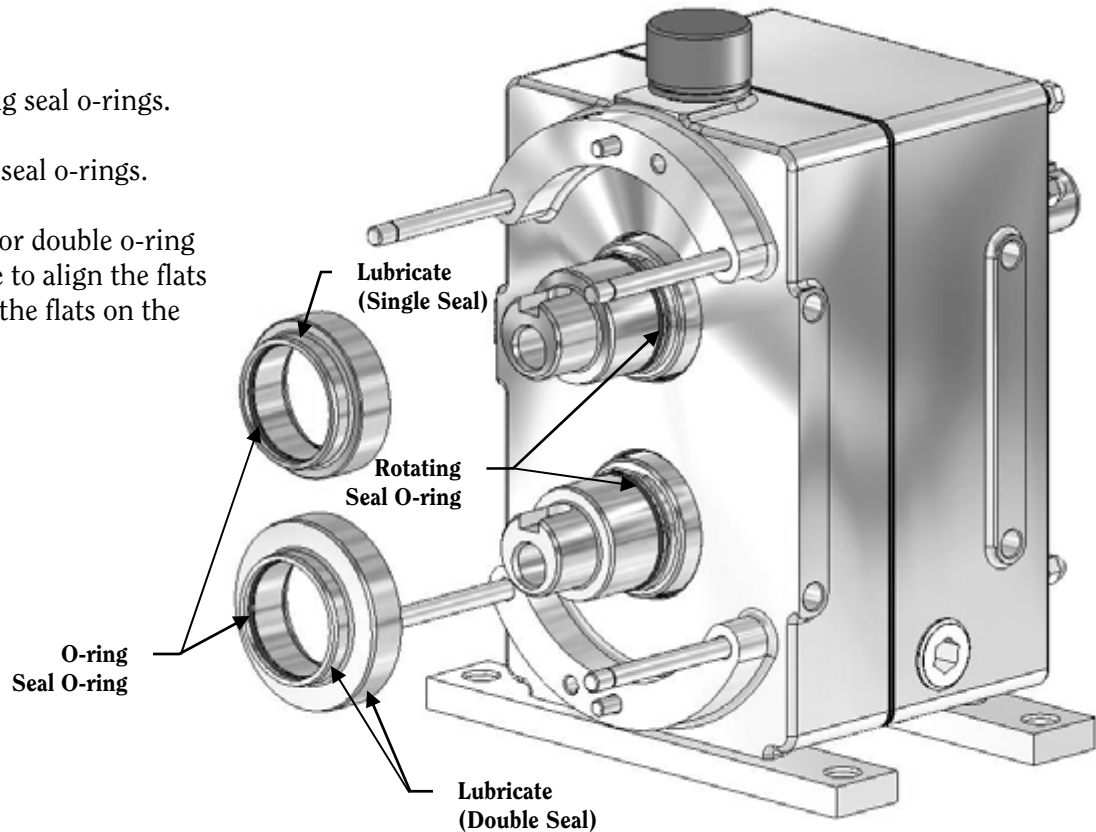


FIGURE 24

Install the rotating seal o-rings.

Install the o-ring seal o-rings.

Install the single or double o-ring seals making sure to align the flats on the seals with the flats on the shafts.



PUMP HEAD ASSEMBLY

Note: Any debris between the gearbox and pump housing will affect the rotor gap. Make sure the two raised faces on the front of the gearbox and the back face of the housing are clean.

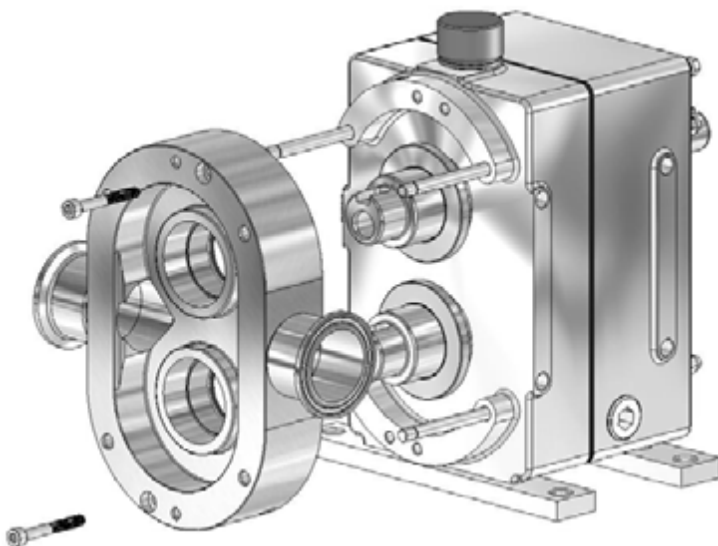


FIGURE 25

Carefully slide the housing onto the studs and over the shafts.

Use a torque wrench to tighten the housing screws.

FIGURE 26

Install the rotor o-ring.



FIGURE 27

Insert the rotor keys into the shaft keyways.

Install the rotors with the rotor o-ring facing the housing.

Note: The rotor with one dot should be installed on the drive shaft and the rotor with two dots should be installed on the idle shaft.

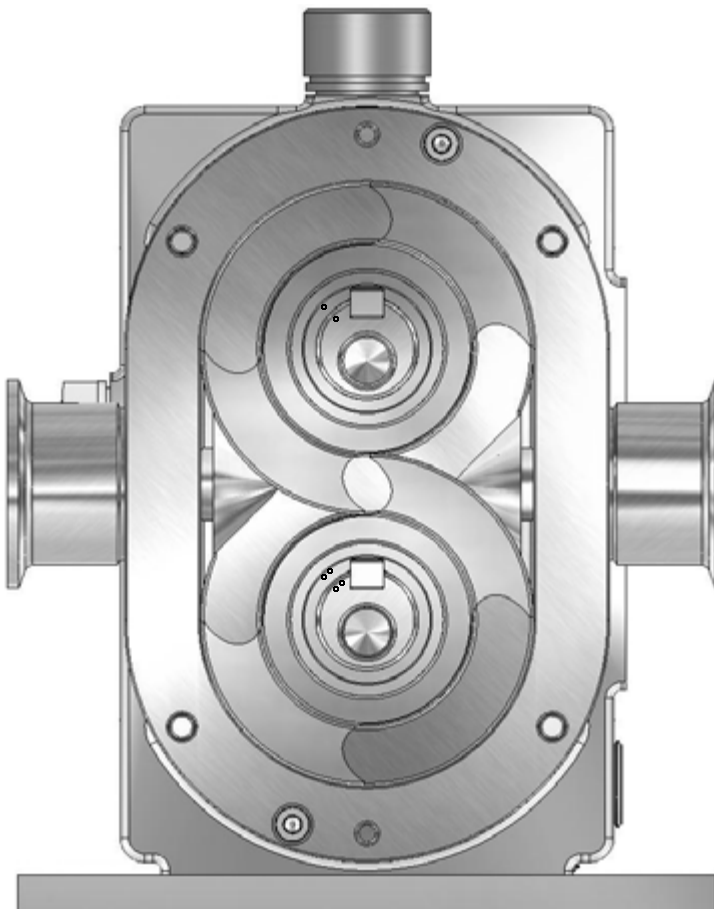
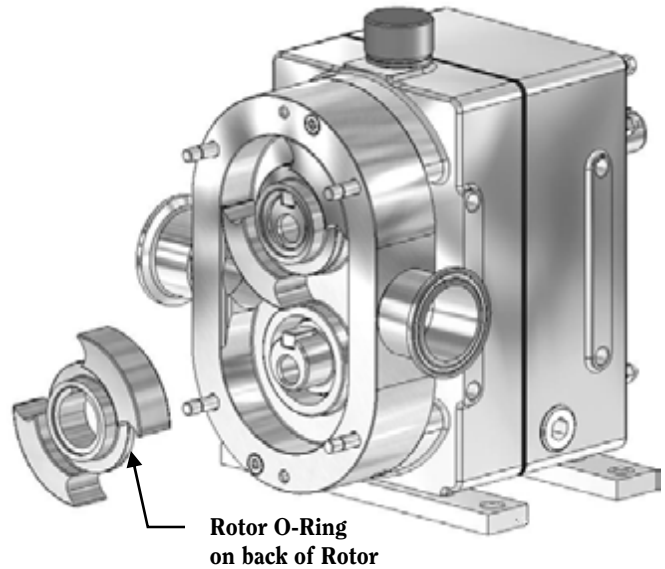


FIGURE 28

Install the rotor with one dot onto the shaft with one dot (drive shaft).

Install the rotor with two dots onto the shaft with two dots (idle shaft).

FIGURE 29

Install the rotor cap o-ring.



FIGURE 30

Install the rotor caps making sure to align the holes with each other.

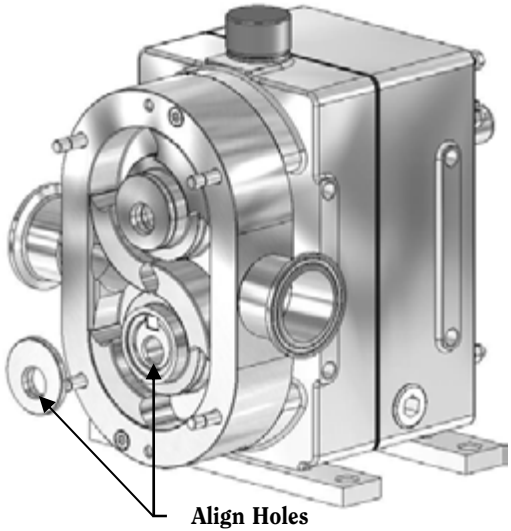


FIGURE 31

Install the rotor bolt o-ring.

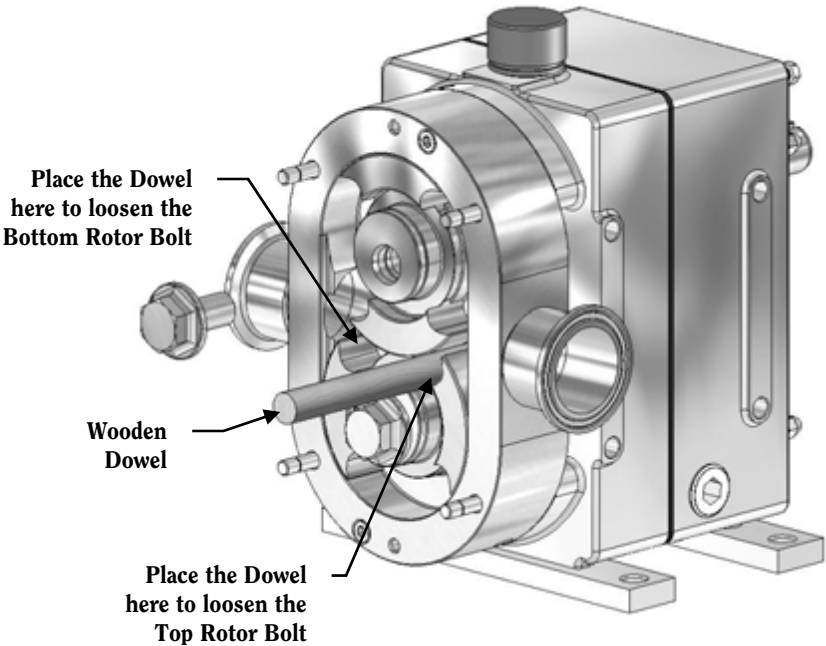
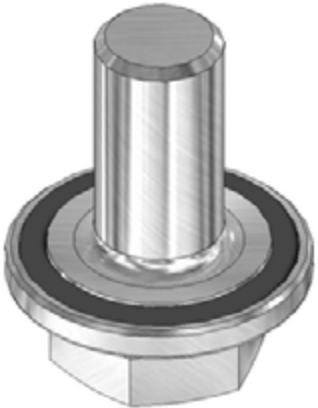


FIGURE 32

Place a 1/2" diameter wooden dowel between the rotors.

Use a torque wrench to tighten the rotor bolts.

FIGURE 33

Install the cover o-ring.

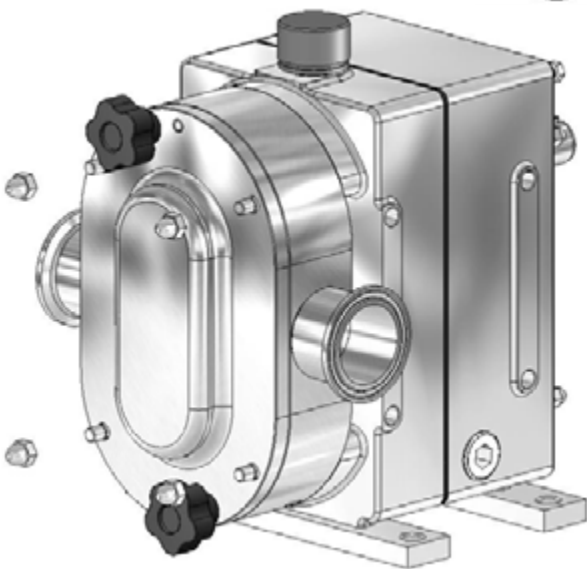
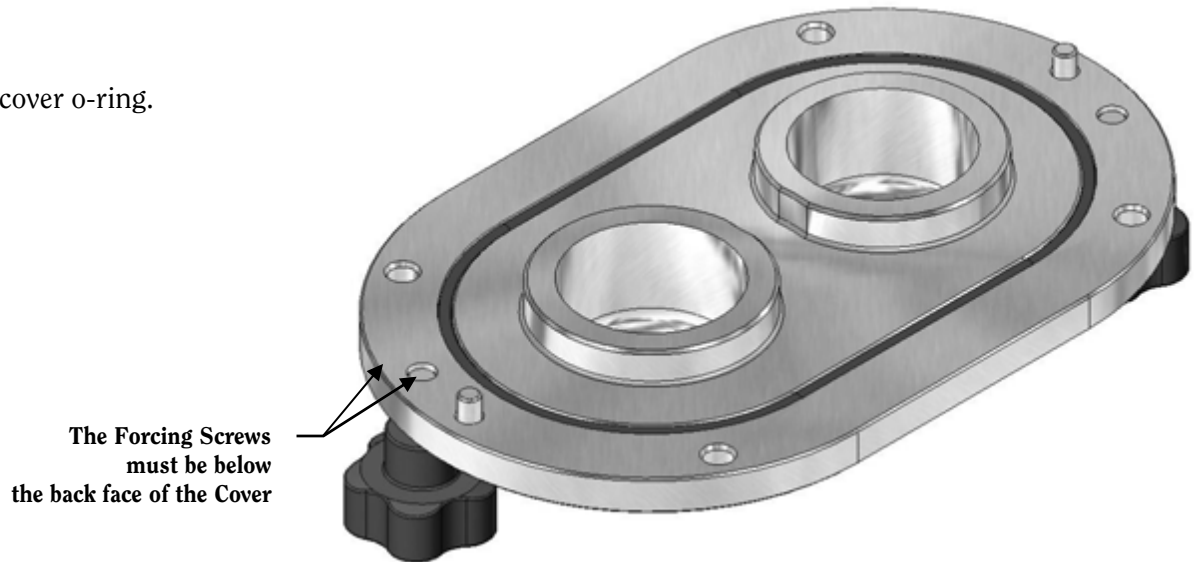


FIGURE 34

Carefully slide the cover onto the housing.

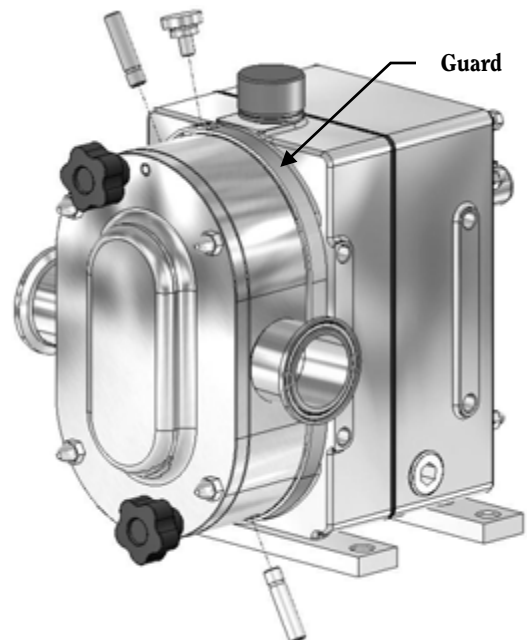
Use a torque wrench to tighten the cover nuts.

FIGURE 35

Install the guard around the housing and fasten with the guard screw.

Reconnect the inlet and outlet piping (see Figure 9-10, page 8).

Double Seal Only: Install the water pipes. Reconnect the seal flush supply and return lines (see Figure 8, page 8).



GEARBOX DISASSEMBLY

Prior to disassembling the gearbox, obtain a gearbox repair kit from Fristam, then complete the pump head disassembly (Figure 11-17, page 15-17).

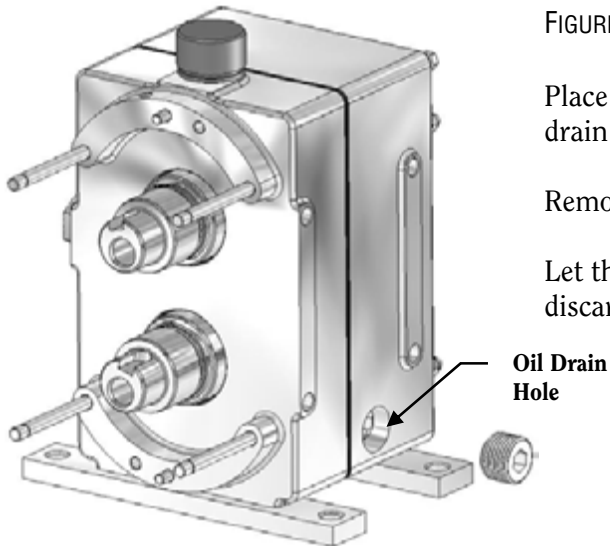


FIGURE 36

Place an oil pan under the gearbox, below the oil drain hole.

Remove the oil drain plug.

Let the oil completely drain out of the gearbox and discard.

FIGURE 37

Remove the gearbox cover nuts.

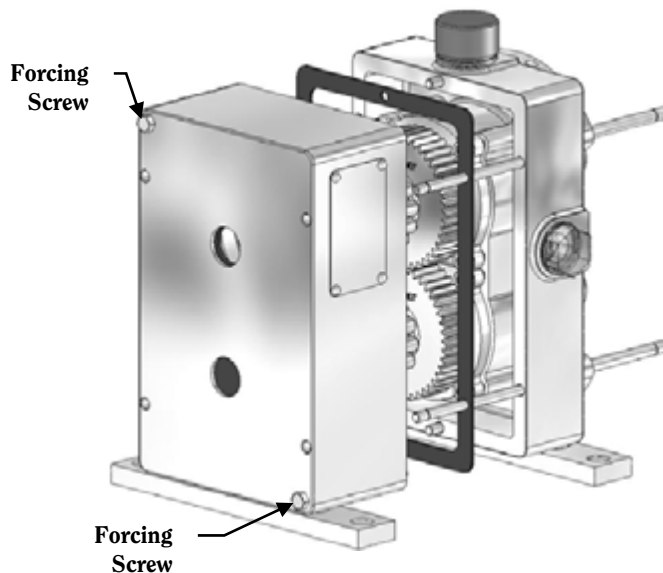
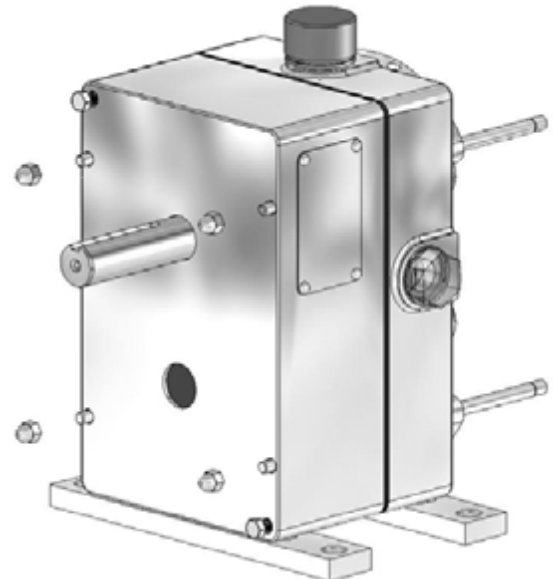


FIGURE 38

Use the forcing screws to force the gearbox back off the pins.

Discard the gearbox gasket.

FIGURE 39

Remove and discard the rear oil seal and shaft hole plug.

Use a screwdriver to remove and discard the rear outer bearing race by pressing through the shaft holes.

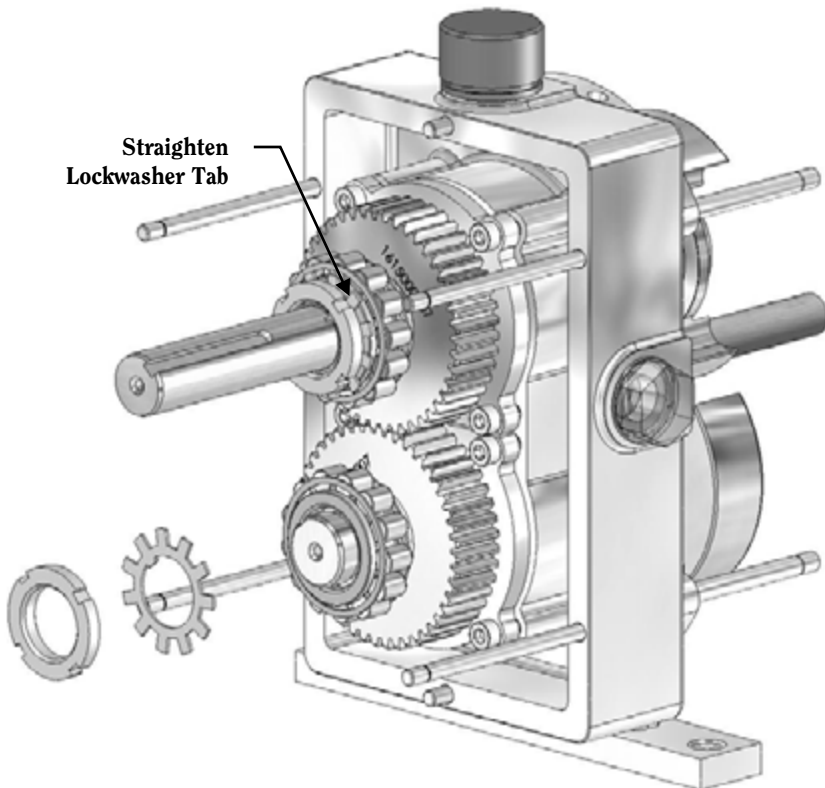
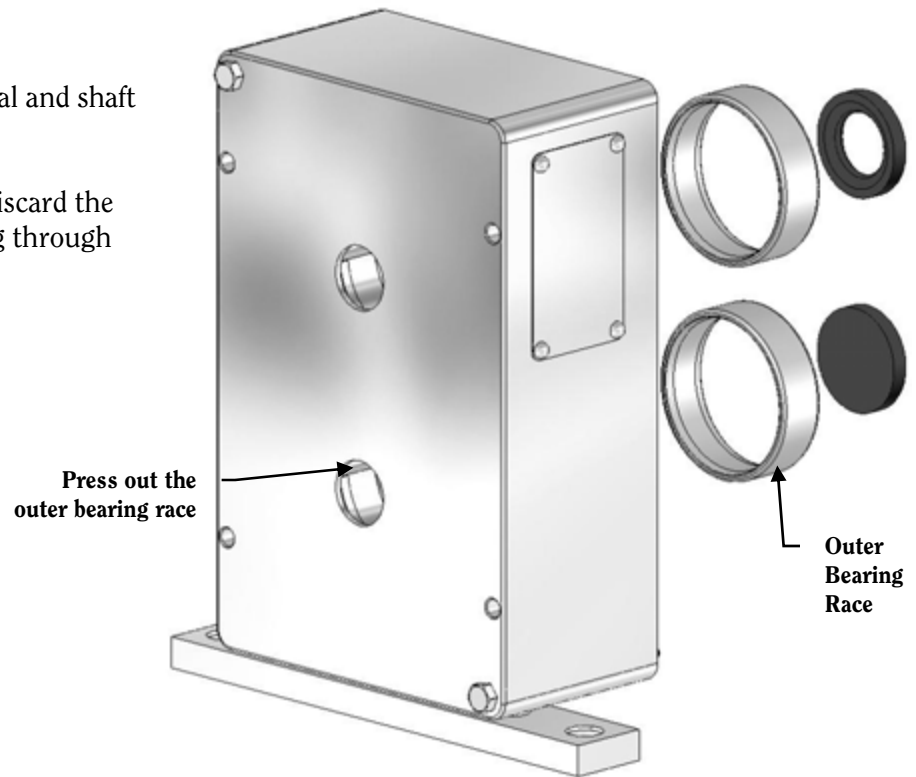


FIGURE 40

Install the rotor keys and rotors onto the shafts.

Place a 1/2" wooden dowel between the rotors to prevent the shafts from turning.

Use a screwdriver to straighten the bearing lockwasher tab.

Remove the bearing locknut.

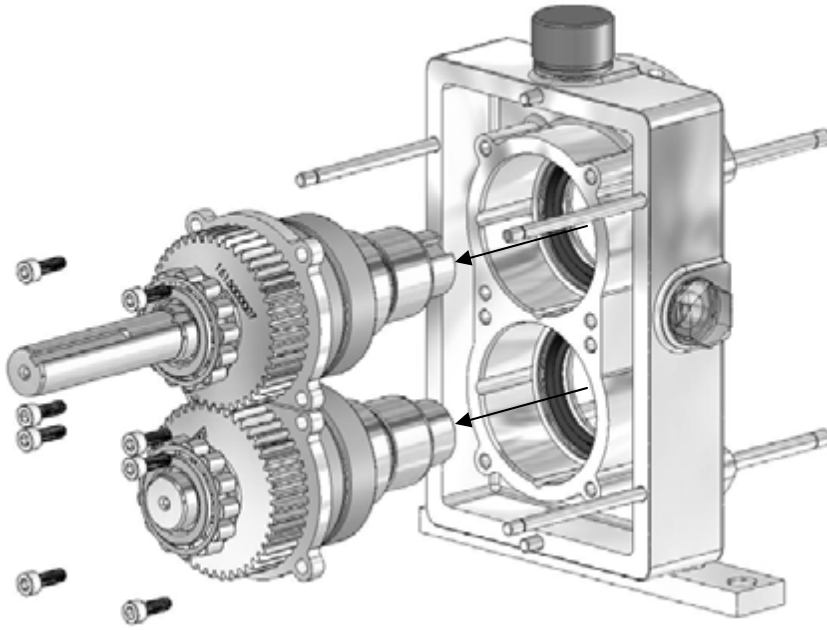


FIGURE 41

Remove the bearing cover bolts.

Remove the shaft assemblies.

FIGURE 42

Remove the rear bearing, gear and gear spacers by pressing on the bearing cover.

Remove the bearing cover and gear key.

Discard the bearing.

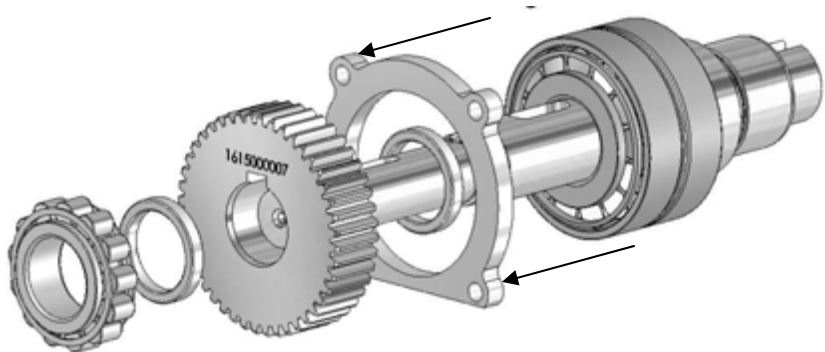


FIGURE 43

Remove the front bearings and bearing spacers by pressing on the inner race of the front bearing.

Discard the bearings.

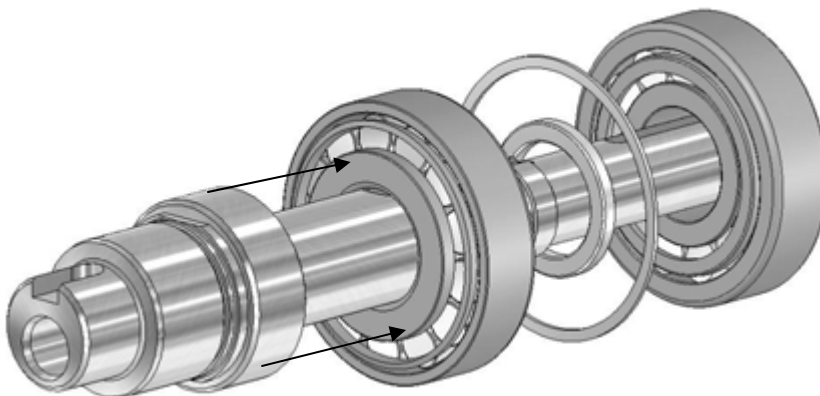
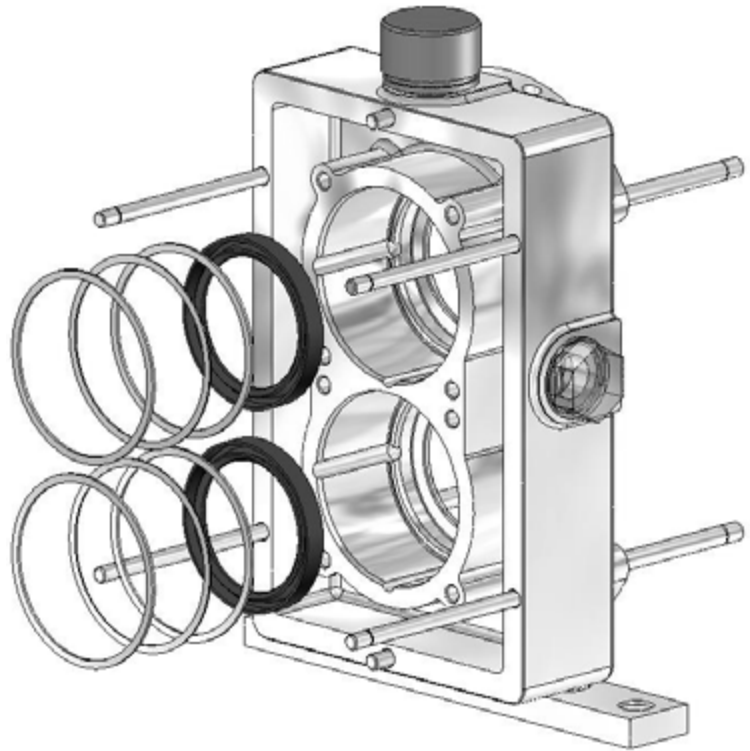


FIGURE 44

Remove and discard the front oil seals and gapping shims.

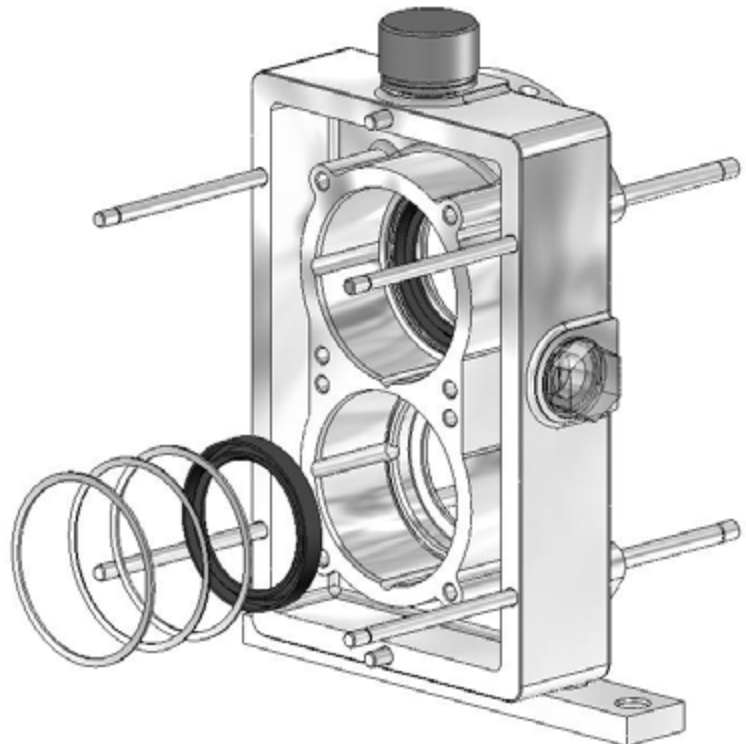


Note: Clean the gearbox, gears and shafts.

GEARBOX ASSEMBLY

FIGURE 45

Install the new front oil seals and gapping shims.



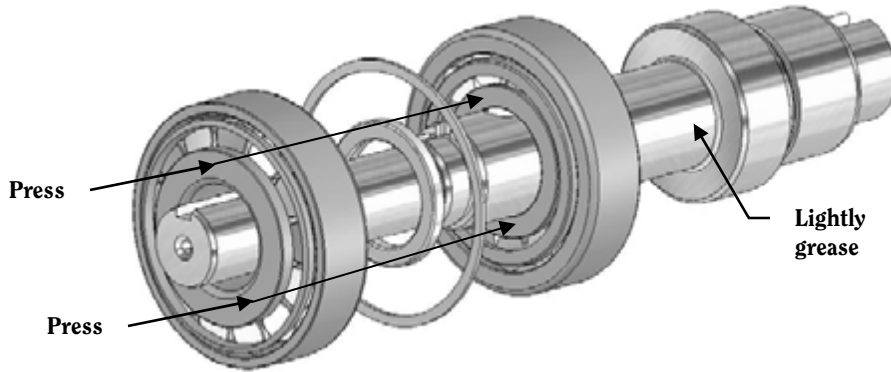


FIGURE 46

Make sure to keep all bearing components together when removing them from the packaging. They must stay together in matched sets.

Lightly grease the front bearing step.

FIGURE 47

Install the first bearing by pressing on the inner race.

Install the inner and outer bearing spacers.

Install the second bearing by pressing on the inner race.

Note: Make sure the outer bearing spacer is flush with the outside of the bearings.

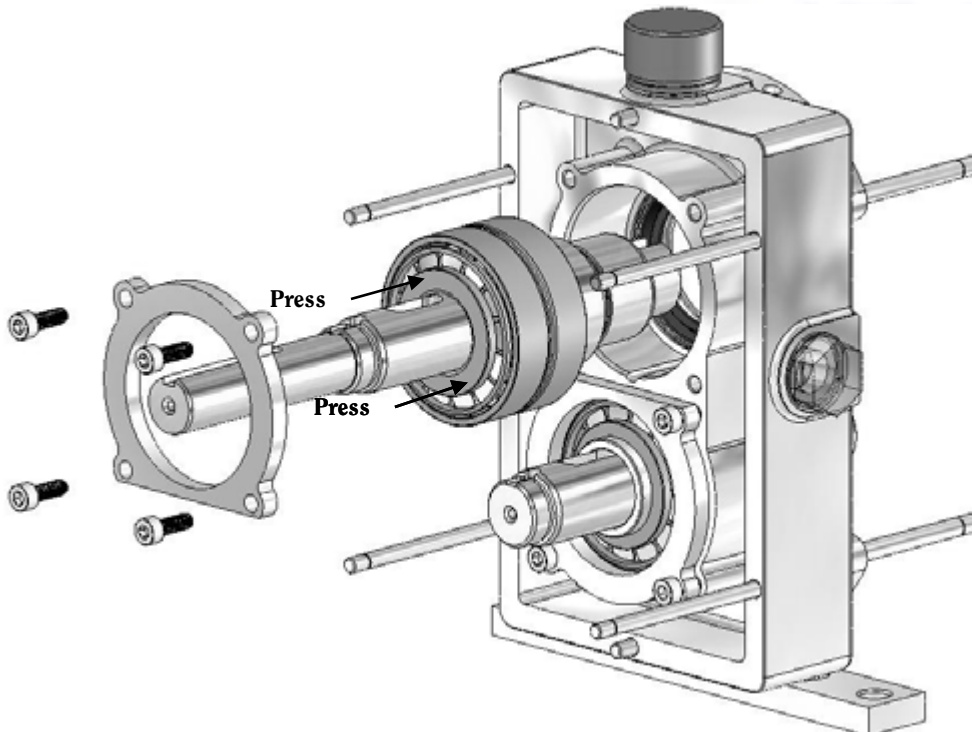
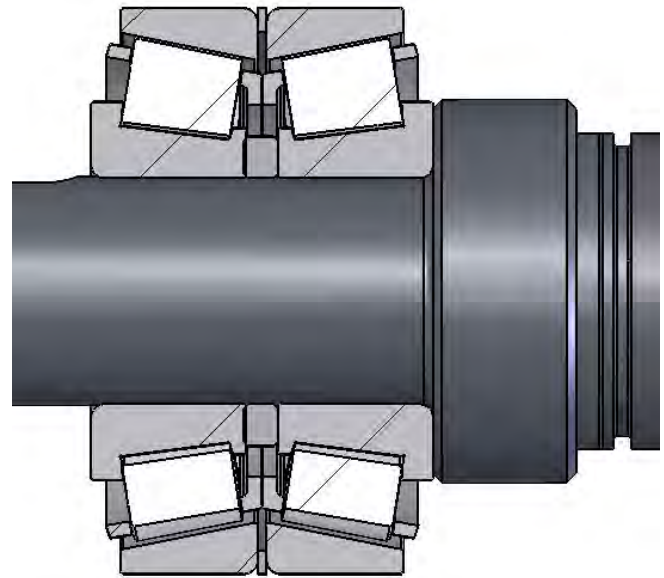


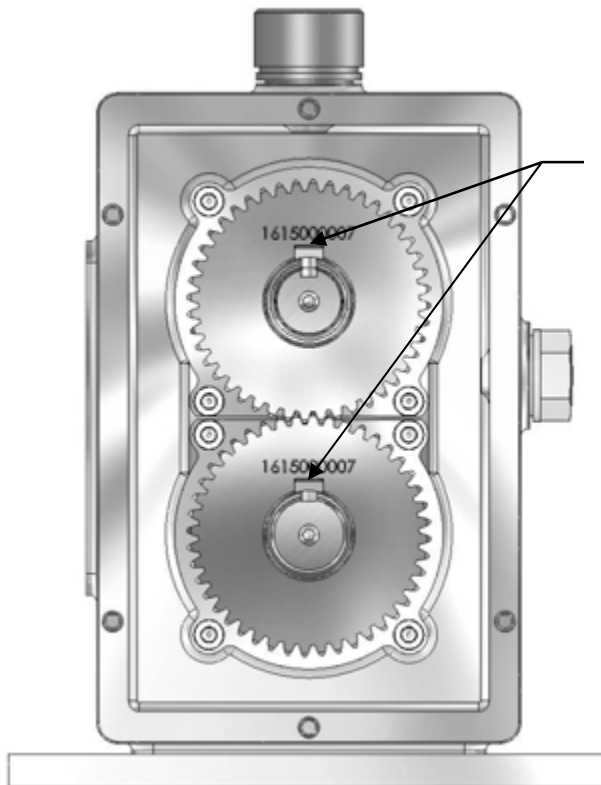
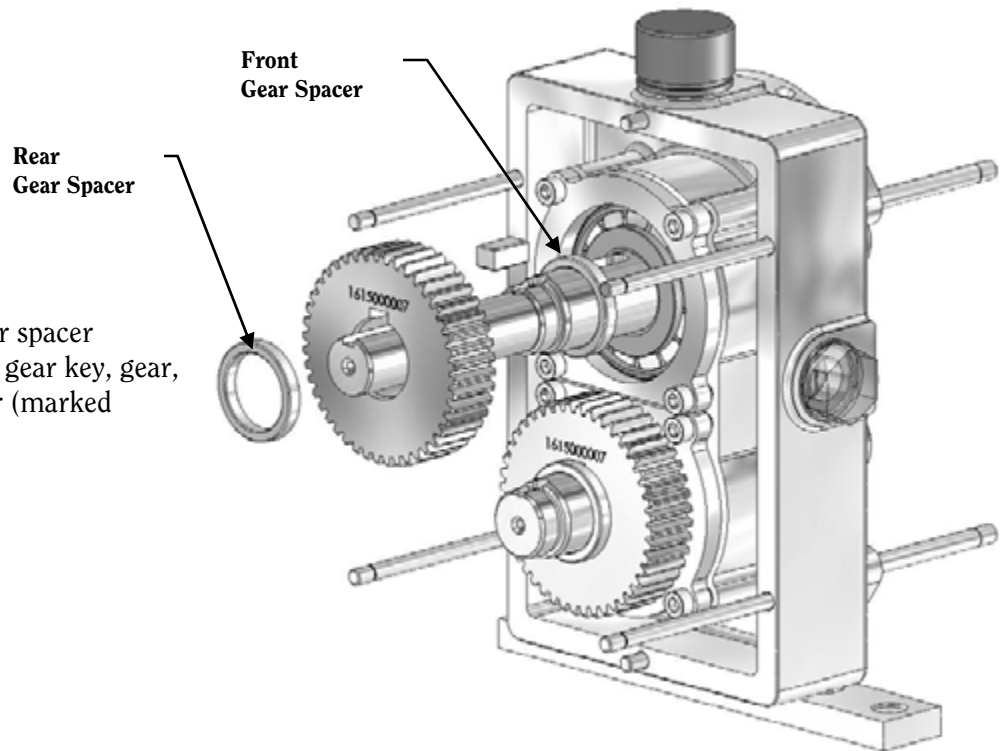
FIGURE 48

Install the shafts into the gearbox front by pressing on the inner bearing race. Be sure to install the drive shaft into its original position.

Use a torque wrench to tighten the bearing cover bolts.

FIGURE 49

Install the front gear spacer (marked "FRONT"), gear key, gear, and rear gear spacer (marked "REAR").



**Keyways
must be
parallel**

FIGURE 50

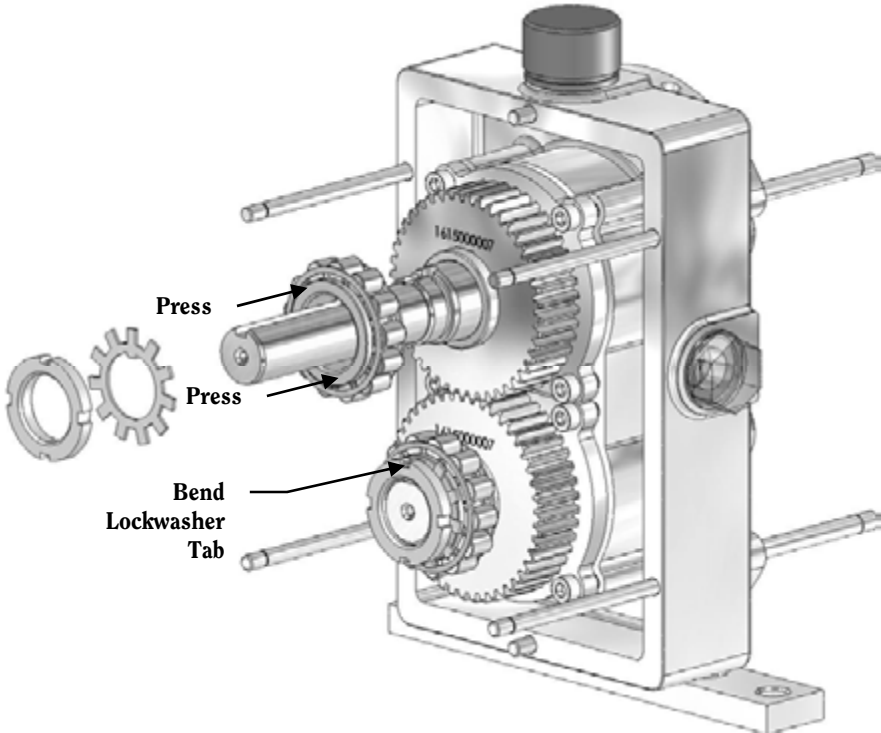
The gear keyways must be parallel.

FIGURE 51

Install the rear bearing by pressing on the inner race.

Install the bearing lockwasher and bearing locknut. Tighten the bearing locknut with a torque wrench

Use a screwdriver to bend the bearing lockwasher tab into one of the slots on the locknut.



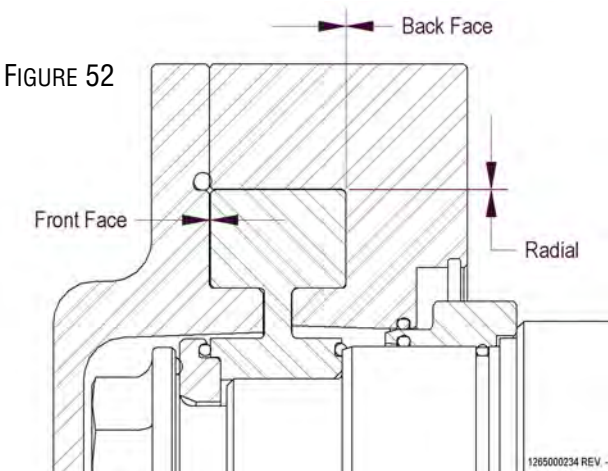
SETTING THE ROTOR GAP

The housing and rotors must be installed to check the rotor gap (seals and o-rings aren't necessary).
(see Figures 25-32, pages 21-23)

Use feeler gages to verify the back face clearances. You must do this for both shafts, as they will most likely be different.

Rotor Clearances

	Standard	High Temp
Back Face	0.04 / 0.06 mm (0.0016 / 0.0024")	0.07 / 0.09 mm (0.0028 / 0.0035")
Radial	0.03 / 0.07 mm (0.0012 / 0.0028")	0.05 / 0.09 mm (0.0020 / 0.0035")
Front Face	0.10 / 0.18 mm (0.0039 / 0.0071")	0.13 / 0.23 mm (0.0051 / 0.0091")



If the clearances are incorrect, you must set the rotor gap.

Measured Back Face Clearance minus Standard Back Face Clearance equals amount of shims to be added or removed from the gearbox. Remove the shafts and add or remove shims as necessary. You may use a combination of gapping shims of different thicknesses to get the correct gap.

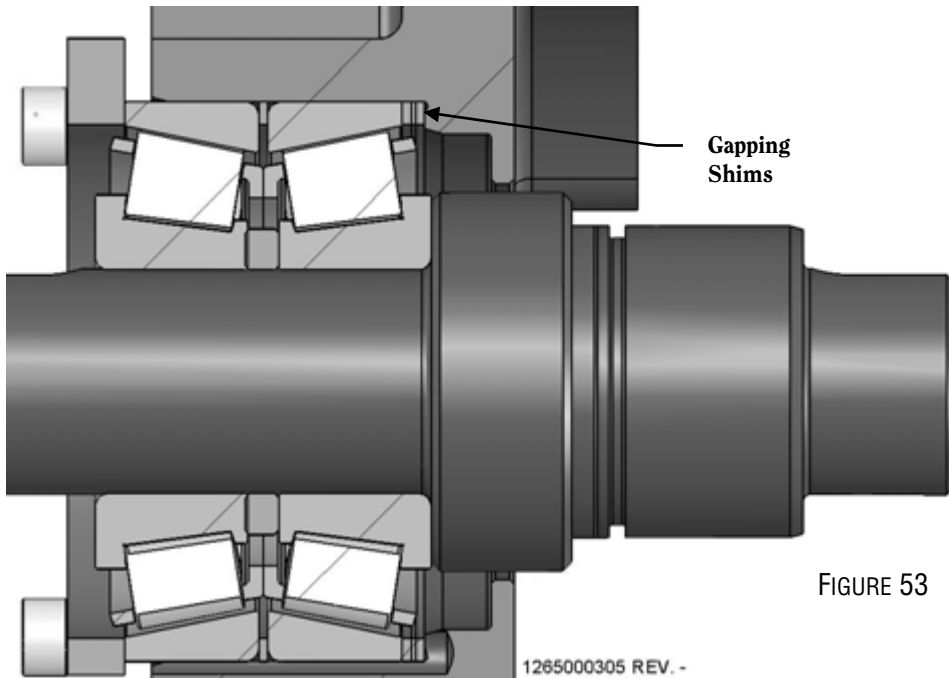


FIGURE 53

Once the clearances are correct, rotate the pump shaft to verify that the rotors turn freely.

FIGURE 54

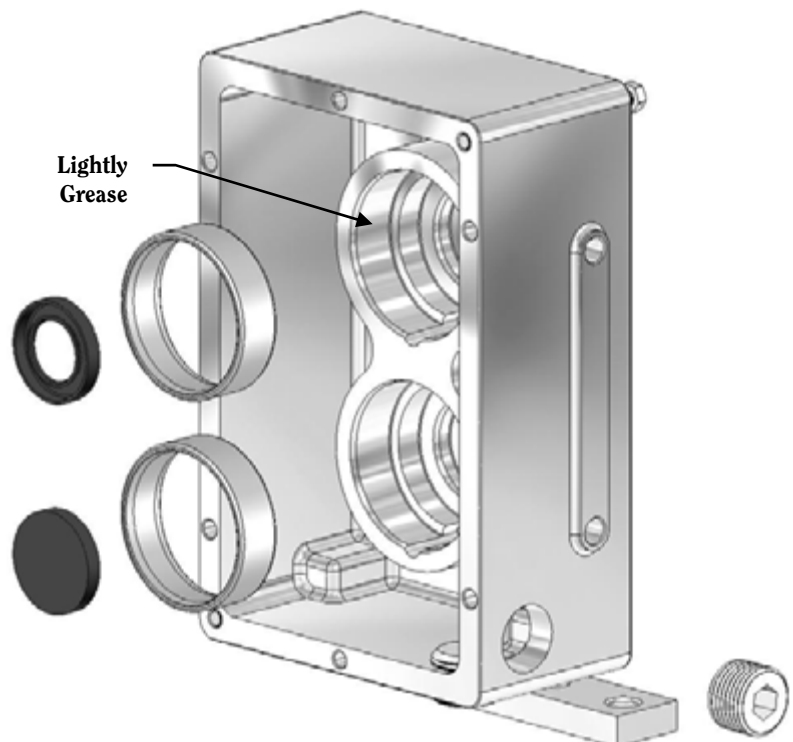
Lightly grease the rear bearing bores.

Press the outer bearing race into the rear bearing bore.

Install the new rear oil seal inside the drive shaft hole in the gearbox back.

Install the new shaft hole plug in the idle shaft hole in the gearbox back.

Re-install the oil drain plug.



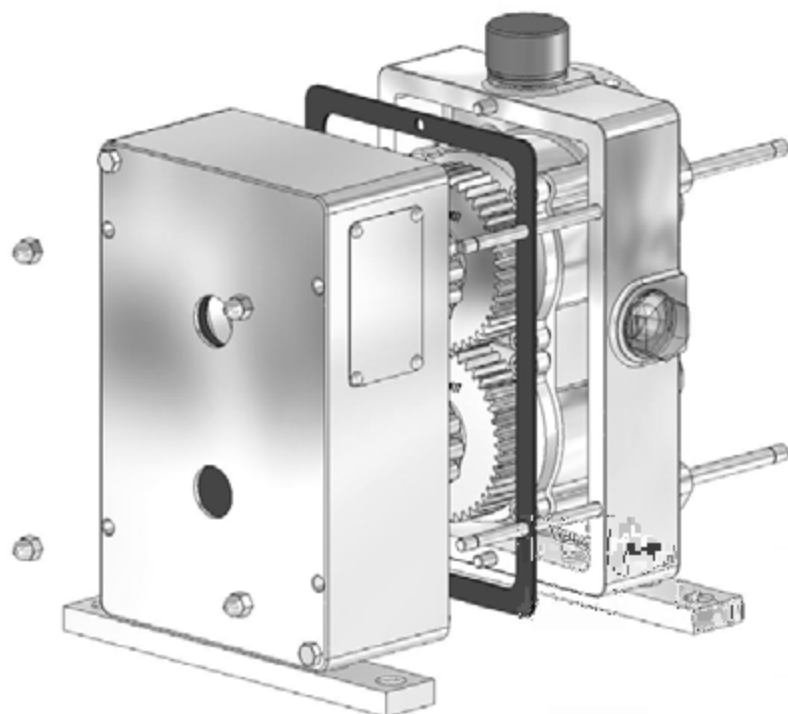


FIGURE 55

Install a new gearbox gasket.

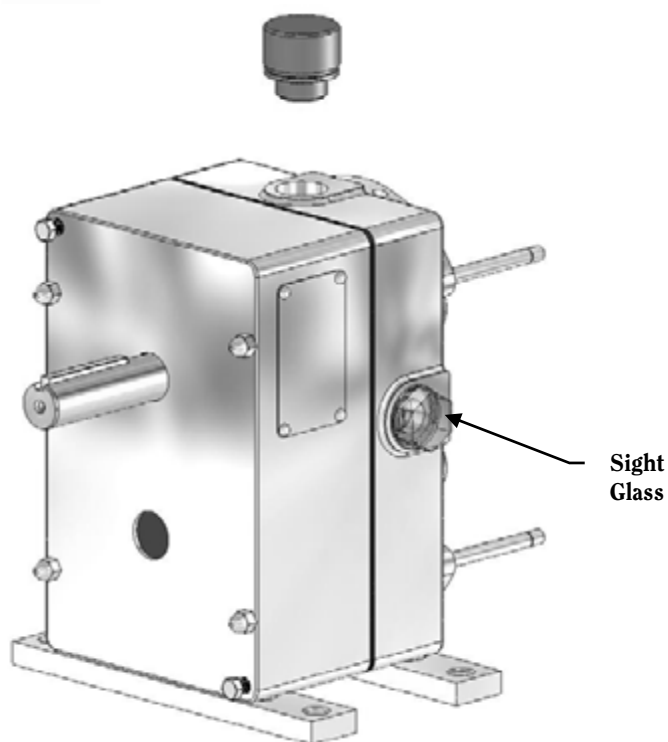
Install the gearbox back.

Use a torque wrench to tighten the gearbox nuts.

FIGURE 56

Remove the vent cap and fill the gearbox with oil to the center of the sight glass.

Replace the vent cap.



Once the gearbox is assembled, the seals and pump head can be assembled (Figure 18-34, page 18-24).

[illegible]

[illegible]

[illegible]

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Each Fristam Pumps item is warranted to be free from manufacturing defects for a period of one (1) year from the date of shipment, providing it has been used as recommended and in accordance with recognized piping practice, and providing it has not been worn out due to severe service, such as encountered under extremely corrosive or abrasive conditions.

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2410 Parview Road • Middleton, WI 53562-2524
1-800-841-5001 • 608-831-5001
Website: www.fristam.com
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