



Engineered For Lasting Performance®

INSTRUCTION AND MAINTENANCE MANUAL:

FKL POSITIVE DISPLACEMENT PUMP

MODELS 25, 50, 75, 150, 205, 250, 400, AND 580



SANITARY POSITIVE DISPLACEMENT PUMP

DESCRIPTION

This manual contains installation, operation and repair instructions for the Fristam FKL 15, 20, 25, 50, 75, 150, 205, 250, 400, and 580 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 series pump features a unique balanced rotor design with heavy-duty shafts allowing the pump to maintain its efficiency at differential pressures up to 500 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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REFERENCE MATERIAL

TECHNICAL INFORMATION

SPECIFICATIONS

Normal Differential Pressure Range	0 to 300 PSI (models 25 and 580)
.....	0 to 500 PSI (models 50–400)
Normal Speed Range	0 to 600 RPM
.....	0 to 400 RPM (model 580)
Normal Temperature Differential (Standard Rotors)	Δ140°F
Normal Temperature Differential (High Temperature Rotors).....	Δ210°F

MATERIALS OF CONSTRUCTION

Major Product Contact Components	AISI 316L (CF3M)
Rotors.....	Non-galling Stainless Steel
Cover Gasket	BUNA (standard)
Also available in	Viton, EPDM and other options available
Surface Finish for Product Contact Surfaces	32 Ra (standard)
Also available in	25 Ra, 20 Ra, and 15 Ra
Cover Gasket and Other O-rings on Aseptic	EPDM

SHAFT SEALS & O-RINGS

Mechanical Seal Type	Single/Double
Stationary Seal Ring Material	Carbon (standard)
Also available in	Silicon Carbide & Chrome oxide/SS
Rotating Seal Ring Material	Chrome Oxide/SS
Also available in	Silicon Carbide
Other O-rings (mechanical seals)	Viton (standard)
Also available in	EPDM and other options available
O-ring Seal Type	Single/Double
O-ring Seal Material	Viton (standard)
Also available in	EPDM and other available upon request

Note: o-ring seal not available on the FKL 400

LUBRICATION

Oil Grade.....	SAE 15W40
Oil Capacity - Horizontal	
FKL 25	1.66 liters (1.75 US quarts)
FKL 50	1.4 liters (1.5 US quarts)
FKL 75	4.2 liters (4.5 US quarts)
FKL 150	7.1 liters (7.5 US quarts)
FKL 205	10.4 liters (11 US quarts)
FKL 250	10.4 liters (11 US quarts)
FKL 400	17.5 liters (18.5 US quarts)

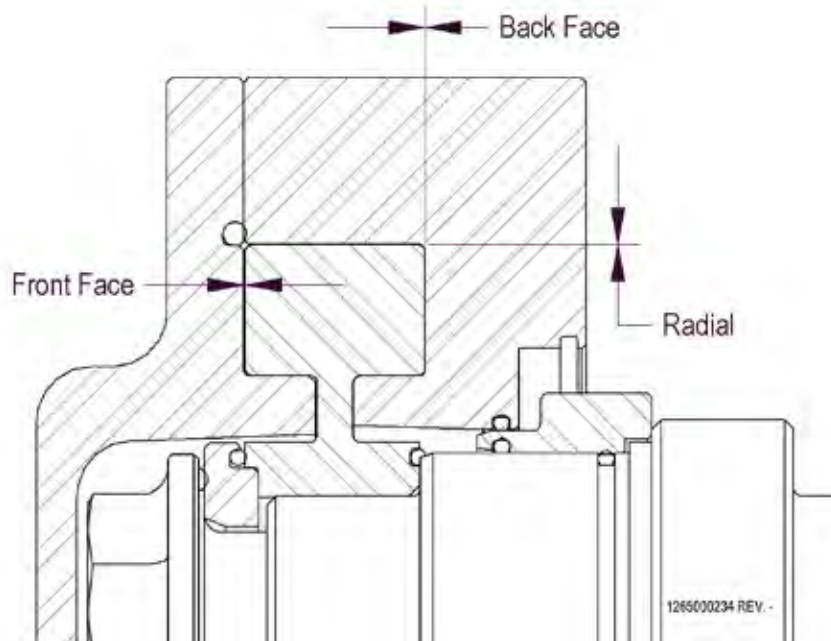
FKL 25	0.65 liters (0.75 US quarts)
FKL 50	0.8 liters (1.5 US quarts)
FKL 75	2.6 liters (2.75 US quarts)
FKL 150	3.9 liters (4.25 US quarts)
FKL 205	10.4 liters (11 US quarts)
FKL 250	4.2 liters (4.5 US quarts)
FKL 400	8.0 liters (8.5 US quarts)
FKL 580	18.0 liters (19 US quarts)

Sleeve Size	Type E			Type H		
	Parallel A	Angular Y max. - Y min.	Y*	Parallel A	Angular Y max. - Y min.	Y*
5	.015	.056	1.938	-	-	-
6	.015	.070	2.375	.010	.016	2.375
7	.020	.081	2.563	.012	.020	2.563
8	.020	.094	2.938	.015	.025	2.938
9	.025	.109	3.500	.017	.028	3.500
10	.025	.128	4.063	.202	.032	4.063
11	.032	.151	4.875	.022	.037	4.875
12	.032	.175	5.688	.025	.042	5.688
13	.040	.195	6.688	.030	.050	6.688
14	.045	.242	7.750	.035	.060	7.750

Dimensions are in inches.
 *The “Y” dimension is shown for reference.

FKL Recommended Torque Values								
Part	FKL 25	FKL 50	FKL 75	FKL 150	FKL 205	FKL 250	FKL 400	FKL 580
Cover Nut	15 ft-lb (20.3 N-m)	45 ft-lb (61 N-m)						110 ft-lb (149 N-m)
Rotor Bolt	25 ft-lb (34 N-m)			50 ft-lb (68 N-m)	65 ft-lb (88 N-m)			
Bearing Cap Screw	5 ft-lb (6.8 N-m)		10 ft-lb (13.5 N-m)				25 ft-lb (34 N-m)	10 ft-lb (13.5 N-m)
Bearing Lock Nut	50 ft-lb (68 N-m)	7 IN-LB (0.8 N-m)	50 ft-lb (68 N-m)					100 IN-LB (11.3 N-m)
Housing Hex Head Bolt	5 ft-lb (6.8 N-m)	10 ft-lb (13.5 N-m)	45 ft-lb (61 N-m)					110 ft-lb (149 N-m)
Gearbox Cover Bolt	10 ft-lb (13.5 N-m)		20 ft-lb (27 N-m)					
Mounting Strap Screw	10 ft-lb (13.5 N-m)		70 ft-lb (95 N-m)				80 ft-lb (108 N-m)	
Seal Housing Screw	2.5 ft-lb (3.4 N-m)						10 ft-lb (13.5 N-m)	14 ft-lb (18.9 N-m)
Housing Socket Head Screw	N/A	10 ft-lb (13.5 N-m)	N/A					

* The torque on the FKL 50 and 580 Bearing Lock Nut is a rotating torque for the shaft without the oil seals in place.

**TABLE A3: FKL ROTOR CLEARANCES**

Model	Standard Rotors			High Temperature Rotors		
	Back Face	Radial	Front Face	Back Face	Radial	Front Face
25	0.06-0.08 (0.0024-0.0031")	0.05-0.09 (0.002-0.0035")	0.07-0.17 (0.0028-0.007")	0.11-0.12 (0.0039-0.0047")	0.08-0.12 (0.0031-0.0047")	0.13-0.23 (0.0051-0.0091")
	0.07-0.11 (0.0028-0.0043")	0.055-0.105 (0.0022-0.0041")	0.08-0.20 (0.0031-0.0079")	0.11-0.15 (0.0043-0.0059")	0.095-0.145 (0.0037-0.0057")	0.15-0.27 (0.0059-0.0106")
50	0.08-0.12 (0.0031-0.0047")	0.075-0.125 (0.003-0.0049")	0.10-0.22 (0.0039-0.0087")	0.12-0.16 (0.0047-0.0063")	0.125-0.175 (0.0049-0.0069")	0.18-0.30 (0.0071-0.0118")
	0.08-0.12 (0.0031-0.0047")	0.085-0.135 (0.0033-0.0053")	0.13-0.25 (0.0051-0.0098")	0.13-0.17 (0.0051-0.007")	0.135-0.185 (0.0053-0.0073")	0.22-0.34 (0.0087-0.0134")
150	0.09-0.13 (0.0035-0.0051")	0.10-0.16 (0.0039-0.0063")	0.15-0.27 (0.0059-0.0106")	TBD	TBD	TBD
	0.09-0.13 (0.0035-0.0051")	0.11-0.17 (0.0043-0.007")	0.16-0.28 (0.0063-0.011")	0.14-0.18 (0.0055-0.0071")	0.18-0.24 (0.0071-0.0094")	0.27-0.39 (0.0106-0.0154")
205	0.10-0.14 (0.0039-0.0055")	0.12-0.18 (0.0047-0.0071")	0.16-0.30 (0.0063-0.0118")	0.16-0.20 (0.0063-0.0079")	0.20-0.26 (0.0079-0.0102")	0.27-0.41 (0.0106-0.0161")
	0.12-0.15 (0.0047-0.0061")	0.14-0.19 (0.0054-0.0075")	0.175-0.31 (0.0069-0.0120")	TBD	TBD	TBD
250	0.12-0.15 (0.0047-0.0061")	0.14-0.19 (0.0054-0.0075")	0.175-0.31 (0.0069-0.0120")	TBD	TBD	TBD
	0.12-0.15 (0.0047-0.0061")	0.14-0.19 (0.0054-0.0075")	0.175-0.31 (0.0069-0.0120")	TBD	TBD	TBD
	Chocolate Rotors			Stainless Rotors		
	Back Face	Radial	Front Face	Back Face	Radial	Front Face
25	0.24-0.26 (0.0094-0.0102")	0.229-0.279 (0.009-0.011")	0.259-0.359 (0.01-0.014")	0.14-0.16 (0.0055-0.0063")	0.105-0.145 (0.0041-0.0057")	0.145-0.245 (0.0057-0.0096")
	0.28-0.32 (0.011-0.0126")	0.293-0.343 (0.0115-0.0135")	0.301-0.421 (0.0119-0.0166")	0.135-0.155 (0.0053-0.0061")	0.12-0.17 (0.0047-0.0067")	0.195-0.295 (0.0077-0.0116")
50	0.28-0.32 (0.011-0.0126")	0.293-0.343 (0.0115-0.0135")	0.301-0.421 (0.0119-0.0166")	0.16-0.18 (0.0063-0.0071")	0.15-0.20 (0.0059-0.0079")	0.21-0.31 (0.0083-0.0122")
	0.31-0.35 (0.0122-0.0138")	0.305-0.355 (0.012-0.014")	0.321-0.441 (0.0136-0.0174")	0.155-0.205 (0.0061-0.0081")	0.16-0.21 (0.0063-0.0083")	0.235-0.365 (0.0093-0.0144")
150	TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD
205	0.33-0.37 (0.013-0.0146")	0.380-0.440 (0.015-0.0173")	0.36-0.48 (0.0142-0.0189")	0.165-0.215 (0.0065-0.0085")	0.205-0.265 (0.0081-0.0104")	0.285-0.415 (0.0112-0.0163")
	0.36-0.40 (0.0142-0.0157")	0.453-0.513 (0.0178-0.0202")	0.388-0.528 (0.0153-0.0208")	0.185-0.235 (0.0073-0.0093")	0.225-0.285 (0.0089-0.0112")	0.285-0.435 (0.0112-0.0171")
250	TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD
400	TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD
580	TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD

Dimensions are in millimeters (inches).

UNPACKING

Check the contents and all wrapping when unpacking the pump. Carefully inspect for any damage that may have occurred during shipping. Immediately report any damage to the carrier. Leave the protective caps over the pump inlet and outlet connections 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 from top drive shaft to bottom drive shaft, or visa versa, the gear cover needs to be rotated 180 degrees. This will move the drain plug, and sight glass to the appropriate positions.
- 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 differential pressure rating.) The pump warranty is void for damage caused by over-pressurization. The differential pressure can be determined by putting a pressure gauge at the discharge side of the pump and a pressure gauge at the inlet side of the pump and calculating the difference.

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.
- Slope inlet piping up to pump to avoid air pockets (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.
- Avoid abrupt transitions in the piping

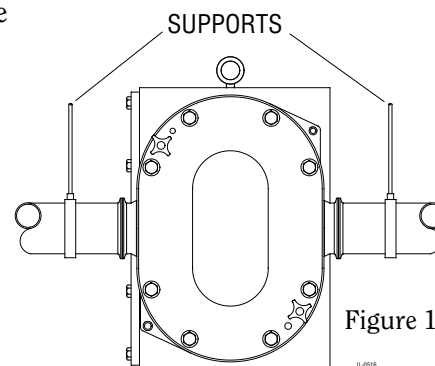


Figure 1

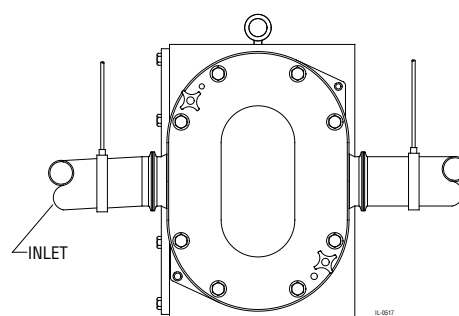


Figure 2

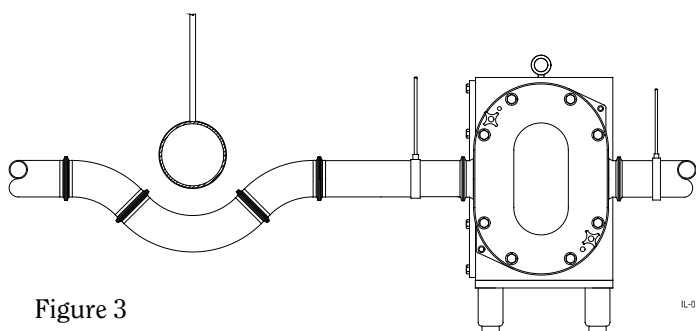


Figure 3

systems (Figure 4).

- 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.
- 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.

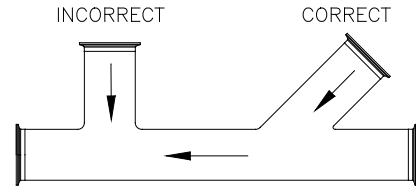


Figure 4

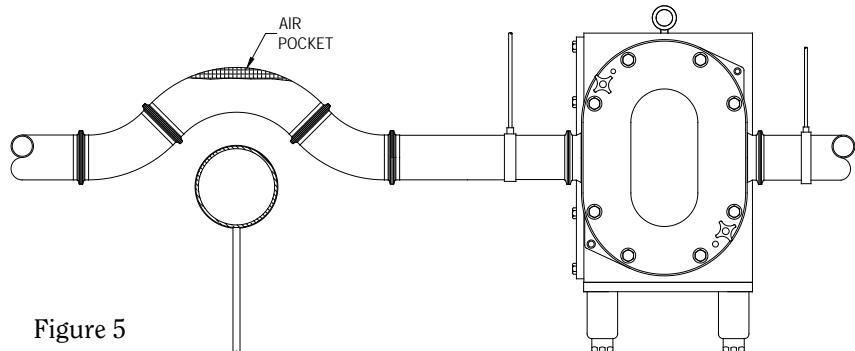


Figure 5

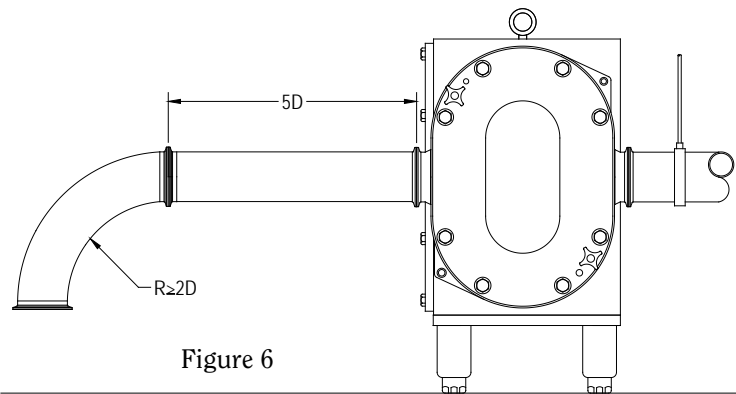
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Figure 6

IL-0803
7/12/01

ALIGNMENT

In most cases, the pump will be shipped with a drive unit mounted on a common 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.

CHECKING 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 exceeds the figure shown under "Parallel" in Table A1 (page 5), 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 Table A1 (page 5). If a correction is necessary, be sure to recheck the parallel alignment.

Reinstall the wire ring on the O.D. of the coupling sleeve.

ELECTRICAL CONNECTIONS

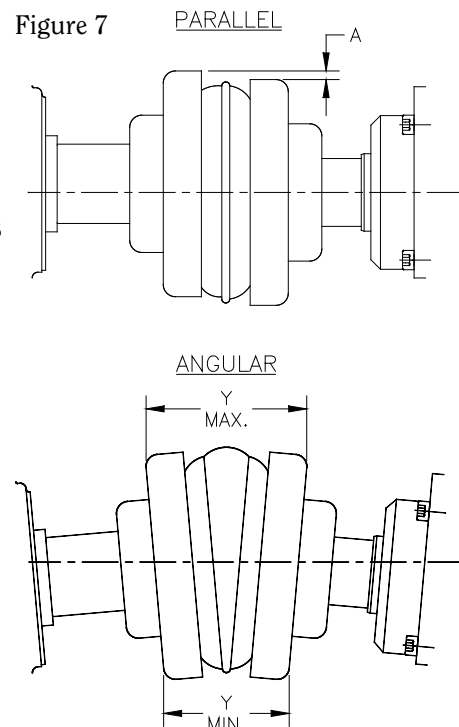


Figure 7

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. 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. See Figure 8 for the proper orientation. 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.

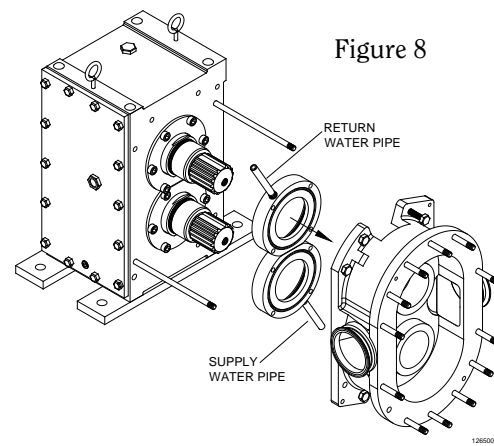


Figure 8

START-UP CHECK-LIST

1. Make sure that the pump and piping system are clear of any foreign matter. Do not use the pump to flush the system.
2. Make sure that the pump and drive are properly lubricated. Check the lubrication section (page 52) in this manual for the pump. See instructions from the manufacturer for the drive.
3. Check to make sure that all guards are in place and secure.
4. Check for proper pump and drive rotation (Figure 9). Make sure that the pump is flooded with product when checking the rotation. Running the pump dry even momentarily can cause seal damage.
5. Check that all valves on the discharge side are open to prevent over-pressurizing the pump.

RECOMMENDED PREVENTIVE MAINTENANCE

RECOMMENDED SEAL MAINTENANCE

Visually inspect the mechanical seal regularly for leakage.

Annually replace mechanical seal under normal conditions.

Replace mechanical seal as often as required under severe conditions (abrasive product, dry running, etc.).

ELASTOMER INSPECTION

Inspect all elastomers when performing pump maintenance. We recommend replacing elastomers (o-rings and gaskets) during seal replacements or every 3 months, whichever comes first.

LUBRICATION

The bearings and gears are lubricated with 15W40 oil. The oil level should be maintained in the center of the sight glass on the side of the gearbox housing. The oil should be changed every 4,000 hours under normal conditions and every 2,000 hours under severe conditions such as wash-down applications.

See the oil capacity listing on page 4.

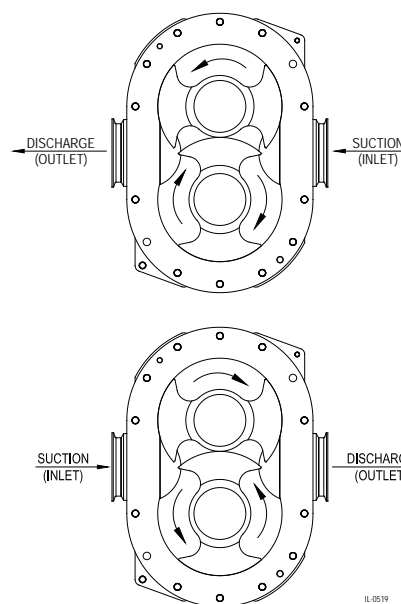


Figure 9

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.

TEMPERATURE DIFFERENTIALS

Positive pump efficiency depends on internal clearances between the rotors and the pump housing. The pump can withstand certain temperature changes based on the rotors. For example, if you are running CIP solution at 180°F and your product is 50°F, that is a 130°F temperature differential. This differential is in the standard rotor range.

The temperature differential is a concern, because if there is a severe temperature change in the pump, the shaft and rotors may expand inside the pump housing. This expansion can result in rotor to cover or rotor to housing damage.

The clearances inside the FKL pump are extremely small, below are the recommended temperature differentials.

FKL Temperature Differential	Correct Rotor
Δ 140°F	standard rotors
Δ 210°F	high temperature rotors

Fristam recommends high temperature rotors for pumps that will be cleaned or steamed at elevated temperatures.

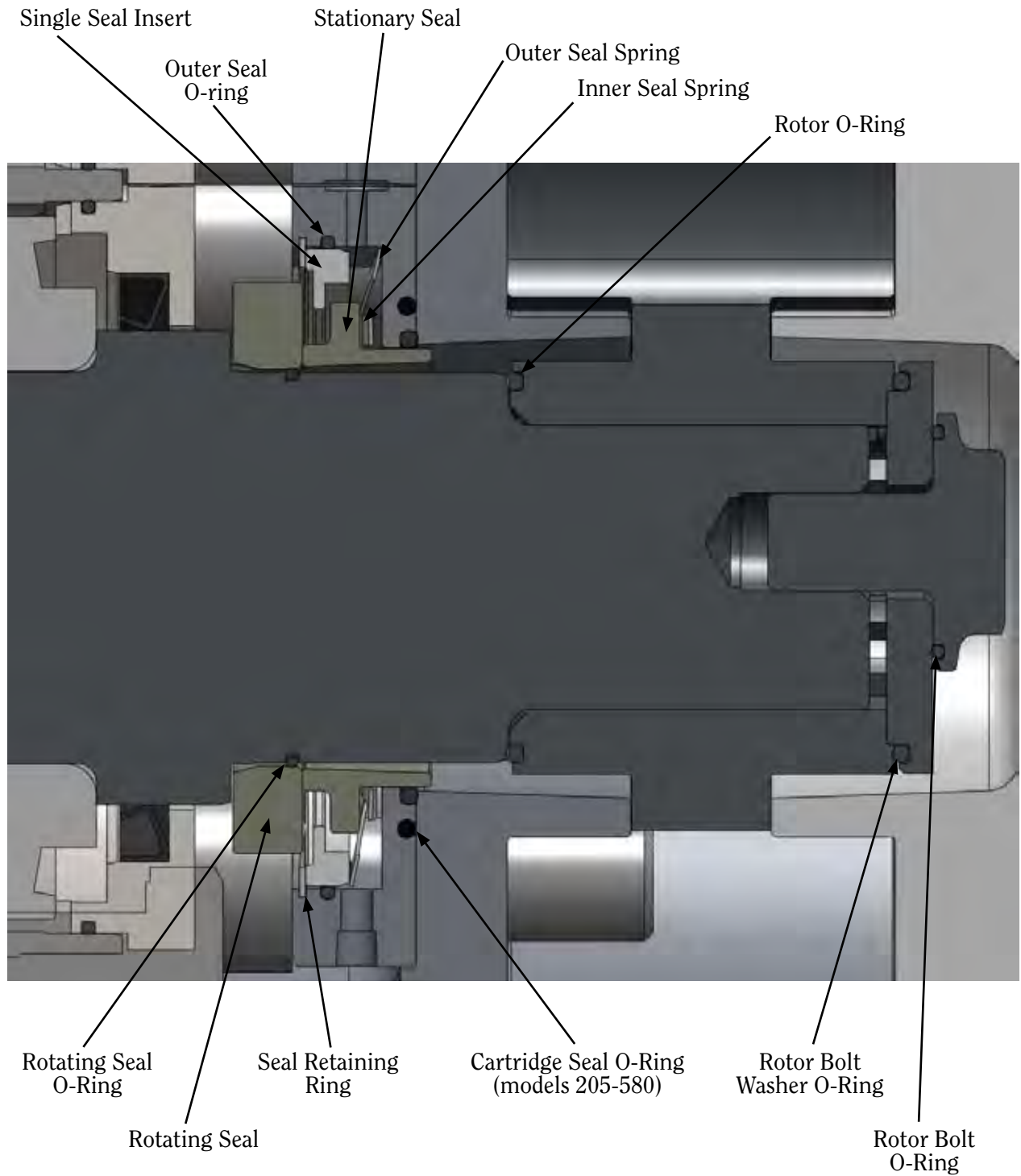
CLEANNING RECOMMENDATIONS FOR FKL PUMPS:

When you are running products or cleaning solutions with different temperatures, you need to allow enough time for all of the wetted components inside the pump to reach a steady-state temperature before you start the pump. If your process does not allow you to stop the pump during this transition, you need to install rotors that provide larger clearances. Note: that the clearances inside the FKL pump are extremely small.

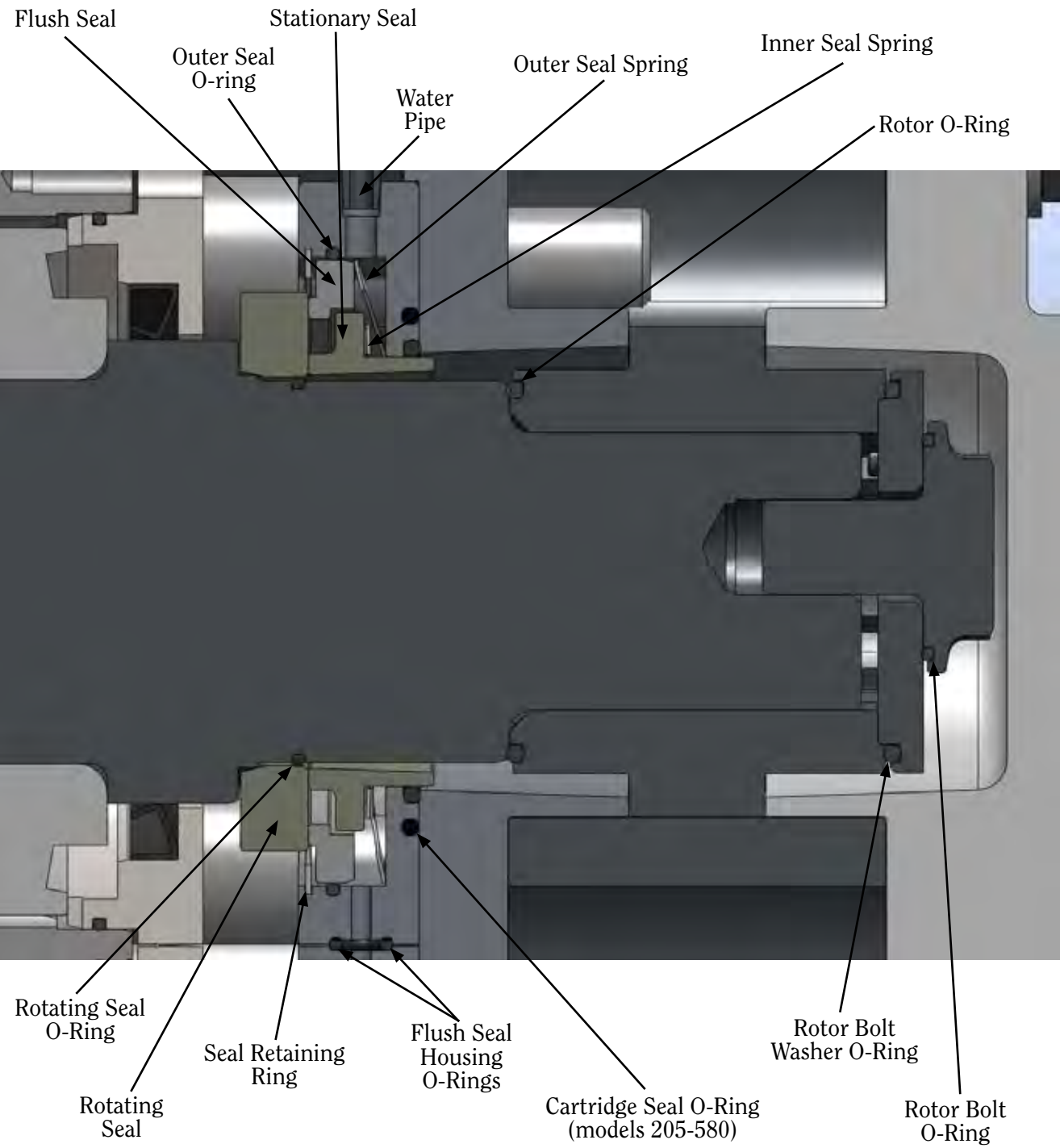
Due to the use of a rotor bolt additional cleaning may be necessary if there is an o-ring failure. If one of the following fail, rotor bolt o-ring, rotor washer o-ring, or rotor o-ring, the threaded hole on the end of the shaft will need to be cleaned. We recommend removing the rotors and rotor bolts/washers while the pump is being CIP'd. This will ensure that the internal threads are cleaned before production resumes.

If the process lines are to be cleaned with the pump, use a by-pass loop around the pump during the CIP mode to maintain pipe velocity. Once the wetted components are at a steady temperature, the pump can be started and run around 100 RPM with a backpressure of at least 10 PSI. As the product viscosity increases, the required backpressure may need to be increased as well.

SINGLE MECHANICAL SEAL ASSEMBLY



DOUBLE MECHANICAL SEAL ASSEMBLY



SEAL REPLACEMENT



CAUTION! Begin all pump maintenance 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.

TOOLS REQUIRED FOR SEAL REPLACEMENT:

Soft-faced hammer
Screwdriver (flat blade)
1" diameter wooden dowel
4 mm Allen wrench
6 mm Allen wrench (FKL 400 only)
Torque wrench
Seal assembly tool or a press (part number 1018000011)

TOOLS REQUIRED FOR SPECIFIC PUMP MODEL (WRENCH SIZE IN MM):

	25	50	75	150	205	250	400	580
cover nuts	13 mm	19 mm	19 mm	19 mm	19 mm	19 mm	19 mm	24 mm
rotor bolt	19 mm	19 mm	19 mm	24 mm	32 mm	32 mm	32 mm	32 mm
housing bolts	10 mm	13 mm	19 mm	19 mm	19 mm	19 mm	19 mm	24 mm

PUMP HEAD DISASSEMBLY

Drain all product from the pump head prior to disassembly. The pump head may be isolated with inlet and outlet valves. Disconnect the suction and discharge piping from the pump. Disconnect the seal flush supply and return lines to your pump if the pump is equipped with a double mechanical or double o-ring product seal.

REMOVE THE COVER

- Loosen and remove the cover nuts and cover nut washers with the appropriate wrench.
- Remove the cover by turning the two forcing screws clockwise.
- Remove the cover o-ring.

For Jacketed Cover - start with instruction A and then remove the jacketed cover, jacketed cover o-ring and then continue with instructions B and C.

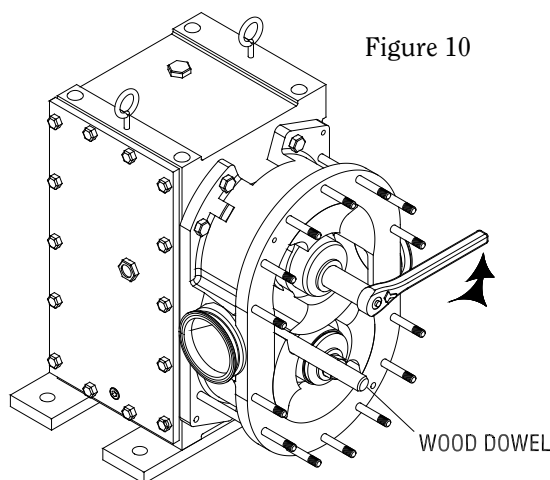
REMOVE THE ROTORS

- To loosen the first rotor, place the wooden dowel between the rotors as shown in Figure 10.
- Turn the first rotor bolt counter-clockwise with the appropriate wrench.
- Remove the rotor bolt and rotor bolt washer with o-rings from the first rotor (note: model 580 has 2 bolts per shaft).
- Repeat instructions a - c for the second rotor.



WARNING

The rotors and rotor o-rings can now be removed from the pump housing by pulling straight out as shown in Figure 11. Handle the rotors with care to avoid damage.



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Inspect the rotors and pump housing for signs of wear. If wear is present, see the trouble-shooting guide for possible solutions.

REMOVE THE PUMP HOUSING

- a) Loosen the hex head housing bolts with the appropriate wrench.
- b) Now carefully pull the pump housing away from the gearbox as shown in Figure 12. You may need to alternately tap on the sides of the pump housing near the inlet and outlet ports with the soft face hammer until the housing pins separate from the gearbox.

You are now ready to remove the seal components from the pump housing.

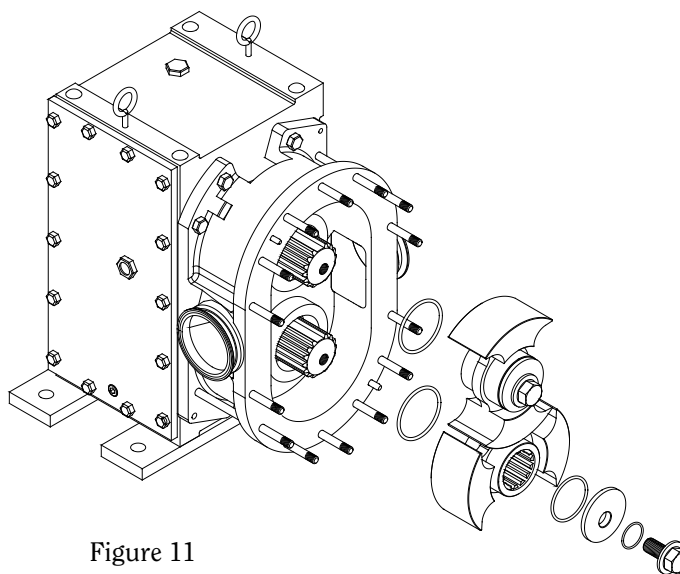


Figure 11

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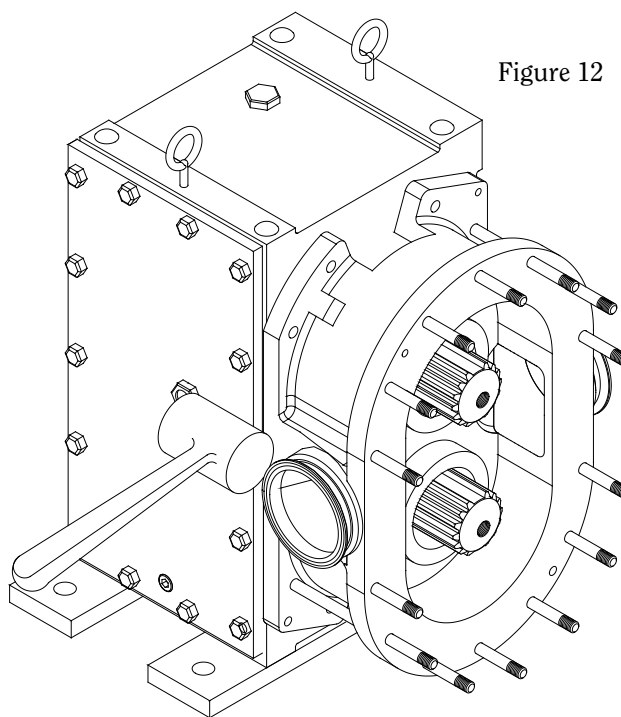


Figure 12

IL-0526

MECHANICAL SEAL CARTRIDGE REMOVAL

- Place the pump housing face down as shown in Figure 13.
- Loosen the seal housing screws with the 4 mm Allen wrench. (For model 580, use wrench to remove M8 hex head cap screws.)
- Remove the seal housing screws, seal cartridges and seal housing o-rings as shown in Figure 13.
- Remove the two rotating seal rings and rotating seal o-rings from the pump shaft.

If replacing the cartridge with a new cartridge proceed to the 'Seal Cartridge Installation' section.

DISASSEMBLY OF SEAL CARTRIDGE FOR MECHANICAL SEALS

Place all of the seal parts on a clean work area and disassemble one cartridge at a time.

- Place the seal cartridge, with the seal face up, onto the seal assembly tool or press.
- Insert the seal compressor disc onto the seal face.
- Use the seal assembly tool to compress the seal so that all of the pressure is off the seal retaining ring.
- Use the flat-faced screwdriver to pry the seal retaining ring out of the seal housing.
- Remove the seal cartridge from the seal assembly tool.
- Use your fingers to gently press the seal elements out of the seal housing.
- Remove the outer and inner seal springs and the outer stationary seal o-ring.
- The seal housing should be cleaned to prepare it for reassembly.

ASSEMBLY OF SEAL CARTRIDGE

Assemble the cartridges one at a time.

- Lubricate the new outer stationary seal o-ring and slightly stretch.
- Fit the outer stationary seal o-ring into its groove inside the seal housing.
- Place the inner and outer seal springs into the seal housing.
- Set the seal housing on the seal assembly tool.
- Place the new inner stationary seal into the seal housing.
- Single mechanical seal: Lubricate the outer edge of the single seal insert and place into the seal housing. Be sure to fit the notches around the pins.
Double mechanical seal: Lubricate the outer edge of the outer stationary seal and place into the seal housing. Be sure to fit the notches around the pins.

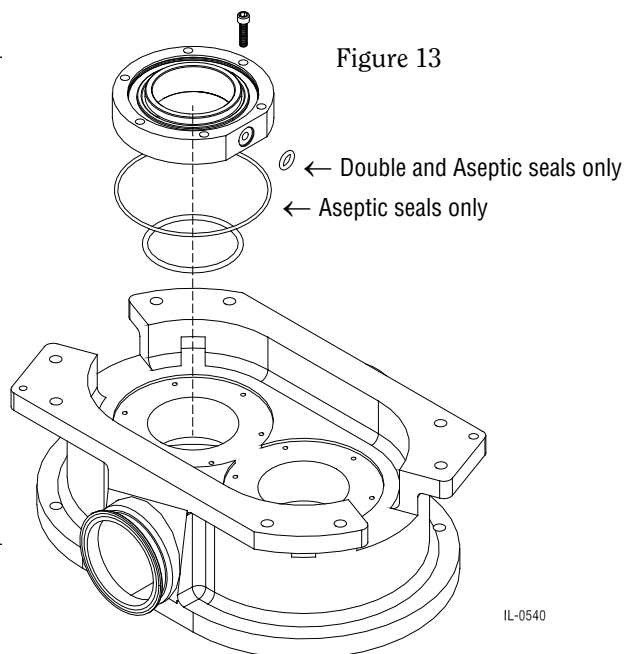
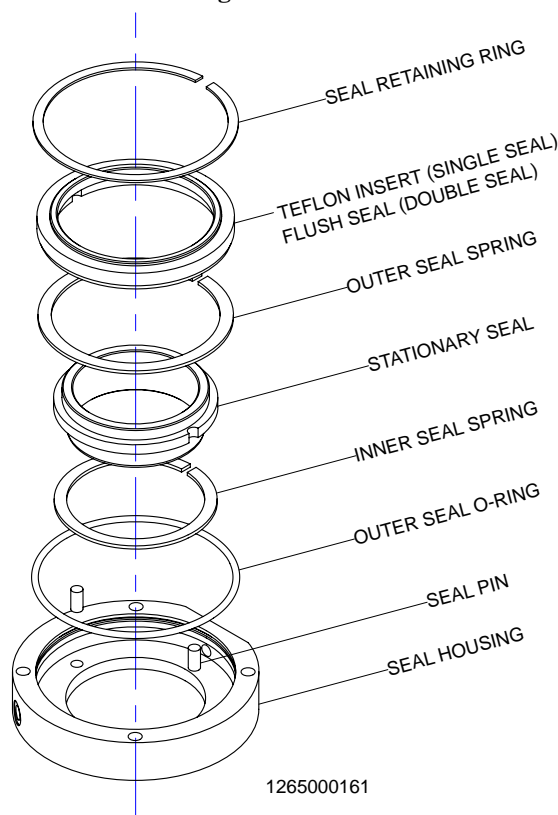


Figure 14



- g) Set the seal retaining ring on top of the seal housing.
- h) Push down on the outer stationary seal until it is past the seal retaining ring groove.
- i) Use your fingers to fit the seal retaining ring into place.

SEAL CARTRIDGE INSTALLATION

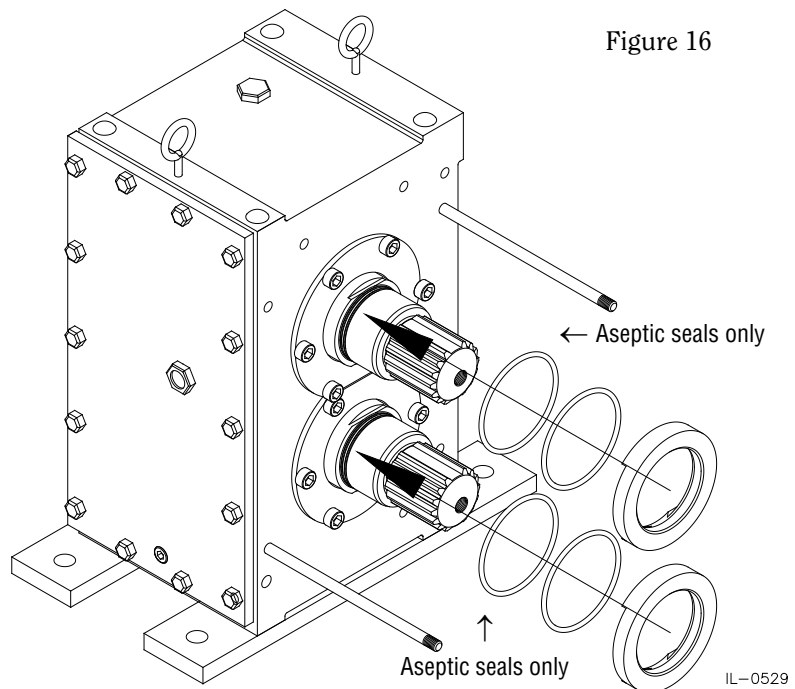
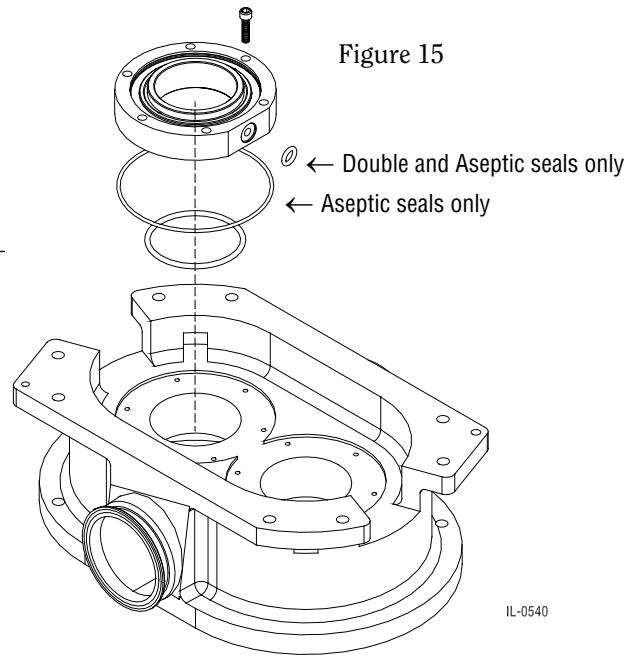
- a) Place the pump housing face down as shown in Figure 15.
- b) Install the new inner stationary seal o-rings into the grooves in the seal housing.
- c) Install the seal housing o-rings into the new seal cartridges.
- d) Install one of the new seal cartridges onto the pump housing with the flat side toward the middle as shown.
- e) Insert the seal housing screws through the holes in the seal cartridges and tighten with the appropriate Allen wrench. (For model 580, use wrench to remove M8 hex head cap screws.)
- f) Double mechanical seal only, place the new small seal housing o-ring into the groove on the secured seal cartridge.
- g) Install the other new seal cartridge onto the pump housing by repeating instructions d and e.
- h) Next lubricate and install the two new rotating seal o-rings into the first groove on the pump shaft as shown in Figure 16. Aseptic seal only, lubricate and install the four rotating seal o-rings.
- i) Finally, install the two new rotating seal rings onto the shaft. The rotating seal ring will fit into the grooves on the shaft and interlock with the shaft. If you can rotate the seal ring, it is not properly seated.

SEAL DISASSEMBLY FOR O-RING SEALS

- a) Place the pump housing face down as shown.
- b) Loosen the seal housing screws with the 4 mm Allen wrench. (For model 580, use wrench to remove M8 hex head cap screws.)
- c) Remove the seal housing screws, o-ring seal cartridges and inner o-rings as shown in Figure 17.
- d) Remove the seal o-rings from the seal housings with the flat screwdriver.

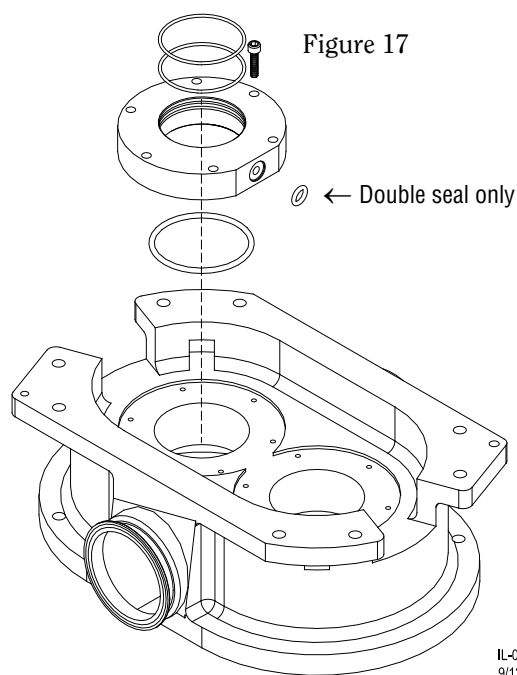
Inspect the pump shafts in the area in which the o-ring seals ride. Clean any o-ring or product residue off the pump shafts. If the shafts are worn excessively they must be replaced.

You are now ready to install the new seal components.



SEAL ASSEMBLY FOR O-RING SEALS

- Place the pump housing face down as shown in Figure 17.
- Install the new inner stationary seal o-rings into the grooves in the seal housing.
- Install the new seal o-rings into the o-ring seal housings. Do not lubricate the o-rings before installing.
- Install one of the seal housings onto the pump housing with the flat side toward the middle as shown.
- Insert the seal housing screws through the holes in the o-ring seal housing and thread into the pump housing. Tighten with the appropriate Allen wrench.
- Double o-ring seals only, place the new small seal housing o-ring into the groove on the secured o-ring seal housing.
- Install the other o-ring seal housing onto the pump housing by repeating instructions e and f.
- Lubricate the pump shafts with a food grade lubricant compatible with the o-rings. Lubricate the shafts where the o-rings will slide.
- You are now ready to install the pump housing onto the gearbox. Install the pump housing while slowly rotating the shaft.

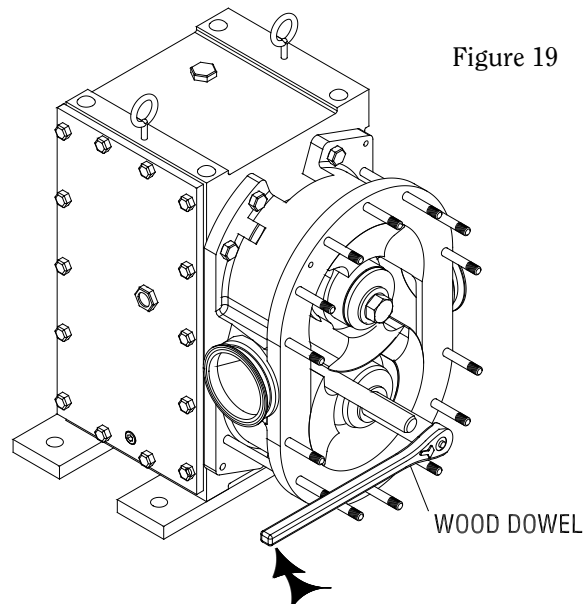
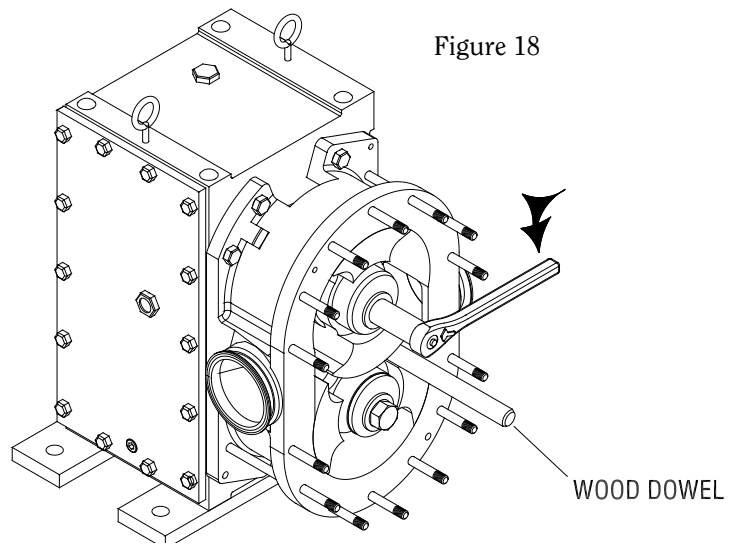


PUMP HEAD ASSEMBLY

Note: Any debris between the gearbox and housing will affect the gap. Make sure the gearbox front face and pump housing surfaces are clean.

- Carefully slide the pump housing over the pump shafts and onto the gearbox. Make sure that the housing is positioned so that the smaller pin slides into the smaller bushing on the gearbox and the larger pin slides into the larger bushing. The long housing studs will help to align the pump housing in the proper position.
- Secure the pump housing with the hex head housing bolts and tighten with the appropriate wrench. On the FKL 25 use six 18mm long bushings over the six housing studs and install the cover nuts to hold the housing in place during assembly.
- Install the new rotor o-rings into the groove on the back of the rotor hub.
- Now slide the rotor with one dot on the drive shaft and the rotor with two dots on the idle shaft.
Note: when sliding the rotor onto the shaft, the o-ring should be facing the pump housing.

- e) Align the rotors with the pump shaft so that the large spline teeth on the rotor slide into the missing teeth on the pump shaft.
- f) Place the new rotor bolt washer o-rings into the groove on the rotor bolt washers. (Note: model 580 has 2 bolts per shaft.)
- g) Install the rotor bolt washers over the rotor. Rotate the rotor bolt washer so that the hole in the rotor bolt washer lines up with the threaded hole in the pump shaft.
- h) Install the new rotor bolt o-rings into the groove in the rotor bolt.
- i) Now thread the rotor bolt through the Rotor bolt washer into the pump shaft.
- j) To tighten the rotor bolt, place the wooden dowel between the rotors as shown in Figure 18. Tighten the first rotor bolt with the appropriate wrench to the torque specified in Table A2, page 5.
- k) To tighten the rotor bolt for the second shaft, place the wooden dowel between the rotors as shown in Figure 19. Tighten the second rotor bolt clockwise with the appropriate wrench to the torque specified in Table A2, page 5.



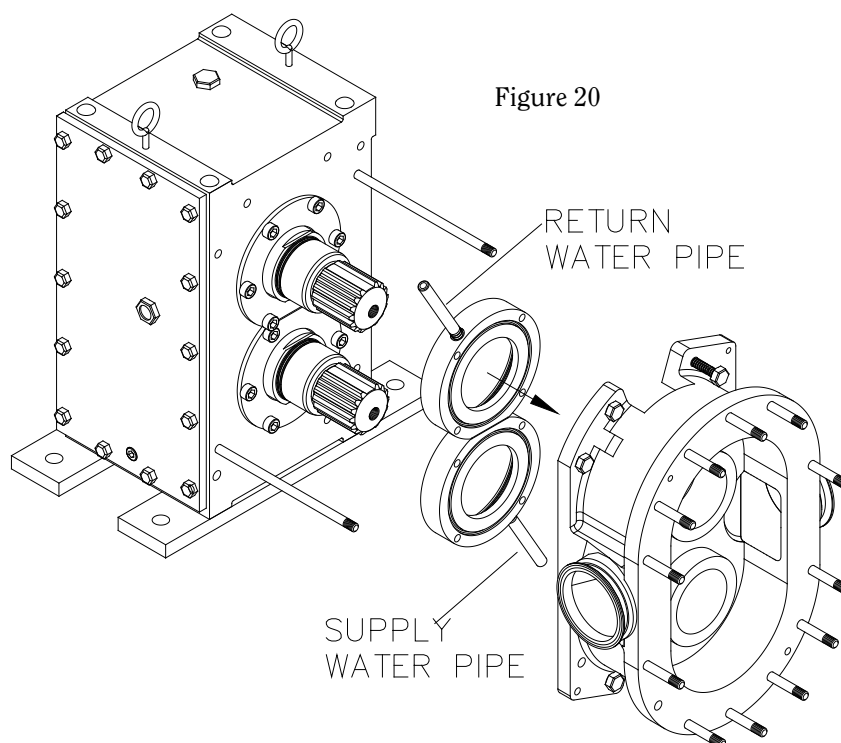
VERIFY ROTOR CLEARANCES

With the rotors installed, you should check the clearances around the rotor to ensure that the pump was assembled properly. Use feeler gauges to verify the back and radial clearance between the rotors and the housing. Use a depth micrometer to verify the front face clearance (see Table A3, page 6). If the gap is incorrect, please see Setting the Rotor Gap section on page 22 (for models 25, 75, 150, 205, 250, and 400) or page 31 (for models 50 and 580). Rotate the input shaft to verify that the pump turns freely. If the gap is correct and the pump turns freely continue Pump Assembly (below).

- a) Install the pump cover o-ring onto the pump cover.
- b) Install the pump cover. Make sure the threaded end of the forcing screws are flush with the inside face of the pump cover.

For Jacketed Cover - install the jacketed cover, replace the jacketed cover o-ring and then continue with instructions below.

- c) Secure the pump cover with the cover nut washers and cover nuts. Tighten with the appropriate wrench to the torque specified in Table A2, page 5.
- d) Replace all shaft guards.
- e) Reconnect the inlet and outlet piping.
- f) Install the seal flush piping as shown in Figure 20.
- g) Replace the seal flush supply and return lines to your pump if the pump is equipped with a double mechanical or double o-ring product seal.
- h) Verify that all valves on the suction and discharge side of the pump are open. You are now ready to start the pump.



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BEARING AND/OR SHAFT REPLACEMENT FOR THE FKL 25, 75, 150, 205, 250 & 400 SERIES



CAUTION! Begin all pump maintenance 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.

For Bearing and/or Shaft Replacement for the FKL 50 & FKL 580 see page 24-29.

TOOLS REQUIRED FOR GEARBOX DISASSEMBLY:

Arbor press
3/8" Allen wrench
Screwdriver (small flat blade)
1" diameter wooden dowel
Soft-faced hammer
Hammer (standard steel)
Brass rod
Bearing heater
Shim stock packet (order from Fristam prior to disassembly)
Torque wrench

INDICATING TORQUE WRENCH TOOLS REQUIRED FOR SPECIFIC PUMP MODEL:

	<u>FKL 25</u>	<u>FKL 75, 150, 205 & 250</u>	<u>FKL 400</u>
Gearbox cover bolts	13 mm wrench	17 mm wrench	17 mm wrench
Bearing cap screws	5 mm Allen wrench	6 mm Allen wrench	8 mm Allen wrench

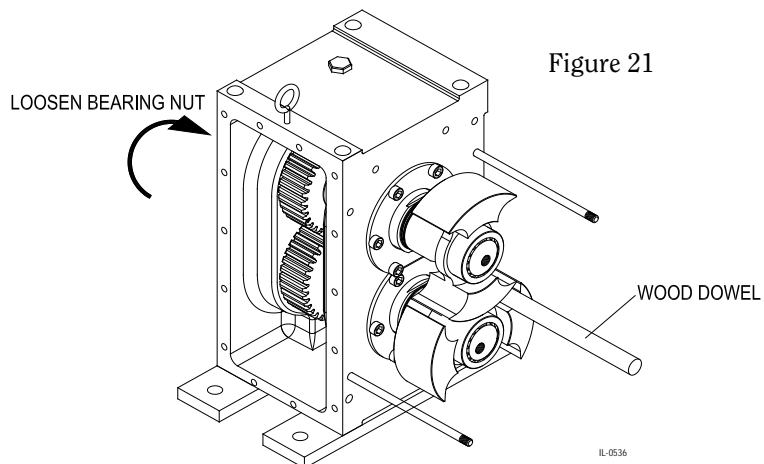
SPANNER WRENCH REQUIRED FOR THE BEARING LOCK NUT FOR SPECIFIC PUMP MODEL:

<u>FKL 25</u>	<u>FKL 75</u>	<u>FKL 150</u>	<u>FKL 205</u>	<u>FKL 250</u>	<u>FKL 400</u>
M35	M50	M55	M75	M75	M85

GEARBOX DISASSEMBLY

To start the gearbox disassembly, complete the Pump Head Disassembly on page 13.

- a) Remove the oil drain plug with the 3/8" Allen wrench and drain the oil.
- b) Use the appropriate wrench to remove the gearbox cover bolts. Then remove the gearbox cover and gearbox cover gasket.
- c) Loosen and remove the bearing cap screws with the appropriate Allen wrench.
- d) Remove the bearing caps.
- e) Remove the bearing cap o-rings from both bearing caps and the rear oil seal from the drive shaft bearing cap.
- f) Install the rotors onto the pump shafts. Secure the rotors from turning by placing the wooden dowel between them as shown in Figure 21.
- g) Straighten the bent tab on the bearing lock nut washer on both the drive and idle pump shafts with the screwdriver.
- h) Loosen the bearing lock nut from both shafts using the spanner wrench.



- i) Remove the bearing lock nuts, bearing lock nut washers and rotors from both pump shafts.
- j) Place the gearbox on an arbor press with the spline ends of the shafts facing down as shown in Figure 22. Press on the shafts, one at a time, to remove them from the gearbox. Make sure to support the shafts so that they do not fall and get damaged. Also, be sure to remove the rear bearing inner race, rear gear spacer and the gear before pressing the other shaft. Press the inner bearing races off both pump shafts. Note: do not press on the outer bearing cage. Set the pump shafts aside.
- k) Remove the gears from the gearbox. The outer races of both front and rear bearings can now be tapped out of the gearbox with a hammer and brass rod. Note that the front outer races may have stayed on the shafts.

You are now ready to reassemble the gearbox.

GEARBOX ASSEMBLY

Note: The front and rear bearing assemblies are matched sets. Do not separate pieces.

Also, for ease of installation, install the idle shaft first. If you are not sure about shaft location, the drive shaft will always be located in the same bore on the gearbox. To locate the correct bore, stand facing the pump end of the gearbox with the gearbox cover on your left side. The drive shaft will be in the top bore position.

ASSEMBLE FRONT BEARINGS ONTO SHAFTS

Cover the coupling area of the drive shaft with tape, to protect it. Lightly grease the front bearing step on the pump shafts.

- a) Press the front bearing cone on the shaft. Use a hose clamp or tape to hold the cups and outer spacer together (Figure 24).
- b) Install the inner bearing spacer and outer cup assembly over the bearing on the shaft.
- c) Press the other bearing cone on the shaft.
- d) Remove the hose clamp or tape
- e) Install the front gear spacer on the shaft.

Figure 24

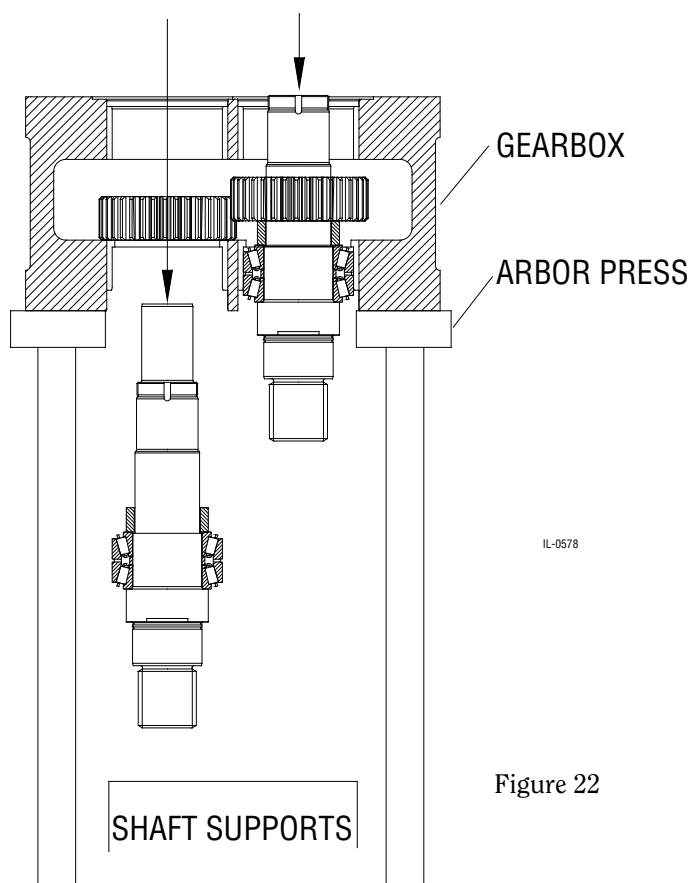
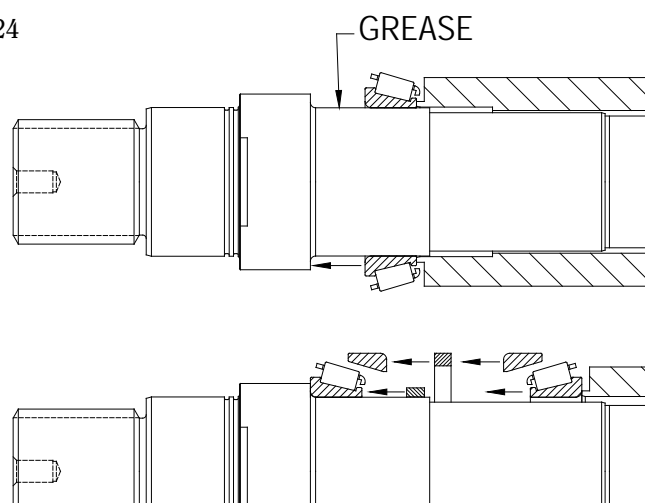


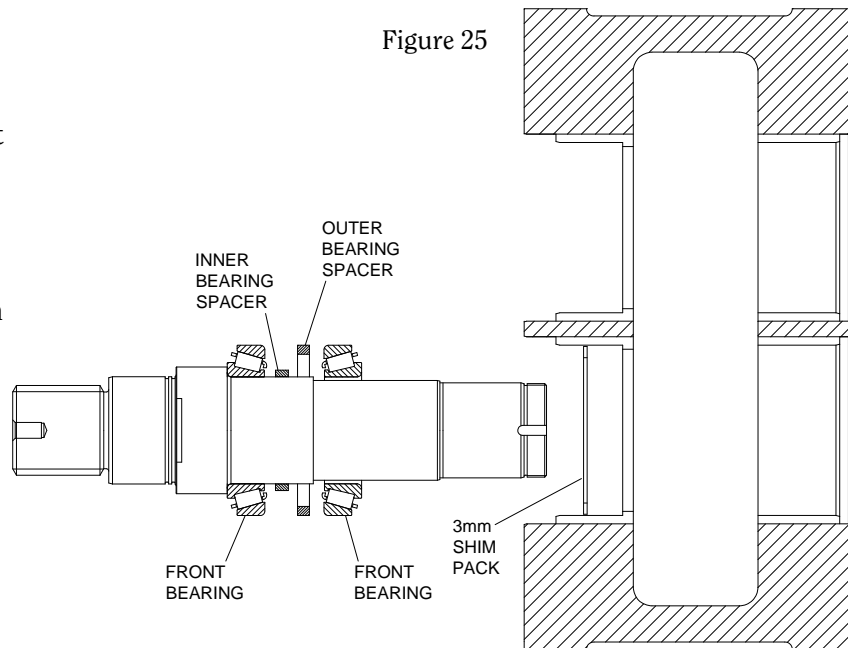
Figure 22



SETTING THE ROTOR GAP

Clean and inspect the gearbox.

- a) Lightly coat the front and rear bearing bores with oil. Note that before you install the outer race for the front bearings, you must place the shims in the bottom of the bore of the gearbox as shown in Figure 25 and 26. For new shafts, use 0.100" of shim and for used shafts use 0.120" of shim.

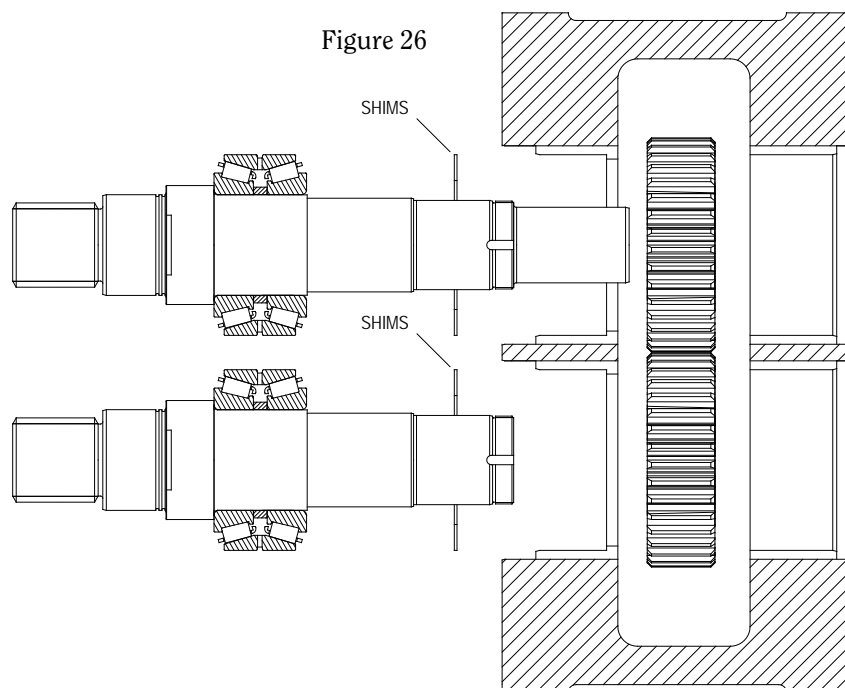


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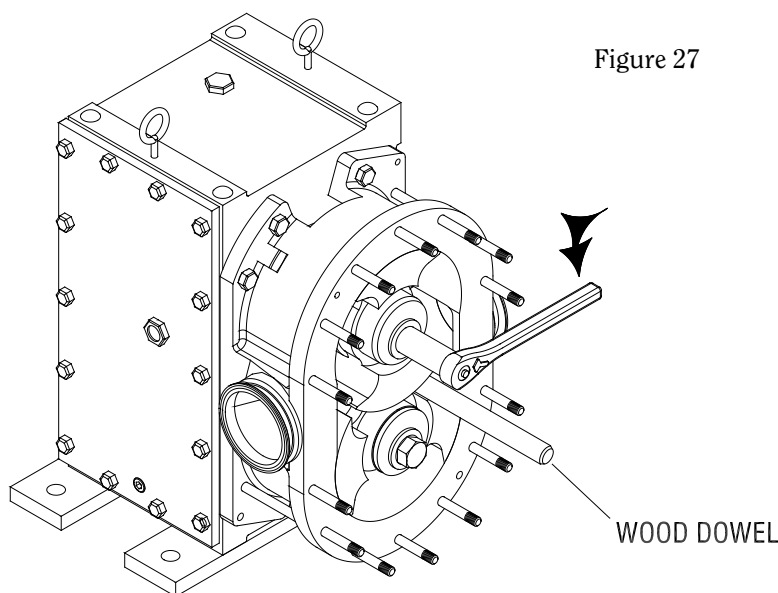
- b) Install the pump shafts into the correct bores. Secure them in position using the front bearing caps, be sure to tighten the bearing cap screws to the appropriate torque.
- c) Carefully slide the pump housing over the pump shafts and onto the gearbox. Make sure that the housing is positioned so that the small pin slides into the small bushing on the gearbox and the large pin slides into the large bushing. The long housing studs will help to align the pump housing in the proper position.
- d) Secure the pump housing with the hex head housing bolts. Note: On the FKL 25 use six 18mm long bushings over the six housing studs and install the cover nuts to hold the housing in place during assembly. Tighten with the appropriate wrench.

- e) Slide the rotors into the pump housing with the rotor o-ring groove toward the back of the pump housing. It is not necessary to have the rotor o-rings installed at this time.

- f) Align the rotors with the pump shaft so that the missing spline teeth on the rotor slides into the missing teeth on the pump shaft.

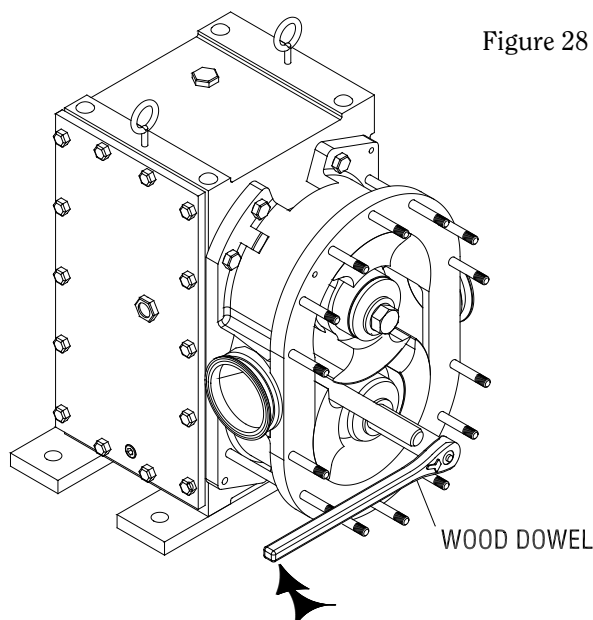


- g) Place the Rotor bolt washers over the rotor.
- h) Rotate the Rotor bolt washer so that the hole in the Rotor bolt washer lines up with the threaded hole in the pump shaft and thread the rotor bolt through the Rotor bolt washer into the pump shaft.
- i) Place the wooden dowel between the rotors as shown in Figure 27.
- j) Tighten the first rotor bolt with the appropriate wrench to the torque specified in Table A2, page 5.



- k) Now place the wooden dowel between the rotors as shown in Figure 28.
- l) Tighten the second rotor bolt clockwise with the appropriate wrench to the torque specified in Table A2, page 5. Rotate the input shaft to verify that the pump turns freely.

With the rotors installed, you may check the rotor gap. Use feeler gauges to verify the back clearance between the rotors and the housing (see Table A3, page 6). You need to do this for both shafts. The values for each shaft may, and probably will, be different. Subtract the clearance value that you measure from the clearance value that is listed in the table. This will give you the amount of shim material that you must remove. This can be accomplished by removing the shims currently in the pump and using a combination of the shims that were acquired from Fristam.



Once you have your rotor to housing measurements, you can remove the rotors, pump housing and remove both pump shafts from the gearbox. You will also need to remove the outer races for the front bearings to remove the current shims and replace them with the shim values that you have determined for each shaft.

INSTALL THE GEARBOX

Once the shims are determined, you can reassemble the gearbox. Lightly oil the pump shafts on the step for the gears. Install the shafts, one at a time, into the gearbox. Remember that the idle shaft will be in the bottom bore as seen from the pump side of the gearbox with the gearbox cover on the left.

- a) Slide the front gear spacer onto the shaft.
- b) Deburr and install the gear key into the shaft.
- c) Place one of the gears with the part number facing the bearing lock nut end of the gearbox, into the gearbox.
- d) Install the shaft through the front bearing bore of the gearbox and through the gear.

- e) Use the front bearing cap to pull the shaft into the gear-box, with the aid of two bolts and some washers.
- f) Slide the gear against the front bearing spacer.
- g) Repeat steps a - f with the other shaft. Be sure to align the key ways to 12 o'clock as shown in Figure 29.
- h) Slide the rear bearing spacer onto the shafts.

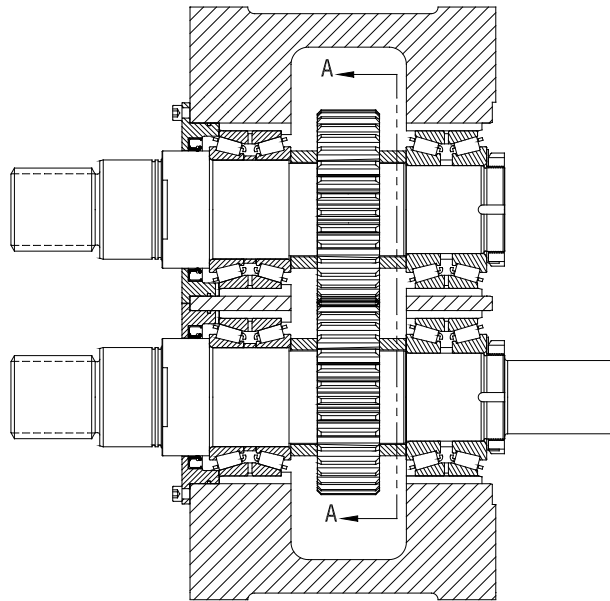
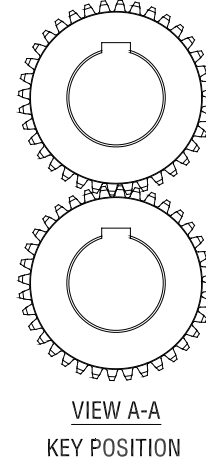


Figure 29



IL-0541

- i) Install the front o-ring bearing caps and tighten to the specified torque. Check to see that the keyways can still be aligned at the 12 o'clock position, as shown in Figure 29.
- j) Install the rotors onto the pump's shafts. Turn the rotors to make sure they spin freely. If they hit, the timing is off. To fix the timing you will need to remove one gear, realign them and then test again.

INSTALL THE REAR BEARING ASSEMBLIES ONTO EACH SHAFT.

Lightly grease the rear bearing step on the pump shafts.

- a) Press the rear bearing cone onto the shaft.
- b) Install the inner bearing spacer, bearing cup, outer spacer and the other cup (Figure 30).
- c) Press the other rear bearing cone onto the shaft.

Position the gearbox on the arbor press, one shaft at a time, to press the bearings into place. Be sure to use the appropriate pressing tube and never exceed the maximum force.

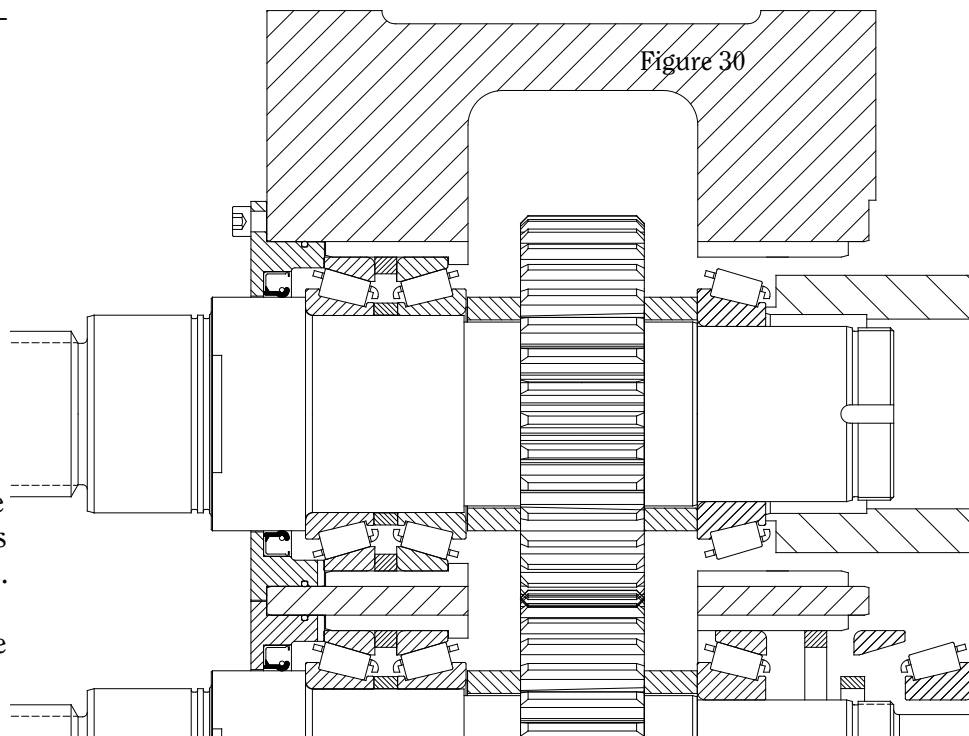
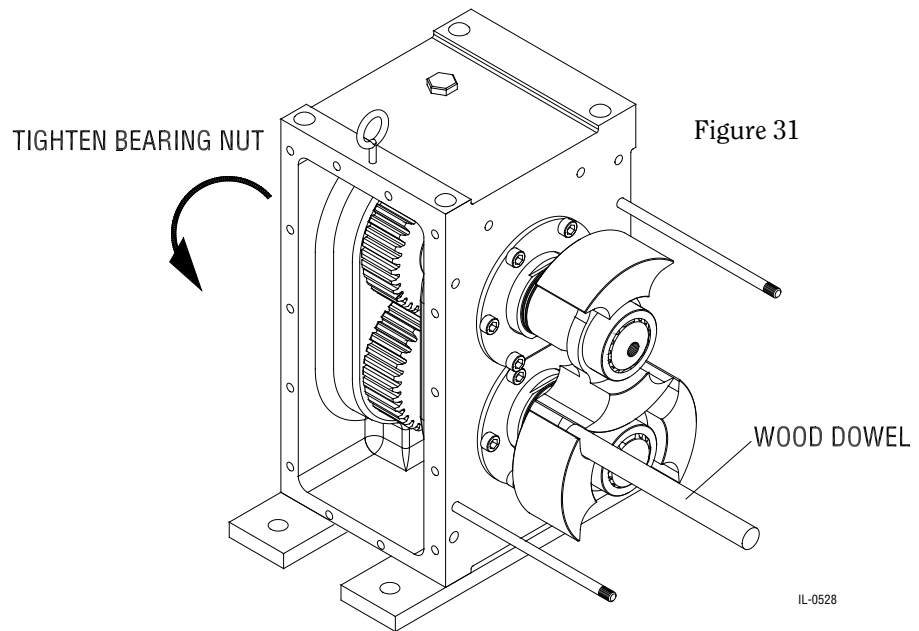
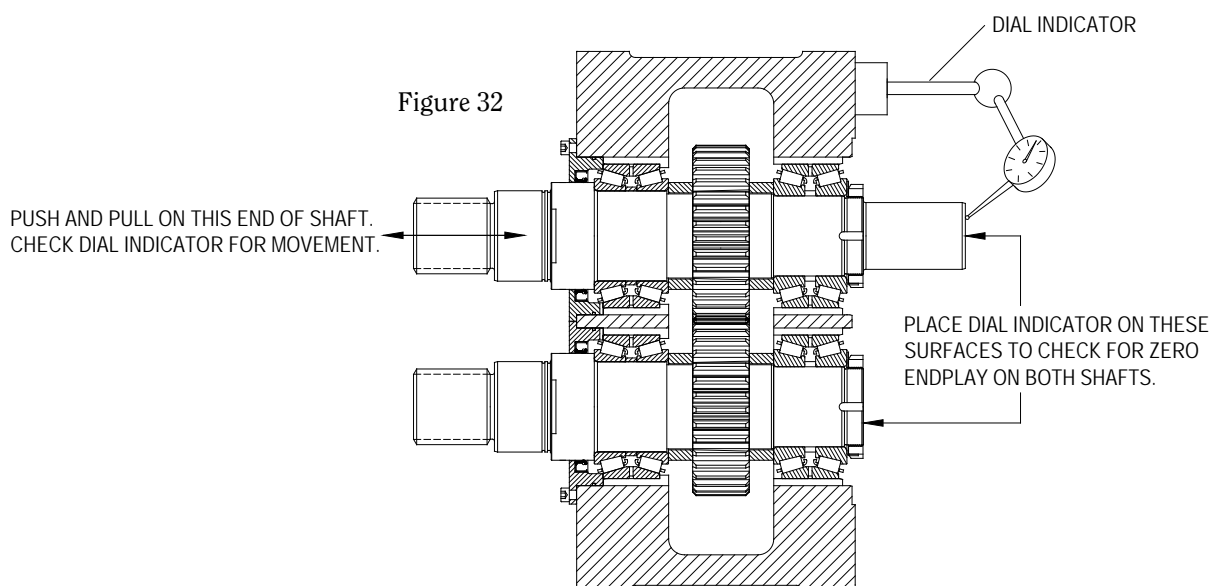


Figure 30

- a) Install the lock washer and lock nut and hand-tighten the nut.
- b) Place a wooden dowel between the rotors as shown in Figure 31 and tighten the bearing lock nuts to the appropriate torque, shown in Table A2, page 5.
- c) After the bearing nut is tightened on both shafts, use a dial indicator to check that there is no endplay on either shaft, as shown in Figure 32.
- d) Install the new rear oil seal into the drive shaft bearing cap.
- e) Install the new bearing cap o-rings into the o-ring grooves in bearing caps.
- f) Install the bearing caps onto the gearbox. Secure with the bearing cap screws and tighten with the appropriate Allen wrench.
- g) Place the new gearbox cover gasket and gearbox cover on the gearbox and secure with the gearbox cover bolts. Tighten to the torque specified in Table A2, page 5.
- h) Re-install the oil drain plug and vent plug onto the gearbox. Fill the gearbox with oil to the center of the oil sight glass.



Once the gearbox is assembled, the pump head can be assembled (pages 15) and the rotor to housing clearances can be checked. Make any necessary adjustments as required.





BEARING AND/OR SHAFT REPLACEMENT FOR FKL 50 AND 580

CAUTION! Begin all pump maintenance 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.

For the FKL 25, 75, 150, 205, 250 and 400 Bearing and/or Shaft Replacement instructions see page 19.

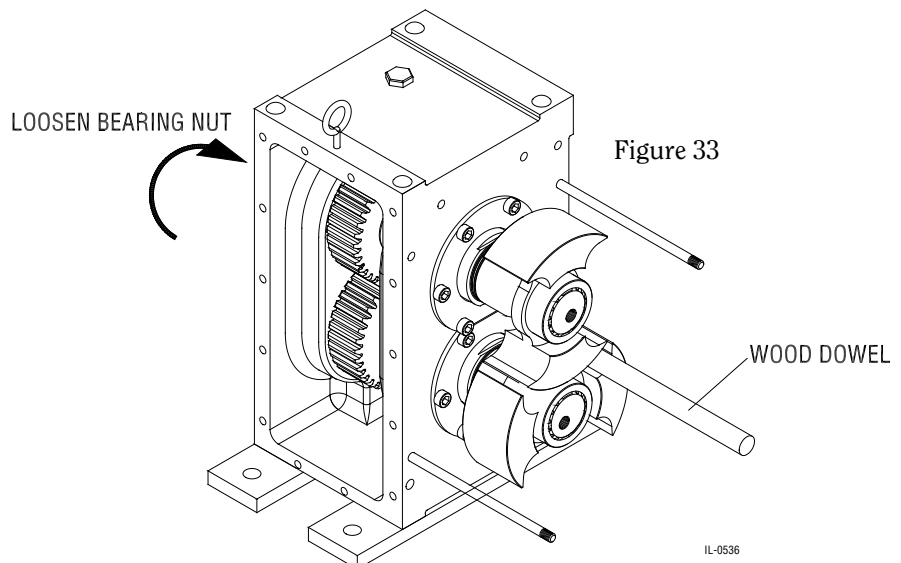
TOOLS REQUIRED FOR GEARBOX DISASSEMBLY:

5 mm Allen wrench (model 50 only)
 3/8" Allen wrench (model 50 only)
 17 mm Allen wrench (model 580 only)
 13 mm wrench
 17 mm wrench (model 580 only)
 Snap ring pliers (with straight and 90° pins)
 Spanner wrench for M45 lock nut (model 50 only)
 Spanner wrench for M110 lock nut (model 580 only)
 Arbor press
 Screwdriver (small flat blade)
 1" diameter wooden dowel
 Soft-faced hammer
 Hammer (standard steel)
 Brass rod
 Bearing heater
 Shim stock packet (order from Fristam prior to disassembly)
 Torque wrench
 Indicating torque wrench

GEARBOX DISASSEMBLY

To start the gearbox disassembly, complete the Pump Head Disassembly on pages 11-12.

- Remove oil drain plug with the 3/8" Allen wrench (580: 17 mm Allen wrench) and drain the oil.
- Remove the gearbox cover bolts with the 13 mm wrench (580: 17 mm wrench) and remove the gearbox cover and gearbox cover gasket.
- Remove the bearing cap screws with the 5 mm Allen wrench (580: 13 mm wrench), then remove the bearing caps.
- Remove the bearing cap o-rings from both bearing caps and the rear oil seal from the drive shaft bearing cap.
- Remove the gear snap rings from the groove in both shafts with the 90° snap ring pliers.
- Install the rotors onto the pump shafts. Secure the rotors from turning by placing the wooden dowel between them as shown in Figure 33.
- Straighten the bent tab on the bearing lock nut washer on both shafts with the screwdriver.



- h) Loosen the bearing lock nut from both shafts using the spanner wrench.
- i) Remove the bearing lock nuts, bearing lock nut washers, bearing spacers and rotors from both pump shafts.
- j) Place the gearbox on an arbor press with the spline ends of the shafts facing down as shown in Figure 34. Press on both shafts to remove them from the gearbox until you hear a click. This will be the sound of the snap ring falling into the groove of the shaft behind the bearing lock nut thread.
- k) Pull the inner race of both rear bearings out of the gearbox.
- l) Remove the snap rings from the pump shafts with the straight snap ring pliers. Make sure to support the shafts so that they do not fall and get damaged. The front oil seals will come out of the gearbox with the shafts.
- m) Press the inner bearing races off both pump shafts as shown in Figure 35. Note: do not press on outer bearing cage. Set pump shafts aside.
- n) Remove the gears from the gearbox. The outer races of both front and rear bearings can now be tapped out of the gearbox with a hammer and brass rod.

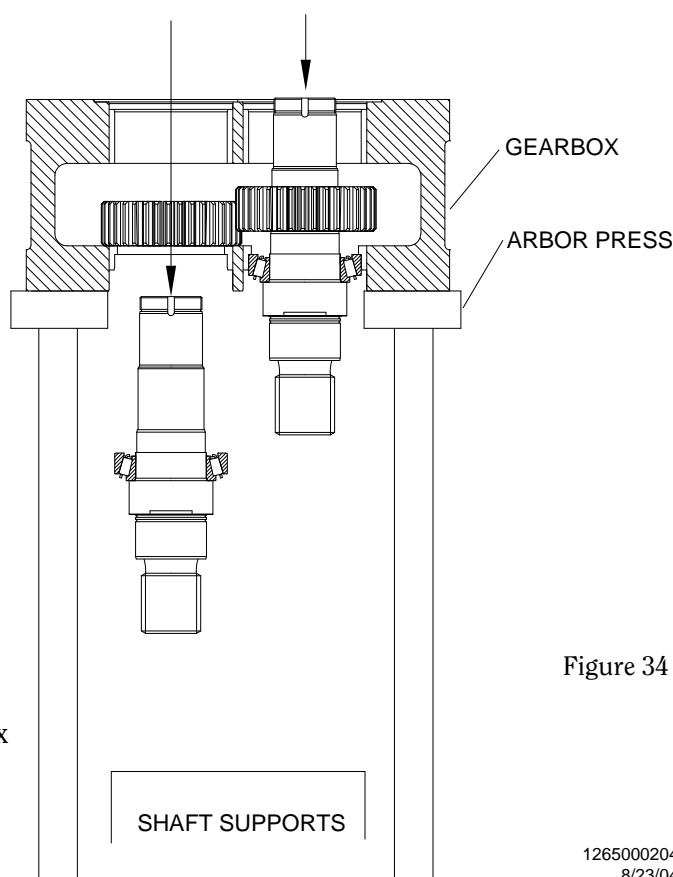


Figure 34

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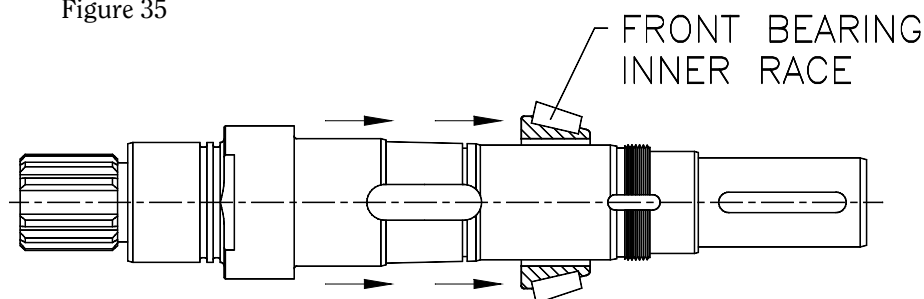
GEARBOX ASSEMBLY

Note: For ease of installation, install the idle shaft first. If you are not sure about shaft location, the drive shaft will always be located in the same bore on the gearbox. To locate the correct bore, stand facing the gearbox with the gearbox cover on your left side. The drive shaft will be in the top bore position.

Figure 35

ASSEMBLE FRONT BEARINGS ONTO SHAFTS

Cover the coupling area of the drive shaft with tape, to protect it. Lightly oil the pumps shafts on the step for the front bearings. Assemble the bearings one shaft at a time.



- a) Heat the inner race of the front bearings to no more than 300°F (580: 400°F) and quickly slide on the shaft.
- b) Let the inner races cool and then use a piece of 0.02 mm shim stock to check if the bearing is properly seated against the step on both shafts.
- c) If the inner race has moved, use a piece of mild steel pipe that only touches the inner race of the bearing to seat the bearing cone against the shaft step. Slide the pipe over the shaft so it is seated on the inner race of the bearing cone and use the Arbor press or a hammer to gently move the inner race into place.

INSERT THE OUTER BEARING RACES

Lightly grease the front and rear bearing bores. Insert the outer races of the front and rear bearings into the gearbox as shown in Figure 36. Ideally these races should be pressed in using an Arbor press and an old bearing race ground down to slide freely in the bearing bore. If this is not possible, a soft drive rod (wood or brass) may be used to install the outer races. Note: before you install the outer race for the front bearings, you must place the shims in the bottom of the bore of the gearbox as shown in Figure 36. For new shafts, use 0.100" of shim and for used shafts use 0.120" of shim. (FKL 580 gearboxes will require 0.010" of shim with a new shaft and 0.020" of shim with a used shaft.)

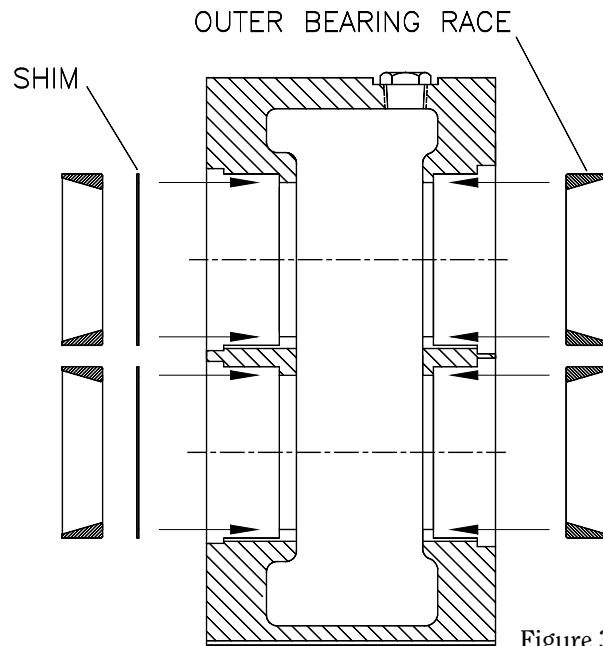


Figure 36

INSTALL THE GEARBOX

Lightly oil the pump shafts on the step for the gears. Install the shafts, one at a time, into the gearbox. Remember that the drive shaft will be in the top bore as seen from the pump side of the gearbox with the gearbox cover on the left.

- Deburr and install the gear key into the shaft.
- Place one of the gears with the part number facing the bearing lock nut end of the gearbox into the gearbox.
- Install the shaft through the front bearing bore of the gearbox and through the gear.
- Slide the gear against the shoulder of the shaft.
- Install the gear snap ring, to secure the gear to the pump shaft, with the straight snap ring pliers (Figure 37).

Note: the part numbers on both gears must face the same direction or timing will be off.

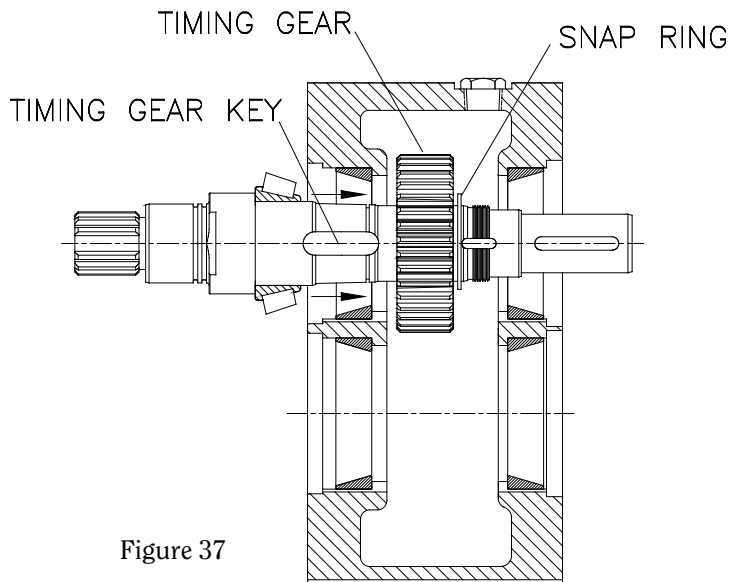


Figure 37

f) Heat the inner race of the rear bearing to no more than 300°F (580: 400°F) and quickly slide on the shaft (Figure 38). Hold the bearing in place for a few seconds so the bearing has a chance to cool.

g) Install the bearing spacer, the bearing lock nut washer and the bearing lock nut onto the shaft (Figure 38). Hand tighten the nut with the spanner wrench.

h) Repeat steps A – G with the other shaft. Be sure to align the key ways to 12 o'clock as shown in Figure 39 and also be sure that the part numbers on both gears face the bearing lock nut end of the gearbox. This will ensure proper timing.

i) Install the rotors onto the shafts.

j) Place a wooden dowel between the rotors, as shown in Figure 40 and tighten the bearing lock nut on the drive shaft with the spanner wrench until a rolling torque of 7 in-lbs (580: 100 in-lbs) is reached. Use an indicating torque wrench.

k) Tighten the idle shaft with the spanner wrench until the rolling torque (measured on the drive shaft) is doubled.

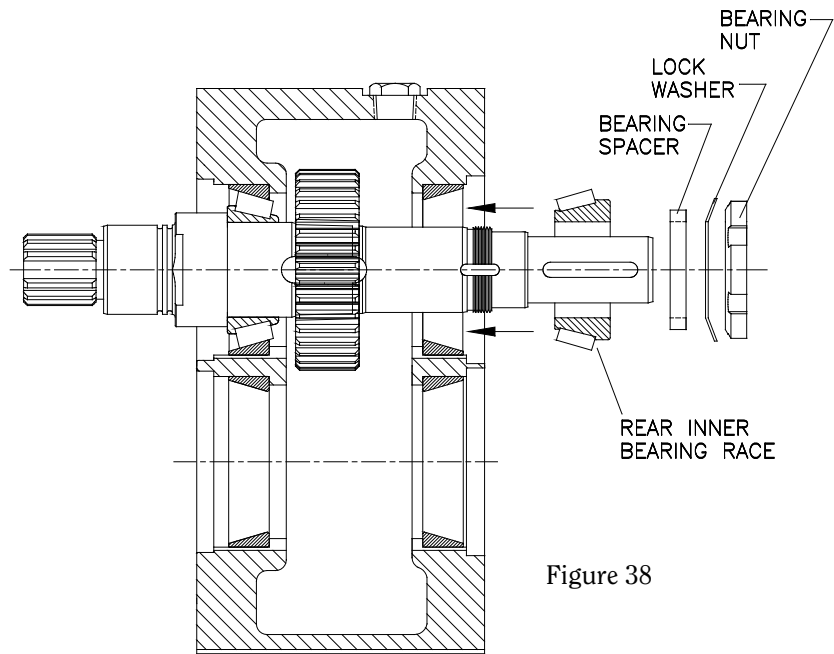


Figure 38

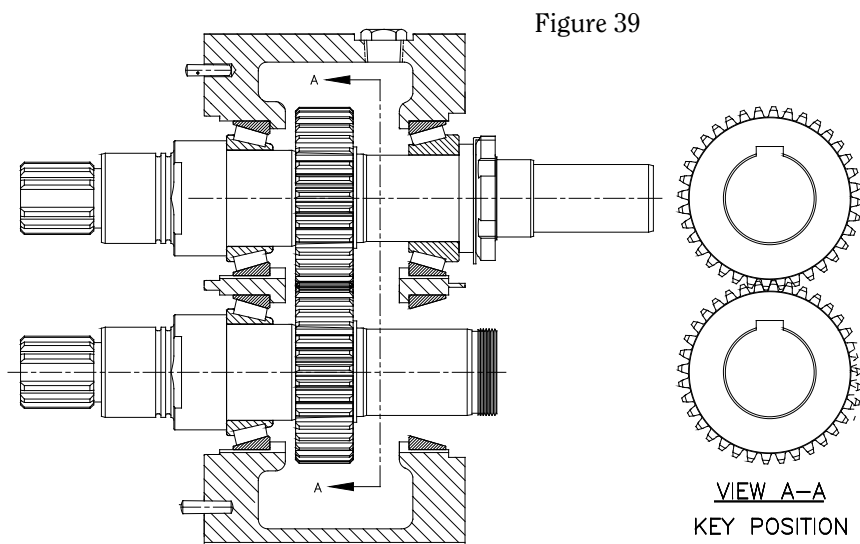
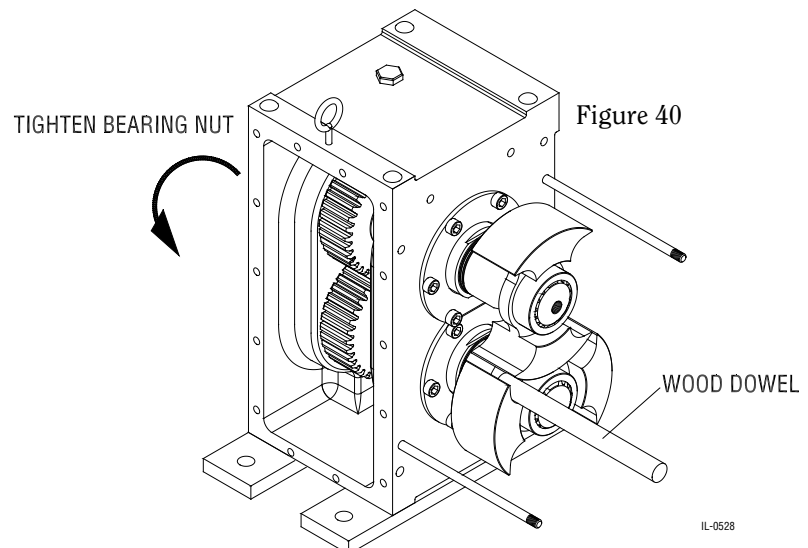
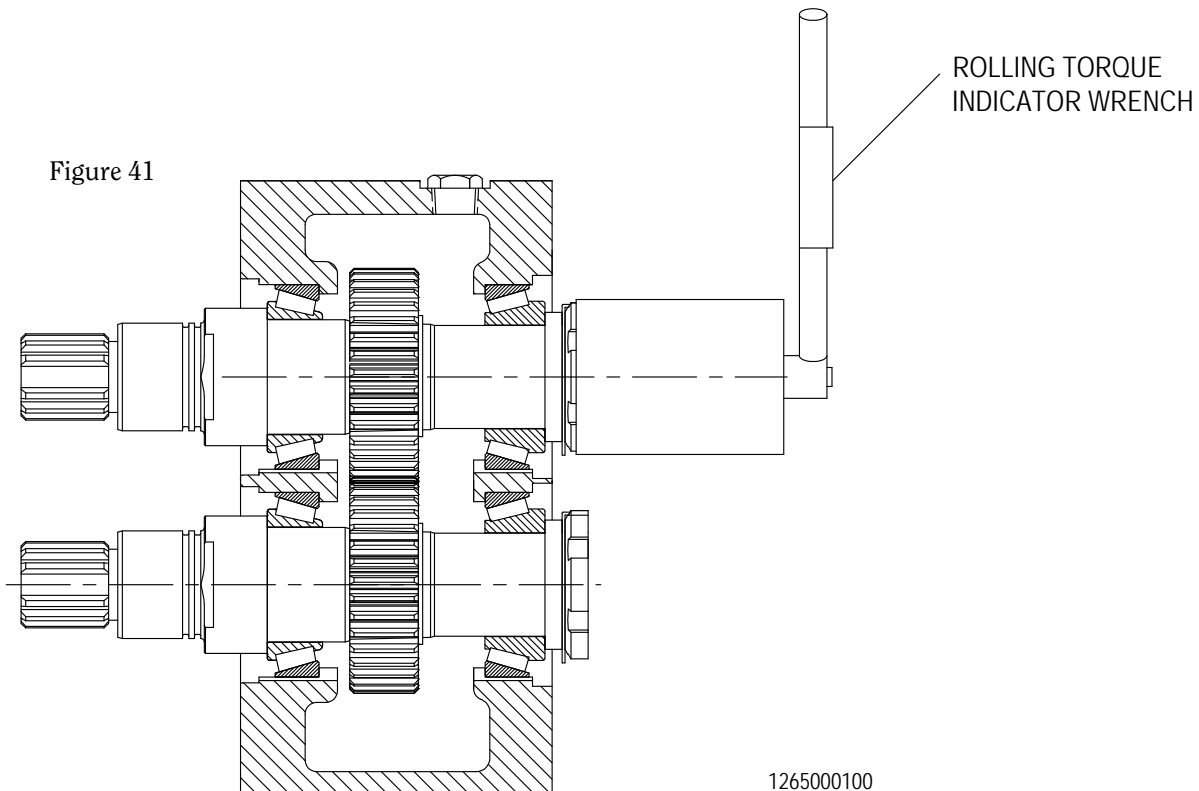


Figure 39



- l) Use a rolling torque wrench to check that there is preload on the bearing (Figure 41). The rolling torque should be 7 in-lbs. (580: 100 in-lbs) if it is not, tighten or loosen the bearing locknut as needed.
- m) Turn the rotors to check the timing. If the timing is off, one shaft will have to be removed and then reinstalled.
- n) Install the new rear oil seal into the drive shaft bearing cap.
- o) Install the new bearing cap o-rings into the o-ring grooves in the bearing caps.
- p) Install the bearing caps onto the gearbox. Secure with the bearing cap screws and tighten to the specified torque (Table A2, page 5).
- q) Lightly oil the outside edge of the two front oil seals and press into the front bearing bores of the gearbox.
- r) Place the new gearbox cover gasket and gearbox cover on the gearbox and secure with the gearbox cover bolts. Tighten to the torque specified in Table A2, page 5.
- s) Re-install the oil drain plug and vent plug onto the gearbox. Fill the gearbox with oil to the center of the oil sight glass.



SETTING THE ROTOR GAP

With the bearings properly assembled, you are now ready to set the rotor gap. This is accomplished by placing shims between the front bearings and gearbox as shown in Figure 42.

To check the rotor gap, the pump housing and rotors need to be installed. Follow the Pump Head Assembly instructions on page 13. The o-rings are not necessary for these measurements.

With the rotors installed, you may now check the rotor gap. Use feeler gauges to verify the back clearance between the rotors and the housing (see Table A3, page 6). You need to do this for both shafts, the values for each shaft may and probably will be different. Subtract the clearance value that you measure from the clearance value that is listed in the table. This will give you the amount of shim material that you must remove. This can be accomplished by removing the shims currently in the pump and using a combination of the shims that were supplied with the new shafts.

Once you have your rotor to housing measurements, you can remove the rotors, pump housing and remove both pump shafts from the gearbox. You will also need to remove the outer races for the front bearings to remove the current shims and replace them with the shim values that you have determined for each shaft. Once the shims are installed you can reassemble the pump per the instructions in the Gearbox Assembly (pages 25) section.

Once the gearbox is assembled, the pump head can be assembled (page 16) and the rotor to housing clearances can be checked. Make any necessary adjustments as required.

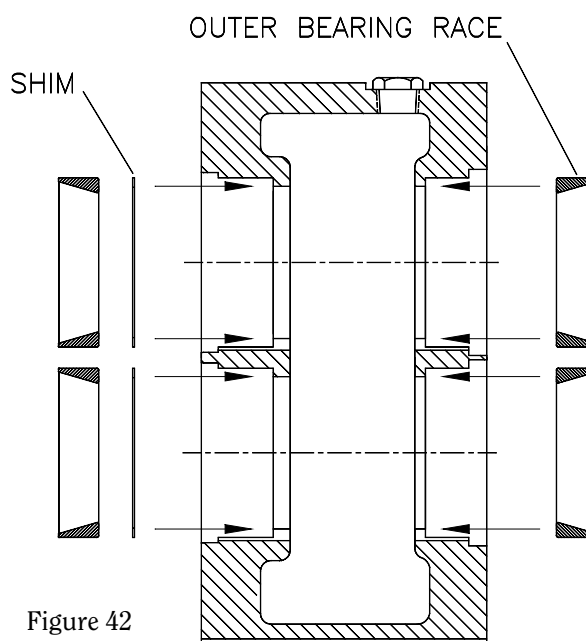
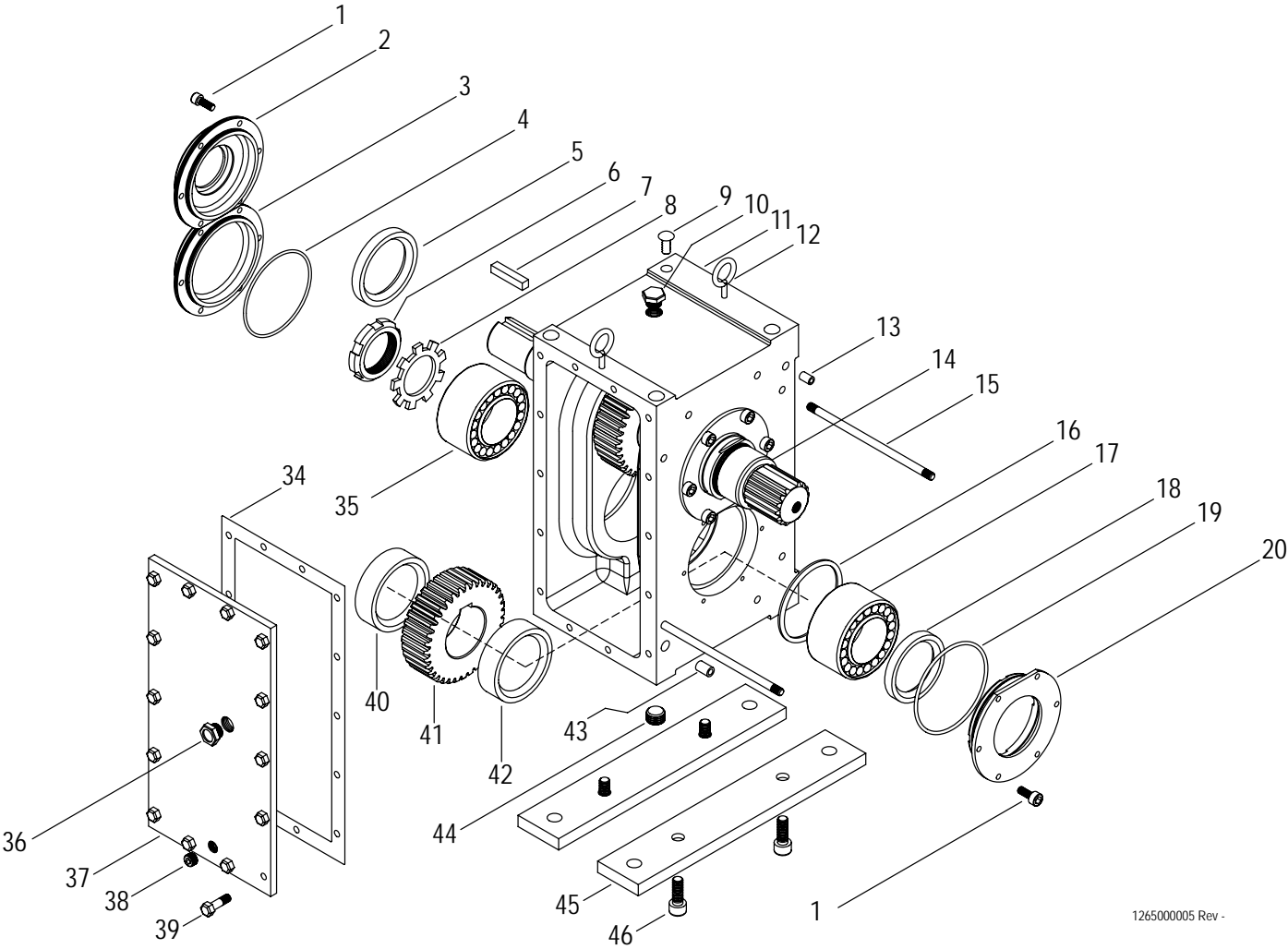
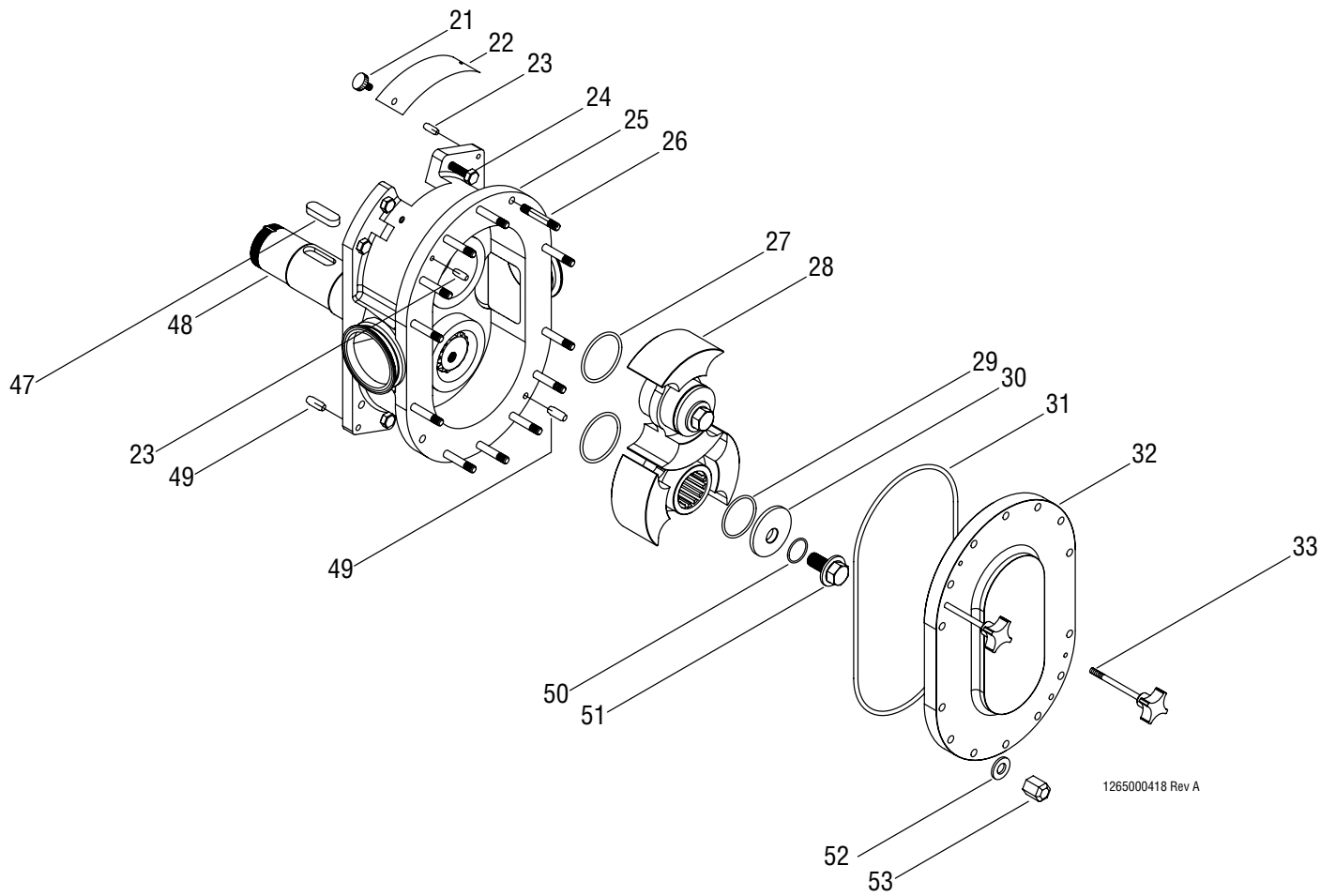


Figure 42

FKL (25, 75, 150, 205, 250 & 400) EXPLODED VIEW



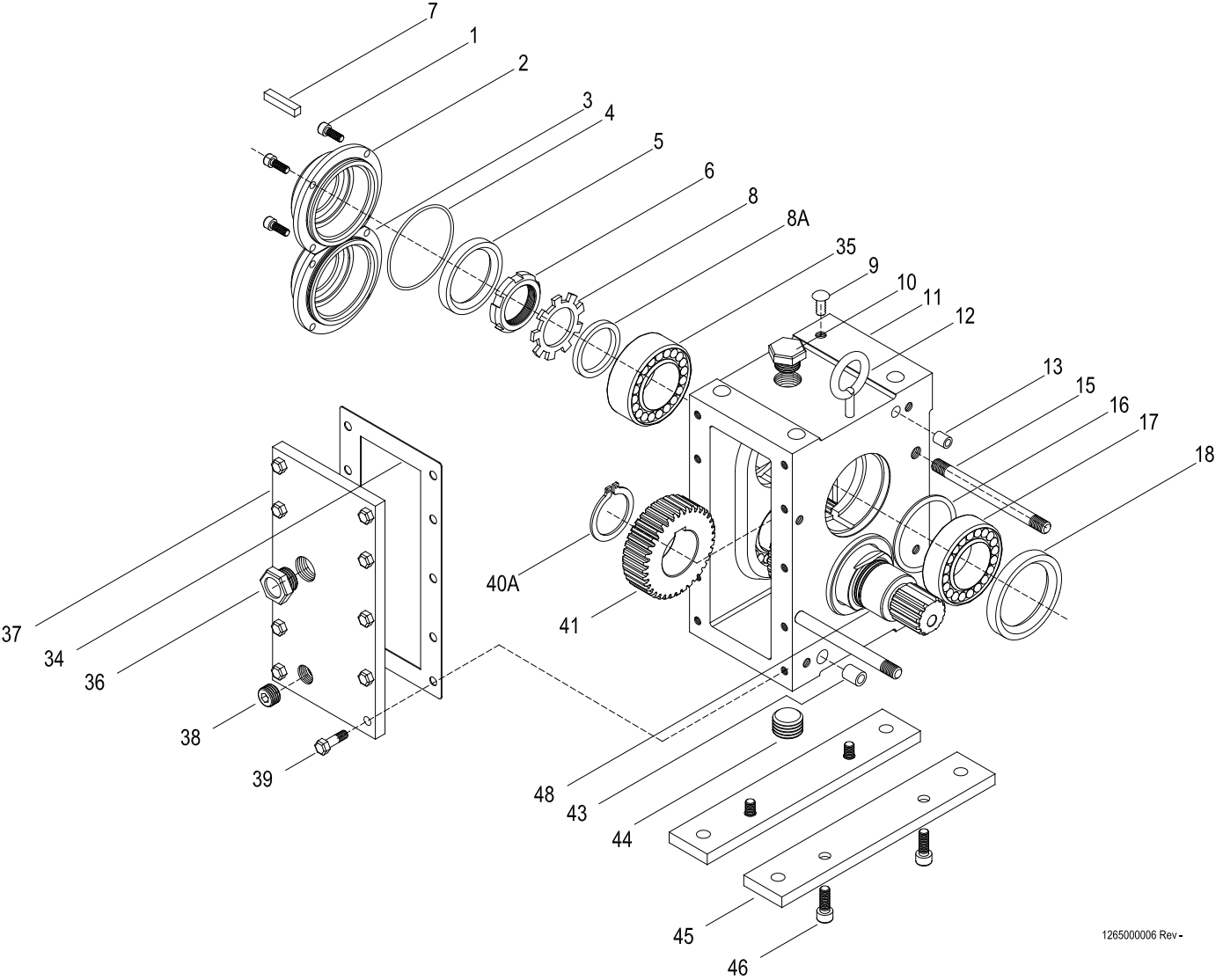


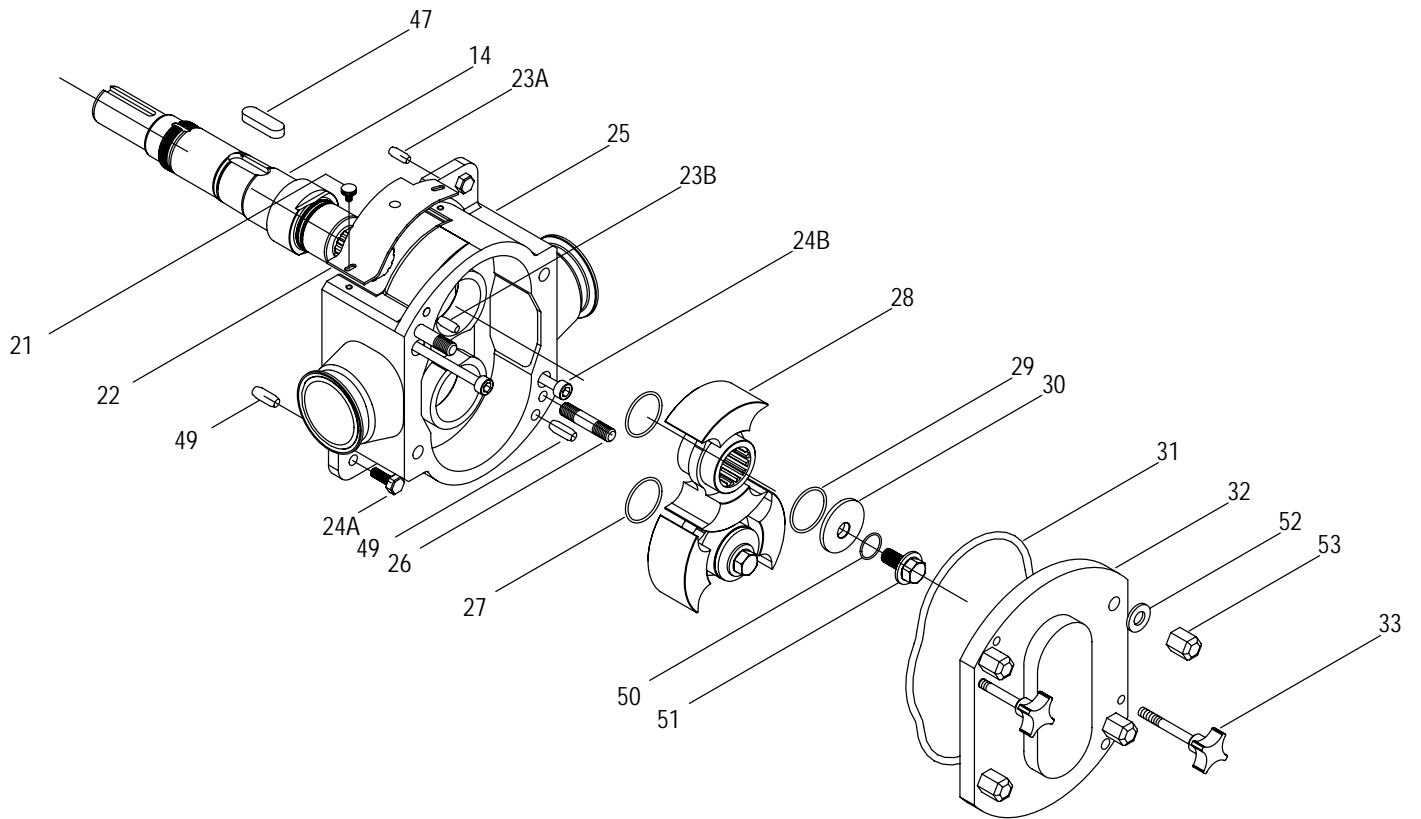
FKL (25, 75, 150, 205, 250 & 400) PART NUMBERS

Item	Description	Qty	25	75	150	205	250	400
1	Bearing cover screw	16*	1101000048	1101000032	1101000032 (18)	1101000032 (24)	1101000032 (24)	1101000036 (24)
2	Rear bearing cover (drive shaft)	1	1304000010	1304000013	1304000002	1304000022	1304000005	1304000009
3	Rear bearing cover (idle shaft)	1	1304000011	1304000014	1304000003	1304000006	1304000006	1304000008
4	Bearing cover o-ring (buna)	2	1180000241	1180000232	1180000148	1180000748	1180000214	1180000246
5	Rear lip seal	1	1812000013	1812000016	1812000012	1812000044	1812000009	1812000011
6	Bearing lock nut	2	1306000006	1306000005	1306000005	1306000004	1306000004	1306000007
7	Coupling key	1	1315000013	1315000026	1315000026	1315000042	1315000025	1315000028
8	Bearing lock nut washer	2	1104000019	1104000018	1104000018	1104000017	1104000017	1104000020
9	Plastic cover plug	8*	1248000002	1248000004	1248000004 (6)	1248000004 (6)	1248000004 (6)	1248000020 (6)
10	Vent plug	1	1248000013	1248000013	1248000013	1248000013	1248000013	1248000013
11	Gearbox	1	1310600045	1310600047	1310600048	1310600166	1310600049	1310600050
12	Eyebolt	2	1101000072 (1)	1101000163	1101000163	1101000163	1101000163	1101000152
13	Small mounting pin bushing	1	1224000002	1224000004	1224000004	1224000004	1224000004	1224000006
14	Drive shaft	1	1372600002	1372600010	1372600024	1372600034	1372600004	1372600006
	Drive shaft (for o-ring seal)		1372600014	1372600016	1372600018	TBD	1372600020	1372600022
15	Housing stud (long)	2*	1103000035 (6)	1103000098	1103000092	1103000094	1103000096	1103000104 (4)
16	Gapping shim kit	1	1080000054	1080000056	1080000056	1080000057	1080000057	1080000058
17	Front bearing assembly	2	1173000013	1173000014	1173000016	1173000018	1173000017	1173000019
18	Front lip seal	2	1812000014	1812000015	1812000011	1812000043	1812000008	1812000010
19	Front bearing cover o-ring	2	1180000241	1180000232	1180000148	1180000748	1180000214	1180000238
20	Front bearing cover	2	1304000012	1304000016	1304000001	1304000021	1304000004	1304000007
21	Guard knob	4	1102000000	1102000000	1102000000	1102000000	1102000000	1102000012
22	Housing guard	2	1936000047	1936000034	1936000035	1936000150	1936000033	1936000116
23a	Small mounting pin (housing)	1	1891000067	1891000069	1891000071	1891000071	1891000071	1891000074
23b	Small mounting pin (cover)	1	1891000067	1891000071	1891000071	1891000072	1891000072	1891000075
24	Hex head housing bolt	6*	1101000040 (2)	1101000046	1101000037	1101000037	1101000037	1101000037 (8)
25	Pump housing	1	1656610000	1660610000	1668610000	1664610000	1670610000	1672610002
26	Housing stud (short)	6*	—	1103000099	1103000091	1103000095 (12)	1103000097 (12)	1103000103 (12)
27	Rotor o-ring (viton)	2	1180000243	1180000014	1180000115	1180000253	1180000212	1180000234
28	Rotor (standard)	2	1657630000	1661630000	1669630000	1665630000	1671630000	1673630000
	Rotor (high-temperature)		1657630001	1661630001	1669630001	TBD	1671630001	1673630001
29	Rotor bolt washer o-ring (viton)	2	1180000243	1180000014	1180000115	1180000253	1180000212	1180000234
30	Rotor bolt washer	2	1104000027	1104000028	1080000042	1104000093	1080000043	1080000044
31	Cover o-ring (buna - standard)	1	1180000165	1180000593	1180000590	1180000817	1180000586	1180000757
32	Pump cover	1	1656620000	1660620000	1668620000	1664620000	1670620000	1672620000
33	Forcing screw	2	1018000012	1018000012	1018000012	1018000013	1018000013	1018000013
34	Gearbox cover gasket	1	1181000059	1181000060	1181000056	1181000175	1181000053	1181000058
35	Rear bearing assembly	2	1173000013	1173000015	1173000015	1173000018	1173000018	1173000017
36	Oil sight glass	1	1248000019	1248000019	1248000019	1248000019	1248000019	1248000019
37	Gearbox cover	1	1367000004	1367000005	1367000002	1367000006	1367000001	1367000003
38	Oil drain plug (small)	2	1248000012	1248000012	1248000012	1248000012	1248000012	1248000012
39	Gearbox cover bolt	8*	1101000011	1101000133	1101000133 (12)	1101000133 (14)	1101000133 (14)	1101000133 (14)
40	Gear spacer (rear)	2	1224000021	1224000024	1224000018	1224000109	1224000016	1224000020
41	Gear	2	1365000003	1365000004	1365000000	1365000013	1365000001	1365000002
42	Gear spacer (front)	2	1224000021	1224000023	1224000017	1224000109	1224000016	1224000019
43	Large mounting pin bushing	1	1224000004	1224000006	1224000006	1224000006	1224000006	1224000008
44	Oil drain plug (large)	1	1248000011	1248000011	1248000011	1248000011	1248000011	1248000011
45	Mounting strap	2	1925000000	1925000002	1925000003	1925000004	1925000004	1925000005
46	Mounting strap screw	4	1101000029	1101000033	1101000033	1101000033	1101000033	1101000039
47	Gear key	2	1315000014	1315000029	1315000012	1315000043	1315000024	1315000027
48	Idle shaft	1	1372600003	1372600011	1372600025	1372600035	1372600005	1372600007
	Idle shaft (for o-ring only)		1372600015	1372600017	1372600019	TBD	1372600021	1372600023
49a	Large mounting pin (housing)	1	1891000069	1891000073	1891000074	1891000074	1891000074	1891000078
49b	Large mounting pin (cover)	1	1891000069	1891000074	1891000074	1891000074	1891000074	1891000077
50	Rotor bolt o-ring (viton)	2	1180000085	1180000085	1180000095	1180000398	1180000398	1180000398
51	Rotor bolt	2	1102000001	1102000001	1102000002	1102000010	1102000010	1102000010
52	Cover nut washer	6*	1104000000	1104000002 (8)	1104000002 (8)	1104000002 (20)	1104000002 (20)	1104000002 (24)
53	Cover nut	6*	1103000032	1103000018 (8)	1103000018 (8)	1103000018 (14)	1103000018 (14)	1103000018 (16)

*Quantities may vary

FKL 50 EXPLODED VIEW





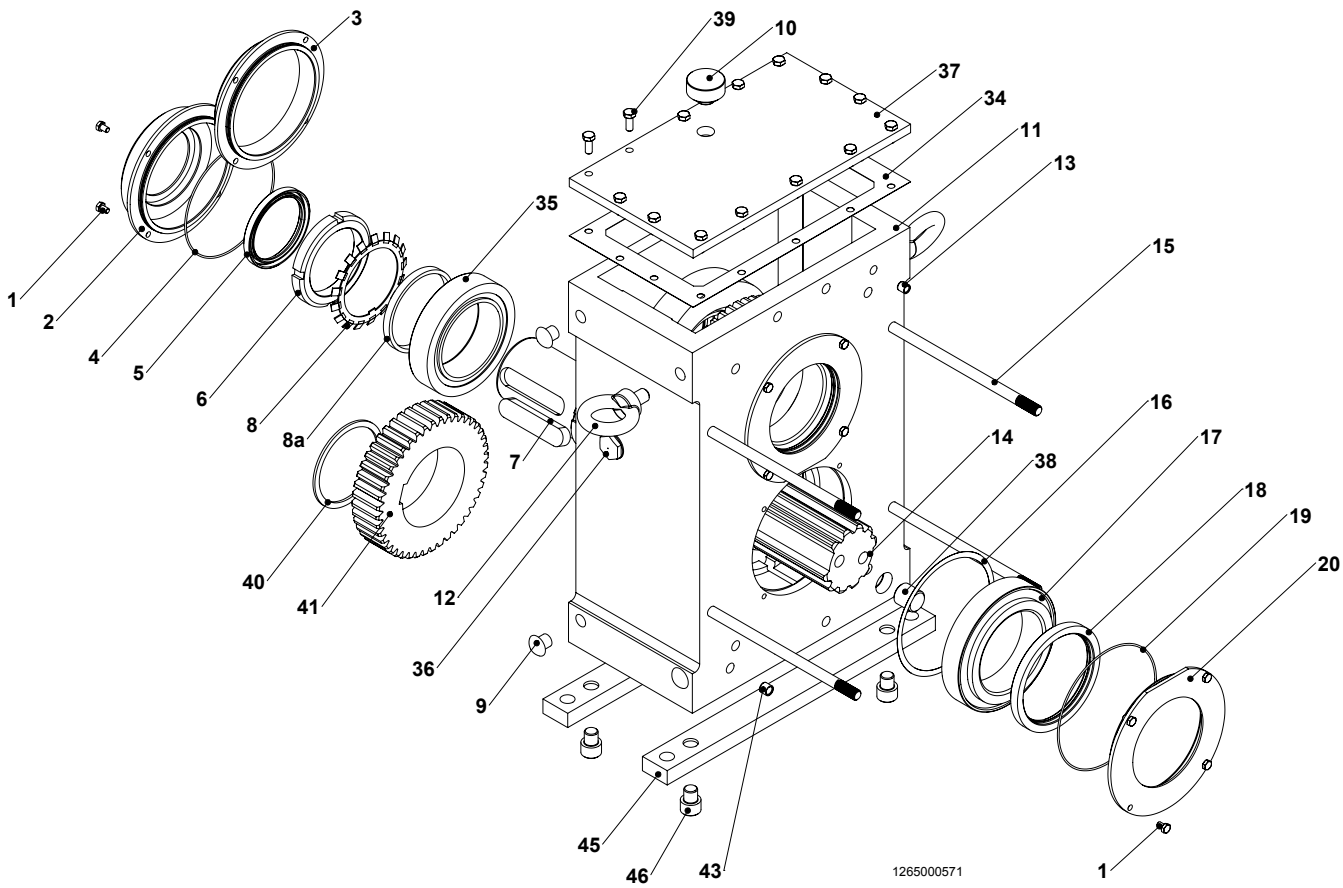
FKL 50 PART NUMBERS

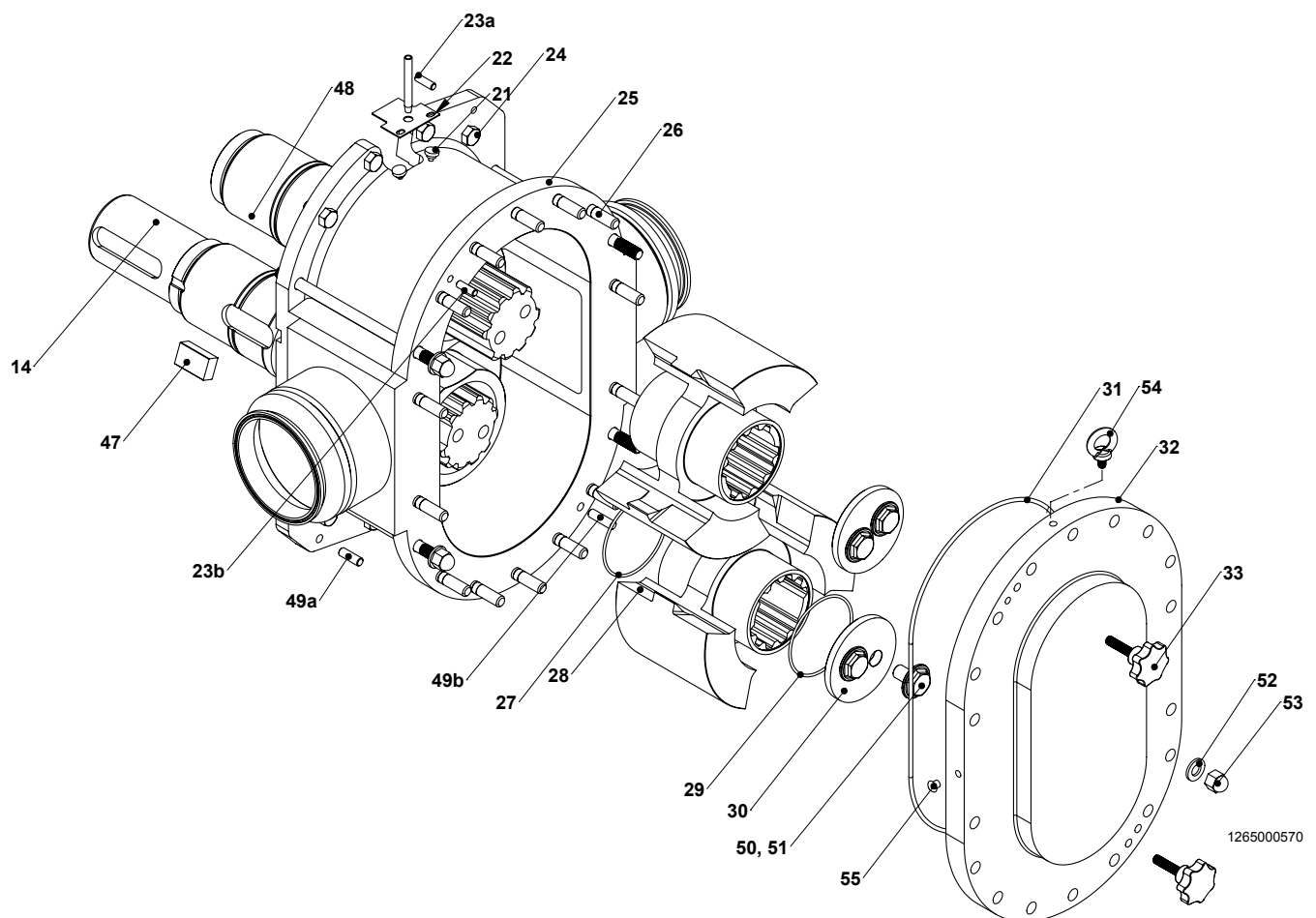
Item	Description	Qty	Part #
1	Bearing cover screw	8	1101000016
2	Rear bearing cover (drive shaft)	1	1304000000
3	Rear bearing cover (idle shaft)	1	1304000015
4	Bearing cover o-ring (buna)	2	1180000317
5	Rear lip seal	1	1812000006
6	Bearing lock nut	2	1306000002
7	Coupling key	1	1315000011
8	Bearing lock nut washer	2	1104000021
8a	Bearing spacer	2	1224000022
9	Plastic cover plug	8	1248000002
10	Vent plug	1	1248000013
11	Gearbox	1	1310600046
12	Eyebolt	1	1101000072
13	Small mounting pin bushing	1	1224000002
14	Drive shaft	1	1372600000
	Drive shaft (for o-ring seal)		1372600012
15	Housing stud (long)	2	1103000102
16	Gapping shim kit	1	1080000055
17	Front bearing assembly	2	1173000007
18	Front lip seal	2	1812000017
21	Guard knob	4	1102000000
22	Housing guard	2	1936000027
23a	Small mounting pin (housing)	1	1891000067
23b	Small mounting pin (cover)	1	1891000068
24a	Hex head housing bolt	2	1101000022
24b	Socket head housing screw	2	1101000023
25	Pump housing (2.5" clamp fittings)	1	1658610000
26	Housing stud (short)	2	1103000101
27	Rotor o-ring (viton)	2	1180000120
28	Rotor (standard)	2	1659630000
	Rotor (high-temperature)		1659630001

Item	Description	Qty	Part #
29	Rotor bolt washer o-ring (viton)	2	1180000120
27	Rotor o-ring (viton)	2	1180000120
28	Rotor (standard)	2	1659630000
	Rotor (high-temperature)		1659630001
29	Rotor bolt washer o-ring (viton)	2	1180000120
30	Rotor bolt washer	2	1104000024
31	Cover o-ring (buna - standard)	1	1180000595
32	Pump cover	1	1658620000
33	Forcing screw	2	1018000012
34	Gearbox cover gasket	1	1181000057
35	Rear bearing assembly	2	1173000008
36	Oil sight glass	1	1248000019
37	Gearbox cover	1	1367000000
38	Oil drain plug (small)	2	1248000012
39	Gearbox cover bolt	10	1101000022
40a	Gear snap ring	2	1148000001
41	Gear	2	1365000005
43	Large mounting pin bushing	1	1224000004
44	Oil drain plug (large)	1	1248000011
45	Mounting strap	2	1925000001
46	Mounting strap screw	4	1101000029
47	Gear key	2	1315000030
48	Idle shaft	1	1372600001
	Idle shaft (for o-ring seal)		1372600013
49a	Large mounting pin (housing)	1	1891000069
49b	Large mounting pin (cover)	1	1891000070
50	Rotor bolt o-ring (viton)	2	1180000085
51	Rotor bolt	2	1102000001
52	Cover nut washer	4	1104000002
53	Cover nut	4	1103000018

*Quantities may vary

FKL 580 EXPLODED VIEW





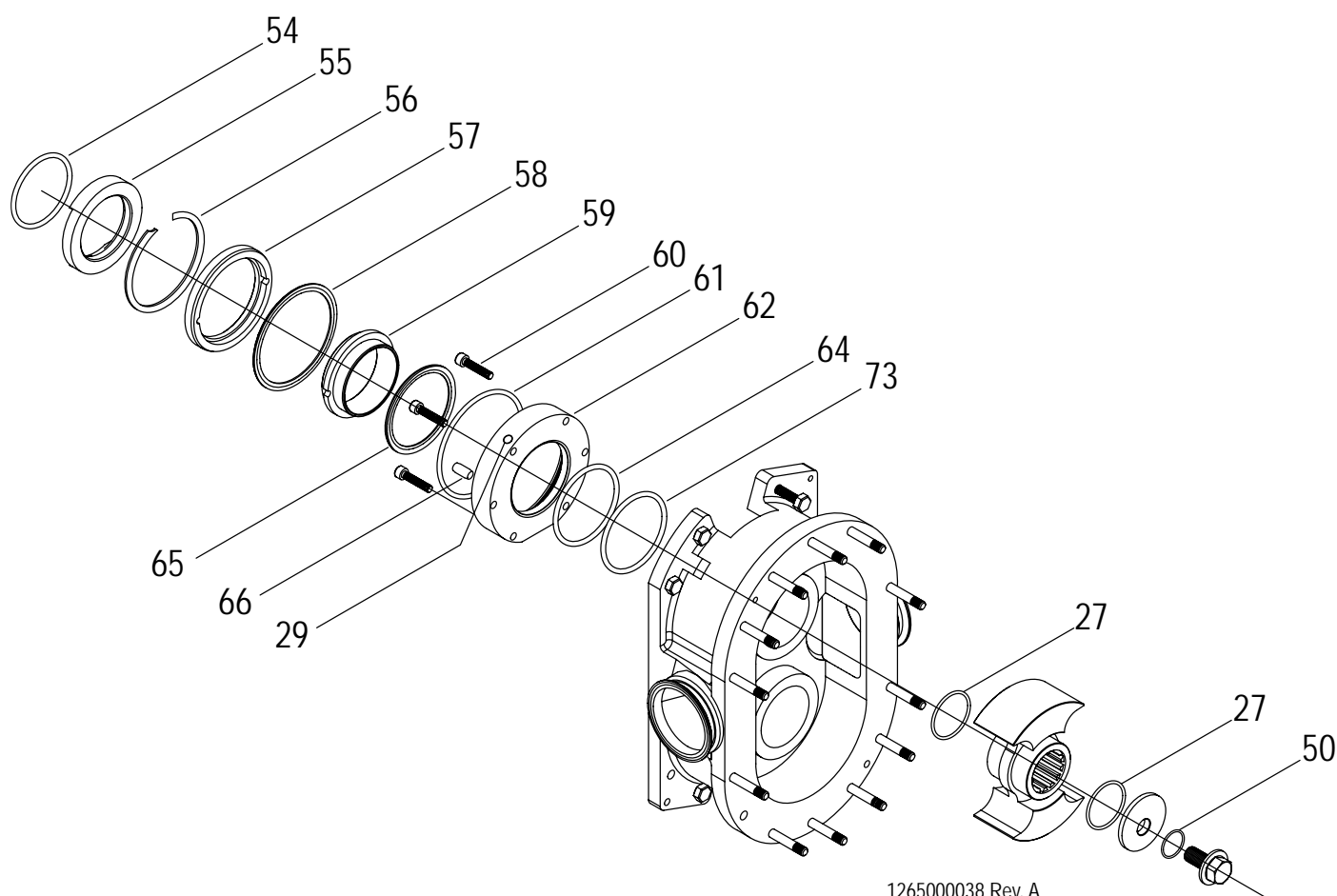
FKL 580 PART NUMBERS

Item	Description	Qty	Part #
1	Bearing cover screw	16	1101000241
2	Rear bearing cover (drive shaft)	1	0386630001
3	Rear bearing cover (idle shaft)	1	0386630000
4	Rear Bearing cover o-ring (buna)	2	1180000001
5	Rear lip seal	1	0182160001
6	Bearing lock nut	2	1306000000
7	Coupling key	1	1315000015
8	Bearing lock nut washer	2	1104000066
8a	Bearing spacer	2	0387660001
9	Plastic cover plug	6	1248000027
10	Vent plug	1	1248000016
11	Gearbox	1	1310600099
12	Gearbox Eyebolt	2	1101000152
13	Small mounting pin bushing	1	1224000006
14	Drive shaft	1	1372600066
	Drive shaft (for o-ring seal)		TBD
15	Housing stud (long)	4	1103000117
16	Gapping shim kit	1	1080000098
17	Front bearing assembly	2	1173000005
18	Front lip seal	2	0182160000
19	Front bearing cover o-ring	2	1180000002
20	Front bearing cover	2	0386630002
21	Guard knob	4	1102000000
22	Housing guard	2	1936000155
23a	Small housing pin (M10x30)	1	1891000074
23b	Small cover pin (M10x40)	1	1891000075
24	Hex head housing bolt	8	1101000001
25	Pump housing (6" clamp fittings)	1	1674610000
26	Housing stud (short)	14	1103000055

Item	Description	Qty	Part #
27	Rotor o-ring (viton)	4	1180000919
28	Rotor (standard)	2	1675630000
	Rotor (high-temperature)		TBD
29	Rotor bolt washer o-ring (viton)	2	1180000919
30	Rotor bolt washer	2	1104000096
31	Cover o-ring (buna - standard)	1	1180000930
32	Pump cover	1	1674620000
33	Forcing screw	2	1018000066
34	Gearbox cover gasket	1	0386650001
35	Rear bearing assembly	2	1173000006
36	Oil sight glass	2	0248120001
37	Gearbox cover	1	0386620001
38	Oil drain plug	1	0129300100
39	Gearbox cover bolt	14	1101000133
40	Gear snap ring	2	1148000000
41	Gear	2	0387670001
43	Large mounting pin bushing	1	1224000008
45	Mounting strap	2	1925000006
46	Mounting strap screw	4	1101001875
47	Gear key	2	1315000000
48	Idle shaft	1	1372600067
	Idle shaft (for o-ring seal)		TBD
49a	Large housing pin (M12x36)	1	1891000077
49b	Large cover pin (M12x40)	1	1891000078
50	Rotor bolt o-ring (viton)	4	1180000398
51	Rotor bolt	4	1102000010
52	Cover nut washer	18	1104000022
53	Cover nut	18	1103000012
54	Cover eyebolt (M10x15)	18	1101000073

*Quantities may vary

FKL SINGLE MECHANICAL SEAL



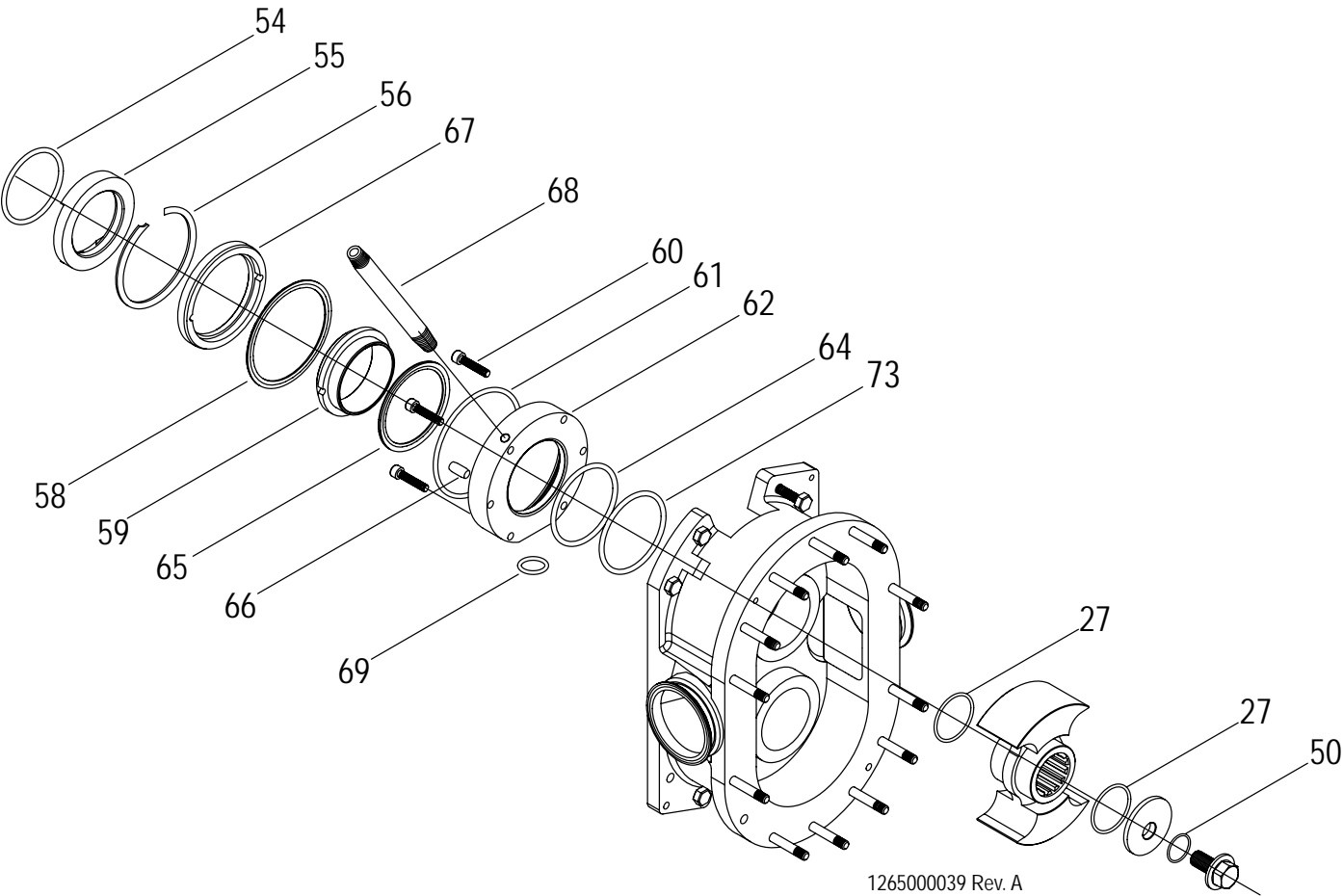
1265000038 Rev. A

PARTS & PART NUMBERS

FKL SINGLE MECHANICAL SEAL										
Item	Description	Qty	25	50	75	150	205	250	400	580
27	Rotor/Rotor bolt washer o-ring (viton)	4*	1180000243	1180000120	1180000014	1180000115	1180000253	1180000212	1180000234	1180000919
29	Plastic cover plug	2				1248000006				1248000002
50	Rotor bolt o-ring (viton)	2*		1180000085		1180000095		1180000398		1180000398 (4)
54	Rotating seal o-ring (viton)	2*	1180000243	1180000032	1180000275	1180000112	1180000184	1180000217	1180000216	1180000919
55	Rotating seal (Chrome oxide/SS)	2	1810600075	1810600057	1810600076	1810600066	1810600124	1810600042	1810600074	1810600130
	Rotating seal (Silicon carbide)		1810600085	1810600036	1810600077	1810600067	1810600123	1810600062	1810600086	TBD
56	Seal retaining ring	2	1148000018	1148000014	1148000019	1148000016	1148000032	1148000015	1148000017	1148000035
57	Single seal insert	2	1815600019	1815600020	1815600021	1815600022	1815600144	1815600023	1815600024	1815600151
58	Double seal spring	2	1820000037	1820000018	1820000040	1820000022	1820000069	1820000020	1820000024	1820000071
59	Stationary seal (carbon)	2	1815600058	1815600049	1815600060	1815600051	1815600142	1815600052	1815600055	1815600157
	Stationary seal (Silicon carbide)		1815600057	1815600050	1815600061	1815600054	1815600140	1815600053	1815600056	TBD
	Stationary seal (Chrome oxide/SS)		1815600086	1815600066	1815600112	1815600108	1815600141	1815600106	1815600097	TBD
60	Seal housing screw	8		1101000220	1101000024	1101000220(12)	1101000221(12)	1101000221(12)	1101000227(12)	1101000010 (16)
61	Outer stationary seal o-ring (viton)	2	1180000256	1180000186	1180000148	1180000225	1180000215		1180000240	1180000922
62	Seal housing	2	1845000010	1845000000	1845000015	1845000006	1845000045	1845000005	1845000004	1845000048
64	Inner stationary seal o-ring (viton)	2	1180000030	1180000014	1180000253	1180000231	1180000234	1180000052	1180000239	1180000634
65	Single seal spring	2	1820000038	1820000017	1820000039	1820000021	1820000068	1820000019	1820000023	1820000070
66	Seal pin	4	1891000011	1891000009	1891000013	1891000009	1891000013	1891000009	1891000010	1891000088
73	Cartridge seal o-ring (viton)	2			(models 205-400 only)		1180000234	1180000148	1180000225	1180000920

*Quantities may vary

FKL DOUBLE MECHANICAL SEAL

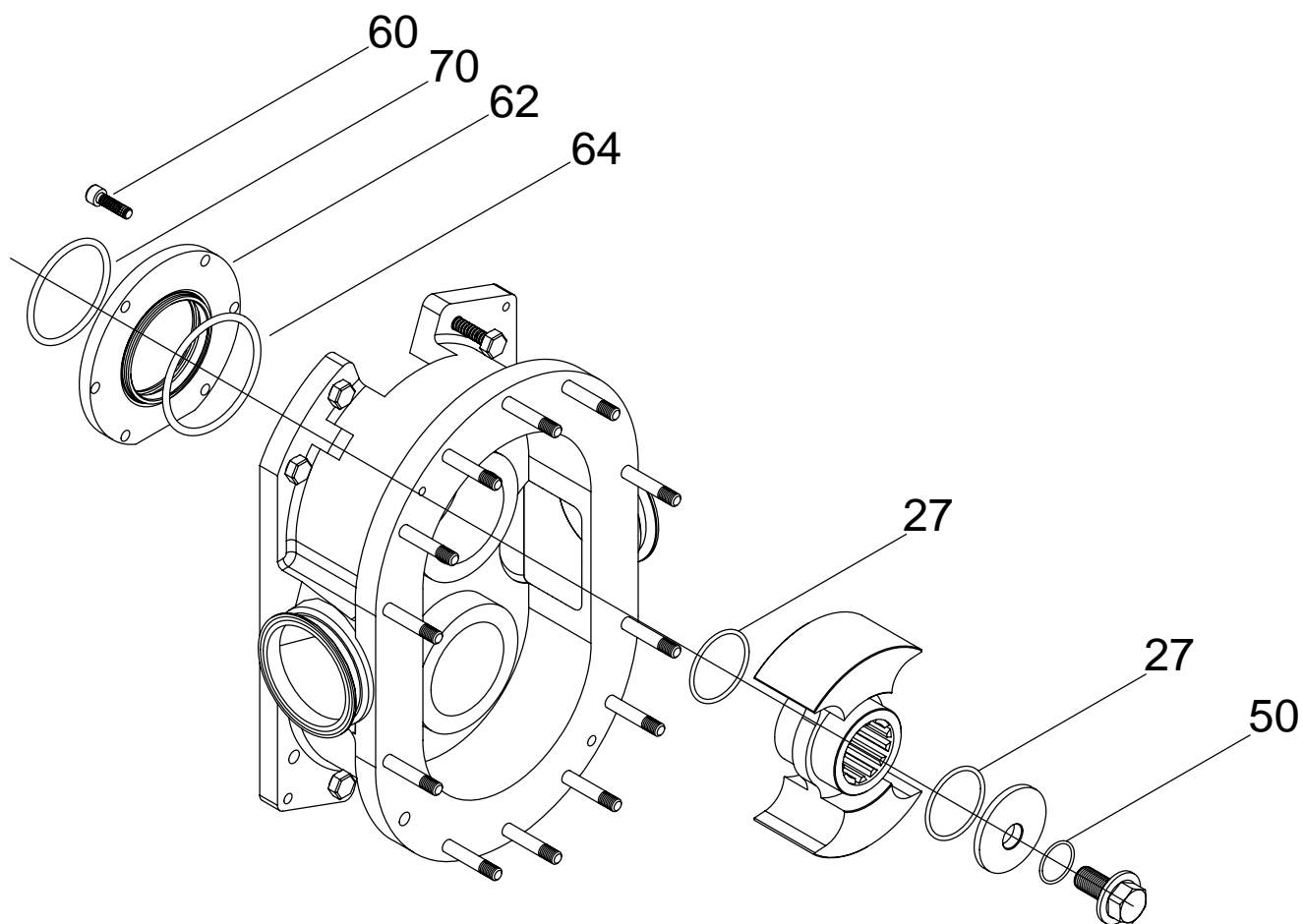


PARTS & PART NUMBERS

FKL DOUBLE MECHANICAL SEAL										
Item	Description	Qty	25	50	75	150	205	250	400	580
27	Rotor/Rotor bolt washer o-ring (viton)	4	1180000243	1180000120	1180000014	1180000115	1180000253	1180000212	1180000234	11800000919
50	Rotor bolt o-ring (viton)	2*	1180000085		1180000095		1180000398		1180000398 (4)	
54	Rotating seal o-ring (viton)	2	1180000243	1180000032	1180000275	1180000112	1180000184	1180000217	1180000216	11800000919
55	Rotating seal (Chrome oxide/SS)	2	1810600075	1810600057	1810600076	1810600066	1810600124	1810600042	1810600074	1810600130
	Rotating seal (Silicon carbide)		1810600085	1810600036	1810600077	1810600067	1810600123	1810600062	1810600086	TBD
56	Seal retaining ring	2	1148000018	1148000014	1148000019	1148000016	1148000032	1148000015	1148000017	1148000035
58	Double seal spring	2	1820000037	1820000018	1820000040	1820000022	1820000069	1820000020	1820000024	1820000071
59	Stationary seal (carbon)	2	1815600058	1815600049	1815600060	1815600051	1815600142	1815600052	1815600055	1815600157
	Stationary seal (Silicon carbide)		1815600057	1815600050	1815600061	1815600054	1815600140	1815600053	1815600056	TBD
	Stationary seal (Chrome oxide/SS)		1815600086	1815600066	1815600112	1815600108	1815600141	1815600106	1815600097	TBD
			1101000220		1101000024	1101000220(12)	1101000221(12)	1101000221(12)	1101000227(12)	1101000010 (16)
60	Seal housing screw	8*	1180000256		1180000186	1180000148	1180000225	1180000215		1180000240
61	Outer stationary seal o-ring (viton)	2	1845000010	1845000000	1845000015	1845000006	1845000045		1845000005	1845000004
62	Seal housing	2	1180000030	1180000014	1180000253	1180000231	1180000234	1180000052	1180000239	1180000634
64	Inner stationary seal o-ring (viton)	2	1820000038	1820000017	1820000039	1820000021	1820000068	1820000019	1820000023	1820000070
65	Single seal spring	2	1891000011	1891000009	1891000013	1891000009	1891000013	1891000009	1891000010	1891000088
66	Seal pin	4	1815600059	1815600071	1815600062	1815600073	1815600143	1815600072	1815600160	1815600158
67	Flush seal (carbon)	2	1910000010		1910000001		1910000001		1910000003	
68	Water pipe	2	1180000293		1180000234		1180000148	1180000225	1180000920	
69	Double seal housing o-ring (viton)	1	(models 205-400 only)							
73	Cartridge seal o-ring (viton)	2								

*Quantities may vary

FKL SINGLE O-RING SEAL

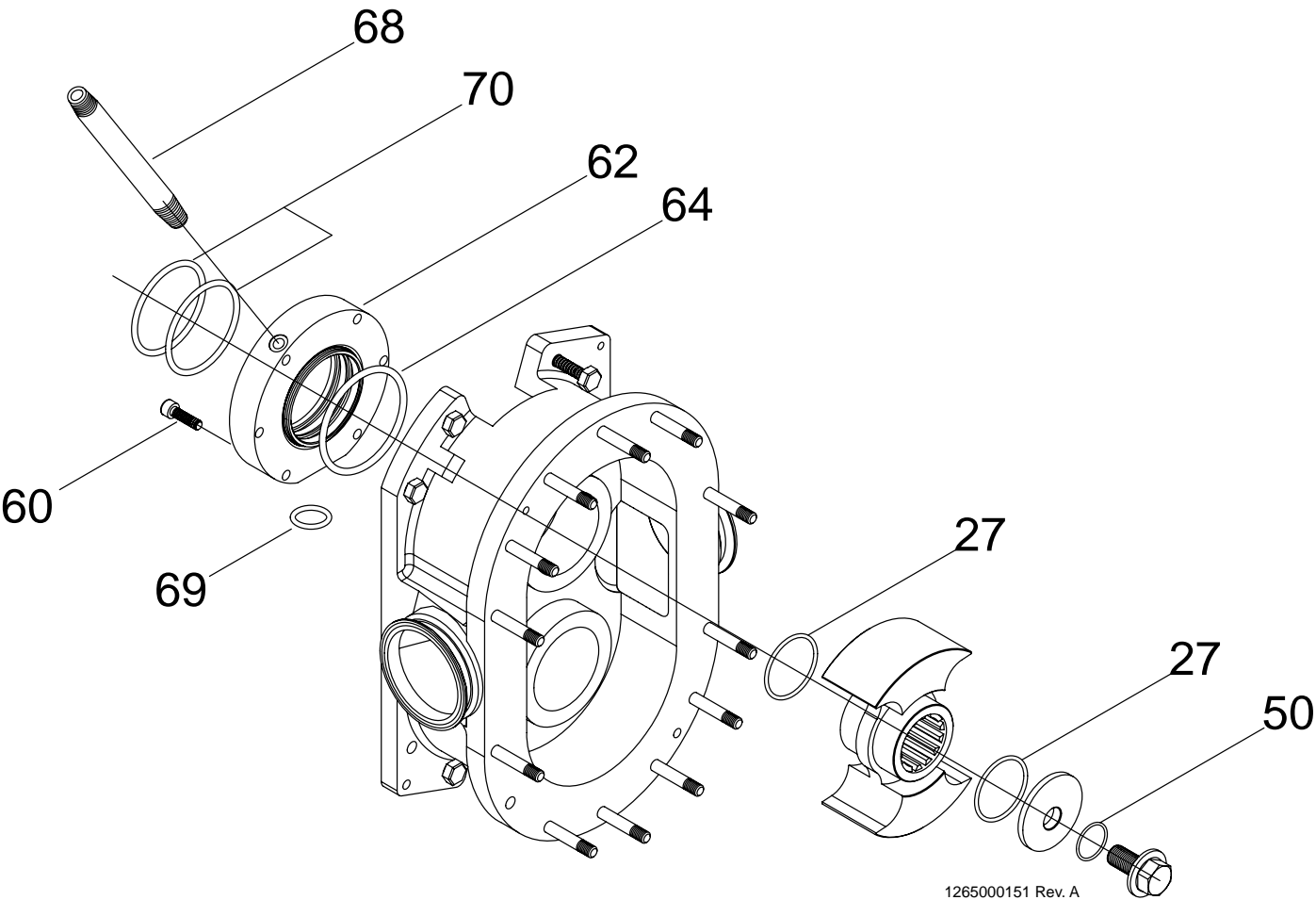


1265000150 Rev. A

PARTS & PART NUMBERS

SINGLE O-RING SEAL								
Item	Description	Qty	25	50	75	150	205	250
27	Rotor/Rotor bolt washer o-ring (viton)	4	1180000243	1180000120	1180000014	1180000115	1180000253	1180000212
50	Rotor bolt o-ring (viton)	2	1180000085			1180000095	1180000398	
60	Seal housing screw	8	1101000219			1101000219(12)		
62	Seal housing	2	1845000012	1845000001	1845000017	1845000008	—	1845000003
64	Inner stationary seal o-ring (viton)	2	1180000030	1180000014	1180000253	1180000231	1180000234	1180000052
70	Seal o-ring (viton)	2	1180000206	1180000044	1180000233	1180000280	1180000234	1180000234

FKL DOUBLE O-RING SEAL



1265000151 Rev. A

PARTS & PART NUMBERS

DOUBLE O-RING SEAL								
Item	Description	Qty	25	50	75	150	205	250
27	Rotor/Rotor bolt washer o-ring (viton)	4	1180000243	1180000120	1180000014	1180000115	1180000253	1180000212
50	Rotor bolt o-ring (viton)	2	1180000085			1180000095	1180000398	
60	Seal housing screw	8	1101000219			1101000219(12)		
62	Seal housing	2	1845000011	1845000002	1845000016	1845000007	—	1845000009
64	Inner stationary seal o-ring (viton)	2	1180000030	1180000014	1180000253	1180000231	1180000234	1180000052
68	Water pipe	2	1910000010			1910000001		
69	Double seal housing o-ring (viton)	1	1180000293					
70	Seal o-ring (viton)	2	1180000206	1180000044	1180000233	1180000280	1180000234	1180000234

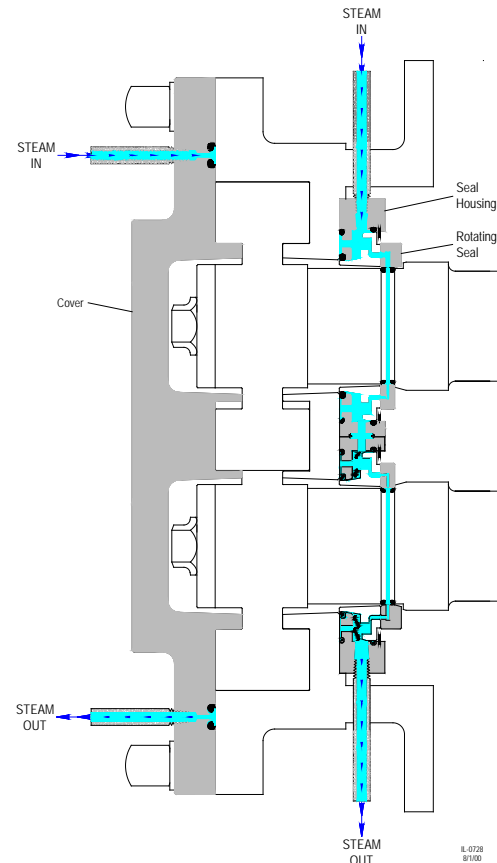
FKL ASEPTIC OPTION

Aseptic designs are available for most of the FKL models. All of the dynamic and static seals are steam traced to ensure product sterility.

Available: FKL 25 -400

Max. Pressure: 40 psi

Connections: 1/16" NPT



FKL JACKETED COVER OPTION

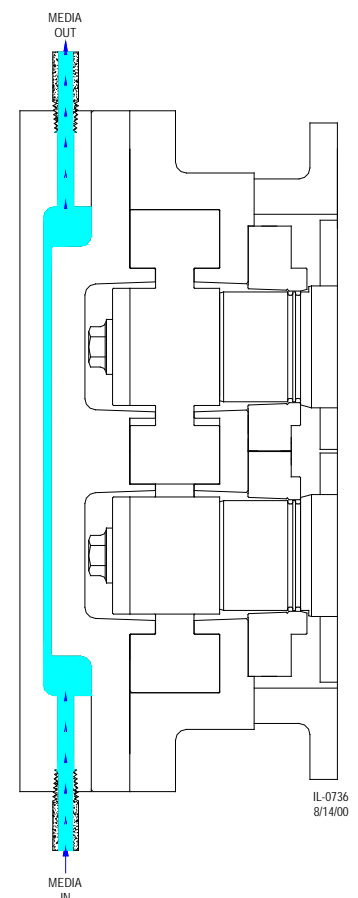
Fristam's jacketed cover is applied directly over the existing cover. It will require longer studs and forcing screws.

Available: all models

Max. Pressure: 100 psi

Connections: 1/8" NPT - FKL 25 - 250; 1/2" NPT - FKL 400

Materials of Construction: 304 stainless steel



TROUBLESHOOTING

Fristam pumps are relatively maintenance free; however, in the event that a problem arises, the following troubleshooting chart will help you with most of your pump-related problems. If a motor or drive problem arises, please contact your local motor repair representative.

This troubleshooting chart has been prepared assuming the installed pump is suitable for the application. If you have questions about your application please contact your local pump distributor to check the system and re-evaluate the application or contact Fristam Pumps, Inc. at 1-800-841-5001 or 608-831-5001.

PROBLEM	CAUSE	SOLUTION
No product flow, pump not turning.	Power is not getting to the drive unit.	Have qualified person check power source.
	Coupler or belts are not connected, slipping or broken.	Install, adjust or repair as necessary.
	Coupler or gear key sheared.	Replace.
No product flow, pump is turning.	Pump rotation is incorrect.	Reverse rotation.
	Valve closed in suction line.	Open valve.
	Suction line clogged or restricted.	Clear suction line.
	Pump speed too slow.	Increase speed.
	Suction line does not remain flooded.	Install foot or check valve.
	Excessive clearances in pump.	Replace out of tolerance components.
	NIPA is too low.	Improve suction conditions to increase NIPA.
Insufficient flow	Speed too low.	Adjust speed as required.
Noisy operation.	Cavitation.	Improve suction conditions to increase NIPA. Slow pump down.
	Improper assembly.	Check assembly.
	Worn or damaged pump components.	Inspect and replace components as necessary.
	Excessive forces from piping,	Support piping independently.
	Excessive discharge pressure Pump/drive misalignment	Reduce discharge pressure. Realign pump and drive.
Drive overload.	Viscosity of product higher than expected.	Increase drive size.
	Higher pressure than expected.	Reduce pump speed, increase piping size.

NOTICE OF TERMS, WARRANTY PROVISIONS INCLUDING DISCLAIMERS, CLAIMS AND LIMITATION OF LIABILITY

Prices and all terms and conditions of sale are established in current price sheets and are subject to change without notice. All orders are subject to acceptance by Fristam Pumps USA Limited Partnership.

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.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. ALL OTHER WARRANTIES WHATSOEVER, EXPRESSED OR IMPLIED BY LAW OR OTHERWISE, ARE HEREBY EXCLUDED.

All claims must be in writing and mailed or delivered by purchaser within thirty (30) days after purchaser learns the facts upon which such claim is based. Any claim not made in writing and within the time period specified above shall be deemed waived.

PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND FRISTAM PUMP'S MAXIMUM LIABILITY FOR CLAIMS ARISING HEREUNDER OR FOR NEGLIGENCE FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM ANY CAUSE SHALL BE EITHER THE REPAIR OR REPLACEMENT OF DEFECTIVE ITEMS OR, AT FRISTAM PUMPS' OPTION, THE REFUND OF THE PURCHASE PRICE FOR SUCH ITEMS. IN NO EVENT, INCLUDING IN THE CASE OF A CLAIM FOR NEGLIGENCE, SHALL FRISTAM PUMPS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFITS.

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If any provision of this Notice is held to be invalid, such provision shall be severed and the remaining provisions shall continue to be in force.

PUMP MAINTENANCE RECORD

[illegible]

PUMP MAINTENANCE RECORD

[illegible]



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Part #: 1050000038
Drawing # 1250000001 Rev C Updated 2/15/10

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