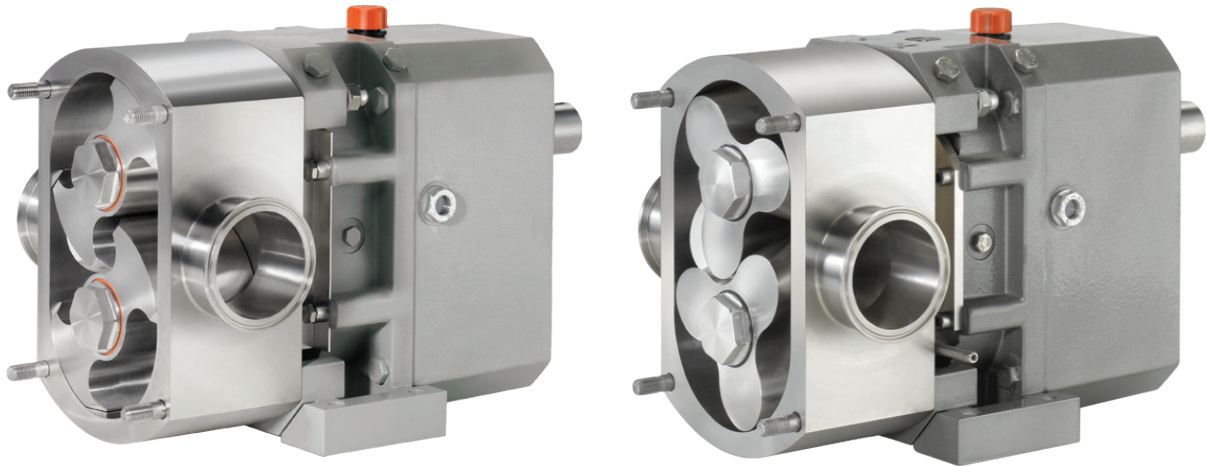




INSTRUCTION AND MAINTENANCE MANUAL:

FL2/FL3 Series Pumps
(Models: 15, 58, 75, 100 & 130)



SANITARY POSITIVE DISPLACEMENT PUMPS

DESCRIPTION

This manual contains installation, operation, assembly, disassembly and repair instructions for the Fristam FL2 15, 58, 75, 100 & 130 models rotary pump and the Fristam FL3 versions of these models.

Fristam FL2 Series bi-wing rotor pumps are positive-displacement pumps with non-contact rotors.

Fristam's FL2 Series bi-wing rotor design combines mechanical simplicity with pumping efficiency. The pump's bi-wing rotor provides easy maintenance, cleanability, gentle product handling and dependability. With nine pump models and a full range of options, you can match your process needs precisely.

The FL2 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.

The FL3 Series pump is a version of the FL2, featuring unique helix-shaped tri-wing rotary lobes, providing increased suction capabilities and virtually eliminating pulsation and reducing noise.



DANGER:

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.

TABLE OF CONTENTS

DESCRIPTION	2
TABLE OF CONTENTS.....	3
TECHNICAL INFORMATION	4
INSTALLATION	7
RECOMMENDED PREVENTIVE MAINTENANCE	9
SEAL REPLACEMENT	10
SINGLE SEAL ASSEMBLY DRAWING.....	11
DOUBLE SEAL ASSEMBLY DRAWINGS	12
PUMP END DISASSEMBLY	13
ADDITIONAL DISASSEMBLY FOR DOUBLE SEAL ONLY.....	14
SEAL ASSEMBLY - DOUBLE SEAL	15
SEAL ASSEMBLY	15
PUMP END ASSEMBLY	16
SHAFT AND/OR BEARING REPLACEMENT	18
GEARBOX DISASSEMBLY	18
GEARBOX ASSEMBLY.....	19
FL2 15 AND 58 (SINGLE SEAL)	21
FL2 15 PART NUMBER LIST	21
PUMP ASSEMBLY DRAWING	22
FL2 58S PART NUMBER LIST.....	24
FL2 58L PART NUMBER LIST.....	25
FL2/3 75 AND 100.....	26
PUMP ASSEMBLY DRAWING	26
FL2 75S PART NUMBER LIST.....	28
FL2/3 75L PART NUMBER LIST.....	29
FL2 100S PART NUMBER LIST.....	30
FL2/3 100L PART NUMBER LIST.....	31
FL2 130	32
PUMP ASSEMBLY DRAWING	32
FL2 130S PART NUMBER LIST.....	34
FL2 130L PART NUMBER LIST.....	35
TROUBLESHOOTING.....	36
PUMP MAINTENANCE RECORD	37
NOTICE OF TERMS, WARRANTY PROVISIONS INCLUDING DISCLAIMERS, CLAIMS AND LIMITATION OF LIABILITY	39

TECHNICAL INFORMATION

SPECIFICATIONS

Maximum Differential Pressure	FL2 15	145 PSI
.....	FL2 58S.....	130 PSI
.....	FL2 58L.....	115 PSI
.....	FL2 75S, 100S & 130S.....	170 PSI
.....	FL2 75L, 100L & 130L.....	120 PSI
.....	FL3 75L & 100L.....	115 PSI
Maximum Inlet Pressure		100 PSI
Temperature Range		up to 350 °F
(For temperatures over 200°F contact your local distributor or Fristam for special pump requirements).		

MATERIALS OF CONSTRUCTION

Primary Product Contact Components	AISI 316L
Cover Gasket.....	Viton (standard)
Also Available in	EPDM
Surface Finish for Product Contact Surfaces	32 Ra (standard)

SHAFT SEALS

Seal Types.....	Single & Double Mechanical
Recommended Seal Flush Water Pressure (double seal)	1-2 PSI (5 PSI maximum)
Recommended Seal Flush Water Flow Rate (double seal).....	3-12 gph
Stationary Seal Ring Material	Carbon
Also Available in	Silicon carbide
Rotating Seal Ring Material	Chrome oxide coated stainless steel
Also Available in	Silicon carbide
O-ring Material	Viton (standard)
Also Available in	EPDM and other options available

LUBRICATION

Oil Grade.....	SAE 15W40
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Oil Capacity - Horizontal

Model 15.....	0.15 liters (0.04 US gallons)
Model 58.....	0.25 liters (0.07 US gallons)
Model 75.....	0.60 liters (0.16 US gallons)
Model 100.....	1.80 liters (0.48 US gallons)
Model 130.....	2.00 liters (0.53 US gallons)

Oil Capacity - Vertical

Model 15.....	0.15 liters (0.04 US gallons)
Model 58.....	0.25 liters (0.07 US gallons)
Model 75.....	0.50 liters (0.13 US gallons)
Model 100.....	1.30 liters (0.34 US gallons)
Model 130.....	1.80 liters (0.48 US gallons)

TABLE A1: 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*
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	.020	.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	6.625
14	.045	.242	7.750	.035	.060	7.750

Dimensions are in inches.

*The "Y" dimension is shown for reference.

TABLE A4: MAXIMUM SPEED

FL2 15	1800 RPM
FL2 58L & S	1000 RPM
FL2 75L & S	800 RPM
FL2 100L & S	600 RPM
FL2 130 L & S	600 RPM
FL3 75-100	1000 RPM

TABLE A2: RECOMMENDED TORQUE VALUES:

	Cover/housing nuts	Rotor nut (standard)	Rotor Nut (flat cover)	Bearing Lock Nut rolling torque
15	5 ft.-lbs.	n/a	5 ft.-lbs. (M8)	
58L & S	15 ft.-lbs.	50 ft.-lbs.	5 ft.-lbs. (M8)	3 in.-lbs.
75L & S	30 ft.-lbs.	80 ft.-lbs.	10 ft.-lbs. (M10)	4 in.-lbs.
100L & S	45 ft.-lbs.	130 ft.-lbs.	n/a	9 in.-lbs.
130 L & S	80 ft.-lbs.	180 ft.-lbs.	n/a	27 in.-lbs.

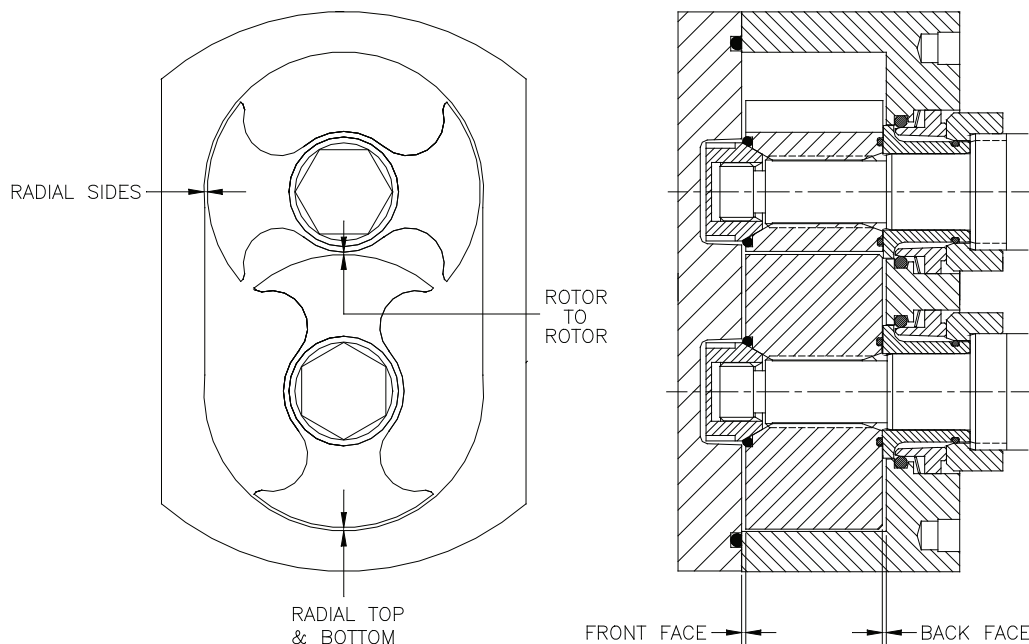


TABLE A3: ROTOR CLEARANCES IN MILLIMETERS (REFERS TO FIGURE 19)

STANDARD FL2/3 ROTOR CLEARANCES					
Model	Back Face	Front Face	Radial Sides	Radial Top & Bottom	Rotor to Rotor
15	0.06-0.08 (0.0024"-0.0031")	0.07-0.15 (0.0028"-0.0057")	0.09-0.12 (0.0036"-0.0046")	0.07-0.10 (0.0028"-0.0039")	0.07-0.12 (0.0028"-0.0047")
58S	0.1-0.13 (0.0039"-0.0051")	0.14-0.23 (0.0055"-0.009")	0.175-0.205 (0.0069"-0.0081")	0.115-0.145 (0.0045"-0.0057")	0.12-0.16 (0.0047"-0.0063")
58L					
75S	0.14-0.17 (0.0055"-0.0067")	0.20-0.29 (0.008"-0.011")	0.264-0.294 (0.010"-0.012")	0.14-0.20 (0.0055"-0.008")	0.125-0.185 (0.005"-0.007")
75L			0.325-0.358 (0.013"-0.014")		
75L (FL3)	0.14-0.17 (0.0055"-0.0067")		0.35-0.39 (0.014"-0.015")	0.22-0.30 (0.009"-0.012")	
100S	0.19-0.23 (0.0075"-0.009")	0.23-0.33 (0.008"-0.0011")	0.4-0.446 (0.016"-0.018")	0.18-0.34 (0.007"-0.013")	0.19-0.265 (0.0075"-0.010")
100L			0.485-0.531 (0.019"-0.021")		
100L (FL3)	0.20-0.22 (0.008"-0.009")		0.50-0.56 (0.020"-0.022")	0.33-0.41 (0.013"-0.016")	
130S	0.19-0.23 (0.0075"-0.009")	0.23-0.33 (0.009"-0.013")	0.46-0.53 (0.018"-0.021")	0.26-0.35 (0.010"-0.014")	0.26-0.34 (0.010"-0.013")
130L	0.21-0.25 (0.008"-0.010")	0.32-0.42 (0.0125"-0.0165")	0.55-0.62 (0.022"-0.024")	0.35-0.44 (0.014"-0.0175")	0.35-0.43 (0.014"-0.017")

HIGH TEMPERATURE FL2/3 ROTOR CLEARANCES					
Model	Back Face	Front Face	Radial Sides	Radial Top & Bottom	Rotor to Rotor
15	0.07-0.09 (0.0028"-0.0035")	0.085-0.165 (0.0033"-0.0065")	0.13-0.16 (0.005"-0.006")	0.11-0.14 (0.0043"-0.0055")	0.11-0.16 (0.0043"-0.0063")
58S	0.12-0.20 (0.0047"-0.008")	0.15-0.28 (0.006"-0.011")	0.215-0.245 (0.0085"-0.0096")	0.16-0.19 (0.006"-0.007")	0.16-0.2 (0.0063"-0.008")
58L					
75S	0.16-0.25 (0.0063"-0.010")	0.2-0.35 (0.008"-0.014")	0.3-0.33 (0.012"-0.013")	0.18-0.24 (0.007"-0.009")	0.16-0.22 (0.0064"-0.009")
75L			0.35-0.38 (0.014"-0.015")		
75L (FL3)	0.22-0.24 (0.0086"-0.0094")		0.35-0.39 (0.014"-0.015")	0.22-0.30 (0.009"-0.012")	
100S	0.27-0.31 (0.011"-0.012")	0.29-0.39 (0.011"-0.015")	0.43-0.48 (0.017"-0.019")	0.21-0.37 (0.008"-0.015")	0.22-0.30 (0.009"-0.012")
100L			0.52-0.56 (0.020"-0.022")		
100L (FL3)	0.29-0.31 (0.011"-0.012")		0.50-0.56 (0.020"-0.022")	0.33-0.41 (0.013"-0.016")	
130S	0.29-0.31 (0.011"-0.012")		0.30-0.38 (0.012"-0.015")	0.50-0.55 (0.020"-0.022")	
130L	0.33-0.35 (0.013"-0.014")		0.58-0.64 (0.023"-0.025")	0.38-0.46 (0.015"-0.018")	

INSTALLATION

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.

PIPING

Follow good piping practices when installing your FL 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 or if suction piping is larger than the pump inlet, use an eccentric reducer, straight side up, to prevent air pockets from forming. (*Figure 2*).
- 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.
- Use a check or “foot” valve on the inlet side of the pump in lift applications to keep the suction piping flooded.

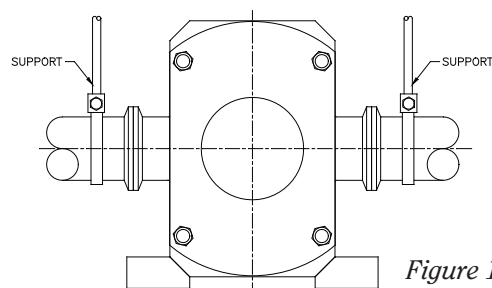


Figure 1

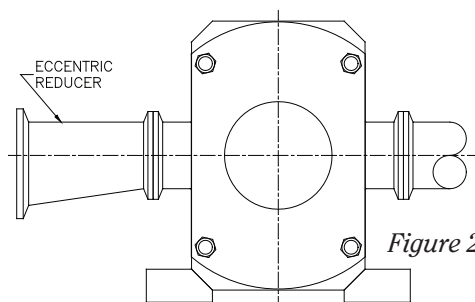


Figure 2

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 3*). 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.

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

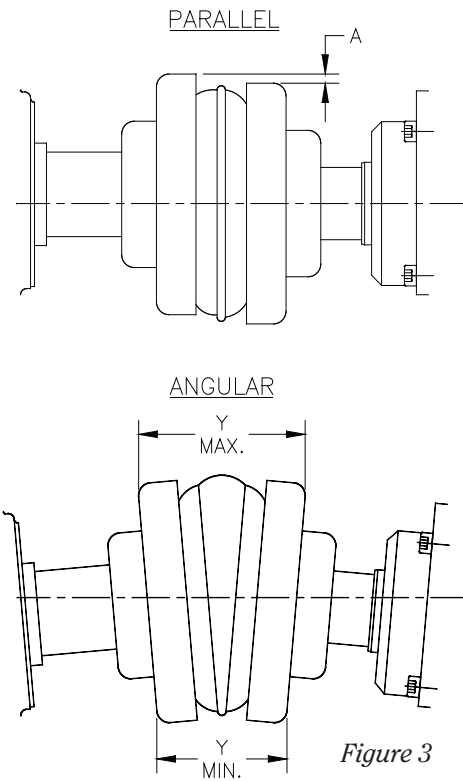


Figure 3

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, lower head losses) 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 seal, water must be supplied to provide cooling and lubrication. Connect supply and return lines to the water pipes supplied with product seal on your pump. See *Figure 4* for the proper orientation. Use about 3-12 gallons (11-45 lph) per hour of water at 1-2 psi (0.07 - 0.14 bar). Note: maximum pressure = 5 psi. Excessive seal pressure and/or flow rate through the product seal cavity may cause increased seal wear and shorten seal life.

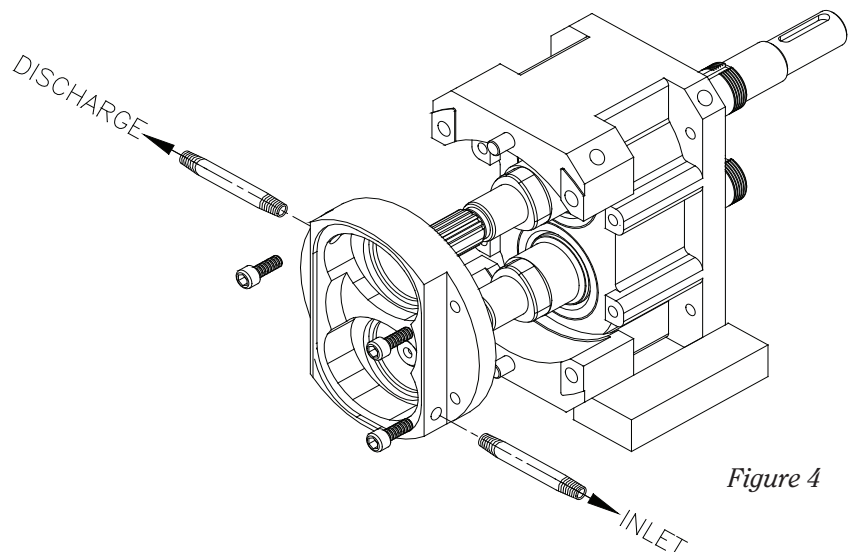


Figure 4

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 4) in this manual for the pump. See instructions from the drive 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. 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. *Do not rotate the shafts with the cover removed. Rotors and housing could be damaged.*

CLEANING RECOMMENDATIONS

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. Please contact your Fristam representative for assistance.

If the process lines are to be cleaned with the pump, use a by-pass loop around the FL2 pump during the CIP mode to maintain pip 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.

Contact Fristam if you have any questions.

RECOMMENDED PREVENTIVE MAINTENANCE

RECOMMENDED TORQUE VALUES

Table A2, page 5.

RECOMMENDED SEAL MAINTENANCE

Visually inspect the mechanical seal regularly for leakage.

Annually replace the mechanical seal under normal conditions.

Replace the 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 mechanical seal replacements.

Model 15: If the rotor bolt o-ring, rotor washer o-ring, or rotor o-ring fails, the threaded hole on the end of the shaft and the rotor bolt threads 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. We recommend cleaning the external threads on the rotor bolt with a wire brush.

Models 58-130: If the rotor nut gasket fails, the threaded hole on the rotor nut and the threads on the end of the shaft will need to be cleaned. A wire brush is recommended for cleaning these threads.

LUBRICATION

Gearbox - 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 4000 hours under normal conditions and every 2000 hours under severe conditions. See the oil capacity listing in the front.

Elastomers - Use a food grade lubricant on o-rings and gaskets unless otherwise specified. If using EPDM o-rings or gaskets, an oil-based lubricant can't be used.

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.

SEAL REPLACEMENT



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:

15: 10 mm wrench
5 mm Allen wrench
Flat cover rotor bolt tool
(included w/pump)
1" socket for flat cover tool

100L & S: 19 mm wrench
41 mm socket
6 mm Allen wrench

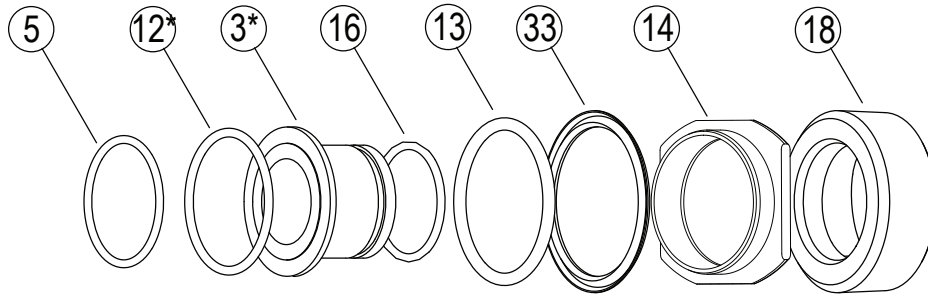
58L & S: 13 mm wrench
24 mm socket
6 mm Allen wrench
Flat cover rotor bolt tool
(included w/pump)
1" socket for flat cover tool

130 L & S: 24 mm wrench
50 mm socket

75L & S: 17 mm wrench
30 mm socket
5 mm Allen wrench
Flat cover rotor bolt tool
(included w/pump)
1" socket for flat cover tool

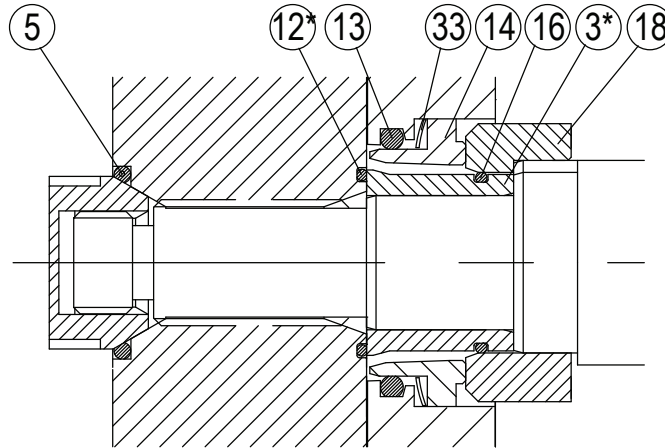
All Models: Torque wrench
1/2" dowel
Soft-faced hammer
Small flat blade screwdriver
Feeler gauges

Figure 8-B: FL2/3 15 - 130 Single seal assembly



DESCRIPTION

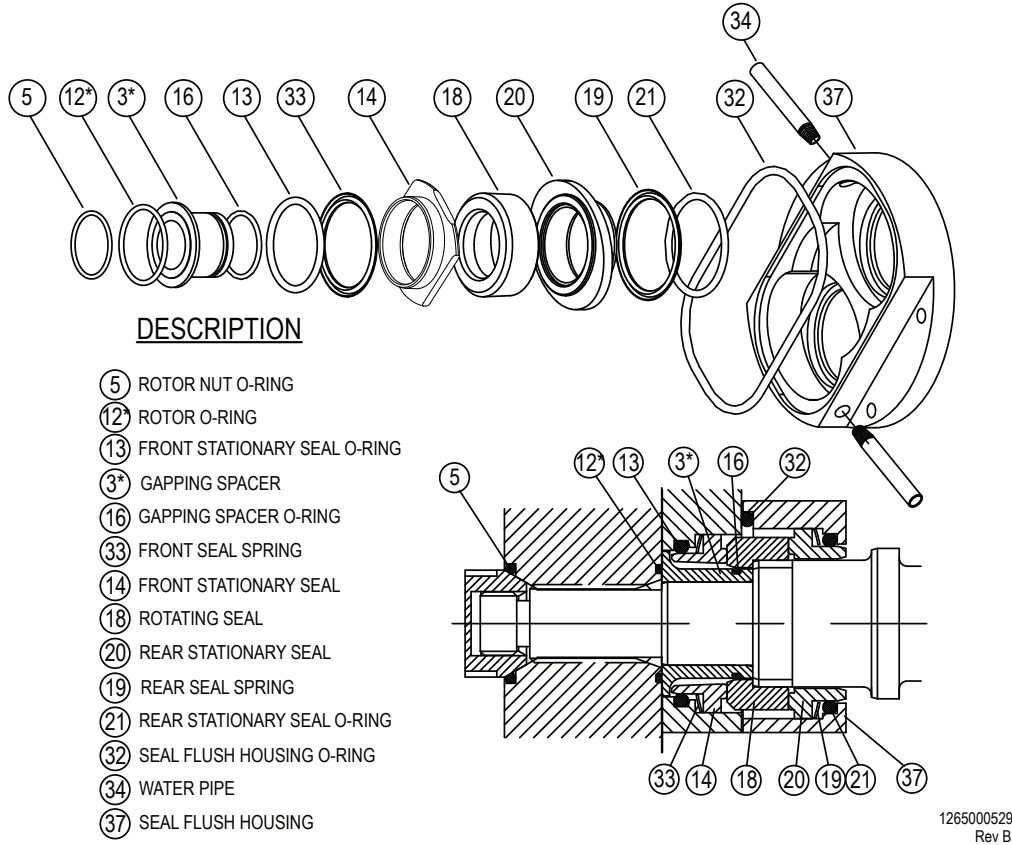
- ⑤ ROTOR NUT O-RING
- ⑫* ROTOR O-RING
- ⑬ STATIONARY SEAL O-RING
- ⑳ SEAL WAVE SPRING
- ⑭ STATIONARY SEAL
- ⑯ GAPPING SPACER O-RING
- ③* GAPPING SPACER
- ⑱ ROTATING SEAL



*PARTS NOT INCLUDED IN FLII 15 PUMPS PRIOR TO MARCH 2009

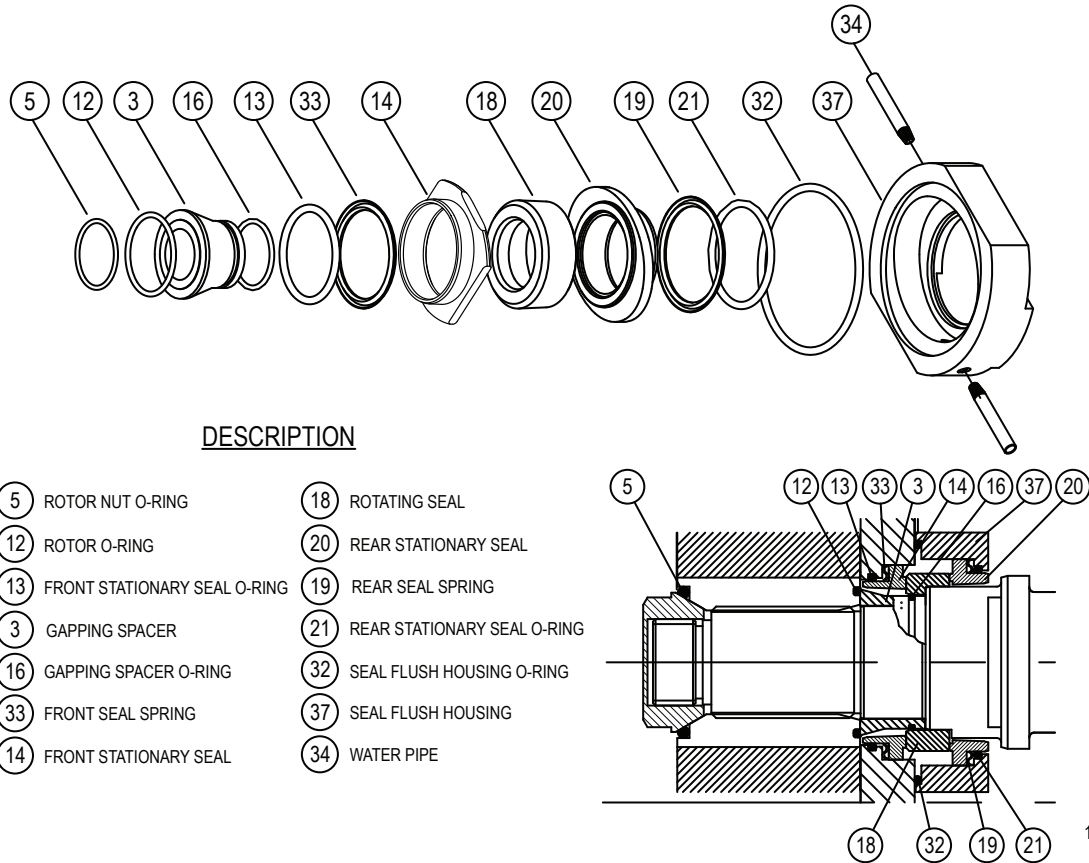
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Figure 12-B: FL2/3 58 - 100 Double seal assembly



*PARTS NOT INCLUDED IN FLII 15 PUMPS PRIOR TO MARCH 2009

Figure 12: FL2 130 Double seal assembly



PUMP END DISASSEMBLY



WARNING 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 seal.

- a) Loosen and remove the four cover dome nuts from the cover.
- b) Next remove the cover. If it is stuck, tap on the cover with a soft-faced hammer (*Figure 5*).
- c) Remove the cover o-ring.
- d) To remove the rotors, first loosen the first rotor, place the dowel between the rotors to prevent rotation as shown in *Figure 6*.

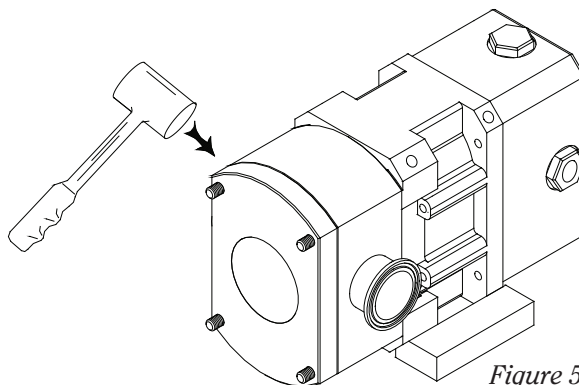


Figure 5

FL3 Only: Secure the drive shaft with a chain wrench to prevent rotation.

- e) Turn the first rotor nut counter-clockwise (models 15-75 require a Flat Cover Rotor Bolt Tool).
- f) Remove the rotor nut and o-ring.
- g) To loosen the other rotor, place the dowel between the rotors on the opposite side of the pump (FL2 only). Again turn the rotor nut counter-clockwise.

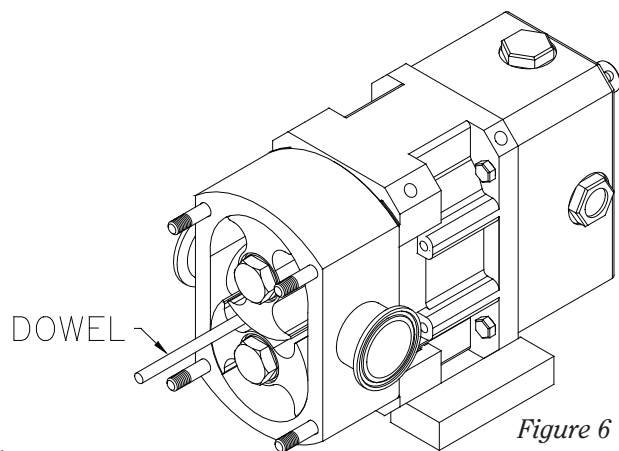


Figure 6

- h) Remove the rotor nut and o-ring.
- i) The rotors and rotor o-rings can now be removed from the pump housing by pulling straight. Handle the rotors with care to avoid damage. While removing the rotors watch for the stamped markings. There should be one dot on the rotor for the drive shaft and two dots on the rotor for the idle shaft.

FL3 Only: Both rotors must be removed at the same time.

REMOVE THE MECHANICAL SEAL

- a) Remove the two housing nuts securing the pump housing to the gearbox.
- b) Slide the pump housing away from the gearbox. If the housing is stuck, alternately tap on the inlet and outlet ports with a soft-faced hammer (*Figure 7*). *Note:* the gapping spacers and the rotating seals will come off with the pump housing (except for the FL2 15).
- c) Clean and examine all of the pump components for damage. Replace damaged com-

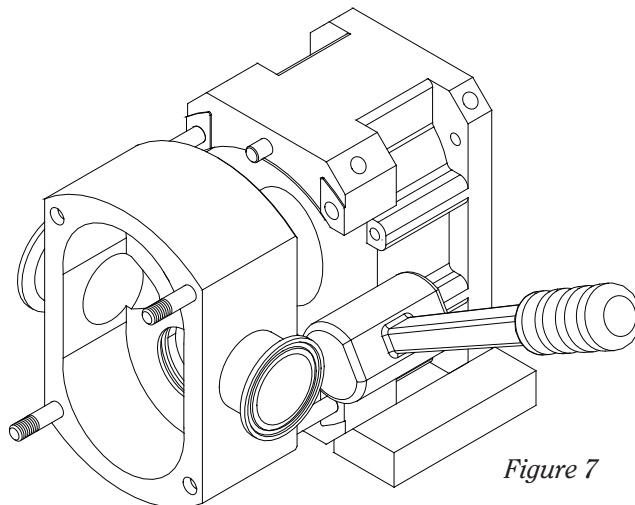


Figure 7

ponents as required. Fristam recommends replacing all of the wetted elastomers during reassembly.

- d) Pull the rotating seals off the gapping spacers and remove both from the pump housing.
- e) Place the pump housing face up on a bench and rest it on the housing studs.
- f) Place your thumbs on the ID of the front stationary seals and push downward to press the stationary seals out of the pump housing (*Figure 9*).
- g) The front seal springs will come out with the stationary seals.
- h) Turn the pump housing over. Use a small flat blade screwdriver to remove the front stationary seal o-rings from the grooves in the pump housing (*Figure 10*).
- i) Discard the o-rings.
- j) Remove the gapping spacer o-rings from the grooves in the gapping spacers and discard.

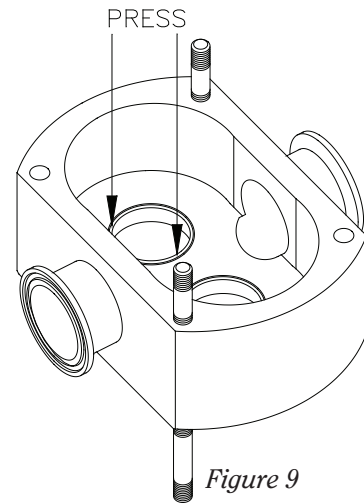


Figure 9

ADDITIONAL DISASSEMBLY FOR DOUBLE SEAL ONLY

For pumps with double mechanical seals, you now have to remove the rear stationary seals.

- a) Remove the seal housing o-ring from the front of the seal flush housing.
FL2 15 only - pull off housing.
 - b) Loosen the seal housing bolts with the Allen wrench.
 - c) Place the seal flush housing face down on the bench.
Place your thumbs on the ID of the rear stationary seals and push downward to press the stationary seals out of the seal flush housing (*Figure 11*).
 - d) The rear seal springs and rear stationary seal o-rings will come out with the stationary seals.
- You are now ready to begin seal assembly.

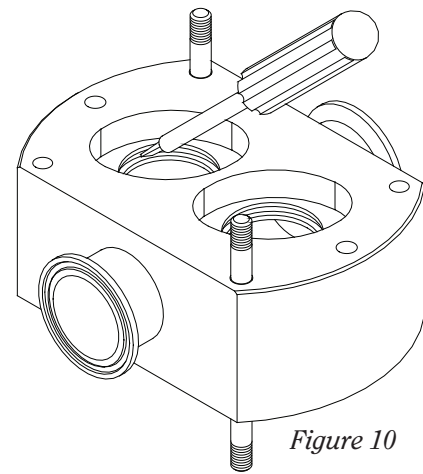
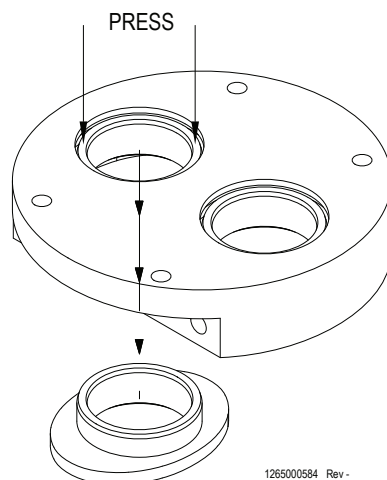
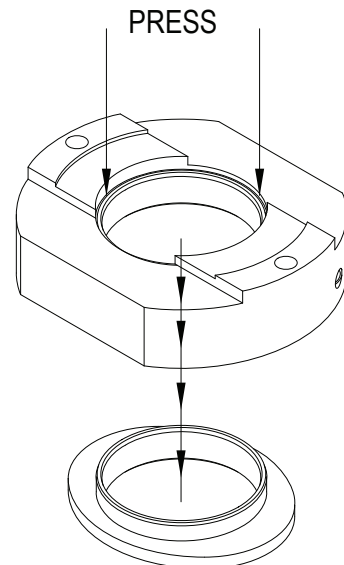


Figure 10



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Figure 11 for models 15 - 100



1265000585 Rev -

Figure 11 for model 130

SEAL ASSEMBLY – FOR DOUBLE SEAL ONLY

- a) Place the seal flush housing face up on a bench.
- b) Lubricate and install the rear stationary seal o-ring in the bottom of the stationary seal cavity.
- c) Install the rear stationary seal spring into the stationary recess.
- d) Install the rear stationary seals into the stationary seal cavity and press into place. Wipe the face of the stationary seals to remove any dirt or oil.
- e) Fasten the seal flush housing to the front of the gearbox.
- f) Install the seal flush housing o-ring onto the seal flush housing.

Finish assembling the seal as outlined in the “Seal Assembly” section.

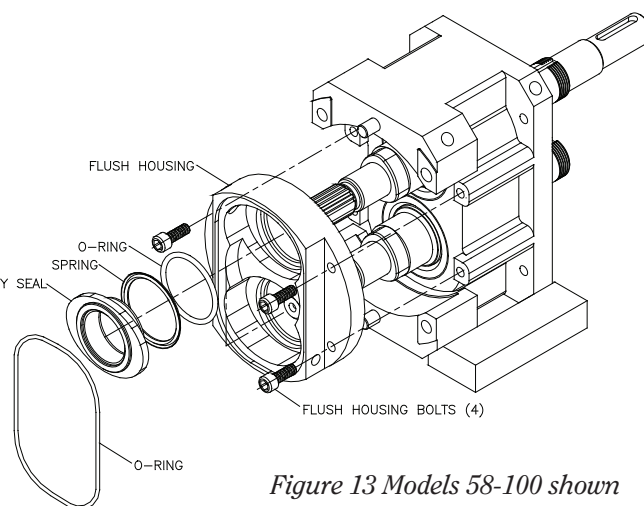
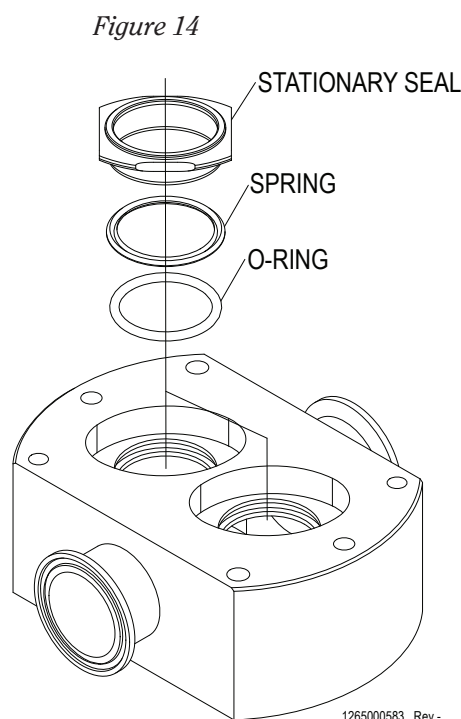


Figure 13 Models 58-100 shown

SEAL ASSEMBLY

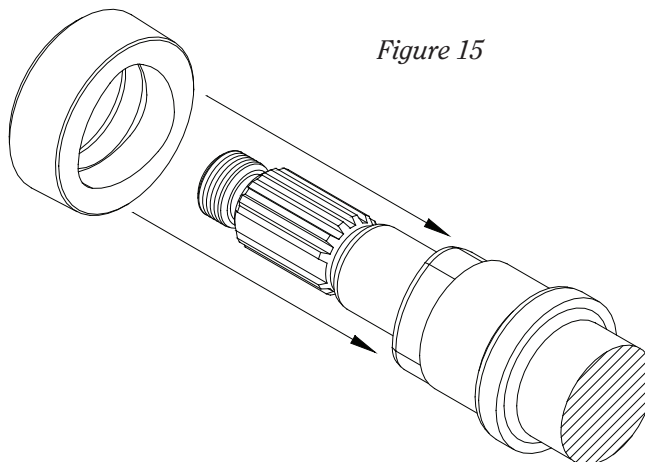
Note: when installing the new seal components make sure that you use all of the components supplied with the replacement seal kit. Using some of the old components may reduce seal life.

- a) With the pump housing lying face down on a table, lubricate and install the front stationary seal o-ring in the housing o-ring groove.
- b) Place the stationary seal spring into the stationary seal cavity in the back of the housing (*Figure 14*).
- c) Use your thumbs to install the front stationary seal into the oval shaped stationary seal cavity in the back of the housing. Wipe the face of the stationary seals to remove any dirt or oil.
- d) Install the rotating seal onto the pump shaft (*Figure 15*). *Note:* the back of the rotating seal has a triangular recess that fits on to the triangular area of the shaft.



1265000583 Rev -

Figure 15



PUMP END ASSEMBLY

- a) Install the pump housing onto the gearbox and secure the housing dome nuts.

NOTE: FOR FL2 15 PRIOR TO MARCH 2009:

- b) Install the gapping spacer and rotor on to the appropriate shaft. Install the rotor with one dot onto the drive shaft and the rotor with two dots onto the idle shaft (*Figure 16a*).

FOR ALL OTHER MODELS:

- b) Install the gapping spacer o-ring into the o-ring groove on the gapping spacer.
- Install the gapping spacer with one dot onto the drive shaft. Install the gapping spacer with two dots onto the idle shaft (*Figure 16*).
 - Install the rotor o-rings into the grooves on the back of the rotors (*Figure 17*).
 - Install the rotors, o-ring side first, into the pump housing. Install the rotor marked with one dot onto the drive shaft. Install the rotor with two dots onto the idle shaft. Note: the dots are located in the o-ring groove on the front of the rotor.

FL3: Both rotors must be installed at the same time.

FOR ALL MODELS:

- c) Install the rotor nut o-rings into the rotor nut groove on the front of the rotor.
- d) Apply one drop of removable thread lock to the shaft threads and thread the rotor nuts onto the shaft in the clockwise direction.
- e) Place the wooden dowel between the rotors as shown in *Figure 18*.

FL3 Only: Secure the drive shaft with a chain wrench to prevent rotation.

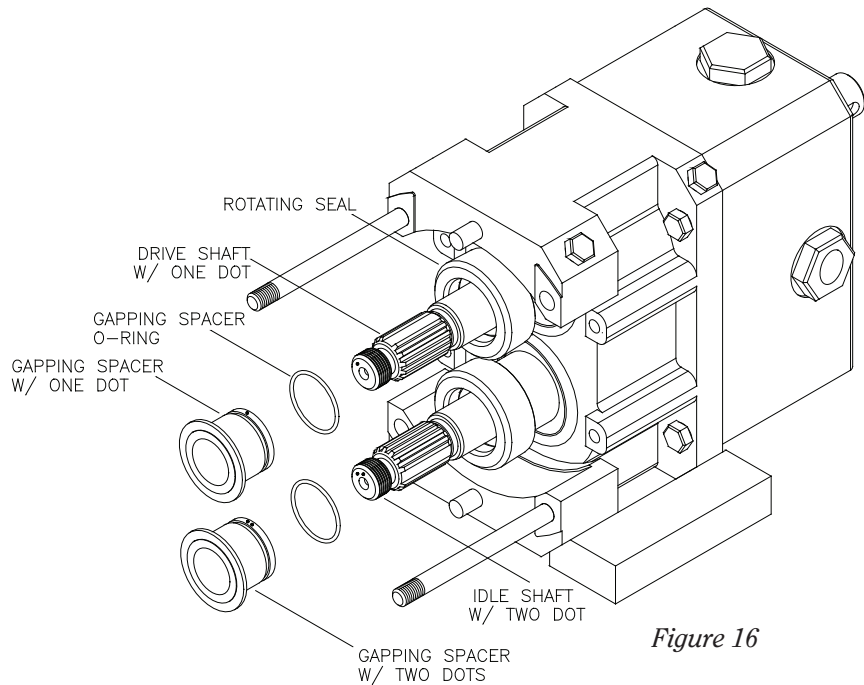


Figure 16

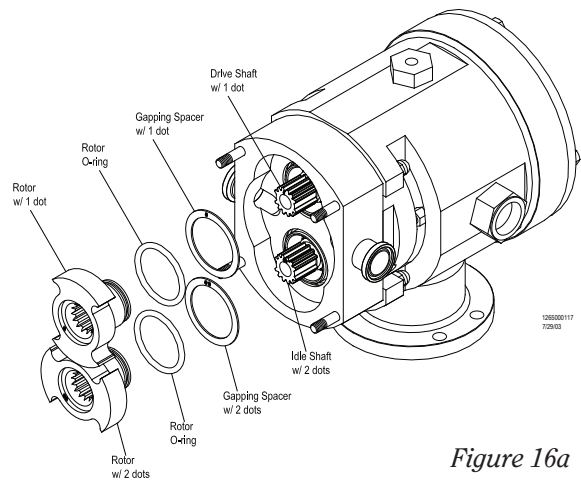


Figure 16a

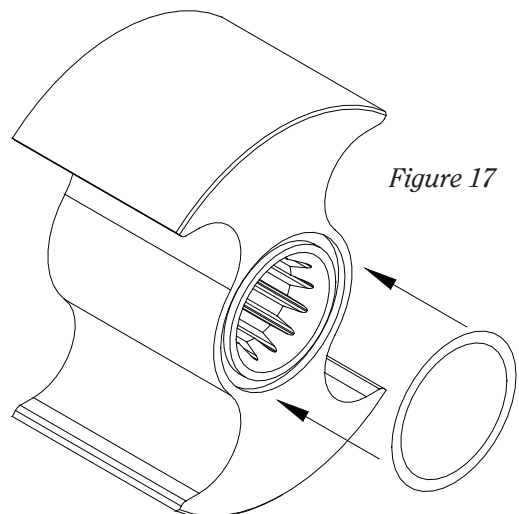


Figure 17

Tighten the first rotor nut with a socket wrench (and Flat Cover Rotor Bolt Tool on models 15-75), to the recommended torque (*Table A2, page 5*).

- f) To tighten the second rotor place the dowel on the opposite side of the pump and tighten the second rotor nut to the proper torque.

Use feeler gauges to verify the back and radial clearances between the rotors and the housing. A depth gauge should be used to verify the front clearance (see *Table A3*).

BACK FACE CLEARANCE

The rotor to housing back face clearance is maintained by the gapping spacer.

To check the back clearance, mount the pump housing onto the gearbox. Make sure to use washers and dome nuts on the long housings studs, to secure the housing. Assemble the gapping spacer, rotor and rotor nut onto the shaft. (Refer to *Table A2* for the proper rotor nut torque.) Measure the clearance between the back face of the pump housing and the back of the rotor with a feeler gauge. Check the reading with the recommended clearance, *Table A3*.

TOO MUCH CLEARANCE

If the clearance is greater than the clearance specified in *Table A3*, remove the gapping spacer or the rotor and gapping spacer on the FL2 15. Machine and lap the o-ring end of the gapping spacer to the required length. Lap the gapping spacer until the shim faces are perfectly flat and the spacer thickness is the same around the entire circumference of the shim. (Recommended lap compound – Liquid Diamond 14 microns)

Re-assemble the gapping spacer, rotor, and rotor nut. Recheck the back face clearance.

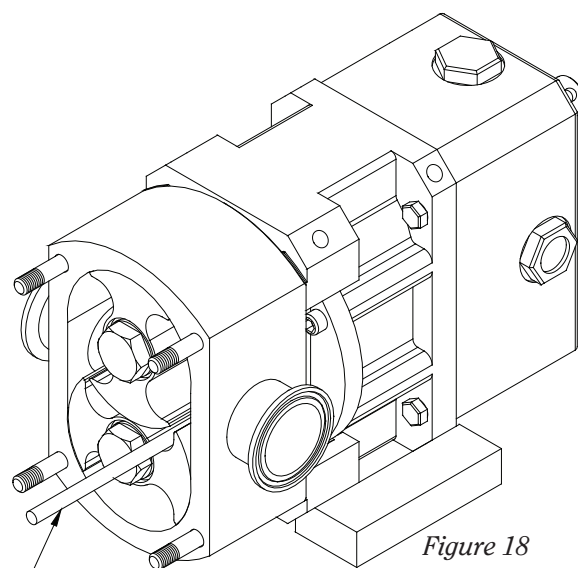
Assemble the pump wet end up as outlined in the “Pump End Assembly” section.

NOT ENOUGH CLEARANCE

If the back clearance is less than the clearance specified in *Table A3* a thicker shim must be added. Remove the gapping spacer. Install a new standard length gapping spacer. Follow the procedures outlined in the *Too Much Clearance* section above.

PUMP END ASSEMBLY (CONT.)

- g) Install the cover o-ring into the o-ring groove in the cover. Install the cover and tighten the dome nuts.
- h) Rotate the drive shaft to verify that the pump turns freely. *Do not rotate the shafts with the cover removed. Rotors and housing could be damaged.*
- i) Check that the oil level is in the center of the oil level sight glass.
- j) Install all required shaft guards. Install inlet and outlet piping. Verify that all valves on the suction and discharge side of the pump are open. Follow proper lockout procedures to re-supply the pump drive with the power. Start the pump.



SHAFT AND/OR BEARING REPLACEMENT



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 SHAFT AND/OR BEARING REPLACEMENT

15

- 10 mm wrench
- 5 mm Allen wrench

100 L & S

- 17 mm wrench
- 6 mm Allen wrench

Tools for all models:

- Spanner wrench
- Soft-faced hammer
- Indicating torque wrench
- Bearing heater

58 L & S

- 10 mm wrench
- 5 mm Allen wrench
- 10 mm tube for bearings

130 L & S

- 17 mm wrench
- 8 mm Allen wrench
- KM12 spanner wrench

- Wooden dowel
- Flat blade screwdriver
- Mild steel rod
- Arbor press (beneficial)

75 L & S

- 10 mm wrench
- 5 mm Allen wrench
- 15 - 17 mm tube for bearings

- Feeler gauges

GEARBOX DISASSEMBLY

Remove the oil drain plug and drain the oil.

Remove the coupling key from the drive shaft.

FL2 15 & 58: remove guards.

Remove the rear cover bolts from the rear cover.

Pull the rear cover off the drive shaft extension. If the cover sticks use a soft-faced hammer to loosen it.

Remove the rear cover oil seal from the rear cover and discard.

Remove the rear cover o-ring from the rear cover and discard.

Straighten the locking tab of the bearing lock washer. Reinstall the rotors on the drive and idle shafts. Lock the rotor with a wood dowel. Remove the lock nut and lock nut washer from the drive shaft and idle shaft.

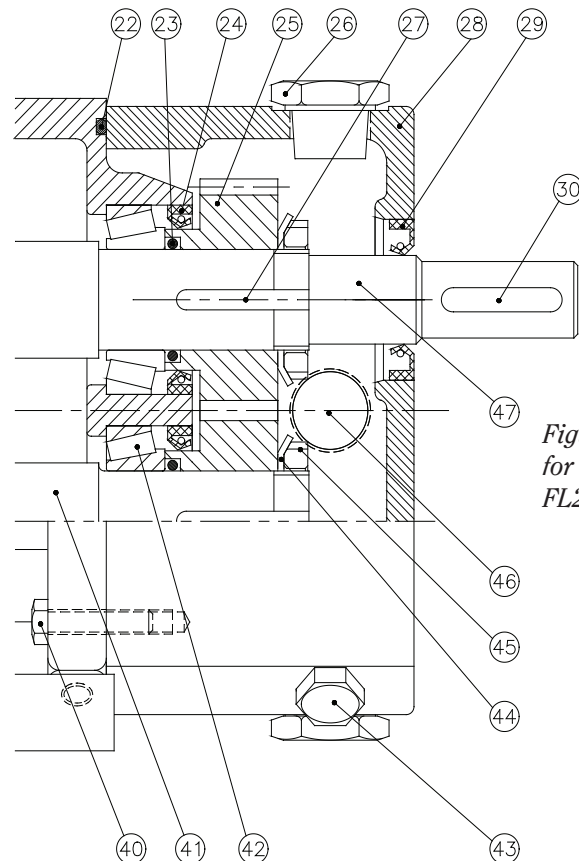


Figure 20
for models
FL2 55-100

Pull the two gears off the pump shafts. Remove the gear keys.

For models 75-130 only: Remove and discard the rear bearing o-rings from the pump shafts and rear bearing lip seals from the rear bearing bore.

Remove and discard the front bearing lip seals from the front bearing bore.

Place the gearbox, wet end down, on an arbor press.

Protect the shaft ends with a wood block and press the drive and idle shaft out of the gearbox.

Remove the rear bearing assemblies from the rear bearing bores and discard.

Remove and discard the rear bearing cups from the rear bearing bores.

Remove and discard the front bearing cups from the front bearing bores.

Heat the front bearing cones on the drive and idle shafts until they expand and drop off. Remove the bearing cones from the pump shafts.

GEARBOX ASSEMBLY

Position the gearbox with wet end up.

Unwrap the front bearing assemblies.

Insert the front bearing cups with the smaller inner diameter toward the inside of the gearbox, into the bearing bores until seated against the shoulder. There should be a tight sliding fit between the housing bore and the bearing cups.

Position the gearbox with the drive end up.

Unwrap rear bearing assemblies.

Insert the rear bearing cups, with the smaller inner diameter toward the inside of the gearbox, into the rear bearing bores until seated against the shoulder. There should be a tight sliding fit between the housing bore and the bearing cups.

Place the bi-wing rotors on a flat surface and insert the shafts into the rotor splines to stand them vertical on a flat surface.

Lubricate the front and rear bearing areas of the drive and idle shafts with grease.

Heat the front bearing cone to 250°F (110°C).

Place the cone and roller assembly over the shaft, with the larger outer diameter toward the rotor.

After the front bearing cone is cooled, use a .02 mm shim stock to check if the cone has moved. The shim stock should not be able to fit between the front bearing cone and shaft shoulder. If the shim can fit between the cone and shaft shoulder the cone will need to be pressed back into place. A piece of mild or stainless steel pipe cut to fit over the shaft and hammer could be used to seat the cone against the shaft shoulder. NOTE: Only tap on the inner cone of the race.

For models 75-130 only: Pack the front cone and roller assemblies with grease for both shafts.

Place the gearbox over the shafts.

For models 75-130 only: Generously apply grease to the rear bearing cups and insert into the rear bearing bore.

For models 75-130 only: Pack the rear cone and roller assemblies with grease then heat the cones to 250°F (110°C).

Place the cone and roller assemblies over the shafts with the smaller diameter end sliding over the shaft first. Tap them into place if necessary. Make sure that there is some endplay.

Lubricate the gear area of the shaft and the face of the lock washer, with oil.

For models 75-130 only: Place the rear bearing o-rings over the shafts and seat against the cone of the rear bearing.

For models 75-130 only: Lubricate the rear bearing lip seals with oil. Press the rear bearing lip seals into the rear bearing bores. The flat side of the seal goes inside the gearbox and the recessed side should face you.

Position both shaft gear keys to the 12:00 position.

Place the gear, lock washer and lock nut onto the shafts and hand tighten.

After the gears are installed, turn the shafts to make sure they turn freely and that the rotors are timed correctly.

Use a spanner wrench to tighten the bearing lock nut on the drive shaft.

Measure rolling torque with no load on bearing. Set the torque wrench to zero while rotating, this will remove the load caused by the lip seal.

For models 15 & 58: Measure rolling torque with no load on bearing, there should be zero endplay on the shafts.

The bearing locknut should be tightened until the rolling torque on the shaft measures the values in Table A3, Page 6.

Tighten the locknut on the idle shaft, following the previous steps.

For models 75-130 only: Measure the shaft endplay to be sure it is zero. If the endplay is not zero, repeat the tightening steps. To repeat these steps, the locknut will have to be backed off and the bearing will have to be tapped to remove the loading.

Lubricate and install the front bearing lip seals.

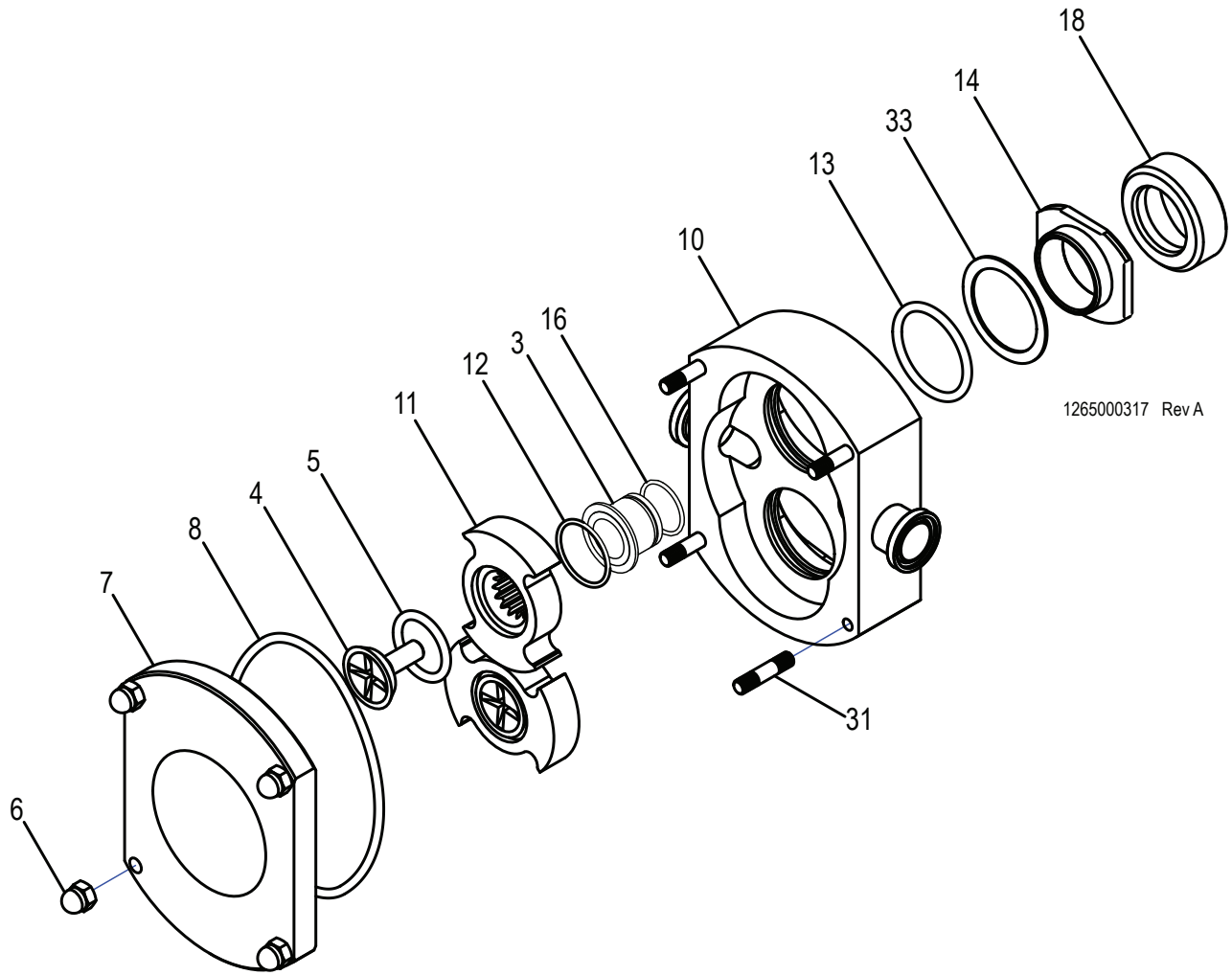
Lubricate and install the rear cover oil seal into the rear cover.

Install the rear cover o-ring and mount the rear cover assembly over the drive shaft extension onto the gearbox.

Fill the oil reservoir with oil to the middle of the sight glass.

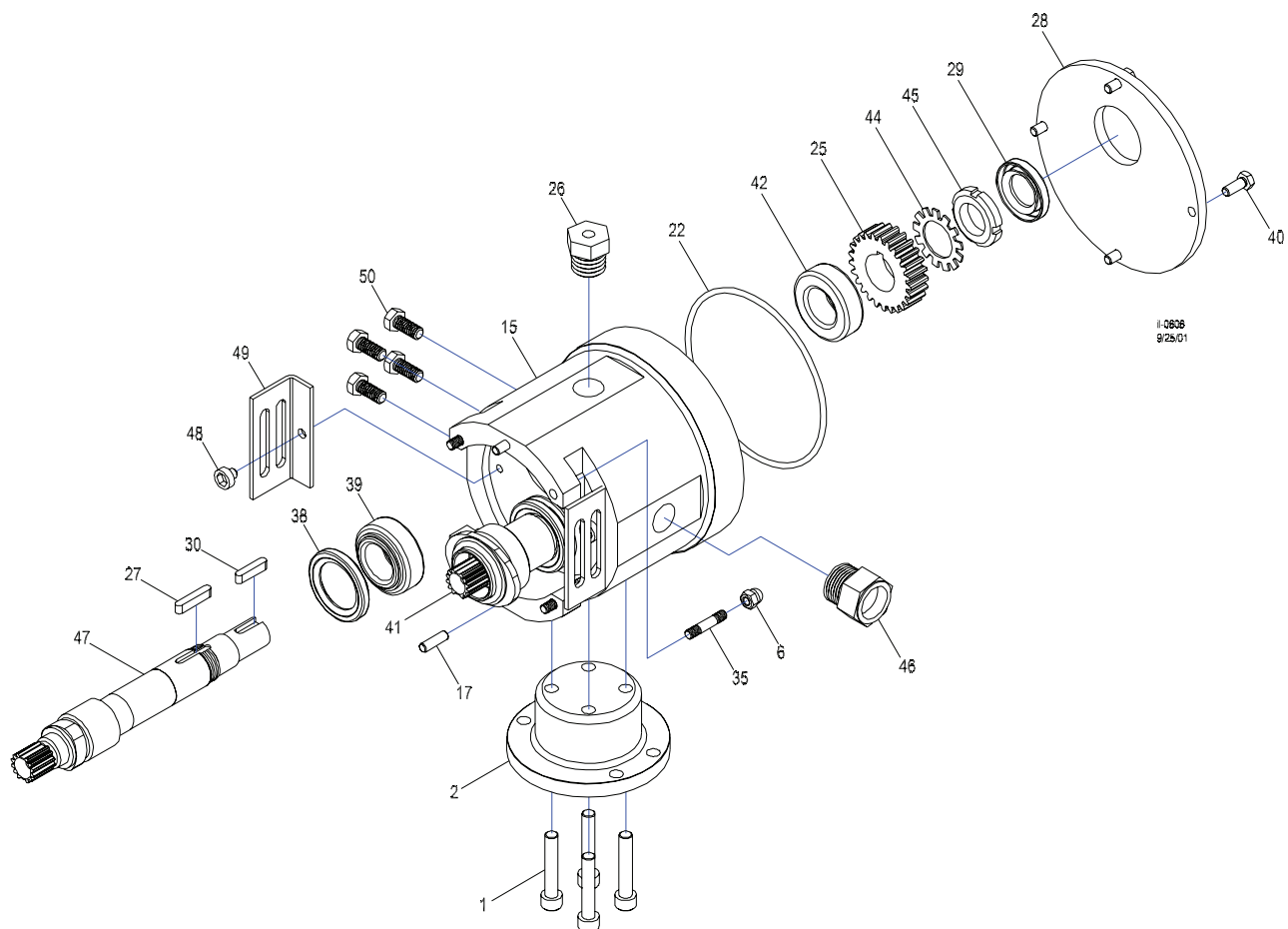
FL2 15 PART NUMBERS

Item No.	Description	Qty.	Part No.	Item No.	Description	Qty.	Part No.
1	Mounting foot bolt	4	1101000129	28	Gearbox cover	1	1383001405
2	Mounting foot	1	1925001403	29	Rear oil seal	1	1812002503
3	Gapping shim	2	1224000110	30	Coupling key	1	1315002621
4	Rotor nut	2	1102004220	31	Cover stud	2	1103001406
5	Rotor nut o-ring (viton)	2	1180000379	32	Seal flush housing o-ring (viton)	1	1180000234
	Rotor nut o-ring (EPDM)		1180000393		Seal flush housing o-ring (EPDM)		1180000235
6	Cover/Housing nut	8	1103004836	33	Front seal spring	2	1820004238
7	Cover	1	1650621420	34	Water pipe	4	1910000011
8	Cover o-ring (viton)	1	1181000075	35	Housing stud	2	1103001407
	Cover o-ring (EPDM)		1180000557	37	Seal flush housing	1	1845001480
10	Housing	1	1650611412	38	Front oil seal	2	1812002516
11	Rotor (standard)	2	1650631408	39	Front bearing	2	1173001002
	Rotor (high temperature)		1650631409	40	Gearbox cover bolt	4	1101000040
12	Rotor o-ring (viton)	2	1180000121	41	Idle shaft	1	1382001461
	Rotor o-ring (EPDM)		1180000249	42	Rear bearing	2	1173001002
13	Front stationary seal o-ring (viton)	2	1180000380	44	Bearing lock washer	2	1104001003
	Front stationary seal o-ring (EPDM)		1180000395	45	Bearing lock nut	2	1103001004
14	Front stationary seal (carbon)	2	1815604240	46	Sight glass	1	1248000029
	Front stationary seal (silicon carbide)		1815600188	47	Drive shaft	1	1382001460
15	Gearbox	1	1310601401	48	Guard screw	2	1101000130
16	Gapping shim o-ring (viton)	2	1180000326	49	Guard	2	1936001437
	Gapping shim o-ring (EPDM)		1180000347	50	Bolt	4	1101000131
17	Pin	2	1891002618	51	Distance screw	2	1891001439
18	Rotating seal (chrome oxide/SS)	2	1810604241				
	Rotating seal (silicon carbide)		1810600149	Tool	Flat Cover Rotor Bolt Tool	1	1018004111
19	Rear seal spring	2	1820000060	Notes:			
20	Rear stationary seal (carbon)	2	1815604242				
21	Rear stationary seal o-ring (buna)	2	1180000387				
22	Rear cover o-ring (viton)	1	1180000919				
25	Gear	2	1365001404				
26	Oil plug	1	1248000023				
27	Gear key	2	1315002619				



MODELS 15 & 58 EXPLODED VIEW

1	Mounting Foot Bolt	13	Front Stationary Seal O-ring
2	Mounting Foot	14	Front Stationary Seal
3	Gapping Spacer	15	Gearbox
4	Rotor Nut	16	Gapping Spacer O-Ring
5	Rotor Nut O-ring	17	Pin
6	Cover/Housing Nut	18	Rotating Seal
7	Cover	19	Rear Seal Spring (double seal only)
8	Cover O-ring	20	Rear Stationary Seal (double seal only)
10	Housing	21	Rear Stationary Seal O-ring (double seal only)
11	Rotor	22	Rear Cover O-ring
12	Rotor O-ring		



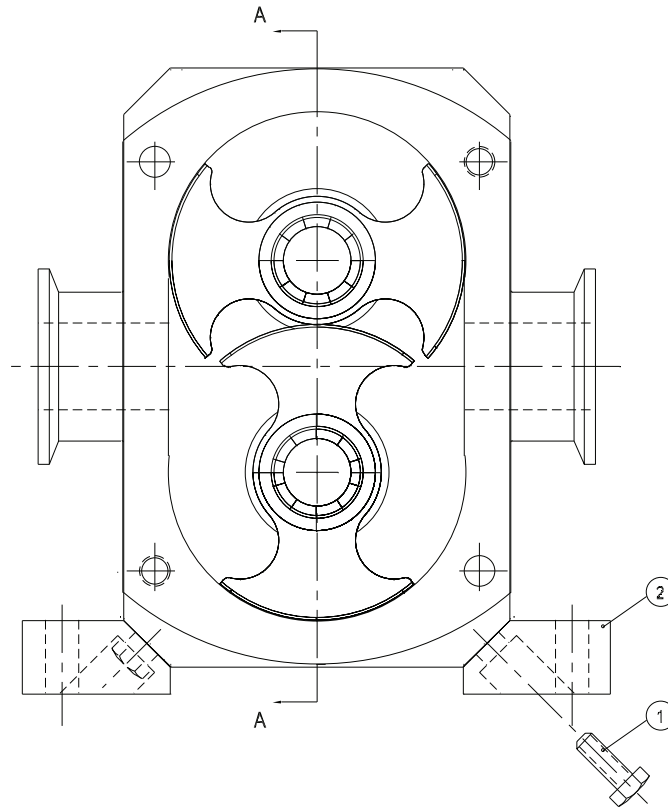
25	Gear	38	Front Oil Seal
26	Oil Plug	39	Front Bearing
27	Gear Key	40	Gearbox Cover Bolt
28	Gearbox Cover	41	Idle Shaft
29	Rear Oil Seal	42	Rear Bearing
30	Coupling Key	44	Bearing Lock Washer
31	Cover Stud	45	Bearing Lock Nut
32	Seal Flush Housing O-ring (double seal only)	46	Sight Glass
33	Front Seal Spring	47	Drive Shaft
34	Water Pipe (double seal only)	48	Guard screw (single seal only)
35	Housing Stud	49	Guard (single seal only)
37	Seal Flush Housing (double seal only)	50	Bolt
		51	Distance screw (double seal only)

FL2 58S PART NUMBERS

Item No.	Description	Qty.	Part No.	Item No.	Description	Qty.	Part No.
1	Mounting foot bolt	4	1101000129	28	Gearbox cover	1	1383001305
2	Mounting foot	1	1925001303	29	Rear oil seal	1	1812002503
3	Gapping shim	2	1224001330	30	Coupling key	1	1315002605
4	Rotor nut	2	1103003509	31	Cover stud	4	1103001506
5	Rotor nut o-ring (viton)	2	1180000379	32	Seal flush housing o-ring (viton)	1	1180000011
	Rotor nut o-ring (EPDM)		1180000393		Seal flush housing o-ring (EPDM)		1180000005
6	Cover/Housing nut	8	1103004836	33	Front seal spring	2	1820004238
7	Cover	1	1679621320	34	Water pipe	4	1910000011
8	Cover o-ring (viton)	1	1181000141	35	Housing stud	4	1103001506
	Cover o-ring (EPDM)		1181000081	37	Seal flush housing	1	1845001380
10	Housing	1	1678611312	38	Front oil seal	2	1812002517
11	Rotor (standard)	2	1678631308	39	Front bearing	2	1173001021
	Rotor (high temperature)		1678631312	40	Gearbox cover bolt	4	1101000040
12	Rotor o-ring (viton)	2	1180000326	41	Idle shaft	1	1382001397
	Rotor o-ring (EPDM)		1180000347	42	Rear bearing	2	1173001021
13	Front stationary seal o-ring (viton)	2	1180000380	44	Bearing lock washer	2	1104000023
	Front stationary seal o-ring (EPDM)		1180000395	45	Bearing lock nut	2	1103001012
14	Front stationary seal (carbon)	2	1815601340	46	Sight glass	1	1248000029
	Front stationary seal (silicon carbide)		1815600189	47	Drive shaft	1	1382001396
15	Gearbox	1	1310601301	48	Guard screw	2	1101000130
16	Gapping shim o-ring (viton)	2	1180000413	49	Guard	2	1936001437
	Gapping shim o-ring (EPDM)		1180000450	50	Bolt	4	1101000131
17	Pin	2	1891002606	51	Distance screw	2	1891001339
18	Rotating seal (chrome oxide/SS)	2	1810601341	Notes: special rotor bolt tool, see page 21			
	Rotating seal (silicon carbide)		1810600150				
19	Rear seal spring	2	1820000060				
20	Rear stationary seal (carbon)	2	1815604242				
21	Rear stationary seal o-ring (buna)	2	1180000569				
22	Rear cover o-ring (buna)	1	1180000568				
25	Gear	2	1365001304				
26	Oil plug	1	1248000023				
27	Gear key	2	1315002620				

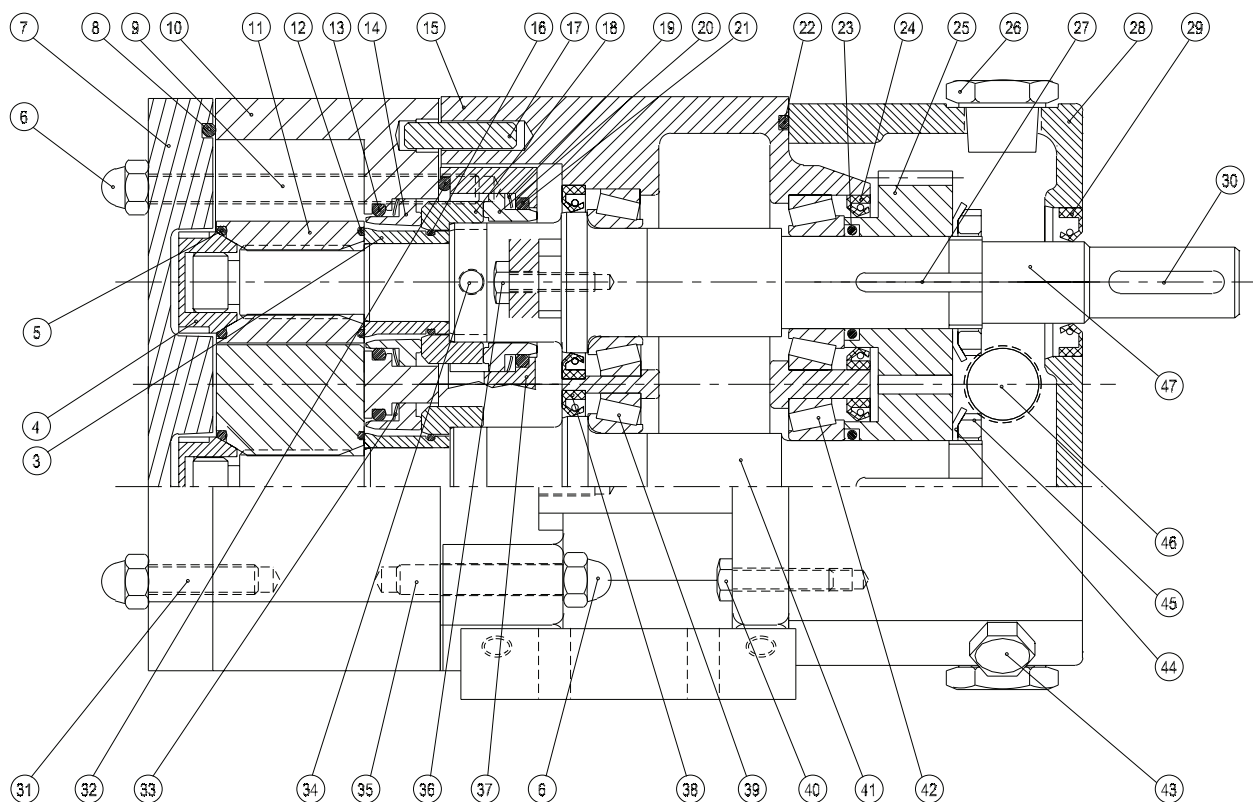
FL2 58L PART NUMBERS

Item No.	Description	Qty.	Part No.	Item No.	Description	Qty.	Part No.
1	Mounting foot bolt	4	1101000129	28	Gearbox cover	1	1383001305
2	Mounting foot	1	1925001303	29	Rear oil seal	1	1812002503
3	Gapping shim	2	1224001330	30	Coupling key	1	1315002605
4	Rotor nut	2	1103003509	31	Cover stud	4	1103001506
5	Rotor nut o-ring (viton)	2	1180000379	32	Seal flush housing o-ring (viton)	1	1180000011
	Rotor nut o-ring (EPDM)		1180000393		Seal flush housing o-ring (EPDM)		1180000005
6	Cover/Housing nut	8	1103000032	33	Front seal spring	2	1820004238
7	Cover	1	1679621320	34	Water pipe	4	1910000011
8	Cover o-ring (viton)	1	1181000141	35	Housing stud	4	1103001506
	Cover o-ring (EPDM)		1181000081	37	Seal flush housing	1	1845001380
10	Housing	1	1679611352	38	Front oil seal	2	1812002517
11	Rotor (standard)	2	1679631362	39	Front bearing	2	1173001021
	Rotor (high temperature)		1679631349	40	Gearbox cover bolt	4	1101000040
12	Rotor o-ring (viton)	2	1180000326	41	Idle shaft	1	1382001399
	Rotor o-ring (EPDM)		1180000347	42	Rear bearing	2	1173001021
13	Front stationary seal o-ring (viton)	2	1180000380	44	Bearing lock washer	2	1104000023
	Front stationary seal o-ring (EPDM)		1180000395	45	Bearing lock nut	2	1103001012
14	Front stationary seal (carbon)	2	1815601340	46	Sight glass	1	1248000029
	Front stationary seal (silicon carbide)		1815600189	47	Drive shaft	1	1382001398
15	Gearbox	1	1310601301	48	Guard screw	2	1101000130
16	Gapping shim o-ring (viton)	2	1180000413	49	Guard	2	1936001437
	Gapping shim o-ring (EPDM)		1180000450	50	Bolt	4	1101000131
17	Pin	2	1891002606	51	Distance screw	2	1891001339
18	Rotating seal (chrome oxide/SS)	2	1810601341	Notes: special rotor bolt tool, see page 21			
	Rotating seal (silicon carbide)		1810600150				
19	Rear seal spring	2	1820000060				
20	Rear stationary seal (carbon)	2	1815604242				
21	Rear stationary seal o-ring (buna)	2	1180000569				
22	Rear cover o-ring (buna)	1	1180000568				
25	Gear	2	1365001304				
26	Oil plug	1	1248000023				
27	Gear key	2	1315002620				



EXPLODED VIEW OF FL2/3 75 & 100

1	Mounting Foot Bolt	13	Front Stationary Seal O-ring
2	Mounting Foot	14	Front Stationary Seal
3	Gapping Spacer	15	Gearbox
4	Rotor Nut	16	Gapping Spacer O-ring
5	Rotor Nut O-ring	17	Housing Pins
6	Cover/Housing Dome Nuts	18	Rotating Seal
7	Cover	19	Rear Seal Spring
8	Cover O-ring	20	Rear Stationary Seal
9	Housing thru studs	21	Rear Stationary Seal O-ring
10	Pump Housing	22	Rear Cover O-ring
11	Rotor/Bi-wing Rotors	23	Rear Bearing O-ring
12	Rotor O-ring	24	Rear Bearing Lip Seal



SECTION A-A

1285000319
11/18/05

25	Gear	37	Seal Flush Housing
26	Oil Fill Plug	38	Front Bearing Lip Seal
27	Gear Key	39	Front Bearing
28	Rear Cover	40	Rear Cover Bolt
29	Rear Cover Oil Seal	41	Idle Shaft
30	Coupling Key	42	Rear Bearing
31	Cover Studs	43	Drain Plug
32	Seal Flush Housing O-ring	44	Bearing Lock Washer
33	Front Seal Spring	45	Bearing Lock Nut
34	Water Pipe	46	Sight Glass
35	Housing Studs	47	Drive Shaft
36	Flush Housing Bolts		

FL2 75S PART NUMBERS

Item #	Part #	Description	QTY
1	1101000080	Mounting Foot Screw	4
2	1925004303	Foot (zinc plated)	2
2	1925004304	Foot (stainless steel)	2
2	1925004403	Vertical Mount Foot (zinc plated)	2
2	1925004404	Vertical Mount Foot (stainless steel)	2
3	1224004315	Gapping Spacer	2
4	1103003609	Rotor Nut	2
4	1102004420	Rotor Nut (flat cover)	2
5	1181000073	Rotor Nut O-ring (viton)	2
5	1181000079	Rotor Nut O-ring (epdm)	2
6	1101000137	Dome Nut	6
7	1687621620	Pump Cover	1
7	1687624320	Pump Cover (flat cover)	1
8	1181000072	Cover O-ring (viton)	1
8	1181000080	Cover O-ring (epdm)	1
9	1103004433	Thru Stud	2
10	1685614340	Pump Housing	1
11	1685634401	Rotor	2
12	1180000341	Rotor O-ring (viton)	2
12	1180000077	Rotor O-ring (epdm)	2
13	1180000044	Stationary Seal O-ring (viton)	2
13	1180000168	Stationary Seal O-ring (epdm)	2
14	1815600190	Front Stationary Seal (silicon carbide)	2
14	1815604440	Front Stationary Seal (carbon)	2
15	1310604301	Gearbox (cast iron)	1
15	1310604302	Gearbox (S.S.)	1
16	1180000350	Gapping Spacer O-ring (viton)	2
16	1180000076	Gapping Spacer O-ring (epdm)	2
17	1891002613	Pin	2
18	1810600151	Silicon Carbide Rotating	2
18	1810604441	Chrome Oxide Rotating	2
19	1820000015	Rear Spring	2
20	1815604442	Rear Stationary Seal (carbon)	2
21	1180000030	Rear Stationary Seal O-ring (buna)	2
22	1181000077	Rear Cover O-ring	1

Item #	Part #	Description	QTY
23	1180000354	Gear O-ring (viton)	2
24	1812002508	Gear Lip Seal	2
25	1381001604	Gear	2
26	1248000023	Vent Plug	1
27	1315002611	Gear Key	2
28	1383004305	Rear Cover (cast iron)	1
28	1383004306	Rear Cover (S.S.)	1
29	1812002509	Rear Lip Seal	1
30	1315002638	Coupler Key	1
31	1103001606	Front Housing Stud	2
32	1180000389	Seal Flush Housing O-ring (buna)	1
33	1820000062	Front Spring	2
34	1910000012	Water Pipe	4
35	1103001607	Rear Housing Stud	2
36	1101000080	Flush Housing Bolt	4
37	1845004380	Seal Flush Housing	1
38	1812002510	Front Lip Seal	2
39	1173001009	Front Bearing	2
40	1101000127	Rear Cover Bolt	4
41	1382004322	Idle Shaft	1
41	1382004324	Idle Shaft (flat cover)	1
42	1173001010	Rear Bearing	2
43	1248000012	Drain Plug	1
44	1104001011	Lock Washer	2
45	1103001012	Gear Nut	2
46	1248000029	Sight Glass	2
47	1382004321	Drive Shaft D	1
47	1382004323	Drive Shaft (flat cover)	1

Note: special rotor bolt tool, see page 21

FL2/3 75L PART NUMBERS

Item #	Part #	Description	QTY
1	1101000080	Mounting Foot Screw	4
2	1925004303	Foot (zinc plated)	2
2	1925004304	Foot (stainless steel)	2
2	1925004403	Vertical Mount Foot (zinc plated)	2
2	1925004404	Vertical Mount Foot (stainless steel)	2
3	1224004315	Gapping Spacer	2
4	1103003609	Rotor Nut	2
4	1102004420	Rotor Nut (flat cover)	2
5	1181000073	Rotor Nut O-ring (viton)	2
5	1181000079	Rotor Nut O-ring (epdm)	2
6	1101000137	Dome Nut	6
7	1687621620	Pump Cover	1
7	1687624320	Pump Cover (flat cover)	1
8	1181000072	Cover O-ring (viton)	1
8	1181000080	Cover O-ring (epdm)	1
9	1103004433	Thru Stud	2
10	1687614360	Pump Housing	1
11	1687634411	Rotor (FL2)	2
11	0688630013	Left Rotor (FL3)	1
11	0688630012	Right Rotor (FL3)	1
12	1180000341	Rotor O-ring (viton)	2
12	1180000077	Rotor O-ring (epdm)	2
13	1180000044	Stationary Seal O-ring (viton)	2
13	1180000168	Stationary Seal O-ring (epdm)	2
14	1815600190	Front Stationary Seal (silicon carbide)	2
14	1815604440	Front Stationary Seal (carbon)	2
15	1310604301	Gearbox (cast iron)	1
15	1310604302	Gearbox (S.S.)	1
16	1180000350	Gapping Spacer O-ring (viton)	2
16	1180000076	Gapping Spacer O-ring (epdm)	2
17	1891002613	Pin	2
18	1810600151	Silicon Carbide Rotating	2
18	1810604441	Chrome Oxide Rotating	2
19	1820000015	Rear Spring	2
20	1815604442	Rear Stationary Seal (carbon)	2
21	1180000030	Rear Stationary Seal O-ring (buna)	2
22	1181000077	Rear Cover O-ring	1

Item #	Part #	Description	QTY
23	1180000354	Gear O-ring	2
24	1812002508	Gear Lip Seal	2
25	1381001604	Gear (FL2)	2
25	0396660004	Gear (FL3)	2
26	1248000023	Vent Plug	1
27	1315002611	Gear Key	2
28	1383004305	Rear Cover (cast iron)	1
28	1383004306	Rear Cover (S.S.)	1
29	1812002509	Rear Lip Seal	1
30	1315002638	Coupler Key	1
31	1103001606	Front Housing Stud	2
32	1180000389	Seal Flush Housing O-ring (buna)	1
33	1820000062	Front Spring	2
34	1910000012	Water Pipe	4
35	1103001607	Rear Housing Stud	2
36	1101000080	Flush Housing Bolt	4
37	1845004380	Seal Flush Housing	1
38	1812002510	Front Lip Seal	2
39	1173001009	Front Bearing	2
40	1101000127	Rear Cover Bolt	4
41	1382004332	Idle Shaft (FL2)	1
41	1382004334	Idle Shaft (FL 2 flat cover)	1
41	0393640005	Idle Shaft (FL3)	1
42	1173001010	Rear Bearing	2
43	1248000012	Drain Plug	1
44	1104001011	Lock Washer	2
45	1103001012	Gear Nut	2
46	1248000029	Sight Glass	2
47	1382004331	Drive Shaft (FL2)	1
47	1382004333	Drive Shaft (FL 2 flat cover)	1
47	0393650005	Drive Shaft (FL3)	1

Note: special rotor bolt tool, see page 21

FL2 100S PART NUMBERS

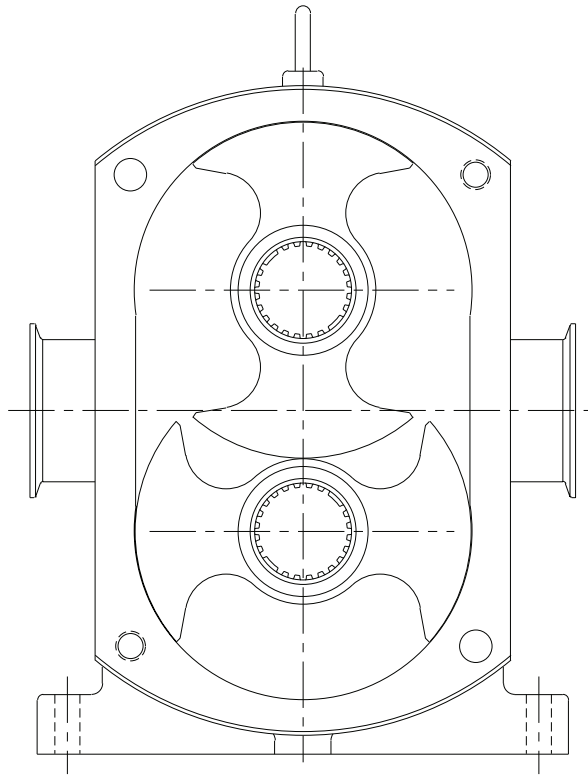
Item #	Part #	Description	QTY
1	1101000007	Mounting Foot Screw	4
2	1925004503	Foot (zinc plated)	2
3	1224004515	Gapping Spacer	2
4	1103003709	Rotor Nut	2
5	1180000260	Rotor Nut O-ring (viton)	2
5	1180000394	Rotor Nut O-ring (epdm)	2
6	1103004835	Dome Nut	6
7	1692621720	Pump Cover	1
8	1180000998	Cover O-ring (viton)	1
8	1180000007	Cover O-ring (epdm)	1
9	1103004632	Thru Stud	2
10	1690614540	Pump Housing	1
11	1690634601	Rotor	2
12	1180000383	Rotor O-ring (viton)	2
12	1180000397	Rotor O-ring (epdm)	2
13	1180000253	Stationary Seal O-ring (viton)	2
13	1180000278	Stationary Seal O-ring (epdm)	2
14	1815600191	Silicon Carbide Stationary	2
14	1815604640	Carbon Stationary	2
15	1310604501	Gearbox (cast iron)	1
16	1180000343	Gapping Spacer O-ring (viton)	2
16	1180000396	Gapping Spacer O-ring (epdm)	2
17	1891002609	Pin	2
18	1810600152	Silicon Carbide Rotating	2
18	1810604641	Chrome Oxide Rotating	2
19	1820000029	Rear Spring	2
20	1815604640	Rear Seal (carbon)	2
21	1180000253	Rear Stationary Seal O-ring (viton)	2
22	1180000385	Rear Cover O-ring	1
23	1180000378	Gear O-ring	2
24	1812002505	Rear Lip Seal	2
25	1381001704	Gear	2

Item #	Part #	Description	QTY
26	1248000023	Vent Plug	1
27	1315002607	Gear Key	2
28	1383004505	Rear Cover (cast iron)	1
29	1812002507	Rear Cover Lip Seal	1
30	1315002637	Coupler Key	1
31	1103001706	Front Housing Stud	2
32	1180000390	Seal Flush Housing O-ring (buna)	1
33	1820000029	Front Spring	2
34	1910000013	Water Pipe	4
35	1103001707	Rear Housing Stud	2
36	1101000080	Flush Housing Bolt	4
37	1845004580	Seal Flush Housing	1
38	1812002504	Front Lip Seal	2
39	1173001005	Front Bearing	2
40	1101000136	Rear Cover Bolt	4
41	1382004522	Idle Shaft	1
42	1173000008	Rear Bearing	2
43	1248002614	Drain Plug	1
44	1104001021	Lock Washer	2
45	1103001008	Gear Nut	2
46	1248000029	Sight Glass	2
47	1382004521	Drive Shaft	1

FL2/3 100L PART NUMBERS

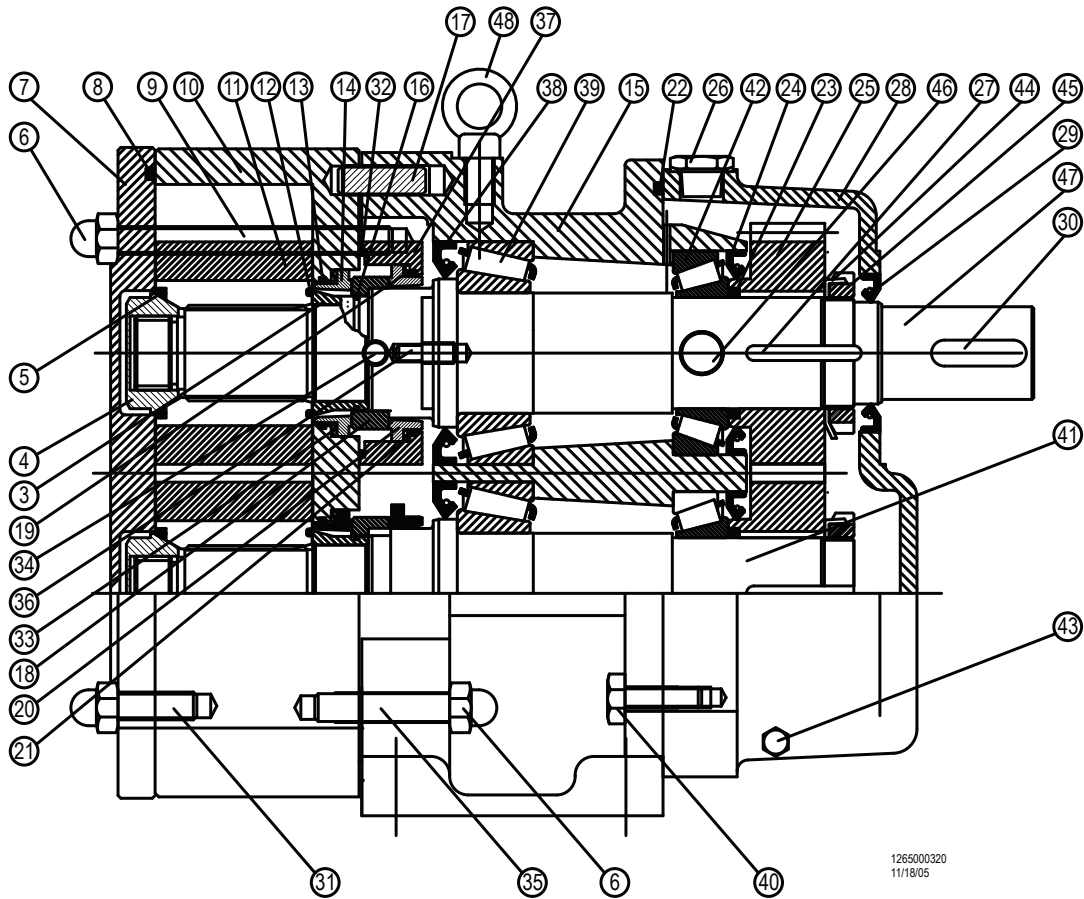
Item #	Part #	Description	QTY
1	1101000007	Mounting Foot Screw	4
2	1925004503	Foot (zinc plated)	2
3	1224004515	Gapping Spacer	2
4	1103003709	Rotor Nut	2
5	1180000260	Rotor Nut O-ring (viton)	2
5	1180000394	Rotor Nut O-ring (epdm)	2
6	1103004835	Dome Nut	6
7	1692621720	Pump Cover	1
8	1180000998	Cover O-ring (viton)	1
8	1180000007	Cover O-ring (epdm)	1
9	1103004633	Thru Stud	2
10	1692614560	Pump Housing	1
11	1692634611	Rotor (FL2)	2
	0688630021	Left Rotor (FL3)	1
	0688630020	Right Rotor (FL3)	1
12	1180000383	Rotor O-ring (viton)	2
12	1180000397	Rotor O-ring (epdm)	2
13	1180000253	Stationary Seal O-ring (viton)	2
13	1180000278	Stationary Seal O-ring (epdm)	2
14	1815600191	Silicon Carbide Stationary	2
14	1815604640	Carbon Stationary	2
15	1310604501	Gearbox (cast iron)	1
16	1180000343	Gapping Spacer O-ring (viton)	2
16	1180000396	Gapping Spacer O-ring (epdm)	2
17	1891002609	Pin	2
18	1810600152	Silicon Carbide Rotating	2
18	1810604641	Chrome Oxide Rotating	2
19	1820000029	Rear Spring	2
20	1815604640	Rear Seal (carbon)	2
21	1180000253	Rear Stationary Seal O-ring (viton)	2
22	1180000385	Rear Cover O-ring	1
23	1180000378	Gear O-ring	2
24	1812002505	Rear Lip Seal	2
25	1381001704	Gear (FL2)	2
25	0397660005	Gear (FL3)	2

Item #	Part #	Description	QTY
26	1248000023	Vent Plug	1
27	1315002607	Gear Key	2
28	1383004505	Rear Cover (cast iron)	1
29	1812002507	Rear Cover Lip Seal	1
30	1315002637	Coupler Key	1
31	1103001706	Front Housing Stud	2
32	1180000390	Seal Flush Housing O-ring (buna)	1
33	1820000029	Front Spring	2
34	1910000013	Water Pipe	4
35	1103001707	Rear Housing Stud	2
36	1101000080	Flush Housing Bolt	4
37	1845004580	Seal Flush Housing	1
38	1812002504	Front Lip Seal	2
39	1173001005	Front Bearing	2
40	1101000134	Rear Cover Bolt	4
41	1382004532	Idle Shaft (FL2)	1
41	0394640007	Idle Shaft (FL3)	1
42	1173000008	Rear Bearing	2
43	1248002614	Drain Plug	1
44	1104000021	Lock Washer	2
45	1103001008	Gear Nut	2
46	1248000029	Sight Glass	2
47	1382004531	Drive Shaft (FL2)	1
47	0394650007	Drive Shaft (FL3)	1



FL2 130 EXPLODED VIEW

3	Gapping Spacer	19	Rear Seal Spring
4	Rotor Nut	20	Rear Stationary Seal
5	Rotor Nut O-ring	21	Rear Stationary Seal O-ring
6	Cover/Housing Dome Nuts	22	Rear Cover O-ring
7	Cover	23	Rear Bearing O-ring
8	Cover O-ring	24	Rear Bearing Lip Seal
9	Housing thru studs	25	Gear
10	Pump Housing	26	Oil Fill Plug
11	Rotor/Bi-wing Rotors	27	Gear Key
12	Rotor O-ring	28	Rear Cover
13	Front Stationary Seal O-ring	29	Rear Cover Oil Seal
14	Front Stationary Seal	30	Coupling Key
15	Gearbox	31	Cover Studs
16	Gapping Spacer O-ring	32	Seal Flush Housing O-ring
17	Housing Pins	33	Front Seal Spring
18	Rotating Seal	34	Water Pipe



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11/18/05

- 35 Housing Studs
- 36 Seal Flush Housing Pins
- 37 Seal Flush Housing
- 38 Front Bearing Lip Seal
- 39 Front Bearing
- 40 Rear Cover Bolt
- 41 Idle Shaft
- 42 Rear Bearing
- 43 Drain Plug
- 44 Bearing Lock Washer
- 45 Bearing Lock Nut
- 46 Sight Glass
- 47 Drive Shaft
- 48. Lifting Lug

FL2 130S PART NUMBERS

Item #	Part #	Description	QTY
3	1224004715	Gapping spacer	2
4	1103001809	Rotor bolt	2
5	1180000384	Rotot bolt o-ring (viton)	2
5	1180000392	Rotor bolt o-ring (EPDM)	2
6	1103000012	Cover nut	6
7	1692621820	Pump cover	1
8	1181000074	Cover o-ring (viton)	1
8	1181000082	Cover o-ring (EPDM)	1
9	1103004832	Housing stud FL2 130S	2
10	1695614740	Pump housing with 3" clamp fittings	1
10	1695614742	Pump housing with 4" clamp fittings	1
11	1695634801	Rotor	2
12	1180000233	Rotor o-ring (viton)	2
13	1180000381	Front stationary seal o-ring (viton)	2
13	1180000365	Front stationary seal o-ring (EPDM)	2
14	1815604840	Front stationary seal (carbon)	2
14	1815600191	Front stationary seal (silicon carbide)	2
15	1310604702	Gearbox (cast iron) horizontal	1
15	1310604701	Gearbox (cast iron) vertical	1
16	1180000115	Gapping spacer o-ring (viton)	2
16	1180000205	Gapping spacer o-ring (EPDM)	2
17	1891002617	Housing pins	2
18	1810604841	Rotating seal (chrome oxide)	2
18	1810600153	Rotating seal (silicon carbide)	2
19	1820004839	Rear seal wave spring	2
20	1815604842	Rear stationary seal (carbon)	2
21	1180000388	Rear stationary seal o-ring (buna)	2
22	1180000339	Rear cover o-ring (buna)	1
23	1181000078	Rear Bearing o-ring	2
24	1812002514	Rear oil seal	2
25	1381001804	Gear	2

Item #	Part #	Description	QTY
26	1248000023	Vent plug	1
27	1315002635	Gear key	2
28	1383001805	Rear cover (cast iron)	1
29	1812002515	Rear cover oil seal	1
30	1315002636	Coupling key	1
31	1103001806	Cover studs	2
32	1180000382	Seal flush housing o-ring (viton)	1
33	1820004838	Front seal wave spring	2
34	1910000013	Water pipe	4
35	1103001807	Housing stud	2
36	1103004834	Seal flush housing stud	4
37	1845004780	Seal flush housing	2
38	1812002513	Front oil seal	2
39	1173001017	Front bearing	2
40	1101000138	Rear cover bolt	4
41	1382004722	Idle shaft	1
42	1173001018	Rear bearing	2
43	1248002614	Oil drain plug	1
44	1104001019	Bearing lock nut washer	2
45	1103001020	Bearing lock nut	2
46	1248000029	Sight glass	2
47	1382004721	Drive shaft	1
48	1101001826	Eyebolt	1
	1936004717	Shaft guard	2

FL2 130L PART NUMBERS

Item #	Part #	Description	QTY
3	1224004715	Gapping spacer	2
4	1103001809	Rotor bolt	2
5	1180000384	Rotot bolt o-ring (viton)	2
5	1180000392	Rotor bolt o-ring (EPDM)	2
6	1103000012	Cover nut	6
7	1692621820	Pump cover	1
8	1181000074	Cover o-ring (viton)	1
8	1181000082	Cover o-ring (EPDM)	1
9	1103004833	Housing stud FL2 130L	2
10	1697614760	Pump housing -4" clamp fittings	1
11	1697634811	Rotor	2
12	1180000233	Rotor o-ring (viton)	2
13	1180000381	Front stationary seal o-ring (viton)	2
13	1180000365	Front stationary seal o-ring (EPDM)	2
14	1815604840	Front stationary seal (carbon)	2
14	1815600191	Front stationary seal (silicon carbide)	2
15	1310604702	Gearbox (cast iron) horizontal	1
15	1310604701	Gearbox (cast iron) vertical	1
16	1180000115	Gapping spacer o-ring (viton)	2
16	1180000205	Gapping spacer o-ring (EPDM)	2
17	1891002617	Housing pins	2
18	1810604841	Rotating seal (chrome oxide)	2
18	1810600153	Rotating seal (silicon carbide)	2
19	1820004839	Rear seal wave spring	2
20	1815604842	Rear stationary seal (carbon)	2
21	1180000388	Rear stationary seal o-ring (buna)	2
22	1180000339	Rear cover o-ring (buna)	1
23	1181000078	Rear bearing o-ring (viton)	2
24	1812002514	Rear oil seal	2
25	1381001804	Gear	2

Item #	Part #	Description	QTY
26	1248000023	Vent plug	1
27	1315002635	Gear key	2
28	1383001805	Rear cover (cast iron)	1
29	1812002515	Rear cover oil seal	1
30	1315002636	Coupling key	1
31	1103001806	Cover stud	2
32	1180000382	Seal flush housing o-ring (viton)	2
33	1820004838	Front seal wave spring	2
34	1910000013	Water pipe	4
35	1103001807	Housing stud	2
36	1103004834	Seal flush housing stud	4
37	1845004780	Seal flush housing	2
38	1812002513	Front oil seal	2
39	1173001017	Front bearing	2
40	1101000138	Rear cover bolt	4
41	1382004732	Idle shaft	1
42	1173001018	Rear bearing	2
43	1248002614	Oil drain plug	1
44	1104001019	Gear locknut washer	2
45	1103001020	Gear locknut	2
46	1248000029	Sight glass	2
47	1382004731	Drive shaft	1
48	1101001826	E yebolt	1
	1936004717	Shaft guard	2

TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Pump not turning	Interruption of electrical power.	Reset circuit breaker, check fuses.
	Keys sheared or missing.	Replace.
	Coupler or belts are not connected.	Replace or adjust.
	Pump shaft or gears sheared.	Replace.
	Wrong rotation.	Reverse.
Pump not priming	Relief valve not properly adjusted.	Adjust valve.
	Valve closed in suction line.	Open valve.
	Suction line clogged or restricted.	Clear suction line.
	Air leak in connections or seal.	Repair leak.
	Pump speed too slow.	Increase speed.
	Suction line does not remain flooded.	Install foot valve.
	Air lock.	Bleed suction line.
Insufficient flow	Excessive clearances in pump.	Replace out of tolerance parts.
	NIPA low.	Increase suction pressure.
Noisy operation	Speed too low.	Adjust speed as required.
	Air leak.	Repair leak.
Noisy operation	Cavitation.	Increase NIPA.
	Viscous product.	Slow pump, reduce product.
	High vapor pressure, high temp.	Reduce temperature.
	Leaks in piping or pump.	Repair leaks.
	Dissolved gas in product.	Reduce discharge pressure.
	Mechanical noise.	Check tolerances.
	Excessive weight from piping, pump body distorted.	Support piping.
	Excessive discharge pressure.	Reduce discharge pressure.
	Worn bearing.	Replace bearing.
	Worn gears.	Replace gears.
Rotor-to-rotor contact.	Time rotors, replace twisted shafts, replace worn gears.	
Pump overloads	Viscosity of product higher than expected.	Reduce pump speed, increase piping size.
	Higher pressure than expected	Reduce pump speed, increase piping size.
Play between gears	Worn gear teeth.	Replace gear.
	Gear loose on shaft.	Inspect gear key, keyway and shaft. If all are undamaged, retighten the gear retaining nut. Check for backlash.

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