Fristam PUMPS®

Engineered For Lasting Performance®

INSTRUCTION AND MAINTENANCE MANUAL:

FP-Style Pump Bearing Block Style

(For pumps with 56 - 365TS motor frame)

3-A®

Sanitary Centrifugal Pumps

Description

This manual contains installation, operation, assembly, disassembly and repair instructions for the Fristam “L” bearing block style centrifugal pump.

The “L” style pump is flange mounted to a heavy-duty cast iron bearing block. The bearing block is coupled to a motor and mounted on a stainless steel adjustable baseplate.

The motors used on “L” style pumps are standard NEMA totally enclosed fan cooled (TEFC) rigid base motors. Replacement motors are readily available from local motor distributors. IEC motors are also available.

There are three general styles of pump heads in “L” type Fristam pumps. The FP 700 and 1700 series are non-volute style pumps. The FP 3400 and 3500 series are volute style. The FP 1050 and 1150 are also volute style. In general, maintenance procedures for all three series are generally the same. Any variations are clearly noted.

CAUTION: Begin all pump maintenance operations by disconnecting the energy source to the pump. Observe all lock out/tag out procedures as outlined by ANSI Z244.1-1982 and OSHA 1910.147 to prevent accidental start-up and injury.

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Technical Information

Specifications

Maximum Inlet Pressure ..... 150 PSI
Temperature Range ..... -40°F - 400°F
Noise Level ..... 60 - 85 dB(A)

Materials of Construction

Primary Product Contact Components ..... AISI 316L
Cover Gasket ..... BUNA (standard)
Also available in ..... Viton, EPDM, Silicone, Chemraz, Kalrez
Surface Finish for Product Contact Surfaces ..... 32 Ra (standard)

Shaft Seals

Mechanical Seal Type ..... Single or Double Internal
Stationary Seal Ring Material ..... Carbon (standard)
Also available in ..... Silicon Carbide
Rotating Seal Ring Material ..... Chrome Oxide coated Stainless Steel
Also available in ..... Silicon Carbide
Seal O-ring Material ..... Viton (standard)
Also available in ..... BUNA-N, EPDM

Motor Information

Uses standard NEMA TEFC rigid base motors. Options include washdown, high efficiency, explosion proof, chemical duty and IEC.

Voltage and Frequency

3 phase, 60 Hz, 208-230/460 VAC ..... 1750/3500 RPM
3 phase, 60 Hz, 575 VAC ..... 1750/3500 RPM
3 phase, 50 Hz, 208-220/330-415 VAC ..... 1450/2900 RPM

Available Motor Sizes (Horsepower)

3, 5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75

Lubrication

Bearing Block Oil ..... ISO VG 68

Recommended Preventive Maintenance

Recommended Torque Values

Impeller nut	70-80 ft.-lbs.
Seal retaining ring bolts	10 ft.-lbs.
Housing bolts	50 ft.-lbs. (for 3VR bearing block only)
Housing clamp bolts	80 ft.-lbs. (for #1 bearing block only)
Adapter bolt	80 ft.-lbs. (for #1 bearing block only)
Bearing cap bolts	10 ft.-lbs. (for #1 bearing block only)
Bearing cap bolts	20 ft.-lbs. (for #1 bearing block only)

Recommended Seal Maintenance

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

Elastomer Inspection

Inspect all elastomers when performing pump maintenance. We recommend replacing elastomers (o-rings and gaskets) during seal, pump shaft and/or motor replacement. If the impeller nut gasket fails, the threaded hole on the impeller nut and the threads on the end of the shaft will need to be cleaned. A wire brush is recommended for cleaning these threads.

Bearing Block Oil Recommendations

The oil level should be maintained to the center of the sight glass on the side of the bearing block. It is recommended that when the pump is first installed the oil is changed after the initial 20 hours of operation. After this, the oil should be changed every 2,000 hours or 3 months under normal operating conditions. Make sure the oil drain pipe and cap are properly tightened to prevent any oil leakage from the bearing block.

Motor Lubrication Recommendations

Use a high-grade ball and roller bearing grease. Recommendations for standard service conditions include **Shell Dolium R** or **Chevron SRI**. (See **Tables 1-3** for more details.)

Table 1: Motor Lubrication Intervals for Standard Conditions

NEMA (IEC) Frame Size	**Rated Speed - RPM**	
	3500	**1750**
Up to 210 (132)	5500 hrs.	12000 hrs.
Over 210 to 280 incl. (180)	3600 hrs.	9500 hrs.
Over 280 to 360 incl. (225)	2200 hrs.	7400 hrs.

For severe service conditions, multiply interval hours by .5
For extreme service conditions, multiply interval hours by .1

Table 2: Service Condition Definitions

Service Conditions	Max. Ambient Temperature	Atmospheric Contamination
Standard	40°C	Clean, little corrosion
Severe	50°C	Moderate dirt, corrosion
Extreme	>50°C	Severe, dirt abrasive dust, corrosion

Table 3: Volume of Grease to be Added

Frame Size NEMA/(IEC)	Grease Volume IN.3	TSP
Over 210 to 280 incl. (180)	1.2	3.9
Over 280 to 260 incl. (225)	1.5	5.2

Installation

Unpacking

Before accepting a pump from a carrier, visually inspect the packaging for damage.

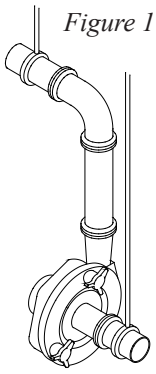
Check the contents and all wrapping when unpacking the pump. Inspect carefully for any damage that may have occurred during shipping. Immediately report any damage to the carrier. Remove the coupling guard and protective cover from pump outlet. Place your ear near the pump outlet and turn the shaft by hand. A small amount of noise from the seals is normal. Metal-to-metal contact will be very noticeable. If you have metal-to-metal contact, shipping damage is likely. Leave the caps over the pump inlet and outlet in place until you are ready to install the pump.

Installing

Prior to actually installing the pump, ensure that:

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

Figure 1



We ship pumps fully assembled.

Piping Guidelines

This section describes good piping practices to obtain maximum efficiency and service life from your pump.

Maximum performance and trouble-free operation require adherence to good piping practices.

- Ensuring proper piping support and alignment at both the suction inlet and discharge outlet can help prevent serious damage to the pump housing (**Figure 1**).
- Avoid abrupt transitions in the piping system (**Figure 2**).
- Avoid throttling valves in the suction piping.

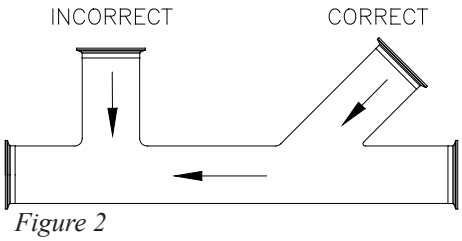


Figure 2

• Keep suction lines as short and direct as possible.

• Ensure that the NPSH available in the system is greater than NPSH required by the pump.

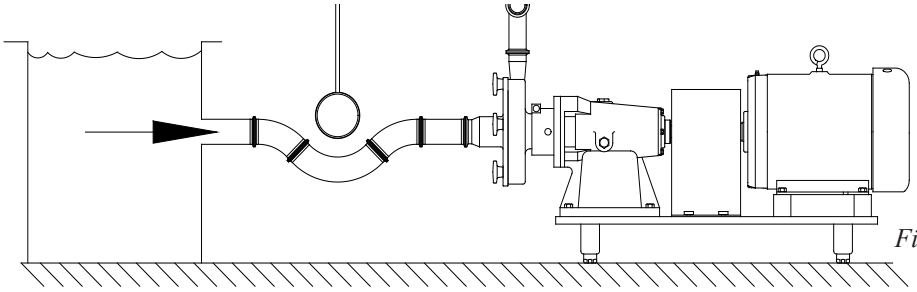


Figure 3

• Avoid sump areas where sediments may collect (**Figure 3**).

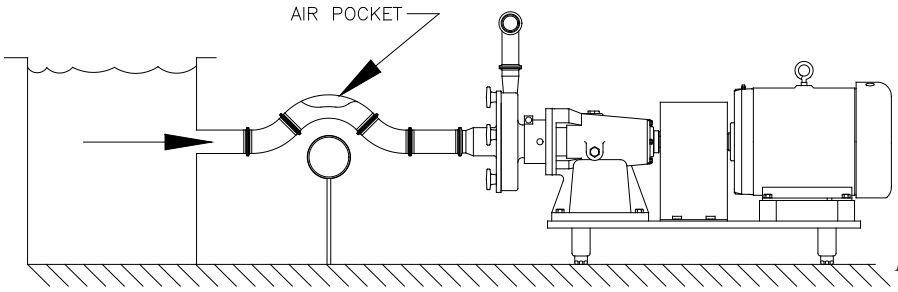


Figure 4

• Avoid the formation of air pockets in the piping (**Figure 4**).

• 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 5**).

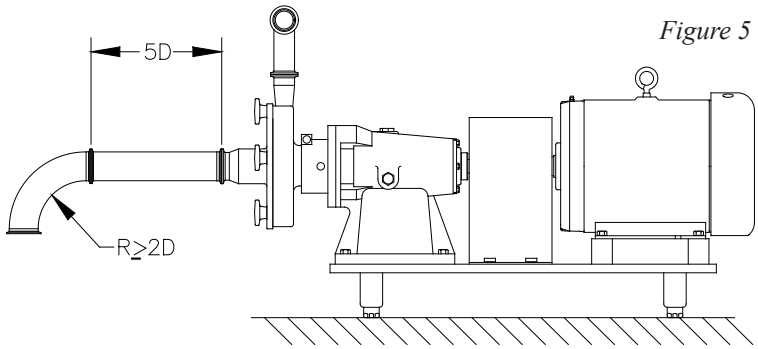


Figure 5

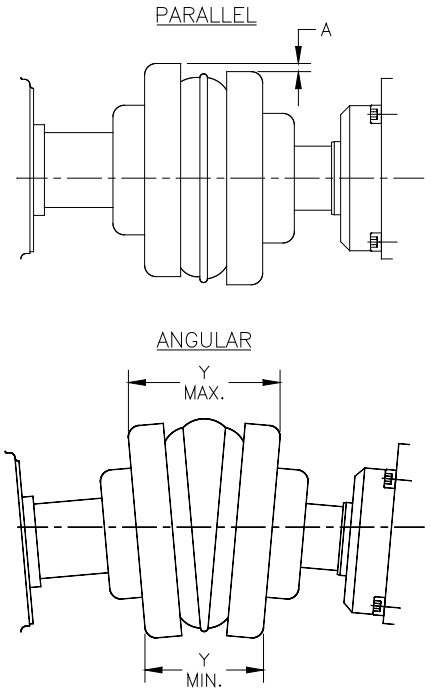
Alignment

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 6**). 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 the table, realign the shafts.



Check the angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other ("Y") at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions without rotating the coupling. The difference between the maximum and minimum must not exceed the figure given under "Angular" in the table. If a correction is necessary, be sure to recheck the parallel alignment.

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

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 1: Sure-Flex Coupling Maximum Allowable Misalignment

Electrical Installation

We use standard duty TEFC motors unless otherwise specified. Many motor options are available: washdown, flameproof, explosion proof, hostile duty or chemical duty.

Have an electrician connect the motor using sound electrical practices. Provide adequate protection. Pumps fitted with mechanical seals must not run dry, not even momentarily. **Determine the direction of rotation by watching the motor fan, which must turn clockwise.**

The motor selected should meet the requirements of the specified operating conditions. A change in conditions (for example, higher viscosity, higher specific gravity, lower head losses) can

overload the motor. When changing operating conditions or whenever there is any doubt, please contact Fristam Pumps for technical assistance.

Pump Operations

Start-up instructions

- Remove any foreign matter that may have entered the pump.
- Do not use the pump to flush the system!

Check pump for proper rotation as indicated on the pump. **Proper motor direction is clockwise when looking at the fan end of the motor.** (NOTE: When checking the direction of rotation, the pump must be full of liquid.)

- Never run the pump dry, even momentarily. Seal damage can result.

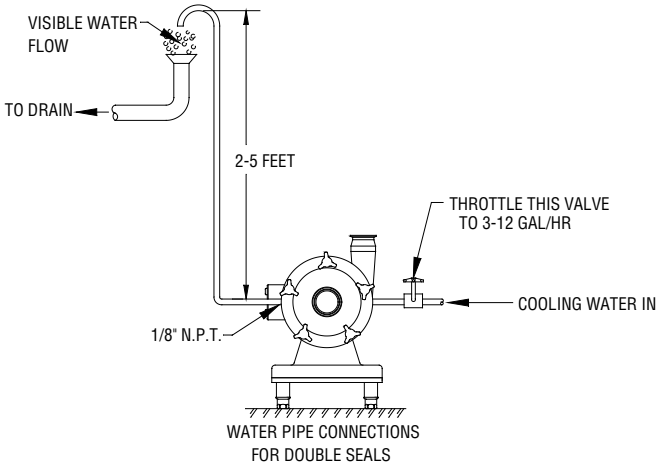
Shut-down instructions

- Shut off the power supply to the pump.
- Close the shut-off valves in the suction and discharge piping.
- Drain and clean the pump as required.
- Protect the pump against dust, heat, moisture and impact damage.

Installation of Water Flush for Double Mechanical Seal

Set up the water flush for the double mechanical seal as shown (**Figure 6**). **Use only between 3-12 gallons per hour of water at a pressure of 1-2 PSI**. Excessive flow of water through the seal increases the pressure inside the seal. **Note:** maximum pressure inside the seal is 15 PSI. **Excessive flow/pressure through the seal flush will cause excessive wear and shorten seal life.**

Figure 6



Pipe the exit side of the water flush with 2-5 feet physical height of tubing. This ensures that some water is always in the stationary seal and the seal never runs dry.

It is possible to inject steam through the stationary seal (within the pressure requirements). We do not recommend using steam alone for the cooling/lubricating of the seal.

It is desirable to have the flush water on the outlet side visible. This allows an easy check to see that the flush water is on and also if the seal is functioning properly. In a malfunctioning seal the flush water will disappear, become discolored, or show an unusual increase in flow. If these conditions exist, check the seal and replace if necessary.

Seal Replacement for a 3VR Bearing Block Pump

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 for Seal Replacement

One 1¼" socket wrench (For 324 and larger motor frames and 1150 Series pumps)
One 15/16" socket wrench (For motor frames up to 256T)
One ¾" wrench
One 7/16" wrench
Pliers (channel locks) - double mechanical seal pumps only
One soft-faced hammer
One pair tack pullers (impeller pullers)
Chain wrench
Feeler gauge

Pump head disassembly

Note: the reference numbers listed in the text (#) refer to the 3VR bearing block assembly drawing on pages 22 & 23.

WARNING

Disconnect the suction and discharge pipe from the pump. Drain all fluid from the pump prior to disassembly.

a) Loosen the cover nuts (47) with the soft-faced hammer and remove.

b) Next remove the pump cover (46) and the cover gasket (45).

c) Remove the seal water pipes (48) (on double mechanical seal pumps only) by turning them counter-clockwise with the pliers.

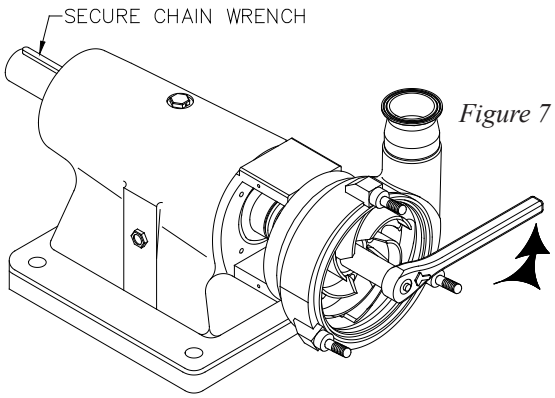


Figure 7

d) Remove the coupling guards (24) by loosening and removing the guard nuts (25).

e) Secure the pump shaft (17) from rotating with the chain wrench while loosening the impeller nut (44) with the 15/16" or 1¼" wrench (**Figure 7**). Remove the impeller nut and impeller nut gasket (43).

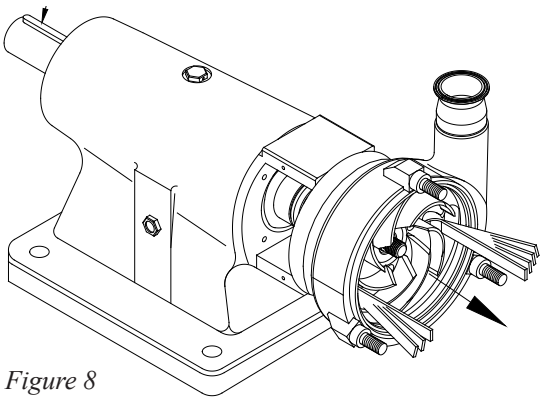


Figure 8

f) Remove the impeller (42) from the pump shaft by grasping an impeller blade in each hand and pulling the impeller toward you. If the impeller is difficult to pull off the shaft, wedge the tack pullers between the pump housing and the back of the impeller and pry off the impeller (**Figure 8**).

g) Compress the seal spring (38) by pushing on the front seal driver (40) and lift out the key (16) (**Figure 9**). (You may find it easier to rotate the keyway to the bottom of the shaft, compress the seal spring and let the key drop out.)

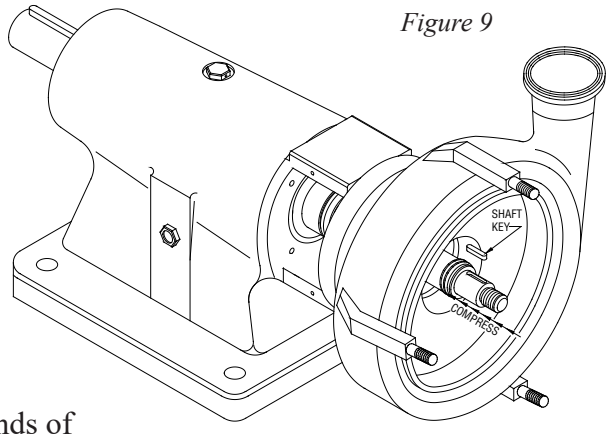


Figure 9

h) Next remove the front seal driver (40) and seal spring (38) by pulling them off the pump shaft (17) and discard them.

i) Now remove the rotating seal (37), seal washer (28) and o-ring (29) by gently placing the flat ends of two impeller pullers on either side of the rotating seal and carefully pulling (wiggling the seal ring side-to-side should aid removal) until the rotating seal face comes off the shaft (**Figure 10**). Discard the seal components after you remove them.

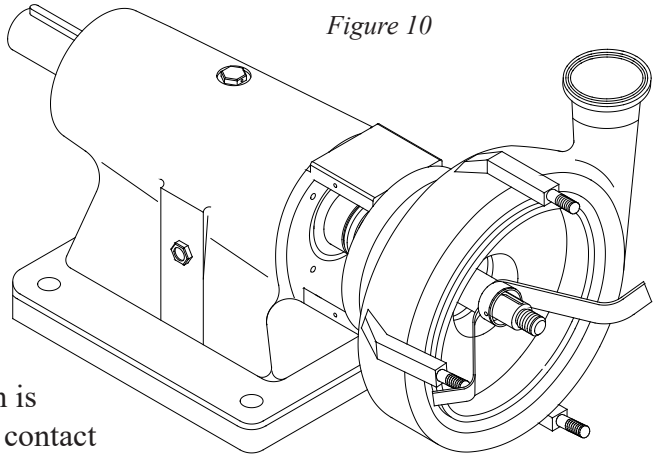


Figure 10

j) Loosen and remove the four housing bolts that pass through the bearing block and thread into the back of the pump housing with the 3/4” wrench. Now carefully slide the pump housing off the pump shaft (17), ensuring that the stationary seal (which is mounted inside the pump housing) does not contact the pump shaft. The stationary seal may be damaged if it makes hard contact with the pump shaft.

k) Place the pump housing (36) face down on the housing studs (49).

l) Loosen the four retaining ring bolts (31) with the 7/16” wrench and remove them from the hub of the pump housing. Remove the seal retaining ring (32).

m) Place a finger through the stationary seal and pull it out of the seal cavity and discard (**Figure 11**). If the stationary seal has been in the pump for an extended period, it may be necessary to softly tap it out from the opposite end using a soft-faced hammer.

n) Check the flat gasket (35) in the bottom of the rear cavity. Remove this gasket completely and clean the seal cavity if necessary.

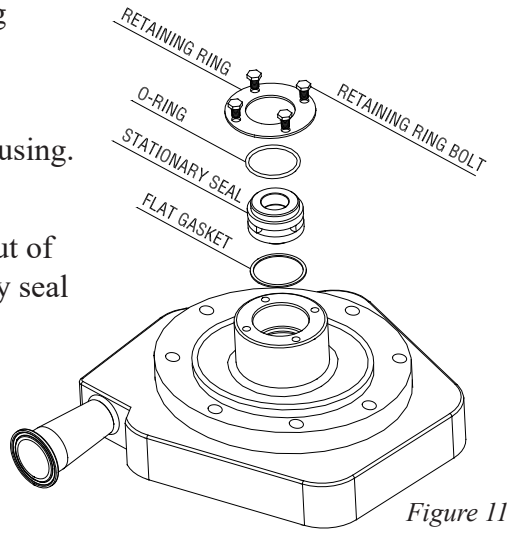


Figure 11

Additional Disassembly for Double Seal Only

To remove the rear seal components (only pumps with double seal), carefully slide the rear rotating seal (30), seal washer (28) and the seal o-ring (29) off the pump shaft and discard. The rear seal driver and spring (27) should be left on the shaft.

Pump Head Assembly – (See Seal Assembly Drawing - Figures 12 & 13)

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.

For double mechanical seals only, first install the rear seal components. Note: this includes the seal washer (28), the seal o-ring (29) and the rear rotating seal (30). Note: the rear seal driver and spring should already be on the pump shaft.

You are now ready to install the stationary seal (34) into the pump.

a) To install the stationary seal into the pump housing, place the pump housing on a clean surface with the hub side up. Inspect the hub area to ensure that it is clean.

b) Place the flat gasket (35) into the hub of the pump housing. Make sure that it is all the way to the bottom and seated evenly.

c) Install the stationary seal into the housing hub smaller face side first.

d) Install the stationary seal o-ring (33) (do not lubricate this o-ring) onto the back of the stationary seal (34). Improper fit may cause leakage or seal damage.

e) Place the retaining ring (32) over the stationary seal o-ring (33) and stationary seal (34). Align the holes in the retaining ring with the holes threaded in the hub. Thread the four retaining bolts (31) through the holes in the retaining ring and into the housing hub. Tighten the bolts with the 7/16" wrench to the proper torque (see page 5).

f) Carefully slide the pump housing over the pump shaft (17) and back against the bearing block (10). **The stationary seal may be damaged if it makes hard contact with the pump shaft.** If the pump has a double mechanical seal, make sure that the water pipe holes in the pump housing are aligned with the slots in the bearing block. If there are no water pipe holes, turn the housing so the outlet pipe is vertical unless otherwise specified.

g) While holding the pump housing against the bearing block, place the four housing bolts through the bearing block. Thread them into the back of the pump housing and tighten them with the 3/4" wrench. Check for the proper torque on page 5.

h) Install the seal water pipes (if a double mechanical seal), by threading them into the housing and tighten with the pliers.

i) You are now ready to install the rotating seal asse a food grade lubricant (unless the o-ring material is EPDM, then only water should be used for lubrication). Place the seal o-ring inside the rotating seal (37).

j) Now place the seal washer (28) into the rotating seal. (**Note:** for frame sizes 254 and up, the larger end of the seal spring goes into the rotating seal **Figure 14**).

k) Next install the larger end of the seal spring (38) into the rotating seal making sure that the tab of the spring is in the slot on the rotating seal.

l) Finally, install the tab on the other end of the seal spring into the hole on the front seal driver (40)

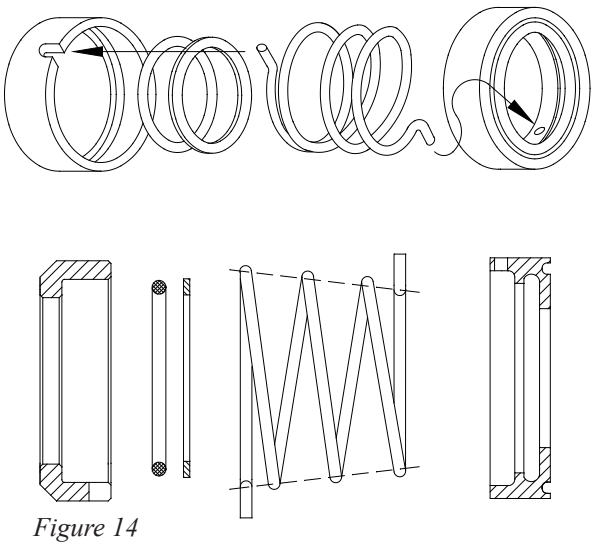


Figure 14

(**Figure 14**). The rotating seal assembly is now ready to be installed onto the pump shaft.

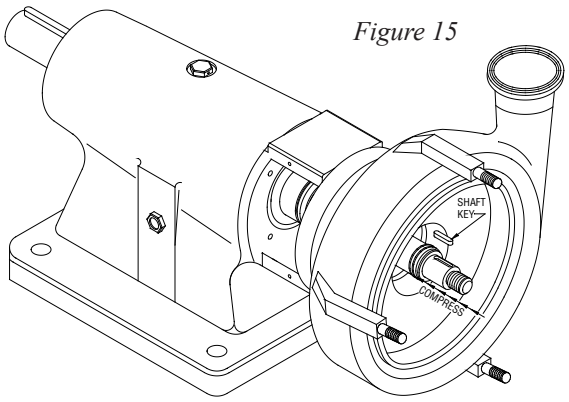


Figure 15

m) Rotate the pump shaft (17) so the keyway is on top. Now slide the rotating seal assembly which includes: the rotating seal (37), the seal o-ring (29), the seal washer (28), the seal spring (38) and the seal driver (40) onto the pump shaft.

n) Lubricate the outside o-ring (41) with a food grade lubricant, if it is not EPDM, and install it in the groove on the front of the seal spring (38) and driver assembly.

o) Compress the spring assembly with two fingers and install the impeller key (16) into the keyway on the pump shaft (**Figure 15**).

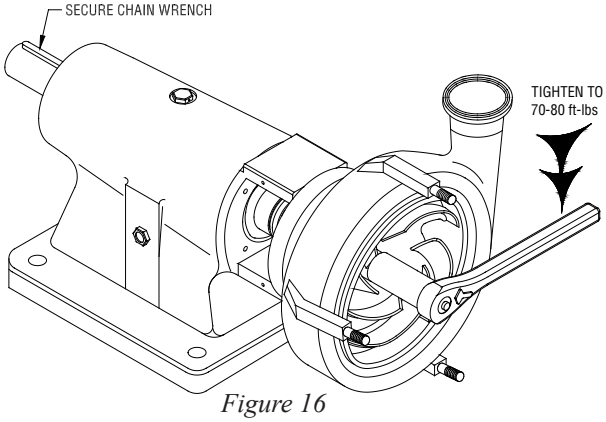


Figure 16

p) Slide the impeller (42) onto the pump shaft (17). The slot in the impeller hub will slide over the impeller key (16).

q) Generously lubricate the new impeller nut gasket (43) with a food grade lubricant (if it's not EPDM) and place it onto the impeller nut (44).

r) Thread the impeller nut with the gasket in place onto the pump shaft (17). Secure the pump shaft with the chain wrench and tighten the impeller nut to the proper torque (see page 5).

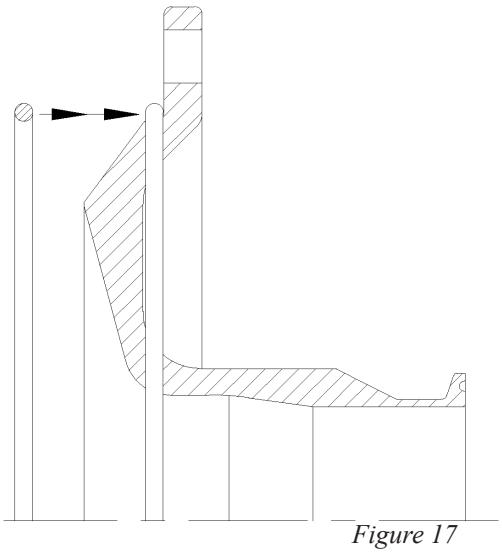


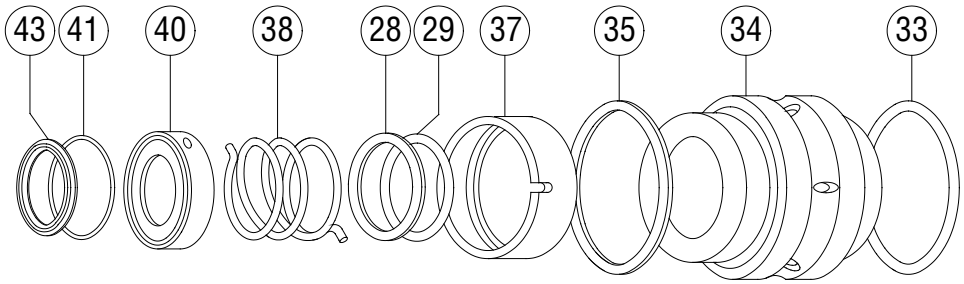
Figure 17

s) Now install the new cover gasket (45) onto the pump cover (46) (**Figure 17**) and install them onto the front of the pump. (**Note:** the pump serial number is embossed into the 'top' of the pump cover.) When placing the cover gasket into the pump cover, gently stretch the gasket into position. Do not roll the gasket into position. Thread the cover nuts (47) onto the housing studs (49). Make sure the cover gasket is properly seated in the cover to ensure that it will not get pinched when tightening the cover nuts. Tighten the cover nuts by tapping on them with the soft-faced hammer.

t) Now rotate the pump shaft (17) to make sure that the impeller (42) moves freely. If it does not, recheck your assembly to make sure that gaskets are not pinched and everything is seated properly. Listen to the pump as you turn the shaft. A small amount of noise from the seals is normal, but if there is metal-to-metal contact, the sound will be noticeable. If there is metal-to-metal contact, recheck the assembly. If there is no metal-to-metal contact, replace the coupling guard (24) and secure with the guard nuts (25).

Reconnect the suction and discharge piping.

WARNING: Mechanical seals must never run dry, even momentarily. Seal damage will result.



DESCRIPTION

43 IMPELLER NUT GASKET

39 INSIDE SEAL DRIVER O-RING
(FACTORY INSTALLED)

41 OUTSIDE SEAL DRIVER O-RING

40 SEAL DRIVER

38 SEAL SPRING

28 SEAL WASHER

29 ROTATING SEAL O-RING

37 ROTATING SEAL

35 FLAT GASKET

34 STATIONARY SEAL

33 STATIONARY SEAL O-RING

32 RETAINING RING

31 RETAINING RING BOLT

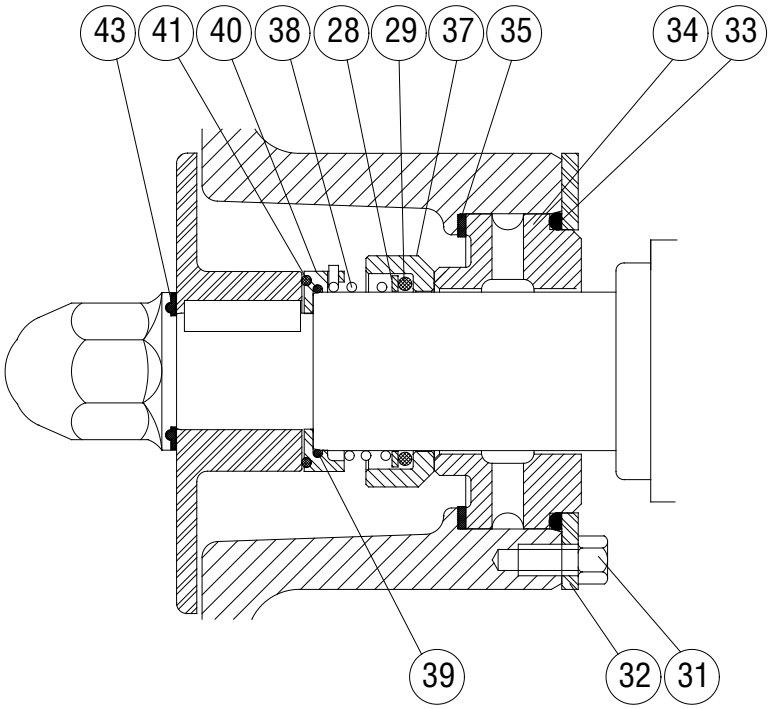
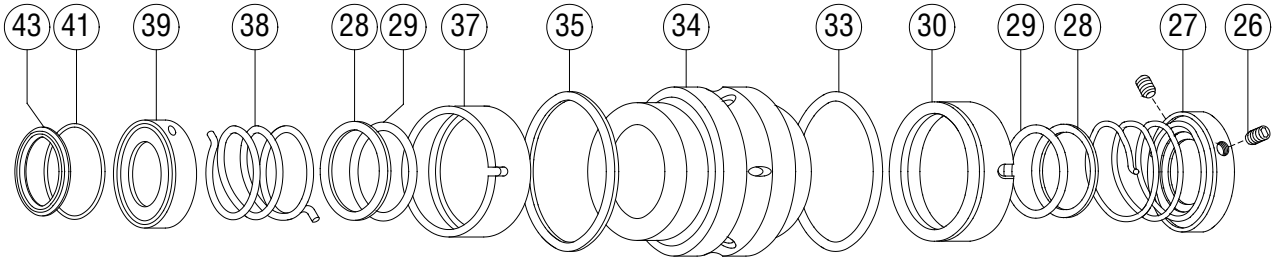


Figure 12: Single Seal Assembly



DESCRIPTION

43 IMPELLER NUT GASKET

39 INSIDE SEAL DRIVER O-RING
(FACTORY INSTALLED)

41 OUTSIDE SEAL DRIVER O-RING

40 FRONT SEAL DRIVER

38 SEAL SPRING

28 SEAL WASHER

29 ROTATING SEAL O-RING

37 FRONT ROTATING SEAL

35 FLAT GASKET

34 STATIONARY SEAL

33 STATIONARY SEAL O-RING

30 REAR ROTATING SEAL

27 REAR SEAL DRIVER

26 SET SCREW (2)

32 RETAINING RING

31 RETAINING RING BOLT

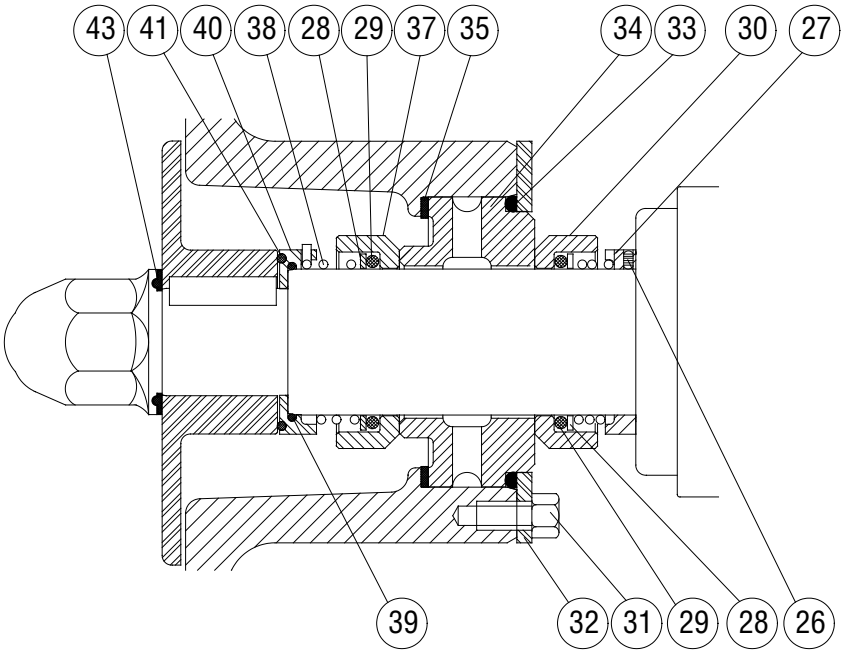


Figure 13: Double Seal Assembly

Seal Replacement for a #1 Bearing Block Pump

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 for Seal Replacement

One 15/16” socket wrench
Two 3/4” wrench
One 7/16” wrench
Pliers (channel locks) - double mechanical seal pumps only
One soft-faced hammer
One pair tack pullers (impeller pullers)
Chain wrench
Feeler gage

Pump head disassembly

Note: the reference numbers listed in the text (#) refer to the #1 bearing block assembly drawing on pages 24 & 25.

WARNING Disconnect the suction and discharge pipe from the pump. Drain all fluid from the pump prior to disassembly.

a) Loosen the cover nuts (47). with the soft-faced hammer and remove.

b) Remove the pump cover (46) and the cover gasket (45).

c) Remove the seal water pipes (48) (on double mechanical seal pumps only) by turning them counter-clockwise with the pliers.

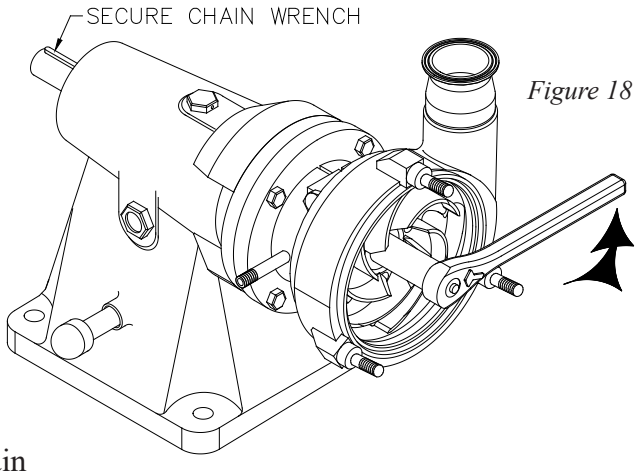


Figure 18

d) Remove the coupling guards by loosening and removing the guard nuts (25). Secure the pump shaft (17) from rotating with the chain wrench while loosening the impeller nut (44). with the 15/16” wrench (**Figure 18**). Remove the impeller nut and impeller nut gasket (43).

e) Remove the impeller (42) from the pump shaft by grasping an impeller blade in each hand and pulling the impeller toward you. If the impeller is difficult to pull off the shaft, wedge the tack pullers between the pump housing and the back of the impeller and pry off the impeller (**Figure 19**).

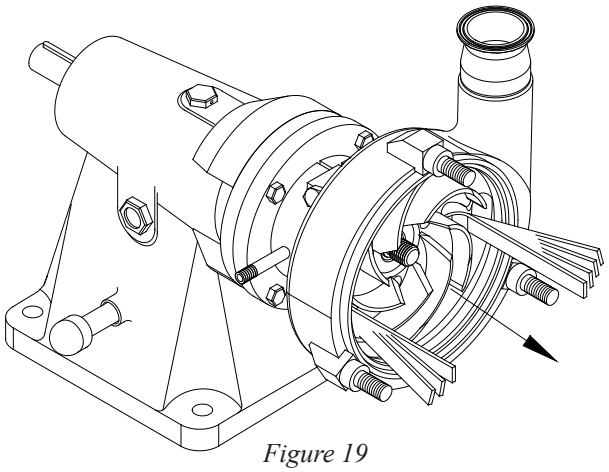


Figure 19

f) Compress the seal spring (38) by pushing on the front seal driver (40) and lift out the key (**Figure 20**). (You may find it easier to rotate the keyway to the bottom of the shaft, compress the seal spring and let the key drop out.)

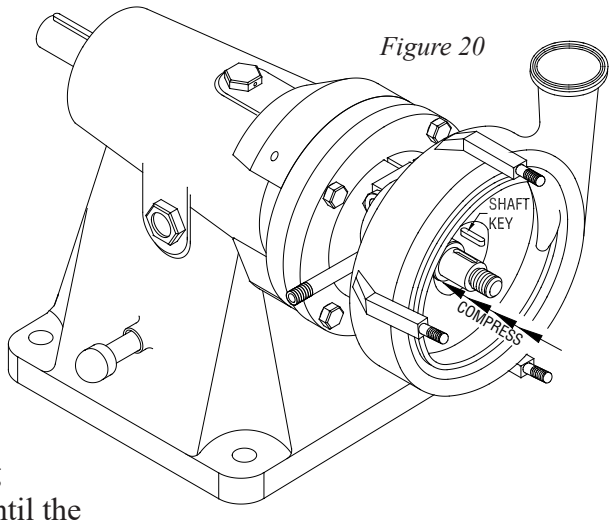


Figure 20

g) Next remove the front seal driver (40) and seal spring (38) by pulling them off the pump shaft (17) and discard them.

h) Remove the rotating seal (37), seal washer (28) and o-ring (29) by gently placing the flat ends of two impeller pullers on either side of the rotating seal and carefully pulling (wiggling the seal ring side-to-side should aid removal) until the rotating seal face comes off the shaft (**Figure 21**). Discard the seal components after you remove them.

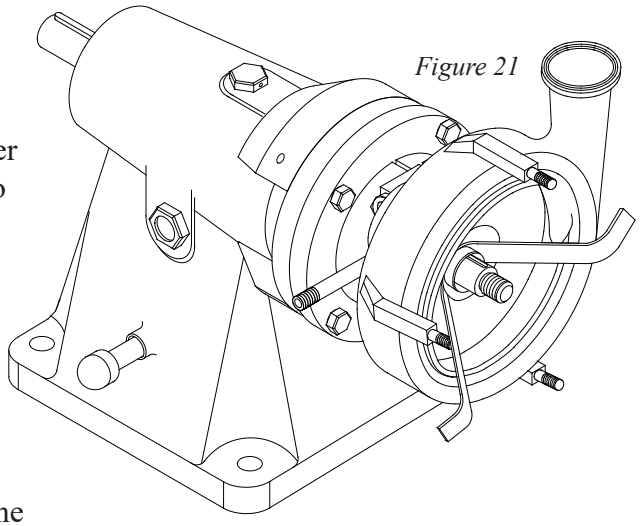


Figure 21

i) Loosen the adapter bolt (51) with the 3/4" wrenches until it is loose in the flange adapter (50). (Note: the adapter bolt does not have to be removed.) Now carefully slide the pump housing off the pump shaft (17), ensuring that the stationary seal (which is mounted inside the pump housing) does not contact the pump shaft. The stationary seal may be damaged if it makes hard contact with the pump shaft.

j) Place the pump housing (36) face down on the housing bolts (49).

k) Loosen the four retaining ring bolts (31) with the 7/16" wrench and remove them from the hub of the pump housing. Remove the seal retaining ring (32).

l) Place a finger through the stationary seal and pull it out of the seal cavity and discard (**Figure 22**). If the stationary seal has been in the pump for an extended period, it may be necessary to softly tap it out from the opposite end using a soft-faced hammer.

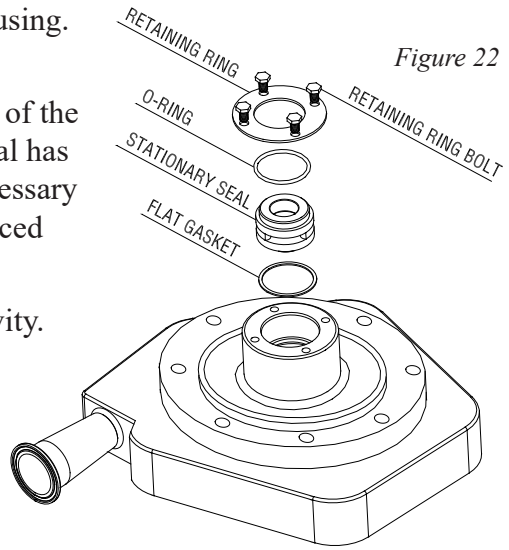


Figure 22

m) Check the flat gasket (35) in the bottom of the rear cavity. Remove this gasket completely and clean the seal cavity if necessary.

Additional Disassembly for Double Seal Only

To remove the rear seal components (only pumps with double seal), carefully slide the rear rotating seal (30), seal washer (28) and the seal o-ring (29) off the pump shaft and discard. The rear seal driver and spring (27) should be left on the shaft.

Pump Head Assembly – (See Seal Assembly Drawing - Figures 12 & 13)

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.

For double mechanical seals only, first install the rear seal components. Note: this includes the seal washer (28), the seal o-ring (29) and the rear rotating seal (30). Note: the rear seal driver and spring should already be on the pump shaft.

You are now ready to install the stationary seal (34) into the pump.

a) To install the stationary seal into the pump housing, place the pump housing on a clean surface with the hub side up. Inspect the hub area to ensure that it is clean.

b) Place the flat gasket (35) into the hub of the pump housing. Make sure that it is all the way to the bottom and seated evenly.

c) Install the stationary seal into the housing hub smaller face side first.

d) Install the stationary seal o-ring (33) (do not lubricate this o-ring) onto the back of the stationary seal (34). Improper fit may cause leakage or seal damage.

e) Place the retaining ring (32) over the stationary seal o-ring (33) and stationary seal (34), align the holes in the retaining ring with the holes threaded in the hub. Thread the four retaining bolts (31) through the holes in the retaining ring and into the housing hub. Tighten the bolts with the 7/16” wrench to the proper torque (see page 5).

f) Carefully slide the pump housing over the pump shaft (17) and back against the flange adapter (50). **The stationary seal may be damaged if it makes hard contact with the pump shaft.** If the pump has a double mechanical seal, make sure that the water pipe holes in the pump housing are aligned with the holes in the bearing block. If there are no water pipe holes, turn the housing so the outlet pipe is vertical unless otherwise specified.

g) While holding the pump housing against the bearing block, tighten the adapter bolt (51) with the 3/4” wrench to the proper torque (see page 5.

h) Install the seal water pipes (if a double mechanical seal), by threading them into the housing and tighten with the pliers.

i) First lubricate the seal o-ring (29) with a food grade lubricant (unless the o-ring material is EPDM, then only water should be used for lubrication). Place the seal o-ring inside the rotating seal (37).

j) Now place the seal washer (28) into the rotating seal.

k) Next install one end of the seal spring (38) into the rotating seal making sure that the tab of the spring is in the slot on the rotating seal.

l) Finally, install the tab on the other end of the seal spring into the hole on the front seal driver (40) (**Figure 23**).

m) Rotate the pump shaft (17) so the keyway is on top. Now slide the rotating seal assembly which includes: the rotating seal (37), the seal o-ring (29), the seal washer (28), the seal spring (38) and the seal driver (40) onto the pump shaft.

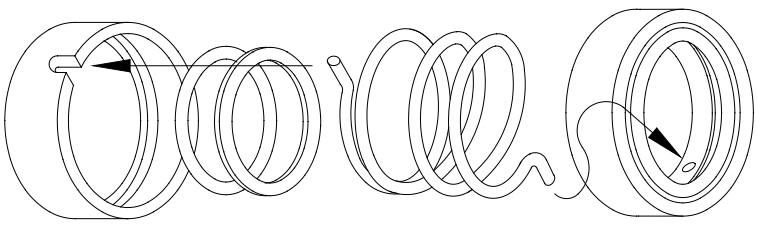


Figure 23

n) Lubricate the outside o-ring (41) with a food grade lubricant, if it is not EPDM, and install it in the groove on the front of the seal spring (38) and driver assembly.

o) Now compress the spring assembly with two fingers and install the impeller key (16) into the keyway on the pump shaft (**Figure 24**).

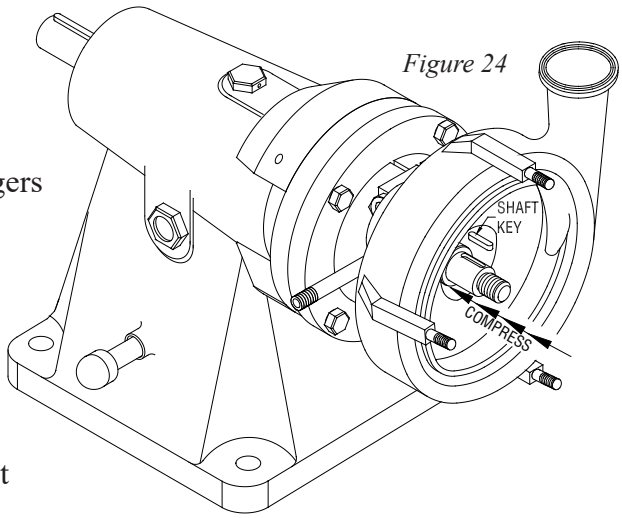


Figure 24

p) Slide the impeller (42) onto the pump shaft (17). The slot in the impeller hub will slide over the impeller key (16).

q) Generously lubricate the new impeller nut gasket (43) with a food grade lubricant (if it is not EPDM) and place it onto the impeller nut (44).

r) Thread the impeller nut with the gasket in place onto the pump shaft (17). Secure the pump shaft with the chain wrench and tighten the impeller nut to the proper torque (see page 5).

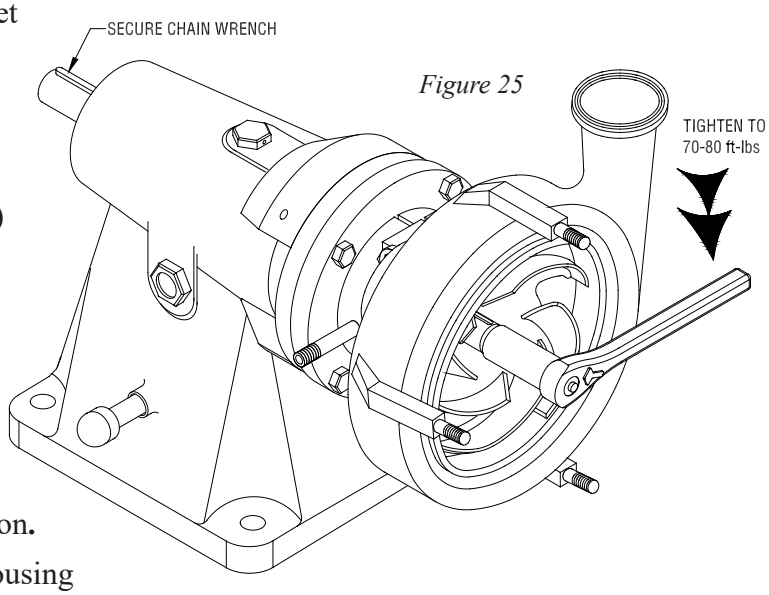


Figure 25

s) Now install the new cover gasket (45) onto the pump cover (46) (**Figure 25**) and install them onto the front of the pump. (**Note:** the pump serial number is embossed into the 'top' of the pump cover.) When placing the cover gasket into the pump cover, gently stretch the gasket into position. Do not roll the gasket into position**.**

t) Thread the cover nuts (47) onto the housing studs (49). Make sure the cover gasket is properly seated in the cover to ensure that it will not get pinched when tightening the cover nuts. Tighten the cover nuts by tapping on them with the soft-faced hammer.

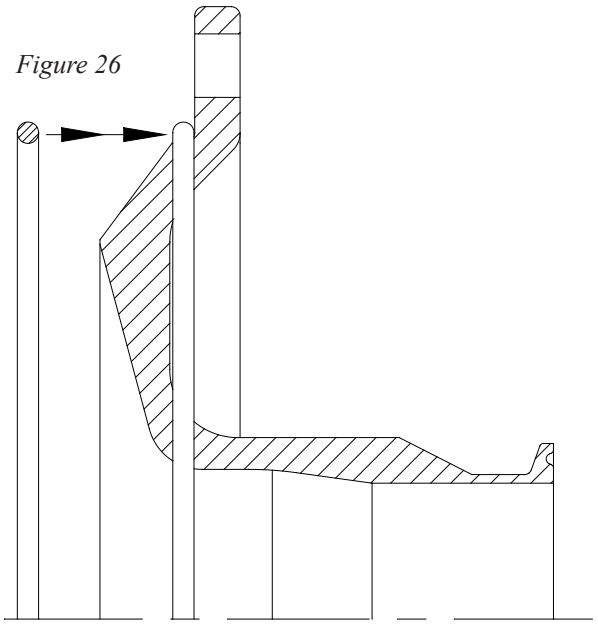


Figure 26

u) Now rotate the pump shaft (17) to make sure that the impeller (42) moves freely. If it does not, recheck your assembly to make sure that gaskets are not pinched and everything is seated properly. Listen to the pump as you turn the shaft. A small amount of noise from the seals is normal, but if there is metal-to-metal contact, the sound will be noticeable. If there is metal-to-metal contact, check your assembly. Replace the coupling guard (24) and secure with the guard nuts (25).

Reconnect the suction and discharge piping.

WARNING: Mechanical seals must never run dry, even momentarily. Seal damage will result.=

Shaft 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.

Required Tools

- One 1/2” wrench
- One 15/16” wrench
- Snap ring pliers
- One spanner wrench
- One pair of pliers or channel locks
- Shaft alignment tool
- One 9/16” wrench (for #1 bearing block only)
- One 3/8” wrench (for #1 bearing block only)
- One 3/32” Allen wrench
- One 3/16” Allen wrench
- One 5 lb. soft-faced hammer
- Screwdriver
- Shims

Bearing Block Disassembly

Disassemble the pump housing as described on pages 9-10 for 3VR bearing blocks and pages 15-16 for #1 bearing blocks. To remove the rear spring and driver assembly, loosen the set screws with 3/32” Allen wrench and pull off the shaft.

Next drain the oil from the bearing block by removing the oil drain plug cap (14) with the pliers or channel locks. Unbolt the bearing block (10) from the baseplate by removing the bearing block mounting bolt with the 15/16” wrench. Slide the bearing block away from the motor and remove the rubber coupling sleeve. Loosen the set screws on the coupling flange (1) with the 3/16” Allen wrench and remove the coupling flange and coupling key (9) from the pump shaft. For a #1 bearing block pump, remove the four housing flange bolts with the 9/16” wrench.

Remove the front and rear bearing block caps and labyrinth seals (2) by removing the bearing cap bolts (3) with the 1/2” wrench (for 3VR) or the 3/8” wrench (for #1). Discard the used front and rear bearing cap O-rings (20 & 5).

Remove the snap ring (19) which secures the radial bearing (18) from the pump shaft with the snap-ring pliers. Tap the impeller end of the pump shaft with the soft-faced hammer to remove the shaft assembly from the bearing block (10). **Support the shaft while tapping so that it does not fall and become damaged.**

Stand the pump shaft on end (impeller end down) and slowly heat the inner race of the radial bearing (18) with the flame torch until it drops off the pump shaft. Loosen the bearing lock nut (6) with the spanner wrench. Remove the bearing lock nut and lock nut washer (7) from the pump shaft. Press the thrust bearings (8) off the pump shaft using an arbor press with caution to prevent damaging the pump shaft in the process (**Figure 27**). Remove the outer race radial bearing from the bearing block.

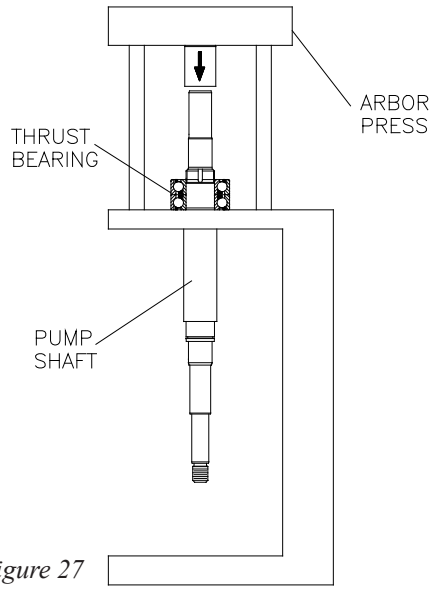


Figure 27

Bearing Block Assembly

Replace the pump shaft (17) if necessary. Heat the new thrust bearings (8) on a bearing heater to 230ºF **(Do not heat bearing above 250ºF or bearing damage may result)** and slide onto the pump shaft in a back-to-back arrangement (**Figures 24 & 25**). Slide the bearings onto the pump shaft quickly as the bearings cool rapidly when they come in contact with the shaft. A light film of oil on the pump shaft may ease assembly. Replace the bearing lock nut washer (7) and lock nut (6). **Note**: the tab on the bearing lock nut washer fits into the slot on the pump shaft. Tighten the bearing lock nut with the spanner wrench until the bearings do not wobble but still rotate freely **(do not overtighten).**

Heat the inner race of the radial bearing to 230ºF and slide it onto the pump shaft. Allow the shaft/bearing assembly to cool to room temperature while keeping the assembly covered to prevent dirt from getting into the bearings. Recheck tightness of the bearing lock nut (6) to ensure that the thrust bearings (8) are tight and still rotate freely. Bend one of the tabs on the bearing lock nut washer (7) into one of the slots of the bearing lock nut with a screwdriver. This keeps the bearing lock nut secure during pump operation.

Press the outer race of the new radial bearing into the bearing block (10). Now you are ready to install the pump shaft assembly into the bearing block. Slide the impeller end of the pump shaft into the motor end of the bearing block. Move the shaft forward until the thrust bearings (8) meet the bearing block. Now press or tap the outer race of the thrust bearings into the bearing block while supporting the impeller end of the shaft so that the inner race of the radial bearing (18) clears the rollers secured in the outer race. **Do not press on the pump shaft or the inner race of the thrust bearings. Bearing damage may result.** It may be easier to install the pump shaft assembly into the bearing block with the bearing block standing on end. Note that you need to allow for clearance of the impeller end of the pump shaft to protrude through the face of the bearing block. Replace the snap ring (19) for the radial bearing with the snap-ring pliers

With the pump shaft assembly installed, you are now ready to install the front and rear bearing caps (20 & 5). Inspect the labyrinth seals (2) and replace if damaged or worn. The labyrinth seals are press fit into the bearing caps. Press the old seals out and press the new labyrinth seals into the bearing cap, preferably with an Arbor press. Make sure the drain port on the labyrinth seals will be in the downward position when the bearing caps are mounted on the bearing block. **Note:** it is normal for some of the outer o-ring on the labyrinth seal to shear off when it is pressed into the bearing cap.

Generously lubricate the inside o-rings on the labyrinth seals with a food grade lubricant such as Haynes CIP-Lube and press the labyrinth seal/bearing cap assemblies onto the pump shaft. Replace the bearing cap bolts (3) and tighten with the 1/2” wrench to 20 ft.-lbs for 3VR bearing blocks and tighten with the 3/8” wrench to 10 ft.-lbs. for #1 bearing blocks. Replace the drain plug cap (14) and fill the bearing block with oil to the center of the sight glass (13). **See ‘Bearing Block Oil Recommendations’ on page 5.**

Replace the coupling key (9) and the coupling flange (1). Tighten the set screws on the coupling flange with the 3/16” Allen wrench.

Pump/Motor Shaft Alignment

The bearing block can now be returned to the baseplate and aligned with the motor. Align the bearing block over the bearing block mounting holes in the baseplate and loosely thread the bearing block mounting bolts. Mount the shaft alignment tool between the pump and motor and align the shafts. **Note:** shims may be required under the mounting feet of the motor. The shafts should not have more than .020" parallel misalignment and .094" angular misalignment. Once the shafts are aligned, tighten the bearing block mounting bolts securely with the 15/16" wrench to 70-80 ft-lbs. Replace the rubber coupling sleeve and slide the two coupling flange halves together. Tighten the set screws on the coupling flange with the 3/16" Allen wrench. Slide the rear seal driver (27) onto the pump shaft. Make sure that it is tight against the shaft step and tighten the two set screws (26) with the 3/32" Allen wrench.

Setting the Impeller Gap

If you have removed the pump shaft (17) from the motor shaft for any reason (such as replacing the shaft or motor), you must re-set the gap.

The gap is measured between the impeller (42) and pump housing (46) using feeler gauges. (NOTE: Due to polishing and balancing the impeller, the gap behind each impeller blade may vary. The gap should be checked behind each blade and the smallest value should be used as your gap setting.) The correct gap dimensions are as follows:

.020" (.5 mm) for FP 700 and 1700 series pumps

.040" (1.0 mm) for FP 3400, 3500 and 1000 series pumps

To set the gap, place the original brass housing shim, if supplied, with the pump and the pump housing (less the stationary seal) on the flange or flange adapter (50). Bolt the housing in place. Slide the front seal driver (or seal drive spacer) onto the pump shaft (17). Install the impeller key (16), impeller (42) and impeller nut (44). Tighten the impeller nut while holding onto the impeller blades. Once the impeller is secure, place the appropriate feeler gauge between the impeller blades and the housing (shim stock may also be used). To set the proper gap, you will need to add or remove shims until the appropriate feeler gauge fits snug between the impeller and housing.

If the gap is incorrect, the shims between the flange and pump housing may be changed. A variety of shim thicknesses are available from Fristam Pumps, Inc.

The pump head may now be assembled as described on pages 11-12 for 3VR bearing blocks and pages 17-18 for #1 bearing blocks.

Troubleshooting

Fristam pumps are relatively maintenance free, however, in the event that a problem does arise, the troubleshooting chart below should help you with most of your pump related problems. If a motor problem arises please contact your local motor repair representative.

This troubleshooting chart has been prepared assuming that the pump installed is suitable for the application. Symptoms of cavitation can result when a pump is not properly applied. Examples of these symptoms are noisy operation, insufficient discharge, and vibration. If these conditions are present, check the system and re-evaluate the application. If you need assistance, contact Fristam Pumps at 1-800-841-5001 or 608-831-5001.

Problem	Possible Cause of Trouble (Index)*
Pump does not deliver liquid	1, 2, 4, 8, 10, 11, 14, 16, 29, 30
Not enough capacity delivered	2, 3, 4, 5, 8, 11, 14, 16, 20, 21, 29
Pump loses prime after starting	2, 3, 4, 5
Pump requires too much power	9, 12, 13, 16, 19, 24
Leaking seal	7, 18, 23, 24, 25
Seal fails prematurely	6, 7, 18, 20, 23, 24, 25, 26, 27
Pump vibrates or is noisy	2, 12, 15, 16, 17, 18, 19, 20, 21, 26, 28, 29, 31, 32, 33
Motor bearings fail prematurely	15, 18, 20, 26, 28, 29, 31, 32
Pump overheats and seizes	1, 15, 19, 20, 26, 28

**See pages 24-25 for index of problems and solutions*

Possible Suction Problems

1. Pump inlet is not flooded
2. NPSHA is not sufficient
3. Too much air or gas in liquid
4. Air pocket in suction line
5. Air entering the pump through the seal area
6. Seal flush water not on
7. Seal water flush pressure too high

Possible Mechanical Problems

8. Drive speed too low or too high
9. Direction of shaft rotation is incorrect
10. Total head of system is higher than design head of pump
11. Total head of system is lower than pump design head
12. Specific gravity of liquid greater than expected
13. Viscosity of liquid is greater than expected
14. Operation is at a very low capacity for the pump model chosen
15. Foreign matter in pump
16. Pump foundation not rigid
17. Bent shaft
18. Impeller rubbing on pump housing or cover
19. Motor worn or damaged
20. Pump damaged
21. Cover gasket defective, permitting leakage
22. Shaft worn or scored
23. Seal improperly installed
24. Type of seal incorrect for operating conditions
25. Impeller out of balance, causing vibration
26. Dirt or grit in seal flush liquid leading to scoring of shaft or seal surfaces
27. Lack of lubrication in motor bearing
28. Piping is obstructed
29. Power is not being supplied
30. Piping is being supported by the pump
31. Pump and motor shaft are not aligned
32. Bearing failure

Possible Suction Solutions

1a) Adjust piping so the pump inlet is flooded
b) Install a foot valve to keep liquid in the suction piping

2a) Raise the level of liquid on the inlet side of the pump or lower the pump
b) Use larger pipe on the inlet side of the pump
c) Eliminate restrictions in suction line where possible
d) Check inlet pipe for obstructions
e) Shorten the inlet piping, move pump
f) Lower the temperature of the liquid

3a) Install air relief valve
b) Turn pump head so discharge is at 45° angle

4. Adjust pipe to eliminate pocket

5. Check seal for proper installation, replace seal if defective

6. Turn on water to seal flush

7. Adjust water flow to seal flush to 10-12 gph at 1-2 psi

Possible Mechanical Solutions

8. Have a qualified person check that the power supplied matches the power of the drive

9. Reverse rotation

10a) Check for restrictions in the piping
b) Use larger diameter pipe
c) Use a larger diameter impeller
d) Check application with Fristam Pumps

11a) Install throttling valve in discharge line
b) Trim diameter impeller
c) Check with Fristam Pumps

12. Use larger motor, check application with Fristam Pumps

13a) Increase piping diameter and eliminate restrictions
b) A larger drive or pump may be required, check application with Fristam Pumps

14. Check application with Fristam Pumps.

15. Remove pump cover and clear foreign matter

16. Provide firmer foundation for the pump

17. Replace shaft (see pages 19-21 for directions)

18a) Check gap of the impeller
b) Replace defective components
c) Make sure impeller nut is tightened properly

19. Take motor to authorized service center

20. Remove pump cover and inspect for damage. Replace defective parts

21. Replace cover gasket

22. Replace pump shaft

23. Check seal installation, replace defective components

24. Replace seal with correct type of seal, check with your local representative or Fristam Pumps

25. Balance the impeller or contact Fristam

26. Use clean source of water for seal flush

27. Lubricate motor bearings

28. Remove obstruction in pipe, check for closed valve

29. Have qualified person check electrical connections

30. Support the piping independently from the pump

31. Realign

32. Replace pump bearings

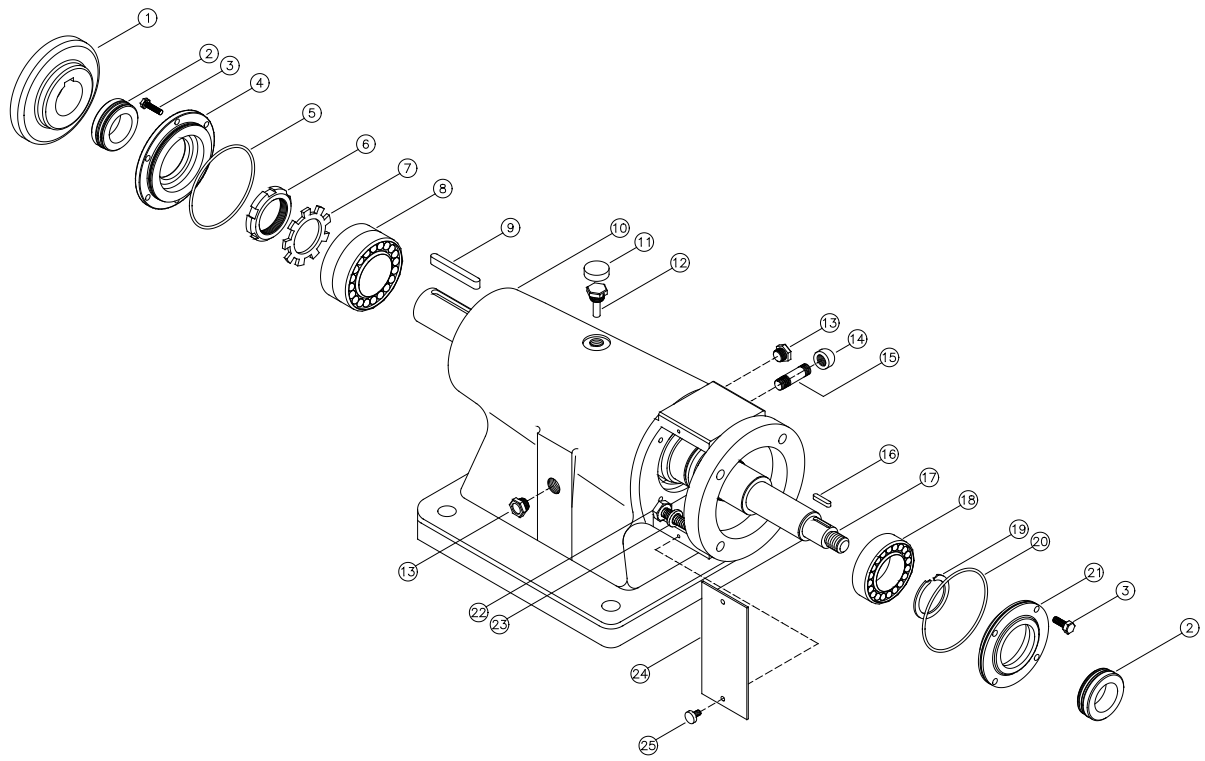
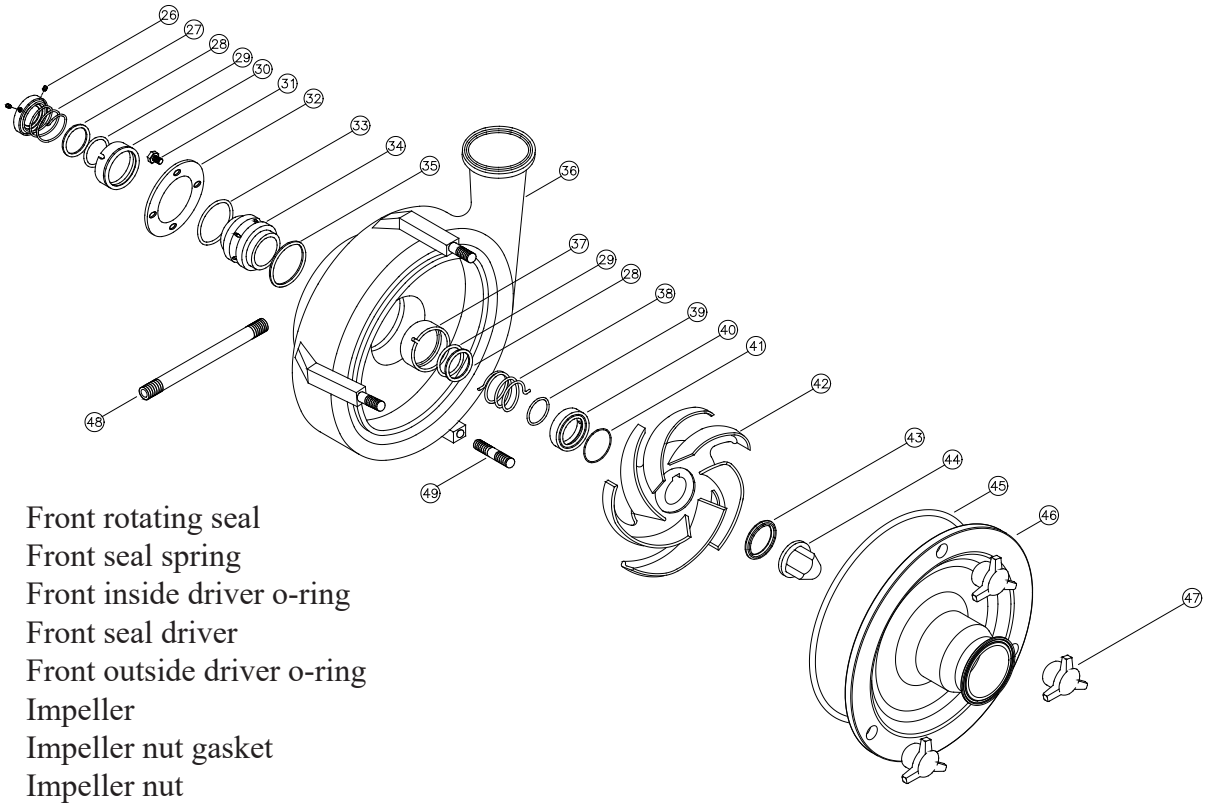


Figure 24: FP 3VR-Bearing Block Pump Assembly

1. Coupling flange
2. Labyrinth seal
3. Bearing cap bolts
4. Rear bearing cap
5. Rear bearing cap o-ring
6. Bearing lock nut
7. Bearing lock nut washer
8. Thrust bearing
9. Coupling key
10. 3VR bearing block
11. Breather cap
12. Breather/fill plug
13. Sight glass
14. Oil drain cap
15. Oil drain pipe
16. Impeller key
17. Pump shaft
18. Radial bearing
19. Snap ring
20. Front bearing cap o-ring
21. Front bearing cap
22. Housing bolt
23. Lock washer
24. Coupling guard
25. Guard nut
26. Set screws
27. Rear seal driver
28. Seal washer
29. Seal o-ring
30. Rear rotating seal
31. Retaining ring bolts
32. Retaining ring
33. Stationary seal o-ring
34. Stationary seal
35. Flat gasket
36. Pump housing



37. Front rotating seal
38. Front seal spring
39. Front inside driver o-ring
40. Front seal driver
41. Front outside driver o-ring
42. Impeller
43. Impeller nut gasket
44. Impeller nut
45. Cover gasket
46. Pump cover
47. Cover nut
48. Water pipe
49. Housing stud

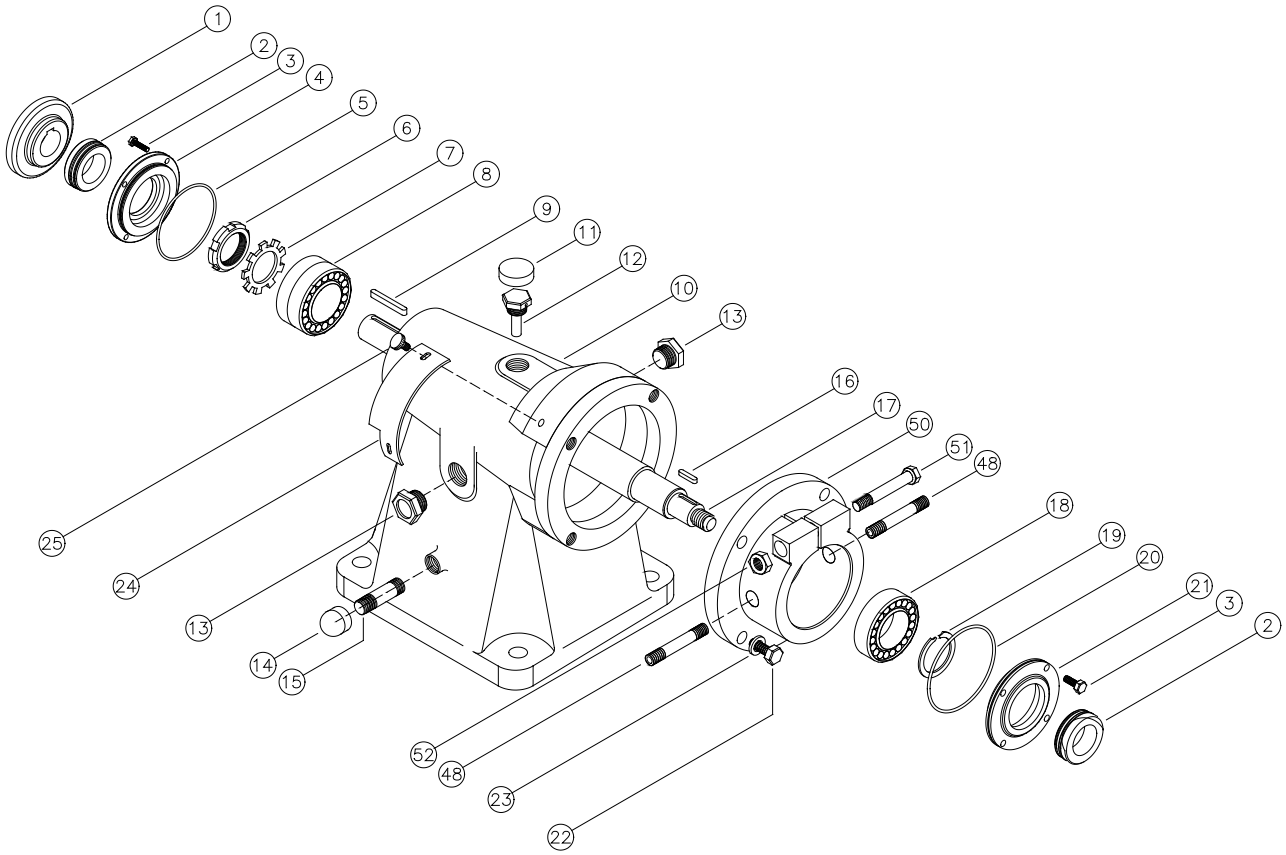
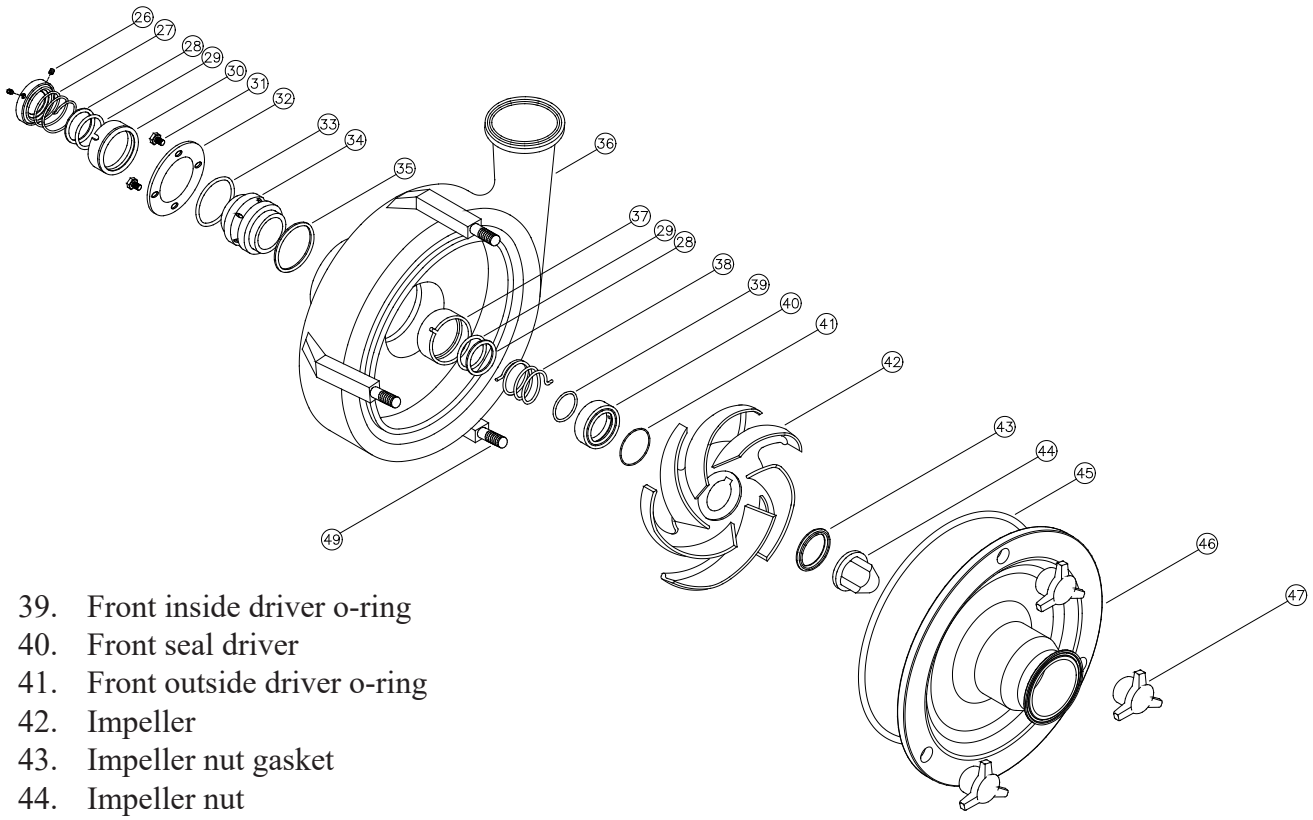


Figure 25: FP #1 Bearing Block Pump Assembly

1. Coupling flange
2. Labyrinth seal
3. Bearing cap bolts
4. Rear bearing cap
5. Rear bearing cap o-ring
6. Bearing lock nut
7. Bearing lock nut washer
8. Thrust bearing
9. Coupling key
10. #1 bearing block
11. Breather cap
12. Breather/fill plug
13. Sight glass
14. Oil drain cap
15. Oil drain pipe
16. Impeller key
17. Pump shaft
18. Radial bearing
19. Snap ring
20. Front bearing cap o-ring
21. Front bearing cap
22. Housing bolt
23. Lock washer
24. Coupling guard
25. Guard nut
26. Set screws
27. Rear seal driver
28. Seal washer
29. Seal o-ring
30. Rear rotating seal
31. Retaining ring bolts
32. Retaining ring
33. Stationary seal o-ring
34. Stationary seal
35. Flat gasket
36. Pump housing
37. Front rotating seal
38. Front seal spring



39. Front inside driver o-ring
40. Front seal driver
41. Front outside driver o-ring
42. Impeller
43. Impeller nut gasket
44. Impeller nut
45. Cover gasket
46. Pump cover
47. Cover nut
48. Water pipe
49. Housing stud
50. Flange adapter
51. Adapter bolt
52. Adapter nut

Pump Maintenance Record

Date	Service Performed	By

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 must be mailed or delivered by purchaser within thirty (30) days after purchaser learns of 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 Pumps 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.

No person, including any representative employee or agent of Fristam Pumps is authorized to assume on behalf of Fristam Pumps any liability or responsibility in addition to or different from that described in this provision. Any and all representations, promises, warranties or statements that are in addition to or different from the terms of this provision are of no force or effect.

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.

Fristam PUMPS®

Engineered For Lasting Performance®

Drawing # 1250000009 Rev - Updated 6/3/11
Part # 1050000053
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2410 Parview Road • Middleton, WI 53562-2524
1-800-841-5001 • 608-831-5001
www.fristam.com
Email: fristam@fristampumps.com