Fristam PUMPS

INSTRUCTION AND MAINTENANCE MANUAL:

FZX 2000 SERIES PUMP

SANITARY LIQUID RING CENTRIFUGAL PUMPS
DESCRIPTION

This manual contains disassembly and assembly instructions, maintenance procedures, troubleshooting, and installation procedures for the FZX 2000 Series Liquid Ring Centrifugal Pumps designed and manufactured by Fristam Pumps, Middleton, Wisconsin.

Read this manual and understand the instructions before installing, using or servicing your pump. Failure to follow the manual may result in personal injury or equipment damage.

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.
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Technical Information

Specifications

Maximum Inlet Pressure .............................................. 150 PSI
Temperature Range ..................................................... 13°F - 250°F
Noise Level ................................................................. 60 - 85 dB(A)

Materials of Construction

Major 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)
Also available in ........................................................... 25 Ra, 20 Ra, electropolish

Shaft Seals

Mechanical Seal Types ....................................................... Single or Double
Maximum Seal Water Pressure (double seal) ......................... 5 PSI of water
Seal Water Consumption (double seal) ................................. 1-2 gph
Inner Stationary Seal Ring Material ...................................... Carbon (standard)
Also available in ........................................................... Silicon Carbide
Outer Stationary Seal Ring Material ....................................... Carbon
Rotating Seal Ring Material ............................................... Chrome Oxide (standard)
Also available in ........................................................... Silicon Carbide
Product O-ring Material ..................................................... Viton (standard)
Also available in ........................................................... others available upon request
Non-Product O-ring Material ................................................ Viton (standard)

Impeller Gap

FZ 2100, 2150, 2200, 2250 .................................................. 0.2 mm (0.008”)
FZ 2400 ............................................................................. 0.5 mm (0.020”)

Recommended Torque Values:

<table>
<thead>
<tr>
<th>Component</th>
<th>Torque Values</th>
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<tbody>
<tr>
<td>Impeller nut</td>
<td>40 ft-lb. (54 Nm)</td>
</tr>
<tr>
<td>Impeller bolt (FZX 2400 model only)</td>
<td>20 ft-lb. (27 Nm)</td>
</tr>
<tr>
<td>Housing bolts</td>
<td>50 ft-lb. (68 Nm)</td>
</tr>
<tr>
<td>Motor bolts (NEMA 182TC-256TC, IEC 100-132)</td>
<td>50 ft-lb. (68 Nm)</td>
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<tr>
<td>Shaft clamping bolt</td>
<td></td>
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<tr>
<td>NEMA 143TC-184TC</td>
<td>6 ft-lb.</td>
</tr>
<tr>
<td>IEC 90-112</td>
<td>15 Nm</td>
</tr>
<tr>
<td>NEMA 213TC-256TC</td>
<td>15 ft-lb.</td>
</tr>
<tr>
<td>IEC 132-180</td>
<td>40 Nm</td>
</tr>
<tr>
<td>NEMA 280TC-360TC</td>
<td>40 ft-lb.</td>
</tr>
<tr>
<td>IEC 200-225</td>
<td>76 Nm</td>
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Motor Information

Uses standard NEMA TEFC C-face motors. Options include washdown, high efficiency, explosion proof, chemical duty and IEC. Motors may be modified with Belleville washers to limit motor shaft end play. The TIR of the motor shaft should be 0.002” or less.

Voltage and Frequency
3 phase, 60 Hz, 208-230/460 VAC ........................................... 1750 RPM
3 phase, 60 Hz, 575 VAC ......................................................... 1750 RPM
3 phase, 50 Hz, 208-220/330-415 VAC ........................................ 1450 RPM
**Recommended Preventive Maintenance**

**Recommended Seal Maintenance:**

Visually inspect mechanical seal daily for leakage.
Replace mechanical seal annually under normal duty.
Replace mechanical seal as often as required under heavy duty.
We recommend having a spare seal kit and cover gasket on hand.

**Elastomer Inspection**

Inspect all elastomers when performing pump maintenance. We recommend replacing elastomers (o-rings and gaskets) during seal, pump shaft and/or motor replacements.

**Pump Shaft Inspection**

Inspect annually for wear.

**Lubrication Recommendations:**

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.

**Motor Lubrication Recommendations:**

Use a high grade ball and roller bearing grease. Recommendations for standard service conditions include *Shell Dolium R* or *Chevron SRI*.

**Motor Lubrication Intervals for Standard Service Conditions:**

<table>
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<tr>
<th>Frame Size</th>
<th>Motor Speed</th>
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<tr>
<td>NEMA/(IEC)</td>
<td>1800 RPM</td>
</tr>
<tr>
<td>Up to 210 (132) inclusive</td>
<td>12,000 hours</td>
</tr>
<tr>
<td>Over 210 to 280 (132 to 180) inclusive</td>
<td>9,500 hours</td>
</tr>
<tr>
<td>Over 280 to 360 (225) inclusive</td>
<td>7,400 hours</td>
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</table>

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

**Service Condition Definitions:**

<table>
<thead>
<tr>
<th>Service Condition</th>
<th>Maximum Ambient Temperature</th>
<th>Atmospheric Contamination</th>
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<tbody>
<tr>
<td>Standard</td>
<td>104°F (40°C)</td>
<td>Clean, little corrosion.</td>
</tr>
<tr>
<td>Severe</td>
<td>122°F (50°C)</td>
<td>Moderate dirt, corrosion.</td>
</tr>
<tr>
<td>Extreme</td>
<td>&gt; 122°F (&gt; 50°C)</td>
<td>Severe, dirt, abrasive dust, corrosion.</td>
</tr>
</tbody>
</table>

**Volume of Grease to Be Added:**

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>Grease Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA/(IEC)</td>
<td>IN.3 TSP</td>
</tr>
<tr>
<td>Up to 210 (132) inclusive</td>
<td>0.6 2.0</td>
</tr>
<tr>
<td>Over 210 to 280 (132 to 180) inclusive</td>
<td>1.2 3.9</td>
</tr>
<tr>
<td>Over 280 to 360 (225) inclusive</td>
<td>4.1 13.4</td>
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</table>
**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:**
- Soft-faced hammer (5 lb. dead blow)
- 15/16” socket wrench
- 3/4” wrench
- Small flat screw driver
- 3/8” diameter rod
- One pair tack pullers (impeller pullers)
- Torque wrench

**Pump Head Disassembly**

*Note: the reference numbers listed in the text (#) refer to the assembly drawing on pages 16 & 17.*

Disconnect the suction and discharge piping.

a) Loosen the cover nuts (1) with the soft-faced hammer and remove. Note: fluid in pump will drain out.

b) Remove the pump cover (2) and cover gasket (4).

c) Remove the flange guard (31).

d) Place the 3/8” diameter rod in the hole on the shaft. Allow the rod to rest against the pump flange support (23) to keep the shaft from rotating while loosening the impeller nut (3) with the 15/16” socket wrench (loosen the impeller bolt with 3/4” wrench on the 2400 model only) *(Figure 4)*.

e) Remove the impeller nut and impeller nut gasket (5). Discard the impeller nut gasket.

f) Remove the impeller (6) by pulling the impeller toward you. Remove and discard the impeller o-ring (7). *(If the impeller is difficult to pull off the shaft, wedge the tack pullers between the pump housing (9) and the impeller and pry the impeller off the shaft.)*

g) Remove the impeller key (20).

h) Remove the three housing bolts (25) and washers (24) which attach the pump housing to the flange support (23) using the 3/4” wrench.

i) Slide the pump housing off the end of the pump shaft (21).
j) Place the pump housing (9) face down on the housing studs (8) (Figure 5).

k) Remove the stationary seal (16) by placing two fingers in the center of the seal and pulling up. Discard after removal.
For Double Mechanical Seal - remove both the inner and outer stationary seals (16 & 17) by placing your fingers in the center of the seals and pulling up. The seals should come out of the seal cavity as one unit (Figure 5). Discard after removal.

l) Remove and discard the wave spring (14).
For Double Mechanical Seal - remove and discard both the inner and outer wave springs (13 & 14).

m) Remove the inner stationary seal o-ring (11) with a small flat screwdriver. Discard after removal.
For Double Mechanical Seal - remove and discard both the inner and outer stationary seal o-rings (11 & 15) with a small flat screwdriver.

n) Pull the rotating seal (18) off the shaft and discard. Also remove and discard the rotating seal o-ring (19).

Pump Head Assembly (See seal assembly drawings figure 8, 8A, 9 & 9A, pages 11-14.)

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

You are now ready to install the new mechanical seal into the pump.

a) Start by lubricating the new rotating seal o-ring (19) with a food grade lubricant (unless the o-ring is EPDM) and placing it into the rotating seal (18).

b) Snap the new rotating seal into place on the shaft. (The rotating seal will fit into the grooves on the shaft and interlock with the shaft. If you can rotate the seal ring on the shaft, it is not properly seated.)

c) Lubricate the new inner stationary seal o-ring (11) with a food grade lubricant and place into seal cavity.
For Double Mechanical Seal - lubricate both the new inner and outer stationary seal o-rings (11 & 15) and place into the seal cavity.
d) Place the inner wave spring (14) into the seal cavity. Align the notches in the wave spring with the pins in the seal cavity. Place the wave spring with the waves in a downward position around the pins (Figure 6).

For Double Mechanical Seal - place both the inner and outer wave springs (14 & 13) into the seal cavity. Align the notches in the inner wave spring with the pins in the seal cavity and place on the inside of the pins. Align the notches in the outer wave spring with the pins in the seal cavity and place on the outside of the pins. Again, it fits best if the waves around the pins are in a downward position (Figure 6).

e) Insert the new inner stationary seal (16) aligning the notches with the pins in the seal cavity. (If you touch the face of the seal, clean with isopropyl alcohol.)

For Double Mechanical Seal - after the new inner stationary seal (16) is in place, the new outer stationary seal (17) will need to be installed. Align the notches in the outer stationary seal with the pins in the seal cavity. The outer stationary seal will fit around the inner stationary seal that is already in place.

f) Carefully slide the pump housing (9) on the pump shaft, 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.) Make sure the discharge fitting is in the correct position.

g) Install and tighten the three housing bolts (25) with the 3/4" wrench to the correct torque (see page 4).

h) Place the impeller key (20) into the keyway on the shaft (21).

i) Lubricate the new impeller o-ring (7) and place in the groove on back of the impeller (6).

j) Slide the impeller onto the pump shaft.

k) Lubricate the new impeller nut gasket (5) and place on the impeller nut (3).
l) Place the 3/8” diameter rod in the shaft. Allow the rod to rest against the pump flange support (23) to keep the shaft from rotating while tightening the impeller nut (3) with the 15/16” socket wrench (tighten the impeller bolt with a 3/4” socket on the FZX 2400 model only) to the appropriate torque (see page 5).

m) Place the cover gasket (4) in the groove on the pump cover (2). Note: when installing the cover gasket, gently stretch the gasket to aid in assembly. Do not roll the gasket into position. Next install the pump cover onto the front of the pump and thread the cover nuts (1) onto the housing studs (8). Note: the pump cover only fits onto the housing one way. The pump serial number is embossed into the ‘top’ of the pump cover.

n) Tighten the cover nuts with the soft-faced hammer.

Now rotate the pump shaft (21) to make sure that the impeller (6) 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 the impeller gap (see page 16) and total indicated run-out of the pump shaft (see page 17). Regap the impeller or align the shaft if necessary.

Replace the flange guard (31) using the guard screws (22).

Reconnect the suction and discharge piping.
Figure 8: Single Seal Assembly for FZX 2100 - 2250 models

5 IMPELLER NUT GASKET
7 IMPELLER O-RING
11 INNER STATIONARY SEAL O-RING
12 PIN
14 INNER STATIONARY SEAL SPRING
16 INNER STATIONARY SEAL
18 ROTATING SEAL
19 ROTATING SEAL O-RING
Figure 8a: Single Seal Assembly for FZX 2400 model

- IMPELLER BOLT O-RING
- IMPELLER WASHER O-RING
- IMPELLER O-RING
- INNER STATIONARY SEAL O-RING
- PIN
- INNER STATIONARY SEAL SPRING
- INNER STATIONARY SEAL
- ROTATING SEAL
- ROTATING SEAL O-RING
Figure 9: Double Seal Assembly for the FZX 2100 - 2250 models

- 5 IMPELLER NUT GASKET
- 7 IMPELLER O-RING
- 11 INNER STATIONARY SEAL O-RING
- 12 PIN
- 13 OUTER STATIONARY SEAL SPRING
- 14 INNER STATIONARY SEAL SPRING
- 15 OUTER STATIONARY SEAL O-RING
- 16 INNER STATIONARY SEAL
- 17 OUTER STATIONARY SEAL
- 18 ROTATING SEAL
- 19 ROTATING SEAL O-RING
Figure 9a: Double Seal Assembly for the FZX 2400 model

- IMPELLER BOLT O-RING
- IMPELLER WASHER O-RING
- IMPELLER O-RING
- INNER STATIONARY SEAL O-RING
- PIN
- OUTER STATIONARY SEAL SPRING
- INNER STATIONARY SEAL SPRING
- OUTER STATIONARY SEAL O-RING
- INNER STATIONARY SEAL
- OUTER STATIONARY SEAL
- ROTATING SEAL
- ROTATING SEAL O-RING
Pump shaft and/or Motor Replacement

Begin all pump maintenance by disconnecting the energy source connected 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 pump shaft and/or motor replacement:

- 3/4” wrench
- 3/4” socket
- 1/4” Allen wrench
- Plastic gapping spacer (supplied by Fristam)
- 3/8” diameter rod
- 15/16” socket wrench
- Soft-face hammer

Pump Disassembly

Disassemble the pump head as described on pages 6-7.

a) Loosen the shaft clamping bolt (26) (or shaft clamping bolts for the FZX 2400 model) with the 1/4” Allen wrench.

b) Pull the pump shaft (21) off the motor shaft.

If you are replacing the motor (27), the flange support (23) must be removed.

a) Loosen and remove the four motor bolts (33) with the 3/4” wrench. Also remove the washers (32).

b) Remove the flange support from the motor.

C) Clean off the motor face of the flange support and lubricate liberally with a food grade grease such as NEVER-SEEZ.

Pump Assembly

If replacing the motor check to make sure Belleville washers are installed to reduce motor shaft end play. It is recommended to check the TIR (total indicated run-out) of the motor shaft before using the new motor. If the TIR is not within .002” call your motor supplier.

Replacing the motor - Place the flange support (23) on the new motor (27), replace the motor bolts (33) and washers (32) and tighten to the appropriate torque (see page 5).

To replace the pump shaft:

a) Lubricate the inside of the pump shaft (21) liberally with NEVER-SEEZ.

b) Slide the pump shaft onto the motor shaft. Note: the pump shaft should slide freely on motor shaft.

Setting the Impeller Gap

The next step is to gap the pump shaft.
a) Place the pump housing (9) onto the flange support (23). *Note: it is recommended not to have the mechanical seals in place for gapping the pump.*

b) Install the housing bolts (8) and tighten with a 3/4” wrench.

c) Install the pump shaft key (20).

d) Place the correct plastic gapping shim (page 4) over the pump shaft and slide it against the pump housing. Slide the impeller onto the pump shaft. (The gapping shim is supplied with the pump. Additional shims may be ordered from Fristam Pumps, Inc.)

e) Place the impeller nut (or impeller bolt) (3) onto the pump shaft (21).

f) Place the 3/8” diameter rod in the hole on the shaft. Allow the rod to rest against the flange support (23) to keep the shaft from rotating while tightening the impeller nut with the 15/16” socket wrench (tighten the impeller bolt with the 3/4” socket wrench for the FZX 2400 model). Tighten to the correct torque (see page 5).

g) Push on the impeller nut (3) until the shim is tight between the impeller (6) and housing (9). See Figure 10.

h) **Align the slot of the clamping ring (26) directly over one of the slots on the shaft (Figure 11).**

g) Secure the shaft clamping bolt with the 1/4” Allen wrench (Figure 10) to the specified torque (see page 5).

i) Now remove the impeller nut (3) (or impeller bolt for the FZX 2400 model), impeller (6), impeller key (20), shim and pump housing (9).

Assemble the pump head as described on pages 7-9.
**Figure 14: Exploded View of FZX**

1. Cover Nut
2. Pump Cover
3. Impeller Nut
3a. Impeller Bolt*
3b. Impeller Bolt Washer *
4. Cover Gasket
5. Impeller Nut Gasket
5a. Impeller Bolt O-ring*
5b. Impeller Washer O-ring*
6. Impeller
7. Impeller O-ring
8. Housing Studs
9. Pump Housing
10. Water Pipes

**Single External Seal**

11. Inner Stationary Seal O-ring
12. Pin
14. Inner Seal Spring
16. Inner Stationary Seal
18. Rotating Seal
19. Rotating Seal O-ring

**Double External Seal**

20. Impeller Key
21. Pump shaft
22. Guard Screws
23. Flange Support
24. Housing Bolt Washer
25. Housing Bolt
26. Shaft Clamping Ring
26a. Shaft Clamping Ring*
27. Motor
28. Leg Bolt
29. Leg Bolt Washer
30. Leg Strap
31. Flange Guard
32. Motor Bolt Washer
33. Motor Bolt

*parts for the FZX 2400 model only
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Part Number</th>
<th>Previous Part No.</th>
<th>Qty</th>
<th>Item No.</th>
<th>Description</th>
<th>Part Number</th>
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INSTALLATION

UNPACKING EQUIPMENT

Check the contents and all wrapping when unpacking the pump. Inspect the pump carefully for any damage that may have occurred during shipping. Immediately report any damage to the carrier. Remove the shaft guard and rotate the pump shaft by hand to make sure the impeller rotates freely. Keep the protective caps over the pump inlet and outlet in place until you are ready to install the pump.

PIPING AND INSTALLATION GUIDELINES

- Properly support and align the suction and discharge piping to prevent stress at pump connections. *(Figure 1)*
- Provide for adequate motor ventilation.
- Keep suction piping as short and direct as possible.
- Install the pump so that it is readily accessible for maintenance, inspection and cleaning.
- Ensure that any mounting structure is properly sized to support the weight of the pump.
- Consider local noise level regulations when installing the pump.
- Ensure that the pump motor type is suitable for the environment where the pump is to be operated. (Pumps intended for use in hazardous environments eg., explosive, corrosive, etc., must use a motor with the appropriate enclosure characteristics. Failure to use an appropriate motor type may result in serious damage and/or injury.)
- Install throttling valves in the discharge piping to control the pump performance. Do not install throttling valves in the suction piping.
- Check valves in the discharge line should be a minimum of 5 ft. away from the pump outlet *(Figure 1).*
- In applications where the pump may lose its prime when shut off, an elbow or foot valve (or check valve) may be installed at the piping inlet to prevent the liquid from draining out of the suction line. See *(Figure 2).*

![Figure 1](image1)

![Figure 2](image2)
**Electrical Installation**

- We use standard duty TEFC motors unless otherwise specified. Other motor options are available such as: washdown, flameproof, explosion-proof, hostile duty or chemical duty.
- Check pump for proper rotation. The shaft should rotate clockwise when viewing the motor fan.
- Note that a change in operating conditions (for example, higher viscosity, higher specific gravity, lower head losses) may change the load requirements on the motor. If you have a question regarding the power requirements for your application, please contact your local Fristam distributor or Fristam Pumps, Inc. for technical assistance.

**Installation of Water Flush for Double Mechanical Seal**

- Set up the water flush for the double mechanical seal (if installed). As shown in Figure 3. The seal flush water should be supplied at a maximum flow rate of 1-2 gph (45.42 lph) at a maximum pressure of 5 psi (.35 bar). Excessive flow/pressure through the seal flush will cause excessive wear and shorten seal life.
- 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.

**Pump Operations**

**Start-up instructions**

- Remove any foreign matter in the pump or piping system before start-up. Do not use the pump to flush the system!
- Make sure the pump housing is filled with liquid before start-up.
- Avoid abrupt closure of valves. This can cause hydraulic shock which may cause severe damage to the pump and system.
- Maximum inlet pressure to the pump should not exceed 150 psi.

**Shut-down instructions**

- Shutoff the power supply to the pump.
- Close the shut-off valves in the suction and discharge piping.
- Drain and clean the pump.
- Protect the pump against dust, hear, moisture and impact damage.
**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.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause of Trouble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump does not deliver liquid</td>
<td>(see following pages)</td>
</tr>
<tr>
<td>Not enough capacity delivered</td>
<td>1, 2, 6, 7, 9, 10, 13, 15, 27, 28</td>
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<tr>
<td>Pump loses prime after starting</td>
<td>2, 3, 7, 10, 13, 15, 19, 20, 27</td>
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<tr>
<td>Pump requires too much power</td>
<td>2, 3, 6</td>
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<tr>
<td>Leaking seal</td>
<td>8, 11, 12, 15, 18, 19, 23</td>
</tr>
<tr>
<td>Seal fails prematurely</td>
<td>5, 17, 22, 23, 24, 25</td>
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<tr>
<td>Pump vibrates or is noisy</td>
<td>4, 6, 17, 19, 22, 23, 24, 25</td>
</tr>
<tr>
<td>Motor bearings fail prematurely</td>
<td>2, 11, 14, 15, 16, 17, 18, 19, 20, 26, 27, 29</td>
</tr>
<tr>
<td>Pump overheats and seizes</td>
<td>14, 17, 19, 26, 27</td>
</tr>
<tr>
<td>Pump head leaking</td>
<td>1, 14, 18, 19, 26</td>
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<td>21</td>
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</tbody>
</table>

**Possible Cause of Suction Problems**

1. Pump inlet is not flooded
2. NPSHA is not sufficient
3. Air entering the pump through the seal area

**Possible Solutions**

1a) Adjust piping so the pump inlet is flooded
1b) 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
2b) Use a larger pipe on the inlet side of the pump
2c) Eliminate restrictions in suction line where possible
2d) Check the inlet pipe for obstructions
2e) Shorten the inlet piping, move pump
2f) Lower the temperature of the liquid
3. Check seal for proper installation, replace seal if defective
4. Seal flush water not on (double seal only)
5. Seal water flush pressure too high (double seal only)
6. Not enough liquid is retained in the pump housing

**Possible Cause of Mechanical Problems**

4. Turn on water to seal flush
5. Adjust water flow to seal flush to 10-12 gph at 1-2 psi
6. Install an elbow on the pump inlet

7. Drive speed too low
8. Drive speed 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

7. Have a qualified person check that the power supplied matches the power of the drive
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
10b) Use larger diameter pipe
10c) Check application with Fristam Pumps
11a) Install throttling valve in discharge line
11b) Check with Fristam Pumps
12. Use larger motor, check application with Fristam Pumps
13a) Increase piping diameter and eliminate restrictions
13b) 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 20-21 for directions)
18a) Check the impeller gap
18b) Replace defective components
18c) 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. Type of seal incorrect for operating conditions
24. Replace seal with correct type of seal, check with your local representative or Fristam Pumps

25. Dirt or grit in seal flush liquid leading to scoring of shaft or seal surfaces (double seal only)
25. Use clean source of water for seal flush

26. Lack of lubrication in motor bearing
26. Lubricate motor bearings

27. Piping is obstructed
27. Remove obstruction in pipe, check for closed valve

28. Power is not being supplied
28. Have qualified person check electrical connections

29. Piping is being supported by the pump
29. Support the piping independently from the pump
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<tr>
<th>Date</th>
<th>Service Performed</th>
<th>By</th>
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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.

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