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INSTRUCTION AND MAINTENANCE MANUAL: ORIGINAL INSTRUCTIONS

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.

SAFETY

This instruction and maintenance manual shall be read and completely understood prior to operation of the pump. The manual should be kept available at the pump installation location.

All applicable local/national regulation and laws shall be followed.

All work described herein may only be performed by qualified personnel.

Personal protective equipment (PPE) such as hearing protection may be required.

Despite inherent safe design measures some amount residual risk will remain. Throughout the manual these risks will be pointed out.

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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SPARE PARTS

Use of replacement parts that are not approved by Fristam Pump can lead to serious personal injury and material damage. If you have any questions regarding approved replacement parts, please contact Fristam.

TRANSPORTATION

Transportation may only be performed by trained personnel. The pump may be moved using approved lifting devices suitable for the weight/size of the pump. Improper securing the pump may result in injury from falling, tipping, or unsecured parts. Dimensional information is available for download at www.fristam.com/usa. Weight information is based on motor selection, and is available upon request.

NOISE REDUCTION

Operating the pump within its intended design range will aid in reducing the noise to acceptable levels.

- Avoid excessively low or very high flow rates.
- Avoid cavitation of the pump.
- Maintain good piping practices (see below).

INSTALLATION

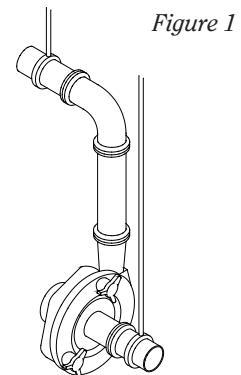
UNPACKING

Check the contents and all wrapping when unpacking the pump. Inspect the pump carefully for any damage that may have occurred during shipping. Immediately report any damage to the carrier. 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.

INSTALLING

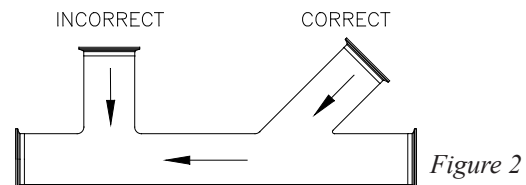
Prior to actually installing the pump, ensure that:

- 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.



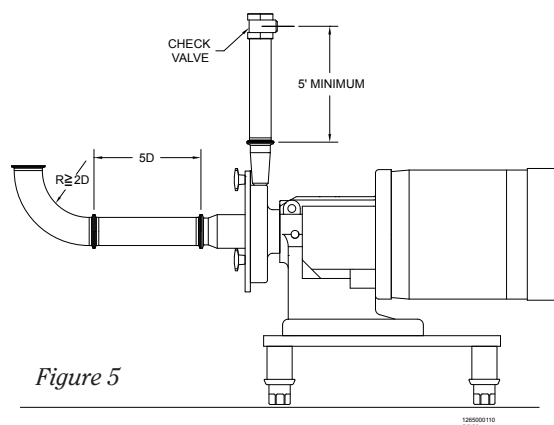
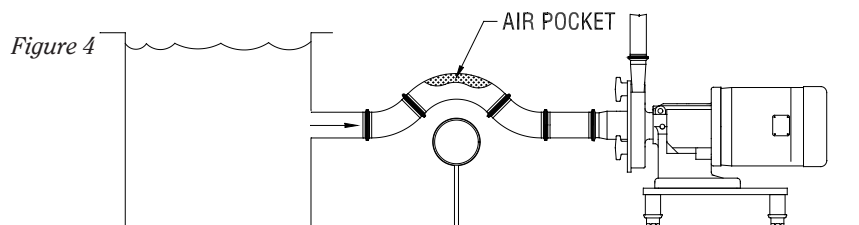
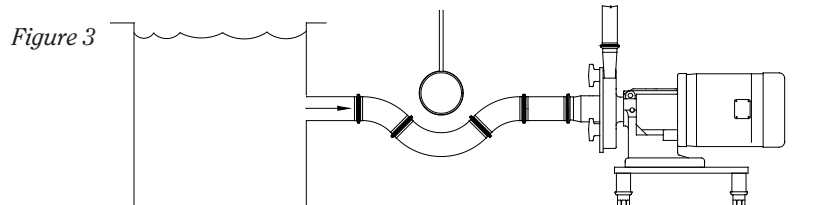
PIPING GUIDELINES

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.
- 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.
- Avoid sump areas where sediments may collect (*Figure 3*).
- 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*).
- Check valves in discharge line should be a minimum of 5 ft. away from the pump outlet (*Figure 5*).



ELECTRICAL INSTALLATION

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

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, Inc., for technical assistance.

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.*

PUMP OPERATIONS

INTENDED USE

The standard FP/FPX centrifugal pump versions are designed for use in hygienic applications. Each pump is specified according to customer specifications, including performance and materials of construction. The pump may only be used for the application it was specified for.

General Specifications:

- Motor sizes up to 75 HP
- Flow rate up to 400 GPM
- Viscosity up to 5000 CPS
- Inlet pressure up to 150 psi
- Discharge pressure up to 100 psi

IMPROPER USE

The standard FZX pump versions may not be used in explosive atmospheres. Special explosion-proof versions may be available. Please consult Fristam for more information.

Pumping media other than those specified can cause serious damage to the pump and/or personnel. Any modifications to the pump or its use are only permissible with the explicit consent of Fristam.

START-UP INSTRUCTIONS

- Remove any foreign matter that may have entered the pump.
- Turn shaft by hand to make sure seals do not stick together otherwise, if motor is bumped in wrong direction it may unwind the seal spring.
- 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.
- Protect the pump against dust, heat, moisture and impact damage.

CLEANING

SIP PROCESS

FP/FPX series pumps should only be used for SIP (Sterilization In Place) process with the prior approval of Fristam. Suitability may depend on selected elastomers and/or process temperatures.

CIP PROCESS

FP/FPX series pumps are suitable for the CIP (Cleaning In Place) process. The following is a general example of the CIP process:

- Preliminary flush with water
- Caustic flush (NaOH, ~1-2%)
- Intermediate flush with water
- Acid flush (HNO₃, ~1%)
- Final flush with water

The pump's differential pressure should be sufficient to achieve adequate flow rates for proper cleaning. The result of the CIP process is dependent on many factors (temperature, time, chemical compositions/concentrations, speed, differential pressure, e.g.). Therefore, it is recommended that the cleaning cycle is validated prior to being put into service.

FZX 2400 IMPELLER BOLT CLEANING

If the impeller bolt o-ring, impeller washer o-ring, or impeller o-ring fails, the threaded hole on the end of the shaft will need to be cleaned. We recommend removing the impeller and impeller bolt/washer while the pump is being CIP'd. This will ensure that the internal threads are cleaned before production resumes.

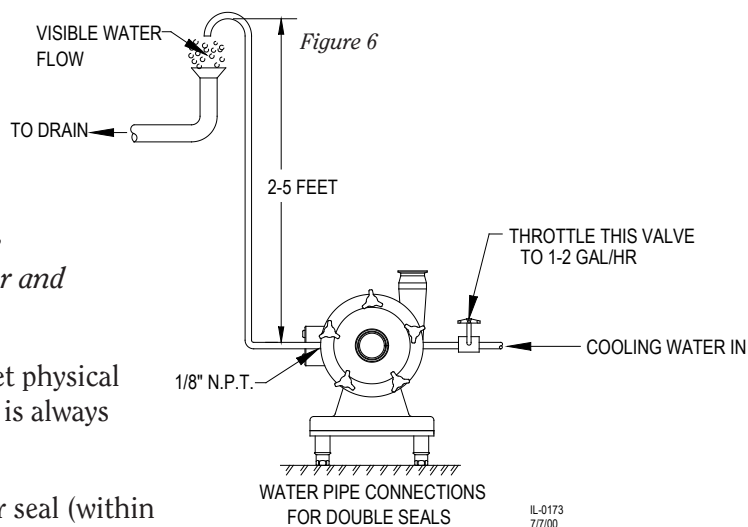
INSTALLATION OF WATER FLUSH FOR DOUBLE MECHANICAL SEAL

Set up the water flush for the double mechanical seal as shown (Figure 6). Use only between 1-2 gallons per hour of water at a maximum pressure of 5 PSI. Excessive flow of water through the seal increases the pressure inside the seal. Note: maximum pressure inside the seal is 5 PSI. Excessive flow/pressure through the seal flush will cause excessive wear and shorten seal life.

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 center seal and the seal never runs dry.

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

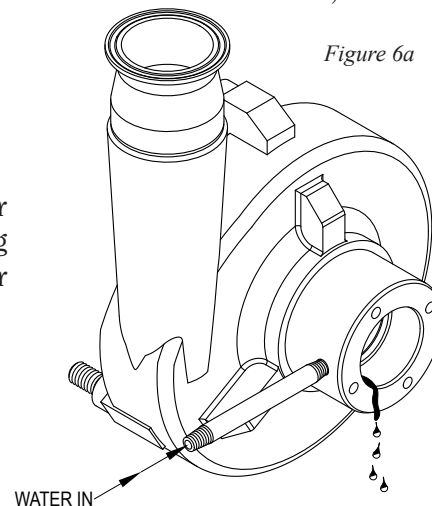
It is desirable to have the flush water on the outlet side visible. This allows an easy check to see that the flush water is on and also if the seal is functioning properly. In a malfunctioning seal the flush water will disappear, become discolored, or show an unusual increase in flow. If these conditions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



INSTALLATION OF WATER CASCADE

Note: Not all pumps require a water cascade on the seal. The water cascade (if supplied) is piped through the hub of the pump housing and into the stationary seal. Since there is no rear seal, the flush water will exit through the rear of the seal area (Figure 6a).

Use about 1-2 gallons per hour of water at a maximum pressure inside the seal of 5 psi.



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

FZX 2010	0.15 mm (0.006")
FZX 2100, 2150, 2200, 2250	0.2 mm (0.008")
FZX 2350, 2400.....	0.5 mm (0.020")

RECOMMENDED TORQUE VALUES:

Impeller nut (model 2010).....	25 ft-lb. (34 Nm)
Impeller nut (models 2100-2400)	40 ft-lb. (54 Nm)
Impeller bolt (models 2350-2400)	20 ft.-lb. (27 Nm)
Housing bolts	50 ft-lb. (68 Nm)
Motor bolts (NEMA 180TC-250TC, IEC 100-132)	50 ft-lb. (68 Nm)
Shaft clamping bolt	
NEMA 140TC-180TC	12 ft-lbs
IEC 90-112.....	15 Nm
NEMA 210TC-250TC	24 ft-lbs
IEC 132-180.....	40 Nm
NEMA 280TC-360TC	43 ft-lbs
IEC 200-225.....	76 Nm

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 the pump shaft and collar annually for wear. Inspect the shaft collar bolt(s) annually or more often in corrosive environments.

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:

<i>FRAME SIZE</i>	<i>MOTOR SPEED</i>
<i>NEMA/(IEC)</i>	<i>1800 RPM</i>
Up to 210 (132) inclusive	12,000 hours
Over 210 to 280 (132 to 180) inclusive	9,500 hours
Over 280 to 360 (225) inclusive	7,400 hours

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

SERVICE CONDITION DEFINITIONS:

<i>SERVICE</i>	<i>MAXIMUM AMBIENT</i>	<i>ATMOSPHERIC</i>
<i>CONDITION</i>	<i>TEMPERATURE</i>	<i>CONTAMINATION</i>
Standard	104°F (40°C)	Clean, little corrosion.
Severe	122°F (50°C)	Moderate dirt, corrosion.
Extreme	> 122°F (> 50°C)	Severe, dirt, abrasive dust, corrosion.

VOLUME OF GREASE TO BE ADDED:

<i>Frame Size</i>	<i>Grease Volume</i>	
<i>NEMA/(IEC)</i>	<i>IN.³</i>	<i>TSP</i>
Up to 210 (132) inclusive	0.6	2.0
Over 210 to 280 (132 to 180) inclusive	1.2	3.9
Over 280 to 360 (225) inclusive	4.1	13.4

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.

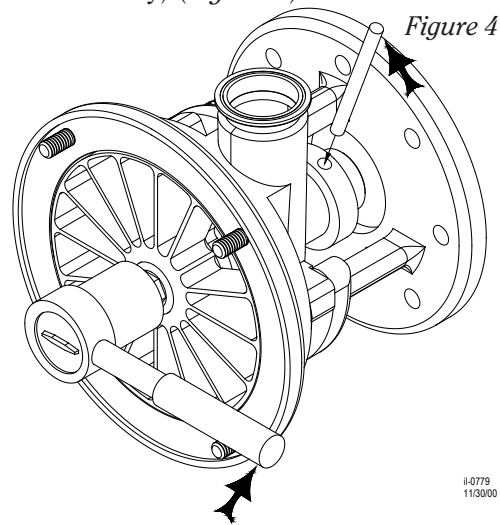
TOOLS REQUIRED FOR SEAL REPLACEMENT:

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

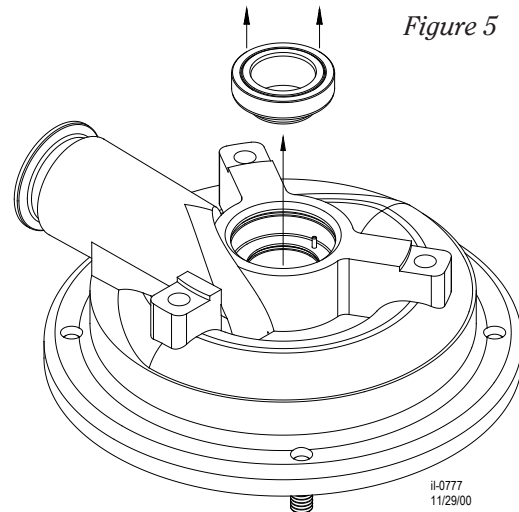
Disconnect the suction and discharge piping.

- a) Loosen the cover nuts with the soft-faced hammer and remove. Note: fluid in pump will drain out.
- b) Remove the pump cover and cover gasket.
- c) Remove the flange guard.
- d) Place the 3/8" diameter rod in the hole on the shaft. Allow the rod to rest against the pump flange support to keep the shaft from rotating while loosening the impeller nut with the 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.
Discard the impeller nut gasket.
- f) Remove the impeller by pulling the impeller toward you. Remove and discard the impeller o-ring. (If the impeller is difficult to pull off the shaft, wedge the tack pullers between the pump housing and the impeller and pry the impeller off the shaft.)
- g) Remove the impeller key.
- h) Remove the three housing bolts and washers which attach the pump housing to the flange support using the wrench.
- i) Slide the pump housing off the end of the pump shaft.



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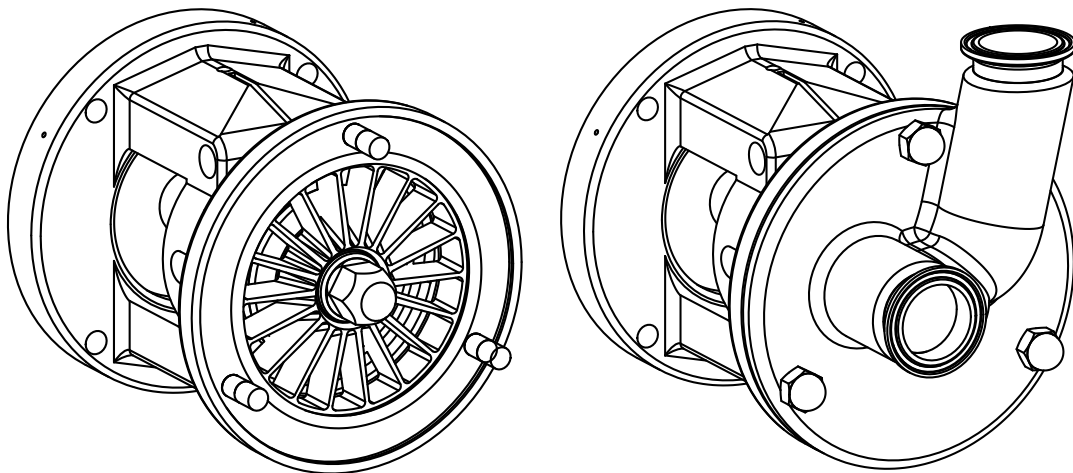
- j) Place the pump housing face down on the housing studs (*Figure 5*).
- k) Remove the stationary seal by placing two fingers in the center of the seal and pulling up. Discard after removal.
For *Double Mechanical Seal* - remove both the inner and outer stationary seals by placing your fingers in the 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.
For *Double Mechanical Seal* - remove and discard both the inner and outer wave springs.
- m) Remove the inner stationary seal o-ring with a small flat screwdriver. Discard after removal.
For *Double Mechanical Seal* - remove and discard both the inner and outer stationary seal o-rings with a small flat screwdriver.



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

Figure 5b

Note: On FZX model 2010, the outlet is located on the cover, not the housing



PUMP HEAD ASSEMBLY (SEE SEAL ASSEMBLY DRAWINGS FIGURE 8, 8A, 9, & 9A)

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 with a food grade lubricant (unless the o-ring is EPDM) and placing it into the rotating seal.
- 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 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 and place into the seal cavity.

- d) Place the inner wave spring 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 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 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 is in place, the new outer stationary seal 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 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.

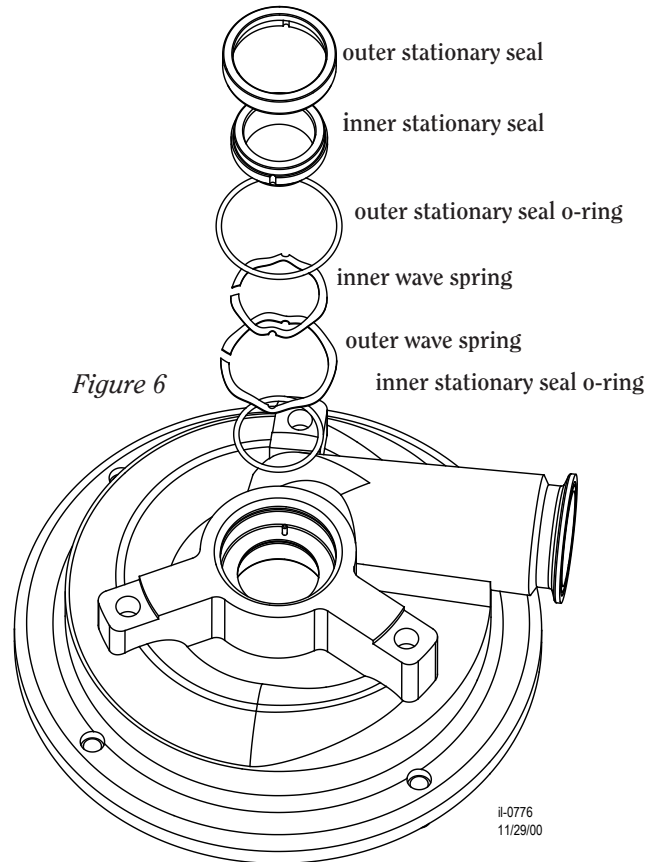
- g) Install and tighten the three (one on model 2010) housing bolts with the wrench to the correct torque (see Technical Information section).

- h) Place the impeller key into the keyway on the shaft.

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

- j) Slide the impeller onto the pump shaft.

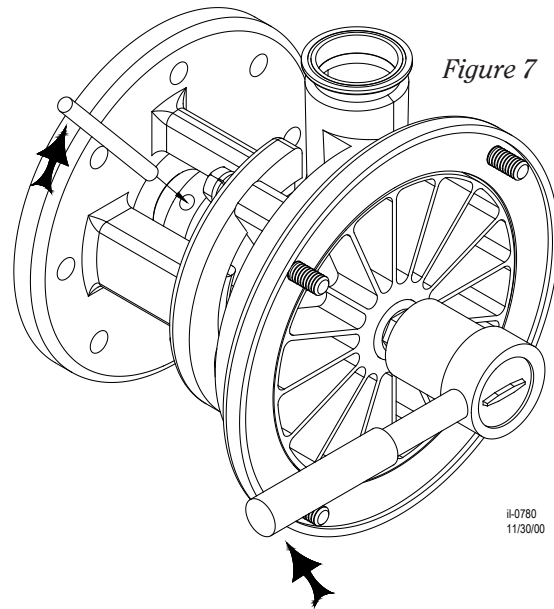
- k) Lubricate the new impeller nut gasket and place on the impeller nut.



l) Place the 3/8" diameter rod in the shaft (*Figure 7*). Allow the rod to rest against the pump flange support to keep the shaft from rotating while tightening the impeller nut with the socket wrench to the appropriate torque (see Technical Information section).

m) Place the cover gasket in the groove on the pump cover. *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 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.

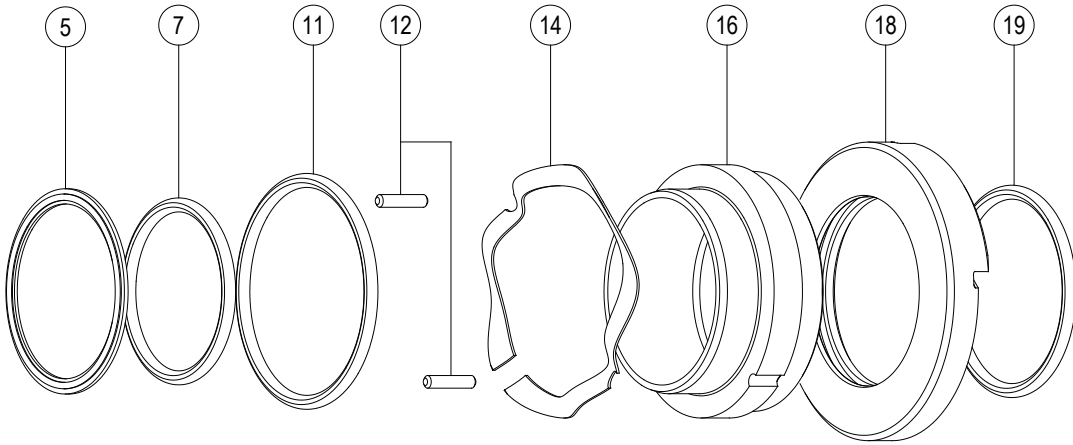


Now rotate the pump shaft to make sure that the impeller moves freely. If it does not, recheck your assembly to make sure that gaskets are not pinched and everything is seated properly. Listen to the pump as you turn the shaft. A small amount of noise from the seals is normal, but if there is metal-to-metal contact, the sound will be noticeable. If there is metal-to-metal contact, check the impeller gap (see gapping section) and total indicated run-out of the pump shaft). Regap the impeller or align the shaft if necessary.

Replace the flange guard using the guard screws.

Reconnect the suction and discharge piping.

Figure 8: Single Seal Assembly for FZX 2010 - 2250 models



- | | |
|--------------------------------|-------------------------|
| ⑤ IMPELLER NUT GASKET | ⑬ INNER STATIONARY SEAL |
| ⑦ IMPELLER O-RING | ⑭ ROTATING SEAL |
| ⑪ INNER STATIONARY SEAL O-RING | ⑮ ROTATING SEAL O-RING |
| ⑫ PIN | |
| ⑭ INNER STATIONARY SEAL SPRING | |

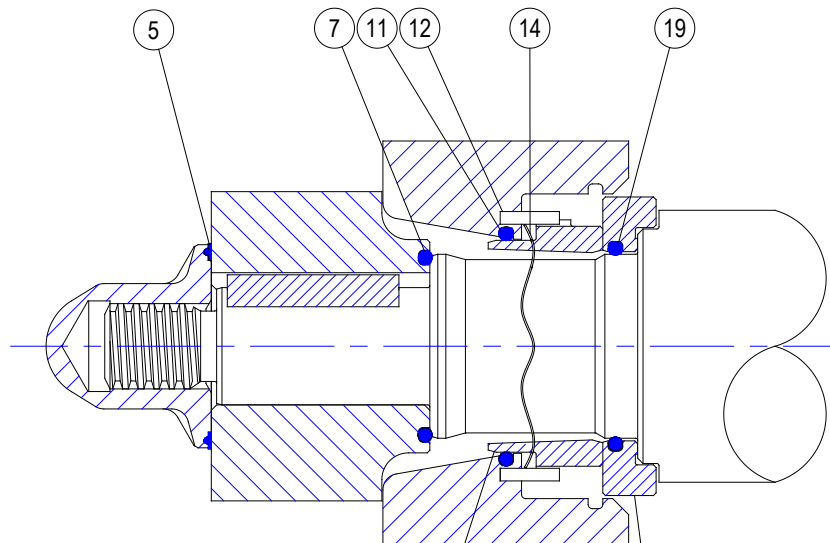
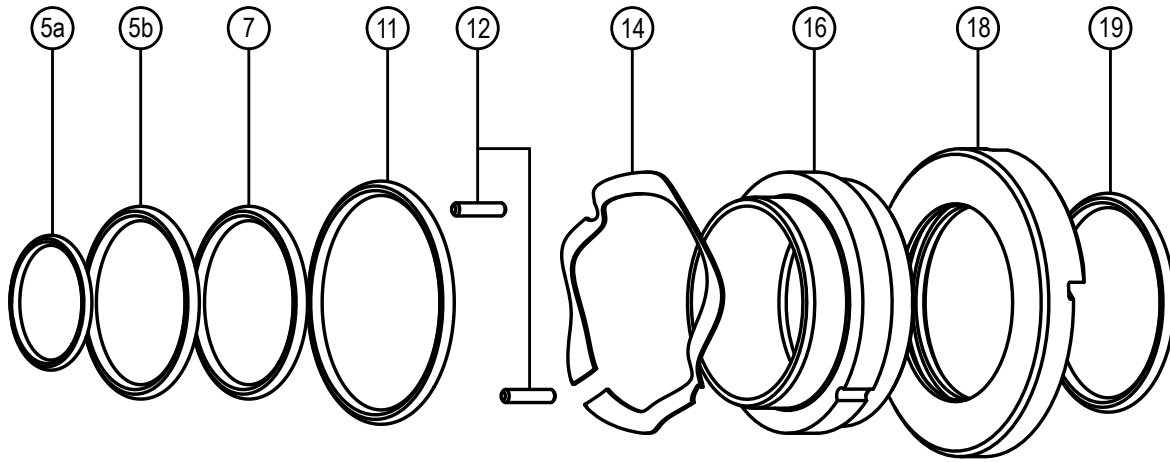


Figure 8a: Single Seal Assembly for FZX 2350 - 2400 models



- | | | | |
|----|------------------------------|---|-----------------------|
| ⑤a | IMPELLER BOLT O-RING | ⑬ | INNER STATIONARY SEAL |
| ⑤b | IMPELLER WASHER O-RING | ⑱ | ROTATING SEAL |
| ⑦ | IMPELLER O-RING | ⑲ | ROTATING SEAL O-RING |
| ⑪ | INNER STATIONARY SEAL O-RING | | |
| ⑫ | PIN | | |
| ⑭ | INNER STATIONARY SEAL SPRING | | |

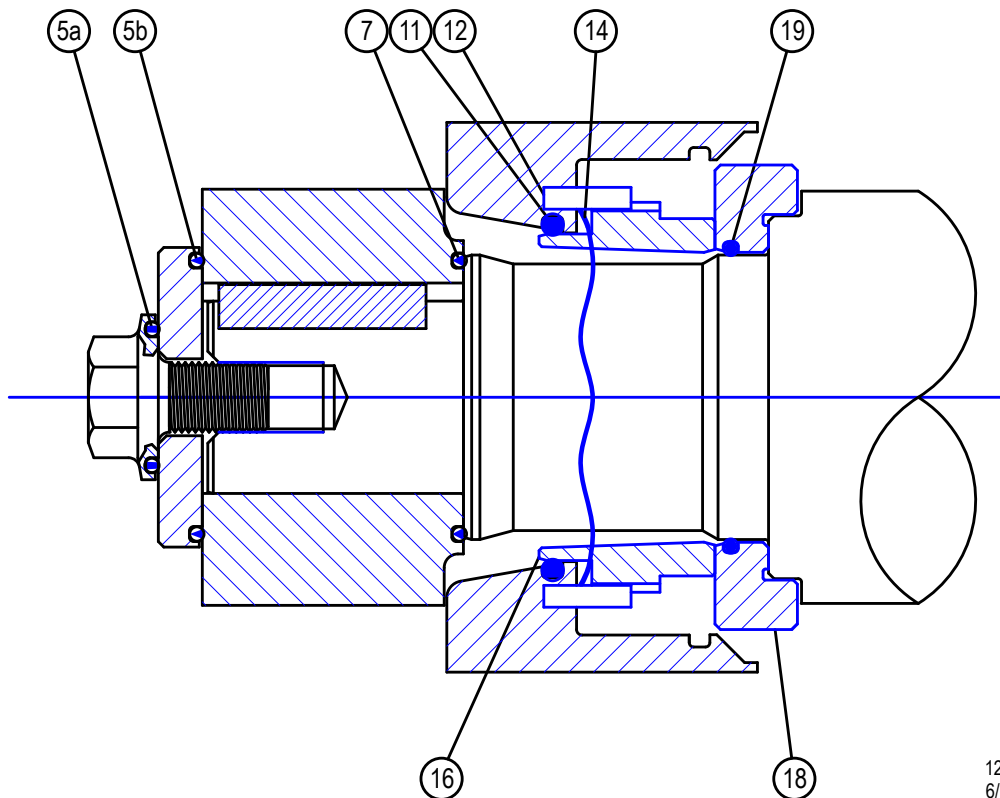
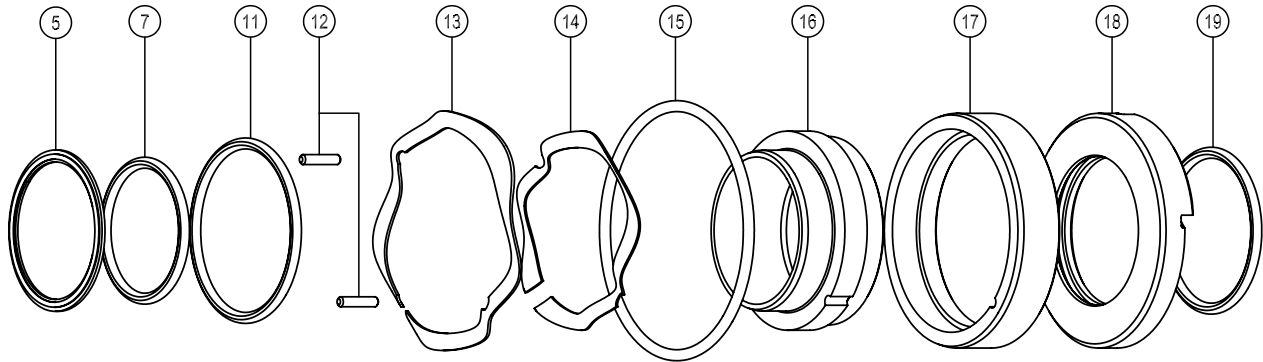
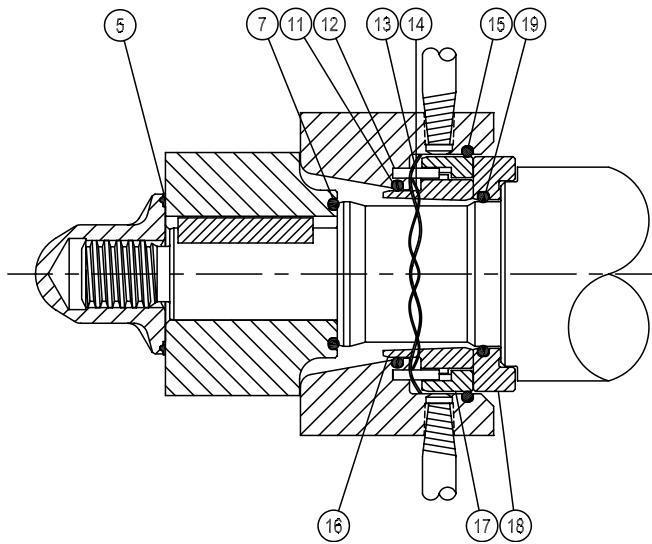


Figure 9: Double Seal Assembly for the FZX 2010 - 2250 models

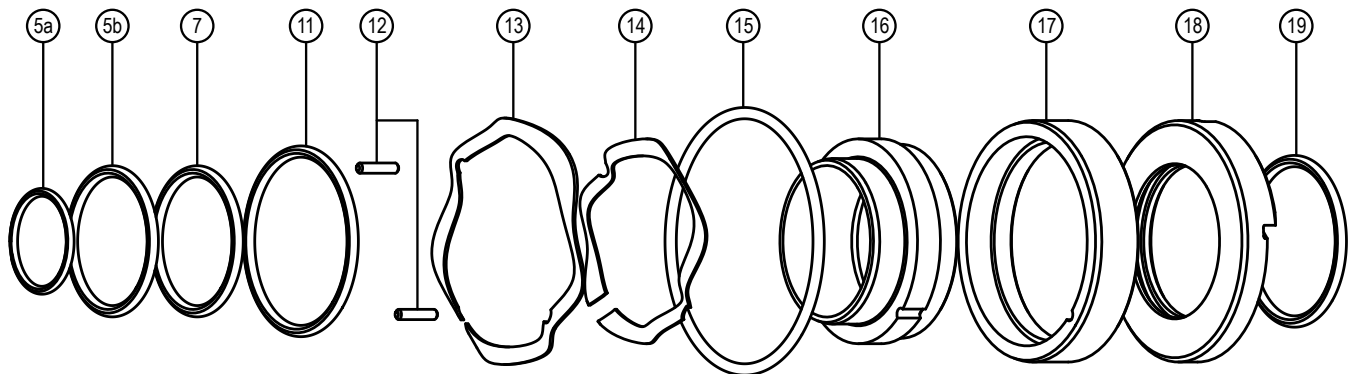


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|--------------------------------|--------------------------------|
| ⑤ IMPELLER NUT GASKET | ⑮ OUTER STATIONARY SEAL O-RING |
| ⑦ IMPELLER O-RING | ⑯ INNER STATIONARY SEAL |
| ⑪ INNER STATIONARY SEAL O-RING | ⑰ OUTER STATIONARY SEAL |
| ⑫ PIN | ⑱ ROTATING SEAL |
| ⑬ OUTER STATIONARY SEAL SPRING | ⑲ ROTATING SEAL O-RING |
| ⑭ INNER STATIONARY SEAL SPRING | |

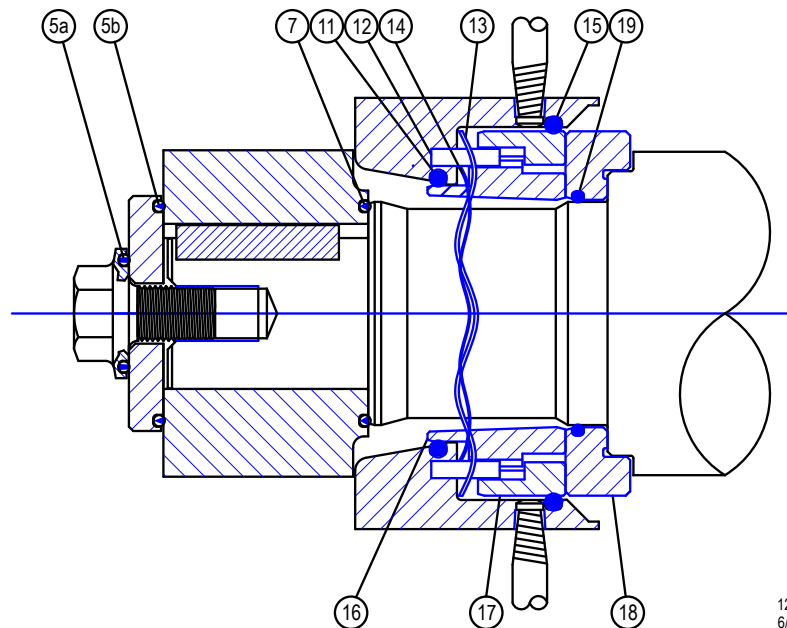


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Figure 9a: Double Seal Assembly for the FZX 2350 - 2400 models



- | | | | |
|----|------------------------------|---|------------------------------|
| ⑤a | IMPELLER BOLT O-RING | ⑮ | OUTER STATIONARY SEAL O-RING |
| ⑤b | IMPELLER WASHER O-RING | ⑯ | INNER STATIONARY SEAL |
| ⑦ | IMPELLER O-RING | ⑰ | OUTER STATIONARY SEAL |
| ⑪ | INNER STATIONARY SEAL O-RING | ⑱ | ROTATING SEAL |
| ⑫ | PIN | ⑲ | ROTATING SEAL O-RING |
| ⑬ | OUTER STATIONARY SEAL SPRING | | |
| ⑭ | INNER STATIONARY SEAL SPRING | | |



1265000044
6/19/02

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 (9/16" model 2010)
3/4" socket
1/4" Allen wrench (3/16" model 2010)
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 earlier.

a) Loosen the shaft clamping bolt (or shaft clamping bolts for the FZX 2400 model) with the Allen wrench.

b) Pull the pump shaft off the motor shaft.

If you are replacing the motor the flange support must be removed.

a) Loosen and remove the four motor bolts with the 3/4" wrench. Also remove the washers.

b) Remove the flange support from the motor.

c) Clean off the motor face of the flange support and cover liberally with a food grade lubricant.

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 on the new motor, replace the motor bolts and washers and tighten to the appropriate torque (see technical spec section).

To replace the pump shaft:

a) Lubricate the inside of the pump shaft liberally with a food grade lubricant.

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 onto the flange support. *Note:* it is recommended NOT to have the mechanical seals in place for gapping the pump.
- b) Install the housing bolts and tighten with a wrench.
- c) Install the pump shaft key.
- d) Place the correct plastic gapping shim 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)
- e) Place the impeller nut (or impeller bolt) onto the pump shaft.
- f) Place the 3/8" diameter rod in the hole on the shaft. Allow the rod to rest against the flange support to keep the shaft from rotating while tightening the impeller nut with the socket wrench (tighten the impeller bolt with the 3/4" socket wrench for the 2350 - 2400 models). Tighten to the correct torque.
- g) Align the slot of the clamping ring directly over one of the slots on the shaft (*Figure 11*).
- h) Secure the shaft clamping bolt with the Allen wrench (*Figure 10*) to the specified torque .
- i) Now remove the impeller nut (or impeller bolt for the 2350 - 2400 models), impeller, impeller key, shim and pump housing.

Assemble the pump head as described earlier.

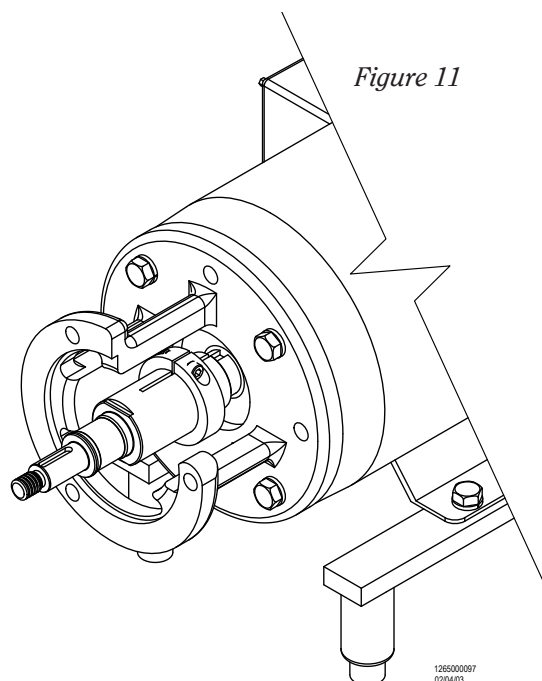
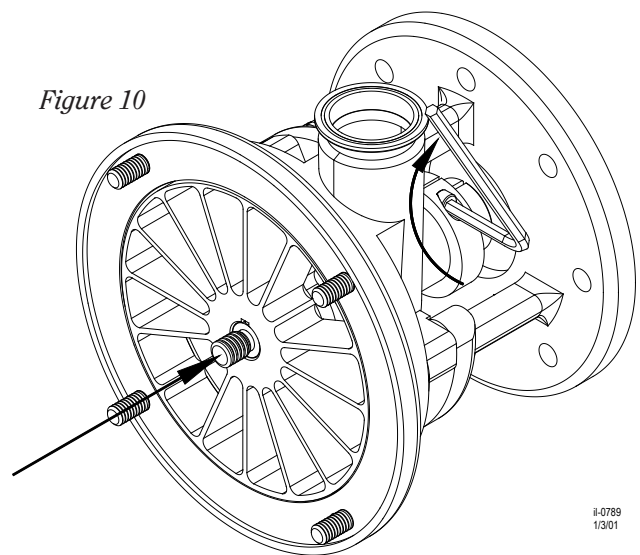


FIGURE 14: EXPLODED VIEW OF FZX

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

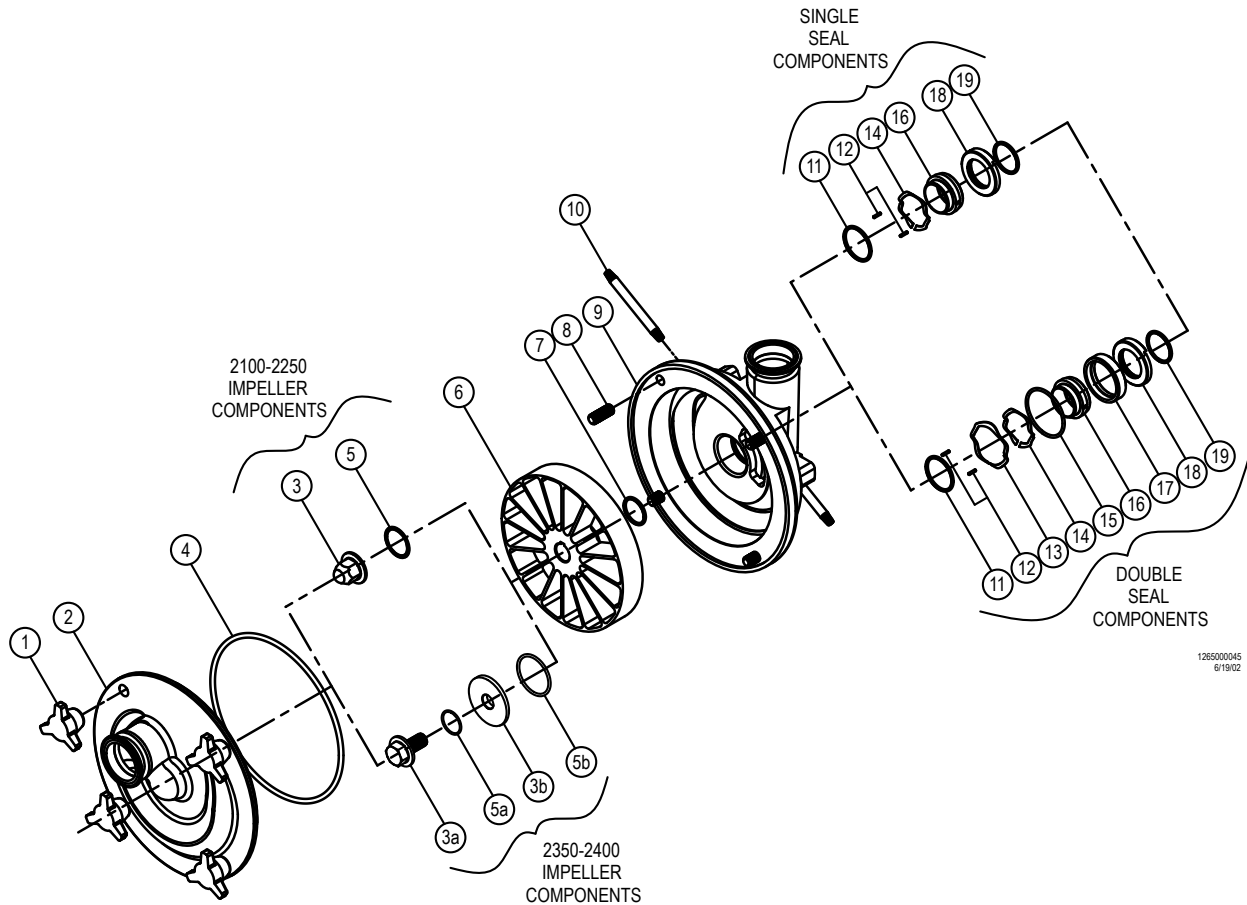
- DOUBLE EXTERNAL SEAL
11. Inner Stationary Seal O-ring
 12. Pin (installed in housing)
 13. Outer Stationary Seal Spring
 14. Inner Stationary Seal Spring
 15. Outer Stationary Seal O-ring
 16. Inner Stationary Seal
 17. Outer Stationary Seal
 18. Rotating Seal
 19. Rotating Seal O-ring

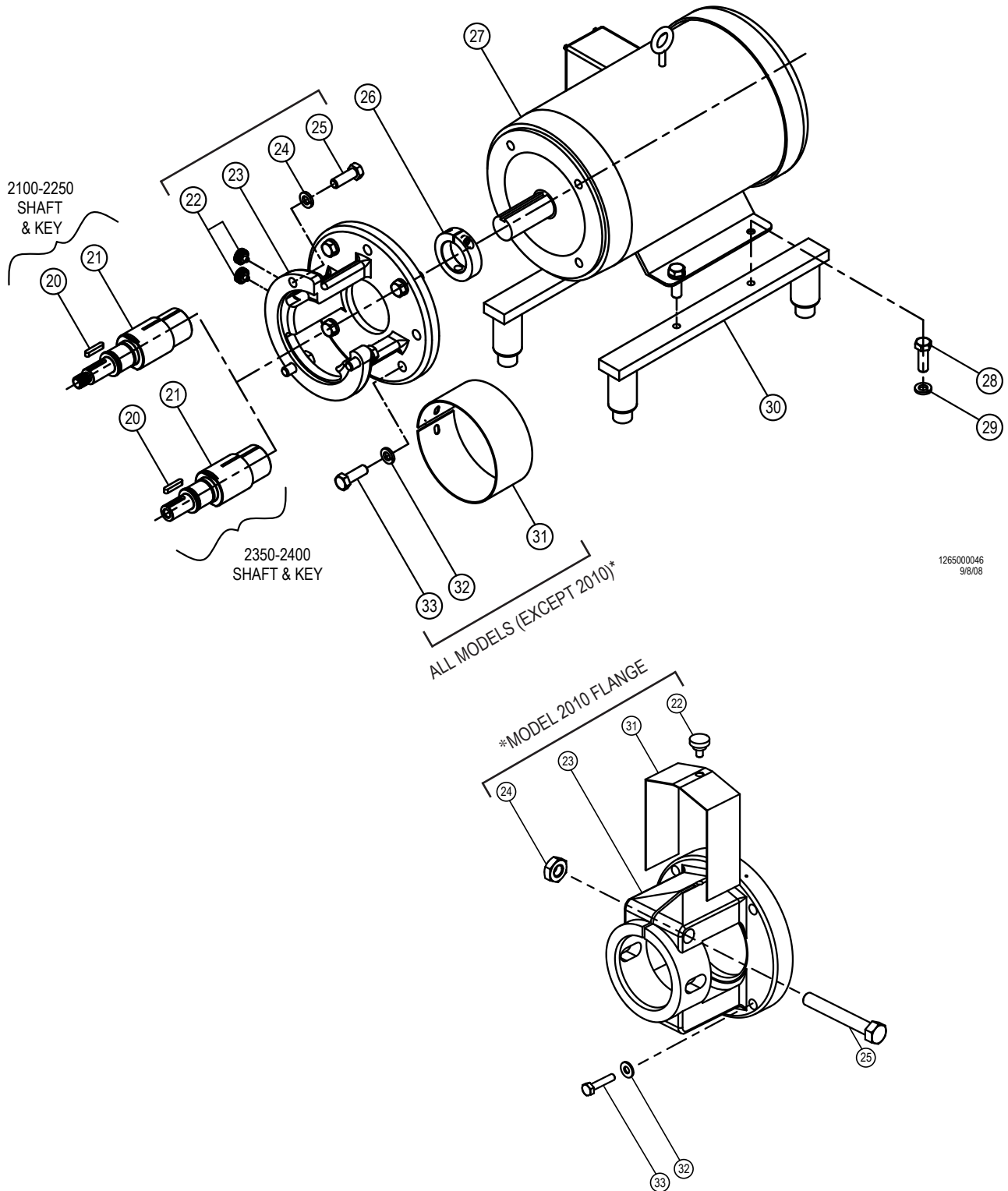
20. Impeller Key
21. Pump shaft
22. Guard Screws
23. Flange Support
24. Housing Bolt Washer
25. Housing Bolt
26. Shaft Clamping Ring
- 26a. Shaft Clamping Ring*
27. Motor
28. Leg Bolt
29. Leg Bolt Washer
30. Leg Strap
31. Flange Guard
32. Motor Bolt Washer
33. Motor Bolt

*parts for 2350 - 2400 models only

SINGLE EXTERNAL SEAL

11. Inner Stationary Seal O-ring
12. Pin (installed in housing)
14. Inner Seal Spring
16. Inner Stationary Seal
18. Rotating Seal
19. Rotating Seal O-ring





FZX 2010 PARTS LIST

Item No.	Description	Part Number	Previous Part No.	Qty.
1	Cover nut	1101000137		3
2	Pump cover	1531620000		1
3	Impeller nut	1954000000		1
4	Cover gasket (buna)	1180000382		1
5	Impeller nut gasket	1181000089		1
6	Impeller	1530630000		1
7	Impeller o-ring	1180000095	65503353	1
8	Housing studs (M10 x 303SS)	1103000175		3
9	Pump housing - single seal	1530610002		1
	Pump housing - double seal	1530610002		1
10	Water pipes	1910000007	58500714	2
11	Inner stationary seal o-ring (viton)	1180000398	65507191	1
12	Seal pin	1891000012	66507139	2
13	Outer stationary seal spring	1820000042	66507195	1
14	Inner seal spring	1820000041	66507194	1
15	Outer stationary seal o-ring (viton)	1180000115	65503717	1
16	Inner stationary seal (carbon)	1815600063	66507151	1
17	Outer stationary seal (carbon)	1815600042	66507152	1
18	Rotating seal (chrome oxide coated)	1810600051	66507150	1
19	Rotating seal o-ring (viton)	1180000086	65503080	1
20	Impeller key	1315000002		1
21	Shaft	1322000033		1
22	Guard screw	1102000000	63501412	1
23	Flange support	1310600259		1
24	Housing nut	1103000044		1
25	Housing bolt	1101000098		1
26	Shaft clamping ring	1318000013		1
31	Flange guard	1936000005		1
32	Motor bolt washer	1104000030		4
33	Motor bolt	1101000101		4

FZX 2100 PARTS LIST

Item No.	Description	Part Number	Previous Part No.	Qty.
1	Cover nut	1103000028	58504738	3
2	Pump cover	1508620000	59507185	1
3	Impeller nut	1954000007	53501835	1
4	Cover gasket (buna)	1180000334	65500048	1
5	Impeller nut gasket	1181000083	65501825	1
6	Impeller	1508630000	55507185	1
7	Impeller o-ring	1180000095	65503353	1
8	Housing studs (M12 x 33SS)	1103000001	58500317	3
9	Pump housing - ss	1508610000	57507142	1
	Pump housing - ds	1508610001	57508126	1
10	Water pipes	1910000007	58500714	2
11	Inner stationary seal o-ring (viton)	1180000398	65507191	1
12	Pin	1891000012	66507139	2
13	Outer stationary seal spring	1820000042	66507195	1
14	Inner seal spring	1820000041	66507194	1
15	Outer stationary seal o-ring (viton)	1180000115	65503717	1
16	Inner stationary seal (carbon)	1815600063	66507151	1
17	Outer stationary seal (carbon)	1815600042	66507152	1
18	Rotating seal (chrome oxide coated)	1810600051	66507150	1
19	Rotating seal o-ring (viton)	1180000086	65503080	1
20	Impeller key	1315000018	53500310	1
21	Impeller shaft (180 frame)	1302000005	52507179	1
	Impeller shaft (210 frame)	1302000015	52507180	1
	Impeller shaft (100/112 IEC frame)	1302000016	52507181	1
22	Guard screws	1102000000	63501412	2
23	Flange support	1310600036	62507139	1
	Flange support (110/112 IEC frame)	1310600058	62507190	1
24	Housing bolt washer	1104000006	13506364	4
25	Housing bolt	1101000037	13505799	4
26	Shaft clamping ring (180 frame)	1318000014	53504917	1
	Shaft clamping ring (210 frame)	1318000015	53504918	1
	Shaft clamping ring (100/112 IEC frame)	1318000018	53505769	1
31	Flange guard	1936000043	63507189	1
32	Motor bolt washer	1104000031	13500568	4
33	Motor bolt	1101000082	13500564	4

FZX 2150 PARTS LIST

Item No.	Description	Part Number	Previous Part No.	Qty.
1	Cover nut	1103000028	58504738	4
2	Pump cover	1508620001	59507186	1
3	Impeller nut	1954000007	53501835	1
4	Cover gasket (buna)	1180000334	65500048	1
5	Impeller nut gasket	1181000083	65501825	1
6	Impeller	1508630000	55507185	1
7	Impeller o-ring	1180000095	65503353	1
8	Housing studs (M12 x 33SS)	1103000001	58500317	3
9	Pump housing - ss	1508610000	57507142	1
	Pump housing - ds	1508610001	57508126	1
10	Water pipes	1910000007	58500714	2
11	Inner stationary seal o-ring (viton)	1180000398	65507191	1
12	pin	1891000012	66507139	2
13	Outer stationary seal spring	1820000042	66507195	1
14	Inner seal spring	1820000041	66507194	1
15	Outer stationary seal o-ring (viton)	1180000115	65503717	1
16	Inner stationary seal (carbon)	1815600063	66507151	1
17	Outer stationary seal (carbon)	1815600042	66507152	1
18	Rotating seal (chrome oxide coated)	1810600051	66507150	1
19	Rotating seal o-ring (viton)	1180000086	65503080	1
20	Impeller key	1315000018	53500310	1
21	Impeller shaft (210 frame)	1302000015	52507180	1
	Impeller shaft (100/112 IEC frame)	1302000016	52507181	1
22	Guard screws	1102000000	63501412	2
23	Flange support	1310600036	62507139	1
	Flange support (110/112 IEC frame)	1310600058	62507190	1
24	Housing bolt washer	1104000006	13506364	4
25	Housing bolt	1101000037	13505799	4
26	Shaft clamping ring (210 frame)	1318000015	53504918	1
	Shaft clamping ring (100/112 IEC frame)	1318000018	53505769	1
31	Flange guard	1936000043	63507189	1
32	Motor bolt washer	1104000031	13500568	4
33	Motor bolt	1101000082	13500564	4

FZX 2200 PARTS LIST

Item No.	Description	Part Number	Previous Part No.	Qty.
1	Cover nut	1103000028	58504738	4
2	Pump cover	1512620000	59506256	1
3	Impeller nut	1954000007	53501835	1
4	Cover gasket (buna)	1180000363	65504685	1
5	Impeller nut gasket	1181000083	65501825	1
6	Impeller	1512630000	55506255	1
7	Impeller o-ring	1180000095	65503353	1
8	Housing studs (M12 x 33SS)	1103000001	58500317	4
9	Pump housing - ss	1512610000	57507146	1
	Pump housing - ds	1512610001	57508127	1
10	Water pipes	1910000007	58500714	2
11	Inner stationary seal o-ring (viton)	1180000398	65507191	1
12	pin	1891000012	66507139	2
13	Outer stationary seal spring	1820000042	66507195	1
14	Inner seal spring	1820000041	66507194	1
15	Outer stationary seal o-ring (viton)	1180000115	65503717	1
16	Inner stationary seal (carbon)	1815600063	66507151	1
17	Outer stationary seal (carbon)	1815600042	66507152	1
18	Rotating seal (chrome oxide coated)	1810600051	66507150	1
19	Rotating seal o-ring (viton)	1180000086	65503080	1
20	Impeller key	1315000018	53500310	1
21	Impeller shaft (180 frame)	1302000005	52507179	1
	Impeller shaft (210 frame)	1302000015	52507180	1
	Impeller shaft (250 frame)	1302000023	52507148	1
	Impeller shaft (100/112 IEC frame)	1302000016	52507181	1
	Impeller shaft (132 IEC frame)	1302000017	52507182	1
22	Guard screws	1102000000	63501412	2
23	Flange support (180-250 frame)	1310600036	62507139	1
	Flange support (110/112 IEC frame)	1310600058	62507190	1
	Flange support (132 IEC frame)	1310600059	62507198	1
24	Housing bolt washer	1104000006	13506364	4
25	Housing bolt	1101000037	13505799	4
26	Shaft clamping ring (180 frame)	1318000014	53504917	1
	Shaft clamping ring (210 frame)	1318000015	53504918	1
	Shaft clamping ring (250 frame)	1318000016	53504919	1
	Shaft clamping ring (100/112 IEC frame)	1318000018	53505769	1
	Shaft clamping ring (132 IEC frame)	1318000019	53505065	1
31	Flange guard	1936000043	63507189	1
32	Motor bolt washer	1104000031	13500568	4
33	Motor bolt	1101000082	13500564	4

FZX 2250 PARTS LIST

Item No.	Description	Part Number	Previous Part No.	Qty.
1	Cover nut	1103000028	58504738	5
2	Pump cover (2.5" fitting)	1514620000	59507187	1
3	Impeller nut	1954000007	53501835	1
4	Cover gasket (buna)	1180000363	65504685	1
5	Impeller nut gasket	1181000083	65501825	1
6	Impeller	1514630000	55507189	1
7	Impeller o-ring	1180000095	65503353	1
8	Housing studs (M12 x 33SS)	1103000001	58500317	5
9	Pump housing - ss	1514610000	57507143	1
	Pump housing - ds	1514610001	57508128	1
10	Water pipes	1910000007	58500714	2
11	Inner stationary seal o-ring (viton)	1180000398	65507191	1
12	pin	1891000012	66507139	2
13	Outer stationary seal spring	1820000042	66507195	1
14	Inner seal spring	1820000041	66507194	1
15	Outer stationary seal o-ring (viton)	1180000115	65503717	1
16	Inner stationary seal (carbon)	1815600063	66507151	1
17	Outer stationary seal (carbon)	1815600042	66507152	1
18	Rotating seal (chrome oxide coated)	1810600051	66507150	1
19	Rotating seal o-ring (viton)	1180000086	65503080	1
20	Impeller key	1315000018	53500310	1
21	Impeller shaft (180 frame)	1302000005	52507179	1
	Impeller shaft (210 frame)	1302000015	52507180	1
	Impeller shaft (250 frame)	1302000023	52507148	1
	Impeller shaft (100/112 IEC frame)	1302000016	52507181	1
	Impeller shaft (132 IEC frame)	1302000017	52507182	1
22	Guard screws	1102000000	63501412	2
23	Flange support (180-250 frame)	1310600036	62507139	1
	Flange support (110/112 IEC frame)	1310600058	62507190	1
	Flange support (132 IEC frame)	1310600059	62507198	1
24	Housing bolt washer	1104000006	13506364	4
25	Housing bolt	1101000037	13505799	4
26	Shaft clamping ring (180 frame)	1318000014	53504917	1
	Shaft clamping ring (210 frame)	1318000015	53504918	1
	Shaft clamping ring (250 frame)	1318000016	53504919	1
	Shaft clamping ring (100/112 IEC frame)	1318000018	53505769	1
	Shaft clamping ring (132 IEC frame)	1318000019	53505065	1
31	Flange guard	1936000043	63507189	1
32	Motor bolt washer	1104000031	13500568	4
33	Motor bolt	1101000082	13500564	4

FZX 2350 PARTS LIST

Item No.	Description	Part Number	Qty.
1	Cover nut	1103000028	5
2	Pump cover (3" fitting)	1516620000	1
3a	Impeller bolt	1102000001	1
3b	Impeller bolt washer	1104000049	1
4	Cover gasket (buna)	1180000339	1
5a	Impeller bolt o-ring	1180000085	1
5b	Impeller washer oring	1180000474	1
6	Impeller	1516630000	1
7	Impeller o-ring	1180000474	1
8	Housing studs (M12 x 33SS)	1103000013	5
9	Pump housing - w/3" fitting	1516610000	1
10	Water pipes	1910000007	2
11	Inner stationary seal o-ring (viton)	1180000233	1
12	Seal pin (5/32" od by 5/8" long ss)	1891000033	2
13	Seal spring, double	1820000050	1
14	Seal spring, single	1820000048	1
15	Outer stationary seal o-ring (viton)	1180000234	1
16	Inner stationary seal (carbon)	1815600088	1
	Inner stationary seal (silicon carbide)	1815600089	
17	Outer stationary seal (carbon)	1815600090	1
18	Rotating seal (chrome oxide coated)	1810600095	1
	Rotating seal (silicon carbide)	1810600096	
19	Rotating seal o-ring (viton)	1180000467	1
20	Impeller key	1315000033	1
21	Impeller shaft	1302000104	
22	Guard screws	1102000000	2
23	Flange support	1310600121	1
24	Housing bolt washer	1104000013	3
25	Housing bolt	1101000001	3
26	Shaft clamping bolt	1318000027	1
31	Flange guard	1936000252	1
32	Motor bolt washer	1104000037	4
33	Motor bolt	1101000110	4

FZX 2400 PARTS LIST

Item No.	Description	Part Number	Qty.
1	Cover nut	1103000028	5
2	Pump cover (3" fitting)	1518620000	1
3a	Impeller bolt	1102000001	1
3b	Impeller bolt washer	1104000049	1
4	Cover gasket (buna)	1180000020	1
5a	Impeller bolt o-ring	1180000085	1
5b	Impeller washer oring	1180000474	1
6	Impeller	1518230000	1
7	Impeller o-ring	1180000474	1
8	Housing studs (M12 x 33SS)	1103000013	5
9	Pump housing - w/3" fitting	1518610000	1
10	Water pipes	1910000007	2
11	Inner stationary seal o-ring (viton)	1180000233	1
12	Seal pin (5/32" od by 5/8" long ss)	1891000033	2
13	Seal spring, double	1820000050	1
14	Seal spring, single	1820000048	1
15	Outer stationary seal o-ring (viton)	1180000234	1
16	Inner stationary seal (carbon)	1815600088	1
	Inner stationary seal (silicon carbide)	1815600089	
17	Outer stationary seal (carbon)	1815600090	1
18	Rotating seal (chrome oxide coated)	1810600095	1
	Rotating seal (silicon carbide)	1810600096	
19	Rotating seal o-ring (viton)	1180000467	1
20	Impeller key	1315000033	1
21	Impeller shaft (324-326TC)	1302000092	
	Impeller shaft (364-365TC)	1302000093	
22	Guard screws	1102000000	2
23	Flange support (324-365TC)	1310600080	1
24	Housing bolt washer	1104000013	3
25	Housing bolt	1101000001	3
26	Shaft clamping ring (324-326TC)	1318000023	2
	Shaft clamping ring (364-365TC)	1318000024	
31	Flange guard	1936000080	1
32	Motor bolt washer	1104000037	4
33	Motor bolt	1101000110	4

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
	(see following pages)
Pump does not deliver liquid	1, 2, 6, 7, 9, 10, 13, 15, 27, 28
Not enough capacity delivered	2, 3, 7, 10, 13, 15, 19, 20, 27
Pump loses prime after starting	2, 3, 6
Pump requires too much power	8, 11, 12, 15, 18, 19, 23
Leaking seal	5, 17, 22, 23, 24, 25
Seal fails prematurely	4, 6, 17, 19, 22, 23, 24, 25
Pump vibrates or is noisy	2, 11, 14, 15, 16, 17, 18, 19, 20, 26, 27, 29
Motor bearings fail prematurely	14, 17, 19, 26, 27
Pump overheats and seizes	1, 14, 18, 19, 26
Pump head leaking	21
POSSIBLE CAUSE OF SUCTION PROBLEMS	POSSIBLE SOLUTIONS
1. Pump inlet is not flooded	1a) Adjust piping so the pump inlet is flooded 1b) Install a foot valve to keep liquid in the suction piping
2. NPSHA is not sufficient	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. Air entering the pump through the seal area	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

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

POSSIBLE CAUSE OF MECHANICAL PROBLEMS

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 |

EC DECLARATION OF CONFORMITY

The manufacturer: Fristam Pumps
2410 Parview Road
Middleton, WI 53562
USA

herby declares that the following product (pump with motor):

- Centrifugal pump types: FPR, FPX, FP, FZX, FM, FPH/FPHP, FS
- Positive displacement pump types: FKL conforms to the requirements of the Machinery Directive (2006/42/EC).

The machine also complies with all requirements of the Low Voltage Directive (2006/95/EC) and the EMC Directive (2004/108/EC).

The following harmonized standards have been applied:

- DIN EN 809 Pumps and pump units for liquids – Common safety requirements
- DIN EN 12100 Safety of machinery – General principles for design – Risk assessment and risk reduction

Authorized person responsible for the compilation of the technical file:



Duane Ehlke / Vice President of Operations
2410 Parview Road
Middleton, WI 53562

Date: 2014-5-9

EG DECLARATION OF INCORPORATION

The manufacturer: Fristam Pumps
2410 Parview Road
Middleton, WI 53562
USA

herby declares that the following product (pump without motor):

- Centrifugal pump types: FPR, FPX, FP, FZX, FM, FPH/FPHP, FS
- Positive displacement pump types: FKL are partly completed machines in accordance with the Machinery Directive (2006/42/EC) Annex II B.

The above mentioned products meet the relevant general health and safety requirements laid down in Annex I of the above Directive.

The above named partly completed machines must not be put into service until the final machinery into which they are to be incorporated has been declared in conformity with the provisions of the Machinery Directive (2006/42/EC).

The above products comply with the following standards:

- DIN EN 809 Pumps and pump units for liquids – Common safety requirements
- DIN EN 12100 Safety of machinery – General principles for design – Risk assessment and risk reduction

On request, the manufacturer shall forward the special documentation of the partly completed machine in electronic format to the relevant state authorities. The special technical documentation relating to the machine according to Annex VII B has been compiled.

Authorized person responsible for the compila-



Duane Ehlke / Vice President of Operations
2410 Parview Road
Middleton, WI 53562

Date: 2014-5-9

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

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

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Visit www.fristam.com/usa for a current list of literature.

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