

**INSTRUCTION AND
MAINTENANCE MANUAL:
FZX SERIES PUMP**



SANITARY CENTRIFUGAL PUMPS



R1: 4/00

DESCRIPTION

This manual contains disassembly and assembly instructions, maintenance procedures, troubleshooting, and installations procedures for all FZX Series Self Priming Centrifugal Pumps designed and manufactured by Fristam Pumps, Inc. 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 (standard), EPDM, Silicon, Chemraz, Kalrez
Surface Finish for Product Contact Surfaces	32 Ra (standard)

SHAFT SEALS

Mechanical Seal Types	Single or Double External
Maximum Seal Water Pressure (double seal)	5 PSI of water
Seal Water Consumption (double seal)	1-2 gph
Stationary Seal Ring Material	Silicon Carbide
Rotating Seal Ring Material	Carbon (standard) or Silicon Carbide
O-ring Material	Viton (standard)
Also available in	BUNA-N, EPDM

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.

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	1500 RPM

Available Motor Sizes (Horsepower)

3, 5, 7.5, 10, 15, 20, 25

RECOMMENDED PREVENTIVE MAINTENANCE

RECOMMENDED TORQUE VALUES:

Cover nuts	40-50 ft-lb.
Impeller nut	70-80 ft-lb.
Housing bolts	30 ft-lb.
Motor bolts	50 ft-lb. (for 182TC-286TC motor frames)
Seal retaining ring bolts	10 ft-lb.
Seal driver set screw	0.4 ft-lb. (5 in-lb.)
Shaft clamping bolts	30 ft-lb.

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.

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:

FRAME SIZE NEMA/(IEC)	MOTOR SPEED	
	3600 RPM	1800 RPM
Up to 210 (132) inclusive	5500 hours	12000 hours
Over 210 to 280 inclusive	3600 hours	9500 hours

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

SERVICE CONDITION DEFINITIONS:

SERVICE CONDITION	MAXIMUM AMBIENT TEMPERATURE	ATMOSPHERIC CONTAMINATION	BEARING TYPE
Standard	40°C	Clean, little corrosion.	Deep groove ball bearing.
Severe	50°C	Moderate dirt, corrosion.	Ball thrust, roller.
Extreme	> 50°C	Severe, dirt, abrasive dust, corrosion.	All bearings.

VOLUME OF GREASE TO BE ADDED:

FRAME SIZE NEMA/(IEC)	GREASE VOLUME	
	IN. ³	TSP
Up to 210 (132) inclusive	0.6	2.0
Over 210 to 280 inclusive	1.2	3.9

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 impeller shaft by hand to make sure that the impeller rotates freely. Keep the protective caps over the 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.
- 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**.

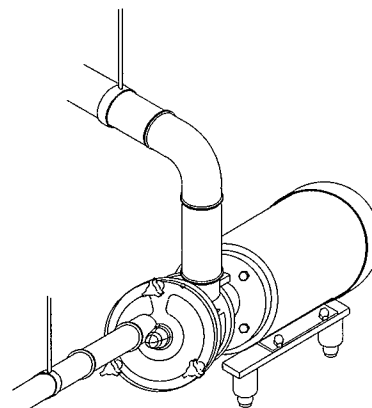


Figure 1

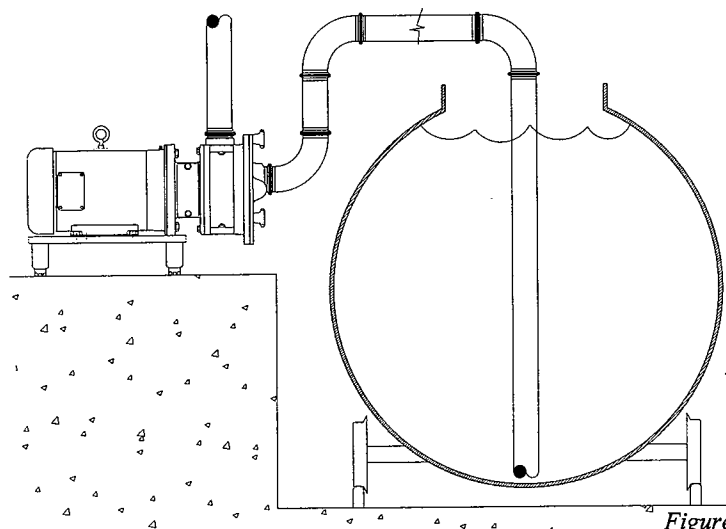


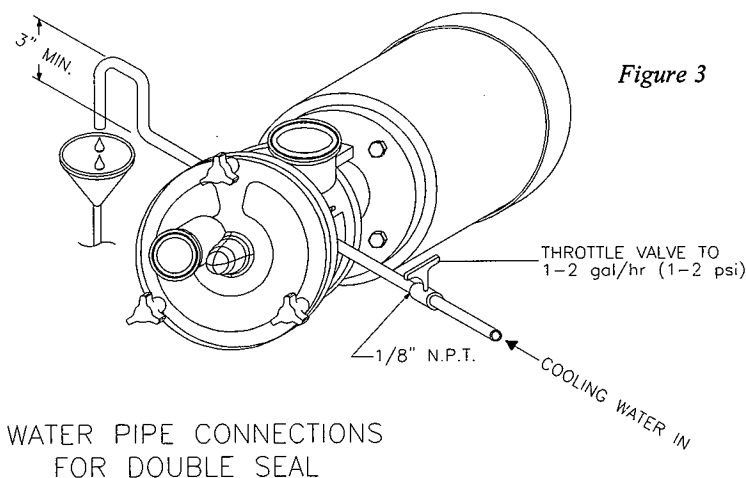
Figure 2

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.



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.
- Make sure that the NPSH available is greater than or equal to the NPSH required by the pump.

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.

SEAL REPLACEMENT FOR A PUMP SUPPLIED WITH A SINGLE MECHANICAL SEAL (FOR DOUBLE SEAL SEE PAGES 12-13 & 18-19)

TOOLS REQUIRED FOR SEAL REPLACEMENT:

Soft-faced hammer (5 lb. dead blow)
15/16" socket wrench
9/16" wrench
Flat screw driver
3/8" diameter rod
One pair tack pullers (impeller pullers)

PUMP HEAD DISASSEMBLY

Note: the reference numbers listed in the text (#) refer to the assembly drawing on pages 14 & 15.



WARNING

Disconnect the suction and discharge piping. Remove all fluid from the pump prior to disassembly.

Remove the cover nuts (1). These may be loosened by tapping on them with the soft-faced hammer. Remove the cover (2) and cover gasket (3).

Remove the housing guard (12) and flange guards (37) by loosening and removing the guard screws (13). Place the 3/8" diameter rod in the hole opposite the shaft clamping bolts (31) on the impeller shaft. Allow the rod to rest against the pump flange adapter (32) to keep the shaft from rotating while loosening the impeller nut (4) with the 15/16" socket wrench (**Figure 4**).

Remove the impeller nut (4) and impeller nut gasket (5). Remove the impeller (6) from the impeller shaft (30) 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 (10) and the impeller and pry the impeller off the shaft. Remove the impeller key (29) from the impeller shaft.

Next remove the impeller spacer assembly which includes the impeller spacer (8) and two O-rings (7, 9). To remove this assembly from the shaft, place the tack pullers on both sides of the assembly and pull toward the end of the shaft.

To replace the mechanical seal, the pump housing (10) needs to be removed. Remove the four housing bolts (34) which attach the pump housing to the flange adapter (32) using the 9/16" wrench. Carefully slide the pump housing off the end of the impeller shaft (30), ensuring that the stationary seal (15), which is mounted inside the pump housing, does not contact the impeller shaft. **The stationary seal may be damaged if it makes hard contact with the impeller shaft.**

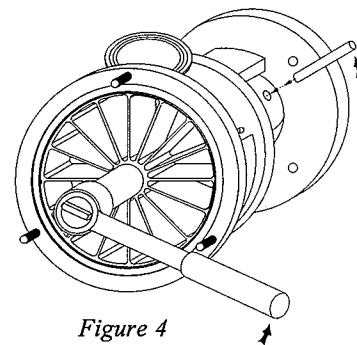


Figure 4

Place the pump housing (10) face down on the housing studs (11). Loosen and remove the retaining ring bolts with the flat screw driver. Remove the retaining ring (17), the teflon flat gasket (16), the stationary seal (15) and the viton flat gasket (14). Discard the gaskets and stationary seal after you remove them.

Remove the rotating seal components from the impeller shaft (30), which includes: rotating seal (19), the rotating seal O-rings (20), the seal spring (21) and the seal drive ring (22). Discard seal components (except the seal driver) after you remove them. The seal driver (23) may remain on the impeller shaft (30).

PUMP HEAD ASSEMBLY (SEE SINGLE SEAL ASSEMBLY DRAWING FIGURE 8, PAGE 11.)

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. Start by sliding the seal drive ring (22) onto the impeller shaft (30) with the shorter length tabs facing the seal driver (23). Align the tabs with the slots in the seal driver. Slide the new seal spring (21) onto the impeller shaft and position it against the seal drive ring. Lubricate the new rotating seal O-ring (20) with a food grade lubricant such as Haynes CIP-Lube (unless the O-ring material is EPDM, then only water should be used for lubrication). Place the O-ring inside the new rotating seal ring (19). Slide the rotating seal ring and O-ring into place on the impeller shaft and align the slots with the tabs in the seal drive ring.

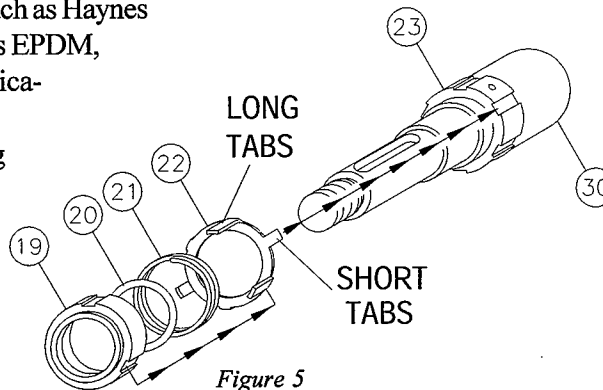


Figure 5

Now replace the stationary seal (15). Place the new viton flat gasket (14), stationary seal (15) and teflon flat gasket (16) into the hub of the pump housing (10). Position the teflon flat gasket so that it is within the OD of the stationary seal. Replace the retaining ring (17) onto the pump housing (10). Insert the retaining ring bolts (18) into the mounting holes and alternately tighten with the flat screw driver to 10 ft. lbs.

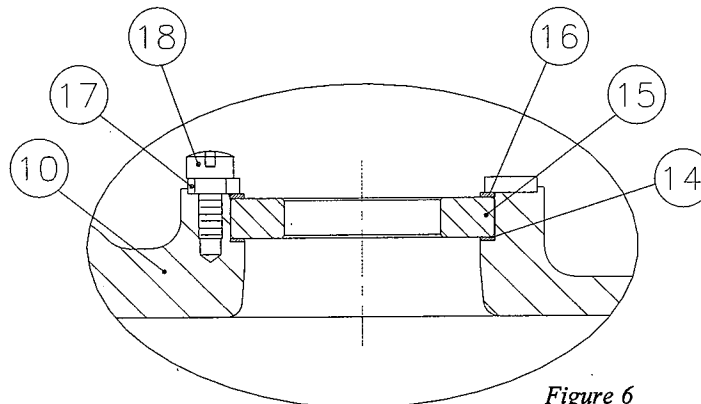


Figure 6

With the seals installed, carefully slide the pump housing (10) over the shaft (30) and back against the flange adapter (32). **The stationary seal may be damaged if it makes hard contact with the steps of the impeller shaft.** Install the four housing bolts (34) through the flange adapter into the pump housing. Tighten them with the 9/16" wrench to 30 ft-lb.

Replace the two O-rings (7,9) on the impeller spacer (8) and slide the impeller spacer assembly onto the impeller shaft (30). Again it is recommended to lubricate the O-rings with Haynes CIP-Lube if they are not EPDM. Place the impeller key (29) into the shaft keyway and slide the impeller (6), with the raised hub facing the motor, onto the impeller shaft (30).

Locate the new impeller nut gasket (5) and lubricate generously with Haynes CIP-Lube (if it is not EPDM) and place it onto the groove on the impeller nut (4). Thread the impeller nut with the gasket onto the impeller shaft (30). Place the 3/8" diameter rod in the hole opposite the shaft clamping bolts (31) on the impeller shaft. Allow the rod to rest against the pump flange adapter (32) to keep the shaft from rotating while tightening the impeller nut with the 15/16" socket wrench (**Figure 7**). Tighten to 70-80 ft-lb.

Place the new cover gasket (3) in the groove on the pump cover (2). **Note:** when installing the cover gasket, gently stretch the gasket into position. **Do not roll the gasket into position.** Next install the cover onto the front of the pump and thread the cover nuts (1) onto the housing studs (11) **Note:** the pump cover only fits onto the housing one way. The pump serial number is embossed into the 'top' of the pump cover. Tighten the cover nuts by tapping on them with the soft-faced hammer (approx. 40-50 ft-lb.).

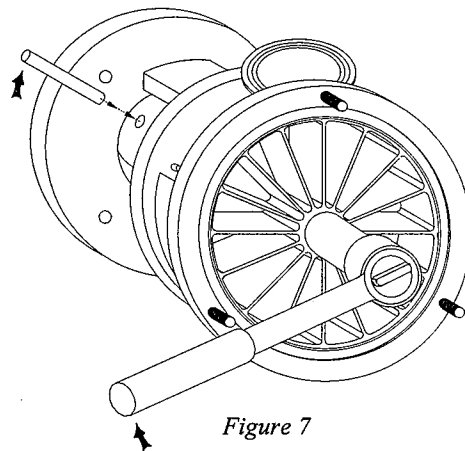
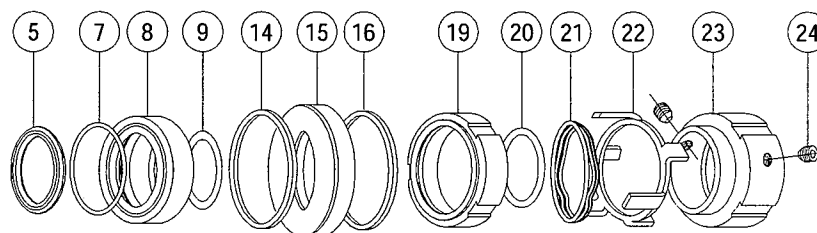


Figure 7

Now rotate the impeller shaft (30) to make sure that the impeller (6) moves freely. If it does not, re-check 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 21) and total indicated run-out of the shaft (see page 22). Regap the impeller or align the shaft if necessary.

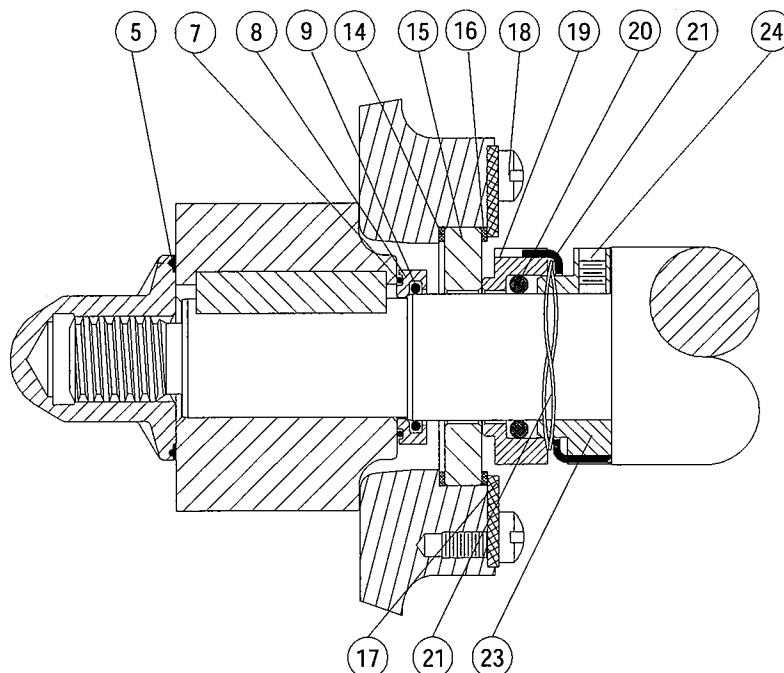
Replace the housing guard (12) and flange guards (37) and tighten the guard screws (13).

Reconnect the suction and discharge piping.



DESCRIPTION

- | | |
|----------------------------------|-----------------------------|
| ⑤ IMPELLER NUT GASKET | ①⑨ EXTERNAL SEAL RING |
| ⑦ OUTSIDE O'RING IMPELLER SPACER | ②⑩ EXTERNAL SEAL O'RING |
| ⑧ IMPELLER SPACER* | ②② EXTERNAL SEAL DRIVE RING |
| ⑨ INSIDE O'RING IMPELLER SPACER | ②④ SET SCREWS* |
| ①④ VITON FLAT GASKET | ①⑦ RETAINING RING* |
| ①⑤ EXTERNAL STATIONARY SEAL | ①⑧ RETAINING RING BOLTS* |
| ①⑥ TEFLON FLAT GASKET | ②① EXTERNAL SEAL SPRING |
| | ②③ EXTERNAL SEAL DRIVER* |



Note: * indicates items not included in the seal assembly replacement kits.

Figure 8: Single Seal Assembly

SEAL REPLACEMENT FOR A PUMP SUPPLIED WITH A DOUBLE MECHANICAL SEAL

TOOLS REQUIRED FOR SEAL REPLACEMENT:

Soft-faced hammer (5 lb. dead blow)
15/16" socket wrench
9/16" wrench
Flat screw driver
Pliers (channel locks)
3/32" Allen wrench
3/8" diameter rod
One pair (two) tack pullers (impeller pullers)

PUMP HEAD DISASSEMBLY



WARNING

Shut off the water supply to the pump seal. Disconnect the suction and discharge piping. Remove all fluid from the pump prior to disassembly.

Remove the cover nuts (1). They may be loosened by tapping on them with the soft-faced hammer. Remove the cover (2) and cover gasket (3).

Remove the housing guard (12) and flange guards (37) by loosening and removing the guard screws (13). Place the 3/8" diameter rod in the hole opposite the shaft clamping bolts (31) on the impeller shaft (30). Allow the rod to rest against the pump flange adapter (32) to keep the shaft from rotating while loosening the impeller nut (4) with the 15/16" socket wrench (**Figure 9**).

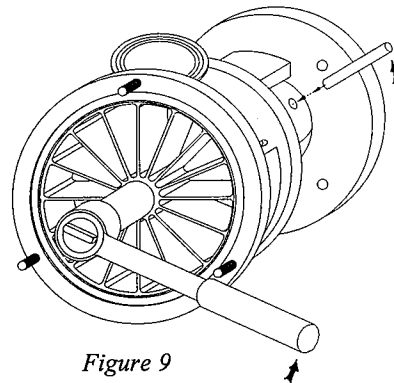


Figure 9

Remove the impeller nut (4) and impeller nut gasket (5). Remove the impeller (6) from the impeller shaft (30) 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 (10) and the impeller and pry the impeller off the shaft. Remove the impeller key (29) from the impeller shaft.

Next remove the impeller spacer assembly which includes the impeller spacer (8) and two O-rings (7,9). To remove this assembly from the shaft (30), place the tack pullers on both sides of the assembly and pull toward the end of the shaft.

To replace the mechanical seal, the pump housing (10) needs to be removed. First remove the two water pipes (27) on either side of the seal flush housing (26) using pliers or channel locks. Next loosen the two set screws (24) on the seal driver (25) which are located inside the seal flush housing. This is done by rotating the shaft (30) so that the set screws are in line with the hole in the seal flush housing where the water pipes were removed. Then place the 3/32" Allen wrench through the hole and loosen the set screws (**Figure 10**).

Remove the four housing bolts (34) which attach the pump housing (10) to the flange adapter (32) using the 9/16" wrench. Carefully slide the pump housing off the end of the impeller shaft (30), ensuring that the stationary seals (15) (which are mounted inside the pump housing hub and the seal chamber) do not contact the impeller shaft. **The stationary seals may be damaged if they make hard contact with the impeller shaft. Note:** that the entire seal assembly is contained within the pump housing hub.

Place the pump housing (10) face down on the housing studs (11). Loosen and remove the retaining ring bolts (28) on the hub of the pump housing with the flat screw driver. Remove the retaining ring (17). The seal components can now be removed in order. Remove the stationary seal (15) and the viton flat gasket (14) from the seal flush housing (26). Lift the seal flush housing off the pump housing. Remove the seal housing O-ring from the seal flush housing. The rotating seal (19) can now be removed from the hub of the pump housing. This includes: a seal driver (25) with set screws (24), two rotating seals (19), two seal springs (21), two seal drive rings (22) and two rotating seal O-rings (20). Finally remove the teflon flat gasket (16), stationary seal and viton flat gasket from the hub of the pump housing.

PUMP HEAD ASSEMBLY

You are now ready to install the new mechanical seal into the pump. Start with placing the new viton flat gasket (14), stationary seal (15) and teflon flat gasket (16) into the hub of the pump housing (10). Position the teflon flat gasket so that it is within the OD of the stationary seal. Reassemble the rotating seal assembly with the new rotating seal rings (19), rotating seal O-rings (20) and seal springs (21). Lubricate the rotating seal O-rings with a food grade lubricant such as Haynes CIP-Lube (unless the O-ring material is EPDM, then only water can be used for lubrication). Place the rotating seal assembly on top of the stationary seal in the pump housing. (**Figure 11**)

Position the seal flush housing (26) over the rotating seal assembly onto the pump housing. **Note:** Make sure that the seal flush piping holes are properly aligned to ensure proper installation of the water pipes (27). Place the new viton flat

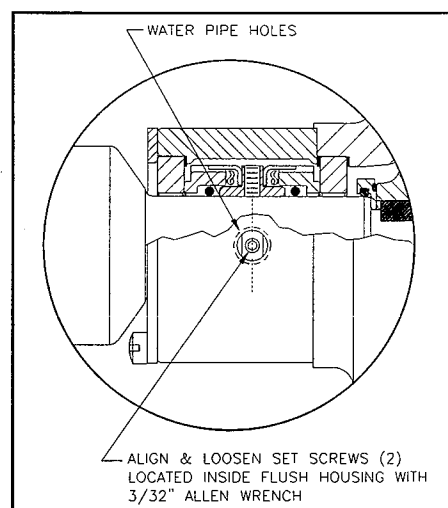


Figure 10: Loosening of the two set screws on the seal driver

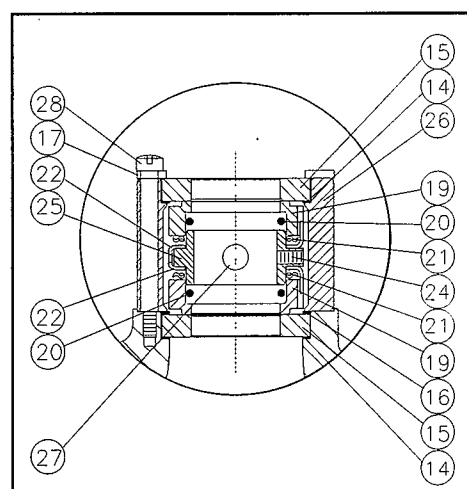


Figure 11: External seal mounts into the hub of the housing.

FIGURE 12: EXPLODED VIEW OF FZX

1. Cover Nut
2. Cover
3. Cover Gasket
4. Impeller Nut
5. Impeller Nut Gasket
6. Impeller
7. Inside O-ring
8. Impeller Spacer
9. Back O-ring
10. Housing
11. Housing Stud
12. Housing Guard
13. Guard Screws

SINGLE EXTERNAL SEAL

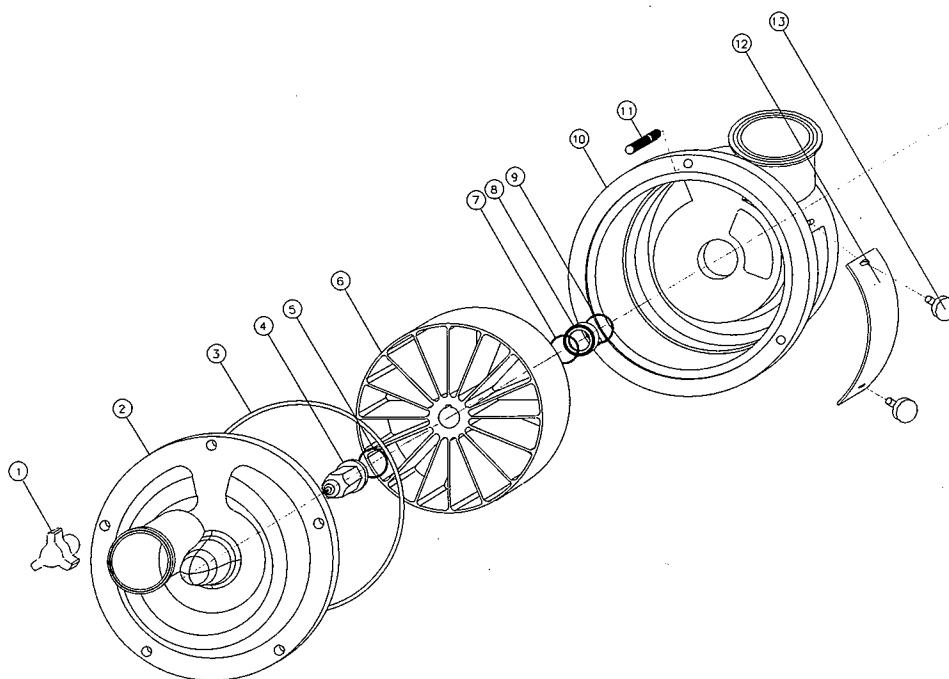
14. Viton Flat Gasket
15. External Stationary Seal
16. Teflon Flat Gasket
17. Retaining Ring
18. Retaining Ring Bolt
19. Rotating Seal
20. Rotating Seal O-ring
21. Seal Spring
22. Seal Drive Ring
23. Seal Driver
24. Seal Driver Set Screw

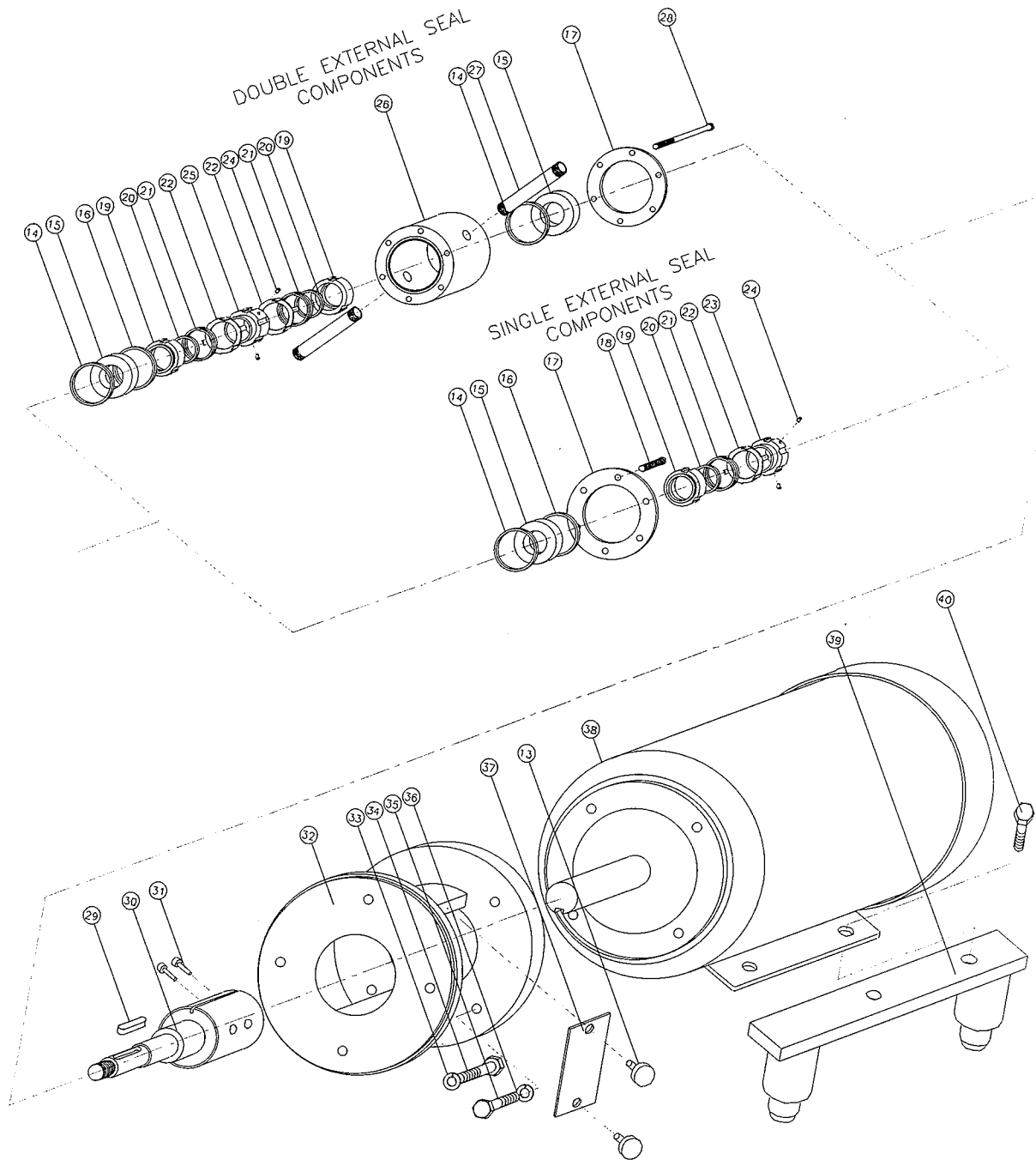
DOUBLE EXTERNAL SEAL

14. Viton Flat Gasket
15. External Stationary Seal
16. Teflon Flat Gasket
17. Retaining Ring
18. Seal Retaining Ring Bolt
19. Rotating Seal
20. Rotating Seal O-ring
21. Seal Spring
22. Seal Drive Ring

24. Seal Driver Set Screw
25. Seal Driver
26. Seal Flush Housing
27. Water Pipe
28. Retaining Ring Bolt

29. Impeller Key
30. Impeller Shaft
31. Shaft Clamping Bolt
32. Flange Adapter
33. Housing Lock Washer
34. Housing Bolt
35. Motor Lock Washer
36. Motor Bolt
37. Flange Guard
38. Motor
39. Leg Strap
40. Leg Bolt





FZX 100

Item No.	Description	Qty.	Part Number	Motor Frame Size
1	Cover nut	3	58502867	
2	Cover w/2" fitting	1	59504500	
3	Cover gasket (buna)	1	65500048	
4	Impeller nut	1	53501835	
5	Impeller nut gasket (viton)	1	65501825	
6	100/150 impeller	1	55504593	
7	Inside o'ring (viton)	1	65503353	
8	Impeller spacer	1	66503352	
9	Outside o'ring (viton)	1	65500034	
10	100/150 housing w/2" fitting	1	57504499	
11	Housing stud	3	58500317	
12	100/150 housing guard	2	63504503	
13	Guard screws	8	63501412	
14	Flat gasket (viton) - ss Flat gasket (viton) - ds	1 2	65504260 65504260	
15	Ext. stationary seal (carbide) ss Ext. stationary seal (carbide) ds	1 2	66504257 66504257	
16	Flat gasket (teflon) - ss Flat gasket (teflon) - ds	1 1	65504261 65504261	
17	Retaining ring	1	58504258	
18	Retaining ring bolts - ss	6	13504281	
19	Ext. rotating seal ring (carbon) ss Ext. rotating seal ring (carbon) ds	1 2	66503355 66503355	
20	Rotating seal o'ring (viton) ss Rotating seal o'ring (viton) ds	1 2	65502398 65502398	
21	External seal spring-ss External seal spring - ds	1 2	66504533 66504533	
22	External seal drive ring -ss External seal drive ring - ds	1 2	66503357 66503357	
23	External single seal driver	1	66503358	
24	Seal driver set screw - ss Seal driver set screw - ds	2 2	13504945 13504945	
25	External double seal driver	1	66504259	
26	Seal flush housing	1	57604256	
27	Water pipes	2	58500714	
28	Retaining ring bolts - ds	6	13504280	
29	Impeller key	1	53500310	
30	Impeller Shaft - ss Impeller Shaft - ds	1 1	52504247 52504912	182-184TC 182-184TC
31	Shaft clamping bolt	2	13504279	
32	Flange adapter	1	62504473	182-215TC
33	Housing lock washer	4	13504416	
34	Housing bolt	4	13503837	
35	Motor lock washer	4	13504401	
36	Motor bolt	4	13504381	
37	Flange guard	2	63504288	182-215TC

ss = single seal
ds = double seal

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FZX 150

Item No.	Description	Qty.	Part Number	Motor Frame Size
1	Cover nut	3	58502867	
2	Cover w/2" fitting	1	59504502	
3	Cover gasket (buna)	1	65500048	
4	Impeller nut	1	52501835	
5	Impeller nut gasket (viton)	1	65501825	
6	100/150 impeller	1	55504593	
7	Inside o'ring (viton)	1	65503353	
8	Impeller spacer	1	66503352	
9	Outside o'ring (viton)	1	65500034	
10	100/150 housing w/2" fitting	1	57504499	
11	Housing stud	3	58500317	
12	100/150 housing guard	2	63504503	
13	Guard screws	8	63501412	
14	Flat gasket (viton) - ss Flat gasket (viton) - ds	1 2	65504260 65504260	
15	Ext. stationary seal (carbide) ss Ext. stationary seal (carbide) ds	1 2	66504257 66504257	
16	Flat gasket (teflon) - ss Flat gasket (teflon) - ds	1 1	65504261 65504261	
17	Retaining ring	1	58504258	
18	Retaining ring bolts - ss	6	13504281	
19	Ext. rotating seal ring (carbon) ss Ext. rotating seal ring (carbon) ds	1 2	66503355 66503355	
20	Rotating seal o'ring (viton) - ss Rotating seal o'ring (viton) - ds	1 2	65502398 65502398	
21	External seal spring - ss External seal spring - ds	1 2	66504533 66504533	
22	External seal drive ring - ss External seal drive ring - ds	1 2	66503357 66503357	
23	External single seal driver	1	66503358	
24	Seal driver set screw - ss Seal driver set screw - ds	2 2	13504945 13504945	
25	External double seal driver	1	66504259	
26	Seal flush housing	1	57604256	
27	Water pipes	2	58500714	
28	Retaining ring bolts - ds	6	13504280	
29	Impeller key	1	53500310	
30	Impeller shaft - single seal Impeller shaft - double seal	1 1 1 1	52504247 52504249 52504912 52504914	182-184TC 213-215TC 182-184TC 213-215TC
31	Shaft clamping bolt	2	13504279	
32	Flange adapter	1	62504473	182-215TC
33	Housing lock washer	4	13504416	
34	Housing bolt	4	13503837	
35	Motor lock washer	4	13504401	
36	Motor bolt	4	13504381	
37	Flange guard	2	63504288	182-215TC

FZX 250

Item No.	Description	Qty.	Part Number	Motor Frame Size
1	Cover nut	5	58502867	
2	Cover w/2.5" fitting	1	59504243	
3	Cover gasket (buna)	1	65504685	
4	Impeller nut	1	53501835	
5	Impeller nut gasket (viton)	1	65501825	
6	250 impeller	1	55504423	
7	Inside o'ring (viton)	1	65503353	
8	Impeller spacer	1	66503352	
9	Outside o'ring (viton)	1	65500034	
10	250 housing w/2.5" fitting	1	57504241	
11	Housing stud	5	58500317	
12	250 housing guard	2	63504262	
13	Guard screws	8	63501412	
14	Flat gasket (viton) - ss Flat gasket (viton) - ds	1 2	65504260 65504260	
15	Ext. stationary seal (carbide) ss Ext. stationary seal (carbide) ds	1 2	66504257 66504257	
16	Flat gasket (teflon) - ss Flat gasket (teflon) - ds	1 1	65504261 65504261	
17	Retaining ring - ss	1	58504258	
18	Retaining ring bolt	6	13504281	
19	Ext. rotating seal ring (carbon) ss Ext. rotating seal ring (carbon) ds	1 2	66503355 66503355	
20	Rotating seal o'ring (viton) - ss Rotating seal o'ring (viton) - ds	1 2	65502398 65502398	
21	External seal spring - ss External seal spring - ds	1 2	66504533 66504533	
22	External seal drive ring - ss External seal drive ring - ds	1 2	66503357 66503357	
23	External single seal driver	1	66503358	
24	Seal driver set screw - ss Seal driver set screw - ds	2 2	13504945 13504945	
25	External double seal driver	1	66504259	
26	Seal flush housing	1	57604256	
27	Water pipes	2	58500714	
28	Retaining ring bolt - ds	6	13504280	
29	Impeller key	1	53500310	
30	Impeller shaft - ss Impeller shaft - ds	1 1	52504251 52504367	254-256TC 254-256TC
31	Shaft clamping bolt	2	13504279	
32	Flange adapter	1	62504474	254-256TC
33	Housing lock washer	4	13504416	
34	Housing bolt	4	13503837	
35	Motor lock washer	4	13504401	
36	Motor bolt	4	13504381	
37	Flange guard	2	62604289	254-256TC

Continued from page 13.

gasket (14) and stationary seal (15) into the flush housing. Replace the retaining ring (17) on the seal flush housing (26). Insert seal retaining ring bolts (28) into the mounting holes and tighten with the flat screw driver to 10 ft.-lbs.

Before sliding the pump housing (10) back onto the pump, place your index fingers inside the housing hub and align the ID of the rotating seal assembly with the ID of the stationary seal (15). Carefully slide the pump housing over the shaft (30) and slide back onto the flange adapter (32). **The seals may be damaged if they make hard contact with the steps in the impeller shaft.**

Install the four housing bolts (34) through the flange adapter (32) into the pump housing (10). Tighten with the 9/16" wrench to 30 ft.-lb. Next tighten the two set screws on the seal driver (25) which are located inside the seal flush housing (26). This is done by rotating the shaft (30) so that the set screws are in line with the hole in the seal flush housing where the water pipes (27) were removed. Then place the 3/32" Allen wrench through the hole and tighten the set screws (approx. 0.4 ft.-lb./5 in.-lb.) (**Figure 13**).

Replace the two O-rings (7,9) on the impeller spacer (8) and slide the impeller spacer assembly onto the impeller shaft (30). Again it is recommended to lubricate the O-rings with Haynes CIP-Lube if they are not EPDM. Place the impeller shaft key (29) into the shaft keyway and slide the impeller (6), with the raised hub facing the motor, onto the impeller shaft.

Locate the new impeller nut gasket (5) and lubricate generously with Haynes CIP-Lube (if it is not EPDM) and place it into the groove on the impeller nut (4). Thread the impeller nut and the gasket onto the impeller shaft (30). Place the 3/8" diameter rod in the hole opposite the securing screws on the impeller shaft. Allow the rod to rest against the pump flange adapter (32) to keep the shaft from rotating while tightening the impeller nut with the 15/16" socket wrench (**Figure 14**). Tighten to 70-80 ft.-lb.

Place the new cover gasket (3) in the groove on the pump cover (2) and install it onto the front of the pump. Thread the cover nuts (1) onto the housing studs (11). Tighten the cover nuts tapping on them with the soft-faced hammer (approx. 40-50 ft.-lb.).

Now rotate the impeller shaft (30) to make sure that the impeller (6) moves freely. If it does not, re-check your assembly to make sure that gaskets are not pinched and everything is seated properly.

Place pipe compound on the water pipes (27) and thread them into the seal flush housing (26). Tighten with a pliers. Reinstall the piping to the water pipes. 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 21) and total indicated run-out of the shaft (see page 22). Regap the impeller or align the shaft if necessary.

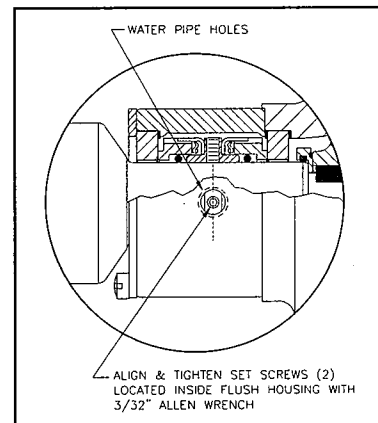


Figure 13: Tightening of the two set screws on the seal driver.

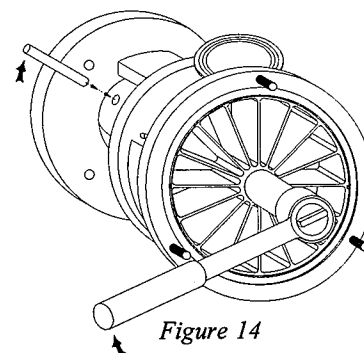
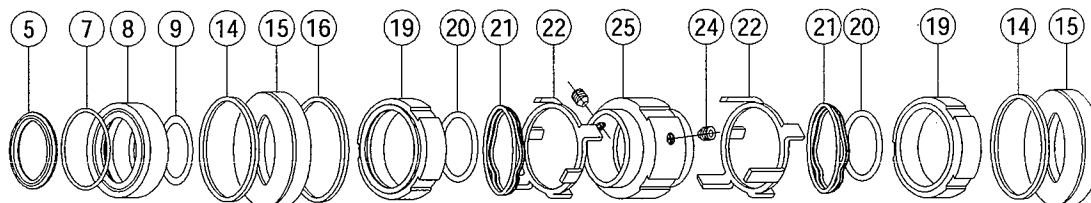


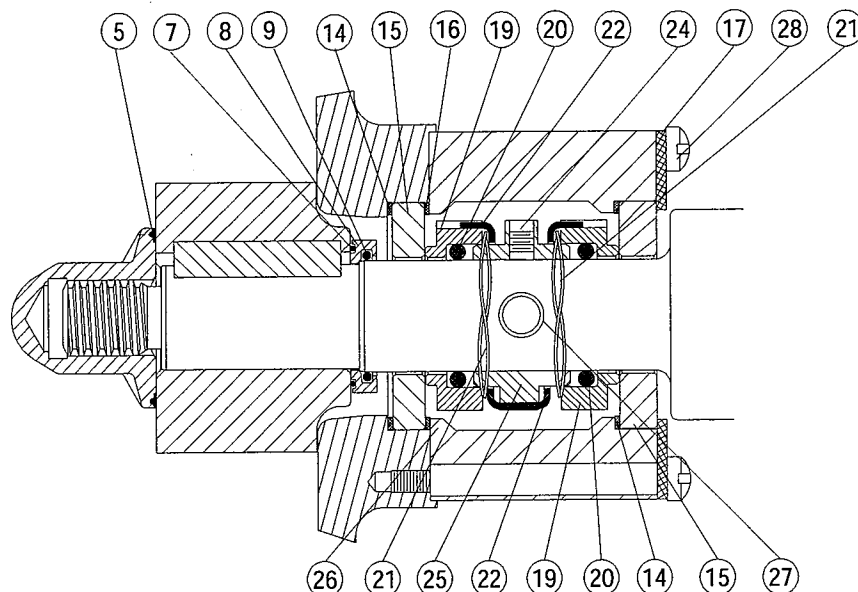
Figure 14

Replace the housing guard (12) and flange guards (37) and tighten the guard screws (13). Reconnect the suction piping, discharge piping and seal flush piping.



DESCRIPTION

- | | |
|----------------------------------|------------------------------------|
| ⑤ IMPELLER NUT GASKET | ②① EXTERNAL SEAL O'RING |
| ⑦ OUTSIDE O'RING IMPELLER SPACER | ②② EXTERNAL SEAL SPRING |
| ⑧ IMPELLER SPACER* | ②③ EXTERNAL SEAL DRIVE RING |
| ⑨ INSIDE O'RING IMPELLER SPACER | ②④ SET SCREWS* |
| ①④ VITON FLAT GASKET | ①⑦ RETAINING RING* |
| ①⑤ EXTERNAL STATIONARY SEAL | ②⑧ RETAINING RING BOLTS* |
| ①⑥ TEFLON FLAT GASKET | ②⑥ EXTERNAL SEAL HOUSING EXTENSION |
| ①⑨ EXTERNAL SEAL RING | ②⑤ EXTERNAL SEAL DRIVER* |
| | ②⑦ WATER PIPE |



Note: * indicates items not included in the seal assembly replacement kits.

Figure 15: Double Seal Assembly

IMPELLER 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 IMPELLER SHAFT AND/OR MOTOR REPLACEMENT:

3/4" wrench
1/4" Allen wrench
Brass gapping spacer
Dial indicator

PUMP DISASSEMBLY

Disassemble the pump head as described on pages 8-9 for pumps supplied with single mechanical seals and on pages 12-13 for pumps supplied with double mechanical seals.

To remove the impeller shaft (30), loosen the two shaft clamping bolts (31) with the 1/4" Allen wrench. Pull the impeller shaft off the motor shaft.

If you are replacing the motor (38), the flange adapter (32) must be removed. To do this, loosen the four motor bolts (36) with the 3/4" wrench. Remove the flange adapter from the motor. Clean off the motor face of the flange adapter 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. Place the flange on the new motor, replace the motor bolts and tighten to 50 ft-lb.

Lubricate the inside of the impeller shaft (30) liberally with NEVER-SEEZ. Slide the impeller shaft onto the motor shaft and position the slot of the impeller shaft opposite the motor shaft keyway (**Figure 16**).

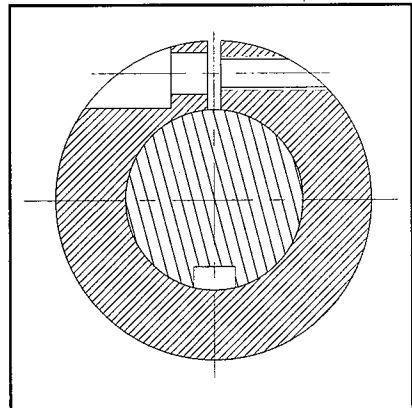


Figure 16: Position the slot of the impeller shaft opposite the motor shaft keyway.

SETTING THE IMPELLER GAP

The next step is to gap the impeller shaft. To do this, place the pump housing (10) onto the flange adapter (32). **Note:** it is recommended not to have the mechanical seals in place for gapping the pump. Install the housing bolts (34) and tighten with a 9/16" wrench. Slide the impeller spacer (8) onto the impeller shaft (30). Place the impeller shaft key (29) into the shaft keyway. Place the proper brass gapping shim over the shaft against the pump housing and slide the impeller onto the impeller shaft. The thickness of the gapping shim for the specific pump model is listed below.

PUMP MODEL	NOMINAL GAP
FZX 100	.2 mm (.008")
FZX 150	.2 mm (.008")
FZX 250	.2 mm (.008")

The gapping shim is supplied with the pump. Additional shims may be ordered from Fristam Pumps, Inc. Place the impeller nut gasket (5) onto the impeller nut (4) and thread the impeller nut with the gasket in place onto the impeller shaft (30). Place the 3/8" diameter rod in the hole opposite the securing screws on the impeller shaft. Allow the rod to rest against the pump flange adapter (32) to keep the shaft from rotating while tightening the impeller nut with the 15/16" socket wrench. Tighten securely. Now use the soft-faced hammer to tap on the impeller nut until the gapping shim is tight between the impeller (6) and pump housing (10). Once this is accomplished, tighten the two shaft clamping bolts (31) with the 1/4" Allen wrench.

Now remove the impeller nut (4), impeller nut gasket (5), impeller key (29), impeller (6), shim, impeller spacer (8) and pump housing (10). You are ready to check TIR.

ALIGNING THE IMPELLER SHAFT FOR TOTAL INDICATED RUN-OUT

After the impeller gap is set, you must ensure the impeller shaft is aligned with the motor stub shaft. Remove the impeller and housing if they are mounted onto the flange support.

Use a dial indicator to align the impeller shaft to **within .002" TIR** (total indicated run-out). Place the dial indicator so the stylus sits against the impeller shaft just behind the keyway (**Figure 17**). Rotate the shaft by hand noting the highest and lowest reading. If the difference in the highest and lowest is more than .002", turn the highest point upward. Remove the dial indicator and hold the shaft from turning. Using a soft-faced hammer, gently tap downward on the end of the impeller shaft (**Figure 18**). This tapping will be enough to move the impeller shaft slightly inside the shaft sleeve.

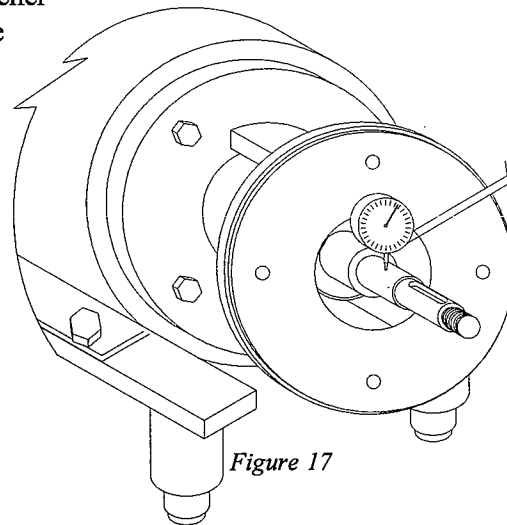


Figure 17

Repeat this procedure until the shaft indicates to less than .002" difference in TIR. Proper shaft alignment is necessary for the pump to run properly and for long seal life.

After establishing the TIR, check to see if the shaft sleeve will tighten further. If the set screws tighten further, recheck the shaft for TIR.

If you do not have a dial indicator or you cannot get the shaft to indicate within .002", call Fristam Pumps Inc.

Assemble the pump head as described on pages 9-10 for pumps supplied with single mechanical seals and on pages 13, 18-19 for pumps supplied with double mechanical seals.

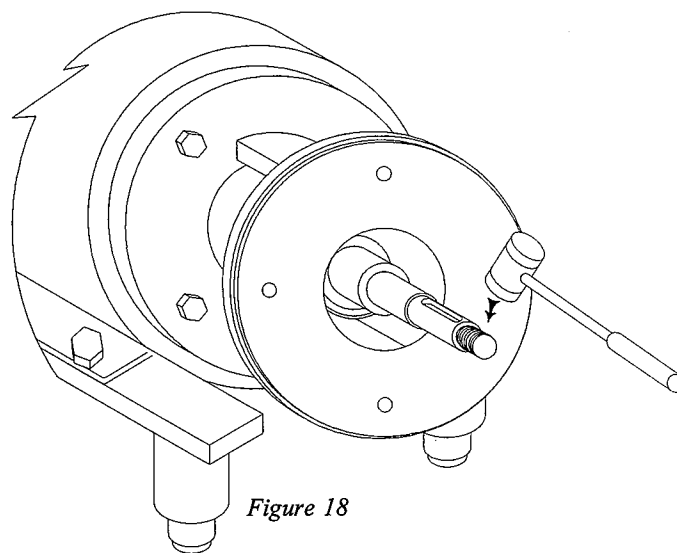


Figure 18

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, Inc. 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, 23
Leaking seal	5, 17, 22, 23, 24
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

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
4. Seal flush water not on
5. Seal water flush pressure too high
6. Not enough liquid is retained in the pump housing

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

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. 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. 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, Inc.
- 11a) Install throttling valve in discharge line
- 11b) Check with Fristam Pumps, Inc.
12. Use larger motor, check application with Fristam Pumps, Inc.

- | | |
|--|--|
| 13. Viscosity of liquid is greater than expected | 13a) Increase piping diameter and eliminate restrictions |
| | 13b) A larger drive or pump may be required, check application with Fristam Pumps, Inc. |
| 14. Operation is at a very low capacity for the pump model chosen | 14. Check application with Fristam Pumps, Inc. |
| 15. Foreign matter in pump | 15. Remove pump cover and clear foreign matter |
| 16. Pump foundation not rigid | 16. Provide firmer foundation for the pump |
| 17. Bent shaft | 17. Replace shaft (see pages 20-21 for directions) |
| 18. Impeller rubbing on pump housing or cover | 18a) Check the impeller gap |
| | 18b) Replace defective components |
| | 18c) Make sure impeller nut is tightened properly |
| 19. Motor worn or damaged | 19. Take motor to authorized service center |
| 20. Pump damaged | 20. Remove pump cover and inspect for damage. Replace defective parts |
| 21. Cover gasket defective, permitting leakage | 21. Replace cover gasket |
| 22. Shaft worn or scored | 22. Replace impeller shaft |
| 23. Seal improperly installed | 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 Inc. |
| 25. Dirt or grit in seal flush liquid leading to scoring of shaft or seal surfaces | 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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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, Inc.

Each Fristam Pumps, Inc. 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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