



Instruction and Maintenance Manual

FDS Positive Displacement Pump (Original Instructions)



DESCRIPTION

This manual contains installation, operation and repair instructions for the Fristam FDS Series double screw pump.

The FDS pump is a positive displacement pump characterized by its double screw design. The screws travel through a precisely machined, close clearance screw bores in the housing and cover allowing the product to be pumped very efficiently and smoothly.

The FDS series pump is ideal for pumping products that are shear sensitive, have a high viscosity and/or contain large particulates. The FDS series pump excels in applications with high differential pressure and/or low inlet pressures and its high efficiency, low slip performance makes it an excellent pump for metering applications for consistent flow control.

The FDS series pump is available with any connection type desired and may be mounted with the inlet/outlet connections in a horizontal or vertical orientation. The pump should be coupled to a motor/drive assembly properly specified to give the desired performance for the required application.

CAUTION: BEGIN ALL PUMP MAINTENANCE OPERATIONS BY DISCONNECTING THE ENERGY SOURCE TO THE PUMP. OBSERVE ALL LOCK OUT/TAG OUT PROCEDURES AS OUTLINED BY ANSI Z244.1-1982 AND OSHA 1910.147 TO PREVENT ACCIDENTAL START-UP AND INJURY.

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.

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



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TECHNICAL INFORMATION

SPECIFICATIONS

Max. Flow Rate.....	88 GPM (FDS 1)
.....	176 GPM (FDS 2)
.....	440 GPM (FDS 3)
.....	793 GPM (FDS 4)
Max. Speed Range.....	3600 RPM
Max. Viscosity.....	1,000,000 cps
Rotation	Reversible
Mounting	Horizontal (vertical optional)
Max. Temperature.....	302°F
Standard Fitting Size	2 in. cover / 2 in. housing (FDS 1)
.....	3 in. cover / 2.5 in. housing (FDS 2)
.....	4 in. cover / 3 in. housing (FDS 3)
.....	6 in. cover / 4 in. housing (FDS 4)
.....	8 in. cover / 6 in. housing (FDS 5)

MATERIALS OF CONSTRUCTION

Major Product Contact Components	AISI 316L
Cover Gasket.....	Viton
Also available in	EPDM and other options available
Surface Finish for Product Contact Surfaces	32 Ra (standard)
Also available in	25 Ra, 20 Ra

SHAFT SEALS & O-RINGS

Mechanical Seal Type	Single
Stationary Seal Material.....	Silicon Carbide (standard)
Also available in.....	Tungsten Carbide
Rotating Seal Material	Silicon Carbide
Also available in.....	Tungsten Carbide
Mechanical Seal Type	Double
Outer Stationary Seal.....	Carbon
Outer Rotating Seal	Tungsten Carbide
Other O-rings (mechanical seals)	Viton (standard)
Also available in.....	EPDM and other options available

LUBRICATION

Oil Grade.....	Flow_Guard Synthetic ISO 100 Food Grade (standard)
Oil Capacity	
FDS 1	0.35 liters (0.4 US quarts)
FDS 2	0.55 liters (0.6 US quarts)
FDS 3	0.95 liters (1.0 US quarts)
FDS 4	2.70 liters (2.9 US quarts)
FDS 5	4.50 liters (4.8 US quarts)

MAXIMUM PRESSURE

Screw Size	1	2	3	4	5	6	L1	L2
Max. Pressure: PSI (bar) MODELS 2-5	360 (25)	320 (22)	260 (18)	190 (13)	160 (11)	130 (9)	115 (8)	90 (6)
Max. Pressure: PSI (bar) MODEL 1	290 (20)	260 (18)	230 (16)	175 (12)	145 (10)	115 (8)	N/A	N/A

WOODS SURE-FLEX COUPLING ALIGNMENT

TABLE A1: Woods Sure-Flex Coupling Alignment						
Sleeve Size	Type E			Type H		
	Parallel A	Angular Y max. - Y min.	Y*	Parallel A	Angular Y max. - Y min.	Y*
5	.015	.056	1.938	-	-	-
6	.015	.070	2.375	.010	.016	2.375
7	.020	.081	2.563	.012	.020	2.563
8	.020	.094	2.938	.015	.025	2.938
9	.025	.109	3.500	.017	.028	3.500
10	.025	.128	4.063	.202	.032	4.063
11	.032	.151	4.875	.022	.037	4.875
12	.032	.175	5.688	.025	.042	5.688
13	.040	.195	6.688	.030	.050	6.688
14	.045	.242	7.750	.035	.060	7.750

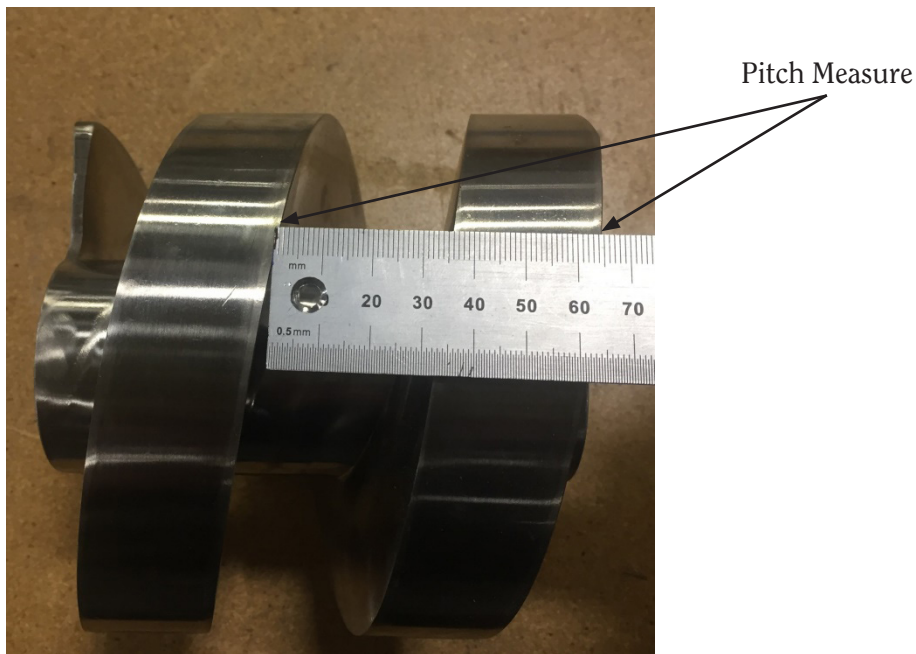
Dimensions are in inches.
*The "Y" dimension is shown for reference.

RECOMMENDED TORQUE VALUES

	FDS 1	FDS 2	FDS 3	FDS 4
Housing/Cover Bolt	27 ft-lb / 36 Nm	46 ft-lb / 63 Nm	105 ft-lb / 143 Nm	193 ft-lb / 262 Nm
Screw Nut	44 ft-lb / 60 Nm	90 ft-lb / 120 Nm	118 ft-lb / 160 Nm	148 ft-lb / 200 Nm
Idle Shaft Bolt	46 ft-lb / 63 Nm		105 ft-lb / 143 Nm	193 ft-lb / 262 Nm
Bearing Lock Nut	50 ft-lb / 68 Nm			
Gearbox End Plate	13 ft-lb / 18 Nm	27 ft-lb / 36 Nm		105 ft-lb / 143 Nm
Gearbox Cover	13 ft-lb / 18 Nm			27 ft-lb / 36 Nm
Bearing Retainer Bolts	65 in-lb / 7 Nm		13 ft-lb / 18 Nm	27 ft-lb / 36 Nm
Gear Retainer Bolts	45 in-lb / 5 Nm	65 in-lb / 7 Nm	15 ft-lb / 20 Nm	25 ft-lb / 34 Nm
Mounting Foot Bolts	27 ft-lb / 36 Nm		46 ft-lb / 63 Nm	105 ft-lb / 143 Nm
Housing Bolt	10 ft-lb / 13.5 Nm			45 ft-lb / 61 Nm

SCREW PITCH SIZE

	FDS 1	FDS 2	FDS 3	FDS 4	FDS 5
Pitch 1	15 mm .59"	21 mm .83"	26 mm 1.02"	35 mm 1.38"	
Pitch 2	19 mm .75"	26 mm 1.02"	32 mm 1.26"	44 mm 1.73"	
Pitch 3	25 mm .98"	35 mm 1.38"	43 mm 1.69"	58 mm 2.28"	
Pitch 4	37 mm 1.46"	52 mm 2.05"	65 mm 2.56"	87 mm 3.43"	



PUMP OPERATIONS

INTENDED USE

The standard FDS positive displacement 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 150 HP
- Flow rate up to 1,600 GPM
- Viscosity up to 1,000,000 CPS
- Discharge pressure up to 363 PSI

IMPROPER USE

The standard FDS positive displacement 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.
- 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.

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).

CLEANING

SIP PROCESS

FDS 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

FDS 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.

Recommendation: Use FDS to drive CIP cycle

(NOTE: Negative differential pressure should be avoided)

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. 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.
- When switching the pump mounting to vertical, please contact Fristam Pumps.

PIPING

CAUTION: Because the FDS pump is a highly efficient positive displacement pump, the user needs to ensure that the pump will not be over-pressurized during operation as this can cause severe damage to the pump. (Over-pressurization can occur if a valve is closed on the discharge of the pump and the pump continues to run beyond its maximum pressure rating.) The pump warranty is void for damage caused by over-pressurization. The pressure can be determined by putting a pressure gauge at the discharge side of the pump.

Follow good piping practices when installing your FDS series pump:

- Support all piping independently to minimize the forces exerted on the pump.
- Ensure that the piping can accommodate thermal expansion without stressing the pump.
- Slope inlet piping up to pump to avoid air pockets.

- Avoid sump areas where sediment may collect (figure 3).
- Use a check or “foot” valve on the inlet side of the pump in lift applications to keep the suction piping flooded.
- Avoid throttling valves in the suction piping.
- Keep suction lines as short and direct as possible.
- Avoid abrupt transitions in the piping systems (figure 4).
- Avoid the formation of air pockets in the piping (figure 5).
- Ensure that the NPSH available in the system is greater than NPSH required by the pump.
- 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 6).
- Install a relief valve on the discharge side of the pump with a bypass loop back to the suction side to ensure that the pump cannot be over-pressurized.

FIGURE 3

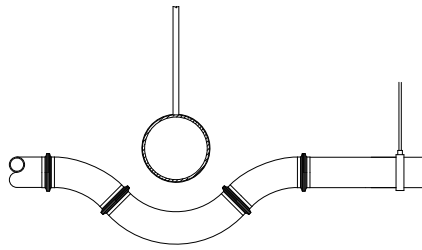
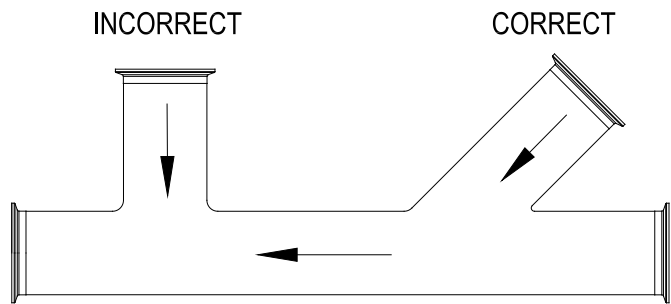


FIGURE 4



1265000245
REV. -

FIGURE 5

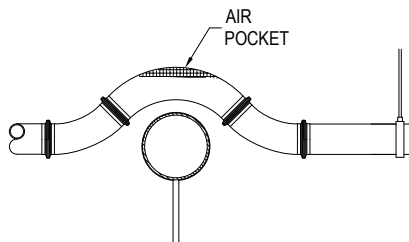
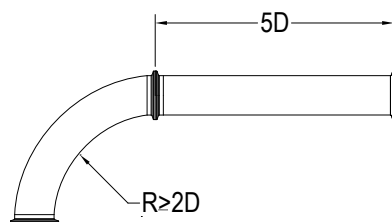


FIGURE 6



ALIGNMENT

In most cases, the pump will be shipped with a drive unit mounted on a baseplate. The drive and pump are aligned at the factory; however, this alignment should be checked after installation (Figure 7).

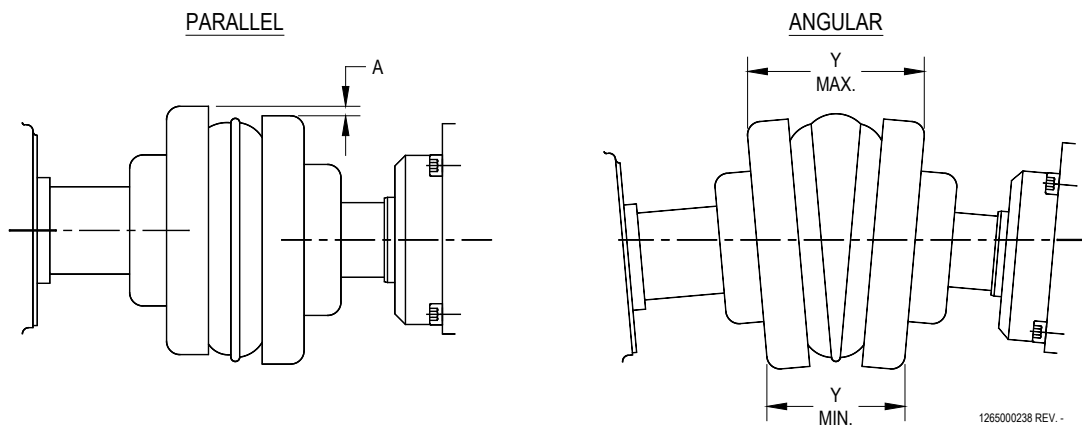
Misalignment between the pump and drive can result in premature bearing failure or other damage.

If the pump is not shipped with a drive unit, use a flexible coupling between the pump and drive unit. Align the pump and drive unit according to the coupling requirements.

To check the alignment:

- Remove the wire ring from the coupling sleeve and let it hang between the sleeve and one of the flanges.
- To check the parallel alignment place a straight edge across the two coupling flanges and measure the maximum offset at various points around the periphery of the coupling without rotating the coupling. If the maximum offset (“A”) exceeds the figure shown under “Parallel” in the table below, realign the shafts.
- Check the angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other (“Y”) at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions without rotating the coupling. The difference between the maximum and minimum must not exceed the figure given under “Angular” in the table referenced below. If a correction is necessary, be sure to recheck the parallel alignment.
- Reinstall the wire ring on the O.D. of the coupling sleeve.

FIGURE 7



WOODS SURE-FLEX COUPLING ALIGNMENT

See Table A1 (page 5).

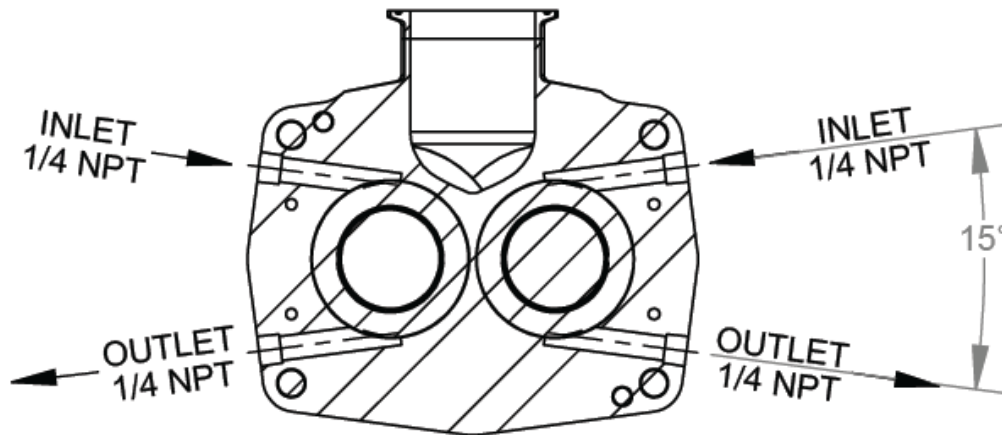
ELECTRICAL CONNECTIONS

Have an electrician connect the drive motor using sound electrical practices. Ensure that proper motor overload protection is provided. The size of the drive selected should meet the requirements of the operating conditions. A change in conditions (for example, higher viscosity product, higher differential pressure) can overload the motor. For technical assistance regarding operating condition changes, please contact Fristam Pumps. Make sure that the pump is rotating in the correct direction.

WATER FLUSH CONNECTIONS

If your pump is equipped with a double mechanical product seal, water must be supplied to provide cooling and lubrication. Connect supply and return lines to the water pipes supplied with the product seal on your pump.

Flush recommendations: Fluid: should be maintained at the exit/drain not to exceed 113°F. Flow rate: 16 gal/hr (1/4 gpm). Pressure: not to exceed 100 PSI.



Double Mechanical Seal Flush (optional)

START-UP CHECK-LIST

- Make sure that the pump and piping system are clear of any foreign matter. Do not use the pump to flush the system.
- Make sure that the pump and drive are properly lubricated (see Technical Information section). See instructions from the manufacturer for the drive.
- Check to make sure that all guards are in place and secure.
- Check for proper pump and drive rotation. Make sure that the pump is flooded with product when checking the rotation. Running the pump dry even momentarily can cause seal damage (except double seal).
- Check that all valves on the discharge side are open to prevent over-pressurizing the pump.
- Place an in-line screen (mesh size >1.0 mm) before the pump inlet to ensure no foreign objects run through the pump and alter critical clearances.

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.

When replacing ANY seal part, it is important to replace ALL seal wear parts.

LUBRICATION

The bearings and gears are lubricated with ISO 100 synthetic oil. *Note: other lubricants are available.*

The oil level should be maintained in the center of the sight glass on the rear of the gearbox housing.

The oil should be changed every 4,000 hours under normal conditions and every 2,000 hours under severe conditions such as washdown applications.

See the oil capacity listing in the Technical Information section.

PERIODIC MAINTENANCE

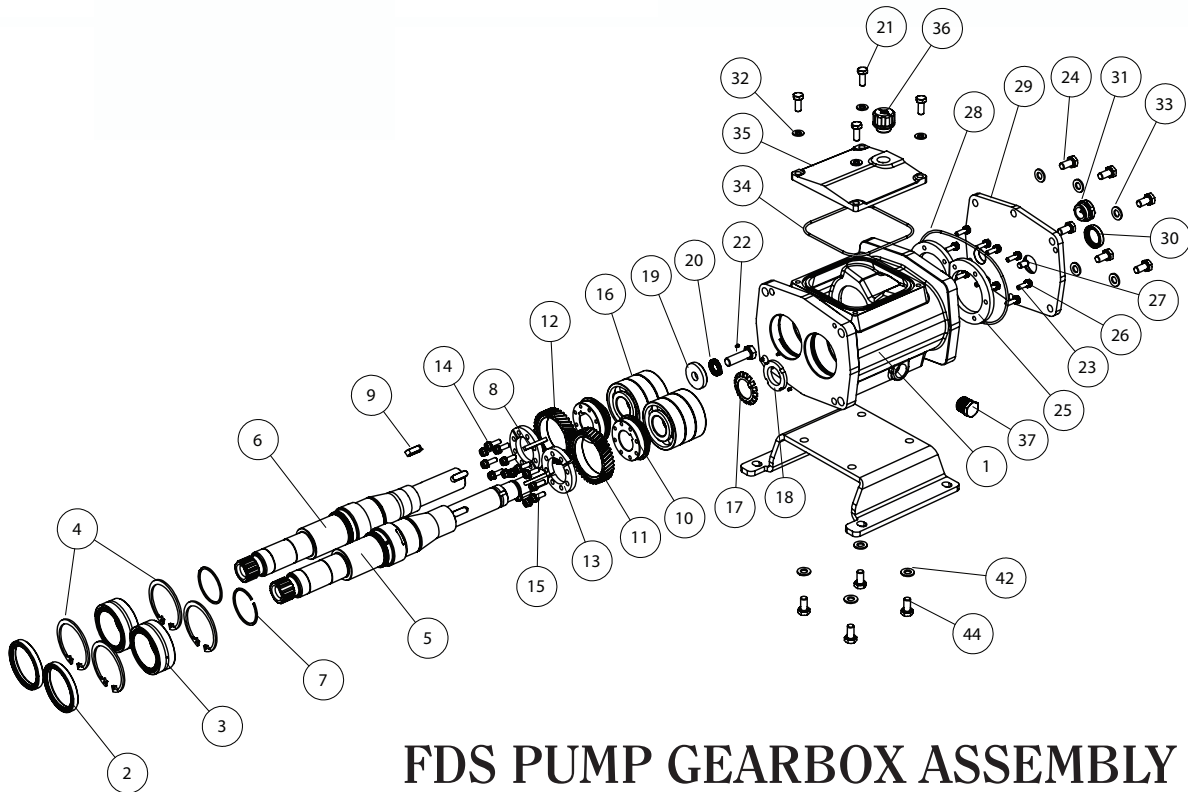
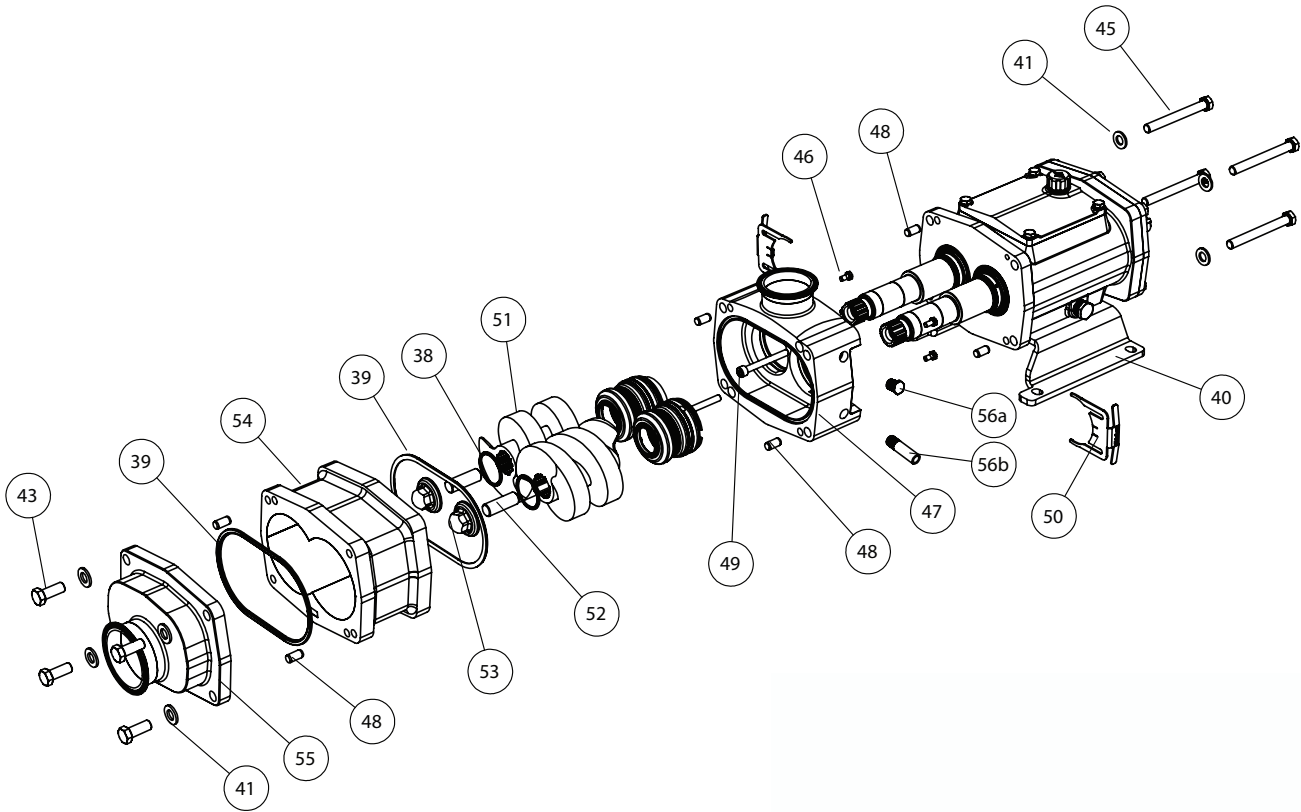
Periodically inspect the pump housing, cover and screws for any signs of wear or damage. If wear is present this could be a sign of over-pressurization, incorrect screw gaps or bearing wear.

TEMPERATURE DIFFERENTIALS

Positive pump efficiency depends on internal clearances between the screws and the pump housing. Because of the tight clearances, temperature differential* is a concern, because if there is a severe temperature change in the pump, the shaft and screws may expand inside the pump housing. This expansion can result in screw to screw or screw to housing damage. You must ensure enough time must be provided for natural thermal expansion and contraction to occur.

** For example, if you are running CIP solution at 180°F and your product is 50°F, that is a 130°F temperature differential.*

FDS PUMP HEAD ASSEMBLY



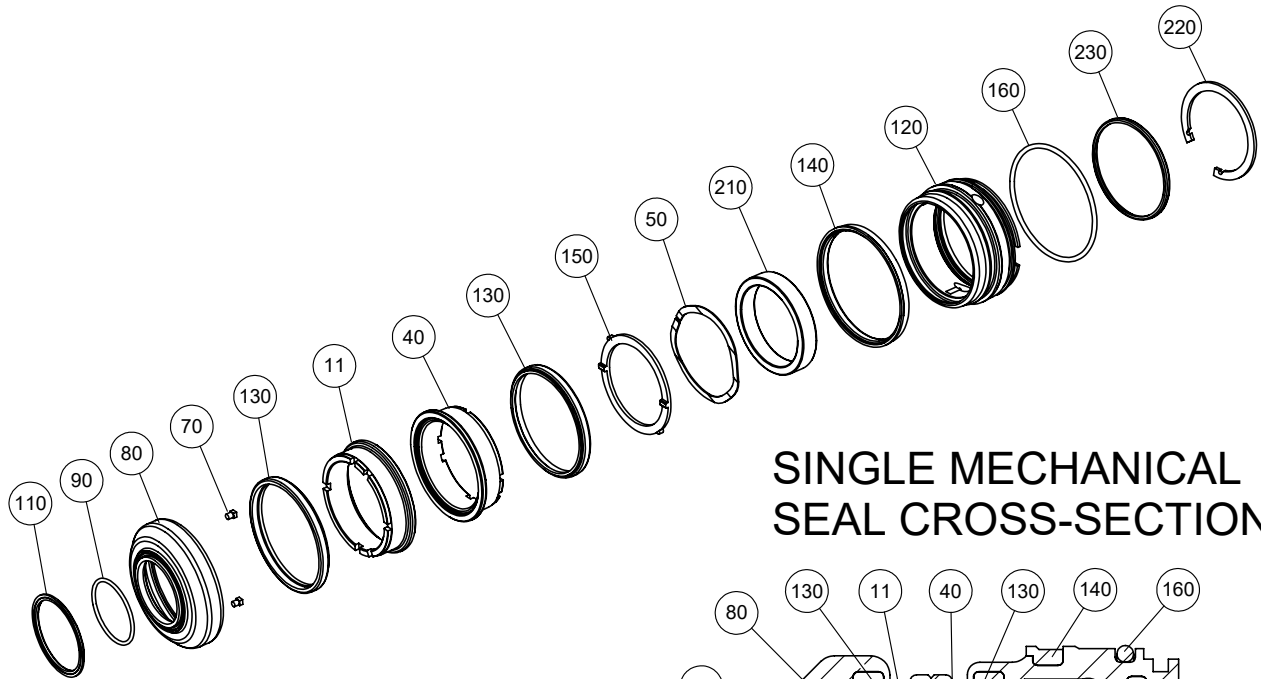
FDS PUMP GEARBOX ASSEMBLY

FDS PARTS LIST

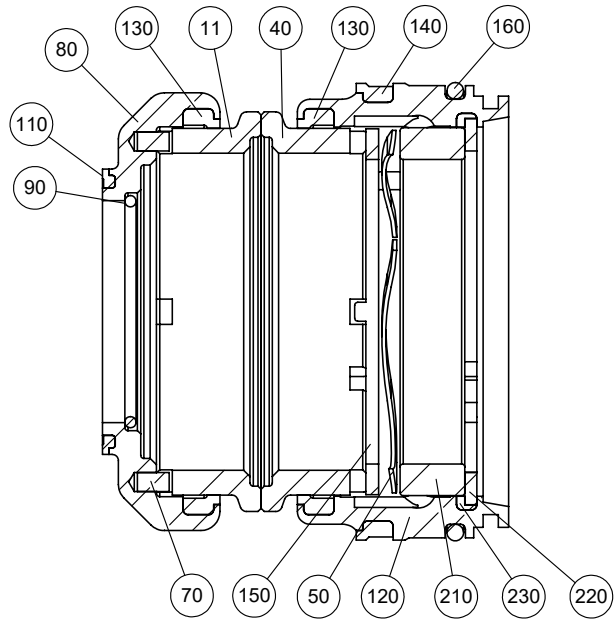
ITEM	DESCRIPTION	QTY.	FDS 1	FDS 2	FDS 3	FDS 4
1	Gearbox	1	1310606100	1310606202	1310606300	1310606400
2	Gearbox Seal	2	1812000072	1812000036	1812000075	1812000077
3	Bearing, Front	2	1173001030	1173001028	1173001032	1173001034
4	Internal Retaining Ring	4	1148000042	1148000039	1148000045	1148000050
5	Drive Shaft	1	1391000002	1391000000	1391000004	1391000009
6	Idle Shaft	1	1391000003	1391000001	1391000005	1391000010
7	Ext. Retaining Ring, Bearing Retainer	2	1148000043	1148000040	1148000046	1148000051
8	Shaft Key	1	1315000050	1315000047	1315000051	1315000056
9	Gear Bushing Key	2	1315000048	1315000046	1315000049	1315000055
10	Gear Bushing	2	1224004720	1224004719	1224004721	TBD
11	Gear, Left	1	1390000002	1390000000	1390000004	1390000006
12	Gear, Right	1	1390000003	1390000001	1390000005	1390000007
13	Gear Retainer	4	1224004722	1224004718	1224004723	TBD
14	Lock Washer, Gear Retainer	16	1104001090	1104001086	1104001091	1104001106
15	SHCS, Gear Retainer	16	1101000041	1101000255	1101000032	1101000036
16	Bearing, Rear	6	1173001031	1173001029	1173001033	1173001035
17	Bearing Lock Nut Washer	1	1104001093	1104000023	1104001051	1104001108
18	Bearing Lock Nut	1	1306000134	1306000008	1306000112	1306000135
19	Tensioning Washer, Shaft	1	1224004724	1224004717	1224004725	TBD
20	Lock Washer, Idle Shaft	1	1104001087	1104001087	1104001092	1104001107
21	Hex Bolt, Gearbox Cover	4	1101000011	1101000011	1101000011	1101000133
22	Hex Bolt, Idle Shaft	1	1101000087	1101000037	1101001850	TBD
23	Hex Bolt, Bearing Retainer	10*	1101000040 (8)*	1101000040	1101000011	1101000133
24	Hex Bolt, Gearbox End Plate	6	1101000011	1101018627	1101000133	TBD
25	Bearing Retainer	2	1304000046	1304000045	1304000047	TBD
26	Lock Washer	10*	1104001086 (8)*	1104001086	1104001091	1104001106
27	Pin, Gearbox End Plate	2	1891000096	1891000096	1891000073	1891000073
28	O-ring, Gearbox End Plate	1	1180000389	1180000238	1180000571	1180000989
29	Gearbox End Plate	1	1392000003	1392000004	1392000006	TBD
30	Drive Shaft Seal	1	1812000074	1812000073	1812000076	1812000078
31	Oil Sight Glass	1	1248000029	1248000028	1248000028	1248000028
32	Flat Washer, Gearbox Cover	4	1104000000	1104000000	1104000000	1104000062
33	Flat Washer, Gearbox End Plate	6	1104000000	1104000062	1104000062	1104000022
34	O-ring, Gearbox Cover	1	1180000919	1180000246	1180000922	1180000572
35	Gearbox Cover	1	1392000001	1392000000	1392000002	TBD
36	Vent Plug	1	1248000034	1248000034	1248000034	1248000034
37	Drain Plug	1	1248000025	1248000025	1248000025	130300012
38	Screw Nut Gasket - Viton	2	0240800071	0240800057	0240800055	0240800063
39	Gasket, Cover/Casing - Viton	2	0240800070	0240800056	0240800054	0240800062
40	Mounting Foot	1	1925004605	1925004604	1925004606	TBD
41	Flat Washer, Housing/Cover	8	1104000062	1104000002	1104000022	TBD
42	Flat Washer, Mounting Foot	4	1104000062	1104000062	1104000002	1104000022
43	Hex Bolt, Cover	4	1101000134	1101000046	1101001850	1101001853
44	Hex Bolt, Mounting Foot	4	1101018615	1101018627	1101018630	TBD
45	Hex Bolt, Housing/Casing	4	1101018631	1101018626	1101018632	TBD
46	Hex Bolt, Seal Retainer	4	1101018628	1101018628	1101018628	1101018628
47	Pump Housing	1	1710611003	1720611002	1730611000	1740611000
48	Locating Pin	6	1891000096	1891000073	1891000073	1891000073
49	SHCS, Housing	2	1101018633	1101018629	1101018634	1101000265
50	Mechanical Seal Retainer	2	1148000041	1148000038	1148000044	1148000048
51	-4 Screw Set	1	1710630002	1720630001	1730630001	1740630002
	-3 Screw Set		1710630001	1720630002	1730630002	1740630003
	-2 Screw Set		1710630000	1720630000	1730630000	1740630000
	-1 Screw Set		1710630003	1720630004	1730630003	1740630004
52	Screw Stud, Std.	2	1103006405	1103006402	1103006406	1103006408
53	Screw Nut	2	1103006100	1103006200	1103006300	1103006400
54	Casing, Standard	1	1710671000	1720671000	1730671000	1740671000
55	Pump Cover	1	1710621001	1720621001	1730621001	1740621001
56a	Single Seal Plug	4	1248000035	1248000035	1248000035	TBD
56b	Double Seal Water Pipe		1910000026	1910000026	1910000026	TBD

* quantities may vary

SINGLE MECHANICAL SEAL ASSEMBLY



SINGLE MECHANICAL SEAL CROSS-SECTION



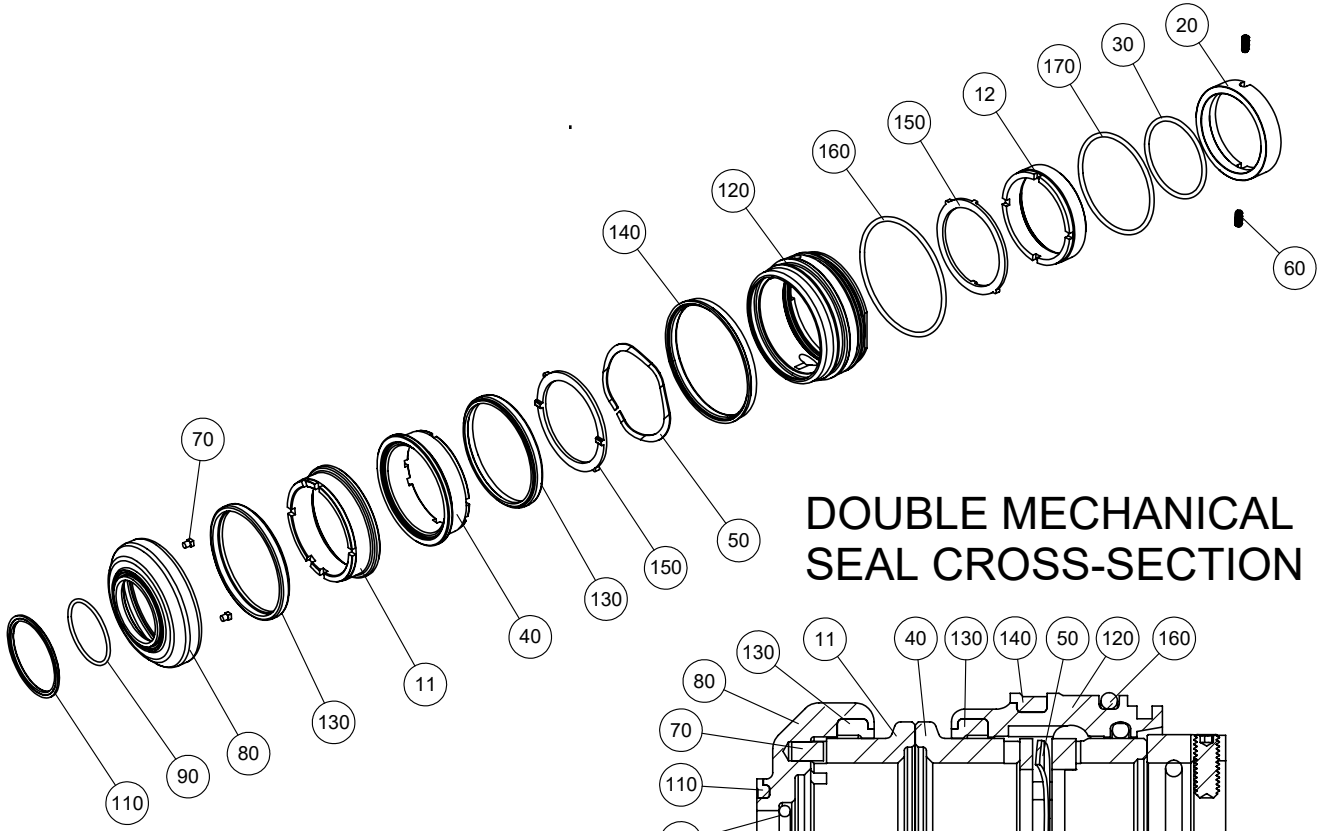
FDS Single Mechanical Seal		
Item	Qty	Description
11	1	Seal Face - Rotating
40	1	Seal Face - Stationary
50	1	Wave Spring
70	2	Drive pin
80	1	Inboard Rotor Holder*
90	1	O-ring
110	1	Lip O-ring HFO
120	1	Inboard Flange*
130	2	Lip O-ring HRI
140	1	Lip O-ring HRO
150	1	Drive Disc*
160	1	O-ring
210	1	Spacer*
220	1	Retaining Ring*
230	1	Backup Ring*

* Complete Kit only

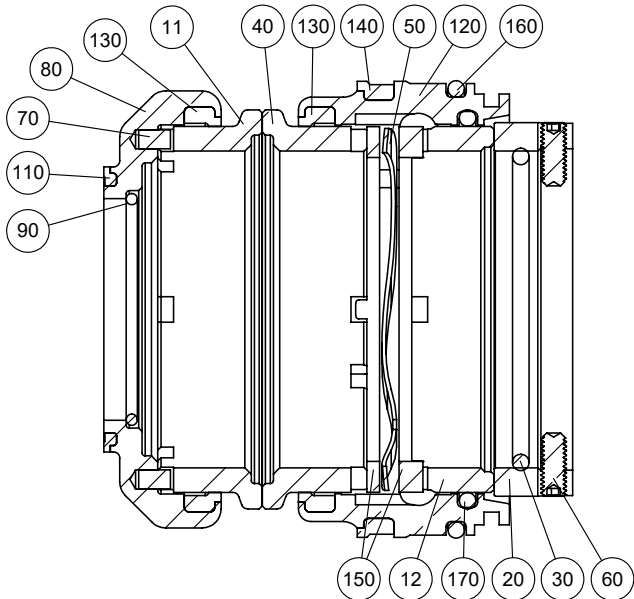
FDS Single Mechanical Seal Kits			
Model	Materials*		Wear Kit
	Stationary	Rotating/Elastomer	
FDS1	C/C/V	1802601451	1802601452
FDS 2	C/C/V	1802601459	1802601460
FDS 3	C/C/V	1802601467	1802601468
FDS 4	C/C/V	1802601475	1802601476

* C = Silicon Carbide; N = Carbon; V = Viton; Contact Fristam for other seal materials

DOUBLE MECHANICAL SEAL ASSEMBLY



DOUBLE MECHANICAL SEAL CROSS-SECTION



FDS Double Mechanical Seal		
Item	Qty	Description
11	1	Seal Face - Rotating
12	1	Outboard Stationary
20	1	Outboard Rotating
30	1	O-ring
40	1	Seal Face - Stationary
50	1	Wave Spring
60	2	Set Screw - Cup Point
70	2	Drive pin
80	1	Inboard Rotor Holder*
90	1	O-ring
110	1	Lip O-ring HFO
120	1	Inboard Flange*
130	2	Lip O-ring HRI
140	1	Lip O-ring HRO
150	2	Drive Disc*
160	1	O-ring
170	1	O-ring

*Complete Kit only

FDS Double Mechanical Seal Kits			
Model	Materials*		Wear Kit
	Stationary/Rotating/ Outboard Stationary/ Outboard Rotating/Elastomer	Complete Cartridge	
FDS1	C/C/N/TC/V	1802601455	1802601456
FDS 2	C/C/N/TC/V	1802601463	1802601464
FDS 3	C/C/N/TC/V	1802601471	1802601472
FDS 4	C/C/N/TC/V	1802601479	1802601480

* C = Silicon Carbide; N = Carbon; V = Viton; TC = Tungsten Carbide
Contact Fristam for other seal materials

REQUIRED TOOLS

FDS Tool List

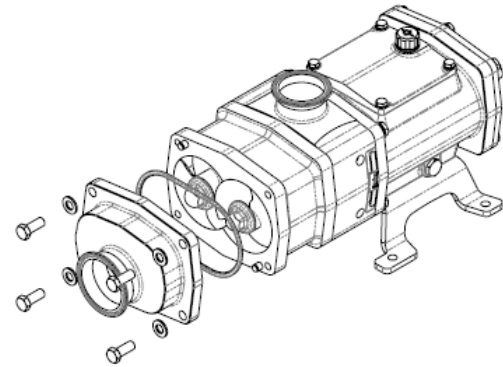
	FDS1	FDS2	FDS3	FDS4
Pump Assembly				
Hex Head Bolt, Cover	17mm Socket	19mm Socket	24mm Socket	30mm Socket
Hex Bolt, Housing/Casing	17mm Wrench	19mm Wrench	24mm Wrench	30mm Wrench
SHCS, Housing	6mm Allen Socket	6mm Allen Socket	6mm Allen Socket	10mm Allen Socket
Screw Nut	21mm Socket	24mm Socket	30mm Socket	36mm Socket
Hex Bolt, Seal Retainer	10mm Socket	10mm Socket	10mm Socket	10mm Socket
Water Pipe Plug	5/8" Socket	5/8" Socket	5/8" Socket	13mm Socket

	FDS1	FDS2	FDS3	FDS4
Gearbox Assembly				
Hex Bolt, Gearbox Cover	13mm Socket	13mm Socket	13mm Socket	16mm Socket
Hex Bolt, Gearbox End Plate	13mm Socket	17mm Socket	17mm Socket	24mm Socket
SHCS, Gear Retainer	4mm Allen Wrench	4mm Allen Wrench	6mm Allen Wrench	8mm Allen Wrench
Hex Bolt, Idle Shaft	19mm Socket	19mm Socket	24mm Socket	30mm Socket
Hex Bolt, Bearing Retainer	10mm Socket	10mm Socket	13mm Socket	16mm Socket
Bearing Lock Nut	Spanner Wrench for 32mm	Spanner Wrench for 45mm	Spanner Wrench for 58mm	Spanner Wrench for 75mm
Drain Plug	1-1/16" Socket	1-1/16" Socket	1-1/16" Socket	19mm Socket
Oil Sight Glass	23mm Socket	30mm Socket	30mm Socket	30mm Socket
Hex Bolt, Mounting Foot	17mm Socket	17mm Socket	19mm Socket	24mm Socket
Internal Retaining Ring	Internal Retaining Ring Pliers for 55mm ID	Internal Retaining Ring Pliers for 68mm ID	Internal Retaining Ring Pliers for 90mm ID	Internal Retaining Ring Pliers for 115mm ID
Ext. Retaining Ring	External Retaining Ring Pliers for 40mm OD	External Retaining Ring Pliers for 50mm OD	External Retaining Ring Pliers for 65mm OD	External Retaining Ring Pliers for 85mm OD

PUMP DISASSEMBLY

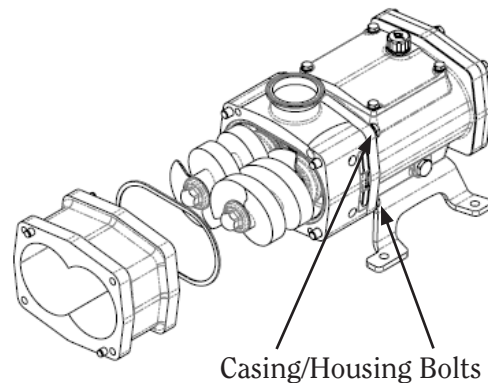
REMOVE THE COVER

- Remove the cover bolts and washers.
- Remove the cover from the casing. You may have to use a rubber mallet to gently tap the cover off the casing dowel pins.
- Remove and inspect the cover gasket for damage.



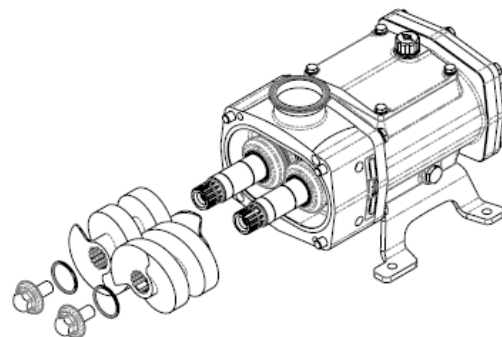
REMOVE THE CASING

- Loosen the casing/housing bolts.
- Remove the casing from the housing. You may have to use a rubber mallet to gently tap the casing off the housing dowel pins.
- Remove and inspect the casing/housing gasket for damage.



REMOVE THE SCREWS

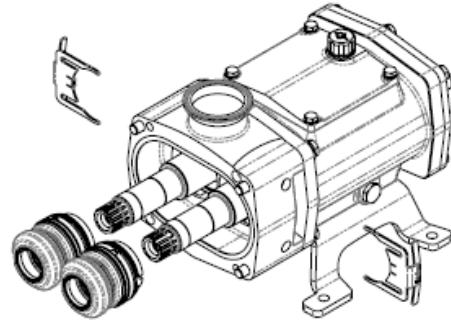
- Place a brass or aluminum block between the screws; to block rotation.
- Remove the screw nut from the drive screw.
- Remove the screw nut from the idle screw. You will have to move the block to the underside, near the housing, to torque the opposite screw.
- Inspect the screw nut gaskets for damage.
- Remove the screws simultaneously.



SEAL REPLACEMENT

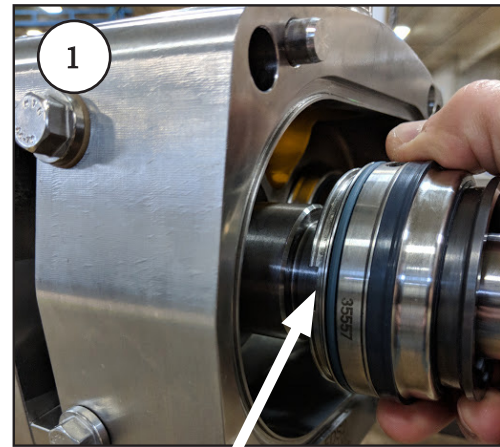
MECHANICAL SEAL REMOVAL

- Loosen the four mechanical seal retainer bolts
- Remove the mechanical seal retainers.
- Remove the rotating units from the shafts.
- Remove the stationary units from the housing.
- Inspect as necessary.



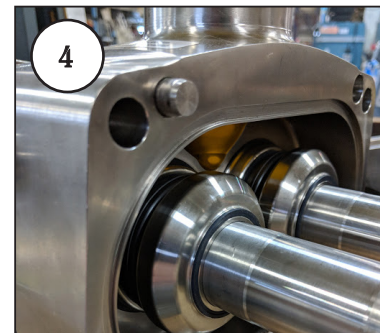
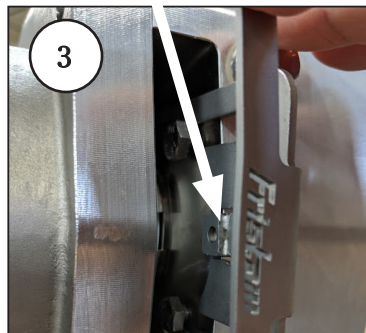
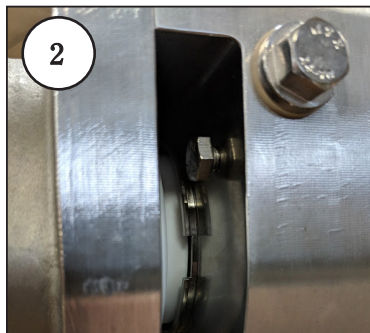
MECHANICAL SEAL INSTALLATION

- Lubricate the outer O-ring of the stationary seal.
- Line up the notch to the outside of the housing (1).
- Install the stationary seal (2); ensure that it is fully seated against the spacer (single seal) or the outboard rotor (double seal).
- Install the mechanical seal retainer (3); ensure that it is fully engaged with the notch of the stationary seal.
- Secure the mechanical seal retainer bolts.
- Install the rotating seal (4).



Stationary seal notch

Seal retainer tab



PUMP ASSEMBLY

SCREW INSTALLATION

- Casing must be removed from the gearbox.
- Apply lubricant to the splines.
- Install both screws simultaneously and ensure they are parallel in the front and back. NOTE: The screw with one dot should be assembled in the drive shaft and the screw with two dots should be installed on the idle shaft.
- Ensure that both screws come in contact with the rotating seal driver.
- Apply lubricant to the form gasket of the screw nut/stud assembly.
- Apply blue thread locker to the threads.
- Install and hand tighten each nut.
- Place a brass or aluminum block between the screws; to block rotation.
- You will have to move the block to the underside, near the housing, to torque the opposite screw.
- IMPORTANT – be sure to torque the screws back and forth, until they are fully torqued. Not doing so will result in a loose screw, change in gap and potential rubbing.



GAPPING THE PUMP

- Remove the gearbox cover.
- Using an Allen wrench, loosen the socket head cap screws on the idle gear retainer.
- The idle shaft will be loose; allowing it to spin. The gap between the screws will change as you spin the idle shaft back and forth.
- Determine the proper gap for the model.
- Install gapping shims between the front and back of the screws.
- NOTE – to ensure the gap doesn't change, place a larger shim in the rear (towards to housing), when you tighten. The screw will tend to pull towards the housing when tightening.
- Tighten two of the screws on the idle shaft gear retainer.
- Remove both of the gapping shims and check the gap between flanks in multiple locations, to ensure the gap is correct and consistent.
- Once you have confirmed the gap is correct, tighten the remaining gear retainer screws.
- Rotate the shafts, to ensure the screws turn freely; without interference.
- Install the casing – NOTE the orientation of the taper, per your configuration.
- Determine the radial gap for your pump.
- With the casing secure, check the radial gap between the screws and casing.

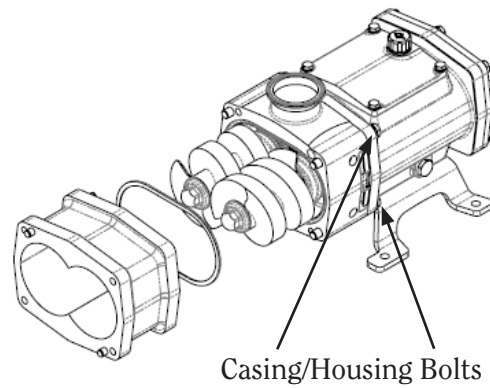


Larger shim



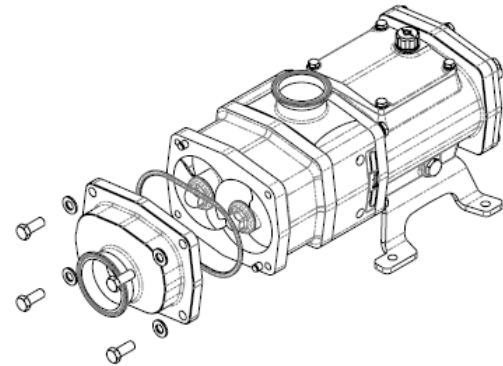
INSTALL THE CASING

- Install the casing/housing gasket onto the housing.
- Install the casing onto dowel pins of the housing.
- Tighten the casing/housing bolts.
- Note taper location per your configuration



INSTALL THE COVER

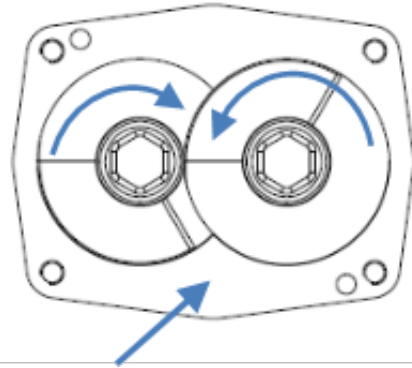
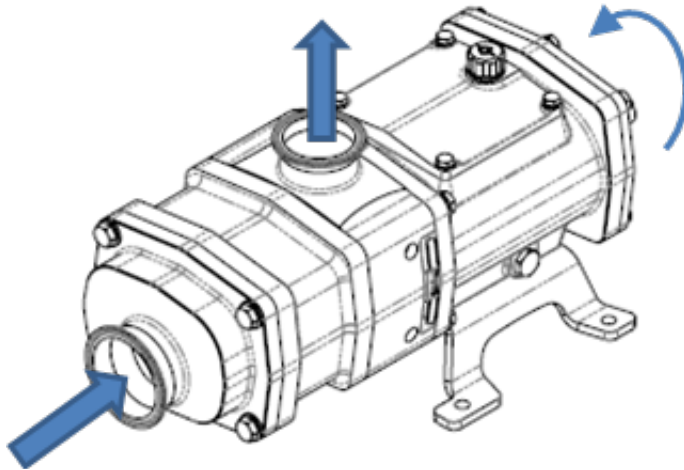
- Install the cover gasket onto the cover.
- Install the cover onto the casing.
- Install the cover bolts and washers and tighten.



CHANGING SCREW ROTATION DIRECTION

STANDARD (CONFIGURATION 1)

- Inlet front, outlet top
- Clockwise drive shaft rotation (view from the motor)
- Casing taper located at the bottom



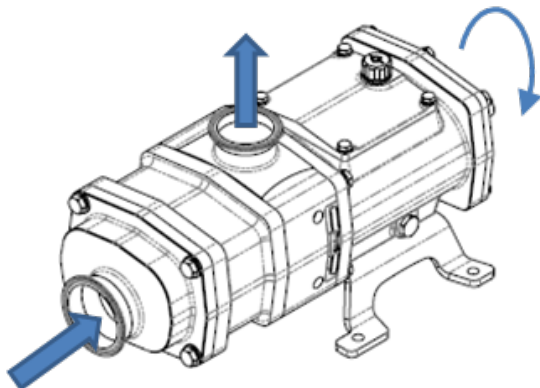
Laser marking indicates location of casing taper [view from front, cover removed]

REVERSE SCREW ROTATION (CONFIGURATION 2)

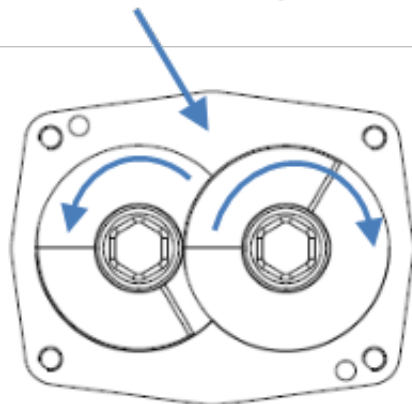
- Inlet front, outlet top
- Counter-clockwise drive shaft rotation (view from the motor)
- Casing taper located at the top

DIRECTIONS

- Switch left and right screws
- Rotate casing 180° (taper at top)
- Reverse drive shaft rotation



Laser marking indicates location of casing taper [view from front, cover removed]



CHANGING FLOW DIRECTION



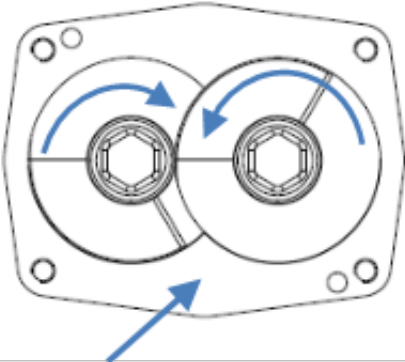
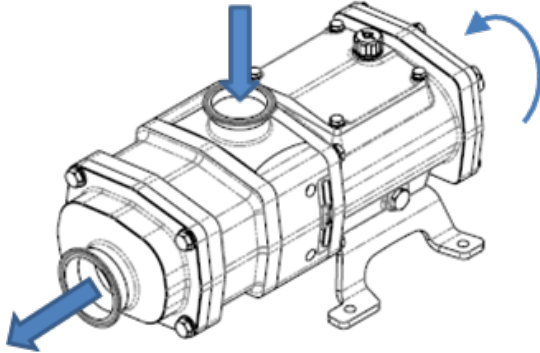
WARNING! Contact Fristam for pressures above 115 psi differential pressure. Modification to the shaft assembly is necessary.

CONFIGURATION 3

- Inlet top, outlet front
- Clockwise drive shaft rotation (view from the motor)
- Casing taper located at the bottom

DIRECTIONS

- Switch left and right screws



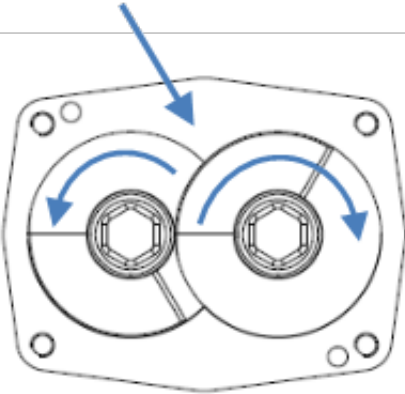
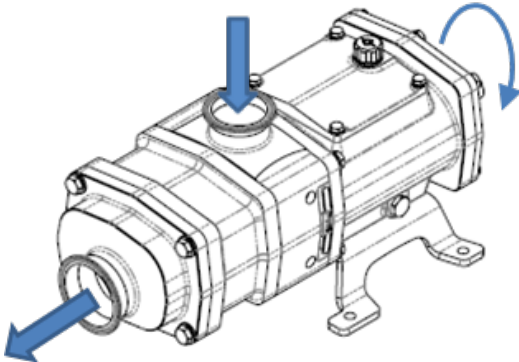
Laser marking indicates location of casing taper [view from front, cover removed]

CONFIGURATION 4

- Inlet top, outlet front
- Counter-clockwise drive shaft rotation (view from the motor)
- Casing taper located at the top

DIRECTIONS

- Rotate casing 180° (taper at top)
- Reverse drive shaft rotation



Laser marking indicates location of casing taper [view from front, cover removed]

EC DECLARATION OF CONFORMITY

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

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

- Centrifugal pump types: FPR, FPX, FP, FZX, FM, FPH/FPHP, FS
- Positive displacement pump types: FKL, FDS 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

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

- Centrifugal pump types: FPR, FPX, FP, FZX, FM, FPH/FPHP, FS
- Positive displacement pump types: FKL, FDS 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 compilation of the technical file:



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

Prices and all terms and conditions of sale are established in current price sheets and are subject to change without notice. All orders are subject to acceptance by Fristam Pumps USA Limited Partnership.

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

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All claims must be in writing and mailed or delivered by purchaser within thirty (30) days after purchaser learns the facts upon which such claim is based. Any claim not made in writing and within the time period specified above shall be deemed waived.

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

End-of-Life Disposal

At the end of its life, our products should be recycled according to local guidelines.

