

SSD Pumps for Seawater Reverse Osmosis

Installation, Operation & Maintenance Manual

Models

SSD-500

SSD-1000



Fluid Equipment Development Company, LLC

Tel. 734-241-3935

Fax 734-241-5173

techsupport@fedco-usa.com

www.fedco-usa.com

COMPLETE AND RETURN WARRANTY FORM TO FEDCO TO ACTIVATE YOUR WARRANTY COVERAGE

1. General Information

1.1 Introduction

This manual provides information on the installation, operation and maintenance of your SSD series pump. Proper installation and operation will help ensure extended pump life while preventing costly downtime.

Before installing and operating your SSD Series pump, please read this entire manual. Be sure to keep the manual in a handy place for future use.

WARNING
These instructions must be followed to insure safe and proper installation, operation and maintenance of the pump.

1.2 Receiving and Inspection

The SSD pump was tested before shipping to ensure it meets all performance requirements. When the equipment is received, promptly open and inspect the crates and/or boxes for damage. Report any damage to the freight company. Please save any documents that may be enclosed. Check whether all shipped items match the shipping documentation. Contact FEDCO if there are any discrepancies:

FEDCO
800 Ternes Dr.
Monroe, MI 48162
USA

Tel: 734-241-3935
Fax: 734-241-5173
e-mail: techsupport@fedco-usa.com
Web: www.fedco-usa.com

Table of Contents

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1. General Information	2
1.1 Introduction	2
1.2 Receiving and Inspection	2
1.3 Application Range	3
1.4 General Terminology	3
1.5 Storage	3
2. Installation	4
2.1 Floor Mounting	4
2.2 General Instructions	4
2.3 Required Tools	5
2.4 Motor Installation	5
2.5 Filter Installation	5
2.6 Pipe Installation	5
2.7 Pump Installation	6
2.8 Pump-Motor Alignment	7
2.9 Pump Testing (?)	6
3. Operation	11
3.1 Rotation Direction	11
3.2 Startup Checklist	11
3.3 Startup Procedure	11
3.4 Shutdown Procedure	12
4. Maintenance	12
4.1 Preparation	12
4.2 Drop Out Coupling Disassembly	12
4.3 Seal Cap Removal	13
4.4 End Cap Removal	14
4.5 Impeller and Shaft Removal	15
4.6 Impeller and Shaft Disassembly	
4.7 Parts Inspection	
4.8 Impeller and Shaft Assembly	
4.9 End Cap Assembly	
4.10 Seal Cap Assembly	
4.11 Drop Out Coupling Assembly	
5. Troubleshooting	
6. Parts Return and Warranty	
7. Installation Record/Notes	
Appendix A – General Notes	
Warranty Registration Form	

1.1 Safety Considerations




Safety practices and precautions for the operation and maintenance of all FEDCO Pump Products **MUST BE FOLLOWED**.

This information supplements oral or written instructions that may be received. Safety **MUST** be practiced as part of the standard operating procedures for equipment at any installation. To ensure that safe operating and maintenance procedures are followed operators should develop and keep up a program of safety checks and current instructions.













This manual contains certain operating and maintenance procedures that involve exposure to potentially hazardous situations. The three levels of hazardous situations are identified by the following signal words: ***DANGER, WARNING, CAUTION, ELECTRICAL and SKIN PUNCTURE HAZARD.*** The levels of hazardous situations are as follow:

Safety Message Symbol	Indication
 DANGER	Hazards which are <u>IMMEDIATELY ACCESSIBLE</u> , and capable of causing <u>SEVERE PERSONAL INJURY OR DEATH</u>
 WARNING	Hazards which are <u>NOT IMMEDIATELY ACCESSIBLE</u> , but are capable of causing <u>SEVERE PERSONAL INJURY OR DEATH.</u>
 CAUTION	Hazards which are <u>NOT IMMEDIATELY ACCESSIBLE</u> , and can cause <u>PERSONAL INJURY.</u>
 ELECTRICAL HAZARD	Hazards which are related to Electrical Components and can <u>RESULT IN ELECTRICAL RISKS, SHOCK, ELECTROCUTION OR DEATH</u> if instructions are not followed properly.
 SKIN PUNCTURE FROM HYDRAULIC	Hazards which are <u>NOT IMMEDIATELY ACCESSIBLE</u> and can <u>RESULT IN SEVERE PERSONAL INJURY OR DEATH</u> if instructions are not followed properly.

WARNINGS AND SAFETY CONCERNS:

-  Pump and safety precautions must be followed to prevent physical injury to the operator.
-   A pump is a pressure-generating device with rotating parts that can be hazardous. Any device containing generated pressure can rupture, explode or discharge its contents if it is sufficiently over-

pressurized and may possibly result in personal injury, property damage, environmental damage and death. **All necessary precautions must be exercised to insure over-pressurization does not occur. FEDCO will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual.**

-  Installation, operation or maintenance of the pump unit in any manner which is not covered in this manual could cause damage to the equipment, serious injury or death. This includes any modification to the equipment or the use of parts not provided by FEDCO. If there is a question regarding the intended use of the equipment, please contact a FEDCO representative before proceeding.
-  This manual clearly identifies accepted methods for safe disassembly. These methods must be strictly adhered to.
-  **Do not** use the pump equipment for a different application than originally specified without the approval of a FEDCO representative.
-  **Never** operate the pump equipment below the minimum flow rate, when dry, or without priming.
-    **Never** operate the pump equipment without safety devices installed.
-  Do not operate equipment without the guards.
-   **Never** operate the pump equipment with the discharge valve closed.
-  **Never** operate the pump with the suction valve closed.
-  Always follow the **Lock-out / Tag-out procedure** developed by your company before starting any maintenance or repair.

User Health and Safety

Safety Equipment should be used in accordance with company regulations. The following safety equipment should be used within the work area:

- Helmet.
- Safety Glasses with shields or goggles.
- Safety Shoes.
- Protective Gloves.
- Hearing Protection is recommended.
- Follow safe lifting methods to avoid personal injury.

In the Work Area

- Always keep the work area clean and dry.
- Avoid all electrical dangers. Be aware of risks from electric shock or arc flash hazards.
- Utilize adequate lifting equipment and methods.

Electrical Connections and Regulations

- Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations.
- Insure the product is isolated from the power supply and cannot be energized by mistake.
- Make sure all thermal contacts are connected to a protection circuit according to the product approvals.
- All electrical equipment must be properly grounded (earthed).

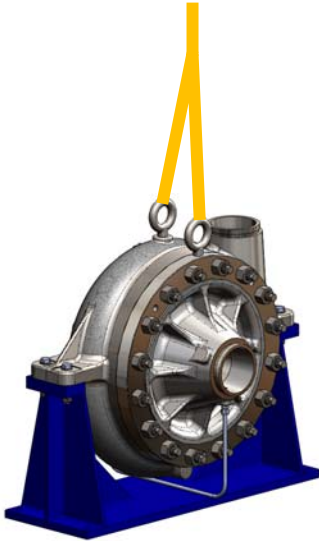
- During installation, service and repair, must follow your company's Lock-out / Tag-out procedure.



Lifting Provisions

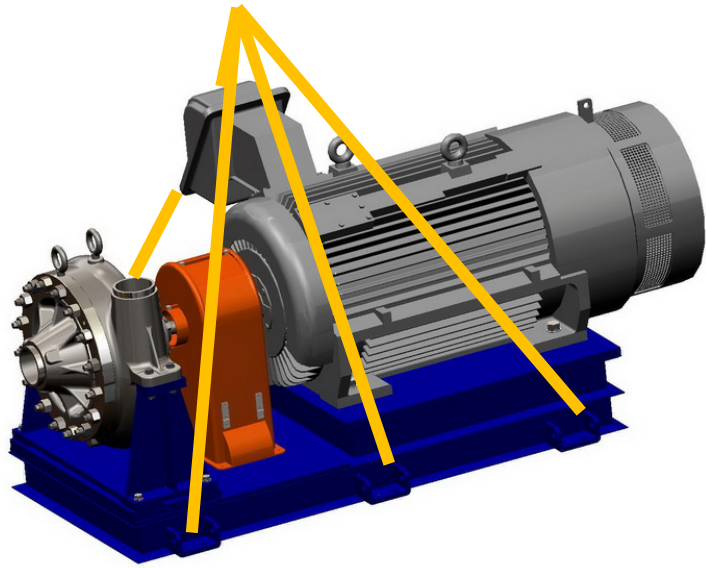
The SSD pump will be delivered either as: A) standalone, or B) on a common baseplate. Below are the lifting provisions for both cases.

Utilize properly rated straps and lifting equipment to move the pump. The weight can be found on the nameplate of each piece of equipment.



(A) Standalone

The SSD has 2 eye hooks for moving the pump and its base. Use caution not to bend the drain line or damage the shaft.



(B) With common motor baseplate

Note! The motor, depending on order, might not be shipped on the baseplate. Typically, the baseplate will have 3 eye hooks on each side.
CAUTION! Do not lift the entire baseplate by the motor or pump eye hooks. These are rated for the individual components only.

1.3 Application Range

In general, minimum inlet pressure should not be lower than 30 psi (about 2 bar) in order to avoid cavitation. The SSD pump should only be used within the following limits:

Maximum fluid temperature: 158 degrees F (70°C)
Maximum working pressure: 600 psig (41.5 barg)
Maximum particulate size: 20 micron

Each pump is designed for a specific application. Therefore, the application limits can vary from model to model. Specific application limits are provided on the nameplate of each pump.

1.4 General Terminology

Figure 1 identifies some major pump components:

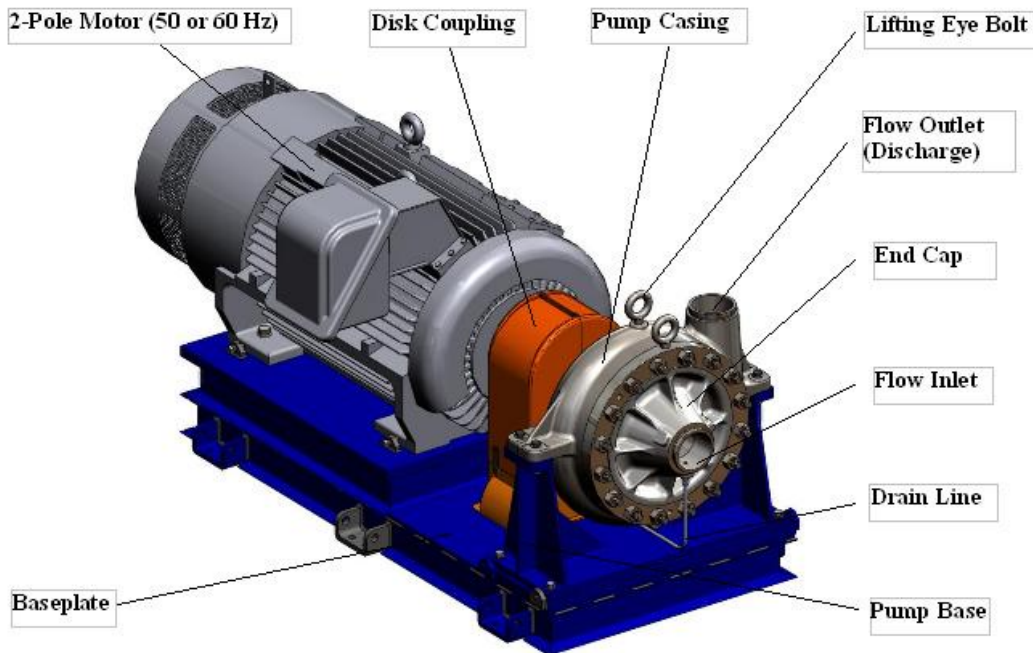


Figure 1 SSD-500 pump and motor assembly

1.5 Storage

The SSD pump must be protected from moisture, sand, grit, and other foreign matter. Therefore, store the pump in a dry and clean area indoors. Do not remove the protective covers on the pipe connections until ready to install.

2. Installation

2.1 Foundation Mounting

As with all pumps, it is a good practice to provide a rigid foundation for the pump-motor assembly in order to prolong the life of critical components, such as the pump shaft and motor bearings. The foundation is built in order to absorb vibrations and to isolate the pump and motor from the surrounding area. Pump-motor assembly comes with a steel baseplate and should be installed on a concrete foundation massive enough to sustain the equipment's total weight and dynamic loads.

2.1.1 Concrete Foundations

A concrete foundation serves as a good support for the pump-motor assembly and provides good means for vibration absorption. As a general rule, the foundation should have a mass that is 50% more than the total weight of the equipment, and its perimeter should extend at least 6 inches (15 cm) on each side from the pump and motor.

2.1.2 Baseplates

Baseplates (see [Figure 2](#)) provide good mounting surfaces for motor and pump feet and allow for a better alignment process. FEDCO will provide a common baseplate for the pump and motor but it can be also optional for the customer to provide their own. In that case, please consult with FEDCO for coupling length and other design measurements.

Installation of the motor and pump should be completed after the grout has completely cured.

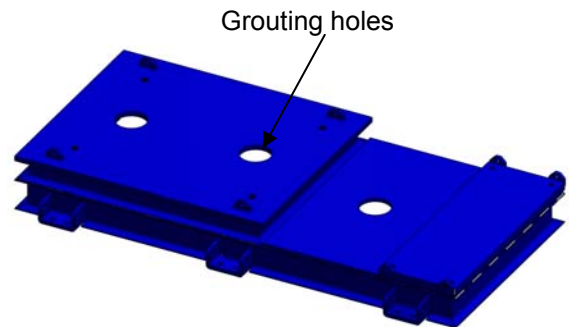


Figure 2 Baseplate

Note! If connecting piping of the system has been started, it might be necessary to temporarily install the pump onto the baseplate to tram the baseplate in place such that the pump connections will align with the system piping without creating stresses.

2.1.3 Anchor Bolts

Anchor bolts ([Figure 3](#)) should be installed in accordance with the bolt manufacturer's recommendations. They should be long enough to ensure that they can withstand the vibration during pump operation. The anchor bolts can be inserted into the foundation by drilling the necessary holes, or they can be inserted before the concrete is poured and the baseplate trammed in place (preferred method).

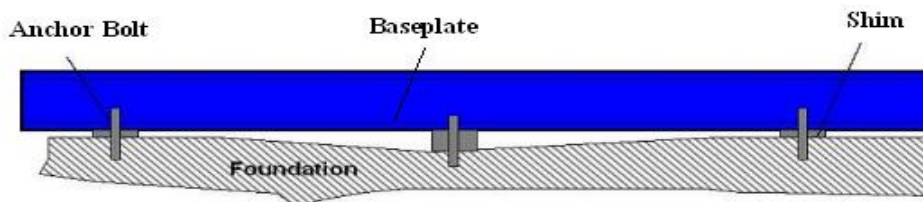


Figure 2 Anchoring a baseplate on foundation (temp)

2.1.4 Grout

Besides the additional vibration absorption, grout prevents lateral shifting of the baseplate. Wet the concrete and start pouring the grout through the top baseplate openings, completely filling the space inside the lower part of the baseplate. Let the grout harden before pouring the rest of the grout to fill the

top part where the motor mounts. Make sure the concrete and non-shrink grout are completely dry before installing any machinery.

2.2 Pipe Installation

All pipes must be supported independently of the pump in order to avoid strains on the pump. Pipe elbows should be properly made and tightened before applying pressure to the system.



The pump must never be throttled on the inlet side.



The feed inlet pipe to the unit should be straight for at least a length equal to 7 times the pipe diameter and should never be smaller than the pump connection.



Keep the inlet pipe free of high points which could trap air and could disrupt pump priming.

IMPORTANT – Flush the Pipes!



Pipe debris such as welding slag can damage the unit. Thoroughly flush all pipes before installing the pump. Pressure gages should be installed on all pipes to measure pump performance.



A pressure switch should be installed at the pump inlet to prevent pump operation if the feed pressure to the pump is below the pump's NPSHR value. This can be found in FEDCO's data sheet of the proposal. If the NPSHR value is not available, the minimum inlet pressure should generally not drop below 30 psi (about 2 bar). (???)

2.2.1 Strainer Installation

The pump must be protected from debris in the feed water such as sand, gravel, welding slag, etc. A temporary strainer is recommended to be installed at the pump inlet to protect the pump from accidental release of any leftover slag and dirt in the pipe system. This strainer can be removed after 1 – 3 months, once the system has been cleared completely of all foreign matter.

2.3 General Instructions

The pump with baseplate and motor are shipped in separate crates. This allows easier movement of the motor and pump to the final installation location. The pump crate also contains the coupling and accessories necessary for the pump-motor installation.

2.4 Required Tools

The following is a list of tools which will be required for installation and maintenance of the SSD pump:

- | | |
|---|-----------------------------------|
| 1. Allen wrench (hex key) (size?) | 6. Shims |
| 2. Adjustable wrench (8" or 10", optional) | 7. Anti-seize compound (provided) |
| 3. Adjustable wrench (24") | 8. 2-pin spanner (3") |
| 4. Pry bar / screwdriver | 9. 4-pin spanner (provided) |
| 5. Jack bolts $\frac{7}{8}$ – 9 x 2 $\frac{3}{4}$ | 10. Socket wrench |

2.5 Motor Installation

It is a standard FEDCO procedure to ship a SSD pump with a baseplate. This means that mounting bolt holes for pump and motor were already predetermined and drilled. In a rare case a customer specifically requested a pump without a baseplate, the distance between pump and motor shafts should be about the length of the drop out coupling.

The motor diagram located on the motor name plate, electrical junction, junction box cover, or wiring tag should be used to correctly wire the motor according to the voltage available. Be sure to follow all manufacturer's instructions on motor lubrication and wiring.

Motor installation can begin once the baseplate has been installed, grouted and the grout has cured.

1. Bring the motor to the baseplate align the mounting holes on the motor with the holes on the baseplate.
2. Install the 4 (or 6) mounting bolts with washers and lockwashers.
 - a. Do not tighten the bolts at this time.
3. Verify that the motor shaft is in approximate alignment with the inlet connection of the system's pipe.

2.5.1 Motor Rotation

1. Before pump is connected to the motor, connect power to the motor.
2. Briefly jog motor to determine direction of rotation. Correct rotation is indicated by an arrow on the pump. Rotation is clockwise when viewing motor from fan end.
3. If rotation is incorrect, switch any two leads to the motor to change rotation. Note that changing leads to the VFD (variable frequency drive) will not change rotation.

2.6 Pump Installation

Lift the SSD pump and its base by the 2 eye hooks using proper lifting equipment.

1. Bring the SSD pump to the baseplate align the mounting holes on the pump base with the holes on the baseplate and install four (4) mounting bolts with washers and lockwashers.
 - a. Do not tighten the bolts at this time.
2. Verify that the inlet and outlet of the pump is approximately aligned with the inlet and outlet connections of the system's pipes.
3. Do the initial alignment of the shafts by placing a 12" rigid steel scale on both shafts.
4. Shim the motor or the pump until there are no visible gaps between the scale and the shafts.
5. Move the motor or pump sideways by using the jackscrews in the baseplate.
6. Do the final alignment, choosing one of the following methods (all methods require a well-trained technician to perform the task):
 - a. Laser alignment method
 - b. Dual indicator method
 - c. C or D adapter method
 - d. Shaft to coupling spool method
 - e. Face and rim method

Laser method is the most popular, but it is also the most expensive of all alignment methods. In the next section of this manual, the reverse indicator method is described. The method is very accurate; it is not affected by axial float, and can be used with flexible coupling in place.

2.7 Pump-Motor Alignment

2.7.1 General Information

The Reverse Indicator Alignment Method assumes that the motor will be moved and the pump will be stationary. The reverse indicator alignment can be performed with either two or one dial indicator. When two indicators are used, they are placed each on one of the two shafts, where each indicator and bracket setup captures a set of readings on the other shaft. In this section of the manual, a graphical solution is explained. [For a mathematical solution, please see Appendix A.\(?\)](#)

2.7.2 Machine Preparation

1. Loosen all mounting bolts.
2. Remove all existing shims from under the feet and clean them.
3. Loosen the set screw on the coupling on the motor (movable) side.
4. Only if you are using a dropout coupling, you can take it out.
5. Pre-align the two shafts as closely as possible, preferably by a level and straight edge.

2.7.3 Soft Foot

Soft foot is a condition in which one of the feet does not sit flat on the base. The foot or the base may have been warped. When you tighten the bolt on such foot, the machinery will distort.

1. When all mounting bolts are loosened, check for an obvious soft spot and any loose shim packs. Correct the loose shim packs by adding shims.
2. Determine your tightening sequence.
3. Make the first pass with about 50% of the desired torque.
4. Make the second pass with 100% of the desired torque.
5. Move indicators to 12 o'clock position, depress indicators and then zero them.
6. Loosen one base bolt.
7. If indicator moves away from zero, slide shims under that foot.
8. Another way is to use a feeler gauge (.002" shim) to check the gap under the foot.
9. Retighten the bolt and make sure the dial indicator needle does not move to zero.
10. Repeat this procedure for the remaining mounting bolts.

2.7.4 Sag Test

This test determines the amount an indicator bracket will sag at a given distance. Sag will always have a negative value, so when allowing for sag on the vertical move, always start the dial indicator with a plus (+) reading. Follow these steps to test for sag:

1. Clamp the brackets on a sturdy piece of pipe the same distance they will be when placed on the equipment.
2. Zero both indicators on top, then rotate to the bottom. The difference between the top and the bottom indicator readings is the sag.

2.7.5 Alignment Preparation

1. Measure distance between the two indicators.

2. Measure distance between indicator and front feet (centerlines of the mounting bolts).
3. Measure distance between front feet and back feet (centerlines of the mounting bolts).
4. Prepare the graph paper and choose the scale.
 - a. Horizontal axis in inches to plot the machinery measurements
 - b. Vertical axis in thousands of an inch (not in inches) to plot the indicator readings and the resulting correction movements of the machinery
5. Make a sketch of the machinery (Figure D).
6. Mark indicator positions and feet positions; write the three measured distances on graph paper.

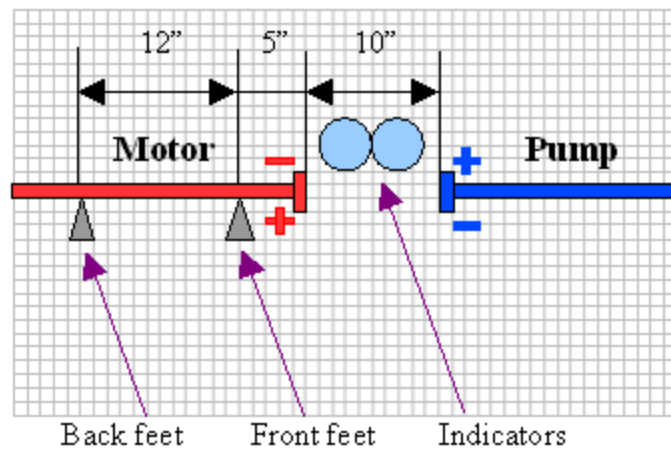


Figure D Schematic view of the pump-motor assembly with some measurements as an example.

2.7.6 Horizontal Alignment

1. Affix the bracket to the shaft or flex coupling (Figure E).
2. Adjust the indicator so that it contacts the shaft you intend to measure.
3. Affix and adjust another indicator on the other shaft, if using two indicators.
4. View the machine from the pump end; make sure that you always view the pump from the same direction in order for you to keep the left and right directions correct.
5. Zero the indicators on the left.
6. Slowly rotate both shafts and read the Total Indicator Reading (TIR) on the right.

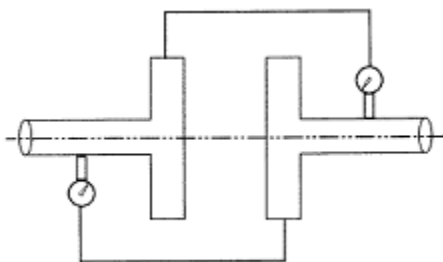


Figure E Schematic diagram.

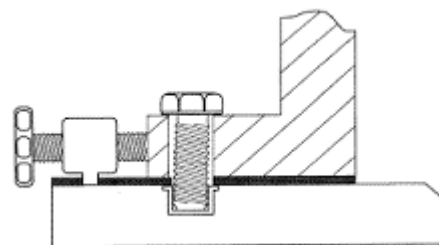


Figure F Jack bolt for moving the motor.

7. Divide each TIR by 2 and round the results to the nearest whole numbers.
8. Under the indicator position on the graph paper, mark two points that are each half of the TIR values for the pump and the motor, respectively (Figure G). Remember to check the signs on graph paper.
9. Connect these points and extend the line past the motor feet.
10. Read the resulting values by how much you need to move the motor for horizontal alignment.
11. Move the motor horizontally (Figure F).

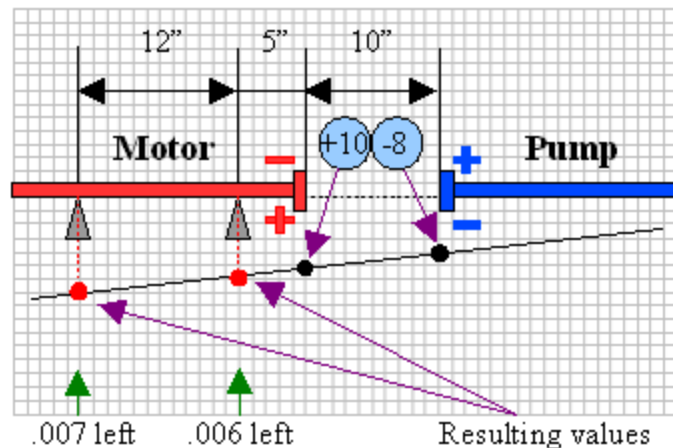


Figure G Vertical alignment.

Example:

Indicator on the pump reads -8 → mark -4 ($\frac{1}{2}$ of -8).
 Indicator on the motor reads +10 → mark +5 ($\frac{1}{2}$ of +10).

Resulting values (red dots in Figure G-2):
 6 for front motor feet → front feet will be moved 0.006 to the left
 7 for back motor feet → back feet will be moved 0.007 to the left

2.7.7 Vertical Alignment

1. Zero the indicators on the top; start with a plus (+) reading if you compensate for sag.
2. Slowly rotate both shafts and read the indicators (TIR) on the bottom.
3. Under the indicator position on the graph paper, mark two points that are each half of the TIR values for the pump and the motor, respectively (Figure G-3). Remember to check the signs on graph paper.
5. Connect these points and extend the line past the motor feet.
6. Read the resulting values by how much you need to move the motor for vertical alignment.
7. Move the motor vertically with shims.

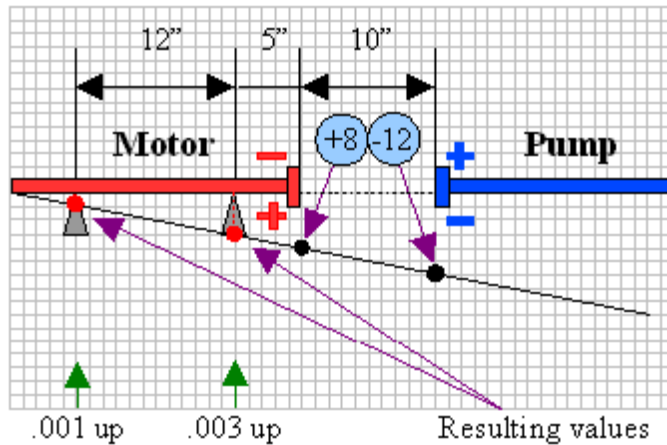


Figure G-3 Vertical alignment.

Example:

Indicator on the pump reads -12 → mark or enter -6 (½ of -12)
 Indicator on the motor reads +8 → mark or enter +4 (½ of +8)

Resulting values (rounded):

3 for front motor feet → front feet will be moved 0.003" up
 1 for back motor feet → back feet will be moved 0.001" up

2.7.8 Subsequent Corrections

1. Continue making further measurements, and corresponding corrections, following the above steps.
2. Always try to alternate horizontal with vertical alignments.
3. Be very careful not to step on or bump into the movable machinery.

2.7.9 Ending Procedure

1. Tighten all mounting bolts.
2. Recheck the indicator readings.
3. If the readings are within tolerance, than the equipment is aligned.
4. Remove alignment brackets and indicators.

2.8 Install Coupling

With the alignment completed, install the drop out coupling.

1. Install motor key on motor shaft.
2. Slide motor hub onto motor shaft and tighten set screws.
 - a. Suggestion to lubricate motor shaft with anti-seize for easier installation.
3. Install pump key on pump shaft. Note that the key has a hole which has to align with the anti-slip pin in the shaft.

4. Install pump hub on pump shaft.
 - a. **Note!** There are no set screws in the pump hub and the clearance is somewhat looser than on the motor hub. This is as it should be because the SSD shaft is designed to move axially as necessary. Do not install any set screws in this hub.
5. Install the spacer by connecting it to both the motor and pump hubs of the coupling and tighten the bolts in a star pattern.
 - a. **Note!** The disc pack has been tightened at the factory per necessary torque. Do not take the disc pack apart.

2.8.1 Verify alignment

With the coupling installed, verify alignment by measuring the gap at the disc pack. Rotate coupling (and both shafts) 90° and measure this gap again. The coupling should turn freely by hand. Check gap at the other side of the spacer and compare gap. The gap should be consistent all the way around the coupling.

Repeat alignment process if this gap is not consistent.

3. Operation

3.1 Rotation Direction

IMPORTANT – Never Operate the Pump Dry!

Before applying power, prime the pump. This means that water must fill all pipes and air must be vented out from all high points in pipes, tanks, filters, etc. Apply power for one second maximum to check whether the motor shaft rotation is still in the right direction. Note that the direction of pump rotation is clockwise when looking at the motor-pump assembly from the motor fan end. Also, there are arrows on the pump casing indicating the required direction of rotation.

3.2 Install Coupling Guard

The coupling guard and all fastening components are supplied with the SSD and shipped in the same crate. The arrangement of the guard should be shown in the outline drawing supplied with the documentation of the SSD.


If the baseplate was not supplied by FEDCO, the guard comes as a generic part and it needs to be cut and trimmed per the specific equipment arrangement. It might also be necessary to drill and tap holes in the baseplate to mount the guard.

3.3 SSD Drain Line

The SSD's axial thrust is handled internally using the pressure difference between the inlet and the discharge. For this to work, the pocket with the inlet pressure has to discharge at a certain flow rate in order for this pressure to be maintained. The SSD drain line routs this flow back into the inlet section of the pump.

Monitoring the drain line flow is crucial to the health of the pump. The drain line is equipped with a magnetic flow meter which gives either a flow rate reading or temperature. FEDCO's setting is on the flow rate option and the temperature option should be used as a

The mag meter should be connected to the plant's PLC system (or something similar) to monitor the pump and shut it down in case of danger before major damage occurs.

 Shut the pump down if the drain line flow at the duty point drops below **0.15%x duty point flow**.

The logic should include a start-up procedure, when the flow rate could be lower, so the motor won't stop the pump when it's not desired.

3.4 Startup Checklist

Before starting the pump, please verify that the following have been checked:

1. Coupling installed and tightened.
2. Coupling guard installed.
3. All anchor bolts tightened.
4. All pipe joints tightened.

5. Motor greased as required.
6. Inlet pressure switch installed.
7. Piping filled with water and bled of all air.
8. Motor rotation same as the pump rotation (check the arrow on pump casing).
9. Mag flow meter connected to PLC.

3.5 Startup Procedure

1. Start low pressure feed pump.
2. Verify that water flows through the piping and SSD pump. The pump will be seriously damaged if operated dry even for one second.
3. Vent air from tanks, high spots, etc.
4. Verify that there are no leaks in the piping.
5. Start SSD pump.
6. Check for unusual noise or vibration.
7. Check for leaks.
8. Adjust system valves and controls as needed to obtain the desired operating condition.
9. If the discharge pressure is erratic or too low, stop the pump and vent the pipes and pump.

The pump will be seriously damaged if operated dry even for one second! The pump must be filled with water prior to starting the motor even if only to check direction of motor rotation.

IMPORTANT – Never Operate the Pump Dry!

Since pump operation generates heat within the pump, a flow of fluid through the pump must be maintained to remove that heat. Pump flow should be at least 50% of the design flow rate to eliminate potential damage.

IMPORTANT – Never Operate the Pump without Adequate Flow!

3.6 Shutdown Procedure

In general, the shutdown procedure depends on the overall operating system. The only requirement is that the SSD pump is not shut down before the low pressure feed pump. This will ensure that SSD pump does not operate dry and that the feed pressure is high enough to avoid cavitation.

If the pump is not going to be used for a longer time period, flush the pump and pipes with fresh water.

4. Troubleshooting

Symptoms	Possible Causes	Remedies
Low flow	Restriction in inlet or outlet pipes	Check pump inlet pressure Check valve position of all control valves for proper settings
	Internal damage	Check outlet piping for material. If a great amount of material is present, the pump may require an overhaul.
Low pressure	Air leaks	Check inlet piping joints Check pump mechanical seal
	Other	Check pump's direction of rotation
Fluctuating flow and pressure	Pump cavitation	Check inlet pressure during pump operation
		Check inlet flow rate
		Restart pump several times to flush air out
Pump vibration or unusual noise	Operating conditions	Flow rate is excessive
		Flow rate is less than minimum specified
	Pump cavitation	Check inlet pressure during pump operation
		Check inlet flow rate
	Electrical problems	Check supply voltage
		Check motor wiring and cables
Misalignment	Check shaft coupling	
	Check alignment of motor and pump	
Leakage	Pipe joints	Disassemble Victaulic joints, check for damaged gasket or debris in gasket area
	O-ring (pump housing)	Find and replace damaged O-ring
	Mechanical seal (shaft)	Replace mechanical seal

5. Maintenance

5.1 Maintenance Schedule

5.1.1 One (1) Day after Commissioning

1. Recheck pump alignment (see section 2.8 – Pump-Motor Alignment above).
2. Visually inspect coupling and, if necessary, tighten the coupling bolts to the specified torque (see coupling manual).
3. Check and clean (if necessary) the strainer at inlet of pump. If there is significant debris, identify the source of the debris and correct the situation.

5.1.2 Six (6) Months after Commissioning

1. Inspect pump alignment (see section 2.8 – Pump-Motor Alignment above).
2. Visually inspect coupling and, if necessary, tighten the coupling bolts to the specified torque (see coupling manual).
3. Check and clean (if necessary) the strainer at inlet of pump. If there is significant debris, identify the source of the debris and correct the situation. If the strainer has been clean, remove it.

5.1.3 Twelve (12) Months after Commissioning

1. Inspect pump alignment (see section 2.8 – Pump-Motor Alignment above).
2. Visually inspect coupling and, if necessary, tighten the coupling bolts to the specified torque (see coupling manual).
3. Replace mechanical seal if early signs of failure are noticed.
4. Inspect center bearing and wear ring. Replace both if one of them shows heavy marks. (see section 4.7 – Parts Inspection).
5. Inspect balance disc and thrust plate (white plastic liner on the back of the mechanical seal cap). Repair or replace, if necessary (see section 5.7 – Parts Inspection).

5.1.4 Annually

1. Inspect pump alignment (see section 2.8 – Pump-Motor Alignment above).
2. Visually inspect coupling and, if necessary, tighten the coupling bolts to the specified torque (see coupling manual).
3. Replace mechanical seal if early signs of failure are noticed.
4. Inspect center bearing and wear ring. Replace both if one of them shows heavy marks. (see section 4.7 – Parts Inspection).
5. Inspect balance disc and thrust plate (white plastic liner on the back of the mechanical seal cap). Repair or replace, if necessary (see section 5.7 – Parts Inspection).

Note: Follow manufacturer's recommendations for motor maintenance and any other auxiliary equipment.

5.2 General Maintenance

IMPORTANT – Power to Motor Must Be Disconnected before Pump Maintenance!

Clean and examine all parts of the pump during any disassembly procedure. Replace any parts as necessary.

Maintenance of a dropout flex coupling between the pump and the motor does not require opening of the pump. It is, however, a prerequisite for the other maintenance procedures. Therefore, it is included into this segment of the SSD pump manual.

Most of the pump maintenance procedures require removing of the seal cap of the pump first in order to reach the pump's internal parts from either side. The following is a table of the maintenance procedures and the required access to the pump:

<u>Seal Cap of the Pump</u>	<u>End Cap of the Pump</u>	<u>Both Sides of the Pump</u>
Mechanical seal	Diffuser	Pump shaft
Balance disk	Wear bearing	Impeller
Center bearing (visually)	Impeller (visually)	Center bearing

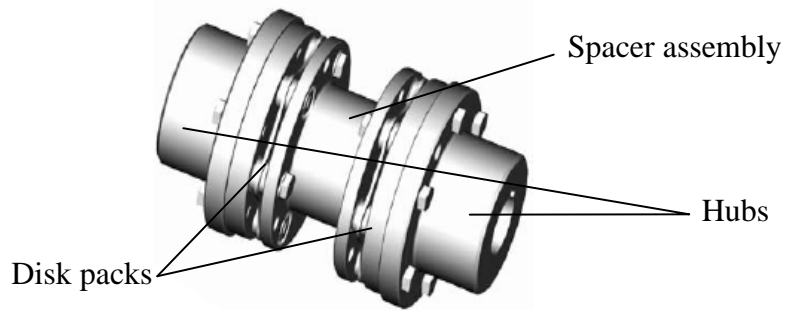
5.3 Preparation

Observe all normal safety precautions. Shutdown the system and relieve all pressure (please see section 3.4). Drain the piping connected to the SSD pump. If necessary, remove the inlet piping from the end cap. Cover the openings of the RO piping to prevent entrance of foreign material.

Follow the plant's Lock out/Tag out procedure to disconnect power to the motor before proceeding with any work.

5.4 Drop Out Coupling Disassembly

1. Open the coupling guard (please refer to [Figure 3](#)).
2. Remove three (3) symmetrically positioned bolts on the pump shaft hub; install them through the spacer assembly into the hub so that they would hold the disk pack of the spacer assembly compressed.
3. Remove the remaining three (3) bolts from the pump shaft hub and put them aside.
4. Take out the set screws on the motor shaft hub.
5. Follow the same procedure as in step 2 and 3 for the motor shaft hub.



a. **Figure 3** Drop out coupling

6. Slide the pump shaft hub away from the spacer assembly and towards the pump.
7. Remove the spacer through the gap between the two shafts.
8. Remove the pump hub and key.

5.5 Seal Cap Removal (Mechanical Seal and Balance Disk)

1. Remove the bearing drain line (for the seal cap removal, please refer to [Figure 4](#)).
 - A. If drain line is equipped with a flow meter, take special care not to damage it.
2. Remove eight (8) seal cap bolts.
3. Remove the seal cap.
 - A. Use the screwdriver slots at 3 and 9 o'clock to ease disassembly.
4. Lubricate the end of shaft with soapy water or glycerin to ease the mechanical seal removal.

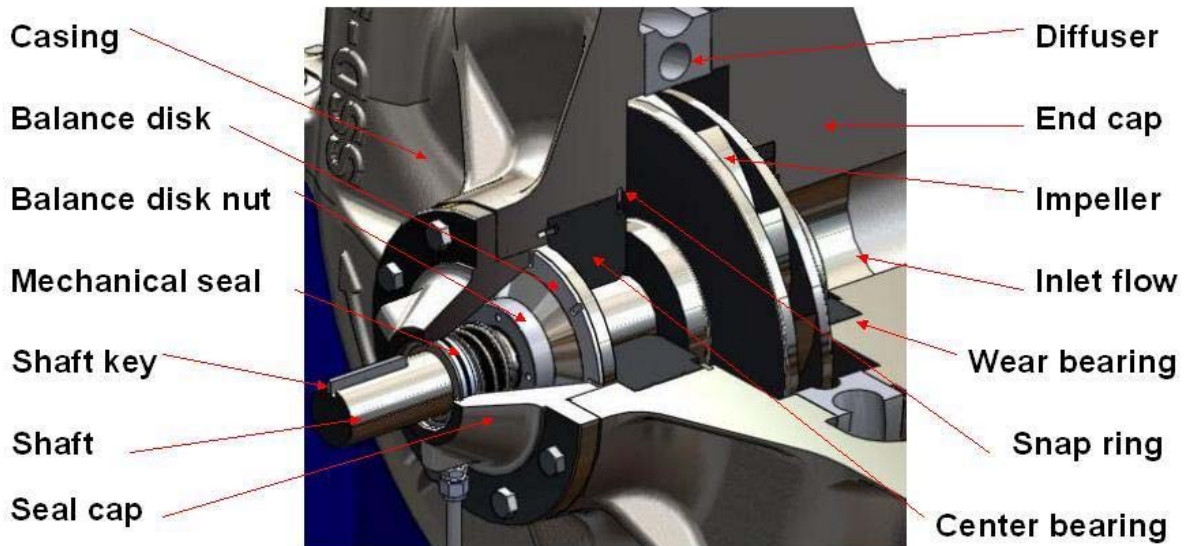


Figure 4 A cutout view of the SSD-500 pump's internal assembly (temporary).

5. Pull out the mechanical seal assembly. The sequence of the parts is (see Figure 5 also):
 - A. Stationary snap ring (sits in a seal cap groove and comes out with the seal cap).
 - B. Stationary washer (larger of the two).
 - C. Stationary seal (graphite ring).
 - D. Rotating seal (boot with spring).
 - E. Rotating washer (smaller of the two).
6. Immobilize the pump shaft by using the 4-pin wrench and installing it in the shaft nut. Hold the shaft from turning.
7. Loosen the balance disk nut (Figure 4), with the second 4-pin wrench, turning it in the direction of the pump shaft rotation during operation. The direction of the pump shaft rotation is indicated by an arrow on the pump casing.
8. Remove the balance disk nut.
9. Insert two hex head bolts in to balance disk and pull the balance disk straight out.
10. Remove the balance disk key.

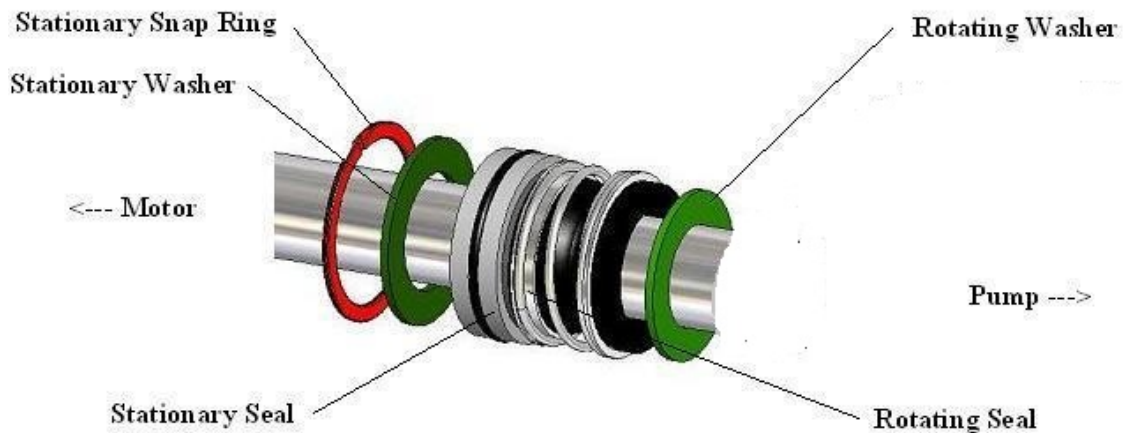


Figure 5 Mechanical seal. (Temporary)

5.6 End Cap Removal (Impeller and Shaft)

1. Remove the bearing drain line (if not done so already).
2. Loosen end cap nuts about $\frac{1}{4}$ turn (Figure 6).
3. Slightly lift the end cap by the lifting eye bolt.
4. Unscrew the end cap nuts (16).
5. Pull the end cap out; if necessary, use three jack bolts ($\frac{7}{8} - 9 \times 2 \frac{3}{4}$) to separate the end cap from the casing.
6. Place the end cap on the floor (or a wooden board) - the outside facing down.
7. Optional – pull the diffuser off the end cap (usually this is not a necessary step).
8. If needed – remove snap ring and wear ring. To remove the wear ring, insert a screwdriver (or a small pry bar) into the machined recess between the end cap and the wear ring; pry the wear bearing out.

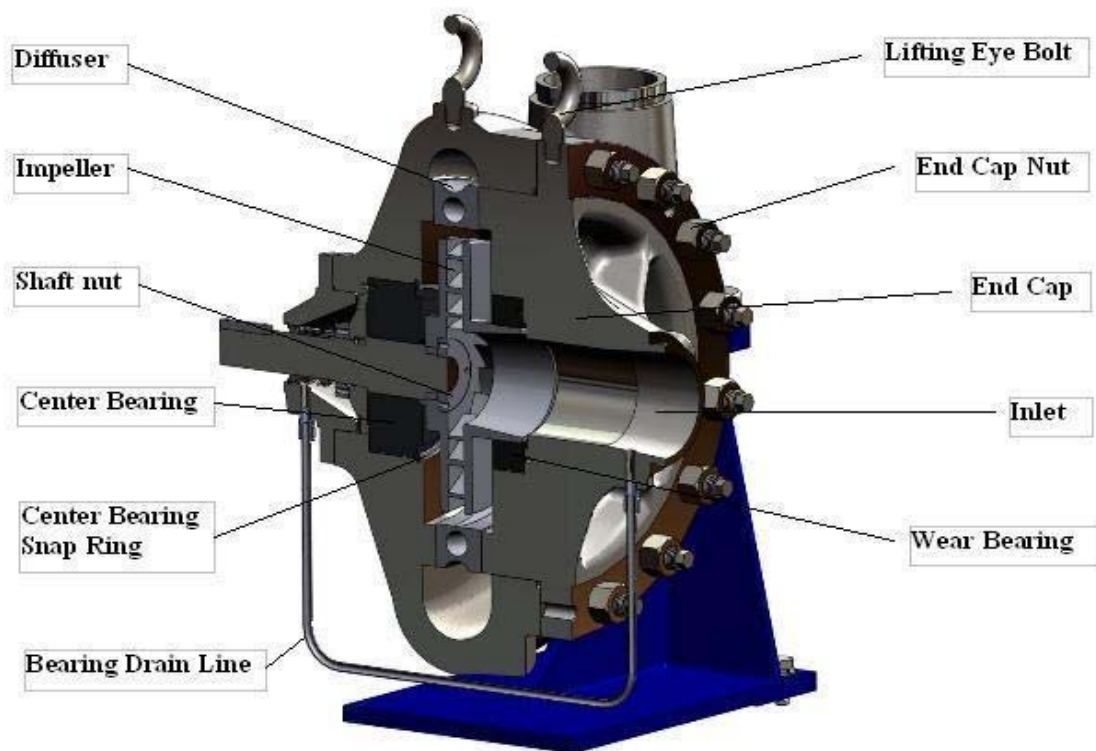


Figure 6 Cross-sectional view of the SSD pump. (Temporary)

5.7 Impeller and Shaft Removal

1. It is assumed that the pump's end cap and seal cap have been removed. If not, please follow the instructions in sections 5.5 and 5.6.
2. Slightly lift the impeller and the shaft, with chain or straps (Figure 6).
3. Pull the impeller and the shaft out of the pump casing.
4. Lay the impeller on a workbench.
5. Take out the center bearing snap ring from the pump casing.
6. Push the center bearing out from the casing by pushing it from the seal cap side of the pump.

5.8 Shaft and Impeller Disassembly

1. Open the pump and remove impeller with shaft following instructions in sections 5.5, 5.6 and 5.7.
2. Set the impeller assembly on a workbench.
3. Remove the shaft nut, with the 4-pin spanner wrench (Figure A).
4. Knock the shaft out of the impeller with a rubber-coated or rubber mallet.
5. Collect all four (4) round impeller keys which are between the impeller and the shaft.

5.9 Parts Inspection

Any damage or malfunction should be used as an opportunity to inspect all or most of the pump parts because parts may damage each other. Moreover, since the pump most likely had to be opened, such inspection would serve as a preventive maintenance.

Balance Disk Thrust Plate	-	If damaged, it means that the pump suffered reverse thrust. This could be the cause of: (1) forcing too much flow through the pump;(2) the flow through the drain line stopped; or (3) could be the effect of a sudden change in the system (like a water hammer). Replace plate if wear is more than .030".
Mechanical seal	-	Even slightly damaged (leaking) mechanical seal should be replaced. A leaky mechanical seal that appears to be in good condition might be a sign of misalignment, a worn center bearing or a seal installation error. Check for the cause before replacing the seal.
Impeller	-	Impeller usually does not require inspection or repairs.
Diffuser	-	Diffuser usually does not require inspection or repairs.
Pump shaft	-	Shaft should be checked for signs of damage and repaired if possible.
Center bearing	-	Some grooves or wear on the balance disc side of the bearing and on the ID is acceptable. If wear on the balance disk side is more than .050", replace bearing. A bearing that has a wear of .070" or more can cause the mechanical seal to leak. If clearance between bearing and impeller exceeds .015", replace bearing.
Wear Ring bearing	-	Some grooves on the ID of the bearing are acceptable. If clearance between bearing and impeller exceeds .020", replace bearing.
Drain line	-	Drain line should be watched for changes in flow. A decrease can cause damage to the pump and therefore it's very important for this line to remain free from obstructions and be monitored. See section 3.3 for flow limits.

5.10 Impeller and Shaft Assembly

1. Put the impeller on a workbench with the inlet part down.
2. Lubricate the four (4) round keys (Figure A) with an acceptable anti-seize compound.
3. Insert the keys on the shaft. Insert the shaft into the impeller, pushing the shaft until it bottoms out on the shoulder.
4. Turn the impeller on its side.
5. Lubricate the thread on the shaft with anti-seize compound.
6. Insert and partially tighten the shaft nut (it will be tightened thoroughly inside the pump casing).

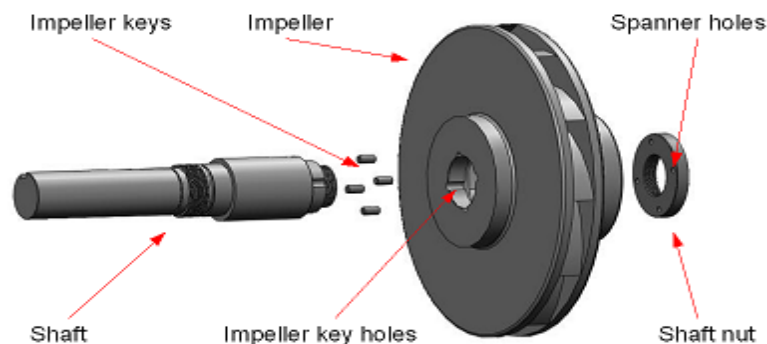


Figure A Impeller and shaft assembly (temporary).

5.11 End Cap Assembly

1. Insert the center bearing (lubricated with a rubber lubricant or soapy water) and align it with the anti-roll pin in the casing. Push bearing until fully seated against the housing.
2. Install retaining ring to keep the center bearing from sliding out.
3. Insert the impeller assembly through the center bearing.
4. On the mechanical seal side of the casing, install the balance disk:
 - A. Install key in the shaft.
 - B. Install a new O-ring on the shaft.
 - C. Slide balance disc until it's seated against the balance disk.
 - D. Install balance disk nut. Use an acceptable anti-seize.
5. Use one 4-pin wrench on the balance disk nut and the second on the impeller nut. Tighten both of these nuts at the same time.
6. Install set screws in both nuts to keep them from coming loose.
7. If the wear ring was removed, install a new wear ring with a new o-ring into the end cap. Use a lubricant to ease installation. Ensure the wear ring is properly aligned with the anti-roll pin and it's fully seated in the end cap.
8. Install retaining ring to keep the wear ring from coming out.
9. If the diffuser was removed from the end cap, insert the diffuser on four (4) alignment pins back on the end cap (usually there is no reason to remove the diffuser).
10. Lift the end cap by the lifting eye bolt and insert it into the casing.
11. Install the 16 end cap nuts on the casing bolts.
12. Tighten all end cap nuts in a start pattern, in increments of 50% of the total torque.

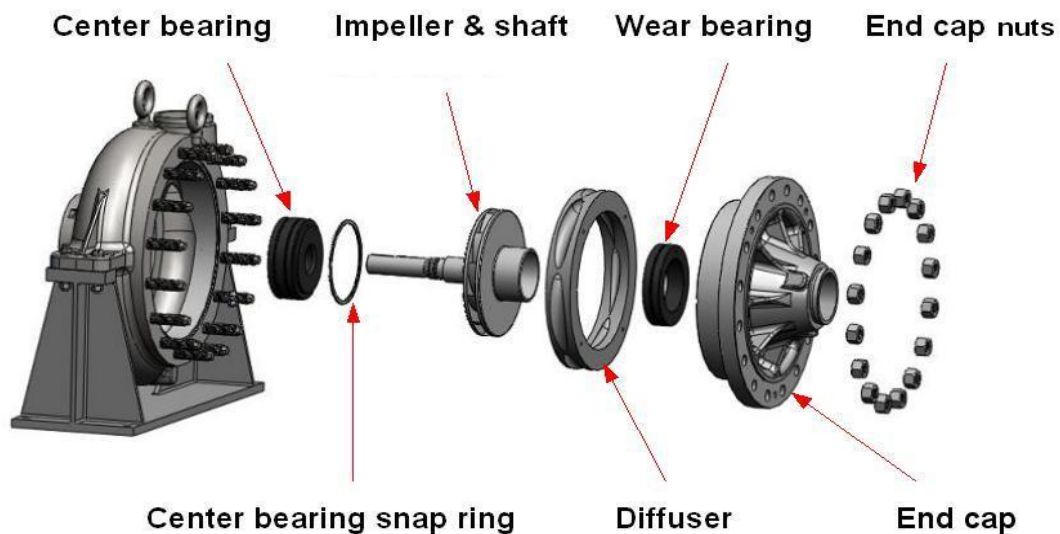


Figure B SSD-500 pump exploded view - end cap (temporary)

5.12 Seal Cap Assembly (Mechanical Seal and Balance Disk)

1. For the balance disk installation, follow items 4 through 6 of section 5.11.
2. Apply a rubber lubricant or soap water on shaft surface of both halves of the mechanical seal.
3. Use [Figure 5](#) as a reference for installation of mechanical seal. Please remember that during assembly the parts move along the shaft from left to right. Also, both halves of mechanical seal will be touching with the “shiny” surfaces.
4. Insert mechanical seal in the following sequence:
 - A. Rotating snap ring (sits in a shaft groove); make sure it is secure in the groove
 - B. Rotating seal washer (smaller of the two)
 - C. Rotating seal (larger of the two, shiny side facing motor)
 - D. Stationary seal (smaller of the two, shiny side facing pump)
 - E. Stationary seal washer (larger of the two)
 - F. Stationary snap ring, which should be inserted into the seal cap groove from inside of the cap.
5. Slide the seal cap with new O-ring onto the shaft, make sure the stationary snap ring is secure inside the seal cap ([Figure C](#)).
6. Install bolts, tightening them in a star pattern, 50% at a time.
7. Attach the drain line to the seal cap and end cap.

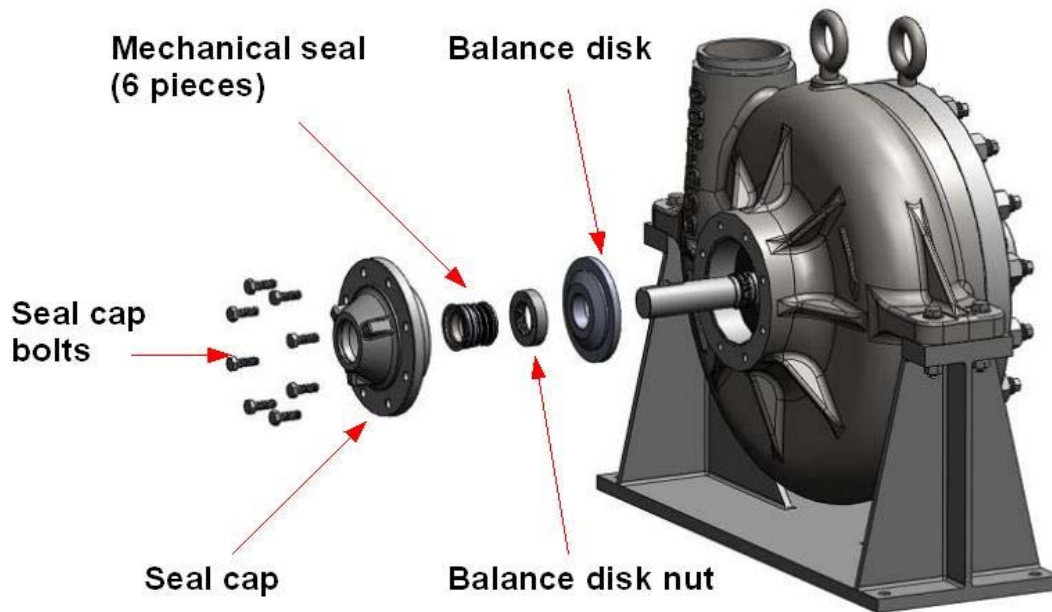


Figure C SSD-500 pump exploded view - seal cap (temporary)

5.13 Drop Out Coupling Assembly

1. Slide pump hub (Figure 3) on the pump shaft and push it towards the pump.
2. Lubricate the pump shaft from the end of the shaft to the end of the key recess with the anti-seize compound, including the key recess.
3. Insert the pump shaft key and lubricate the top of the key with the Anti-seize compound.
4. Slide the spacer assembly on the pump hub and align the bolt holes of the spacer assembly's guard ring with the bolt holes of the pump shaft hub.
5. Remove the first bolt from the spacer assembly's guard ring, insert it through the hub, thread into the spacer assembly's guard ring and hand tighten, making sure the pilots are properly mated.
6. With one bolt in place, adjust the spacer assembly so that all bolt holes are in-line with the mating hub and guard ring.
7. Remove the second bolt from the spacer assembly's guard ring, insert it through the hub at the opposite end of the bolt circle, thread into the spacer assembly's guard ring and hand tighten, making sure the pilots are properly mated.
8. Install all remaining bolts on that end of the coupling and hand tighten each one.
9. If necessary, adjust the motor shaft hub so that it is flush with the motor shaft and lock it with a set screw.
10. Move the spacer assembly towards the motor shaft hub and rotate the spacer so that the hub bolt holes line up with the spacer assembly's guard ring bolt holes, making sure the pilots are properly mated.
11. Connect the spacer assembly to the hub on the motor shaft, following the same procedure as described in steps 6 through 9.

12. Rotate the whole drop out coupling assembly three times.
13. Torque the bolts to $\frac{1}{2}$ the required torque, then to the final torque of 51 ft-lbs (69 N-m).
14. Do not lock the pump shaft hub since the hub must be unlocked during pump alignment.
15. Close the coupling guard.

6. Parts Return and Warranty

IMPORTANT – Please Contact FEDCO before Returning Any Equipment.

6.1 Documentation and Warranty Coverage

You must have a Return Authorization Number (RAN) issued by FEDCO before any parts are accepted. All returned parts must be shipped prepaid to FEDCO with the RAN clearly marked on the package. We need this number to ensure proper handling of the returned parts and supply of new parts, if required.

Should you ever need to contact FEDCO regarding an After-Sales issue, the information in the Installation Records/Notes sheet in chapter 7 is critical to diagnosing the problem. Please be sure to complete this page.

Tel 734-241-3935
Fax 734-241-5173
e-mail: techsupport@fedco-usa.com
internet: www.fedco-usa.com

Repair by FEDCO on equipment that is out-of-warranty will be warranted for **three (3) months (since the time of...?...receiving of the equipment?)**. Ask FEDCO for details of the repair warranty. Parts will be replaced in accordance with the FEDCO warranty. Below is how to contact us:

6.2 Parts Return Procedure

1. Provide FEDCO with the following information:
 - Serial number of the unit;
 - Description of why parts are being returned;
 - Completed Installation Records/Notes sheet.
2. Wait for FEDCO to provide a Return Authorization Number.
3. Pack the unit in original shipping crate or other suitable crate and clearly mark the Return Authorization Number on outside of the crate.
4. Send the unit, freight prepaid, to FEDCO at the following address:

ATTN:
Field Service Department
FEDCO
800 Ternes Drive
Monroe, MI 48162
USA

SSD Pump Warranty

Fluid Equipment Development Company, LLC, (FEDCO), warrants its SSD feed pump to be free from defects in design, materials or workmanship for a period of 18 months from shipment or 12 months from the date of installation of the product, whichever occurs first, when said product is operated in accordance with written instructions and is installed properly.

If the SSD pump is altered or repaired without prior approval of FEDCO, all warranties are void.

All equipment provided by FEDCO, including pump motors, must be installed on a rigid, steel support structure and base capable of handling full loads during operation. Failure to do so will void warranty.

All equipment must be installed such that there are no pipe stresses on FEDCO equipment. Failure to do so will void warranty.

If the SSD pump is not installed and aligned as per FEDCO Installation and Operation Manual, any subsequent damage to the pump and/or motor will be excluded from the warranty

If any defects or malperformance occur during the warranty period, FEDCO's sole obligation shall be limited to alteration, repair or replacement at FEDCO's expense, F.O.B. factory, of any parts or equipment, which upon return to FEDCO and upon FEDCO's examination prove to be defective. All parts returned for warranty service must be shipped prepaid and include FEDCO's return authorization number.

Equipment and accessories not manufactured by FEDCO are warranted only to the extent of and by the original manufacturer's warranty. FEDCO shall not be liable for damage or wear to equipment caused by abnormal conditions, excessive temperatures, and vibration or caused by corrosives, abrasives or foreign objects.

The foregoing warranty is exclusive and in lieu of all other warranties, whether expressed or implied, including any warranty of merchantability or fitness for any particular purpose. In no event shall FEDCO be liable for consequential or incidental damages.

USE OF OTHER THAN FEDCO PUMP PARTS VOIDS THE WARRANTY

7. Installation Record/Notes

Should you ever need to contact FEDCO regarding an After-Sales issue, the information below is critical to diagnose the problem. Please be sure to copy and fill out this page.

Initial Installation

Model #: _____

Serial #: _____

Installation Date: _____

Startup Date: _____

Comments: _____

Overhaul Record

Overhaul Date: _____

Operating Hours: _____

Reason for Overhaul: _____

Operating Data Prior to Overhaul

Feed Flow: _____

Suction Pressure to Pump: _____

Discharge Pressure: _____

Comments: _____

Feed Flow: _____

Suction Pressure to Pump: _____

Discharge Pressure: _____

Operation Data After Overhaul

Feed Flow: _____

Suction Pressure to Pump: _____

Appendix B

(Optional Appendix? Maybe questionable usefulness?)

Reverse Indicator Alignment Method – Mathematical Solution

- Prepare a computer or a calculator; formulas entered into a computer spreadsheet or a programmable calculator can significantly speed up the alignment process.
- Make a sketch of the machinery (Figure 1).

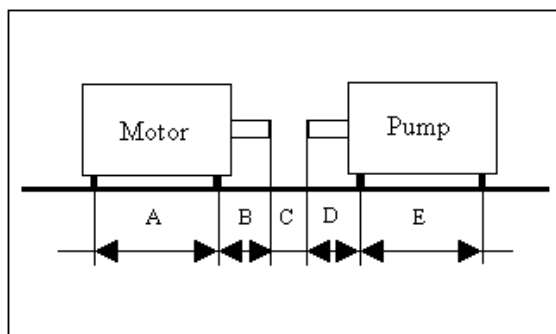


Figure 1 Schematic view of the pump-motor assembly with marked measurements for mathematical solution.

- Mark indicator positions.
- Mark feet positions.
- Mark the three distances (A, B, and C; if pump is movable, then mark C, D, and E) and write down their corresponding values.
- Divide each TIR by 2 and round the result to the nearest whole number.
- Use the same formulas as shown above for the horizontal and vertical alignments, interpreting the results the same way as in the graphical solution.

$$M = \frac{1}{2} \text{ the TIR on the motor shaft}$$

$$P = \frac{1}{2} \text{ the TIR on the pump shaft}$$

Driver (motor)

Driven (pump)

$$\text{Front feet} = \frac{(B + C) \times (M + P)}{C} - (P)$$

$$\text{Front feet} = \frac{(C + D) \times (M + P)}{C} - (M)$$

$$\text{Back feet} = \frac{(A + B + C) \times (M + P)}{C} - (P)$$

$$\text{Back feet} = \frac{(C + D + E) \times (M + P)}{C} - (M)$$

Warranty Registration Form

**THIS FORM MUST BE COMPLETED AND RETURNED TO FEDCO
TO ACTIVATE YOUR WARRANTY COVERAGE.**

FEDCO will send confirmation of start of warranty coverage

FAX or e-mail to FEDCO:

**FAX to: +734.241-5173 (USA)
ATTN: Technical Support**

E-MAIL: techsupport@fedco-usa.com

Initial Installation

Installation Date: _____ Startup Date: _____

Installed by: _____ E-mail: _____

Telephone: _____ Fax: _____

Feed TDS _____ Feed Flow _____ Pump Discharge Pressure: _____

Motor Serial #: _____ Motor Spec. #: _____

MSS & SSD Pumps:

Model #: _____ Serial #: _____

VFD frequency (Hz) if used _____ Voltage and Hz of power supply _____

Inlet Pressure: _____ Flow switch wired Yes _____ No _____

Drain flow rate (high inlet pressure option only) _____

HPB Booster:

Model #: _____ Serial #: _____

Brine Flow _____ Permeate

Flow _____

Brine out let PSI _____ Membrane

PSI _____

Comments:

