



CURFLO ST-Series Self-Priming Pumps

Instructions, Operations and Maintenance

MANUAL



SECTION 1

ST SERIES SELF-PRIMING PUMP GENERAL INFORMATION

- 1. Introduction 3
- 2. Pump Receiving and Inspection 4
- 3. Storage 4
- 4. Lifting 4

SECTION 2

SYSTEM DESIGN

- 1. Clearance 4
- 2. Location 4
- 3. Connections to Pump 5
 - a. Suction Lines 5
 - b. Discharge Lines 6

SECTION 3

PUMP INSTALLATION

- 1. Pump Installation 6
- 2. Rotation Check 6
- 3. Alignment 7
 - i. Direct-Coupled Drive 7
 - ii. Belt Drive 8
- 4. Priming 8
- 5. Cold Weather Preparation 9

SECTION 4

SERVICE

- 1. Pump Exploded View Diagram 10
- 2. Rotating Assembly Exploded View Diagram 11
- 3. Disassemble a Pump 12
- 4. Assemble a Rotating Assembly 12
- 5. Assemble Front Cover and Wear Plate Assembly 13
- 6. ST10 Suction Head Assembly 13
- 7. Install Rotating Assembly 14
- 8. Set Impeller Clearance 14

SECTION 5

LUBRICATION

- 1. Maintenance Schedule 15
- 2. Seal Assembly 15
- 3. Bearings 15

SECTION 1

Introduction

Foreword

This manual contains instructions for the installation, operation, and maintenance of the **CURFLO ST- Series**. As pump service conditions and specifications vary considerably in pump installation, this manual cannot cover every situation, but it is intended that the information included will serve as a guide. Upon receiving the pump, all personnel involved should review this manual in its entirety and should thoroughly understand all procedures prior to installation, maintenance and operation of the **CURFLO ST-Series Self-Priming Pumps**. Any questions concerning the information provided in this manual should be addressed to **CURFLO, INC.**

WARNING!!!

Failure to read and comply with these instructions will void all warranty expressed or written, will void the responsibility of the manufacturer and may result in bodily harm or equipment damage.

This manual is to be kept as a part of the permanent records for the pump assembly and needs to be readily accessible as a reference to all personnel working on the pump assembly. Referenced item numbers can be found on the Sectional Drawings located in Section 7 of this manual.

CURFLO ST-Series Self-Priming Pumps are designed and manufactured for years of safe and reliable operation and performance ONLY when properly used and maintained in accordance with the written instructions contained in this IOM. As a pressure containing device with rotating parts, it should be considered **HAZARDOUS**. All plant personnel must adhere to all safety measures and follow all in-plant instructions when operating and/or maintaining this type of equipment. **CURFLO, INC.** shall not be liable for any physical injury or delays caused by failure to adhere to the instructions of this manual.

DEFINITIONS

Throughout the **CURFLO ST-Series Self-Priming Pumps IOM** manual the words **WARNING**, **CAUTION** and **NOTE** are indicators of procedures and/or situations where special attention is required.

WARNING!!!

Operating practice, procedure or operation can result in personnel injury, loss of life and damage of equipment if not followed correctly.

CAUTION!!!

Operating practice, procedure or operation can result in equipment destruction and damage if not followed.

NOTE:

Operating condition, practice and/or procedure is essential to observe around equipment.

Pump Receiving and Inspection

Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

- a. Inspect the pump for cracks, dents, damaged threads, and other obvious signs of damage.
- b. Check and tighten loose hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- c. Carefully read all warnings and cautions contained in this manual or affixed to the pump, and perform all tasks indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates counterclockwise when facing the impeller.
- d. Check lubrication levels and adjust as necessary. Refer to LUBRICATION in the MAINTENANCE AND REPAIR section of this manual and perform as instructed.

STORAGE OF EQUIPMENT

Proper storage of your **ST-Series Self-Priming Pump** will ensure it is ready for service when needed.

SHORT TERM STORAGE: For pumps stored for six (6) months or less, no special steps are required as long as the bearings are well lubricated and the pump is rotated 2-3 times per month. This will ensure the seals and bearings will not flatten from the weight of the rotating element.

LONG TERM STORAGE: For pumps stored in excess of six (6) months, all machined surfaces need to be treated with a rust preventative and the bearings need to be well lubricated. Rotating the shaft of the pump is required at least 3 times monthly. The coupling and driver manufacturers should be contacted to comply with their requirements for long term storage. Pump must be covered and kept in a dry location.

4. LIFTING

Pump units and Rotating Assemblies are heavy; always use adequate lifting equipment when moving them.

SECTION 2

System Design

Clearance

It is recommended that 18 inches of clearance be provided in front of the back cover to permit removal of the cover and easy access to the pump interior.

Location

SUCTION AND DISCHARGE PIPING

Materials

Any piping or hose material compatible with the pumped fluid may be used for suction piping. Regardless of type, the suction line must be of a rigid wall type, selected not to collapse under suction pressure from the pump.

Line Configuration

The pump should be placed as close as possible to the fluid source to minimize suction line losses. Suction and Discharge lines should be kept as short as possible with minimum number of transitions, elbows, valves, and other friction-inducing fittings. Elbows used should be of long-radius type to reduce friction loss. Straight horizontal and vertical piping runs are preferred to diagonal runs in applications that contain solids.

Connections to Pump

Piping flanges should be aligned with the pump before tightening any connecting flanges. Tightening mis-aligned flanges will result in strain on the pump flanges which could result in damage to the flanges, vibration, increased wear, or other conditions which can shorten the life of the pump. Lines to and from the pump should be independently supported. Hose-type lines should be supported and secured against movement when the pump runs.

SUCTION LINES

Suction and Discharge lines should be kept as short as possible with minimum number of transitions, elbows, valves, and other friction-inducing fittings. Elbows used should be of long-radius type to reduce friction loss. Straight horizontal and vertical piping runs are preferred to diagonal runs in applications that contain solids. When operation involves a suction lift, the line must have a constant rise to the pump from the liquid source. Any downturns in the suction piping will allow air bubbles to form, affecting the pump's performance and ability to maintain prime.

Fittings

Suction lines should be sized to the same diameter as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, installed with the flat facing up to avoid air pockets. Valves are not recommended in suction lines, but if used, should be installed with the valve stem oriented horizontally.

Strainers

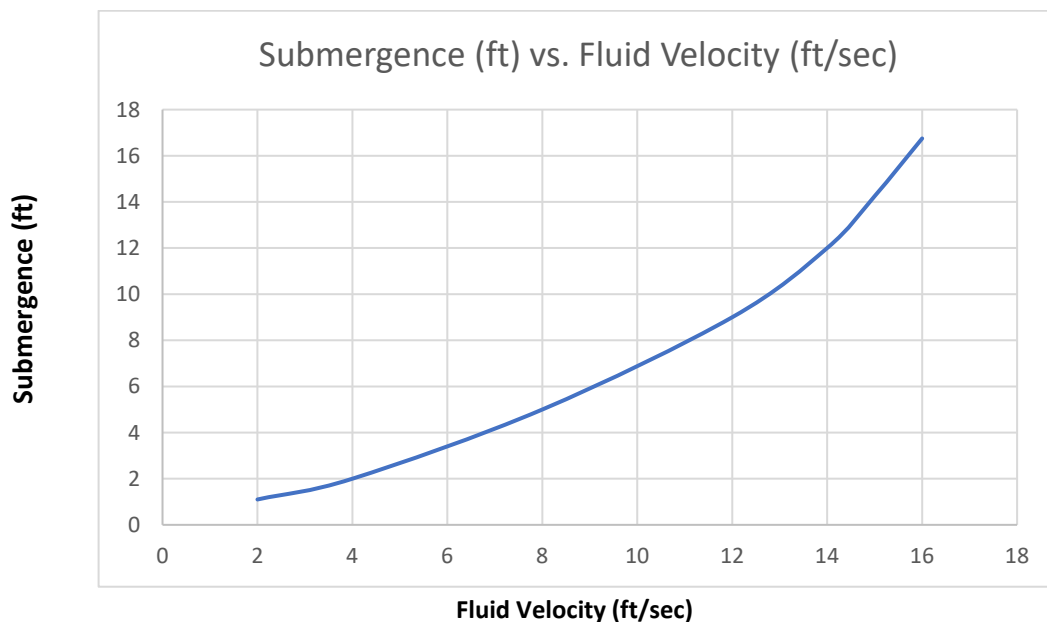
If a strainer is installed, ensure that particles passing through the strainer are small enough to pass through the pump. Care should be taken to ensure that the total area of the strainer openings is equal to at least three times the cross-sectional area of the pump suction line.

Sealing

Any leak in the suction line leak will affect the pump's ability to prime and the pump's ability to perform as designed. All suction lines should be thoroughly sealed against any leaks, and checked for leaks prior to operation.

Suction Line Positioning

The depth of submergence of the suction line has a significant effect on pump performance. Figure below shows recommended minimum submergence vs. velocity



DISCHARGE LINES

Suction and Discharge lines should be kept as short as possible with minimum number of transitions, elbows, valves, and other friction-inducing fittings. Elbows used should be of long-radius type to reduce friction loss. Straight horizontal and vertical piping runs are preferred to diagonal runs in applications that contain solids.

Valves

A valve to throttle and shut off flow the pump is recommended equal to the diameter of the largest discharge line diameter. A discharge check valve is also recommended to prevent backflow into the pump, which could cause reverse rotation and damage to the pump.

Bypass Lines

A bypass line is needed when a check valve is in the discharge line. During the priming cycle, air in the suction piping side must be vented to the atmosphere. If a check valve is installed in the discharge line, the discharge side of the pump must be opened to vent the air in the system. The pump will not prime if there is sufficient static head to keep the discharge check valve closed.

The bypass line should be at least 1 inch diameter to minimize plugging yet small enough to prevent significantly impacting pump performance.

In low discharge head applications (less than 30 feet or 9 meters), it is recommended that the bypass line be run back to the wet well, and located 6 to 8 inches below the minimum liquid level of the sump. In some installations, this bypass line may be terminated with a six-to-eight foot

In applications with more than 30 feet (9 meters) of discharge head a significant amount of liquid could be bypassed. This will negatively impact pump efficiency. To improve this condition an automatic air release valve should be installed in the bypass line. Follow manufacturer's instructions on installation and operation of the automatic air release valve.

SECTION 3

Pump Installation

The installation of the pump assembly to the foundation is straight forward. Lifting procedures have to be followed with safety first. Once the pump assembly is on the foundation it has to be level before it can be permanently mounted to the foundation.

Leveling the pump assembly can be done by using shims or wedges and a level. Once the assembly is level, the pump should be aligned to the drive motor before installing the drive system.

ROTATION CHECK

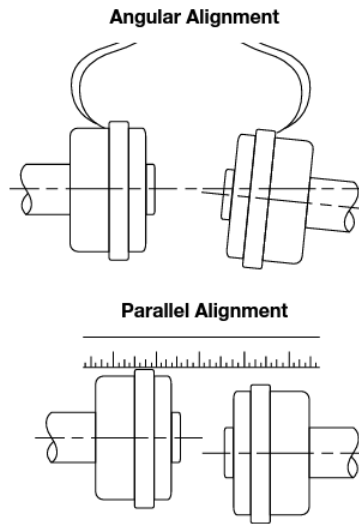
It is recommended to confirm the direction of rotation prior to final drive alignment and installation. Without the drive system attached, apply power to the motor to confirm the direction of rotation. Pump rotation should be clockwise when viewed from driven end of the pump.

ALIGNMENT

Proper alignment is critical to the life of the pumping system. Misalignment can lead to damage of the pump, motor, and/or drive system. Prior to operation, alignment must be checked and set properly.

Direct-Coupled Drive

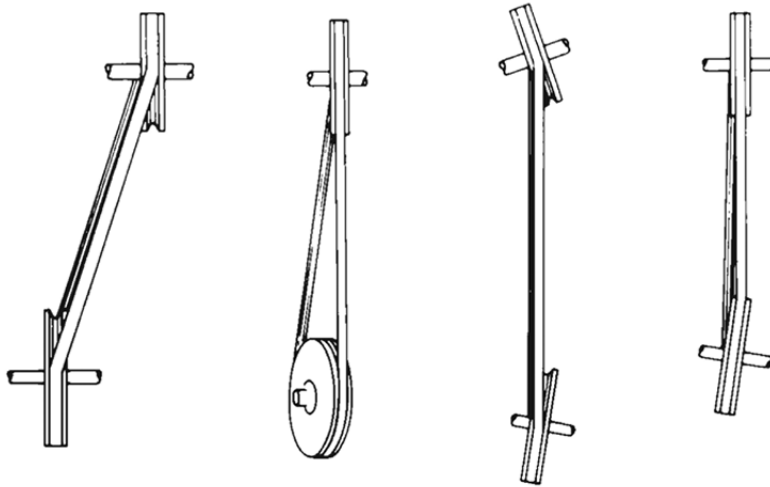
1. Before final alignment, check the anchor bolts, pump, driver mounting bolts and coupling bolts to ensure all are tight.
2. Use filler gauges, straight edge or laser alignment techniques to check angular and parallel alignment. Adjust as necessary to achieve a reading of 0.005 or less. See examples below.
3. After the first month of normal operation, it is advisable to recheck the alignment of 0.005 or less to ensure proper operating reliability.



Drive Belts

1. Before final alignment, check the anchor bolts, pump, driver mounting bolts and coupling bolts to ensure all are tight.
2. Use a straight-edge across the drive and driven pulleys to check for alignment. Both pulleys must be located on same plane, and the angles of the pulleys should be checked for proper alignment. See examples below.
3. Install the belt(s) in accordance with manufacturers recommendations. Initial belt tension must be set correctly to avoid damage to pump and motor. Check belt tension periodically to assure best performance.

Belt Misalignment Examples



PRIMING

Install the pump and piping as described in INSTALLATION. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see LUBRICATION).

This pump is designed to maintain prime via the pumped fluid retained in the pump case. The pump cannot prime itself without fluid present in the case.

CAUTION!!!

Never run the pump dry. Dry-running will result in damage to the pump and potential hazardous overheating of the pump.

In initial setup, the pump case should be completely filled prior to operation. In addition, fluid may need to be added to the case in other circumstances, such as:

- The pump has not been used for a considerable length of time.
- The liquid in the pump casing has evaporated.

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump. Once the pump casing has been filled, the pump will prime and reprime as necessary.

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

Cold Weather Preparation

In below-freezing conditions, drain the pump and clean out any solids to prevent damage from freezing. Once drained, operate the pump for approximately 1 minute to remove any remaining fluid which could freeze in the rotating assembly.

SECTION 4

SERVICE

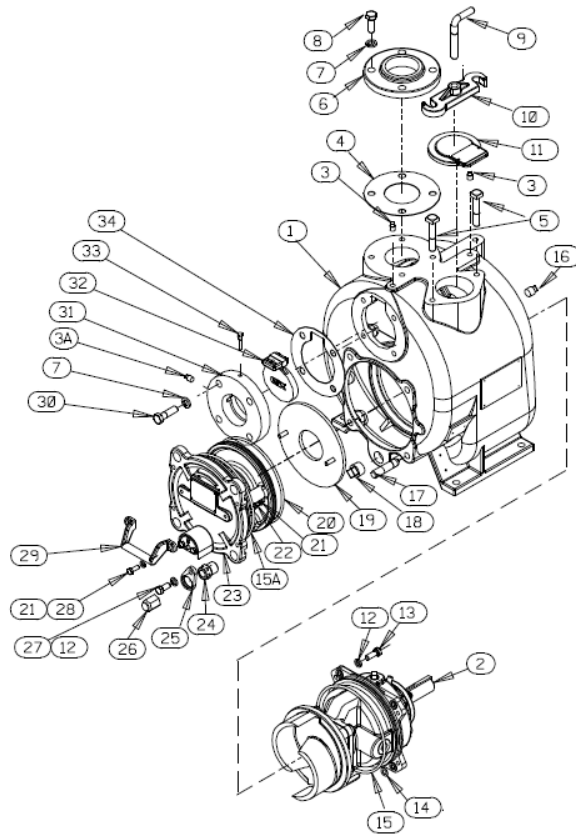
! WARNING ! WARNING ! WARNING !

BEFORE SERVICING PUMPS:

- 1 SHUT DOWN OR DISENGAGE THE PUMP POWER SOURCE.
- 2 SHUT DOWN ALL PUMP ACCESSORY EQUIPMENT.
- 3 RELIEVE OR "BLEED OF" ALL PRESSURE FROM THE LINES PRIOR TO REMOVING PIPING.

FAILURE TO SHUT DOWN POWER AND RELIEVE THE PRESSURE FROM THE PUMP BEFORE SERVICING CAN RESULT IN SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

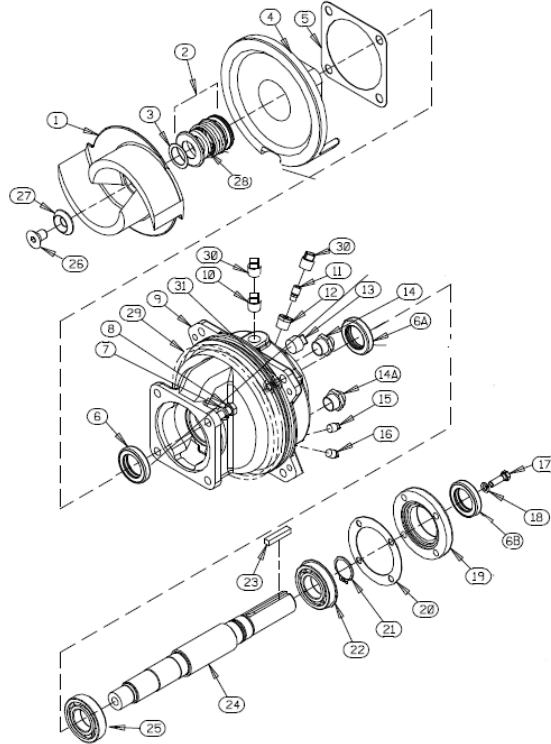
PUMP EXPLODED VIEW



POSITION	QTY	DESCRIPTION
1	1	PUMP CASING
2	1	REPAIR ROTATING ASSY
3	2	PIPE PLUG
3A	1	PIPE PLUG
4	1	DISCH FLANGE GASKET
5	2	MACHINE BOLT
6	1	DISCH FLANGE
7	8	LOCK WASHER
8	4	HEX HEAD CAP SCREW
9	1	CLAMP BAR SCREW
10	1	CLAMP BAR
11	1	FILL COVER PLATE ASSY
12	8	LOCK WASHER
13	4	HEX HEAD CAP SCREW
14	8	ROT ASSY ADJ SHIM
15	1	BRG HSG O-RING
15A	1	BACK COVER O-RING
16	1	PIPE PLUG

POSITION	QTY	DESCRIPTION
17	4	STUD
18	1	CASING DRAIN PLUG
19	1	WEAR PLATE ASSY
20	1	O-RING
21	4	LOCK WASHER
22	2	HEX NUT
23	1	FRONT CVR PLATE ASSY
24	4	FRONT COVER WASHER
25	4	FRONT COVER SHIM
26	4	FRONT COVER NUT
27	4	HEX HEAD CAP SCREW
28	2	HEX HEAD CAP SCREW
29	1	HANDLE
30	4	HEX HEAD CAP SCREW
31	1	SUCTION FLANGE
32	1	FLAP VALVE ASSY
33	1	CHECK VALVE PIN
34	1	SUCT FLANGE GASKET

ROTATING ASSEMBLY EXPLODED VIEW



POSITION	QTY	DESCRIPTION
1	1	IMPELLER
2	1	MECH SEAL ASSY
3	1	IMP ADJ SHIM SET
4	1	SEAL PLATE
5	1	GASKET
6	1	OIL SEAL
6A	1	OIL SEAL
6B	1	OIL SEAL
7	4	LOCK WASHER
8	4	HEX HEAD CAP SCREW
9	1	BEARING HOUSING
10	1	VENTED PLUG
11	1	AIR VENT
12	1	REDUCER PIPE BUSHING
13	1	PIPE PLUG
14	1	SEAL CVTY SIGHT GAUGE
14A	1	BRG CVTY SIGHT GAUGE

POSITION	QTY	DESCRIPTION
15	1	SEAL CAVITY DRAIN PLUG
16	1	BRG CAVITY DRAIN PLUG
17	4	HEX HEAD CAP SCREW
18	4	LOCK WASHER
19	1	BEARING CAP
20	1	BEARING CAP GASKET
21	1	SNAP RING
22	1	OUTBOARD BEARING
23	1	KEY
24	1	IMPELLER SHAFT
25	1	INBOARD BEARING
26	1	IMPELLER SCREW
27	1	IMPELLER WASHER
28	1	SPACER WASHER
29	1	O-RING
30	2	PLUG
31	8	ADJUSTMENT SHIM

Disassemble a Pump

To disassemble a pump:

1. Lock out power supply at motor starter.
2. Close off discharge suction valves.
3. If pumping hot liquid, allow pump to cool.
4. Drain casing and flush as needed (1).
5. Loosen and pull front cover assembly plate (23) from casing.
6. Loosen wear plate nut and remove wear plate (19). Inspect for wear and replace if necessary.
7. If directly driven, remove coupling and motor. If belt driven, remove belts and sheaves.
8. Drain seal cavity lubricant, remove drain plug (15).
9. Wedge a wooden block between the impeller (1) vanes and casing (1). Using a strap wrench turn the pump shaft (24) counter clockwise when facing the drive.
10. Remove vent plug (10)

CAUTION!!!

Use two people or proper lifting equipment for removal of rotating assembly. Assemblies are heavy and not evenly balanced.

11. Remove the four housing-to-case bolts (13).
12. Remove seal plate gasket (5) and bearing housing o-ring (29).
13. Remove impeller from assembly, loosen and remove impeller socket head screw (26) and impeller washer (27).
14. Remove impeller adjusting shims (3) and record thickness - this will aid in re-assembly.
15. Pull the seal assembly off the shaft, use two stiff wires to pull the stationary element and seat.
16. Remove bearing housing drain plug (16), drain oil.
17. Remove bearing cap (19) and oil seal (6B).
18. Slide shaft (24) out of bearing housing (9).
19. Remove radial oil seal (6A).
20. Press radial bearing (25) and thrust bearing (22) off from shaft.
21. Clean bearing housing (9) and bearing cap (19).
22. Inspect all parts removed, replace as required.

Assemble a Rotating Assembly:

1. Clean the disassembled bearing housing (9);
2. Secure the bearing frame to bench or holding stand;
3. Install vent, oil and cavity plugs (10, 11, 13, 15, 16);
4. Install sight glass (14)
5. Install outboard bearing (22) on shaft (24) retaining ring towards end of shaft;

6. Install inboard bearing (25) on shaft (24);
7. Install outboard lip seal (6B) in bearing cap (19);
8. Install inboard lip seal (6A) in bearing housing (9);
9. Slide shaft bearing assembly into bearing housing (9) from drive end of frame until outboard bearing retaining ring is in its groove in frame;
10. Slide bearing cap (19) and gasket (20) over shaft (24);
11. Insert bearing cap bolts (17) through cap (19) and gasket (20).
12. Install shaft o-ring.
13. Slide gasket (5) and back seal plate (4) over impeller end of shaft;
14. Install bolt (17) and lock washer (18) into bearing housing (9) and back seal plate (4) and tighten;
15. To install mechanical seal (2), lubricate seal assembly o-rings and shaft (24). Install complete seal on shaft.
16. Install impeller shim(s) (3) over shaft (24) and between impeller (1) and mechanical seal assembly (2).
17. Screw on and lock down impeller (1) onto shaft (24).
18. Measure space between impeller (1) and seal plate (4). Correct clearance is .026-inches. If not, remove impeller (1) and add or subtract from shim stack (3). Repeat step 16 and 17;
19. When impeller (1) to seal plate (4) clearance is correct, install impeller washer (27) and impeller bolt (26) and tighten. Rotating assembly is now complete and ready for installing in pump or storing as spare.

Assemble Front Cover and Wear Plate Assembly

T2, ST3, ST4, ST6, & ST8

To inspect and assemble a front cover and wear plate assembly:

1. Remove front cover hand nuts (28) and front cover assembly (23).
2. Make sure front cover plate assembly (23) and wear plate (19) are inspected and clean.
3. Replace cover O-ring (20).
4. Install cover plate assembly (23) back into casing (1) and tighten hand nuts (28).
5. The pump is now ready to accept the rotating assembly

ST10 Suction Head Assembly

To assemble an ST10 head assembly:

1. Install the suction head gasket (square suction ring). Use silicone grease to aid holding gasket in place;
2. Use a lifting device and sling to hold suction casing in place;
3. Insert the two large suction to casing bolts in the twelve and six-o'clock positions. Tighten the bolts, being careful that the gasket stays in place. Insert the four smaller suction-to-casing bolts and tighten;
4. The pump is now ready to accept the rotating assembly.

Install Rotating Assembly

Ensure rotating assembly is filled with proper oil, SAE 30 (non-detergent)

Use suitable hoist and rigging to hoist assembly.

To install a rotating assembly:

1. Slide rotating assembly (2) into the casing (1);
2. Insert the bearing housing to casing bolts (13) into the bearing housing (9), tighten until impeller (1) rubs on front wear plate (19);
3. Refer to the impeller clearance section; follow steps 8 through 15 to adjust impeller (1) clearance.

Impeller clearance is the measurement between the impeller (1) and the wear plate (19). This clearance is set at .013 inches during assembly but may need to be adjusted before initial startup.

Check impeller clearance prior to starting the pump. Settings may have changed during transportation

Set Impeller Clearance

WARNING!!!

Electricity can cause electric shock. Lockout and power prior to working on pump

CAUTION!!!

Allow pump to cool before any maintenance work or disassembly. Operation could create enough heat to cause serious burns.

1. Lockout power to the motor.
2. Allow pump to cool if it has been operating.
3. Close the suction and discharge valves.
4. Remove the casing drain plug (18).
5. Remove priming cover clamp bar (10).
6. Loosen priming cover (11).
7. Allow pump to drain if it has been operating.
8. Loosen and remove the front cover assembly (23).
9. Slide one supplied front cover shim (25) over each stud (17).
10. Reinstall the front cover assembly (23).
11. Turn the pump shaft 360 degrees to check for rubbing/binding.

If there is binding, repeat steps 8 thru 10, adding an additional set of shims to each stud.

If there is no rubbing /binding the impeller clearance is correct

12. Reinstall the casing drain plug (18). Reinstall the priming cover (11) then insert the clamp bar (10) and tighten the flap valve pin (33)

SECTION 5

LUBRICATION

MAINTENANCE SCHEDULE

Inspect seal and bearing oil levels weekly and change annually.

SEAL ASSEMBLY

Prior to starting the pump, remove the vented plug (10) and fill with SAE No. 30 nondetergent oil. The oil level should be just below the plug's tapped hole.

BEARINGS

Prior to startup, fill with the bearing chamber with the recommended lubricant of SAE No. 30 or ISO 100, non-detergent oil (approximate 32oz.) through the fill plug (30) to center of sight glass (14A). If a non-detergent oil is not available to you

OIL CAPACITY (approximate)		
Pump Model	Seal Chamber Capacity	Bearing Chamber Capacity
T2	22 oz	32 oz
ST3	22 oz	32 oz
ST4	20 oz	32 oz
ST6	40 oz	32 oz
ST8	90 oz	32 oz
ST10	25 oz	32 oz