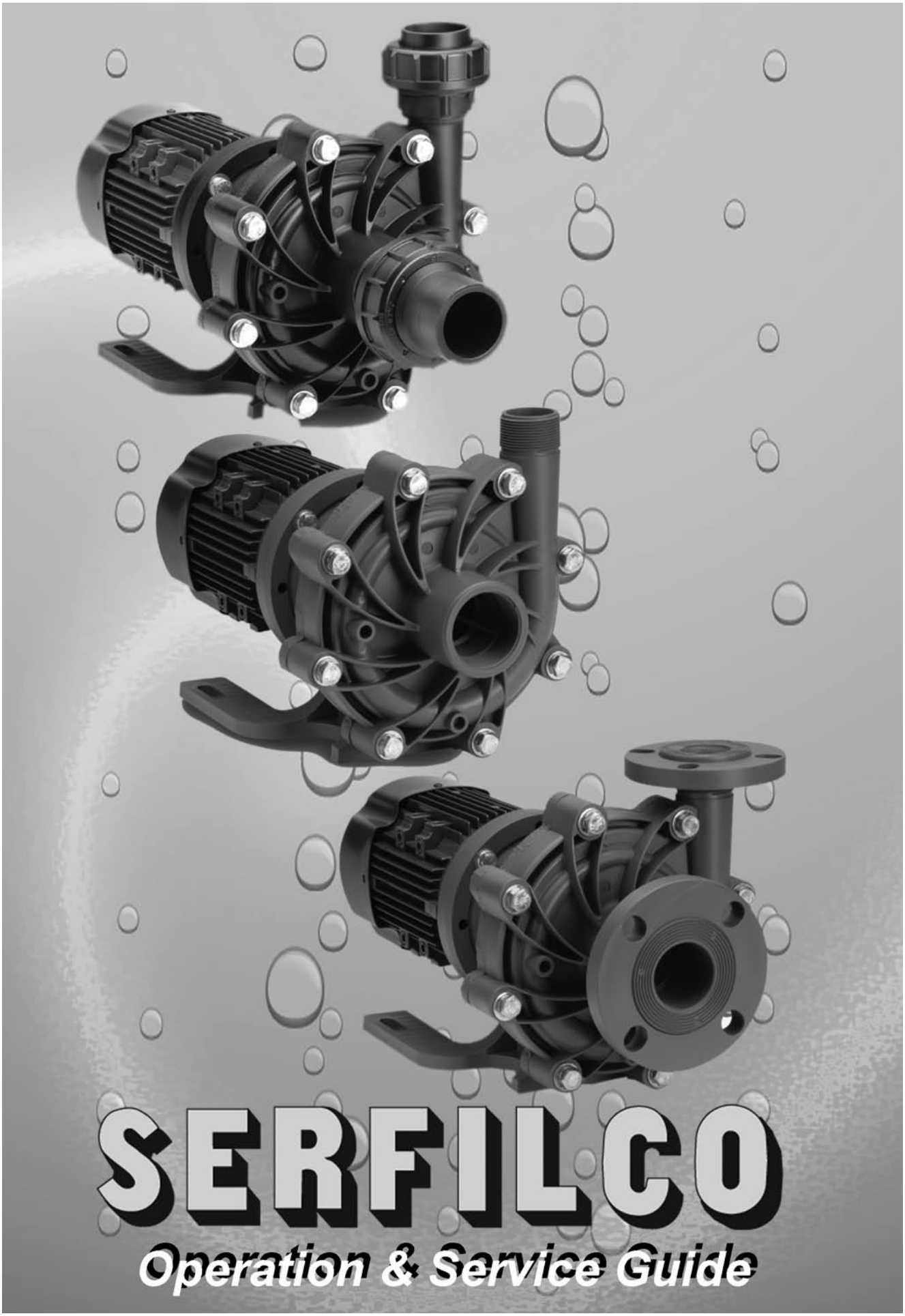

# SERFILCO

## Operation & Service Guide

SERIES 'FE' MAGNETIC COUPLED PUMPS

Refer to Bulletin P-518

O-2804

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## *IMPORTANT INFORMATION - READ ME FIRST*

### MODEL NUMBER AND SERIAL NUMBER

Record the model number and serial number below for future reference. This is important information when ordering replacement parts or when technical assistance is required. The numbers are found on a label located on the motor adapter.

MODEL NUMBER _____

SERIAL NUMBER _____

## *CHEMICAL REACTION DISCLAIMER*

The user must exercise primary responsibility in selecting the product's materials of construction which are compatible with the fluid(s) that come(s) in contact with the product. The user may consult SERFILCO, Ltd or a distributor agent to seek a recommendation of the product's material of construction that offers the optimum available chemical compatibility.

However neither manufacturer nor agent shall be liable for product damage or failure, injuries, or any other damage or loss arising out of a reaction, interaction or any chemical effect that occurs between the materials of the product's construction and fluids that come into contact with the product's components.

## *SAFETY PRECAUTIONS*

⚠ **WARNING:** READ THIS MANUAL COMPLETELY BEFORE INSTALLING AND OPERATING THIS UNIT. FAILURE TO FOLLOW THESE PRECAUTIONS CAN RESULT IN SERIOUS INJURY OR DEATH.

⚠ **WARNING:** Magnetic force hazard. This pump should only be disassembled and assembled using the recommended procedures. The magnetic attraction is powerful enough to rapidly pull the motor end and the wet end together. Do not place fingers between the mating surfaces of the motor and wet ends to avoid injuries. Keep the drive magnet and impeller assembly away from metal chips or particles.

⚠ **WARNING:** Hot surfaces. 'FE' Series pumps are capable of handling liquids with temperatures as high as 220° F (104° C). This may cause the outer areas of the pump to become hot as well and could cause burns.

**WARNING:** Rotating Parts. This pump has components that rotate while in operation. Follow local safety standards for locking out the motor from the power supply during maintenance or service.

⚠ **WARNING:** Chemical Hazard. This pump is used for transferring many types of potentially dangerous chemicals. *Always* wear protective clothing, eye protection and follow standard safety procedures when handling corrosive or personally harmful materials. Proper procedures should be followed for draining and decontaminating the pump before disassembly and inspection of the pump. There may be small quantities of chemicals present during inspection.

⚠ **WARNING:** The pump and associated components are heavy. Failure to properly support the pump during lifting and movement could result in serious injury or damage to the pump and components.

⚠ **WARNING:** Never run pump at less than minimum flow or with the discharge valve closed. This could lead to pump failure.

## ***INSTALLATION/OPERATION PRECAUTIONS***

⚠ **CAUTION:** This pump should never be operated without liquid in the casing. It is recommended that run dry protection be used. Optional electronic power monitors are available to help protect against run dry. If the pump has a PTFE, ceramic or silicon carbide bushing, IT CANNOT BE RUN DRY WITHOUT CAUSING DAMAGE TO THE PUMP. **However, the pump can operate without liquid in the casing if the pump has a carbon bushing. The exact length of time the pump can operate dry with a carbon bushing varies with operating conditions and environment.**

⚠ **CAUTION:** Never start or operate with a closed suction valve. Never operate with a closed discharge valve.

⚠ **CAUTION:** Always provide adequate NPSHa (net positive suction head available). It is recommended to provide at least 2 feet (61 cm) above the NPSHr (net positive suction head required).

⚠ **CAUTION:** If pump is used on variable speed drive, do not exceed the frequency for which the pump was designed (for example, if the pump is a 50 Hz model, do not exceed 50 Hz).

⚠ **CAUTION:** Use of a power monitor is strongly recommended for pumps with ceramic, PTFE or silicon carbide bushings. The power monitor will stop the pump and help prevent damage if the pump should run dry. ATEX certified pumps MUST use a power monitor.

## ***SAFETY PRECAUTIONS FOR ATEX PUMPS***

⚠ **CAUTION:** Proper o-ring material must be chosen for the fluid being pumped. Improper material selection could lead to swelling and be a possible source of leaks. This is the responsibility of the end user.

⚠ **WARNING:** The pump must be checked for leaks on a regular basis. If leaks are noticed, the pump must be repaired or replaced immediately.

⚠ **WARNING:** The pump must be cleaned on a regular basis to avoid dust buildup greater than 5 mm.

⚠ **WARNING:** ATEX pumps must use a power monitor, flow switch, pressure switch or similar device to help protect against dry running, closed discharge valve and decoupling. Any of these conditions could lead to a rise in surface temperature of the pump.

## ***TEMPERATURE CLASSIFICATION***

⚠ The surface temperature of the 'FE' Series pumps depends upon the temperature of the fluid that is being pumped. The following chart lists different fluid temperatures and the corresponding pump surface temperature.

| FLUID TEMPERATURE | MAXIMUM SURFACE TEMPERATURE | TEMPERATURE CLASS | MAXIMUM ALLOWABLE SURFACE TEMPERATURE |
|---|---|---|---|
| 70° F (27° C) | 131° F (55° C) | T6 | 85° C |
| 170° F (85° C) | 168° F (76° C) | T5 | 100° C |
| 220° F (104° C) | 183° F (84° C) | T4 | 135° C |

## ***'FE' CAPABILITIES***

**Maximum Working Pressure:** 90 psi (6.2 bar) (models with o-ring)
**Maximum Working Pressure:** 50 psi (3.5 bar) (models with Gylon® gasket)
**Maximum Viscosity:** 150 cP
**Maximum Temperature:** Polypropylene -180° F (82° C); PVDF – 220° F (104° C)

**Note:** Maximum temperature is application dependent. Consult a chemical resistance guide or the chemical manufacturer for chemical compatibility and temperature limits.

**Solids:** Maximum particle size is 100 microns for slurries and 1/64" (.4 mm) for infrequent particles. Maximum hardness is 80 HS. Maximum concentration is 10% by weight. If solids are being pumped, it is recommended that the pump have either ceramic or for best results, silicon carbide components. Pumping solids may lead to increased wear.

### MINIMUM ALLOWABLE FLOW RATE:

Do not allow the flow rate to drop below the minimum flow rate listed in the chart below.

| MODEL | 3450 RPM | 1725 RPM | 2900 RPM | 1450 RPM |
|---|---|---|---|---|
| FE1 | 4 gpm (.9 m3/hr) | 2 gpm (.5 m3/hr) | .76 m3/hr (3.4 gpm) | .38 m3/hr (1.7 gpm) |
| FE2 | 5 gpm (1.1 m3/hr) | 2.5 gpm (.6 m3/hr) | .95 m3/hr (4.2 gpm) | .48 m3/hr (2 gpm) |

### MAXIMUM ALLOWABLE MOTOR POWER:

Do not exceed the maximum power rating for the pump coupling.

Standard coupling for the FE1 is 6-pole; standard coupling for the FE2 is 8-pole.

6-pole coupling = 2 horsepower (1.5 kW)
8-pole coupling = 3 horsepower (2.2 kW)
10-pole coupling = 5 horsepower (4 kW)

## 'FE' ASSEMBLY, INSTALLATION & OPERATION

### UNPACKING AND INSPECTION

Unpack the pump and examine for any signs of shipping damage. If damage is detected, save the packaging and notify the carrier immediately.

## ***SECTION I - ASSEMBLY***

### PUMPS WITH MOTORS

Proceed to “Installation” Section.

### PUMPS WITHOUT MOTORS

**NOTE:** 184TC and 100/112 frame motors must have feet.

**Tools Required -** Metric socket or wrench set, 9/16” socket or wrench and 3/16” Allen Wrench (NEMA motors only).

1. Remove the pump, drive magnet assembly and hardware package from the carton. Do not remove the shipping plug until after the pump has been installed on the motor.

⚠ **CAUTION:** Keep away from metallic particles, tools, and electronics. Drive magnets **MUST** be free of metal chips.

⚠ **WARNING:** Keep the drive magnet away from the open end of the motor adapter and barrier. Strong magnetic attraction could allow the drive hub to enter the motor adapter resulting in injury or damage.

2. Place motor on the fan end. For 56C/145TC and B5 frame motors go to step 4. See figure 1.

3. For 184 NEMA and IEC motors only - install the motor adapter flange (item 10) on the motor face using bolts, lock washers and flat washers (items 21, 22, 23). See figure 2.

   Torque bolts to the following:

| | | |
|---|---|---|
| 80 frame (M6) | = | 90 in-lb (10.2 N-m) |
| 90/100/112 frame (M8) | = | 130 in-lb (14.7 N-m) |
| 184 NEMA (1/2”) | = | 480 in-lb (54.3 N-m) |

   **Note:** Apply anti-seize compound on threads of the bolts.

4. Coat the motor shaft with anti-seize compound. Insert key supplied with motor into keyway on motor shaft. See figure 3.

   **NOTE:** Make sure the motor shaft is clean and free of burrs. The outer drive is precision machined and has a bore tolerance of +.0005/-0 inch.

5. Slide the outer drive magnet assembly (item 9) onto the motor shaft until the motor shaft contacts the snap ring in the bore of the drive. Figures 4 and 5.

6. Secure the drive on the motor shaft.

   **Metric Motors:** Secure the drive to the motor shaft using bolt, lock washer and flat washer (items 18, 19, 20). Thread the bolt into the end of the motor shaft (while holding the outer drive to prevent it from turning). See figure 6.

*Figure 1*

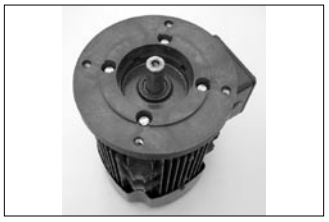

*Figure 2*

*Figure 3*

*Figure 4*

*Figure 5*

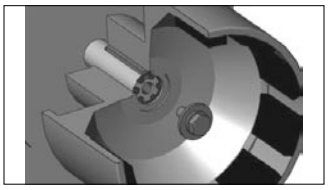

*Figure 6 - IEC Drive*

Tighten the bolt to the following:

80 frame (M6) = 90 in-lb (10.2 N-m)
90 frame (M8) = 130 in-lb (14.7 N-m)
100/112 frame (M10) = 240 in-lb (27.1 N-m)

**NEMA Motors:** Install set screws (item 9A) into threaded holes on the side of the outer drive magnet assembly. Using a 3/16" Allen wrench, tighten to 228 in-lbs. (25.8 N-m). See figure 7.

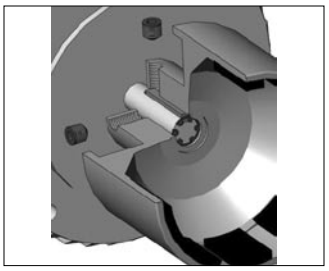

*Figure 7 - NEMA Drive*

7. Install the pump end on the motor/drive magnet assembly. With the motor facing upright, align the pump feet so that the motor feet and pump feet are on the same side.

   Tip the pump end at an angle (discharge is approximately 45°) so that it is just touching the edge of the outer drive magnet assembly. See figure 8.

*Figure 8*

   Carefully lower the pump onto the drive magnet assembly by tipping discharge forward to 90° and dropping straight down. The last 3-4 inches (8-10 cm) before the pump reaches the motor will have STRONG magnetic attraction between the pump and outer drive magnet assembly.

8. Secure the pump to the motor with (4) 3/8" bolts, lock washers and flat washers (items 15,16,17). Tighten to 240 in-lb (27.1 N-m). See figures 9 and 10.

*Figure 9*

   NOTE: B5 motors with clearance holes will require customer supplied hardware

9. Remove the shipping plug from the pump suction.

10. Rotate the motor fan to ensure that there is no binding in the pump.

11. Proceed to Installation Section

*Figure 10*

## ***SECTION II - INSTALLATION***

### MOUNTING

Pump foot should be securely fastened to a solid foundation. If the pump was received with plastic shipping shims, these shims may be used as additional support for the motor feet (though not required).

**Note**: B5 pumps with 100/112 frame do not include a pump foot.

### PIPING

⚠ **CAUTION:** The NPSH available to the pump must be greater than the NPSH required. Filters, strainers and any other fittings in the suction line will lower the NPSH available and should be calculated into the application.

- Install the pump as close to the suction source as possible.
- Support the piping independently near the pump to eliminate any strain on the pump casing. In addition, the piping should be aligned to avoid placing stress on the pump casing.

- The suction side of the pump should be as straight and short as possible to minimize pipe friction.
- Keep bends and valves at least ten pipe diameters away from the suction and discharge.
- The suction line should be at least as large as the suction inlet port or one pipe size larger so that it does not affect the NPSHa. Do not reduce the suction line size.
- The suction line should not have any high spots. This can create air pockets. The suction piping should be level or slope slightly upward to the pump.
- A check valve and control valve (if used) should be installed on the discharge line. The control valve is used for regulating flow. An isolation valves on the suction and discharge are used to make the pump accessible for maintenance. The check valve helps prevent the pump against damage from water hammer. This is particularly important when the static discharge head is high.
- If flexible hose is preferred, use a reinforced hose rated for the proper temperature, pressure and chemical resistance against the fluid being pumped.
- The suction valve must be completely open to avoid restricting the suction flow.
- It is advisable to install a flush system in the piping to allow the pump to be flushed before the pump is removed from service.

  **NOTE**: The pump is provided with a provision for a customer installed ¼" drain in the impeller housing. See the Drain Installation Section for details.
- For units in a suction lift system, install appropriate piping in the discharge to allow priming of the pump ('FE' models are not self-priming).
- When installing pumps with flanges, we recommend use of low seating stress gaskets such as Gore-Tex® or Gylon® (expanded PTFE)

**MOTOR/ELECTRICAL**

Install the motor according to NEC requirements and local electrical codes. The motor should have an overload protection circuit.

Wire the motor for clockwise rotation when facing the fan end of the motor.

⚠ **CAUTION:** Do not operate the pump to check rotation until the pump is full of liquid.

Check all electrical connections with the wiring diagram on the motor. Make sure the voltage, frequency, phase and amp draw comply with the supply circuit.

If utilized, verify that the power monitor has been properly installed according to the manufacturers instructions.

**TO VERIFY CORRECT ROTATION OF THE MOTOR:**

1. Install the pump into the system.
2. Fully open the suction and discharge valves.
3. Allow fluid to flow into the pump. Do not allow the pump to run dry (ceramic, PTFE and silicon carbide bushings can't be run dry without damage to pump components).
4. Jog the motor (allow it to run for 1-2 seconds) and observe the rotation of the motor fan. Refer to the directional arrow molded into the pump casing if necessary.

**NOTE:** A pump running backwards will pump but at a greatly reduced flow and pressure.

## ***SECTION III - START-UP AND OPERATION***

1. This pump must be filled from a flooded suction tank (gravity) or primed with liquid from an outside source. The 'FE' is not self-priming.
2. Open the inlet (suction) and discharge valves completely and allow the pump to fill with liquid.
3. Close the discharge valve.
4. Turn the pump on. Slowly open the discharge valve. Adjust the flow rate and pressure by regulating the discharge valve. Do not attempt to adjust the flow with the suction valve.
5. Use of a power monitor is strongly recommended for pumps with ceramic, PTFE or silicon carbide bushings. The power monitor will stop the pump and help prevent damage if the pump should run dry. ATEX certified pumps MUST use a power monitor.

### SHUTDOWN

Use the following procedure to shutdown the pump.

1. Slowly close the discharge valve.
2. Turn off the motor.
3. Close the suction valve.

### FLUSH SYSTEMS

⚠ **CAUTION:** Some fluids react with water; use compatible flushing fluid.

1. Turn off the pump.
2. Completely close the suction and discharge valves.
3. Connect flushing fluid supply to flush inlet valve.
4. Connect flushing fluid drain to flush drain valve.
5. Open flushing inlet and outlet valves. Flush system until the pump is clean.

### OPTIONAL DRAIN INSTALLATION

1. Remove the impeller housing from the pump assembly.
2. Clamp the impeller housing to a drill press table.
3. Using a 7/16" drill and the molded boss as a guide, drill completely through the molded boss into the interior of the impeller housing. De-burr the hole on the inside of the impeller housing.

⚠ **CAUTION** - Do not tap too deep or the impeller housing may be damaged.

4. Using a 1/4" NPT tap, tap the hole in the molded base to the appropriate depth.
5. Install the drain plug or valve, being careful not to overtighten.

## *SECTION IV - MAINTENANCE*

### RECOMMENDED MAINTENANCE SCHEDULE

The recommended maintenance schedule depends upon the nature of the fluid being pumped and the specific application. If the pump is used on a clean fluid, it is recommended that the pump be removed from service and examined after six months of operation or after 2,000 hours of operation. If the pump is used on fluids with solids, high temperatures or other items that could cause accelerated wear, then this initial examination should be sooner.

After the initial examination of the internal components and wear items are measured, a specific maintenance schedule can be determined. For best results, it is recommended that the pump be removed from service annually for examination.

## *SECTION V - DISASSEMBLY*

⚠ **WARNING:** Rotating Parts. This pump has components that rotate while in operation. Follow local safety standards for locking out the motor from the power supply during maintenance or service.

⚠ **WARNING**: Chemical Hazard. This pump is used for transferring many types of potentially dangerous chemicals. Always wear protective clothing, eye protection and follow standard safety procedures when handling corrosive or personally harmful materials. Proper procedures should be followed for draining and decontaminating the pump before disassembly and inspection of the pump. There may be small quantities of chemicals present during inspection.

⚠ **WARNING**: Magnetic force hazard. This pump should only be disassembled and assembled using the recommended procedures. The magnetic attraction is powerful enough to rapidly pull the motor end and the wet end together. Do not place fingers between the mating surfaces of the motor and wet ends to avoid injuries. Keep the drive magnet and impeller assembly away from metal chips or particles.

*Figure 9*

1. Stop the pump, lock out the motor starter, close all the valves that are connected to the pump, and drain/decontaminate the pump.

⚠ **WARNING**: The pump must be thoroughly flushed of any hazardous materials and all internal pressure relieved prior to opening the pump. Allow the pump to reach ambient temperatures prior to performing maintenance.

*Figure 11*

2. For pumps with motors 2 horsepower (1.5 kW) or smaller, securely clamp the pump feet to the bench. Remove the (4) bolts, lock washers and flat washers (items 15,16,17) securing the pump to the motor. See figure 11.

   Firmly grab the motor and pull straight back to disengage the motor and pump. See figure 12.

   For pumps with motors 3 horsepower (2.2 kW) or larger, place the pump and motor on the floor. Remove the (4) bolts, lock washers and flat washers (items 15,16,17) securing the pump to the motor. See figure 11. Make sure the motor is on the fan end with the pump facing up. Pull straight up to remove the pump from the motor. See figure 13.

*Figure 12*

3. Place pump on bench with housing facing up. Remove (8) 10 mm housing bolts, lock washers and flat washers (items 12, 13, 14). See figure 14.
4. Pull housing (item 1) straight up to remove. Inspect housing for signs of wear or damage. Look for signs of rubbing, cracking on thrust ring, or damage to front shaft support. See figure 15.
5. Remove impeller/inner drive assembly (items 4A, 4, 5, 5A). Inspect im-peller and drive for signs of wear or damage. Look for signs of rubbing or damage and wear to the im-peller and inner drive. See figure 16.

   Check the impeller thrust ring and bushing for wear. See figure 17.
6. Remove the impeller shaft (item 6) from the barrier and check for signs of cracking, chipping, scoring or wear. See figure 18.
7. Remove the barrier (item 7) from the motor adapter (item 8). Make sure the spindle has been removed. If necessary, gently tap on the backside of the barrier with a soft rod (wood, plastic, etc.). Inspect the inside and outside of the barrier for signs of rubbing. See figure 19.
8. Remove the o-ring (item 2) from the barrier and inspect for chemical attack, swelling, brittleness, cuts, etc.
9. Visually inspect the outer drive (item 9) for rubbing, damage, corrosion or loose magnets.

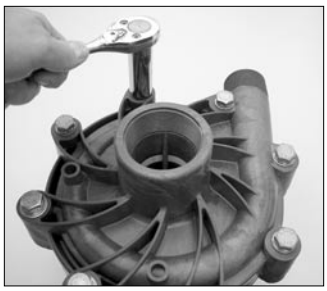

*Figure 14*

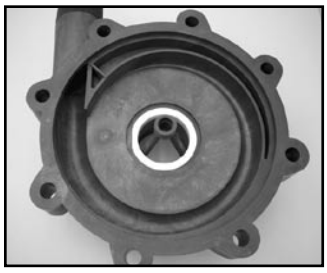

*Figure 15*

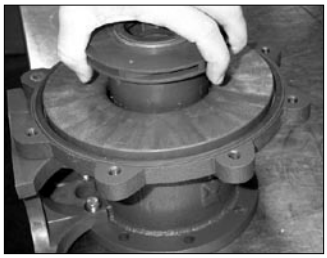

*Figure 16*

**Outer Drive Replacement**

1. Remove the setscrews (item 9A) from the side of the drive (NEMA mo-tors) or the bolt, lock washer and flat washer (items 18, 19, 20) from the center of the drive(metric motors).

⚠ **WARNING:** Be careful, tools will want to be attracted to the magnets.

2. Remove the drive magnet from the motor shaft by gently prying up from the bottom of the drive. See figure 20.
3. To reinstall the drive or a new drive follow the instructions from Section I - Assembly, Pumps without Motors, steps 4-6.

*Figure 18*

*Figure 19*

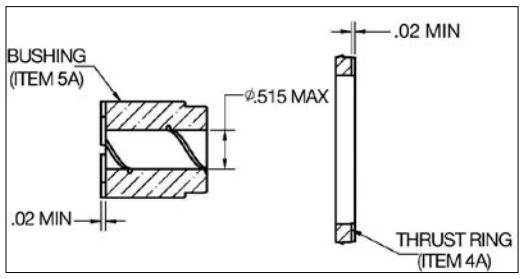


*Figure 17*

*Figure 20*

## THRUST RING REPLACEMENT

1. Thrust ring (item 4A) is held in-place with a snap fit with a ridge. Using a razor knife or side cutters, cut a notch out of the thrust ring. Pull ring up and out of the holder. See figures 21-22.
2. To reinstall, align the two flats on the thrust ring with the flats in the bore of the impeller. Using a piece of wood, press into place using an arbor press until the thrust ring is completely seated in the impeller.

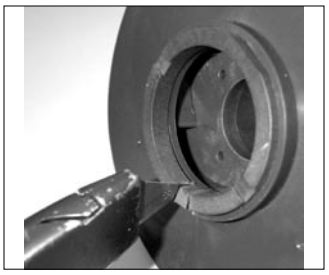

*Figure 21*

## BUSHING REPLACEMENT

1. To remove the bushing, place the impeller/inner drive assembly in an arbor press. Insert a 3/4" diameter plastic or wood shaft through the eye of the impeller and press the bushing out.
2. To replace the bushing (item 5A), place the top of the impeller on an arbor press with the thrust ring face down. Insert the front of the bushing (figure 23) into the center of the impeller/inner drive magnet assembly, aligning the flat on the bushing with the flat in the bore of the inner drive magnet. Using a soft arbor, press into place until the bushing reaches the shoulder molded into the inner drive (figures 24 and 25).

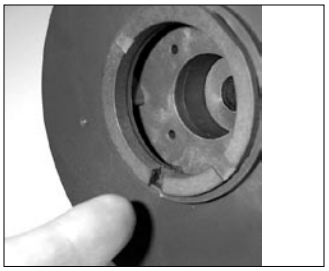

*Figure 22*

## IMPELLER REPLACEMENT

⚠ **CAUTION:** Do not damage the outer surface of the inner drive magnet during impeller replacement.

*Figure 23*

Using the two slots provided, insert a flat blade screw driver into them and pry the impeller (items 4, 4A) up from the body of the inner drive magnet (items 5, 5A). Once a gap has been established, work around the perimeter to evenly increase the gap until the impeller can be removed. See figure 26.

To install a new impeller, place the inner drive magnet assembly face up (splines facing up) on an arbor press. Align the spines in the impeller with the ones in the bore on the inner drive magnet. Place a piece of wood over the top of the impeller thrust ring. Using an arbor press, push down on the impeller until it is completely seated in the inner drive.

*Figure 24*

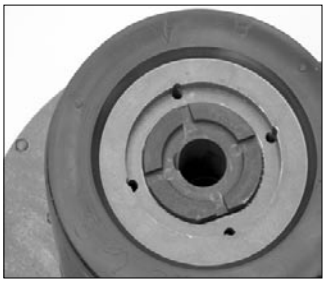

*Figure 25*

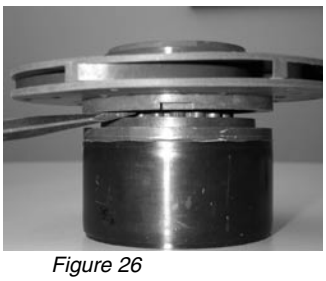

*Figure 26*

## ***SECTION VI - REASSEMBLY***

1. Install barrier (item 7) into motor adapter (item 8). Press firmly to ensure that the barrier is completely seated. See figure 27
2. Install o-ring (item 2) or Gylon gasket in groove in barrier.

   **Note**: If pump has Gylon gasket, a new gasket should be use when the pump is reassembled.
3. Install impeller shaft (item 6) into barrier by aligning the flats on the shaft with the ones in the barrier. Make sure it is completely seated. See figure 28.
4. Carefully install the impeller/inner drive assembly (items 4, 4A, 5, 5A) by sliding it over the impeller shaft in the barrier. It is normal for the impeller/inner drive to pop up a slight amount due to magnetic forces. See figures 29 and 30.
5. Install the impeller housing (item 2). Make sure the discharge is in the correct orientation in relation to pump foot. Align the shaft in the barrier with the front shaft support in the impeller housing. Press down to push the impeller/inner drive magnet assembly into position. Holding the impeller housing with one hand, install and finger-tighten two bolts, lock washers and flat washers (items 12, 13, 14) in opposite locations. See figure 31.
6. Install the remaining bolts, lock washers and flat washers finger tight.
7. Tighten all the bolts evenly using a star pattern. Tighten to 20 foot-lbs (27 N-m).
8. Reinstall the pump on the motor/drive magnet following instructions found in “Assembly, Pumps Without Motors,” steps 7-11.

*Figure 27*

*Figure 28*

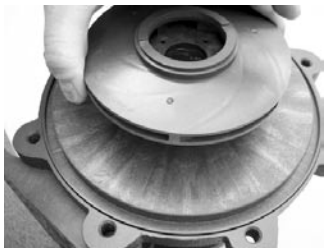

*Figure 29*

*Figure 30*

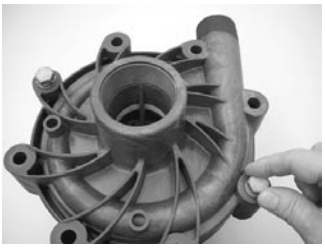

*Figure 31*

## ***SECTION VII - TROUBLESHOOTING***

**GENERAL NOTES:**

- Do not pump liquids containing ferrous metal fines.
- If magnets decouple, stop pump immediately. Operating the pump with the magnets decoupled will eventually weaken the magnets.
- Power monitors are required and must be used with all ATEX certified pumps.
- Do not use mismatched drive magnet assemblies (different number of magnets on inner and outer drive magnet assemblies).
- Contact our Technical Service Department -

  Phone: 1-800-323-5431

  Email: service@serfilco.com

  if you have any questions regarding product operation or repair.

## NO OR INSUFFICIENT DISCHARGE

- Air leaks in suction piping
- Pump not primed
- System head higher than anticipated
- Closed valve
- Viscosity or specific gravity too high
- Motor too large for magnet coupling rating (magnets uncoupled)
- Suction lift too high or insufficient NPSH
- Clogged suction line or impeller vanes
- Motor rotation incorrect (correct rotation when viewed from the fan end is clockwise)

## INSUFFICIENT PRESSURE

- Air or gas in liquid
- Impeller diameter too small
- System head lower than anticipated
- Motors speed insufficient (too low) or motor rotation incorrect (correct rotation when viewed from the fan end is clockwise)

## LOSS OF PRIME

- Leak in suction piping
- Foot valve or suction opening not submerged enough
- Foot valve too small or leaking
- Air or gas in liquid
- Foreign matter in impeller
- Leaking valve. Suction lift too high or insufficient NPSHa

## EXCESSIVE POWER CONSUMPTION

- Head lower than rating
- Excessive flow
- Specific gravity or viscosity too high.

## VIBRATION / NOISE

- Loose magnet
- Drive magnet rubbing
- Pump cavitating from improper suction or feed
- Motor or piping not properly secured
- Foreign object in impeller

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