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## INSTALLATION, OPERATION & MAINTENANCE MANUAL

### POLY-GUARD<sup>®</sup> SERIES

#### FLUOROPOLYMER-LINED, MAGNETIC-DRIVE GEAR PUMPS



**Models P1 thru P4**



**Models P5 thru P7**

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## Section 1: General Information

### 1.1 General Instructions

This manual covers the Poly-Guard® Series Mag-Drive gear pumps, Models P1 thru P7.

The materials of construction of the pump are selected based upon the chemical compatibility of the fluid being pumped. The user must verify that the materials are suitable for the surrounding atmosphere.

If the fluid is non-conductive, methods are available to mechanically ground the isolated shaft. This is only necessary if the surrounding atmosphere is extremely explosive or stray static charges are present.

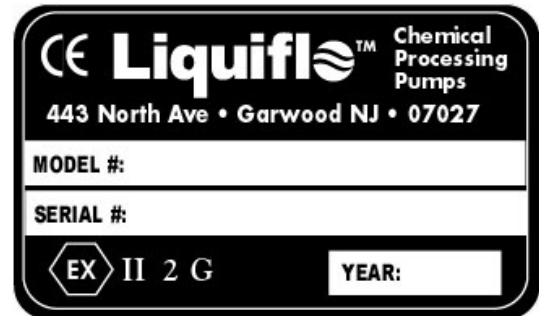
Upon receipt of your Liquiflo pump:

- A) Verify that the equipment has not been damaged in transit.
- B) Verify that the pump *Model Number* and *Serial Number* are stamped on the circular *Stainless Steel Nameplate* on the pump's housing.



- C) For ATEX certification, verify that the following *Stainless Steel Tag* is secured to the pump:

Explanation of ATEX Tag	
<b>Group II</b>	Explosive atmospheres
<b>Category 2</b>	Equipment provides a high level of protection. Explosive atmospheres are likely to occur.
<b>Category 3</b>	Equipment provides a normal level of protection. Explosive atmospheres are unlikely to occur.
<b>D</b>	Dust
<b>G</b>	Gas



- D) Record the following information for future reference:

<b>Model Number:</b>
<b>Serial Number:</b>
<b>Date Received:</b>
<b>Pump Location:</b>
<b>Pump Service:</b>

**NOTE:** By adding a **K** prior to the pump's Model Number, a **Repair Kit** can be obtained which consists of the following parts: drive and idler gears, drive and idler shafts, wear plates, bearings, retaining rings, keys, housing alignment pins, bearing lock pins and O-rings.

## 1.2 Pump Specifications

**Poly-Guard® Series MAG-DRIVE Gear Pump Specifications**

Pump Model		P1	P2	P3	P4	P5	P6	P7	Units
Port Size & Type	ANSI 150# RFF	3/4	3/4	3/4	3/4	1-1/2	1-1/2	1-1/2	in
	DIN PN16 RFF	20	20	20	20	40	40	40	mm
Body Material		303 Stainless Steel, PFA Plastic-Lined							–
Containment Can Material		Alloy-C276, 316 SS, PFA Plastic-Lined (Standard) *							–
Pedestal Material		Cast Iron, Epoxy-Painted							–
Inner Magnet Material		Samarium Cobalt, Carbon Steel, PFA Plastic-Lined							–
Outer Magnet Material		Samarium Cobalt, Carbon Steel, Epoxy-Painted							–
Magnetic Coupling Torque @ 20°C	MCU	75				–			in-lbs
	MCB	120							in-lbs
Theoretical Displacement <sup>1</sup>		.000828	.00138	.00193	.00289	.00491	.00675	.00859	gal/rev
		.00313	.00522	.00731	.01094	.01858	.02555	.03251	L/rev
Max Speed		1750	1750	1750	1750	1750	1750	1750	RPM
Max Flow Rate <sup>1</sup>		1.4	2.4	3.4	5.0	8.6	11.8	15.0	GPM
		5.5	9.1	12.8	19.1	32.5	44.7	56.9	LPM
Max Differential Pressure		100	100	100	100	100	100	100	PSI
		7	7	7	7	7	7	7	bar
Max Allowable Pressure <sup>2</sup>		275	275	275	275	275	275	275	PSI
		19	19	19	19	19	19	19	bar
Max Temperature <sup>3</sup>		212	212	212	212	212	212	212	°F
		100	100	100	100	100	100	100	°C
NPSHR @ Max Speed		2	2	2	3	5.2	5.2	4	ft
		0.6	0.6	0.6	0.9	1.6	1.6	1.2	m
Suction Lift (dry)		1.5	2	4	6	6	7	7	ft
		0.45	0.6	1.2	1.8	1.8	2.1	2.1	m
Approx. Weight <sup>4</sup>		42	42	42	42	63	63	63	lbs
		19	19	19	19	29	29	29	kg

RFF = Raised Face Flanges  
NPSHR = Net Positive Suction Head Required

\* Optional Non-metallic Containment Can material is Carbon Fiber (or rigid plastic) with Fluoropolymer Lining.

### FOOTNOTES:

- 1 Based on Maximum Speed and zero Differential Pressure.
- 2 Based on pressure rating of Flanges at ambient temperature.
- 3 Pump may require trimmed parts depending on the materials and temperature. Consult factory.
- 4 Approximate weight of pump, not including motor.

### NOTES:

- 1 The actual maximum surface temperature depends not on the pump but primarily on the temperature of the fluid being pumped. Temperature class can be controlled with the use of thermal sensors. Pump surfaces will be approximately 20 °F (7 °C) above the temperature of the fluid being pumped.
- 2 Pump is designed to operate within the ambient temperature range of -4 °F (-20 °C) to 104 °F (40 °C).

## Section 2: Safety Precautions

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### 2.1 General Precautions

- **Always** lock out the power to the pump driver when performing maintenance on the pump
- **Always** lock out the suction and discharge valves when performing maintenance on the pump
- **Never** operate the pump without safety devices installed
- **Never** operate the pump with suction and/or discharge valves closed
- **Never** operate the pump out of its design specifications
- **Never** start the pump without making sure that the pump is primed
- Inspect the entire system before start-up
- Monitor the system during operation and perform maintenance periodically or as required by the application
- Decontaminate pump using procedures in accordance with federal, state, local and company environmental regulations
- Before performing maintenance on the pump, check with appropriate personnel to determine if skin, eye or lung protection is required and how best to flush the pump
- Pay special attention to all cautionary statements given in this manual. **Failure to observe safety precautions can result in personal injury, equipment damage or malfunction.** Cautionary statements will have the following format:

**CAUTION! (Statement)**

### 2.2 Special Precautions for Magnetic-Drive Pumps

Magnetic-drive pumps contain strong magnets, which pose health risks. Based on this the following must be observed:

- Individuals with cardiac pacemakers should avoid repairs on these units
- Individuals with internal wound clips, metallic wiring, or other metallic prosthetic devices should avoid repairs on these units
- Strong magnetic fields can cause tools and parts to slam together, injuring hands and fingers

Strong magnets will attract iron, cast iron, carbon steel and some types of stainless steel. Keep magnets away from credit cards, computers, computer discs and watches.

## Section 3: Pump & Motor Installation

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### 3.1 Installation of Pump, Motor & Base

The following guidelines should be observed for proper installation of the pump and motor assembly:

- A) The foundation area should be rigid and level for maintaining the alignment of the pump with the system piping.
- B) The pump and motor assembly must be securely fastened to the base, and the base must be securely attached to the ground.
- C) The pump and motor should be accessible for inspection and servicing.
- D) The pump inlet (suction port) should be as close to the liquid supply as practical and preferably below it.
- E) The piping should be properly supported. **DO NOT** use the pump as a pipe hanger.
- F) Install valves and unions to isolate the pump during maintenance.
- G) Suction and discharge piping should be the same size or larger than the inlet and outlet ports.
- H) Clean piping as necessary to remove dirt, grit, weld slag, etc.
- I) For further instructions on mounting or installing your pump, refer to the Hydraulics Institute Handbook.
- J) A positive displacement pump should have a **pressure relief valve** installed in the discharge line. The relief valve should be the closest valve to the discharge port of the pump and should bypass the discharge line back to the supply tank.
- K) The maximum particle size capable of being passed by the pump is 37 microns. A **filter** of at least 400 U.S. Mesh should be installed in the suction line. Concentration of solids exceeding 1% by volume is not recommended as wear rates will increase to unacceptable levels.
- L) Clean the pump and motor periodically to prevent the build-up of dust.

**NOTE:** The Poly-Guard Series pumps are close-coupled and no alignment procedures between the pump and motor are needed.

## Section 4: Start-Up & Operation

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### 4.1 Start-Up

- A) Open all suction and discharge valves before starting the pump.
- B) Prime the pump and jog the motor to check the direction of rotation. As viewed from the pump end, a clockwise rotation of the motor will result in fluid discharge to the left. Counterclockwise rotation will result in fluid discharge to the right.

**CAUTION! Do not operate the pump dry for more than 30 seconds or damage to internal parts can result.**

- C) The pump should be operated with at least 20 PSI (1.4 bar) differential pressure to ensure that internal components are properly lubricated by the pumped fluid.
- D) The pump is capable of pulling a dry lift, but it is still recommended to prime the pump prior to start-up.
- E) A **pressure relief valve** should be installed in the discharge line to protect the pump and other system components from any type of line blockage including the inadvertent closing of an isolation valve.
- F) If the fluid contains suspended solids, a **filter** of at least 400 U.S. Mesh should be installed in the suction line.

### 4.2 Operation of Pump

During pump operation, inspect for:

- 1) Unusual noise
- 2) Product leakage
- 3) Expected suction and discharge pressures
- 4) Product flow

If any problems occur with the above items, stop the pump and take corrective action. For help with problem solving, refer to the Troubleshooting Guide on Pages 14 & 15.

## Section 5: Maintenance & Repair

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The pump has internal bearings, wear plates, gears and shafts, which require replacement over time due to wear. Standard repair kits are available to facilitate repair of the pump. Repair kits contain all internal wear parts as well as O-rings, keys, bearing lock pins, housing alignment pins and retaining rings. O-rings and retaining rings should never be reused when rebuilding the pump.

### 5.1 Work Safety

Before performing maintenance, review the Safety Precautions given on Page 4.

**CAUTION! The magnetic couplings used in these pumps are extremely powerful. Observe the Special Precautions given in Section 2.2.**

### 5.2 Removal from System

**CAUTION! If the pump was used to move hazardous or toxic fluids, it must be flushed and decontaminated prior to removal from the system piping. Refer to the Material Safety Data Sheet (MSDS) for the liquid and follow all prescribed safety precautions and disposal procedures.**

- 1 Flush the pump.
- 2 Stop the motor and lock out the electrical panel.

**CAUTION! Be certain the pump's motor switch is in the OFF position and the power to the motor is locked out.**

- 3 Close the suction and discharge isolation valves.
- 4 Disconnect the pump from the system piping. (Note: There will be some liquid trapped inside the pump's containment can. This liquid can be drained after the pump cartridge is separated from the pedestal. See **Section 5.3, Steps 1 to 4**, on following page.)

### 5.3 Pump Disassembly

Follow the procedure below and refer to the Exploded View Drawing given on Page 13.

- 1 Remove the four sets of *bolts* (26), *nuts* (27) and *lockwashers* (28) that secure the *front housing* (15) to the *pedestal* (25).
- 2 Remove the **pump cartridge** from the pedestal by pulling it straight out. (Note: Force will have to be applied to overcome the magnetic attraction between the outer and inner magnets.)

**CAUTION! Do not place hands or fingers between Cartridge and Pedestal.**

- 3 Drain the liquid inside the *containment can* (20) thru one of the ports of the cartridge.
- 4 Remove the six *containment can screws* (21) and separate the *containment can* (20) from the *front housing* (15). Remove any residual liquid in the containment can.
- 5 Discard the *containment can O-ring* (22).
- 6 Detach the *inner magnet assembly* (18) from the *drive shaft* (2) by removing the end *retaining ring* (19). Discard the retaining ring.
- 7 Remove the *inner magnet* (18) and *key* (14).
- 8 Remove the *housing bolts* (16) and separate the *rear housing* (9), *center housing* (12) and *front housing* (15).
- 9 Remove the *housing O-rings* (10) and *wear plates* (8). Discard the O-rings.
- 10 Remove the idler and drive gear-shaft assemblies.
- 11 Remove the *idler gear* (3) and *key* (13) from the *idler shaft* (1) by removing the *retaining rings* (5). Discard the retaining rings.
- 12 Remove the *drive gear* (4) and *key* (13) from the *drive shaft* (2) by removing the *retaining rings* (5). Discard the retaining rings.
- 13 Remove the *bearings* (6) and *bearing lock pins* (7) from the front and rear housings. (Note: The bearings have a slip-fit design and can be easily pulled out using a hook-shaped tool.) This completes the disassembly of the pump cartridge.

#### Outer Magnet Removal:

- 14 Remove the motor from the *pedestal* (25) by removing the four *motor mounting bolts* (29). (Note: The pedestal might be attached directly to the *Power Frame* or *S-Adapter*, which are Liquiflo ancillary devices used for long-coupling mag-drive pumps.)
- 15 Loosen the two *setscrews* (17) on the *hub* (23) of the *outer magnet assembly* (24).
- 16 Remove the *outer magnet* (24) from the motor shaft (or shaft of ancillary device).

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**END OF DISASSEMBLY PROCEDURE**

## 5.4 Pump Assembly

Follow the procedure below and refer to the Exploded View Drawing given on Page 13.

### Part A: Pump Cartridge Assembly

- 1 Assemble the *drive gear* (4) to the *drive shaft* (2) using one *gear key* (13) and two *gear retaining rings* (5). (Note: This step is not applicable if the gear-shaft components were supplied as part of a repair kit. See Chart below.)
- 2 Assemble the *idler gear* (3) to the *idler shaft* (1) using one *gear key* (13) and two *gear retaining rings* (5). (Note: This step is not applicable if the gear-shaft components were supplied as part of a repair kit. See Chart below.)

**CAUTION! Do not reuse Retaining Rings.**

**Poly-Guard Series Standard Repair Kit Items:**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| 1. Drive Gear-Shaft Assembly (1) | 6. Housing Alignment Pins (4)       |
| 2. Idler Gear-Shaft Assembly (1) | 7. Housing O-Rings (2)              |
| 3. Wear Plates (4)               | 8. Containment Can O-Ring (1)       |
| 4. Bearings (4)                  | 9. Inner Magnet Key (1)             |
| 5. Bearing Lock Pins (4)         | 10. Inner Magnet Retaining Ring (1) |

- 3 Insert the *bearing lock pins* (7) into the *front housing* (15) and *rear housing* (9).
- 4 Insert two *bearings* (6) into the *front housing* (15) and two *bearings* (6) into the *rear housing* (9). (Note: Align the bearing grooves with the lock pins. The bearings have a slip-fit design and should easily slide into the bearing bores.)
- 5 Place the *rear housing* (9) on a flat surface with the bearing bores facing up; then insert two *housing alignment pins* (11) into the *rear housing* (9).
- 6 Insert one *housing O-ring* (10) into the circular groove of the *rear housing* (9).

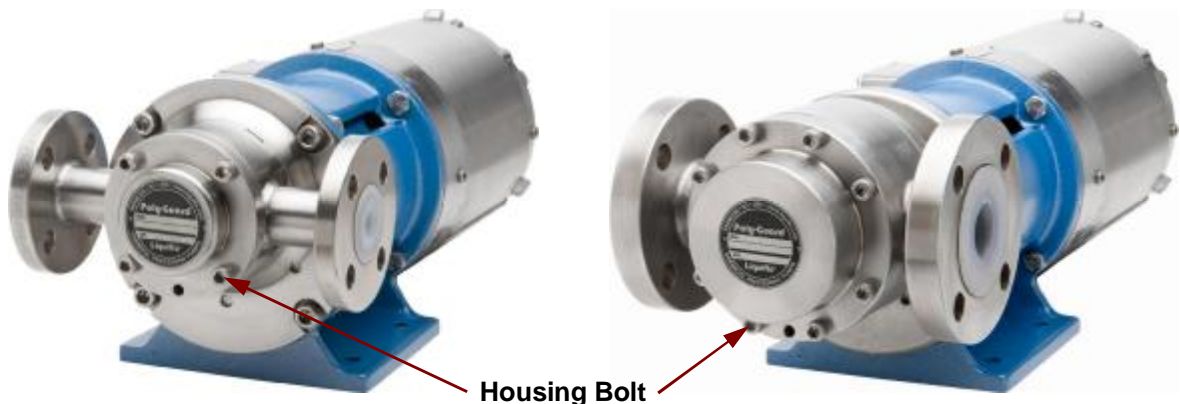
**CAUTION! Do not reuse O-rings.**

- 7 Place *center housing* (12) onto *rear housing* (9). (Note: Be certain the center housing seats properly over the housing alignment pins.)
- 8 Insert two *wear plates* (8) into the *center housing* (12) with the relief grooves facing up. (Note: The wear plates have relief grooves to minimize hydraulically induced separation forces on the gears. These relief grooves must face the gears to be effective.)
- 9 Insert the idler and drive gear-shaft assemblies into the center-rear housing. (Note: The drive shaft is located on the pump's centerline. When the pump is in its normal horizontal orientation, the idler gear will be above the drive gear.)

- 10 Place the remaining two *wear plates* (8) into the *center housing* (12) and on top of the gears, with the relief grooves facing down.
- 11 Insert two *housing alignment pins* (11) into the *center housing* (12).
- 12 Insert the other *housing O-ring* (10) into the circular groove of the *front housing* (15).
- 13 Place the *front housing* (15) onto the *center housing* (12) by allowing the shafts to enter the bearings in the front housing. (Note: Be certain the front housing seats properly over the housing alignment pins. After this step, the drive shaft should protrude from the center of the circular front housing.)
- 14 While holding the front-center-rear housing assembly together, place the assembly in a horizontal position.
- 15 Attach the housings together using the *housing bolts* (16). (Note: Models P1-P4 require four housing bolts; Models P5-P7 require eight housing bolts. See photos below.)
- 16 Insert the *inner magnet key* (14) into the keyway of the *drive shaft* (2).
- 17 Align the keyway of the *inner magnet* (18) with the key on the *drive shaft* (2); then slide the inner magnet onto the drive shaft. (Note: The inner magnet should touch the step on the shaft.)
- 18 Lock the *inner magnet* (18) in place by installing the *retaining ring* (19) on the end of the *drive shaft* (2). (Note: Rotate the inner magnet by hand to ensure that the gears will rotate freely inside the housing.)
- 19 Insert the *containment can O-ring* (22) into the circular groove of the *front housing* (15).

**CAUTION! Do not reuse O-rings.**

- 20 Attach the *containment can* (20) to the *front housing* (15) using six *screws* (21). This completes the **pump cartridge** assembly.



**Models P1-P4, shown  
Close-Coupled to Motor**

**Models P5-P7, shown  
Close-Coupled to Motor**

**Part B: Cartridge-Pedestal Assembly**

- 21 Slide the **pump cartridge** into the *pedestal* (25) and bolt in place using four sets of *bolts* (26), *nuts* (27) and *lockwashers* (28).

**Part C: Outer Magnet Installation to Motor**

- 22 Insert the motor key into the keyway on the motor shaft and then apply a small amount of anti-seize compound to the motor shaft. Align the keyway of the *outer magnet hub* (23) with the key on the motor shaft and then slide the *outer magnet* (24) onto the shaft and position the hub as follows:
- a) For NEMA 56C and IEC 90 (B5 Flange) motors, the end of the motor shaft must be flush with the inner surface of the outer magnet's hub.
  - b) For NEMA 143/145TC motors, the end of the motor shaft must protrude 1/16 in. (1.6 mm) from the inner surface of the outer magnet's hub.
  - c) For IEC 71/80 (B5 Flange) motors, the outer magnet is positioned by a snap ring installed in the hub. The end of the motor shaft must contact the snap ring.
  - d) For NEMA 182/184TC motors, an **adapter plate** is required to mount the motor to the pedestal. The outer magnet is positioned by a snap ring installed in the hub. The end of the motor shaft must contact the snap ring. (Note: Complete pumps ordered for use with these motor frames will be supplied with the *adapter plate* (P/N SP0046) and *adapter mounting bolts* (P/N 641105).)
  - e) For IEC 100/112 (B5 Flange) motors, an **adapter plate** is required to mount the motor to the pedestal. The outer magnet is positioned by a snap ring installed in the hub. The end of the motor shaft must contact the snap ring. (Note: Complete pumps ordered for use with these motor frames will be supplied with the *adapter plate* (P/N SP0048) and *adapter mounting bolts* (P/N 781118).)

Once the outer magnet is in position, tighten the two *setscrews* (17) on the *hub* (23).

**Part D: Pump-Motor Assembly**

23

**CAUTION! Do not place hands or fingers between Pedestal and Motor C-faces. The Outer and Inner Magnets will suddenly pull together with significant force.**

Install the **motor-outer magnet** assembly to the **pedestal-cartridge** assembly using four *motor mounting bolts* (29). (Note: Align the outer and inner magnets when assembling. The motor and pedestal C-faces should mate freely and mount flush.)

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**END OF ASSEMBLY PROCEDURE**

**Section 6: Pump Parts List**

**Parts List for Poly-Guard® Series Pumps**

Item #	Part Description		Quantity
1 *	Idler Shaft		1
2 *	Drive Shaft		1
3 *	Idler Gear (Spur Type)		1
4 *	Drive Gear (Spur Type)		1
5 *	Retaining Ring, Gear	Models P1-P4: O-Ring, Size 2-013	4
		Models P5-P7: O-Ring, Size 2-017	
6 *	Bearing (Sleeve Type)		4
7 *	Pin, Bearing Lock		4
8 *	Wear Plate (Relieved Type)		4
9	Rear Housing		1
10 *	O-Ring, Housing	Models P1-P4: Size 2-037	2
		Models P5-P7: Size 2-043	
11 *	Pin, Housing Alignment		4
12	Center Housing, Flanged	Models P1-P4: 3/4" ANSI 150# or DN-20 PN16	1
		Models P5-P7: 1.5" ANSI 150# or DN-40 PN16	
13 *	Key, Gear		2
14 *	Key, Inner Magnet		1
15	Front Housing		1
16	Bolt, Housing	Models P1-P4: 5/16-18 X 2-1/2 SHCS	4
		Models P5-P7: 5/16-18 X 3-1/4 SHCS	8
17	Setscrew, Hub, Outer Magnet **		2
18	Inner Magnet (Assembly)		1
19 *	Retaining Ring, Inner Magnet	Models P1-P4: O-Ring, Size 2-012	1
		Models P5-P7: O-Ring, Size 2-013	
20	Containment Can		1
21	Screw, Containment Can (5/16-24 X 1/2 SHCS)		6
22 *	O-Ring, Containment Can (Size 2-042)		1
23	Hub, Outer Magnet **		1
24	Outer Magnet (Assembly)		1
25	Pedestal (Mounting Bracket)		1
26	Bolt, Front Housing	Models P1-P4: 3/8-16 X 1-1/4 SHCS	4
		Models P5-P7: 3/8-16 X 1-1/2 SHCS	
27	Nut, Front Housing (3/8-16)		4
28	Lockwasher, Front Housing (3/8)		4
29	Bolt, Motor Mounting (3/8-16 X 1 SHCS) ***		4

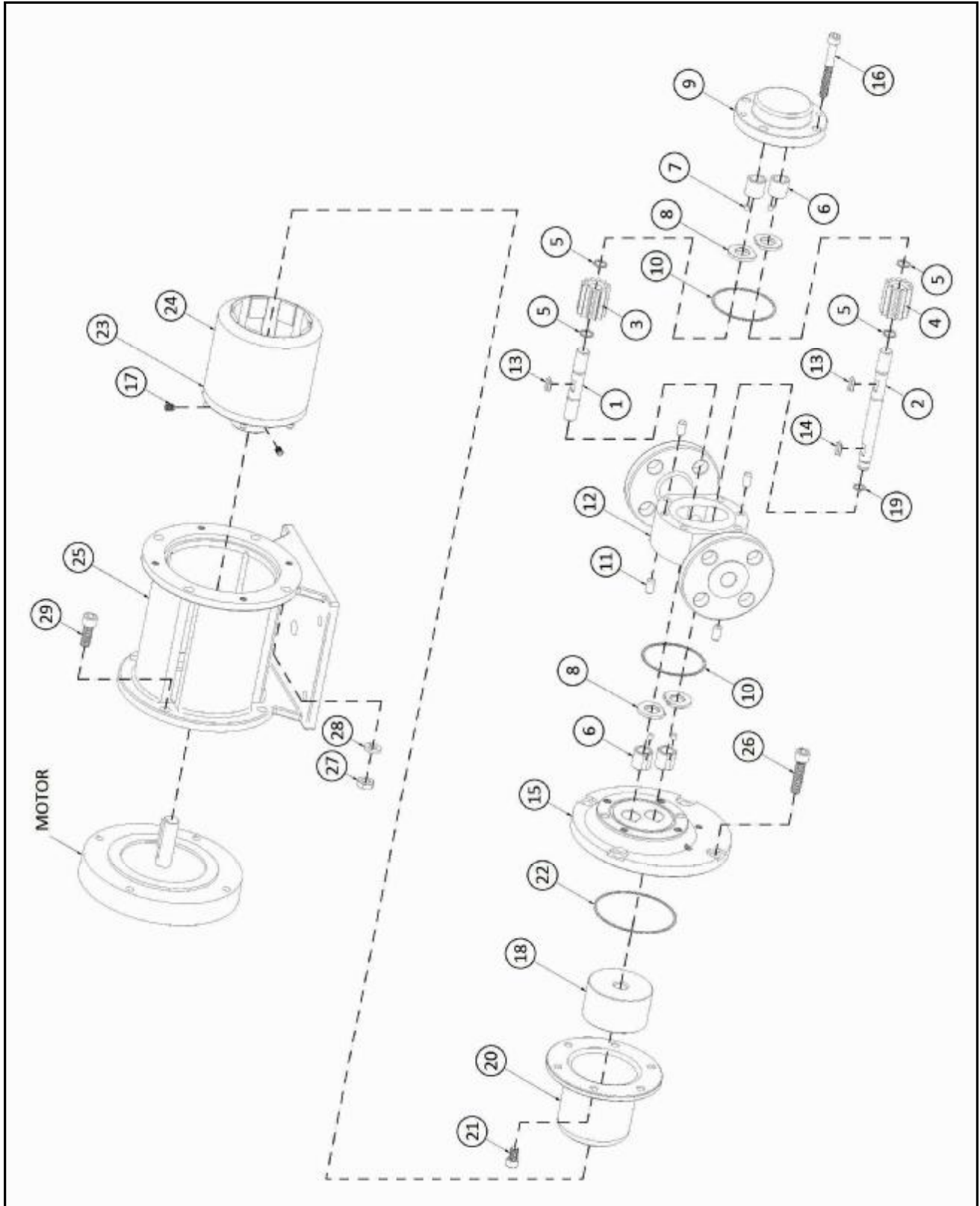
\* Item included in a standard Poly-Guard Series Repair Kit.

\*\* Included with Outer Magnet Assembly. \*\*\* For NEMA motor frames.

Note: Item Numbers above correspond to Exploded View Reference Drawing on following page.

**Section 7: Exploded View Reference Drawing**

**Poly-Guard® Series Mag-Drive Gear Pump – Models P1 thru P7**



**Section 8: Troubleshooting Guide**

**Troubleshooting Guide - Part 1**

<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Action</b>
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Clogged strainer	Clean strainer.
	Pump worn or damaged	Rebuild pump.
Insufficient discharge	Magnetic coupling has decoupled	Stop driver and check temperature and viscosity of fluid. Verify position of outer magnet. Consider stronger magnetic coupling.
	Suction pressure too low	Increase suction pressure. Verify suction piping is not too long. Fully open any suction valves.
	Bypass valve open	Close bypass valve.
	Partly clogged strainer	Clean strainer.
	Speed too low	Increase driver speed, if possible. Use larger size pump, if required.
Loss of suction after satisfactory operation	Pump worn or damaged	Rebuild pump.
	Pump not properly primed	Reprime pump.
	Air leaks in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Air or vapor pockets in suction line	Rearrange piping as necessary.
Excessive power consumption	Increase in fluid viscosity	Heat fluid to reduce viscosity. Reduce pump speed.
	Fluid viscosity higher than specified	Heat fluid to reduce viscosity. Reduce pump speed. Increase driver horsepower.
	Differential pressure greater than specified	Increase pipe diameter. Decrease pipe run.
	Gear clearances insufficient for fluid viscosity	Purchase gears trimmed for the correct viscosity.
	Plastic gear clearance insufficient for fluid temperature	Purchase plastic gear trimmed for the correct temperature.
Rotating parts binding or severely worn	Disassemble and replace worn parts.	

**Troubleshooting Guide - Part 2**

<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Action</b>
Rapid pump wear	Abrasives in fluid	Install suction strainer. Limit solids concentration. Reduce pump speed or use larger pump running at lower speed.
	Corrosion wear	Use materials of construction that are acceptable for fluid being pumped.
	Extended dry running	Install power sensor to stop pump.
	Discharge pressure too high	Increase pipe diameter. Decrease pipe run.
Excessive noise and vibration	Suction and/or discharge piping not anchored or properly supported	Anchor per Hydraulic Institute Standards.
	Base not rigid enough	Tighten hold-down bolts on pump and motor or adjust stilts. Inspect grout and regROUT if necessary.
	Worn pump bearings	Replace bearings.
	Worn motor bearings	Replace bearings or motor.
	Pump cavitation	Increase NPSH available.
Excessive product leakage	Static seal failure caused by chemical incompatibility or thermal breakdown	Use O-rings or gaskets made of material compatible with fluid and temperature of the application.
	Static seal failure caused by improper installation	Install O-rings or gaskets without twisting or bending. Use star-pattern torque sequence on housing bolts during assembly. Allow Teflon O-rings to cold flow and seat during tightening. Torque bolts to specification.
	Pump port connections not properly sealed	Use Teflon tape or other suitable sealant. Use gaskets compatible with fluid and temperature of the application.
	Crevice corrosion of pump housing material	Only pump chemicals that are compatible with the pump housing material. Decrease temperature to reduce corrosion rate to acceptable value. Flush idle pumps that are used to pump corrosive chemicals. Eliminate contaminants in the fluid that can accelerate corrosion wear.