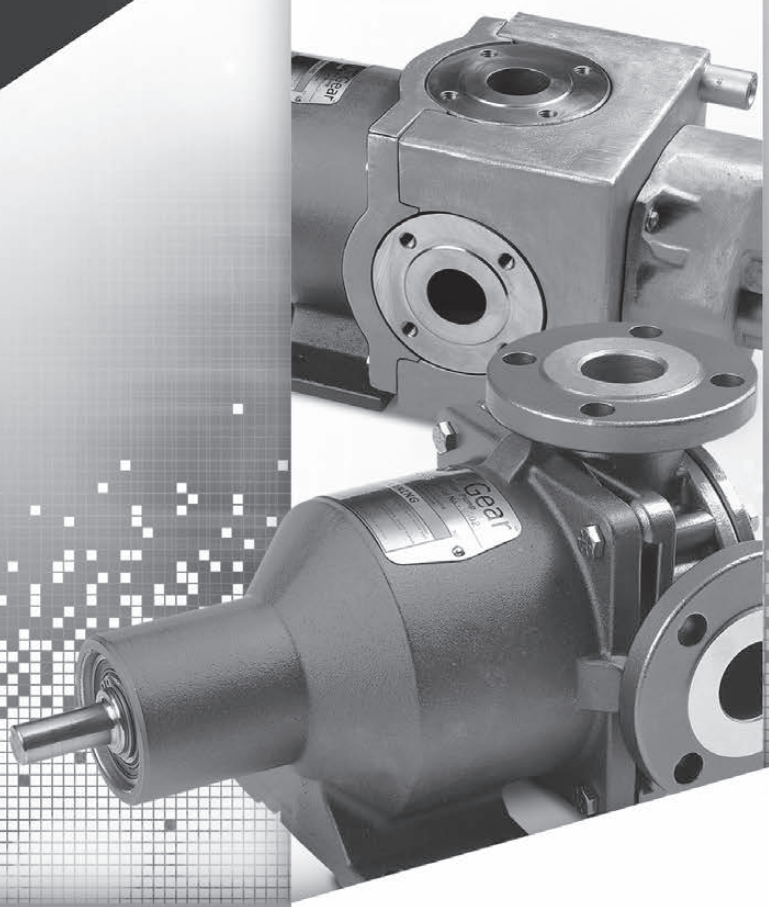
EnviroGear® PUMPS

IOM

Installation
Operation &
Maintenance

E Series

Seal-less Internal
Gear Pumps



Where Innovation Flows

envirogearpump.com

PSG®
a DOVER company

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WARNING: In any positive-displacement pump system, a reliable pressure-protection device must be used in the discharge piping to avoid a dangerous pressure increase, which could cause the pump or any component in the discharge piping to burst and can lead to serious injury. A pump-mounted integral relief valve is not intended to be used in this manner.

WARNING: This pump contains powerful permanent magnets that can cause serious injury. Read the appropriate section of this IOM before doing any service work.

WARNING: Magnetic field can disrupt medical implants such as pacemakers. Implant wearers should remain a minimum of 0.3 m (1 ft) away from pump and 1 m (3 ft) away from disassembled magnets.

Inner and Outer magnets strongly attract each other, which can create pinch points that crush and cut.

WARNING: Magnets inside the pump can damage electronic equipment or magnetic media.

WARNING: This pump is designed to rotate only in the direction indicated. Do not run the pump in the opposite direction for long periods because internal passageways that control axial thrust will not work correctly, causing premature wear and reduced pumping efficiency.

WARNING: The inner magnets on the back of the rotor assembly are strongly attracted to the outer magnets in the outer-drive assembly. During the separation process, there will be a strong force of up to 136 kg (300 lbs) trying to pull them back together, which can create a powerful pinch point.

To safely separate the rotor assembly from the outer-drive assembly, follow the instructions below and use the following equipment:

- Crane, hoist or other suitable lifting device capable of lifting at least 182 kg (400 lbs)
- Sturdy workbench that is positioned beneath the lifting device and is firmly anchored to the floor, or if unanchored, the workbench must weigh at least 182 kg (400 lbs), and be strong enough to resist a lifting force of up to 182 kg (400 lbs)
- Pump Disassembly Tool F-00096 or F-00097

WARNING: Carbon-graphite bushings are very brittle, therefore, they must be handled and assembled using great care.

- Always use an arbor during assembly to guide and align the bushings
- When pressing bushings, use a light lubricant
- When pressing bushings, always use a smooth, continuous motion – stopping with the bushing partially exposed can crack the bushing
- After assembly, always inspect the bushings closely for cracks

WARNING: You must press the bearing by its inner ring to avoid damaging it.

WARNING: Failure to have each magnet segment in opposite polarity with adjacent magnets will cause a significant reduction of coupling torque.

WARNING: Maximum temperature limits are based upon mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperatures. Consult Chemical Resistance Guide for chemical compatibility and temperature limits.

WARNING: Prevent static sparking. If static sparking occurs, fire or explosion could result. Pump, valves and containers must be grounded to a proper grounding point when handling flammable fluids and whenever discharge of static electricity is a hazard.

WARNING: Always wear safety glasses when operating pump.

WARNING: For applications requiring CE or ATEX, refer to the E Series Safety Supplement for addition cautions and warnings.

Always read the most current version of this manual before performing any work on or around this pump. The most current version of the manual is freely available on the web at www.envirogearpump.com.

EnviroGear pumps are specifically configured for your unique application conditions. Those application conditions and the details of the pump configuration were documented during the ordering process. Keep that information available in a safe place, as it may be needed when troubleshooting pump problems or when ordering spare parts or repairs.

EnviroGear pumps are covered by one or more of the following patents: U.S. Patent Nos. 7549205, 7137793, 7183683; Australian Patent No. AU2005233534B2; Korean Patent No. 10-2006-7023162; Mexican Patent No. PA/a/2006/011436; Russian Patent No. 2006138540/06(041952); and other patents pending.

EXAMPLE:

E1-69SA/2ART/TC6L/10/300

E1- MODEL	MATERIAL	CLEARANCE	/ PORTS	ORIENTATION	/ O-RINGS	BUSHINGS	MAGNETS	/ RELIEF VALVE	/ SHAFT	/ SPECIALTY CODE
2	C	A	1.5A	RT	V	C	6L	N	S	010
4	D	B	1.5B	LT	T	B	6M	05	V	050
24	S	C	1.5D	TR	S	H	6H	07	14	200
32		D	1.5N	TL	K6	T	7L	10	18	210
55		E	2A	RL			7M	12	21	300
69		F	2B	LR				15	25	301
82			2D					17		310
			2N					20		901
			3A							
			3D							
			4A							

MODELS:
2
4
24
32
55
69
82

MATERIALS:
C = CARBON STEEL
D = DUCTILE IRON
S = STAINLESS STEEL

CLEARANCES:
A = A [<100 cst, <149C]
B = B [100-5000 cst, <149C]
C = C [>5000 cst, <149C]
D = D [<100 cst, >149C]
E = E [100-5000 cst, >149C]
F = F [>5000 cst, >149C]

PORTS:
1.5A = 1.5" ANSI
1.5B = 1.5" BSPT
1.5D = DN40 (1.5") PN16
1.5N = 1.5" NPT
2A = 2" ANSI
2B = 2" BPST
2D = DN50 (2") PN16
2N = 2" NPT
3A = 3" ANSI
3D = DN80 (3") PN16
4A = 4" ANSI

ORIENTATION:
RT = Right suction, top discharge
LT = Left suction, top discharge
TR = Top suction, right discharge
TL = Top suction, left discharge
RL = Right suction, left discharge
LR = Left suction, right discharge

O-RINGS:
V = Viton®, DuPont Type "A"
T = FEP-encapsulated Viton®
S = PFA-encapsulated silicone
K6 = Kalrez® 6375

BUSHINGS:
C = Carbon-graphite bushings, standard spindle
B = Bronze bushings, standard spindle
H = Carbon-graphite bushings, harden chrome-plated 17-4PH spindle
T = Tungsten-carbide bushings with surface-hardened 4140 spindle
R = Resin-impregnated carbon-graphite bushings, standard spindle

MAGNETS:
6L = M6L standard strength/standard temp [<149C]
6M = M6M standard strength/medium temp [<190C]
6H = M6H standard strength/high temp [<260C]
7L = M7L high strength/standard temp
7M = M7M high strength/medium temp

RELIEF VALVE:
N = NO RELIEF VALVE
05 = Cracks at 50 +/-10 psi delta P
07 = Cracks at 75 +/-10 psi delta P
10 = Cracks at 100 +/-10 psi delta P
12 = Cracks at 125 +/-10 psi delta P
15 = Cracks at 150 +/-10 psi delta P
17 = Cracks at 175 +/-10 psi delta P
20 = Cracks at 200 +/-10 psi delta P

SHAFT:
S = Standard shaft (no optional shaft selected)
V = Smaller shaft (matches mtg dims of Viking L/LQ/LL)
14 = Close Coupled 140TC NEMA
18 = Close Coupled 180TC NEMA
21 = Close Coupled 210TC NEMA
25 = Close Coupled 250TC NEMA

SPECIALTY CODE:
Blank unless required
010 = RTD temperature probe unit w/4-20 mA transmitter (EnviroGear P/N: HW191)
050 = Vented and crimped sleeve (hot-oil applications)
070 = FDA-compliant build flow-path
200 = Reverse cooling flow-path modification (custom head, spindle and bushing, block both ports)
210 = External flush option
300 = Jacketed head
301 = Jacketed head, custom shaft Lg 2.13 (SH17)
310 = Full thermal jacket
901 = SS case substituted for CS

Models Available

Table 2.1 – Ductile Iron

Ductile-Iron Model	Std. Port Size	CAPACITY		MAX. PUMP SPEED	NOMINAL FLOW RATE AT MAX. SPEED		PUMP WEIGHT	
		(mL/rev)	(in^3/rev)	(rpm)	(lpm)	(gpm)	(kg)	(lbs)
E1-24-DI	2" NPT, 2" BSPT, 2" ANSI 150# RF	398	24	780	284	75	69	152
E1-32-DI	2" NPT, 2" BSPT, 2" ANSI 150# RF	534	32	780	379	100	69	152
E1-55-DI	3" ANSI150# RF	900	55	640	512	135	139	307
E1-69-DI	3" ANSI 150# RF	1126	69	640	644	170	139	307
E1-82-DI	3" ANSI 150# RF	1350	82	640	758	200	139	307

Maximum Differential Pressure = 13.8 bar (200 psi)

Table 2.2 – Carbon Steel

Carbon-Steel Model	Std. Port Size	CAPACITY		MAX. PUMP SPEED	NOMINAL FLOW RATE AT MAX. SPEED		PUMP WEIGHT	
		(mL/rev)	(in^3/rev)	(rpm)	(lpm)	(gpm)	(kg)	(lbs)
E1-2-CS	1-1/2" NPT, 1-1/2" BSPT, 1-1/2" ANSI 150# RF, DN40 PN16 RF	36	2	1800	57	15	24	53
E1-4-CS	1-1/2" NPT, 1-1/2" BSPT, 1-1/2" ANSI 150# RF, DN40 PN16 RF	71	4	1800	114	30	24	53
E1-24-CS	2" NPT, 2" BSPT, 2" ANSI 150# RF, DN50 PN16 RF	398	24	780	284	75	69	152
E1-32-CS	2" NPT, 2" BSPT, 2" ANSI 150# RF, DN50 PN16 RF	534	32	780	379	100	69	152
E1-55-CS	3" ANSI 150# RF, DN80 PN16 RF	900	55	640	512	135	139	307
E1-69-CS	3" ANSI 150# RF, DN80 PN16 RF	1126	69	640	644	170	139	307
E1-82-CS	3" ANSI 150# RF, DN80 PN16 RF	1350	82	640	758	200	139	307

Maximum Differential Pressure = 13.8 bar (200 psi)

Table 2.3 – Stainless Steel

Stainless-Steel Model	Std. Port Size	CAPACITY		MAX. PUMP SPEED	NOMINAL FLOW RATE AT MAX. SPEED		PUMP WEIGHT	
		(mL/rev)	(in^3/rev)	(rpm)	(lpm)	(gpm)	(kg)	(lbs)
E1-2-SS	1-1/2" NPT, 1-1/2" BSPT, 1-1/2" ANSI 150# RF, DN40 PN16 RF	36	2	1200	38	10	24	53
E1-4-SS	1-1/2" NPT, 1-1/2" BSPT, 1-1/2" ANSI 150# RF, DN40 PN16 RF	71	4	1200	76	20	24	53
E1-24-SS	2" NPT, 2" BSPT, 2" ANSI 150# RF, DN50 PN16 RF	398	24	640	208	55	69	152
E1-32-SS	2" NPT, 2" BSPT, 2" ANSI 150# RF, DN50 PN16 RF	534	32	640	303	80	69	152
E1-55-SS	3" ANSI 150# RF, DN80 PN16 RF	900	55	520	417	110	139	307
E1-69-SS	3" ANSI 150# RF, DN80 PN16 RF	1126	69	520	531	140	139	307
E1-82-SS	3" ANSI 150# RF, DN80 PN16 RF	1350	82	520	606	160	139	307

Maximum Differential Pressure = 13.8 bar (200 psi)

NOTES:

1. Recommended pump speeds may be lower than the maximum shown in Tables 2.1, 2.2 and 2.3, based on specific application conditions.
2. Pump weights shown in Tables 2.1 and 2.2 are based on standard pumps with a relief valve. This weight will vary, depending on specific pump options.
3. EnviroGear will supply more specific flow-rate values for your application conditions upon request.

Temperature Ratings

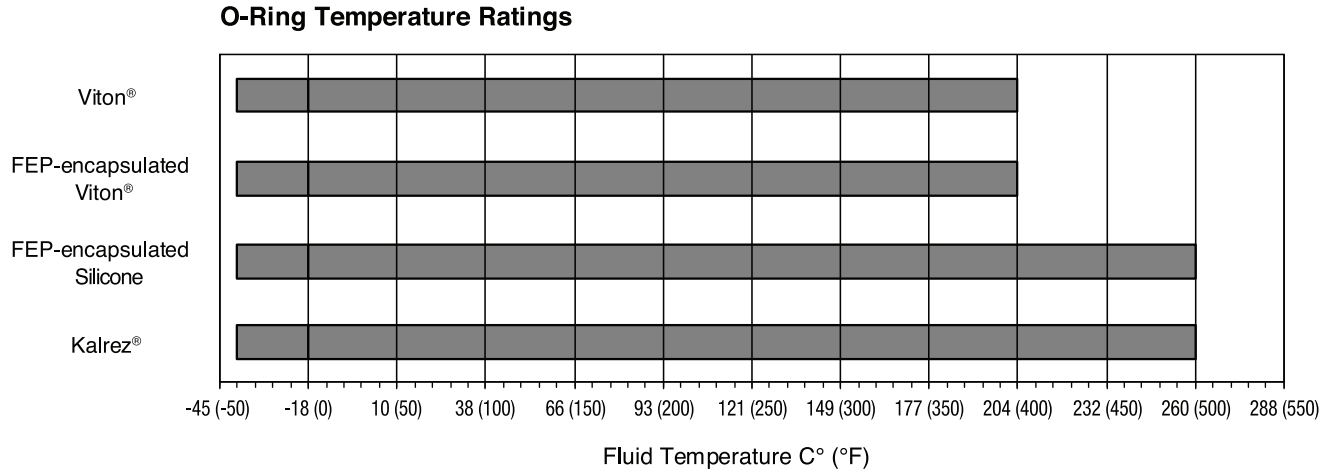


Table 2.4 – O-Ring Temperature Ratings

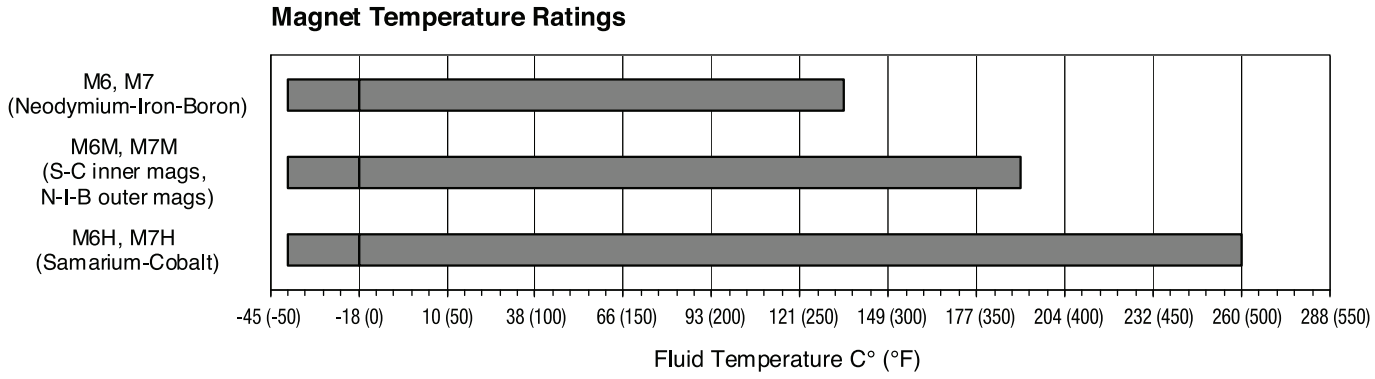


Table 2.5 – Magnet Temperature Ratings

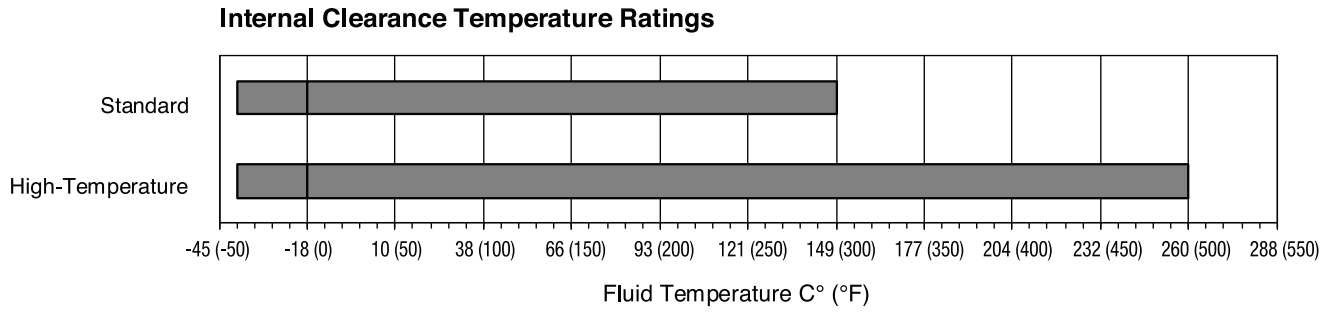


Table 2.6 – Internal Clearance Temperature Ratings

Magnetic-Coupling Strengths

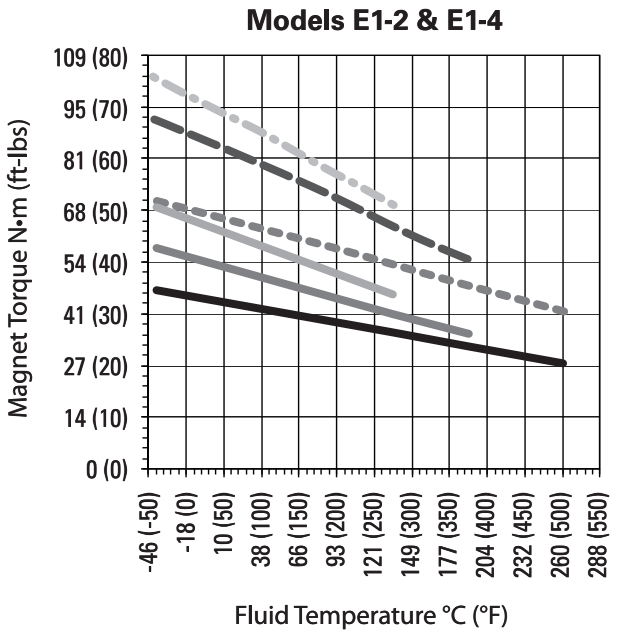


Table 2.7 – E1-2 & E1-4
Magnetic-Coupling Strength

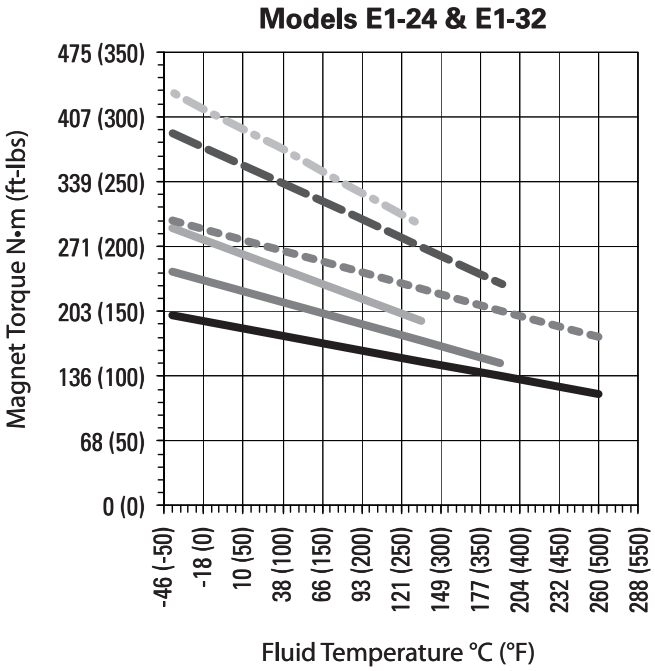


Table 2.8 – E1-24 & E1-32
Magnetic-Coupling Strength

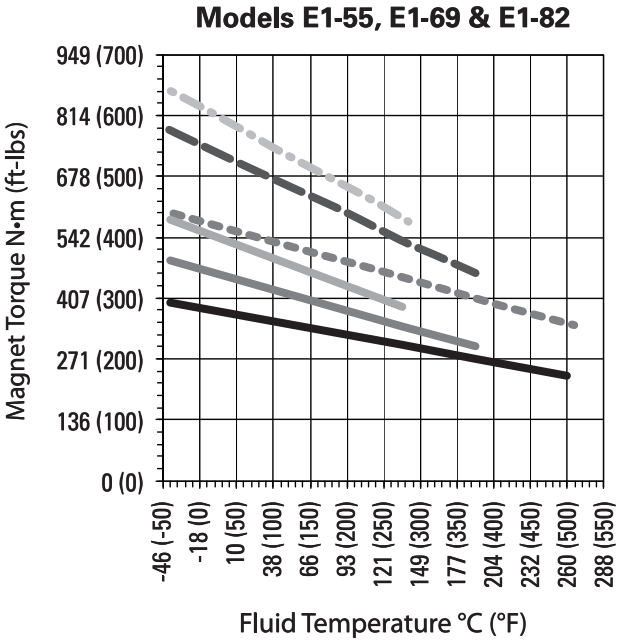
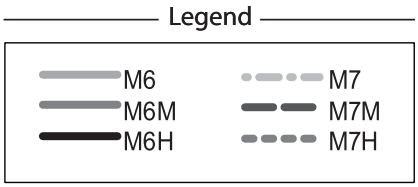


Table 2.9 – E1-55, E1-69 & E1-82
Magnetic-Coupling Strength



Relief Valve Performance

Optional integral relief valves provide pump protection from over-pressure conditions. While not intended for continuous use, internal relief valves protect the pump from closed discharge valves or other intermittent over-pressurization of the system. The E Series design is spring-loaded and contains only three parts. It addresses the problem of over-pressurization by "cracking" (where the poppet lifts off the seat) at the nominal pressure-relief setting, allowing pumped fluid to recirculate internally from the discharge side back to the suction side.

NOTE: The pump-mounted integral relief valve should never be relied upon for system protection.

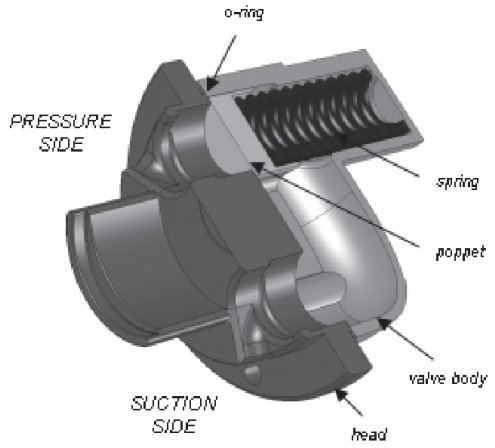


Figure 2.1 – Relief Valve

In order to maintain the integrity of the relief valve setting, the E Series relief valve is not adjusted by means of an external jack screw. Rather, seven relief valve settings are fixed at the factory and adjusted by changing the poppet and spring combinations.

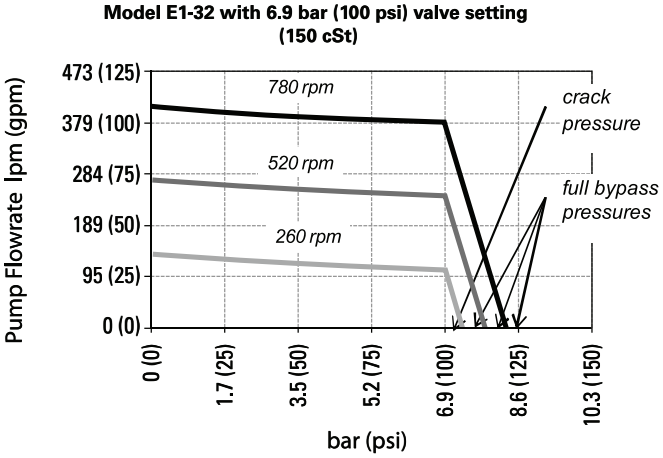


Table 2.10 – Relief Valve Performance

Available relief-valve settings (crack pressure):

- 3.4 bar (50 psi)
- 5.2 bar (75 psi)
- 6.9 bar (100 psi)
- 8.6 bar (125 psi)
- 10.3 bar (150 psi)
- 12.1 bar (175 psi)
- 13.8 bar (200 psi)

To properly size the integral relief valve, it is important to understand the difference between ***crack pressure*** and ***full bypass pressure***.

Crack pressure is the pressure at which the poppet just begins to lift off the seat. This pressure is not affected by variations in fluid viscosity or pump speed. The pump will provide full flow rate at all pressures below the cracking pressure. See Figure 2.1.

Full bypass pressure is the pressure that occurs when 100% of the pump's flow rate is bypassing internally through the valve and no flow is exiting the pump. See Table 2.10.

Internal Cooling Circuit

This pump has an internal cooling circuit that circulates some of the pumped fluid through the magnet chamber. The circuit starts at the discharge port and ends at the suction port. This circuit has three functions:

- Cool the inner magnets
- Keep fluid in the magnet area from becoming stagnant
- Lubricate and cool the rotor and idler bushings

NOTE: Consult factory at low differential pressures to ensure proper cooling-path circulation.

There are special plugs in the casing and head that must be in the correct position to complete the circuit:

1. The casing needs to be vented on the DISCHARGE side. In some cases, this is done with an orifice plug that has a hole in it, positioned in the casing hole behind the DISCHARGE port. In other cases, this is done by leaving the casing hole behind the DISCHARGE port open.
2. The casing block-off plug is solid (no hole). It belongs in the casing hole behind the SUCTION port.
3. The head block-off plug is solid (no hole). It is only used in pumps that have no relief valve, and it belongs in the head hole on the DISCHARGE side.

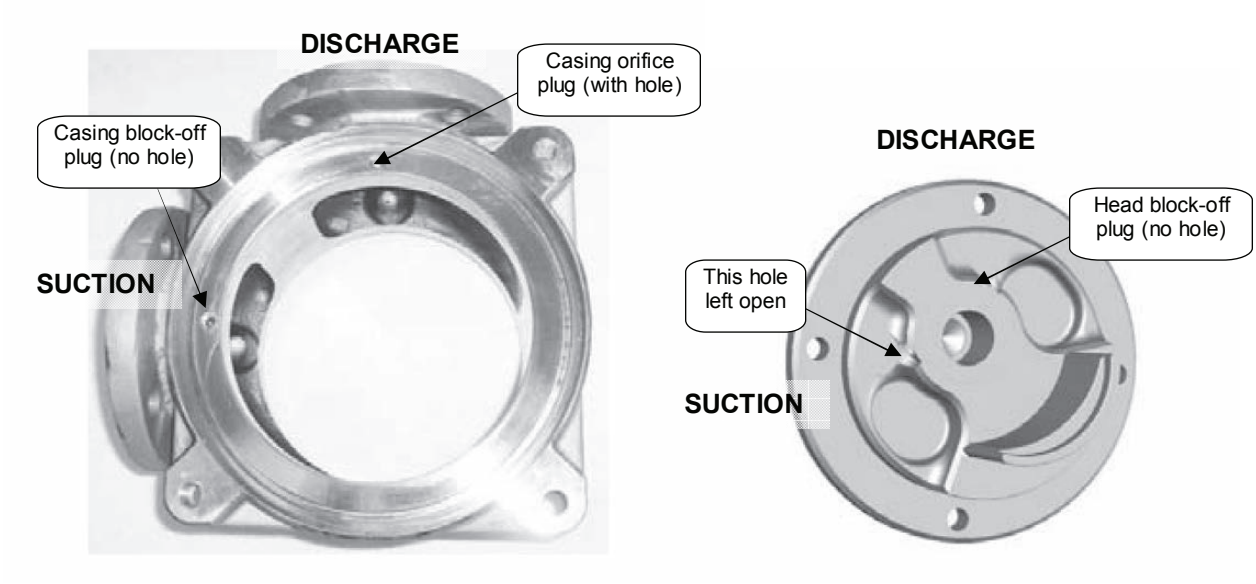


Figure 2.2 – Special Cooling Circuit Plugs in Correct Positions

Pump Location

It is always best to minimize suction-line losses, so the best location for any pump is as close as practical to the liquid supply source. Also, it is best to locate the pump below the liquid supply, if practical, to maximize inlet pressure to the pump. A proper location should leave enough room around the pump to allow for inspection or repair of the pump without removing it from the foundation.

Pump Foundation

With any pump, a rigid foundation is essential for optimal reliability and durability. Always mount the pump on a foundation that is rigid enough to keep the pump from moving during operation or in the event of any stress or impact that may occur during the life of the pump. Please contact EnviroGear for more information on premium EnviroBase® baseplates.

Pressure Relief

This is a positive-displacement pump. As such, for each shaft revolution, it will move a specific volume of fluid from the suction side to the discharge side. If the discharge line is severely restricted or blocked, a dangerous increase in pressure and drive torque will occur rapidly between the discharge port and the restriction, which will lead to one or more of the following events:

- The pipe or other discharge-line components burst
- The drive stalls
- The pump's inner and outer magnets decouple
- A pump component breaks

A reliable pressure-protection device must be used in the discharge piping with any positive-displacement pump. It should be located as close as possible to the discharge port of the pump. Several common devices are:

- External relief valve
- Rupture disc
- Pressure regulator
- Pressure switch that stops the pump driver

Torque-limiting devices cannot react precisely to discharge pressure and therefore must not be used as the primary pressure-protection device.

NOTE: The pump-mounted integral relief valve should never be relied upon for system protection.

Rotation and Port Orientation

The pump is configured in one of the ten (10) possible orientations shown in Table 3.1 and it has labels on it that indicates direction of rotation, suction port and discharge port.

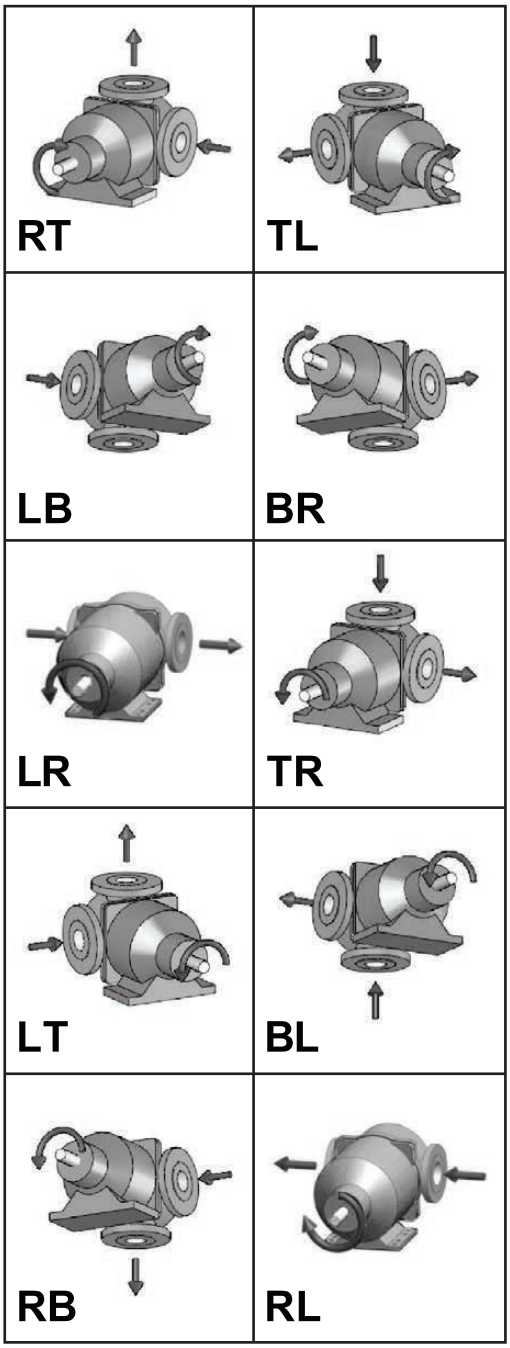


Table 3.1

Piping

Excessive pipe stress can cause reduced pump durability and reliability by affecting shaft alignment and/or distorting pump components. Isolate the pump from any pipe stress. There are several ways to help isolate the pipe stress:

- Properly support all piping with suitable pipe hangers or supports, not with the pump
- Install flexible lines near the pump
- If the pumped liquid will be hot, be sure to calculate pipe expansion and provide provisions for it

All discharge piping components must be designed to safely handle the maximum system pressure.

Make sure all piping and other components are clean prior to installation.

A reliable pressure-protection device must be used in the discharge piping with this positive-displacement pump. See the Pressure Relief section for more details.

Pressure gauges are valuable tools for troubleshooting pump-related problems. Install gauges near both pump ports (some pumps have gauge ports for this purpose). Also, install gauges on both sides of high-restriction components, such as filters, heat exchangers or flow meters. Remember that it is easier to include gauges when the piping is first installed than to add gauges later.

Suction Piping

The suction piping must be able to supply liquid to the pump at the desired flow rate with sufficient pressure at the pump to avoid cavitation. To ensure this, calculate the NPSHa (available) for the suction-piping design and compare it to the NPSHr (required) value for the pump—the piping NPSHa must be greater than the pump NPSHr to avoid cavitation. In order to maximize suction piping NPSHa:

1. Locate the pump below the liquid supply.
2. Keep the suction piping short.
3. Use large-diameter piping. The difference in pipe friction between small and large pipe sizes can be dramatic, especially for high viscosities.
4. Avoid high-restriction components, such as filters, heat exchangers or flow meters. Install these components in the discharge piping instead.
5. Be sure to consider the full range of operating conditions, especially the highest viscosity conditions. Changes in viscosity can have a dramatic effect on pipe friction.

If the suction piping requires a long run and a rise (pump is higher than the liquid level at the supply), it is best to keep most of the run at the lower level and position the rise as close to the pump as possible. This allows gravity to fill most of the piping.

If the suction piping must detour around an obstacle, it is best to go around the obstacle rather than over it. This lowers the vacuum needed for priming.

If your suction has a lift and it can drain back to the supply between runs, consider using a foot valve or check valve. This will keep the suction line filled between runs and ease priming. However, be sure the valve is large enough that it doesn't cause excessive restriction (lowers NPSHa).

Consider using a strainer to protect the pump from any contaminant particles that could be present in the liquid. Be sure the strainer is properly sized so it doesn't cause excessive restriction (lowers NPSHa).

Be sure the suction piping is airtight. Air leakage into the suction line can cause low flow, noise (similar to cavitation) and priming problems.

Shaft Alignment

Accurate alignment of the pump shaft and driver shaft is essential for optimal reliability and durability. Misalignment causes vibrations that reduce the life of the bearings in both the pump and driver, and the life of the couplings. Final shaft alignment must be done AFTER the following events, since both of them can change the alignment:

- Mounting and grouting of the foundation
- Assembly of the piping

Use of precision alignment equipment (such as lasers or dial indicators) is strongly recommended. Checking the alignment using a straight-edge on the couplings is inaccurate and not recommended.

For pumps that will operate at elevated temperature, the alignment at room temperature will change as the pump warms. Be sure to measure or calculate this effect and adjust the alignment, so that it is accurate at operating temperature.

Pump Condition Monitoring

There are several pump conditions that can be monitored.

- **Canister Temperature:** Heat is generated in the canister when the pump is running because of moving magnetic fields that pass through it. The pump has an internal cooling path that pulls heat away from the canister. If this cooling path is obstructed, the canister and magnet could become very hot, which could damage the magnets and/or canister O-ring.
- The canister temperature can be monitored with a temperature probe attached to the access port in the magnet housing near the casing.
- **Bearing Vibration:** The pump shaft is supported by rolling-element bearings. The condition of the bearings can be monitored with a vibration sensor attached to the magnet housing near the bearings. See Figure 3.1.
- **Pumping Chamber Vibration:** The pumping gears rotate with the casing and are supported by journal bushings. The condition of the gears and bushings can be monitored with a vibration sensor attached to the pump head. See Figure 3.2.

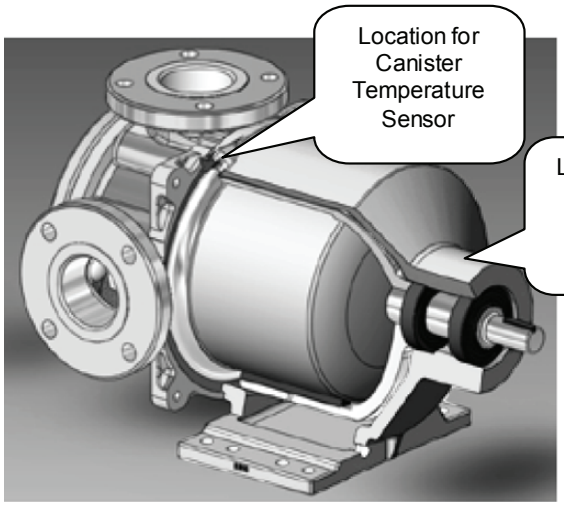


Figure 3.1 – Optional Sensor Locations

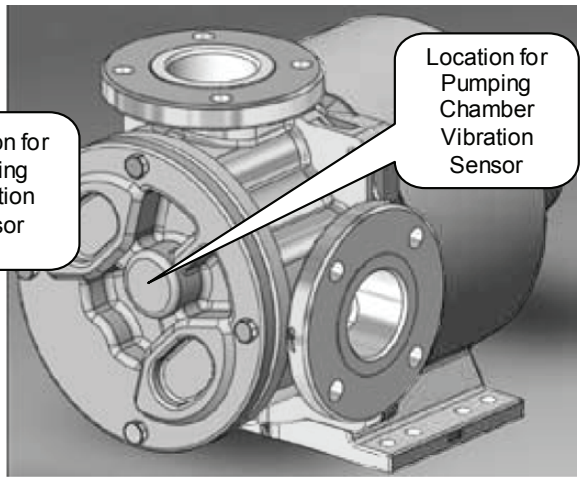


Figure 3.2 – Optional Sensor Locations

Startup

Prior to starting the pump, please perform the following steps:

1. Thoroughly clean the pump, pipes and other components. **NOTE:** In most cases, the pump is shipped clean of any contaminants, except for a thin layer of lubricant on the spindle and bushing surfaces. In some other cases, the pump will contain residual petroleum oil from factory testing. EnviroGear can provide more details for your specific pump upon request.
2. Verify that the piping components are all tightened and in their final position.
3. Ensure the pressure-relief device is installed and working correctly.
4. Verify that the shaft alignment is correct (see ***Shaft Alignment*** section).
5. Verify that the pump freely turns by hand.
6. Verify that the driver rotates the pump shaft in the correct direction.
7. Open or close all valves in the suction piping to ensure that liquid will reach the pump.
8. Open or close all valves in the discharge piping to ensure that liquid will reach the intended location.
9. If the suction is not flooded, add a small volume of compatible liquid into the pump. This will improve the priming ability and lubricate the pump during a dry startup.
10. Verify that all guards and other safety equipment are installed and working correctly.
11. If the driver includes a gearbox, check the manual from the gearbox manufacturer to confirm that the lubricant is at the proper level, and for any additional startup procedure related to the gearbox.

Start the pump.

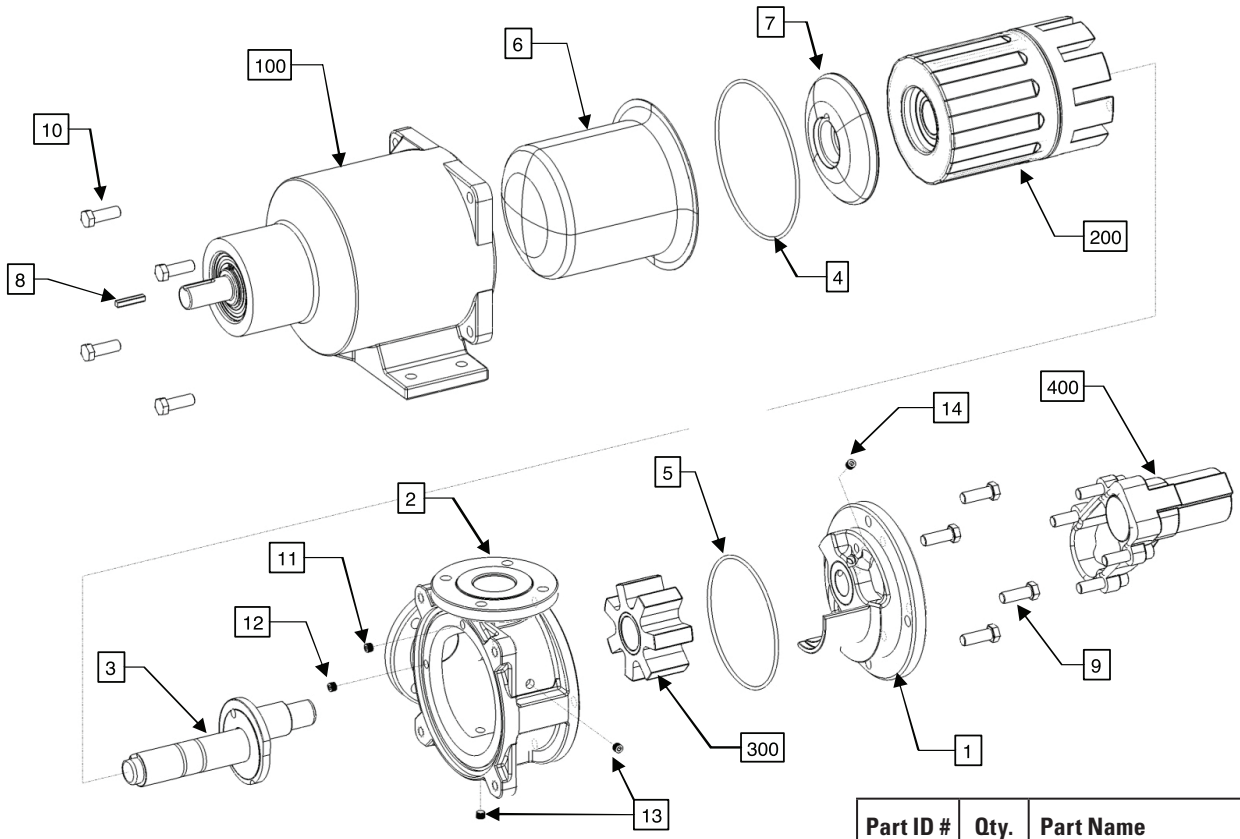
Once started, check the following:

- Pump is moving liquid. If the pump isn't moving liquid within 60 seconds, stop the pump. See ***Troubleshooting*** section to help solve the problems.
- Leaks in the piping. If there are leaks in the piping, stop the pump and fix the leaks.
- Unusual noises or vibrations. If there are unusual noises or vibrations, stop the pump. See ***Troubleshooting*** section to help solve the problems.
- Pump performance is as expected (such as flow rate and pressure). If the pump performance is not as expected, see ***Troubleshooting*** section to help solve the problems.

Repair Parts

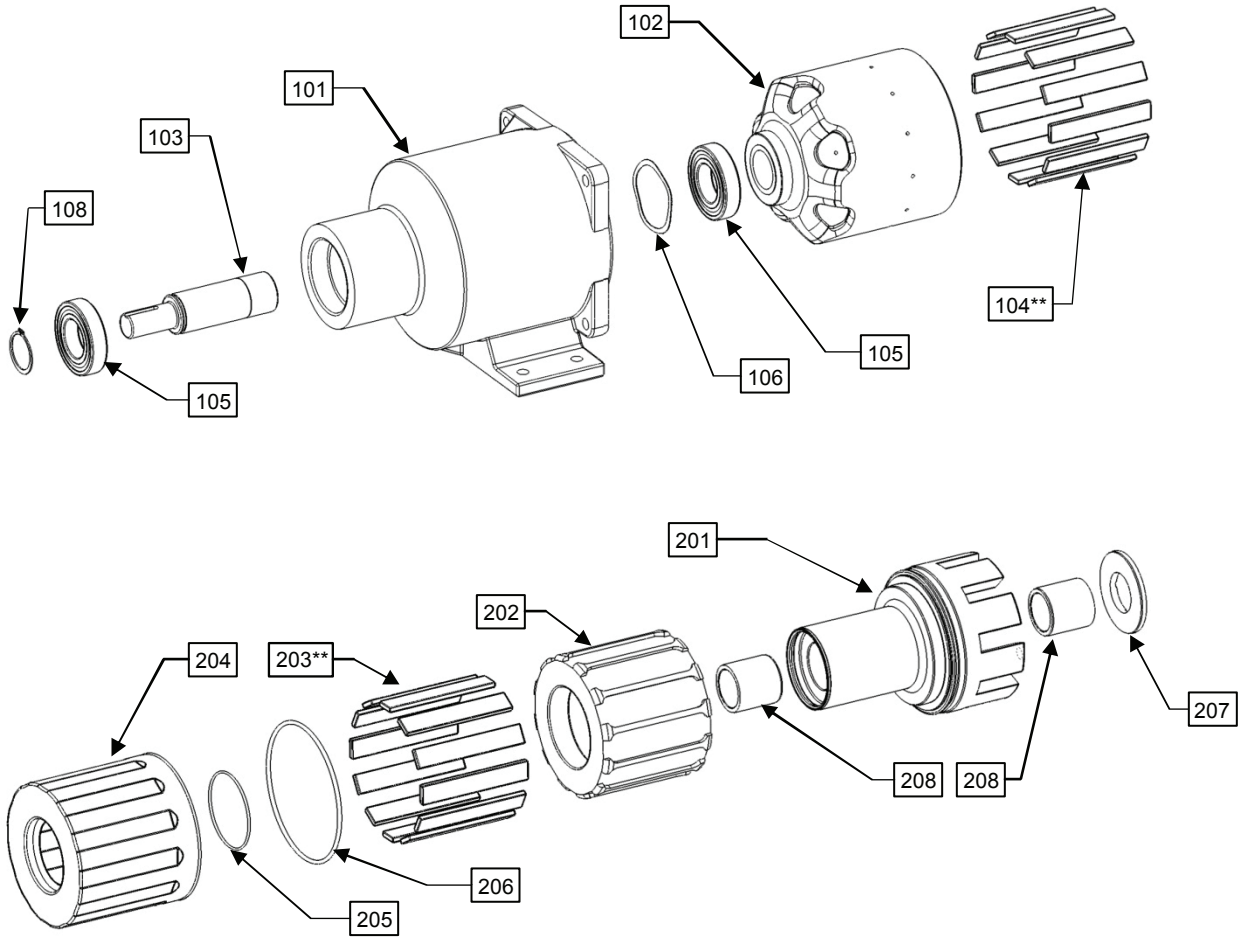
The parts used in this pump are designed and manufactured with exacting tolerances, material specifications and production techniques. Always use authentic repair parts supplied by EnviroGear or its authorized selling partners. Use of any other parts may void the pump's warranty.

This E Series pump was specifically configured for your unique application conditions. EnviroGear can supply a detailed bill of material that includes the part numbers for your specific pump configuration (identified by serial number). Use these part numbers when ordering repair parts.



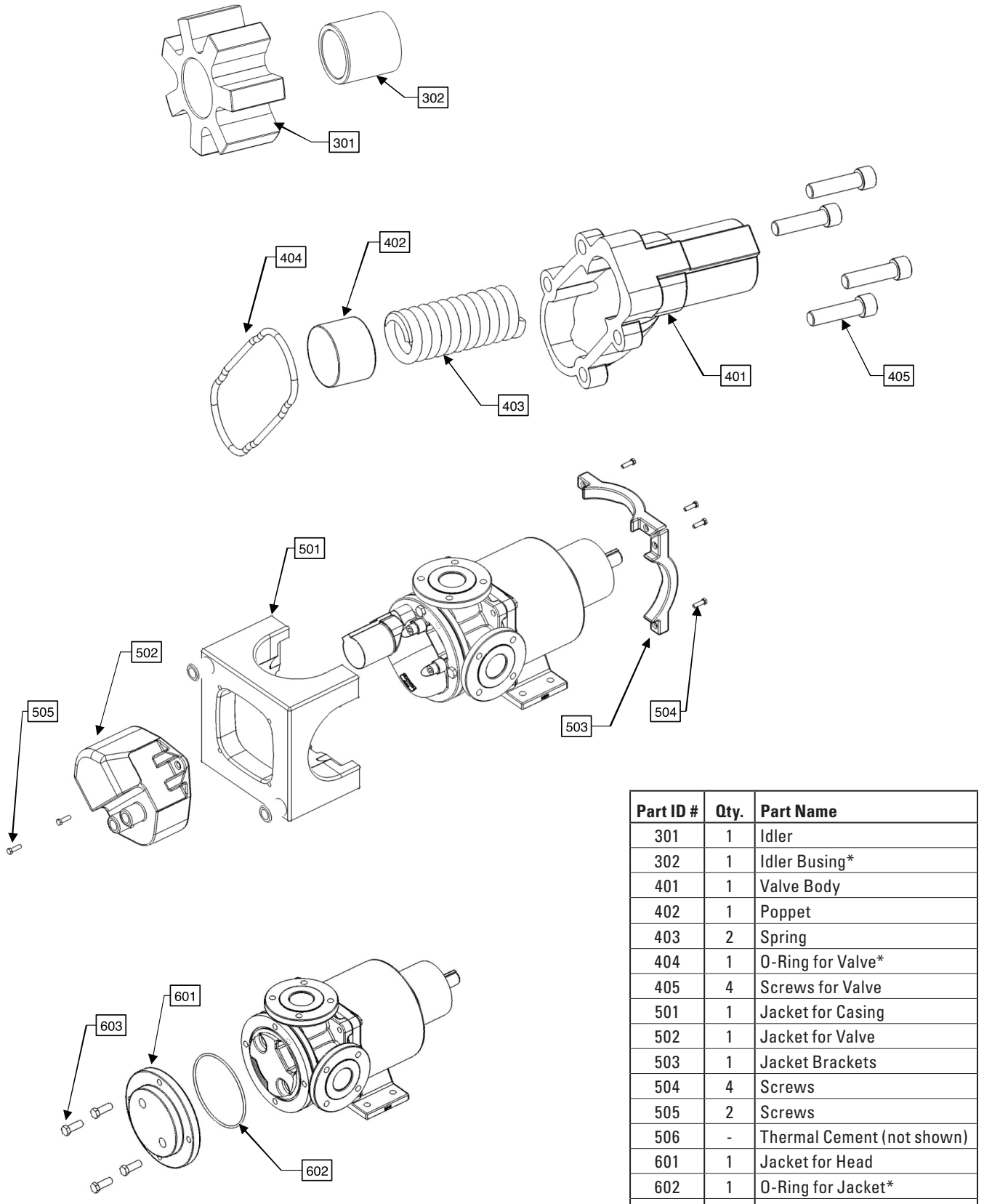
Part ID #	Qty.	Part Name
1	1	Head
2	1	Casing
3	1	Spindle
4	1	O-Ring for Canister*
5	1	O-Ring for Head*
6	1	Canister
7	1	Support Plate
8	1	Key
9	4	Bolts for Head
10	4	Bolts for Outer Drive
11	1	Orifice Plug
12	1	Plug for Casing
13	2	Plugs for Vent/Drain
14	1	Plug for Head
100	1	Outer Drive Assembly
200	1	Rotor Assembly
300	1	Idler Assembly
400	1	Relief Valve Assembly

*Recommended spares.



Part ID #	Qty.	Part Name
101	**1**	**Magnet Housing**
102	1	Outer Ring
103	1	Shaft
104	**	Magnet Segment
105	2	Ball Bearing
106	1	Wave Spring
107	-	Adhesive (not shown)
108	1	Retaining Ring
201	1	Rotor
202	1	Inner Ring
203	****	**Magnet Segment**
204	**1**	**Sleeve**
205	**1**	**O-Ring for back of sleeve**
206	1	O-Ring for front of sleeve
207*	1	Thrust Bushing
208*	2	Radial Rotor Bushing

*Recommended spares.
**Magnet quantities may vary depending on pump configuration.



Part ID #	Qty.	Part Name
301	1	Idler
302	1	Idler Busing*
401	1	Valve Body
402	1	Poppet
403	2	Spring
404	1	O-Ring for Valve*
405	4	Screws for Valve
501	1	Jacket for Casing
502	1	Jacket for Valve
503	1	Jacket Brackets
504	4	Screws
505	2	Screws
506	-	Thermal Cement (not shown)
601	1	Jacket for Head
602	1	O-Ring for Jacket*
603	4	Screw for Jacket

*Recommended spares.

Changing Port Orientation Only

(Shaft Rotation Unchanged)

The following instructions apply for changes when the direction of shaft rotation will not change, such as changing from RT to TL. Since the shaft rotation is unchanged, the discharge and suction positions relative to the casing and head will not change and, therefore, the cooling circuit plugs will not be moved. See ***Internal Cooling Circuit*** in Section 2.

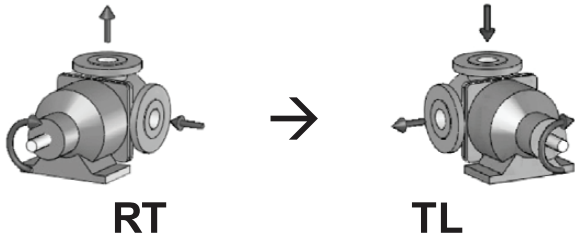


Figure 5.1 – Port Orientation Change When Shaft Rotation Does Not Change

If the pump is equipped with a relief valve, disassemble the relief valve per the instructions in Section 7, ***Pump Disassembly & Repair Processes***. For models E1-24, E1-32, E1-55, E1-69 or E1-82, the relief valve does not need to be disassembled; leave the relief valve attached to the head.

Disassemble the pumping chamber per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.

Assemble pumping chamber in the new orientation per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.

If the pump is equipped with a relief valve, assemble relief valve per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.

Changing Port Orientation and Shaft Rotation

The following instructions apply for changes when the direction of shaft rotation will change, such as changing from RT to LT. Since the shaft rotation will change, the discharge and suction positions relative to the casing and head will also change and, therefore, the cooling circuit plugs will be moved. See ***Internal Cooling Circuit*** in Section 2.

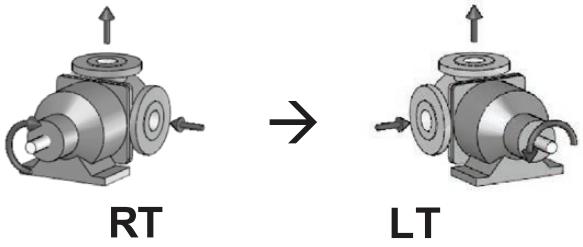


Figure 5.2 – Port Orientation Change When Shaft Rotation Changes

1. If the pump is equipped with a relief valve, disassemble the relief valve per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.
2. Disassemble pumping chamber per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.
3. Remove the casing orifice plug (11) (not found on all configurations) and casing block-off plug (12).
4. Install the casing orifice (if required) plug behind the DISCHARGE port.
5. If the pump is not equipped with a relief valve, remove the head block-off plug (14) and move it to the DISCHARGE side.

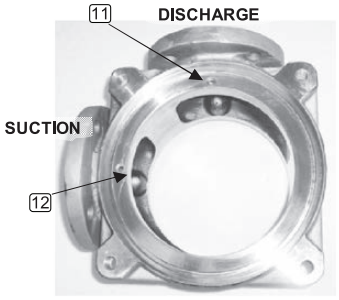


Figure 5.3 – Casing Plugs

6. Assemble pumping chamber in the new orientation per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.
7. If the pump is equipped with a relief valve, assemble relief valve in the new orientation per instructions in Section 7, ***Pump Disassembly & Repair Processes***.

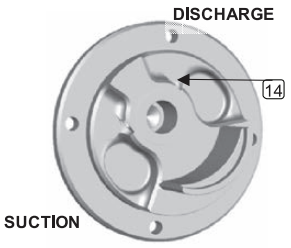


Figure 5.4 – Head Block-Off Plug

Changing Relief Valve Pressure Setting

In order to maintain the integrity of the relief valve setting, the E Series- relief valve is not externally adjustable. Instead, the setting is adjusted by changing the poppet and spring.

1. Obtain a new poppet and spring for the desired relief-valve setting.
2. Disassemble relief valve per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.
3. Reassemble the relief valve using the new poppet and spring per the instructions in Section 7, ***Pump Disassembly & Repair Processes***.

Relief Valve Disassembly

1. Remove the screws (405) that hold the valve body (401) to the head (1). It is normal for the valve spring (403) to push the valve body away from the head during this step; spring must be fully relaxed before the screws are fully removed.
2. Remove the valve body, spring, poppet and O-ring (404).

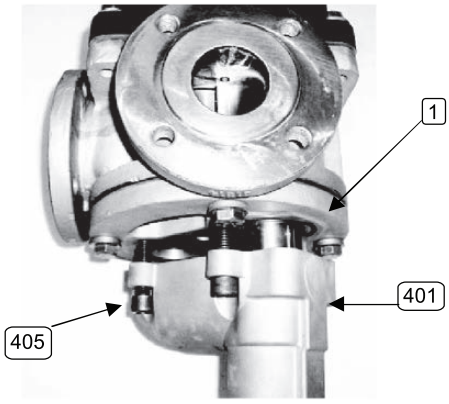


Figure 6.1 – Remove Valve Body

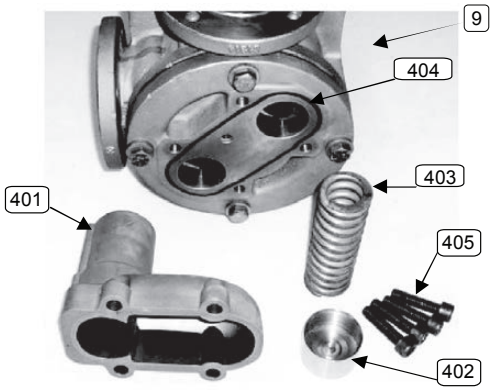


Figure 6.2 – Disassemble Valve Body

Pumping Chamber Disassembly

1. Remove the screws (9) that hold the head (1) to the casing (2).
2. Remove the head.

NOTE: When the head or spindle is removed, the pump will be difficult to turn by hand.

3. Remove the head O-ring (5) from the head.
4. Remove the idler assembly (300) by sliding it off the spindle (3).
5. Pull the spindle out of the rotor assembly (200).
6. Remove the screws (10) that hold the outer drive assembly (100) to the casing.
7. Separate the casing and outer drive assembly.
8. Remove the canister O-ring (4) from its groove in the casing.

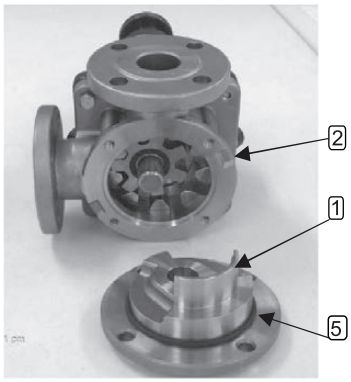


Figure 6.3 – Remove Head

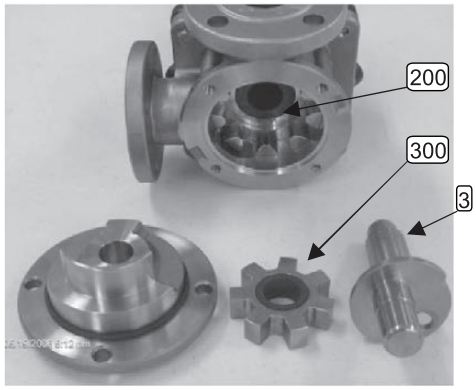


Figure 6.4 – Remove Idler and Spindle

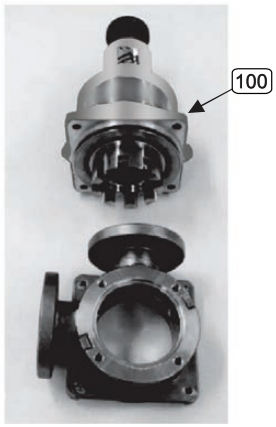


Figure 6.5 – Remove Casing

Remove Rotor Assembly from Outer Drive Assembly

(Models E1-2 & E1-4)

1. Use tool F-00097 to firmly grab the rotor assembly (200) in the bushing bore area.

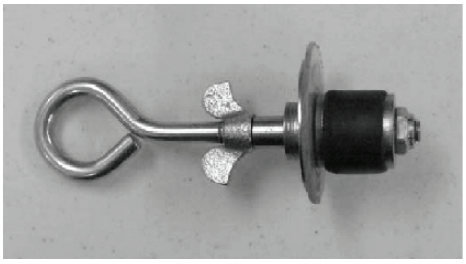


Figure 6.6 – Pump Disassembly Tool F-00097

2. Pull the rotor assembly out of the outer drive assembly (100) using moderate force of 18 to 27 kg (40 to 60 lbs).
3. Remove the tool and set the rotor assembly aside, away from any magnetic material (e.g., steel, iron).
4. Remove the canister (6) that contains the support plate (7) from the outer drive assembly.

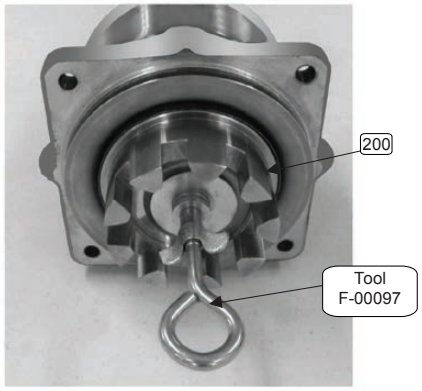


Figure 6.7 – Tool Inserted in Rotor Assembly

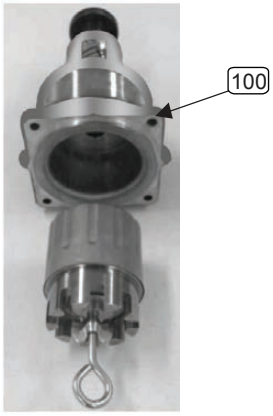


Figure 6.8 – Drive Assembly

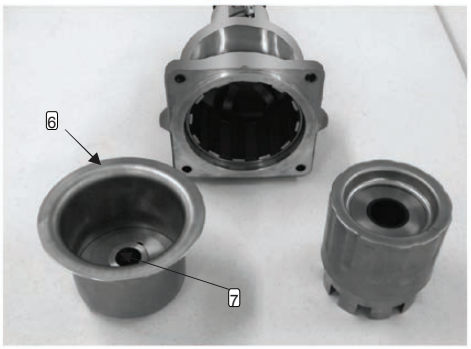


Figure 6.9 – Canister Removed

Remove Rotor Assembly from Outer Drive Assembly

(Models E1-24, E1-32, E1-55, E1-69 & E1-82)

1. Attach the puller plate to the rotor assembly (200) using three of the pump's 12.7 mm (1/2") screws (9 & 10).
2. Loosely fit the two rods into opposite holes on the outer drive assembly (100).
3. Loosely position the two rod ends into the channel.
4. Twist the two rods to tighten the channel nuts that lock the rods to the channel.
5. Assemble the two wing nuts onto the two rods to hold them to the outer drive assembly.

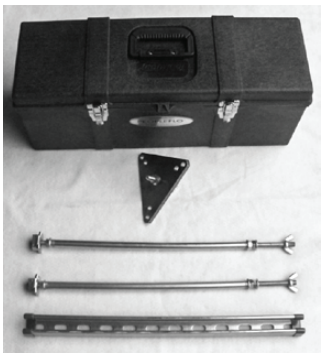


Figure 6.10 – Pump Disassembly Tool F-00096

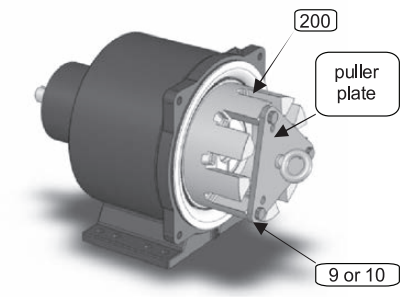


Figure 6.11 – Attach Puller Plate

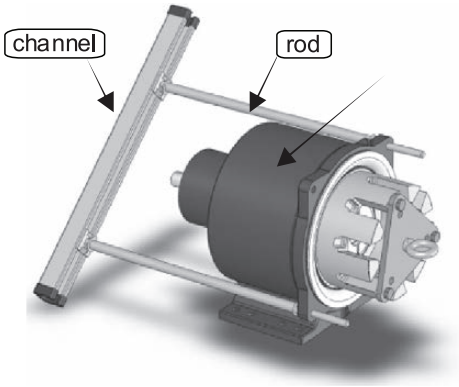


Figure 6.12 – Attach Rods and Channel

6. Carefully lift the outer drive assembly (with the tool kit attached) and set it on a suitable workbench vertically with the rotor teeth facing up.
7. Firmly affix the channel to the workbench surface so it can safely resist a lifting force of up to 182 kg (400 lbs).
8. Slowly pull the rotor assembly up and away from the drive assembly using a crane, hoist or other suitable lifting device.
9. Remove the puller plate and set the rotor assembly aside, away from any magnetic material (e.g., steel, iron).
10. Remove the canister (6) containing the support plate (7) from the outer drive assembly.

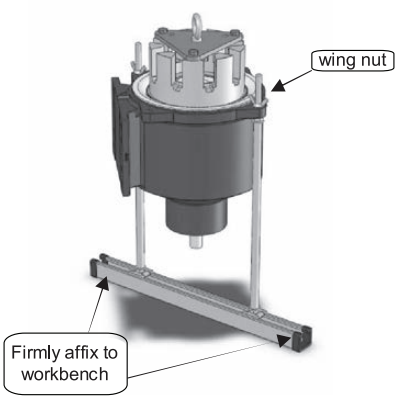


Figure 6.13 – Tool Fully Assembled

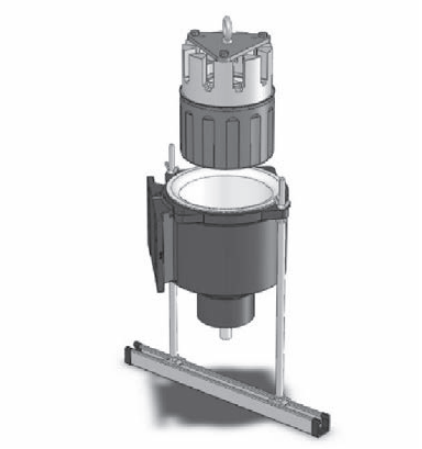


Figure 6.14 – Pull Rotor Assembly Up

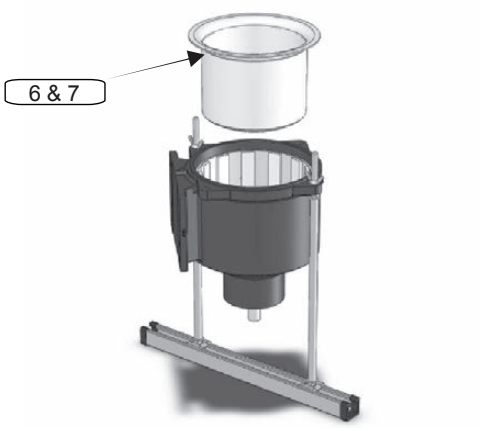


Figure 6.15 – Remove Canister

Replace Idler Bushings

(Carbon-Graphite)

1. Remove the old bushing (302) by pressing it out of the idler (301). If is not unusual for the bushing to crack or break apart during removal.
2. Inspect the idler bore for any damage. Any small scratches or nicks must be filed smooth before installing the new bushing.
3. Press the new idler bushing into the idler, leading with the tapered edge. The bushing is in its proper location when both ends of the bushing are flush or slightly recessed from the idler faces.

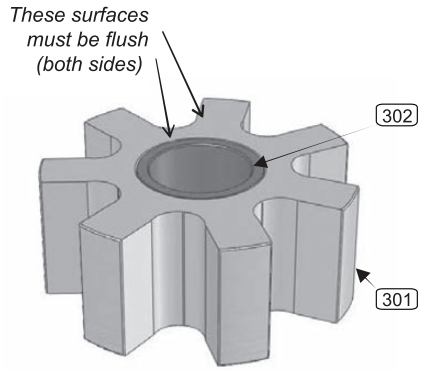


Figure 6.16 – Assemble Idler

Replace Rotor Bushings

(Carbon-Graphite)

1. Remove the old bushings (207 & 208) by pressing them out of the rotor (201). It is not unusual for the bushings to crack or break apart during removal.
2. Inspect the rotor bore for any damage. Any small scratches or nicks must be filed smooth before installing the new bushings.
3. Press the front radial bushing (208) into the rotor, leading with the tapered edge. The bushing is in its proper location when the front face of the bushing is flush with the nearest rotor face.
4. Press the thrust bushing (207) into the rotor, leading with the tapered edge, until it bottoms out.
5. Press the rear radial bushing (208) into the rotor, leading with the tapered edge. The bushing is in its proper location when the rear face of the bushing is flush with the nearest rotor face.

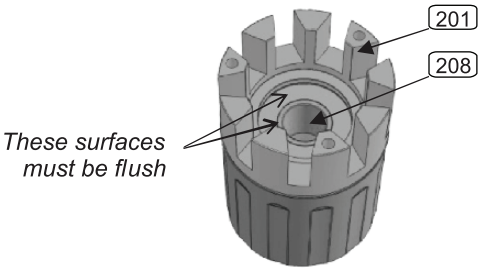


Figure 6.17 – Install Front Radial Bushing

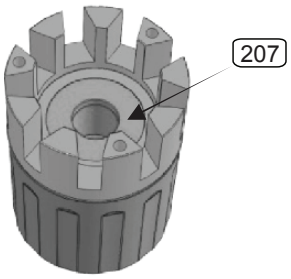


Figure 6.18 – Install Thrust Bushing

Replace Idler Bushings

(Tungsten-Carbide or Silicon-Carbide)

Due to the brittle nature of tungsten-carbide and silicon-carbide bushings, it is recommended they be replaced at the EnviroGear factory.

Replace Rotor Bushings

(Tungsten-Carbide or Silicon-Carbide)

Due to the brittle nature of tungsten-carbide and silicon-carbide bushings, it is recommended they be replaced at the EnviroGear factory.

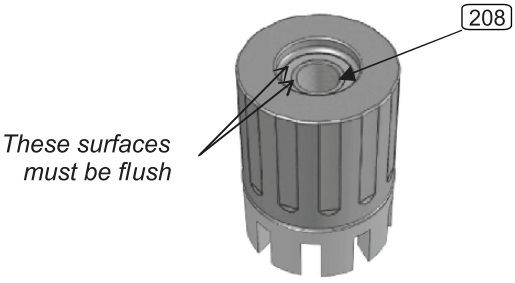


Figure 6.19 Install Rear Radial Bushing

Replace Outer Ball Bearing

1. Position the outer drive assembly (100) on blocks in a suitable press with the shaft (103) facing upward.
2. Remove the snap ring (108) from its groove in the shaft.
3. Press the shaft downward until the outer bearing (105) disengages from the shaft.
4. Remove the outer ring assembly (102) with shaft and inner bearing (105) attached, wave spring (106) and outer bearing.
5. Remove the inner bearing from the shaft with a suitable gear puller.
6. Apply a light oil to the shaft and press the new inner bearing into the shaft. The new bearing inner race should be flush with the outer ring. Be careful to avoid disrupting the shaft position relative to the outer ring.
7. Insert the wave spring into the inner bearing counter-bore of the magnet housing.
8. Insert the outer ring/shaft/inner bearing assembly into the magnet housing.
9. Press the outer bearing onto the shaft until the distance from the end of the shaft to the face of the bearing meets the following specifications:

Model	Distance (D)
E1-2, E1-4	48.2 mm (1.9″)
E1-24, E1-32, E1-55, E1-69	64.4 mm (2.5″)
E1-82	99.3 mm (3.9″)

10. Install the snap ring in its groove in the shaft.

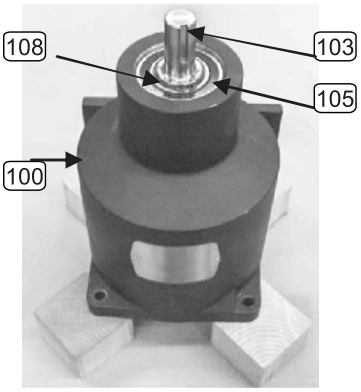


Figure 6.20 – Outer Drive Assembly on Blocks

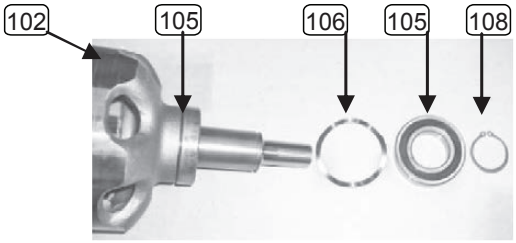


Figure 6.21 – Bearing Area Components

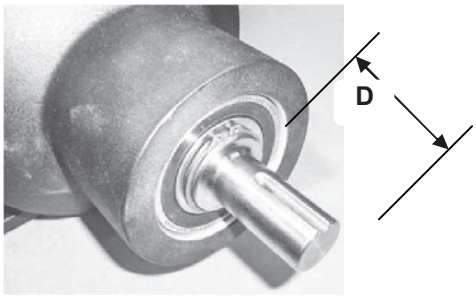


Figure 6.22 – Outer Bearing Location

Replace Inner Magnets

1. There are two methods to remove the sleeve from the rotor.
   a. Support the rotor assembly (200) on the front edge of the sleeve (204) with the teeth facing down. Leave at least 25 mm (1") of clearance beneath the teeth. Then press the rotor down, separating it from the sleeve.
   b. Carefully cut the sleeve as shown in Figure 6.24. Be careful to avoid damaging the rotor in the area around the front O-ring. The sleeve will easily pull off the rotor after this cut is in place.
2. Remove the old magnet segments (203) from the inner ring (202).
   a. In most cases, the magnets are held in place only by the magnetic attraction to the inner ring.
   b. In other cases, the magnets are held in place with epoxy. Contact EnviroGear for instructions on removing the epoxy.
3. Remove the front (206) and rear (205) sleeve O-rings from the grooves in the rotor.
4. Install new O-rings in the grooves of the rotor.
5. Slowly bring one end of the new magnet segment into contact with the end of one flat on the inner ring, such that only a short length of the magnet is in contact with the inner ring.

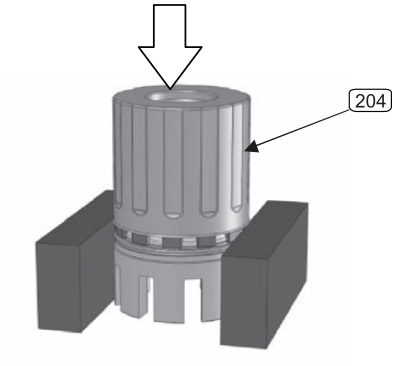


Figure 6.23 – Method A

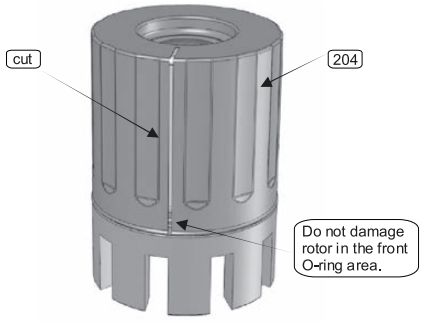


Figure 6.24 – Method B

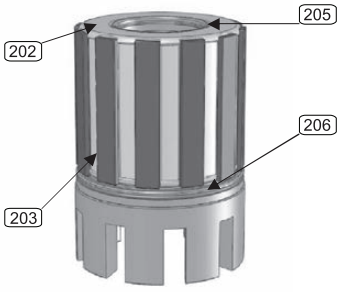


Figure 6.25 – Remove Sleeve

Figure 6.26 – Assemble Magnet Segments

6. Slide the magnet segment along the length of the inner ring until it touches the small stop at the front end of the inner ring.
7. Repeat steps 5 and 6 for the other magnet segments, making sure that each magnet is in opposite polarity with adjacent magnets.
8. Align the new sleeve over the back of the rotor such that the sleeve indentations are lined up with the magnets.
9. Press the sleeve over the magnets and O-rings until it contacts the rear of the inner ring.
10. Visually inspect the front and rear of the sleeve to verify that the O-rings were not damaged by the sleeve.

Figure 6.27 – Proper Magnet Position

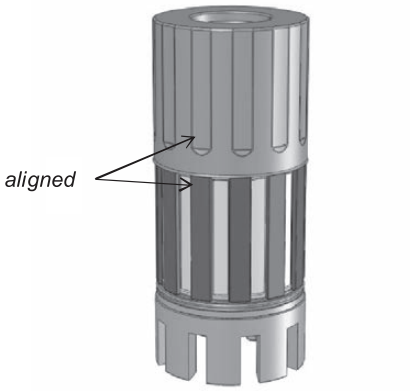


Figure 6.28 – Proper Sleeve Alignment

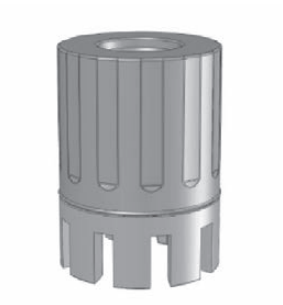


Figure 6.29 – Rotor Assembly

Install Rotor Assembly into Outer Drive Assembly

(Models E1-2 & E1-4)

1. Insert the canister (6) and support plate (7) into the outer drive assembly (100). The support plate has no “top” and “bottom.” Therefore, its orientation is irrelevant.
2. Use Tool F-00097 to firmly grab the rotor assembly (200) in the bushing bore area.
3. Bring the rotor assembly toward the canister until the back of the rotor is about 5 cm (2”) from the front of the outer drive assembly.
4. Slowly let the outer magnets pull the rotor into the canister while using moderate resisting force of about 18 to 27 kg (40 to 60 lbs).
5. Remove the puller tool.

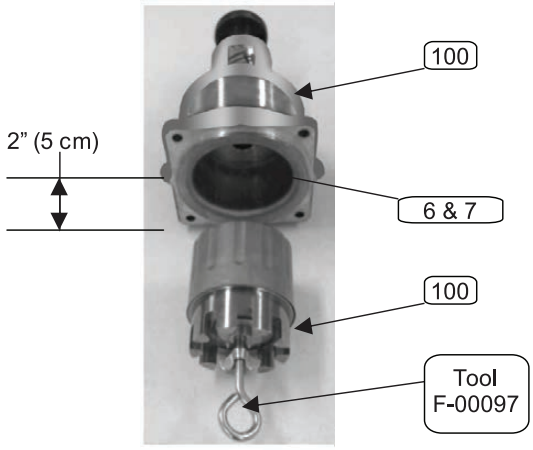


Figure 6.30 – Tool in Rotor Assembly

Figure – 6.31 Rotor Assembly in Place

Install Rotor Assembly into Outer Drive Assembly

(Models E1-24, E1-32, E1-55, E1-69 & E1-82)

1. Loosely fit the two rods into opposite holes on the outer drive assembly (100).
2. Loosely position the two rod ends into the channel.
3. Twist the two rods to tighten the channel nuts and clamp the rods to the channel.
4. Assemble the two wing nuts onto the two rods to hold them to the outer drive assembly.
5. Carefully lift the outer drive assembly (with tool kit attached) and set it vertically on a suitable workbench with the rotating teeth facing upwards.
6. Firmly affix the channel to the workbench surface, so that it can safely resist a lifting force of up to 182 kg (400 lbs).

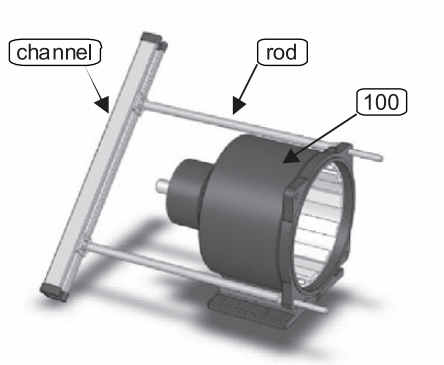


Figure 6.32 – Assemble Rods and Channel

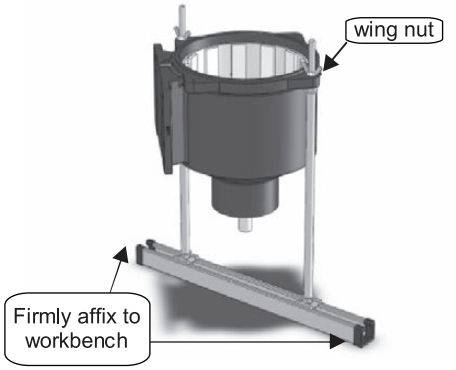


Figure 6.33 – Outer Drive Assembly Mounted to Tool

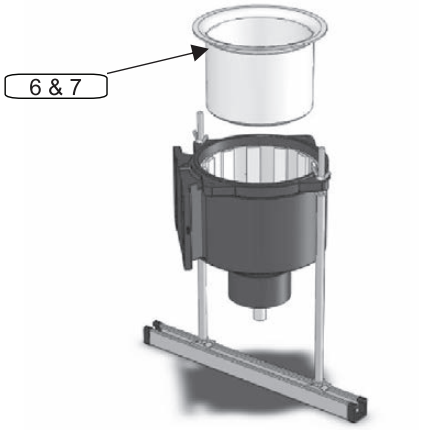


Figure 6.34 – Insert Canister and Support Plate

7. Insert the canister (6) containing the support plate (7) into the outer drive assembly. The support plate has no “top” or “bottom.” Therefore, the orientation is irrelevant.
8. Attach the puller plate to the rotor assembly (200) using three of the pump’s 13 mm (1/2”) screws (9 or 10).
9. Support the rotor assembly using a crane, hoist or other suitable lifting device, and position it above the canister 10 cm (4”) from the front of the outer drive assembly.
10. Slowly lower the rotor assembly into the canister. **NOTE:** During this process, the inner magnets on the rotor assembly will be strongly attracted to the outer magnets in the outer drive assembly.
11. Carefully lift the outer drive assembly (with the tool kit attached) and set it on a workbench, resting on the pump’s foot.
12. Remove the tool rods and puller plate.

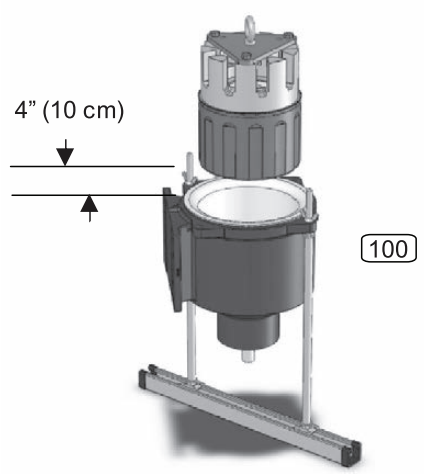


Figure 6.36 – Rotor Assembly Ready for Lowering

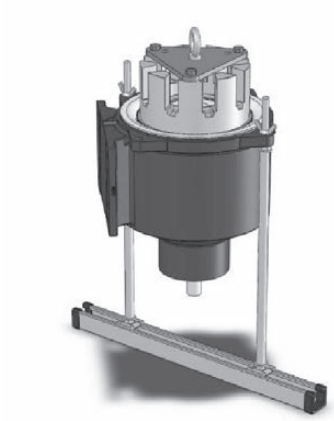


Figure 6.37 – Rotor Assembly in Place

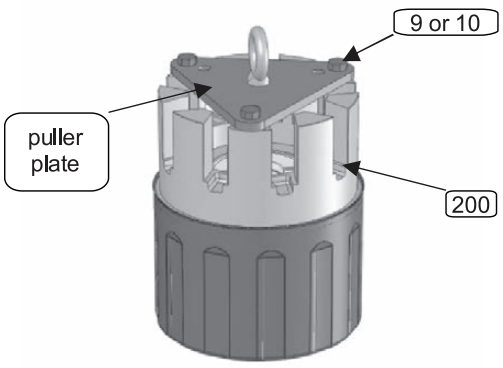


Figure 6.35 – Puller Plate on Rotor Assembly

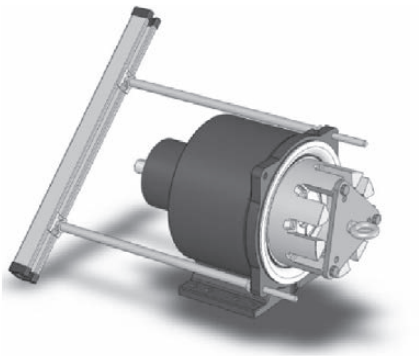


Figure 6.38 – Remove Tool

Pumping Chamber Assembly

1. Make sure the casing orifice plug and casing block-off plug are in the correct locations:
   - Install the casing orifice plug (11) behind the DISCHARGE port, if required.
   - Install the casing block-off plug (12) behind the SUCTION port.
2. Position the canister O-ring (4) in its groove in the casing (2). If necessary, use a small amount of light adhesive to keep the O-ring properly positioned.
3. Slide the casing over the rotor (200), the lip of the canister (6) and magnet housing (101). It may take some wiggling of the casing to get the canister and magnet housing positioned within the casing's alignment counter-bore.
4. If necessary, rotate the casing to get the ports in the preferred position.
5. Insert the screw (10) that holds the outer drive assembly (100) to the casing.
   a. First, torque 7 to 14 N•m (5 to 10 ft-lb) in an alternating pattern
   b. Next, torque 27 N•m (20 ft-lb) in an alternating pattern
   c. Finally, torque final values in an alternating pattern:
      i. 10 mm (3/8") screws: 54 N•m (40 ft-lb)
      ii. 13 mm (1/2") screws: 88 N•m (65 ft-lb)
6. If the pump is not equipped with a relief valve, ensure the head block-off plug (14) is in the correct location on the DISCHARGE side of the head.
7. Slide the head O-ring (5) onto the head (1). Take care to avoid scratching the O-ring.
8. Position the head with the crescent facing upward and set idler assembly (300) and spindle (3) in place.
9. Carefully insert the head/idler/spindle unit into the rotor. Take care to avoid cracking or chipping the carbon bushings.
10. Rotate the head so that the rotor and idler mesh are between the ports.
11. Insert the screws (9) that hold the head to the casing and torque them to their final values:
    a. 10 mm (3/8") screws: 54 N•m (40 ft-lb)
    b. 13 mm (1/2") screws: 88 N•m (65 ft-lb)

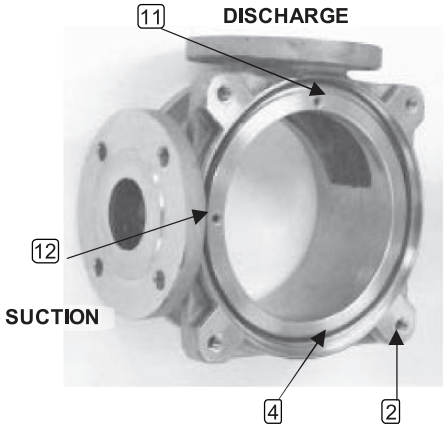


Figure 6.39 – Casing Plugs and O-Rings

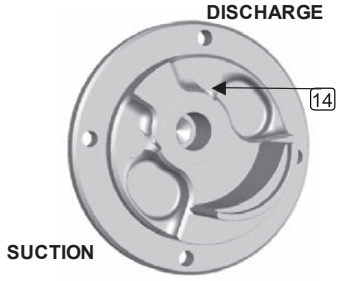


Figure 6.40 – Head Block-Off Plug

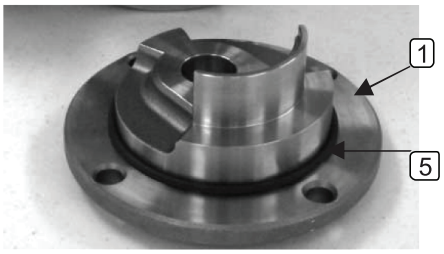


Figure 6.41 – Head O-Ring

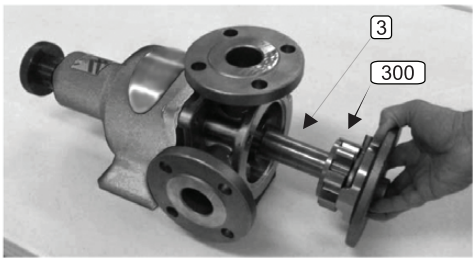


Figure 6.42 – Head/Idler/Spindle Unit

Relief Valve Assembly

1. Check the valve body O-ring (404) for damage or wear and replace, if necessary.
2. Position the valve body O-ring in its groove in the valve body (401). If necessary, use a small amount of light adhesive to keep the O-ring properly positioned.
3. Position the spring (403) and poppet inside the valve body.
4. Determine which pocket in the head (1) is aligned with the discharge port. The relief-valve poppet (402) must be positioned on the discharge pocket for the valve to function correctly.
5. Position the valve body/spring/poppet onto the pump head with the poppet over the discharge pocket and loosely assemble the valve-body screws.
6. Tighten the screws in an alternating pattern until the valve body is fully contacting the head. Torque the screw to their final values:

   a. 10 mm (3/8") screws: 54 N•m (40 ft-lb)

   b. 13 mm (1/2") screws: 88 N•m (65 ft-lb)

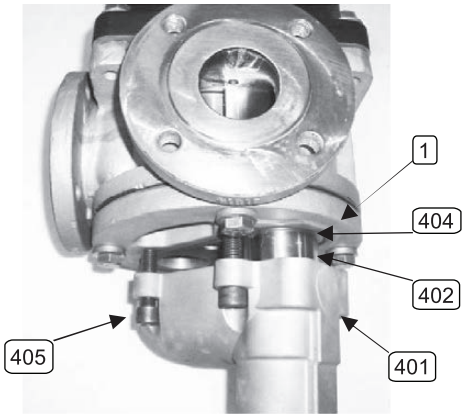


Figure 6.43 – Relief Valve Assembly

Symptom or Problem: Pump is excessively noisy.

Problem Cause(s):

- Air in the inlet fluid stream
- Relief valve is opening
- Pump has decoupled
- Pump components are damaged or worn
- Pump is cavitating
- Discharge line is too restrictive
- Cooling path is plugged
- Ball bearings are worn or damaged

Symptom or Problem: Pump does not prime.

Problem Cause(s):

- Discharge line is too restrictive
- Suction lift is too great
- Pump is not wetted
- Air leak in the suction line
- Pump is running in the wrong direction
- Head is positioned incorrectly
- Cooling-path plugs are not installed
- Pump is locked up with hardened fluid or foreign items
- Pump components are damaged or worn
- Pump has decoupled
- Inner magnets have weakened
- Cooling path is plugged
- Relief valve is stuck open

Symptom or Problem: Flow rate is too low.

Problem Cause(s):

- Head is positioned incorrectly
- Cooling-path plugs are not installed
- Discharge line is too restrictive
- Viscosity is lower than expected
- Air in the inlet fluid stream
- Pump is cavitating
- Relief valve is opening
- Pump components are damaged or worn
- Bypass or auxiliary line in the discharge piping is open
- Cooling path is plugged
- Relief valve is stuck open

Symptom or Problem: Pump does not develop enough pressure.

Problem Cause(s):

- Viscosity is lower than expected
- Air in the inlet fluid stream
- Pump is cavitating
- Relief valve is opening
- Pump components are damaged or worn
- Bypass or auxiliary line in the discharge piping is open
- Head is positioned incorrectly
- Cooling-path plugs are not installed
- Cooling path is plugged
- Relief valve is stuck open

Symptom or Problem: Relief valve does not open.

Problem Cause(s):

- Pump is running in the wrong direction
- Relief valve is stuck closed

Symptom or Problem: Leakage from head/casing area.

Problem Cause(s):

- O-ring material is not compatible with pumped fluid
- Sealing surfaces for the O-rings are damaged
- Bolt(s) are loose or missing
- O-ring is damaged or missing

Symptom or Problem: Leakage from casing/magnet-housing area.

Problem Cause(s):

- O-ring material is not compatible with pumped fluid
- Sealing surfaces for the O-rings are damaged
- Casing or magnet-housing mounting flanges are cracked
- Bolt(s) are loose or missing
- O-ring is damaged or missing

Symptom or Problem: Leakage from head/valve-body area.

Problem Cause(s):

- O-ring material is not compatible with pumped fluid
- Sealing surfaces for the O-rings are damaged
- Bolt(s) are loose or missing
- O-ring is damaged or missing

Symptom or Problem: Leakage from drive-shaft area.

Problem Cause(s):

- Canister is damaged or leaking

Symptom or Problem: Excessive Vibration.

Problem Cause(s):

- Air in the inlet fluid stream
- Relief valve is opening
- Pump has decoupled
- Pump components are damaged or worn
- Pump is cavitating
- Ball bearings are worn or damaged
- Inner magnets have weakened
- Cooling-path is plugged

Symptom or Problem: Pump draws too much power.

Problem Cause(s):

- Pump components are damaged or worn
- Relief valve is stuck closed
- Ball bearings are worn or damaged
- Viscosity is higher than expected

HOW TO RETURN PUMP TO FACTORY

If a pump must be returned to the EnviroGear factory, a Return Goods Authorization (RGA) must be obtained from EnviroGear or its authorized distributor. No RGA can be issued without a review of the appropriate Material Safety Data Sheets (MSDS). Pumps must be cleaned of all fluids and the port plugged to prevent foreign material from entering the pump.

Each and every product manufactured by EnviroGear® Pumps is built to meet the highest standards of quality. Every pump is functionally tested to insure integrity of operation.

EnviroGear Pumps warrants that pumps, accessories and parts manufactured or supplied by it to be free from defects in material and workmanship for a period of five (5) years from date of installation or six (6) years from date of manufacture, whichever comes first. Failure due to normal wear, misapplication, or abuse is, of course, excluded from this warranty.

Since the use of EnviroGear Pumps equipment is beyond our control, we cannot guarantee the suitability of any pump or part for a particular application and EnviroGear shall not be liable for any consequential damage or expense arising from the use or misuse of its products on any application. Responsibility is limited solely to replacement or repair of defective EnviroGear products.

All decisions as to the cause of failure are the sole determination of EnviroGear Pumps.

Prior approval must be obtained from EnviroGear for return of any items for warranty consideration and must be accompanied by the appropriate MSDS for the product(s) involved. A Return Goods Tag, obtained from an authorized EnviroGear distributor, must be included with the items which must be shipped freight prepaid.

The foregoing warranty is exclusive and in lieu of all other warranties expressed or implied (whether written or oral) including all implied warranties of merchantability and fitness for any particular purpose. No distributor or other person is authorized to assume any liability or obligation for EnviroGear Pump Company other than expressly provided herein.

PLEASE PRINT OR TYPE AND FAX TO ENVIROGEAR

PUMP INFORMATION

Item # _____ Serial # _____

Company Where Purchased _____

YOUR INFORMATION

Company Name _____

Industry _____

Name _____ Title _____

Street Address _____

City _____ State _____ Postal Code _____ Country _____

Telephone _____ Fax _____ Email _____ Web Address _____

Number of pumps in facility? _____ Number of EnviroGear pumps? _____

Types of pumps in facility (check all that apply): ☐ Diaphragm ☐ Centrifugal ☐ Gear ☐ Submersible ☐ Lobe

☐ Other _____

Media being pumped? _____

How did you hear of Wilden Pump? ☐ Trade Journal ☐ Trade Show ☐ Internet/Email ☐ Distributor

☐ Other _____

ONCE COMPLETE, FAX TO (909) 783-3440

Where Innovation Flows

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