

**TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE**



SPUR GEAR PRODUCT LINE: *CAST IRON*

SG-04 SERIES™, SG-404 SERIES™, SG-05 SERIES™, SG-405 SERIES™,  
SG-07 SERIES™, SG-407 SERIES™, SG-10 SERIES™, SG-410 SERIES™,  
SG-14 SERIES™, SG-414 SERIES™

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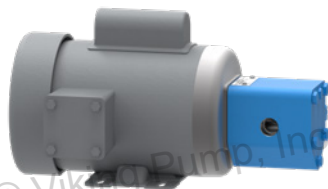
**MODEL NUMBER CHART**

Lip Seal	Mechanical Seal
SG-0417	SG-40417
SG-0418	SG-40418
SG-0425	SG-40425
SG-0470	SG-40470
SG-0518	SG-40518
SG-0525	SG-40525
SG-0535	SG-40535
SG-0550	SG-40550
SG-0570	SG-40570
SG-0510	SG-40510
SG-0514	SG-40514
SG-0519	SG-40519
SG-0528	SG-40528
SG-0729	SG-40729
SG-0741	SG-40741
SG-0758	SG-40758
SG-0782	SG-40782
SG-0711	SG-40711
SG-0716	SG-40716
SG-0722	SG-40722
SG-0732	SG-40732
SG-1009	SG-41009
SG-1013	SG-41013
SG-1026	SG-41026
SG-1420	SG-41420
SG-1436	SG-41436
SG-1456	SG-41456

**INTRODUCTION**

*The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts.* Obtain a parts list from your Viking Pump® representative. Always give a complete name of part, part number and material with the model number and serial number of pump when ordering repair parts. The unmounted pump or pump unit model number and serial number are on the nameplate. This manual only applies to the pump models specified in the "Model Number Chart" on page 1. Pump specifications and recommendations are listed in the Catalog Sections, which are available at vikingpump.com.

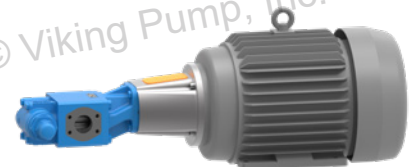
**FIGURE 1: SG-04 SERIES™, SG-05 SERIES™ SHOWN WITH M4 DRIVE**



**FIGURE 2: SG-07 SERIES™ SHOWN WITH D DRIVE**



**FIGURE 3: SG-10 SERIES™ SHOWN WITH M DRIVE**



# SAFETY INFORMATION & INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH, AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP, AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

 **DANGER** = FAILURE TO FOLLOW THE INDICATED INSTRUCTION MAY RESULT IN SERIOUS INJURY OR DEATH.

 **WARNING** = IN ADDITION TO SERIOUS INJURY OR DEATH, FAILURE TO FOLLOW THE INDICATED INSTRUCTION MAY CAUSE DAMAGE TO PUMP AND/OR OTHER EQUIPMENT

## **DANGER**

**BEFORE** opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that:

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational, so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

## **DANGER**

**BEFORE** operating the pump, be sure all drive guards are in place.

## **DANGER**

**DO NOT** operate pump if the suction or discharge piping is not connected.

## **DANGER**

**DO NOT** place fingers into the pumping chamber, or its connection ports, or into any part of the drive train if there is any possibility of the pump shaft being rotated.

## **WARNING**

**DO NOT** exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.

## **WARNING**

**BEFORE** operating the pump, be sure that:

- It is clean and free from debris.
- All valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.

## **WARNING**

**INSTALL** pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

## **WARNING**

**USE** extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate. Lifting eyes installed on the pump must be used only to lift the pump, not the pump with drive and/or base plate. If the pump is mounted on a base plate, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weight of the pump alone (which does not include the drive and/or base plate) refer to the Viking Pump® product catalog.

## **DANGER**

**DO NOT** attempt to dismantle a pressure relief valve that has not had the spring pressure relieved or is mounted on a pump that is operating.

## **DANGER**

**AVOID** contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.

## **WARNING**

**THE PUMP** must be provided with pressure protection. This may be provided through a relief valve mounted directly on the pump, an in-line pressure relief valve, a torque limiting device, or a rupture disk. If pump rotation may be reversed during operation, pressure protection must be provided on both sides of pump. Relief valve adjusting screw caps must always point towards suction side of the pump. If pump rotation is reversed, position of the relief valve must be changed. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure. For additional information, refer to **Appendix, General Installation Notes**, item 5 on Pressure Protection or contact your Viking Pump® representative for Engineering Service Bulletin ESB-31.

## **WARNING**

**THE PUMP** must be installed in a manner that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

## SPECIAL INFORMATION

The SG-04 Series™, SG-404 Series™, SG-05 Series™, SG-405 Series™, SG-07 Series™, SG-407 Series™ pumps do not lend themselves to being rebuilt. If the plates on either side of the gears show wear, then the gears also are likely worn. The cost of replacement would be less than the cost of the required parts and labor.

The only parts recommended for replacement in the pump are the lip seal and o-rings, and must be replaced if the pump is disassembled. These instructions are to be used in conjunction with the **APPENDIX** to assist in inspection and, if warranted, repair of these pumps. To install a new lip seal a large socket slightly less than the outside diameter of the lip seal is recommended, as well as a two-inch length of pipe that has a two-inch inside diameter.

For additional information, contact your Viking Pump® representative to obtain a copy of TR-809 (SG-05 Series™), TR-810 (SG-07 Series™), TR-811 (SG-405 Series™) or TR-812 (SG-407 Series™).

## ROTATION

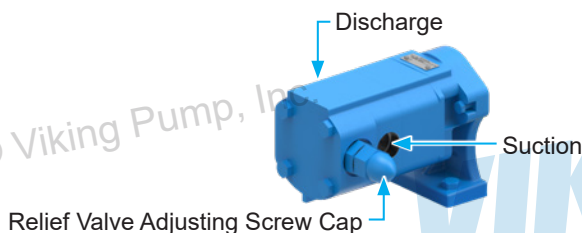
Viking external gear pumps can be offered in a clockwise (-G0) or counter clockwise (-G1) rotation. The intended rotation and inlet / outlet port positions are noted on the pump nameplate. Do not run the pump in reverse, or the seal will be exposed to full discharge pressure.

## PRESSURE RELIEF VALVES

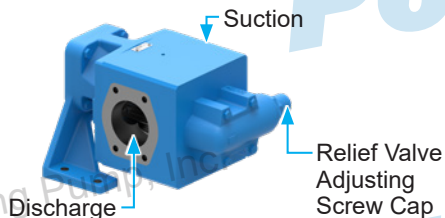
1. Viking pumps are positive placement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. Relief valve adjusting screw cap must always point towards suction side of pump. “**Figure 4**” on page 3 or “**Figure 5**” on page 3.
3. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.

**FIGURE 4: SG-04 SERIES™, SG-05 SERIES™, SG-07 SERIES™**



**FIGURE 5: SG-10 SERIES™, SG-14 SERIES™**



## MOUNTING

1. Surfaces pump mounts against must be clean and flat.
2. For NEMA Mount, use SAE Grade 5 or better capscrews to mount pump.

For IEC Mount, use Class 8.8 or better capscrews to mount pump.

**SG-04 Series™, SG-05 Series™:** The 4 mounting capscrews must have a minimum of ½ inch thread engagement, and must be torqued evenly to 12-15 ft-lbs.

**SG-07 Series™:** The 2 mounting capscrews must have a minimum of ½ inch thread engagement, and be evenly torqued to 50-55 ft-lbs.

3. Standard SG Series pumps are designed to be used with jaw type couplings that do not induce axial thrust on the pump shaft. If an improper type of coupling is used, internal damage may result.
4. Do not strike or press the pump drive coupling to install. Internal pump damage will result. If the coupling does not slide onto the shaft, inspect the coupling, shaft and key for nicks or burrs and remove.
5. If the pump is to be belt or gear driven, the overhung load option must be specified.
8. Once the pump has been mounted and the coupling installed, it is recommended to put lube oil into the suction port and turn the pump by hand to make sure it turns freely.

## MAINTENANCE (SG-10 SERIES™, SG-410 SERIES™, SG-14 SERIES™, SG-414 SERIES™)

These pumps are designed for long, trouble-free service life under a wide variety of application conditions with minimum maintenance. The points listed below will help provide long service life.

## CLEANING PUMP

Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work.

## STORAGE

If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of non-detergent SAE 30 weight oil must be applied to all internal pump parts.

Viking suggests rotating pump shaft by hand one complete revolution every 30 days to circulate the oil. Tighten all pump assembly bolts before putting pump in service after being stored.

## SUGGESTED REPAIR TOOLS

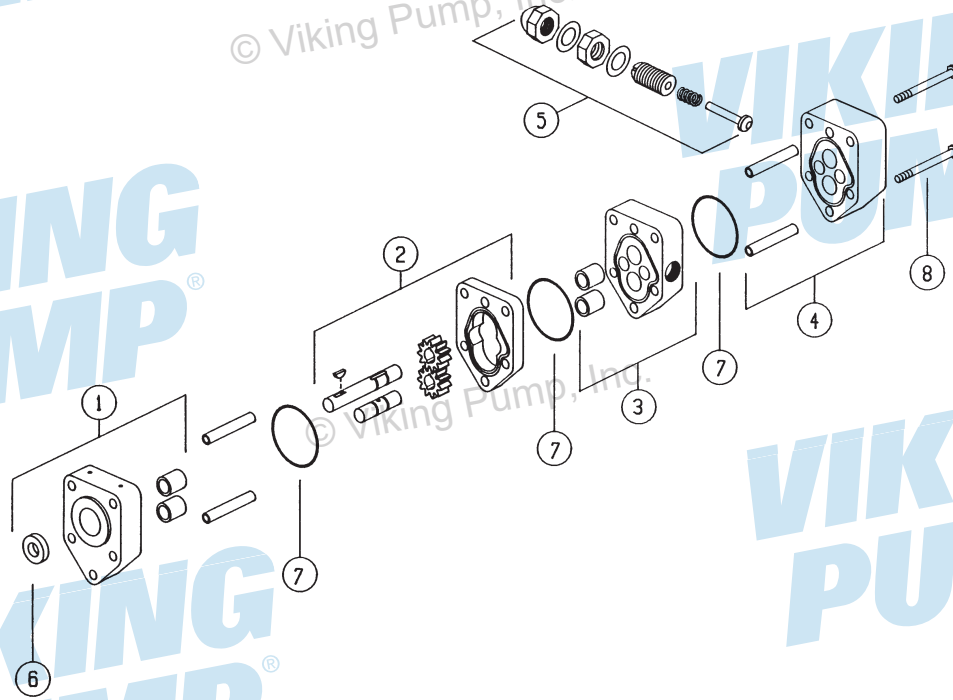
The following tools must be available to properly repair these pumps. These tools are in addition to standard mechanics' tools such as open-end wrenches, pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft headed hammer
2. Snap ring pliers
3. Arbor press
4. Blind bearing puller set



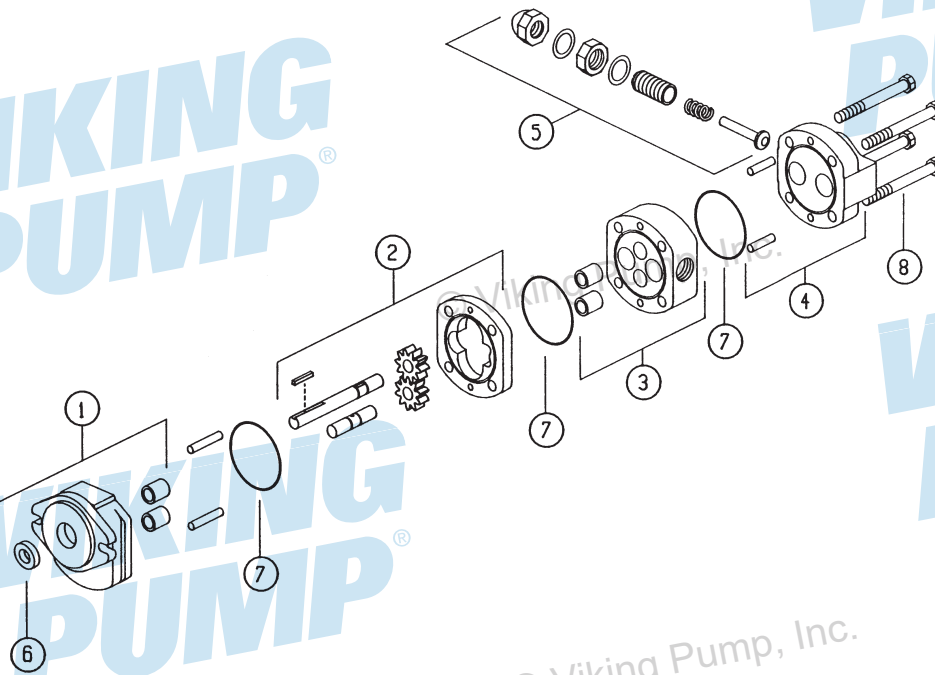
Contact your Authorized Viking Pump® stocking distributor for available seal and rebuild kits

FIGURE 6: EXPLODED VIEW - TYPICAL SG-04 SERIES™ / SG-05 SERIES™



Contact your Authorized Viking Pump® stocking distributor for available seal and rebuild kits

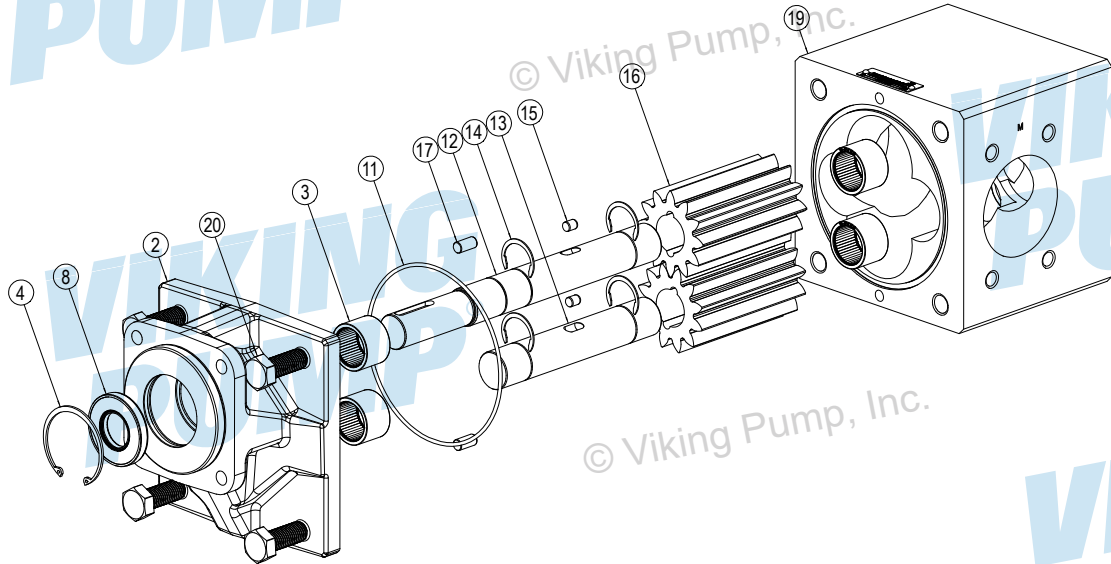
FIGURE 7: EXPLODED VIEW - TYPICAL SG-07 SERIES™ / SG-407 SERIES™



Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
1	Bracket, Lipseal & Bearing Section	4	Head And Alignment Sleeve Assy.	7	O-Ring
2	Match Ground Casing & (2) Gears, Driver & Driven Shafts	5	Relief Valve Kit	8	Assembly Capscrews
3	Separation Plate & Bearing Assy.	6	Lipseal		

Contact your Authorized Viking Pump® stocking distributor for available seal and rebuild kits

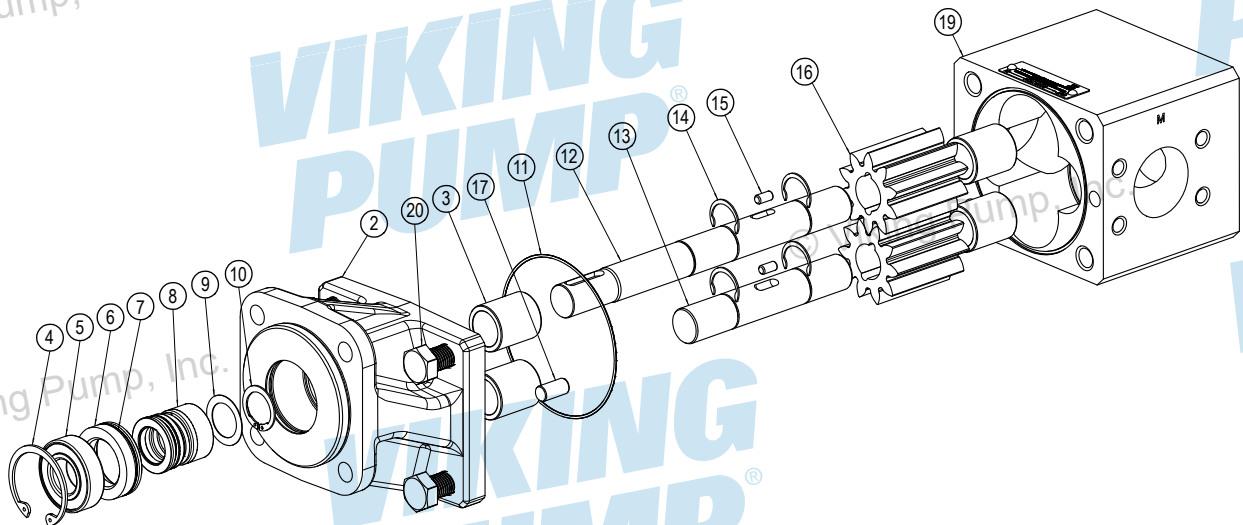
FIGURE 8: EXPLODED VIEW - TYPICAL SG-10 SERIES™ / SG-14 SERIES™ LIP SEAL PUMPS



Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
2	Bracket	12	Drive Shaft	17	Alignment Pins (2 Required)
3	Bearings (4 Required)	13	Driven Shaft	19	Casing
4	Internal Snap Ring	14	Crescent Snap Rings (4 Required)	20	Capscrews (4 Required)
8	Lip Seal	15	Gear Pins (2 Required)		
11	O-ring for Casing	16	Gears (2 Required)		

Contact your Authorized Viking Pump® stocking distributor for available seal and rebuild kits

FIGURE 9: EXPLODED VIEW - TYPICAL SG-410 SERIES™ / SG-414 SERIES™ MECHANICAL SEAL PUMPS



Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
2	Bracket	8	Mechanical Seal	14	Crescent Snap Rings (4 Required)
3	Bearings (4 Required)	9	Spacer	15	Gear Pins (2 Required)
4	Internal Snap Ring	10	External Snap Ring	16	Gears (2 Required)
5	Outboard Bearing	11	O-ring for Casing	17	Alignment Pins (2 Required)
6	Seal Holder	12	Drive Shaft	19	Casing
7	O-ring for Seal Holder	13	Driven Shaft	20	Capscrews (4 Required)

## DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure:

1. That any pressure in the chamber has been completely vented through the suction or discharge lines, or other appropriate openings or connections.
2. That the driving means (motor, turbine, engine, etc.) has been “locked out” or made non-operational, so that it cannot be started while work is being done on pump.
3. That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.

Failure to follow above listed precautionary measures may result in serious injury or death.

## DISASSEMBLY - LIP SEAL PUMPS (SG-10 SERIES™, SG-14 SERIES™)

1. Remove pump from motor or other drive equipment. If the pump is mounted using the footed bracket (B-mount), remove the footed bracket so the pump is flat on the work surface.
2. Refer to “Figure 8” on page 5 for the names of parts.
3. Mark bracket (2) and casing (19) before disassembly to ensure proper reassembly. Remove the capscrews (20) to separate bracket from pump casing. It may be necessary to tap on the ears of the bracket (where capscrews are located) with a soft headed hammer to separate the bracket from the casing.
4. Inspect casing o-ring (11). Replace as needed.
5. Remove driven (13) and drive (12) shaft and gear assemblies from pump.
6. To remove the gears (16) from the shafts, remove both snap rings (14) from both sides of the gear. The gears should then slide freely off the shaft.  
**NOTE:** There is a small pin (15) located under the gear which can fall out of its groove when the gears are removed.
7. Inspect the gears and shafts for wear. Replace as needed.
8. Remove the internal snap ring (4) and lip seal (8) from the bracket.
9. Inspect the bearings or bushings (3). If the bearings or bushings need to be replaced:  
Remove the bearings from the bracket and casing using a Blind Bearing Puller. To remove carbon graphite or silicon carbide bushings, use a cold chisel or punch to break the bushing. Be careful not to damage the bore.

## ASSEMBLY - LIP SEAL PUMPS (SG-10 SERIES™, SG-14 SERIES™)

1. Be sure to clean the bracket and casing thoroughly. If the bearings were removed, install new pump bearings into each bore using an arbor press. See “Table 1” on page 6 for the depth dimension. If carbon graphite, Refer to “Installation of Carbon Graphite Bushings” below.

TABLE 1

Series	Bearing Press Depth
SG-10 Series™ SG-410 Series™	0.060" - 0.080" (1.5 - 2 mm)
SG-14 Series™ SG-414 Series™	0.070" - 0.090" (1.8 - 2.3 mm)

2. Press the lip seal into the pump bracket using an arbor press and install snap ring.
3. Assemble the shaft / gear assemblies. Install one snap ring (14) onto the shaft. Place the gear pin into its groove on the shaft. Slide the gear over the pin and lock into place using the second snap ring. **NOTE:** Proper snap ring orientation can be seen in “Figure 8” on page 5. The gear pin blocks the flow path along the gear ID in one of the grooves. Make sure the snap rings do not block the other.
4. Coat shaft / gear assemblies with light oil. Place both shafts in the casing with the drive shaft (longer shaft) on the top (nameplate side).
5. Lubricate the casing O-ring using a compatible lubricant and place it in the groove of the casing.
6. Slide the pump bracket over the gear and shaft assemblies until flush with the casing.
7. Place the capscrews into the bracket and tighten evenly. See “Table 2” on page 6 for the correct capscrew torque.

TABLE 2

Series	Recommended Capscrew Torque
SG-10 Series™ SG-410 Series™	80 ft. lbs. (110 Nm)
SG-14 Series™ SG-414 Series™	100 ft. lbs. (140 Nm)

## DANGER !

Before starting pump, be sure all drive equipment guards are in place.

Failure to properly mount guards may result in serious injury or death.

## DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure:

1. That any pressure in the chamber has been completely vented through the suction or discharge lines, or other appropriate openings or connections.
2. That the driving means (motor, turbine, engine, etc.) has been “locked out” or made non-operational, so that it cannot be started while work is being done on pump.
3. That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.

Failure to follow above listed precautionary measures may result in serious injury or death.

## DISASSEMBLY - MECHANICAL SEAL PUMPS (SG-410 SERIES™, SG-414 SERIES™)

1. Remove pump from motor or other drive equipment. If the pump is mounted using the footed bracket (B-mount), remove the footed bracket so the pump is flat on the work surface.
2. Refer to “Figure 9” on page 5 for the names of parts.
3. Mark bracket (2) and casing (19) before disassembly to ensure proper reassembly. Remove the capscrews (20) to separate bracket from pump casing. It may be necessary to tap on the ears of the bracket (where capscrews are located) with a soft headed hammer to separate the bracket from the casing.
4. Inspect casing o-ring (11). Replace as needed.
5. Remove driven shaft (13) and gear assembly from pump. Leave drive shaft (12) and gear assembly in place.
6. To remove the gears (16) from the shafts, remove both snap rings (14) from both sides of the gear. The gears should then slide freely off the shaft.  
**NOTE:** There is a small pin (15) located under the gear which can fall out of its groove when the gears are removed.
7. Inspect the gears and shafts for wear. Replace as needed.
8. Remove the internal snap ring (4) from the bracket.
9. Using a soft headed hammer tap the drive shaft, on the gear-side, through the bracket.
10. Remove the bearing (5), seal holder (6) and mechanical seal (8) from the shaft. Replace the bearing, mechanical seal and o-ring (7). The spacer (9) sets the working length of the mechanical seal. Use the factory part if replacement is necessary.
11. Inspect the bearings or bushings (3). If the bearings or bushings need to be replaced:

Remove the bearings from the bracket and casing using a Blind Bearing Puller. To remove carbon graphite or silicon carbide bushings, use a cold chisel or punch to break the bushing. Be careful not to damage the bore.

## ASSEMBLY - MECHANICAL SEAL PUMPS (SG-410 SERIES™, SG-414 SERIES™)

1. Be sure to clean the bracket and casing thoroughly. If the bearings were removed, install new pump bearings into each bore using an arbor press. See “Table 1” on page 6 for the depth dimension. If carbon graphite, Refer to “Installation of Carbon Graphite Bushings” below.
2. Coat the drive shaft with light oil and place the drive gear into the bracket (into through hole) with the snap ring on the drive side of the bracket.
3. Assemble the shaft / gear assemblies. Install one snap ring (14) onto each shaft (the side closest to the bracket for the drive shaft). Place the gear pin into its groove on each shaft. Slide the gear for each shaft over the pin and lock into place using the second snap ring. **NOTE:** Proper snap ring orientation can be seen in “Figure 9” on page 5. The gear pin blocks the flow path along the gear ID in one of the gear grooves. Make sure the snap rings do not block the other.
4. Coat the shaft / gear assemblies with light oil. Place the driven shaft in the blind bracket hole.
5. Lubricate the casing O-ring using a compatible lubricant and place it in the groove of the casing.
6. Slide the pump casing over the gear and shaft assemblies until flush with the bracket. Be sure the casing is oriented correctly.
7. Place the capscrews into the bracket and tighten evenly. See “Table 2” on page 6 for the correct capscrew torque.
8. At this point it may be easier to tip the pump onto the casing (drive shaft pointing up). Slide the spacer (9) over the drive shaft until flush with the snap ring on the keyed side of the shaft. The spacer sets the working length of the mechanical seal. Use the factory part if replacement is necessary.
9. Place the new stationary seat of the mechanical seal in the seal holder with the hard face oriented outwards. The face must be kept clean of any contaminants.
10. Check to be sure the drive shaft is free of any burrs, particularly in the keyway. Lightly lubricate the ID of the elastomeric bellows on the rotating part of the mechanical seal and the area on the shaft where it will be located. Once the bellows has been lubricated the pump must be assembled in approximately 5 minutes. Carefully slide the rotating part of the seal onto the shaft until it contacts the spacer. The flat carbon face must be facing the keyway and be kept clean of any contaminants.
11. Slide the seal holder (seal seat facing rotating face) over the shaft and into the bracket until it contacts the rotating face. Be careful that the o-ring does not get damaged during installation.
12. Slide the outboard bearing over the shaft until it contacts the seal holder.
13. Force will need to be exerted on the bearing to overcome the seal spring force in order to install the internal snap ring. Install the internal snap ring.



## **⚠ DANGER !**

Before starting pump, be sure all drive equipment guards are in place.

Failure to properly mount guards may result in serious injury or death.

## **INSTALLATION: CARBON GRAPHITE BUSHINGS**

When installing carbon graphite bushings, extreme care must be taken to prevent breaking. Carbon graphite is a brittle material and easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation.

1. A press must be used for installation.
2. Be certain bushing is started straight.
3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.
4. Check bushing for cracks after installation.

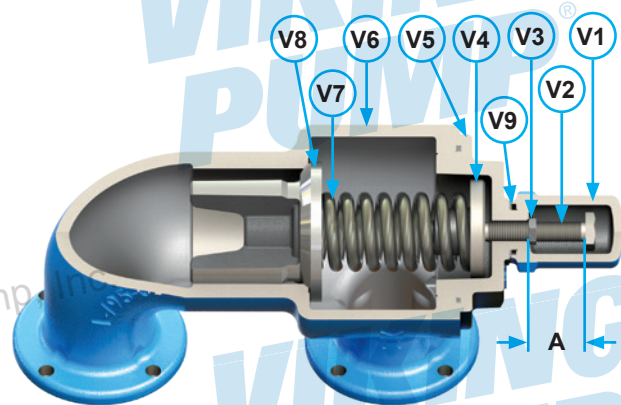
Carbon graphite bushings with extra interference fits are frequently furnished for high temperature operation. These bushings must be installed by a shrink fit.

1. Heat bracket or idler to 750°F.
2. Install cool bushing with a press.
3. If facilities are not available to reach 750°F. temperature, it is possible to install with 450°F. temperature; however the lower the temperature the greater the possibility of cracking the bushing.

Consult your Viking Pump® representative with specific questions on high temperature applications.

## **PRESSURE RELIEF VALVE INSTRUCTIONS**

**FIGURE 10: RELIEF VALVE**  
NOTE: Image is representative only.



**Valve - List Of Parts**

V1.	Valve Cap	V6.	Valve Body
V2.	Adjusting Screw	V7.	Valve Spring(s)
V3.	Lock Nut	V8.	Poppet
V4.	Spring Guide	V9.	Cap Gasket
V5.	Bonnet		

## **⚠ DANGER !**

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure:

1. That any pressure in the chamber has been completely vented through the suction or discharge lines, or other appropriate openings or connections.
2. That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational, so that it cannot be started while work is being done on pump.
3. That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.

Failure to follow above listed precautionary measures may result in serious injury or death.

## **DISASSEMBLY**

Mark valve and head before disassembly to ensure proper reassembly.

1. Remove valve cap.
2. Measure and record length of extension of adjusting screw. Refer to "A" on "Figure 10" on page 6.
3. Loosen locknut and back out adjusting screw until spring pressure is released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or damage and replace if necessary.



## ASSEMBLY

Reverse procedures outlined under Disassembly. If valve is removed for repairs be sure to replace in same position. Relief valve adjusting screw cap must always point towards suction side of pump. If pump rotation is reversed, remove relief valve and turn end for end.

## PRESSURE ADJUSTMENT

If a new spring is installed or if pressure setting of pressure relief valve is to be changed from that which the factory has set, the following instructions must be carefully followed.

1. Carefully remove valve cap which covers adjusting screw.  
Loosen locknut which locks adjusting screw, so pressure setting will not change during operation of pump.
2. Install a pressure gauge in the discharge line for adjusting the relief valve setting during operation.
3. Turn the adjusting screw CW (in) to increase the pressure setting, and CCW (out) to decrease the setting. For guidance dimensions, contact your Viking Pump® representative for Engineering Standard ES-37.
4. Close the discharge line at a point beyond the pressure gauge. Limit the amount of time the pump is operated at this condition. The temperature inside the pump will rise rapidly. The pressure gauge will show maximum pressure that valve will allow while pump is in operation.
5. Once the relief valve pressure is set, tighten locknut and replace the cap gasket and valve cap.

## IMPORTANT ORDERING INFORMATION

In ordering parts for pressure relief valve, always give model number and serial number of pump as it appears on nameplate and name of part wanted. When ordering springs, be sure to give pressure setting desired.

## APPENDIX (FORMERLY TSM 340)

**NOTE:** This Appendix section is for reference only. Not all pump construction features apply to pumps within this Technical Service Manual.

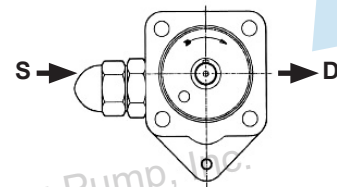
## GENERAL INSTALLATION NOTES

The following items must be considered prior to pump installation:

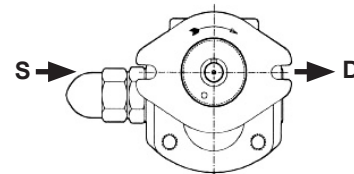
1. **Location** - locate the pump as close as possible to the liquid supply. If possible locate the pump below the liquid supply. Viking pumps are self-priming; but the better the suction conditions, the better the pump will perform.
2. **Accessibility** - the pump must be accessible for inspection, maintenance and repair.
3. **Suction/Discharge** - SG Series pumps are designed for clockwise rotation as standard (viewed from end of shaft). Refer to **Figure A1**.

**FIGURE A1: CLOCKWISE ROTATION  
(VIEWED FROM SHAFT END)**

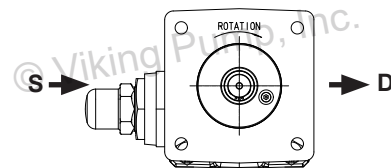
**SG-04 Series™ & SG-05 Series™:**



**SG-07 Series™:**



**SG-10 Series™ & SG-14 Series™:**



4. **Pressure Relief Valve** - the SG Series is a positive displacement pump and requires some form of over pressure protection. Without pressure protection, if the discharge line is blocked or becomes closed, pressure will build up until the motor stalls, drive equipment fails, a pump part breaks, or the piping and/or other equipment in the system bursts. To prevent the possibility of any one or more of the above from occurring, the use of a pressure relief valve is recommended.
5. **Storage** - drain the pump and apply a light coat of non-detergent SAE 30 weight oil to all internal pump parts. Apply grease to the pump shaft extension. Viking suggests rotating the pump shaft by hand one complete revolution every 30 days to circulate the oil.

## ALIGNMENT

Check alignment after mounting.

1. If the unit has a flexible coupling, remove any coupling guards or covers and check the alignment of coupling halves. A straight edge (piece of key stock will work) across the coupling must rest evenly on both rims at the top, bottom and sides. See **Figure A2**.

**FIGURE A2**

Use a straightedge. These surfaces must be parallel.



Check width between these surfaces with inside calipers to be certain the faces are equal distance apart and parallel.

2. Make a final check on alignment after piping is hooked up.

## PIPING/HOSE

The cause of many pumping problems can be traced to the suction piping. It should always be as large in diameter, and as short in length, as possible.

Before starting the layout and installation of your piping system, consider the following points:

1. Never use piping smaller than the pump port connections. Piping larger in diameter than the port connection is sometimes required to reduce friction losses.
2. Be sure the inside of the pipe is clean before installing.
3. When approaching an obstacle to the suction line, go around instead of over it. Going over an obstacle can create an air pocket. Where practical, slope the piping so no air or liquid pockets will be formed. Air pockets in the suction line make it hard for the pump to prime.
4. A strainer on the suction side of the pump should always be considered in any pumping system. The strainer will keep foreign matter from entering the pump. The strainer mesh or perforation size should be large enough so that it does not cause excessive pressure drop, but fine enough to protect the pump. Use of a strainer is particularly important at start up to help clean the system of weld beads, pipe scale and other foreign objects.
5. A pressure relief valve is required in the discharge line. See "**Pressure Relief Valve**" under "**General Installation Notes**" item 4.
6. The pump must not be used to support the piping. Hangers, supports, stands, etc. must carry the weight of the pipes.
7. When fastening piping to the pump do not impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will cause distortion, possible misalignment and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.

8. All joints of piping system must be tight; liquid thread sealant will help assure leak free threaded joints. Loose joints result in liquid leaks or suction side leaks. Leaks in the suction line can permit air to be drawn in, and will cause a noisy pump and reduction in capacity. **CAUTION: Be careful not to over tighten fittings as this can cause cracked ports.** Do not use PTFE tape. Reduced friction makes over tightening very easy, and will result in cracked ports.
9. Drive alignment must be checked after piping is connected.
10. Provide a pressure relief device in any part of a pump and piping system that can be isolated by closing a valve. Isolating a part of the system with a pump can cause a rise in liquid temperature, which causes the liquid to expand. Without overpressure protection, it is possible for the pump or piping to rupture.

## **⚠ DANGER !**

**Before starting the pump, be sure all drive equipment guards are in place. Failure to properly mount guards may result in serious injury or death.**

## START UP

Before starting the pump unit, check the following:

1. Ensure vacuum and pressure gauges (liquid filled) are mounted on or near the pump. Gauges are the quickest and most accurate way of finding out what is happening in the pump.
2. Check the pump and drive alignment.
3. Make sure there is no pipe strain on the pump ports.
4. Rotate the pump shaft by hand to be sure it turns freely.
5. Before connecting to the motor, jog it to be sure it is running in the correct direction. Refer to "**General Installation Notes**".
6. Ensure the pressure relief valve is installed properly.
7. Make sure the suction piping is properly connected and sealed, and that the valves are open.
8. Make sure the discharge piping is properly connected and sealed, the valves are open, and that there is a place for the liquid to go.
9. Make sure all guards are in place.
10. The above checklist is a general guideline to be used prior to starting the pump. Since Viking Pump® cannot foresee every application for our product and possible system design, the final responsibility is with the user. The pump must be utilized within the catalog specifications and the pump system must be designed to provide safe working conditions.

The pump unit may now be started. The pump should begin to deliver liquid within 15 seconds. If not, stop the pump unit. Do not run the pump without liquid flow longer than 30 seconds or the pump may be damaged. Review "**Start Up**" steps 1 through 10. Consider what the suction and discharge gauges may indicate. If everything appears in order, re-prime pump. Refer to "**Mounting**" item 8.

Re-start the pump. If nothing is flowing within 30 seconds, stop the pump. It may be necessary to vent discharge line until liquid begins to flow.

If pump still does not deliver flow, consider one or more of the following:

1. The suction line has air leaks.
2. The end of the suction pipe is not submerged deeply enough in the liquid.
3. The suction lift is too great, or the suction piping is too small.
4. Liquid is vaporizing in the suction line before it gets to the pump.

If the pump does not deliver liquid after considering these points, review all points under “**Start Up**,” read through the “**Troubleshooting**” guide, and try starting the pump again. If pump still will not deliver liquid, contact your Viking Pump® representative.

## TROUBLESHOOTING

A Viking pump that is properly installed and maintained will give long and satisfactory performance. If trouble develops, installing a vacuum gauge on the suction port, and a pressure gauge on the discharge port, will help determine what is occurring. The gauges will assist in determining where to begin investigating.

### VACUUM GAUGE - SUCTION PORT

#### 1. High reading would indicate:

- a. The suction line is blocked or pinched, a valve is closed, or a strainer is plugged.
- b. The suction line is too small.
- c. The liquid is too viscous to flow through the piping.
- d. The lift required is too high.

#### 2. Low reading would indicate:

- a. Air leak in the suction line.
- b. The end of the suction pipe is not in the liquid.
- c. Pump is worn.
- d. Pump is dry - should be primed.

#### 3. Fluttering, jumping, or erratic reading:

- a. The liquid is vaporizing.
- b. The liquid is entering the pump in chunks.
- c. There is an air leak, or insufficient liquid head above the end of the suction pipe.
- d. Vibration from cavitation, misalignment, or damaged parts.

### PRESSURE GAUGE - DISCHARGE PORT

#### 1. High reading would indicate:

- a. High viscosity and small and/or long discharge line.
- b. The strainer or filter is plugged.
- c. The pressure relief valve is set too high.
- d. A valve in the discharge line is partially closed.
- e. The line is partially plugged from buildup on the inside of the pipe, solidified product, or a foreign object.
- f. Liquid in the pipe is not up to temperature.

#### 2. Low reading would indicate:

- a. The relief valve is set too low.
- b. The relief valve poppet is not seating properly.
- c. Pump mounting capscrews not torqued to specifications (GP-04 and GP-05 Series 12-15 ft.-lbs.).
- d. Pump assembly bolts not torqued into specifications (GP-07 Series 50-55 ft.- lbs.).
- e. The bypass around pump partially open.
- f. Pump is damaged or worn.
- g. The pump has too much internal clearance.

#### 3. Fluttering, jumping, or erratic reading:

- a. Cavitation.
- b. Liquid is entering the pump in chunks.
- c. Air leak in the suction line.
- d. Vibration from misalignment or mechanical problems.

Some of the following may also help pinpoint the problem:

#### 1. Pump does not pump.

- a. Pump has lost its prime due to an air leak or low level in tank.
- b. Suction lift is too high.
- c. Rotating in wrong direction.
- d. The motor does not come up to speed.
- e. The strainer is clogged.
- f. Bypass valve open, relief valve set too low, relief valve poppet stuck open.
- g. The pump is worn out.
- h. Any changes in the liquid system or operation that would help explain the trouble, e.g. new source of supply, added more lines, inexperienced operators, etc.
- i. **Mag Drive pumps ONLY:** The magnetic coupling is decoupling. Changes in application (temperature, pressure, viscosity, etc.) may require torque beyond coupling capabilities.

#### 2. Pump starts, then loses its prime.

- a. The supply tank is empty.
- b. Liquid is vaporizing in the suction line.
- c. There are air leaks, or air pockets in the suction line.
- d. The pump is worn out.

#### 3. Pump is noisy.

- a. The pump is cavitating (liquid vaporizing in suction line) or being starved (heavy liquid cannot get to pump fast enough). Increase the suction pipe size, and/or reduce the length, or decrease the pump speed. If the pump is above the liquid, raise the liquid level closer to the center line of the inlet port. If the liquid is above the pump, increase the head of the liquid.
- b. Check alignment.
- c. Anchor the base or piping to eliminate vibration.



#### 4. Pump not delivering up to capacity.

- a. Pump is starving or cavitating. See 3. **Pump is noisy**, item 1.
- b. Strainer partially clogged.
- c. There is an air leak in the suction line.
- d. The pump is running too slowly. Check the motor speed and wiring.
- e. Pressure relief valve is set too low, stuck open or has a damaged poppet seat.
- f. The bypass line around the pump partially opened.
- g. The pump is worn out.

#### 5. Pump takes too much power (stalls motor).

- a. The pump sequence valve set too high.
- b. Liquid is more viscous than the unit is sized to handle.
- c. The system pressure relief valve set too high.
- d. The pump is misaligned.

## DO'S & DON'TS

Do's and Don'ts for installation, operation, and maintenance of Viking pumps to assure safe, long, trouble-free operation.

### INSTALLATION

1. **DO** install the pump as close as possible to the supply tank.
2. **DO** leave working space around the pumping unit.
3. **DO** use large, short, and straight suction piping.
4. **DO** install a strainer in the suction line.
5. **DO** double check alignment after the unit is mounted and piping is hooked up.
6. **DO** provide a pressure relief valve for the discharge side of the pump.
7. **DO** check for proper rotation.
8. **DO** use a return line filter.
9. **DO** use an industrial grade hydraulic oil.
10. **DO** use piping, hose and fittings rated for maximum system pressure.

### OPERATION

1. **DON'T** run the pump at speeds faster than maximum catalog ratings for each model.
2. **DON'T** allow the pump to develop pressure higher than maximum catalog ratings for each model.
3. **DON'T** operate pumps at temperatures above or below maximum catalog ratings for each model.
4. **DON'T** operate unit without all guards in place.
5. **DON'T** operate the pump without a pressure relief valve in the discharge piping. Be sure the valve is mounted and set correctly.
6. **DON'T** stick fingers in ports of pump. Fingers may be pinched between gears.
7. **DON'T** work on the pump unless driver has been "locked out" so it cannot be started while work is being done on the pump.

## MAINTENANCE

1. **DO** record pump model number and serial number, and file for further use.
2. **DO** have spare parts, pump or standby units available, particularly if pump is an essential part of a key operation process.
3. **DO** obtain, read and keep all maintenance instructions furnished with the pump.
4. **DO** make sure any pump that has residual system pressure in it, or that has handled high vapor pressure liquids, has been vented through the suction or discharge lines, or other openings provided for this purpose.
5. **DO** make sure that if the pump is still connected to the driver while maintenance is being performed, that the driver has been "locked out." This will prevent the driver from being started during pump maintenance.
6. **DO** make sure any pump that has handled a corrosive, flammable, hot or toxic liquid has been drained, flushed, vented and/or cooled before it is disassembled.

TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE



SPUR GEAR PRODUCT LINE: CAST IRON

SG-04 SERIES™, SG-404 SERIES™, SG-05 SERIES™, SG-405 SERIES™,  
SG-07 SERIES™, SG-407 SERIES™, SG-10 SERIES™, SG-410 SERIES™,  
SG-14 SERIES™, SG-414 SERIES™

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