



# TECHNICAL SERVICE MANUAL



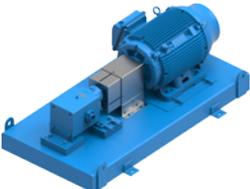
## EXTERNAL GEAR PUMPS SERIES GP-410, -414

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### MODEL NUMBER CHART

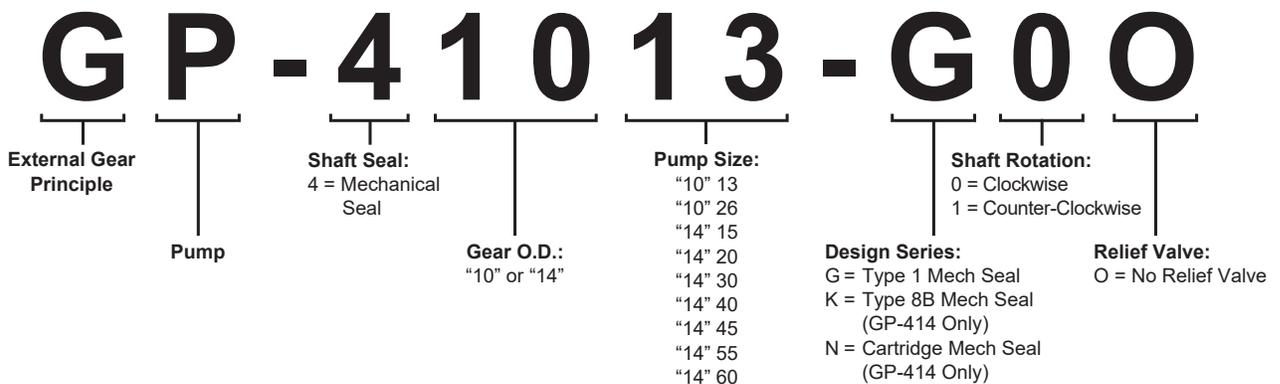
UNMOUNTED PUMP		UNITS
MECH. SEAL		
GP-41013-G00	GP-41013-G10	Units are designated by the unmounted pump model numbers followed by a letter(s) indicating drive style.  D = Direct Drive  
GP-41026-G00	GP-41026-G10	
GP-41415-G00	GP-41415-G10	
GP-41415-K00	GP-41415-K10	
GP-41415-N00	GP-41415-N10	
GP-41420-G00	GP-41420-G10	
GP-41420-K00	GP-41420-K10	
GP-41420-N00	GP-41420-N10	
GP-41430-G00	GP-41430-G10	
GP-41430-K00	GP-41430-K10	
GP-41430-N00	GP-41430-N10	
GP-41440-G00	GP-41440-G10	
GP-41440-K00	GP-41440-K10	
GP-41440-N00	GP-41440-N10	
GP-41445-G00	GP-41445-G10	
GP-41445-K00	GP-41445-K10	
GP-41445-N00	GP-41445-N10	
GP-41455-G00	GP-41455-G10	
GP-41455-K00	GP-41455-K10	
GP-41455-N00	GP-41455-N10	
GP-41460-G00	GP-41460-G10	
GP-41460-K00	GP-41460-K10	
GP-41460-N00	GP-41460-N10	

### INTRODUCTION

The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking representative. Always give the complete name of the part, part number and material with the model number and serial number of the pump when ordering repair parts. The unmounted pump or pump unit model number and serial number are on the nameplate.

This manual deals only with Series GP-410 and GP-414 External Gear Pumps. **Refer to Figures 1 through 6** for general configuration and nomenclature used in this manual. Contact factory for pump specifications and recommendations.

### MODEL NUMBER SYSTEM



# 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.

Symbol  
Legend :



**Danger** - Failure to follow the indicated instruction may result in serious injury or death.

**WARNING**

**Warning** - In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.



**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 means (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.

**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. 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.



**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.



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



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



**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 shafts being rotated.



**WARNING**

**THE PUMP** must be provided with pressure protection. This may be provided through 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. For additional information, refer to Viking Pump's Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.



**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**

**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.



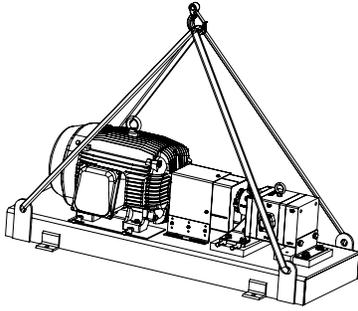
**WARNING**

**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.

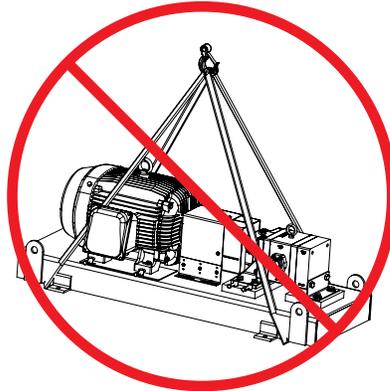
# COMPONENT & UNIT LIFTING FEATURES

Viking will leave all removable lifting features, such as threaded eye bolts and hoist rings, installed in components (pumps, reducers, motors, etc.) and baseplates. These features are used to safely lift and move the individual components. TSM-000 which is shipped with all pumps has been revised to include general details and figures of proper and improper lifting techniques, and the figures are included below. If more detail specific to a pump model or unit is necessary, it will be included in the specific Technical Service Manual.



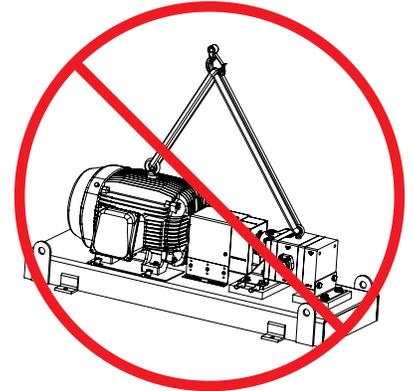
**FIGURE 1**  
**EXAMPLE OF PROPER**  
**LIFTING METHOD**

**NOTE:** Units should be lifted by the base lifting features using two or more lifting slings.



**FIGURE 2**  
**EXAMPLE OF IMPROPER**  
**LIFTING METHOD**

**NOTE: NEVER** lift the unit with slings unsecured under the base. The slings can slide, allowing the unit to tip and/or fall. Improper lifts can result in personal injury and/or damage to the unit.



**FIGURE 3**  
**EXAMPLE OF IMPROPER**  
**LIFTING METHOD**

**NOTE: NEVER** lift the unit with slings connected to the component lifting features. The lifting features are designed for the individual component and are not rated to lift the entire unit. Improper lifts can result in personal injury and/or damage to the unit.

## SPECIAL INFORMATION

### 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.

PORT SIZE	ALLEN WRENCH	CAPSCREW TORQUE
2" Port	3/8"	55-70 Ft-Lbs
3" Port	3/8"	120-135 Ft-Lbs
4" Port	3/8"	200-220 Ft-Lbs

**FLANGE CAPSCREW TORQUE SPECS**

## INSTALLATION

### GENERAL:

The following items must be considered prior to pump installation:

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

### 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.

### PIPING:

The GP Series pumps are high pressure pumps and can have high inlet pressures, as well. Make sure all piping and fittings on both the inlet and discharge side of the pump are rated for the expected pressures!

### **PRESSURE RELIEF VALVES:**

Viking pumps are positive placement pumps and must be provided with some sort of pressure protection. This may be an inline pressure relief valve, a torque limiting device or a rupture disk.

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

### **MOUNTING:**

1. Surfaces that the pump mounts against must be clean and flat.
2. For NEMA Mount, use SAE Grade 5 or better capscrews to mount pump.
3. Standard GP Series pumps are designed to be used with spacer 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. 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.

### **ALIGNMENT:**

Check alignment after mounting.

1. If unit has flexible coupling, remove any coupling guards or covers and check alignment of coupling halves using good laser alignment equipment.

Viking recommends an offset misalignment of .002" or better and an angular misalignment of .003"/10" or better. Consult coupling manufacturer's alignment requirements for acceptability.

2. Make final check on alignment after all piping connections have been made.

### **PIPING/HOSE:**

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

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

1. Never use piping smaller than pump port connections. Piping larger in diameter than the port connection is sometimes required to reduce suction losses.
2. Be sure the inside of 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 "Installation, General".
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. Loose joints result in liquid leaks or suction side leaks. Air leaks make the pump noisy and reduce flow.
9. Drive alignment must be checked after piping has been connected to the pump.
10. Provide a pressure relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. A rise in temperature will cause a liquid to expand. If there is no provision for pressure relief in the closed off section, there is a chance that the pump or piping will 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 pushing "start" button, check the following:**

1. 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. Pump is correctly aligned using good laser alignment equipment.
3. There is no pipe strain on the pump casing.
4. Rotate the pump shaft by hand to be sure it turns freely.
5. Motor has been jogged and is running in the correct direction. Refer to "Installation, General" on page 3.
6. Pressure relief valve is installed properly in the system.
7. Suction piping is connected and tight, and valves are open.
8. Make sure the discharge piping is properly connected and sealed, valves are open, and 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.

### **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.**

The "start" button may now be pushed.

The pump should begin to deliver liquid within 15 seconds! If not, push the stop button. Do not run the pump without liquid flow longer than 30 seconds or the pump may be ruined.

Review Startup steps 1 through 10. Consider what the suction and discharge gauges may indicate. If everything appears in order, re-prime pump. Refer to "Mounting", page 3.

Push the "start" button. If nothing is flowing within 30 seconds, stop the pump. The pump is not a compressor, it will not build up much air pressure. It may be necessary to vent discharge line until liquid begins to flow.

**If pump still does not deliver, 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 after consideration of these points, the pump still does not deliver liquid, review all points given under **START UP** and read through the **TROUBLESHOOTING** guide and try again. If pump still will not deliver liquid, contact your Viking Pump supplier.

## **MAINTENANCE**

Series GP-410 and GP-414 pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of 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 coat of light 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 SEAL REPLACEMENT TOOLS:**

The following tools must be available to properly replace the seals in Series GP-410 and GP-414 external gear 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 or automobile tool supplier.

1. Soft headed hammer
2. Allen wrenches:•
  - 5/32" (Type 1); GP-410 pumps
  - 3/8" (Type 1); GP-414 pumps
  - 3/16", 3/8" (Type 8B); GP-414 pumps
  - 3/8" (Cartridge): GP-414 pumps
3. Hex driver sockets for use with torque wrench:•
  - 5/32" (Type 1); GP-410 pumps
  - 3/8" (Type 1); GP-414 pumps
  - 3/8" (Type 8B); GP-414 pumps
  - 3/8" (Cartridge): GP-414 pumps
4. Snap ring pliers
5. Picks
6. PVC pipe\*
  - 1" ID x 6" long (Type 1); GP-410 pumps
  - 1-1/2" ID x 6" long (Type 1); GP-414 pumps
7. Mechanical seal installation sleeve

\* (Seal type designation)

### **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.**

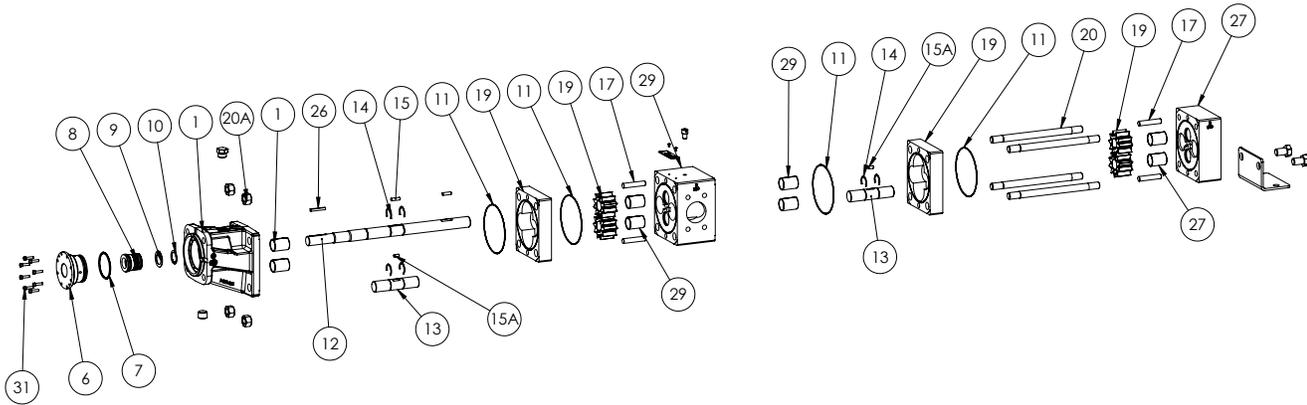
**Failure to follow above listed precautionary measures may result in serious injury or death.**

## **REPAIR PARTS**

The only parts recommended for replacement in the pump are the mechanical seal and o-rings, and must be replaced if the pump is disassembled.

Contact Viking Pump or your Authorized Viking Pump Distributor for price and availability on Genuine Viking Pump seal kits.

The Viking Pump GP series is precision machined with fixed end clearances and assembly tolerances. Viking recommends any repairs beyond seal replacement be facilitated through the Viking Pump Warranty Department.



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket & Bushing Assembly	11	O-Ring Between Sections	19	Match Ground Casing & Gears Assembly
5	Bushing	12	Driver Shaft	20	Studs
6	Seal Holder & Bushing Assembly	13	Driven Shaft	20A	Nuts
7	O-Ring for Seal Holder	14	External Retaining Ring	26	Key
8	Mechanical Seal	15	Gear Pin (Driver Gear)	27	Head & Bushing Assembly
9	Spacer for Mechanical Seal	15A	Gear Pin (Driven Gear)	29	Separation Plate & Bushing Assembly
10	External Retaining Ring	17	Alignment Pins	31	Capscrews

FIGURE 4 – EXPLODED VIEW – SERIES GP-410 TYPE 1 MECHANICAL SEAL PUMPS

## TYPE 1 MECHANICAL SEAL IN GP-410 PUMPS

### Seal Removal:

1. Refer to **Figure 4** for the names of parts.
2. Remove the pump's drive coupling and drive key.
3. Loosen and remove the seal holder capscrews (Item 31). GP-410 models require 3/8" Allen wrenches.
4. Use (2) of these capscrews as "jacking screws" to remove the seal holder (Item 6) slowly from the pump bracket (Item 1).  
**CAUTION:** When removing the seal holder from the bracket, the rotating part of the seal will tend to stick to the stationary seat. When it does this, it can fall off at any time once the seal holder has been removed.
5. Remove the O-ring (Item 7) which seals the seal holder and bracket.
6. The mechanical seal is made up of two primary components or parts. The part closest to the shaft end of the pump is the stationary seat. The part furthest in is the rotating part. Remove the seal face element from the rotating part if still attached. Then use a pair of picks to reach into the seal chamber to hook the seal spring and pull the mechanical seal out.

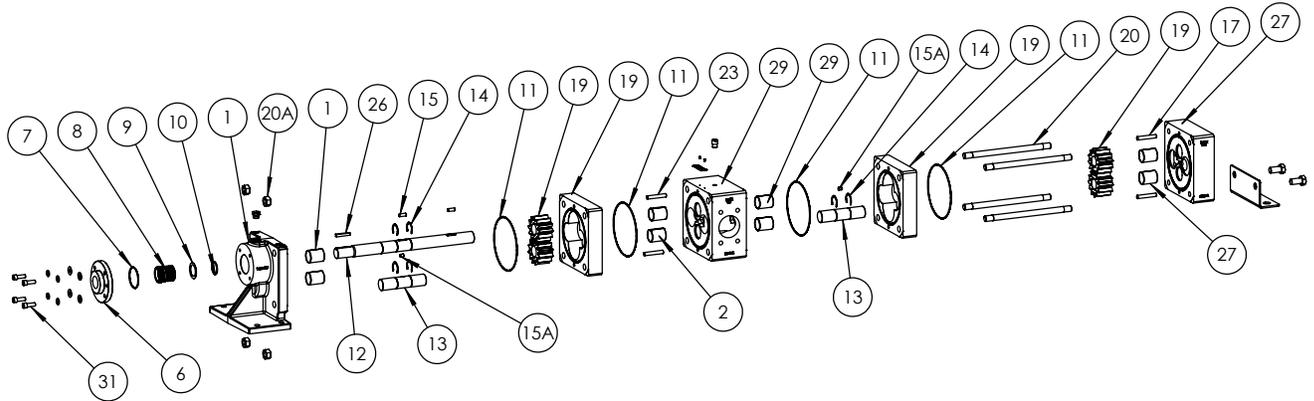
**NOTE:** This is a bellows type of seal and the bellows is designed to grip the shaft to drive the rotating part. It may take some effort to pull the seal out. If the seal cannot be moved, use a piece at least 6" long of 1" PVC pipe to push the rotating part down the shaft and into the pump to break the grip of the bellows on the shaft. Then use the picks to pull the mechanical seal out.

### Seal Installation:

1. If the pump has not been completely disassembled and only the seal is being replaced, the first step after removing the old seal is to use a lint-free towel to clean the shaft and the seal chamber inside the pump. Remove any dirt, sand or dirty oil that has collected in this area. Also clean the counter-bore where the seal holder O-ring (Item 7) is located.
2. Remove the old stationary seal face from the seal holder seat (Item 6). The stationary seat is a slip-fit into the seal holder. The only resistance to its removal will come from the O-ring on the O.D. on the stationary seat.
3. Once the stationary seal has been removed, clean the I.D. and O.D. of the seal holder.
4. To install the new stationary seal face, first lubricate the O-ring on the stationary seat with a generous amount of light oil. Also lubricate the bore for the stationary seat. Second, use your thumbs or the heel of your hand to press the stationary seat into bore of the seal holder (Item 6). Remember the face of the stationary seat has been lapped to a mirror finish. Any damage done to this face during installation will affect the ability of the mechanical seal to seal.
5. Install retaining ring (Item 10) into groove in drive shaft. Install seal washer (Item 9) against retaining ring.  
**CAUTION:** Be careful not to scratch the shaft in the sealing area.
6. Coat drive shaft, tapered installation sleeve and inner diameter of mechanical seal with light oil before assembly.
7. Slide the rotating part of mechanical seal (Item 8) over installation sleeve on shaft until it contacts the seal washer (Item 9).

8. Lubricate O-ring (Item 7) with a light oil and place onto seal holder (Item 6). Install seal holder into pump bracket (Item 1).
9. Tighten in a star pattern the seal holder capscrews (Item 31).

SERIES	ALLEN WRENCH	CAPSCREW TORQUE
GP-410	5/32"	60 in-lbs



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket	12	Driver Shaft	20	Studs
6	Seal Holder	13	Driven Shaft	20A	Nuts
7	O-Ring for Seal Holder	14	External Retaining Ring	26	Key
8	Mechanical Seal	15	Gear Pin (Driver Gear)	27	Head & Bushing Assembly
9	Spacer for Mechanical Seal	15A	Gear Pin (Driven Gear)	29	Separation Plate & Bushing Assembly
10	External Retaining Ring	17	Alignment Pins	29A	Separation Plate & Bushing Assembly
11	O-Ring Between Sections	19	Match Ground Casing & Gears Assembly	31	Capscrews

FIGURE 5 – EXPLODED VIEW – SERIES GP-414 TYPE 1 MECHANICAL SEAL PUMPS

## TYPE 1 MECHANICAL SEAL IN GP-414 PUMPS

### Seal Removal:

1. Refer to **Figure 5** for the names of parts.
2. Remove the pump's drive coupling and drive key.
3. Loosen and remove the seal holder capscrews (Item 31). GP-414 models require a 3/8" Allen wrench.
4. Use (2) of these capscrews as "jacking screws" to remove the seal holder (Item 6) slowly from the pump bracket (Item 1).
 

**CAUTION:** When removing the seal holder from the bracket, the rotating part of the seal will tend to stick to the stationary seat. When it does this, it can fall off at any time once the seal holder has been removed.
5. Remove the O-ring (Item 7) which seals the seal holder and bracket.
6. The mechanical seal is made up of two primary components or parts. The part closest to the shaft end of the pump is the stationary seat. The part furthest in is the rotating part. Remove the seal face element from the rotating part if still attached. Then use a pair of picks to reach into the seal chamber to hook the seal spring and pull the mechanical seal out.

**NOTE:** This is a bellows type of seal and the bellows is designed to grip the shaft to drive the rotating part.

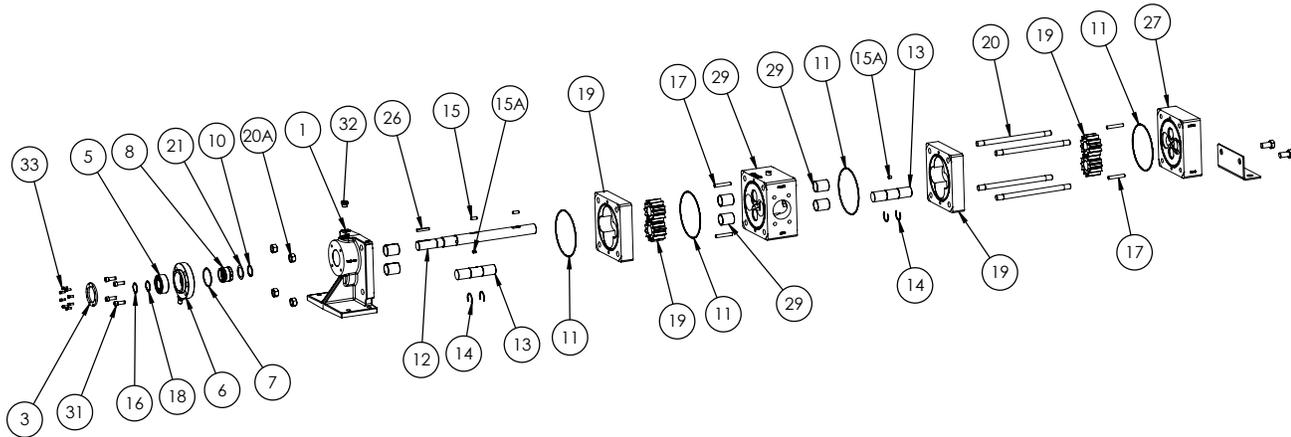
It may take some effort to pull the seal out. If the seal cannot be moved, use a piece at least 6" long of 1-1/2" PVC pipe to push the rotating part down the shaft and into the pump to break the grip of the bellows on the shaft. Then use the picks to pull the mechanical seal out.

### Seal Installation:

1. If the pump has not been completely disassembled and only the seal is being replaced, the first step after removing the old seal is to use a lint-free towel to clean the shaft and the seal chamber inside the pump. Remove any dirt, sand or dirty oil that has collected in this area. Also clean the counter-bore where the seal holder O-ring (Item 7) is located.
2. Remove the old stationary seal face from the seal holder seat (Item 6). The stationary seat is a slip-fit into the seal holder. The only resistance to its removal will come from the O-ring on the O.D. on the stationary seat.
3. Once the stationary seat has been removed, clean the I.D. and O.D. of the seal holder.
4. To install the new stationary seal face, first lubricate the O-ring on the stationary seat with a generous amount of light oil. Also lubricate the bore for the stationary seat. Second, use your thumbs or the heel of your hand to press the stationary seat into bore of the seal holder (Item 6). Remember the face of the stationary seat has been lapped to a mirror finish. Any damage done to this face during installation will affect the ability of the mechanical seal to seal.

5. Install retaining ring (Item 10) into groove in drive shaft. Install seal washer (Item 9) against retaining ring  
**CAUTION:** Be careful not to scratch the shaft in the sealing area.
6. Coat drive shaft, tapered installation sleeve and inner diameter of mechanical seal with light oil before assembly.
7. Slide the rotating part of mechanical seal (Item 8) over installation sleeve on shaft until it contacts the seal washer (Item 9).
8. Lubricate O-ring (Item 7) with a light oil and place onto seal holder (Item 6). Install seal holder into pump bracket (Item 1).
9. Tighten in a star pattern the seal holder capscrews (Item 31).

SERIES	ALLEN WRENCH	CAPSCREW TORQUE
GP-414	3/8"	120 in-lbs



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket	13	Driven Shaft	20A	Nuts
3	Bearing End Cap	14	External Retaining Ring	21	Seal Washer
5	Bearing	15	Gear Pin (Driver Gear)	26	Key
6	Seal Holder	15A	Gear Pin (Driven Gear)	27	Head & Bushing Assembly
7	O-Ring for Seal Holder	16	Beveled Retaining Ring	29	Seperation Plate & Bushing Assembly
8	Mechanical Seal	17	Alignment Pins	31	Capscrews
10	External Retaining Ring	18	External Inverted Retaining Ring	32	Plug
11	O-Ring Between Sections	19	Match Ground Casing & Gears Assembly	33	Bearing End Cap Capscrews
12	Driver Shaft	20	Studs		

FIGURE 5 – EXPLODED VIEW – SERIES GP-414 TYPE 8B MECHANICAL SEAL PUMPS

## TYPE 8B MECHANICAL SEAL IN GP-414 PUMPS

### Seal Removal:

1. Refer to **Figure 5** for the names of parts.
2. Remove the pump's drive coupling and drive key.
3. Loosen and remove the (8) 1/4" button head capscrews (Item 31) with 5/32" Allen wrench.
4. Use (2) of these button head capscrews as "jacking screws" to remove the seal holder (Item 6) slowly from the pump bracket (Item 1).  
**NOTE:** Thrust bearing (Item 5) and the bearing shims will remain in the seal holder (Item 6). These need to be removed prior to reassembly. Also, the stationary seat of the seal will be left on the shaft and kept there by the retaining ring (Item 10A). The stationary seat is a slip-fit into the seal holder. The only resistance to its removal will come from the O-ring on the O.D. on the stationary seat.
5. Use snap ring pliers to remove the retaining ring (Item 10A) on the shaft (Item 12) that locates the thrust bearing.

6. With the retaining ring removed the stationary seat can be removed from the assembly.
7. Remove the SAE O-ring plug on the top of the pump bracket with 7/8" wrench to obtain access to the set screws on the rotating element of the mechanical seal.
8. Use 1/8" Allen wrench to loosen the (4) set screws on the mechanical seal (Item 8). These set screws are 90° apart; rotate pump shaft to access each set screw.
9. The mechanical seal is made up of two primary components or parts. The part closest to the end of the pump is the stationary seat. The part furthest in with the (4) set screws is the rotating part. Use a pair of picks to reach into the seal chamber to hook and pull the mechanical seal out.

### Seal Installation:

1. If the pump has not been completely disassembled and only the seal is being replaced, the first step after removing the old seal is to use a lint-free towel to clean the shaft and the seal chamber inside the pump. Remove any dirt, sand or dirty oil that has collected in this area.

2. Install retaining ring (Item 10) into groove in drive shaft. Install seal washer (Item 9) against retaining ring and install seal shim (Item 9A) against seal washer.

**CAUTION:** Be careful not to scratch the shaft in the sealing area.

3. Loosen set screws on seal and apply a dot of Loctite 242 to set screw threads.

4. Coat drive shaft, tapered installation sleeve and inner diameter of mechanical seal with a light oil before assembly.

5. Slide the rotating part of mechanical seal (Item 8) over installation sleeve on shaft until it contacts the seal shim.

**NOTE:** The longer dog point set screw needs to be lined up with the recess in the shaft that is in line with the keyway. This will also align two set screws with flats on the side of the shaft to prevent the mechanical seal from spinning on the shaft.

6. Make sure the seal is fully seated against the seal shim. Through access hole in top of pump bracket (Item 1), tighten the dog point set screw until it makes contact with the shaft, ensuring it is in the recess located in line with the keyway. Rotate the shaft (Item 12) 180 degrees and tighten the cup point set screw until it makes contact with the shaft. Rotate the shaft 90 degrees and tighten the set screw until it makes contact with the shaft. Rotate the shaft 180 degrees and tighten the set screw until it makes contact with the shaft. Once all set screws are contacting the shaft, evenly tighten them to 36 in-lbs.

**CAUTION:** Overtightening the set screws can distort the seal preventing it from sealing properly.

7. Install SAE O-ring plug (Item 32) into access hole with 7/8" wrench.

8. Clean the I.D. and O.D. of the seal holder (Item 6).

9. To install the new silicon carbide stationary seat, first lubricate the O-ring on the stationary seat with a generous amount of light oil. Also lubricate the bore for the stationary seat. Second, align the notch in stationary seat with pin in seal holder and use your thumbs or the heel of your hand to press the stationary seat into bore of the seal holder (Item 6). Remember the face of the stationary seat has been lapped to a mirror finish. Any damage done to this face during installation will affect the ability of the mechanical seal to seal.

10. Lubricate O-ring (Item 7) with a light oil and place into seal holder groove. Lubricate pump bracket (Item 1) bores with a light oil and install seal holder (Item 6). Hand tighten the (8) 1/4" button head capscrews (Item 31). These will be torqued tight after the bearing installation.

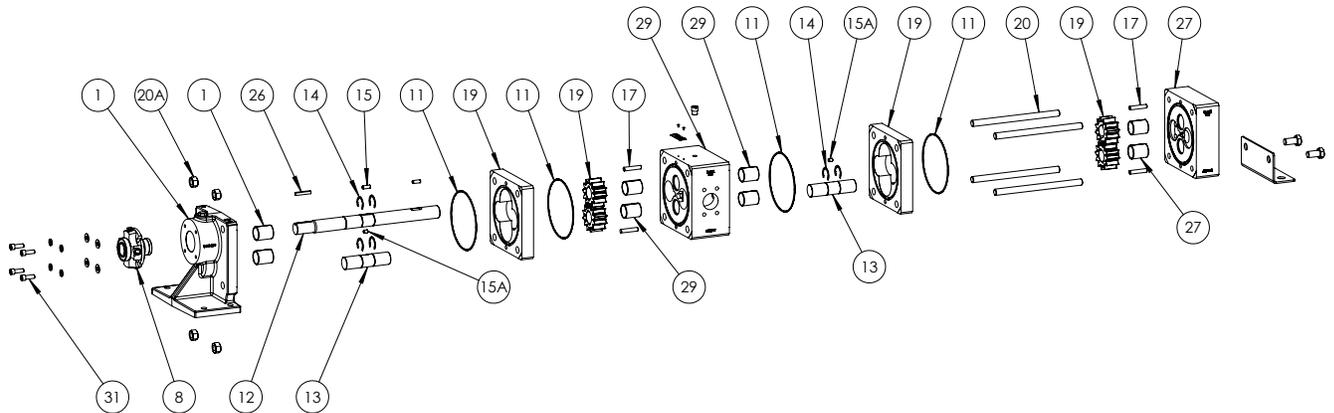
11. Install retaining ring (Item 10A) into groove in shaft (Item 12). Install bearing shim against retaining ring. Slide bearing (Item 5) onto shaft until it contacts the bearing shim.

**NOTE:** The bearing must be installed with the large side of the inner race against the bearing shim. The letters on the bearing outer race will be readable when installed correctly.

12. Install retaining ring (Item 4) into groove in seal holder (Item 6).

13. Tighten in a star pattern the (8) 1/4" button head capscrews (Item 31) with 3/16" Allen wrench. Torque to 96 in-lbs.

SERIES	ALLEN WRENCH	CAPSCREW TORQUE
GP-414	3/8"	120 in-lbs



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket & Bushing Assembly	15	Gear Pin (Driver Gear)	26	Key
8	Mechanical Seal	15A	Gear Pin (Driven Gear)	27	Head & Bushing Assembly
11	O-Ring Between Sections	17	Alignment Pins	29	Separation Plate & Bushing Assembly
12	Driver Shaft	19	Match Ground Casing & Gears Assembly	31	Capscrews
13	Driven Shaft	20	Studs		
14	External Retaining Ring	20A	Nuts		

FIGURE 6 – EXPLODED VIEW – SERIES GP-414 CARTRIDGE MECHANICAL SEAL PUMPS

# CARTRIDGE MECHANICAL SEAL IN GP-414 PUMPS

## Seal Removal:

1. If flush plan or barrier fluid tubes are connected to the seal gland (Item 8), turn off and disconnect before removing seal. Also, remove all pipe plugs from seal gland for ease of removal through bearing housing opening. Place set clips on seal. Loosen the set screws on the cartridge seal collar to free the cartridge seal from the shaft. Remove nuts and washers from studs. Remove all fittings and pipe plugs from seal gland. Slide cartridge seal off of the driver shaft.

## Seal Installation:

1. **NOTE:** Burrs left on shaft can damage O-rings on seal sleeve during installation. Inspect shaft for burrs and remove any found with a fine grade emery cloth.
2. Clean driver shaft and face of seal chamber on bracket.
3. Place tapered installation sleeve on shaft. Coat driver shaft, tapered installation sleeve, and O-rings in the inside diameter of cartridge seal sleeve with a generous amount of light oil. **See Figure 6.**
4. Slide cartridge seal over installation sleeve on shaft until it contacts the seal chamber face. Be sure the flush port opening on the seal gland is at the 12 o' clock position. Remove tapered installation sleeve from shaft.
5. Secure seal gland to bracket face using capscrews (Item 31), flat washers (Item 10), and lock washers (Item 9). **NOTE:** Tighten capscrews enough to compress seal gland gasket. Tighten only enough to contain leakage and not to distort seal gland.
6. Remove or turn seal centering clips so as to clear the seal drive collar prior to operation

# TROUBLESHOOTING

A Viking pump that is properly installed and maintained will give long satisfactory performance.

If trouble does develop, one of the first steps toward finding the difficulty is to install a vacuum gauge in the suction line and a pressure gauge in the discharge line. Readings on these gauges often give a clue on where to start looking for trouble.

## **VACUUM GAUGE - SUCTION PORT:**

### **High vacuum reading would indicate:**

1. The suction line is blocked, valve closed, a strainer is plugged or a pinched suction line.
2. The suction line is too small.
3. The liquid is too viscous to flow through the piping.
4. The lift required is too high.

### **Low reading would indicate:**

1. There may be an air leak in the suction line.
2. The end of the pipe is not in the liquid.
3. The pump is worn.
4. The pump is dry and should be primed.

### **Fluttery, jumping or erratic reading would indicate:**

1. The liquid is vaporizing.
2. Liquid is coming in to the pump in slugs, possibly an air leak or insufficient liquid above the end of the suction pipe.
3. Vibration from cavitation, misalignment, or damaged parts.

## **PRESSURE GAUGE - DISCHARGE PORT:**

### **High reading would indicate:**

1. High viscosity and small diameter and/or lengthy discharge line.
2. A downstream strainer or filter is plugged.
3. The pressure relief valve is set too high.
4. Valve in the discharge line partially closed.
5. Line partially plugged from build up on inside of pump, solidified product or foreign object.
6. Liquid in the pipe not up to temperature.

### **Low reading would indicate:**

1. Pressure relief valve set too low.
2. Pressure relief valve poppet not seating properly.
3. Pump assembly bolts not torqued to specifications.
4. The bypass around pump partially open.
5. Pump is damaged or worn.
6. The pump has too much internal clearance.

### **Fluttery, jumping or erratic reading would indicate:**

1. Cavitation.
2. Liquid is coming to the pump in slugs.
3. Air leak in the suction line.
4. Vibrating from misalignment or mechanical problems.

## **MISCELLANEOUS:**

### **Pump does not pump:**

1. The pump has lost its prime from air leak or low level in tank.
2. The suction lift is too high.
3. Rotating in the wrong direction.
4. The motor does not come up to speed.
5. The strainer is clogged.
6. The bypass valve is open, pressure relief valve set too low or pressure relief valve poppet stuck open.
7. The pump is worn out.
8. Any changes in liquid, system or operation that would help explain the trouble, e.g. new liquid, additional lines or process changes.

### **Pump starts, then loses its prime:**

1. The supply tank is empty.
2. The liquid is vaporizing in the suction line.
3. There is an air leak or air pockets in the suction line.
4. The pump is worn out.

### **Pump is noisy:**

1. 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.
2. Check alignment.
3. Anchor the base or piping to eliminate vibration.

### **Pump not delivering up to capacity:**

1. The pump is starving or cavitating – see Pump is noisy, item 1.
2. The strainer partially clogged.
3. Air leak somewhere in the suction line.
4. Running too slow. Is the motor the correct speed and wired up correctly?
5. Pressure relief valve is set too low, stuck open or has damaged poppet seat.
6. The bypass line around the pump partially opened.
7. The pump is worn out.

### **Pump takes too much power (stalls motor):**

1. Liquid is more viscous than the is unit sized to handle.
2. The system pressure relief valve set too high.
3. 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 to supply tank as possible.
2. **DO** leave working space around the pumping unit.
3. **DO** use large, short and straight suction port.
4. **DO** install a strainer in the suction line.
5. **DO** a double check of alignment after unit is mounted and piping has been connected to the pump.
6. **DO** provide pressure relief valve for discharge side of pump.
7. **DO** check for proper rotation.
8. **DO** use piping, hose and fittings rated for maximum system pressure.

### **OPERATION:**

1. **DON'T** run the pump at speeds faster than those shown in the catalog at that size.
2. **DON'T** allow the pump to develop pressure higher than those shown in catalog at that size.
3. **DON'T** operate pumps at temperatures above or below limits shown in catalog for model.
4. **DON'T** operate unit without all guards in place.
5. **DON'T** operate pump without pressure relief valve in discharge piping; be sure 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 stand by units available, particularly if pump is essential part of key operation process.
3. **DO** obtain, read and keep all maintenance instructions furnished with this pump.

**VIKING  
PUMP**

# TECHNICAL SERVICE MANUAL



## EXTERNAL GEAR PUMPS SERIES GP-410, -414

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## **VIKING PUMP**

### **WARRANTY**

Viking pumps, strainers and reducers are warranted to be free of defects in material and workmanship under normal conditions of use and service. The warranty period varies by type of product. A Viking product that fails during its warranty period under normal conditions of use and service due to a defect in material or workmanship will be repaired or replaced by Viking. At Viking's sole option, Viking may refund (in cash or by credit) the purchase price paid to it for a Viking product (less a reasonable allowance for the period of use) in lieu of repair or replacement of such Viking product. Viking's warranty is subject to certain restrictions, limitations, exclusions and exceptions. A complete copy of Viking's warranty, including warranty periods and applicable restrictions, limitations, exclusions and exceptions, is posted on Viking's website ([www.vikingpump.com/warranty/warranty-info](http://www.vikingpump.com/warranty/warranty-info)). A complete copy of the warranty may also be obtained by contacting Viking through regular mail at Viking Pump, Inc., 406 State Street, Cedar Falls, Iowa 50613, USA.

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