

TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE



SPUR GEAR PRODUCT LINE: *DUCTILE IRON*
 GB-414 SERIES™
 HIGH PRESSURE EXTERNAL GEAR PUMPS
 FOR PIPELINE INJECTION

TSM	1655
Page	1 of 15
Issue	D

TABLE OF CONTENTS

Model Number Chart..... 1

Introduction 1

Safety Information & Instructions..... 2

Component & Unit Lifting Features 3

Foundation 3

Special Information 3

Installation 4

General..... 4

Pressure Protection..... 4

Mounting..... 4

Alignment..... 4

Drain..... 4

Piping/Hose 4

Start Up 5

Maintenance..... 5

Cleaning Pump..... 5

Storage..... 5

Suggested Seal Replacement & Pump Rebuild Tools 5

Type 2 Mechanical Seal..... 7

Seal Removal..... 7

Seal Installation 8

Type 8B5 Mechanical Seal 9

Seal Removal..... 9

Seal Installation 9

Type 5611Q Cartridge Seal..... 10

Seal Removal..... 10

Seal Installation..... 10

Repair Parts 10

Pump Repair 10

Repair Tools 10

Disassembly..... 11

Reassembly 12

Troubleshooting 14

Vacuum Gauge - Suction Port 14

Pressure Gauge - Discharge Port..... 14

Miscellaneous..... 14

Do's & Don'ts 15

Installation 15

Operation..... 15

Maintenance..... 15

MODEL NUMBER CHART

Clockwise	Counter-Clockwise
GB-41415-*00	GB-41415-*10
GB-41420-*00	GB-41420-*10
GB-41430-*00	GB-41430-*10
GB-41440-*00	GB-41440-*10
GB-41445-*00	GB-41445-*10
GB-41455-*00	GB-41455-*10
GB-41460-*00	GB-41460-*10

* R = Type 2 Mechanical Seal
 K = Type 8B5 Mechanical Seal
 N = Cartridge Mechanical Seal

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:
GB-41415 SERIES™**



**FIGURE 2:
GB-41430 SERIES™**



**FIGURE 3:
GB-41445 SERIES™**



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.

COMPONENT & UNIT LIFTING FEATURES

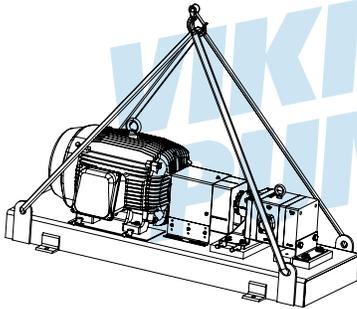
Viking will leave all removable lifting features, such as threaded eye bolts and hoist rings, installed in components (pumps, reducers, motors, etc.) and baseplates. These features are used to safely lift and move the individual components.

FOUNDATION

Every pump should have a solid foundation. It may be any structure sufficiently strong enough to hold the pump rigid and to absorb any strain or shock that may be encountered. A certified print of the pumping unit should be used in preparing the foundation. If a separate foundation is provided, make it at least four inches wider and longer than the base of the unit. When the unit is placed on the foundation, it should be leveled and checked for position against the piping layout and then fastened down.

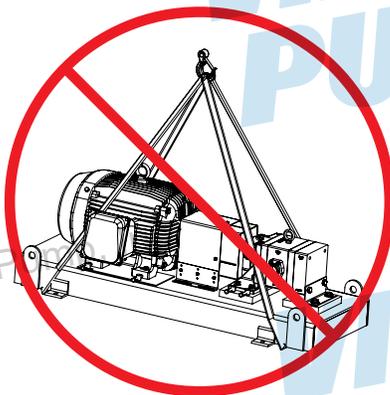
Following are general guidelines for lifting Viking Pump Units.

FIGURE 4: EXAMPLE OF PROPER LIFTING METHOD



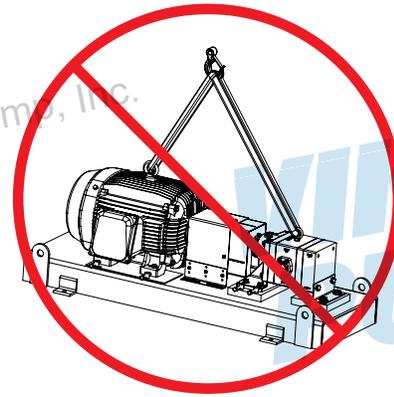
NOTE: Units should be lifted by the base lifting features using two or more lifting slings.

FIGURE 5: 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 6: 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.

TABLE 1: FLANGE CAPSCREW TORQUE SPECS

Port Size	Allen Wrench	Capscrew Torque
2" Port	3/8"	55-70 Ft-Lbs
3" Port	1/2"	120-135 Ft-Lbs
4" Port	3/4"	200-220 Ft-Lbs

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. **Rotation** - GB-414 Series pumps are rotation specific (viewed from end of shaft). Viking GB series external gear pumps can be offered in clockwise (-R00, K00, N00) or counter-clockwise (-R10, K10, N10) rotation. The intended pump shaft 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.
4. **Piping** - GB-414 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!

IMPORTANT NOTE: For Pumps with NPT tapped ports DO NOT USE PTFE TAPE when threading in pipe to the NPT port. Using PTFE tape can crack the pump ports. A compatible liquid pipe sealant must be used.

PRESSURE PROTECTION

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.

MOUNTING

1. Surfaces that the pump mounts against must be clean and flat.
2. Standard GB-414 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.
3. 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.
4. 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.

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

1. 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.

DRAIN

Each pump is equipped with a hose barb fitting to drain product in the event of a seal leak. Viking Pump® recommends installing a tube to a sump location to divert any product that leaks past the seal. Any plugs should be removed to allow product to drain to protect against product washing out the lubrication in the outboard thrust bearing.

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:

IMPORTANT NOTE: When threading in pipe to the NPT tapped ports, DO NOT USE PTFE TAPE. Using PTFE tape can crack the pump ports. A compatible liquid pipe sealant must be used. The GB-414 Series pumps are high pressure pumps, make sure all piping and fittings on both inlet and discharge sides of the pump are rated for the expected pressures.

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 "General" on page 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. 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 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 “General” on page 4.
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 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” on page 4.

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” on page 5 and read through the “Troubleshooting” on page 14 guide and try again. If pump still will not deliver liquid, contact your Viking Pump supplier.

MAINTENANCE

These 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.

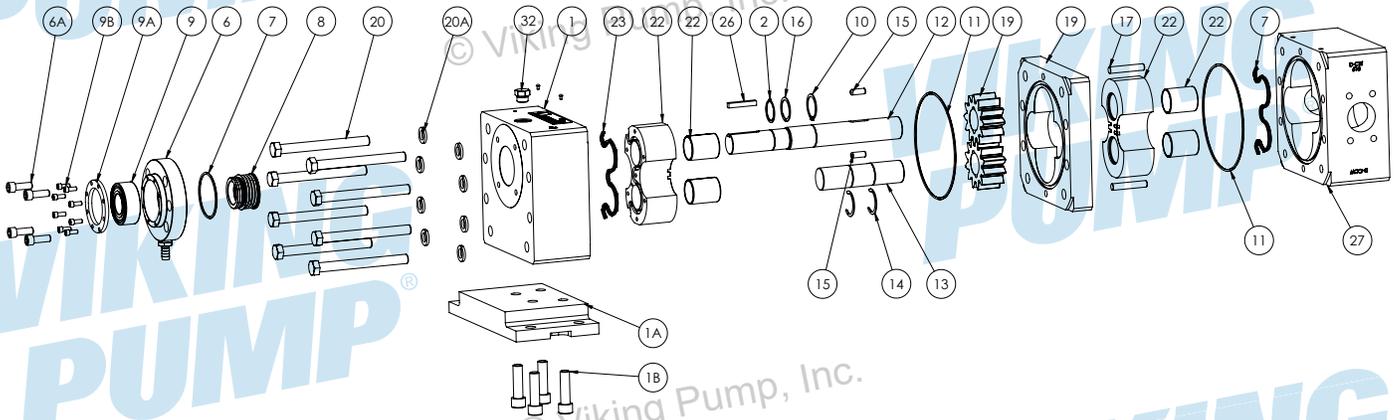
SUGGESTED SEAL REPLACEMENT & PUMP REBUILD TOOLS

The following tools must be available to properly replace the seals in these 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. Some of these tools are available from Viking Pump, please contact your Viking Pump® Representative to obtain a copy of **Viking Technical Reference 805 (TR-805) Suggested Tools for Trouble-Shooting and Field Repair of Viking Pumps:**

1. Soft headed hammer P/N 2-810-032-999-00
2. Allen wrenches:*
 - 3/16”, 3/8” (Type 2); GB-414 pumps
 - 3/16”, 3/8” (Type 8B5); GB-414 pumps
 - 3/8” (Cartridge); GB-414 pumps
3. Hex driver sockets for use with torque wrench:*
 - 3/8” (Type 2); GB-414 pumps
 - 3/8” (Type 8B); GB-414 pumps
 - 3/8” (Cartridge); GB-414 pumps
4. Snap ring pliers
5. Picks
6. PVC pipe*
 - 1-1/2” ID x 6” long (Type 2); GB-414 pumps
7. Mechanical seal installation sleeve (provided with seal)

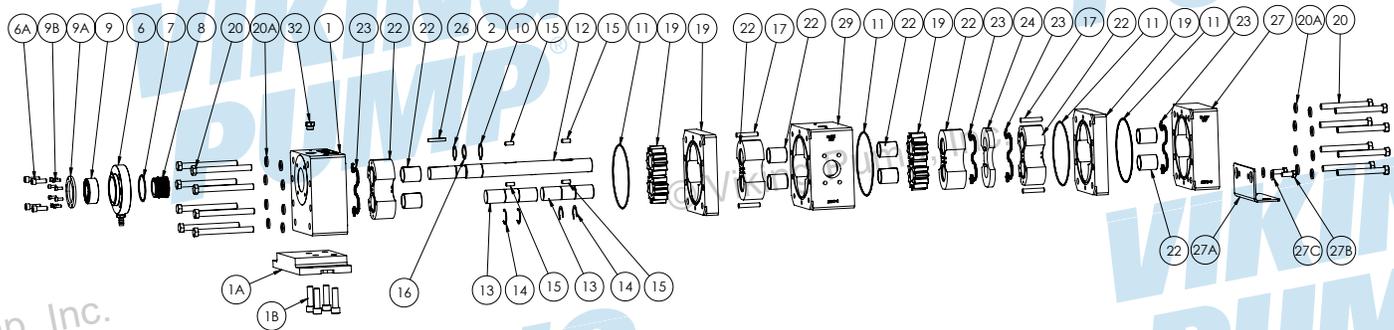
*(Seal type designation)

FIGURE 7: EXPLODED VIEW - GB-41415 & GB-41420 TYPE 2 MECHANICAL SEAL PUMPS



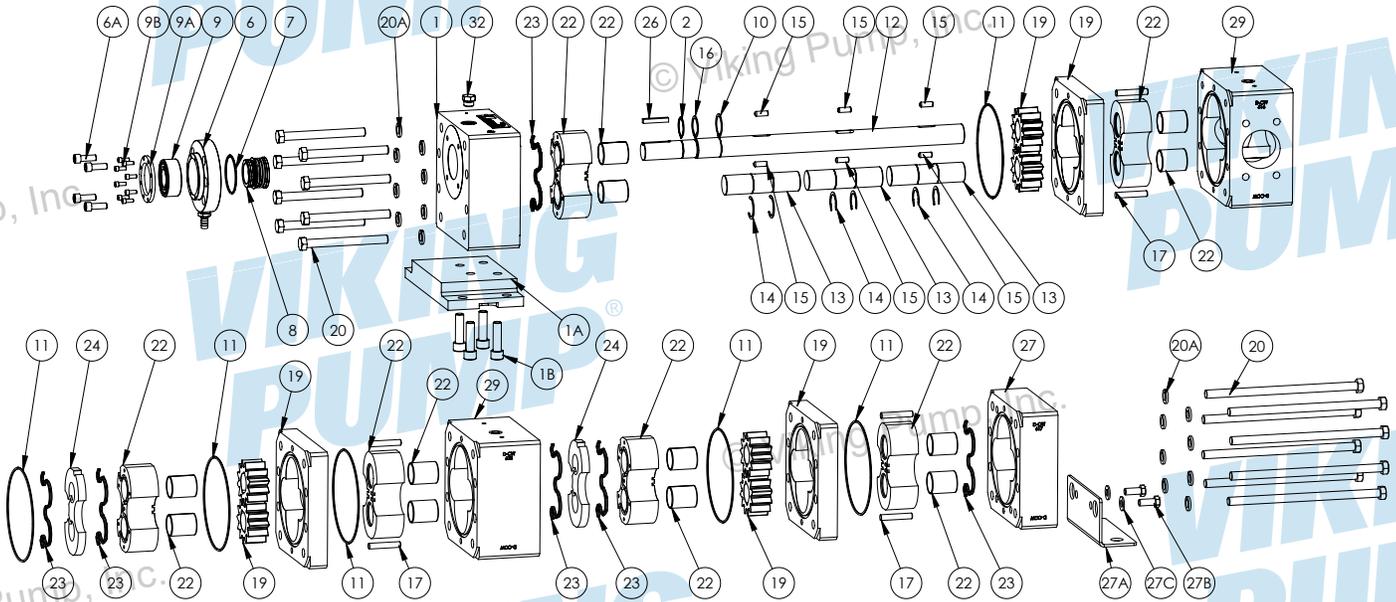
ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket	9A	Bearing End Cap	17	Alignment Pins
1A	Foot	9B	Bearing End Cap Capscrews	19	Match Ground Casing & Gears Assembly
1B	Capscrews	10	External Retaining Ring	20	Pump Assembly Capscrews
2	Beveled Retaining Ring	11	O-Ring Between Sections	20A	Lockwashers
6	Seal Holder Assembly	12	Driver Shaft	22	Gasket Activated Bushing Block (GABB) & Bushing Assembly
6A	Seal Holder Capscrews	13	Driven Shaft	23	GABB Gasket
7	O-Ring For Seal Holder	14	External Retaining Ring	26	Key
8	Mechanical Seal	15	Gear Pins	27	Head
9	Bearing	16	External Retaining Ring	32	Plug

FIGURE 8: EXPLODED VIEW - GB-41430 & GB-41440 TYPE 2 MECHANICAL SEAL PUMPS



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket	10	External Retaining Ring	22	Gasket Activated Bushing Block (GABB) & Bushing Assembly
1A	Foot	11	O-Ring Between Sections	23	GABB Gasket
1B	Capscrews	12	Driver Shaft	24	GABB Spacer
2	Beveled Retaining Ring	13	Driven Shaft	26	Key
6	Seal Holder Assembly	14	External Retaining Ring	27	Head
6A	Seal Holder Capscrews	15	Gear Pins	27A	Foot
7	O-Ring For Seal Holder	16	External Retaining Ring	27B	Capscrews
8	Mechanical Seal	17	Alignment Pins	27C	Washers
9	Bearing	19	Match Ground Casing & Gears Assembly	29	Separation Plate
9A	Bearing End Cap	20	Pump Assembly Capscrews	32	Plug
9B	Bearing End Cap Capscrews	20A	Lockwashers		

FIGURE 9: EXPLODED VIEW - GB-41445, GB-41455 & GB-41460 TYPE 2 MECHANICAL SEAL PUMPS



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bracket	10	External Retaining Ring	22	Gasket Activated Bushing Block (GABB) & Bushing Assembly
1A	Foot	11	O-Ring Between Sections	23	GABB Gasket
1B	Capscrews	12	Driver Shaft	24	GABB Spacer
2	Beveled Retaining Ring	13	Driven Shaft	26	Key
6	Seal Holder Assembly	14	External Retaining Ring	27	Head
6A	Seal Holder Capscrews	15	Gear Pins	27A	Foot
7	O-Ring For Seal Holder	16	External Retaining Ring	27B	Capscrews
8	Mechanical Seal	17	Alignment Pins	27C	Washers
9	Bearing	19	Match Ground Casing & Gears Assembly	29	Separation Plate
9A	Bearing End Cap	20	Pump Assembly Capscrews	32	Plug
9B	Bearing End Cap Capscrews	20A	Lockwashers		

⚠ 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.

TYPE 2 MECHANICAL SEAL

NOTE: For replacing the single component bellows mechanical seal in the GB-414 pumps in the field, be sure to have seal kit P/N 3-464-LACT-K496.

SEAL REMOVAL

1. See "Figure 7" on page 6, "Figure 8" on page 6 and "Figure 9" on page 7 for the names of parts.
2. Remove the pump's drive coupling and drive key.
3. Remove beveled retaining ring (Item 2).
4. Loosen and remove the (4) 7/16" socket head capscrews (Item 6A) with 3/8" Allen wrench
5. Use (2) of the 7/16" capscrews as "jacking screws" to remove the seal holder (Item 6) slowly from the pump bracket (Item 1).

NOTE: Thrust bearing (Item 9) 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 16). 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.

- Using snap ring pliers remove the retaining ring (Item 16) from the driver shaft (Item 12) that locates the thrust bearing.
- 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 element. With the retaining ring removed the stationary seat can be removed from the assembly. 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

- 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.
- 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.
- Remove (8) 1/4" socket head capscrews (Item 9B) with 3/16" Allen wrench.
- Remove end cap (Item 9A), then remove thrust bearing (Item 9) from seal holder (Item 6).
- Once the stationary seat and thrust bearing have been removed, clean the I.D. and O.D. of the seal holder.
- To install the new stationary seal face, first lubricate the O-ring on the stationary seat with a generous amount of temporary assembly lubricant such as P-80® or equivalent. Also lubricate the bore for the stationary seat. Second, align the notch in the stationary seat with the pin in the seal holder (Item 6), 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 properly seal.
- If needed, install retaining ring (Item 10) into groove in drive shaft.

CAUTION !

Be careful not to scratch the shaft in the sealing area.

- Coat drive shaft (Item 12), tapered installation sleeve and inner diameter of mechanical seal (Item 8) with a temporary assembly lubricant such as P-80® or equivalent before assembly.

NOTE: The recommended lubricants for elastomeric bellows are soft hand soap and water, or glycerin; do not use washing-up liquid, liquid soaps, or hand cleaning gels. Light mineral oil may be used sparingly with most elastomers. Do not use grease (including silicone grease) on any elastomer bellows.

- Slide the rotating part of mechanical seal (Item 8) over installation sleeve on shaft, against seal washer (Item 8A), making sure the seal spring is fully seated within the spring guide. Clean the seal faces of any oils or dirt by rinsing the seal faces off with a suitable cleaner such as denatured alcohol prior to installation of the seal holder (Item 6).
- Lubricate O-ring (Item 7) with a light oil and place on to seal holder (Item 6). Install seal holder into pump bracket (Item 1).
- Add anti-seize to threads and hand tighten the (4) 7/16" socket head capscrews (Item 6A) with 3/8" Allen wrench to fasten seal holder (Item 6) to bracket (Item 1). Tighten in a star pattern the (4) 7/16" socket head capscrews (Item 6A) with 3/8" Allen wrench to 120 in-lbs.
- Install retaining ring (Item 16) into groove on shaft.

CAUTION !

Be careful not to scratch the shaft in the sealing area.

- Slide thrust bearing (Item 9) on to shaft until it contacts retaining ring (Item 16).
NOTE: The bearing must be installed with the large side of the inner race against the retainer ring. The letters on the bearing outer race will be readable when installed correctly.
- Install end cap (Item 9A) to seal holder (Item 6) with (8) 1/4" socket head capscrews (Item 9B) with 3/16" Allen wrench hand tight. The capscrews will be torqued to a final value later.
- Install beveled retaining ring (Item 2) with the bevel facing outward towards the motor end of the driver shaft (Item 12).
NOTE: The driver shaft (Item 12) may need to be pulled toward the outside of the pump, compressing the mechanical seal spring to uncover the groove in the shaft for the beveled retaining ring. Verify the beveled retaining ring is fully seated
- Tighten in a star pattern the (8) 1/4" socket head capscrews (Item 9B) with 3/16" Allen wrench to 96 in-lbs.

P-80® is a registered trademark of International Products Corporation

TYPE 8B5 MECHANICAL SEAL

NOTE: For replacing the Type 8B5 mechanical seal in the GB-414 pumps in the field, be sure to have seal kit P/N 3-464-LACT-K448.

SEAL REMOVAL

1. See “Figure 7” on page 6, “Figure 8” on page 6 and “Figure 9” on page 7 for the names of parts.
2. Remove the pump’s drive coupling and drive key.
3. Remove beveled retaining ring (Item 2).
4. Loosen and remove the (4) 7/16” socket head capscrews (Item 6A) with 3/8” Allen wrench.
5. Use (2) of the 7/16” capscrews as “jacking screws” to remove the seal holder (Item 6) slowly from the pump bracket (Item 1).

NOTE: Thrust bearing (Item 9) 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 16). 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.

6. Using snap ring pliers remove the retaining ring (Item 16) from the driver shaft (Item 12) that locates the thrust bearing.
7. With the retaining ring removed the stationary seat can be removed from the assembly.
8. Remove SAE o-ring plug (Item 32) from Bracket (Item 1) with 7/8” wrench to access to the set screws on the rotating element of the mechanical seal.
9. Use 1/8” Allen wrench to loosen (4) setscrews on the mechanical seal (Item 8), the setscrews are 90° apart, rotate the driver shaft (Item 12) to access each setscrew.
10. 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 containing the capscrews is the rotating element. 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.

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. Remove (8) 1/4” socket head capscrews (Item 9B) with 3/16” Allen wrench.
4. Remove end cap (Item 9A), then remove thrust bearing (Item 9) from seal holder (Item 6)
5. Once the stationary seat and thrust bearing have been removed, clean the I.D. and O.D. of the seal holder.

6. 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, align the notch in the stationary seat with the pin in the seal holder (Item 6), 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 properly seal.
7. If needed, install retaining ring (Item 10) into groove in drive shaft.

CAUTION !

Be careful not to scratch the shaft in the sealing area.

8. Coat drive shaft (Item 12), tapered installation sleeve and inner diameter of mechanical seal (Item 8) with light oil before assembly.
9. Slide the rotating part of mechanical seal (Item 8) over installation sleeve on shaft, against seal washer (Item 8A), making sure the seal spring is fully seated within the spring guide.
10. Use 1/8” Allen wrench to tighten setscrews to shaft through access hole at the top of the bracket (Item 1). Tighten the first set screw until it contacts the shaft, rotate the shaft 180 degrees and tighten the second set screw until it contacts the shaft. Rotate the shaft 90 degrees and tighten the third setscrew until it contacts the shaft. Rotate the shaft 180 degrees and tighten the fourth setscrew until it contacts the shaft
11. Once all the setscrews are contacting the shaft, evenly tighten to 36 in-lbs.

CAUTION !

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

12. Install SAE o-ring plug (Item 32) from Bracket (Item 1) with 7/8” wrench
13. Lubricate O-ring (Item 7) with a light oil and place on to seal holder (Item 6). Install seal holder into pump bracket (Item 1).
14. Add anti-seize to threads and hand tighten the (4) 7/16” socket head capscrews (Item 6A) with 3/8” Allen wrench to fasten seal holder (Item 6) to bracket (Item 1). Tighten in a star pattern the (4) 7/16” socket head capscrews (Item 6A) with 3/8” Allen wrench to 120 in-lbs.
15. Install retaining ring (Item 16) into groove on shaft.

CAUTION !

Be careful not to scratch the shaft in the sealing area.

- Slide thrust bearing (Item 9) on to shaft until it contacts retaining ring (Item 16).

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

- Install end cap (Item 9A) to seal holder (Item 6) with (8) ¼" socket head capscrews (Item 9B) with 3/16" Allen wrench hand tight. The capscrews will be torqued to a final value later.

- Install beveled retaining ring (Item 2) with the bevel facing outward towards the motor end of the driver shaft (Item 12).

NOTE: The driver shaft (Item 12) may need to be pulled toward the outside of the pump, compressing the mechanical seal spring to uncover the groove in the shaft for the beveled retaining ring. Verify the beveled retaining ring is fully seated

- Tighten in a star pattern the (8) ¼" socket head capscrews (Item 9B) with 3/16" Allen wrench to 96 in-lbs.

TYPE 5611Q CARTRIDGE SEAL

NOTE: For replacing the Type 5611Q Cartridge seal in the GB-414 Pumps in field, be sure to have Seal P/N 2-478-427-999-00

SEAL REMOVAL

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

- 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.
- Clean driver shaft and face of seal chamber on bracket.
- 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 a temporary assembly lubricant such as P-80® or equivalent. See "Figure 7" on page 6, "Figure 8" on page 6 and "Figure 9" on page 7.
- 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 the tapered installation sleeve from shaft.
- Secure seal gland to bracket face using capscrews (Item 6A), flat washers, and lock washers.

NOTE: Tighten capscrews enough to compress seal gland gasket. Tighten only enough to contain leakage and not to distort seal gland.

- Remove or turn seal centering clips so as to clear the seal drive collar prior to operation

P-80® is a registered trademark of International Products Corporation

REPAIR PARTS

The revolutionary GB-414 Pump design allows for easy pump disassembly for pump repair and rebuild in the field. The available repair parts for a field pump rebuild are listed on the subsequent pages with the exploded view of each pump model & rebuild instructions. Each Pump has Complete Rebuild Kit:

GB-41415 Pumps: Kit P/N 3-464-GB41415-FULL-1

GB-41420 Pumps: Kit P/N 3-464-GB41420-FULL-1

GB-41430 Pumps: Kit P/N 3-464-GB41430-FULL-1

GB-41440 Pumps: Kit P/N 3-464-GB41440-FULL-1

GB-41445 Pumps: Kit P/N 3-464-GB41445-FULL-1

GB-41455 Pumps: Kit P/N 3-464-GB41455-FULL-1

GB-41460 Pumps: Kit P/N 3-464-GB41460-FULL-1

PUMP REPAIR

REPAIR TOOLS

- Hoist (capable of lifting assembled pump)
- Clamps
- 15/16" Socket
- Metal Hammer
- Soft Head Hammer
- Pry Bar
- 2 Flat Head (standard) Screw Drivers
- Cleaning Rag
- Brakleen or similar Brake Cleaning Spray
- Light Oil (Mineral Oil)
- O-Ring Lubrication
- Nickle grade anti-seize
- Torque Wrench (capable of 150 ft-lbs)

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

NOTE: For disassembly of Single Pumps (Models GB-41415 & GB-41420), see “Figure 7” on page 6 and Steps #1-7 & 15-16 below.

For Double Pumps (Models GB-41430 & GB-41440), see “Figure 8” on page 6 and Steps #1-16 below.

For Triple Pumps (Models GB-41445, GB-41455, and GB-41460), see “Figure 9” on page 7 and Steps #1-16

1. Use Clamps to fix the bracket foot (Item 1A) to table/work bench
2. Use 3/4” Socket to remove angled foot (Item 27A) from pump head (Item 27)

NOTE: not required for GB-41415 and GB-41420 pumps

3. Use 15/16” socket to loosen and remove capscrews (Item 20) from head (Item 27) end.
4. Remove the pump head (Item 27) and rear casing (Item 19) from the pump. **NOTE:** This may require the use of a pry bar in the pump corner to help separate the sections. Lift component to take the weight off the alignment pins then pull apart.
5. Remove the driver gear from the driver shaft (Item 12). Remove the driven shaft (Item 13) and gear assembly and keep with driver gear.
6. Remove the pump casing (Item 19) from the pump head (Item 27). This may require the use of a pry bar in the pump corner to help separate the sections. **NOTE:** It is important to keep casing and their gear sections together, as they are match ground assemblies. Serial numbers can be found on face of gears. See “Figure 10” on page 11.
7. Remove the bushing block (Item 22) from the head (Item 27) slowly and smoothly, by pinching the bushing and the flow port. See “Figure 11” on page 11.

NOTE: If working on a GB-41415 or GB-41420 Pump, skip to STEP 15 below.

8. Remove the bushing block (Item 22) from the separation plate (Item 29).
9. Remove the spacer (Item 24) from the separation plate (Item 29).

FIGURE 10



FIGURE 11



10. Use 15/16” socket to loosen and remove capscrews (Item 20) from bracket (Item 1) end. **NOTE:** For GB-41445, GB-41455 and GB-41460 wait to do this step when removing ported separation plate.
11. Remove the separation plate (Item 29). **NOTE:** This may require the use of a pry bar in the pump corner to help separate the sections. Lift component to take the weight off the alignment pins then pull apart.
12. Remove the last bushing block (Item 22) from the separation plate (Item 29). May use soft object, such as rubber mallet, to knock on the backside of the block if the block gets stuck.
13. Remove the driver gear from the driver shaft. Remove the driven shaft and gear assembly.

14. Remove the pump casing from the pump assembly. This may require the use of a pry bar in the pump corner to help separate the sections. **NOTE: It is important to keep casing and their gear sections together, as they are match ground assemblies. Serial numbers can be found on face of gears.**

NOTE: If working on a GB-41445, GB-41455 or GB-41460 repeat STEPS 8 through 13 to remove ported separation plate

15. Remove the bushing block (Item 22) from the pump bracket (Item 1).

16. If driver shaft (Item 12) needs to be removed, first follow the seal removal instructions for the seal type of the pump, then the driver shaft will be free to remove.

REASSEMBLY

NOTE: For reassembly of Single Pumps (Models GB-41415 & GB-41420), see "Figure 7" on page 6 and Steps #1-8 & 18-22 below.

For Double Pumps (Models GB-41430 & GB-41440), see "Figure 8" on page 6 and Steps #1-16 & 18-22 below.

For Triple Pumps (Models GB-41445, GB-41455, and GB-41460), see "Figure 9" on page 7 and Steps #1-22

IMPORTANT NOTE: The casing and gear assembly is match ground together as a set. If one of the gears in the set needs replaced, then both gears, as well as the casing, must be replaced together, to ensure the tolerances are correct for the casing and gear assembly.

1. Clean internal passages on bracket (Item 1), separation plates (Item 29) and head (Item 27) with a cleaning spray and rag.

2. Use the flat head screwdriver to remove all section O-Rings (Item 11) and replace with new O-Rings. Use a light oil or O-Ring lubricant when installing new O-rings to help keep the O-Ring in its groove. Take care during installation to not nick or fray the new O-Rings.

3. Install the gaskets (Item 23) into the grooves of all bushing blocks (Item 22). Use grease to help keep gasket in groove during installation. Lightly coat the bushings in oil.

4. Lightly coat the new gear IDs, faces and all shafts in oil. **NOTE: It is important to keep casing and their gear sections together, as they are match ground assemblies. Serial numbers can be found on face of gears.**

5. Install driven gears onto shorter driven shafts (Item 13), use drive pin (Item 15) into shaft keyway and fasten with snap rings (Item 14) on both sides of gear. Repeat this step for all new driven gears needed.

6. Install the bushing block (Item 22) into the bracket (Item 1). Line up the locating pin on the back of the bushing block with the groove in the bottom of the pocket. **See "Figure 12" on page 12. NOTE: The bushing block may not be flush with face of the bracket. The gasket will be compressed when the fasteners are tightened.**

7. If mechanical seal (Item 8) and driver shaft (Item 12) were removed during disassembly, Install retaining ring (Item 10) into driver shaft (Item 12). Then slide the driver shaft (Item 12) into bracket (Item 1) until the retaining ring contacts the bottom of the seal bore.

FIGURE 12



8. Install the casing (Item 19) using the alignment pins (Item 17). Lightly hammer the alignment pins into place with metal hammer.

9. Install the drive pin (Item 15) into the driver shaft (Item 12) keyway. Install the driver gear onto the driver shaft. Ensure gear and shaft are lightly coated in oil prior to assembly.

10. Install one side of the driven shaft (Item 13) and gear assembly into the lower bracket bushing. **NOTE: It is important to keep casing and their gear sections together, as they are match ground assemblies. Serial numbers can be found on face of gears.**

NOTE: If working on a GB-41415 or GB-41420 Pump, skip to STEP 20 below.

11. Install the spacer (Item 24) into the separation plate (Item 29). Line up the groove with the screw in the bore. **"Figure 13" on page 12.**

FIGURE 13



12. Lightly coat the bushings in oil. Install the bushing block (Item 22) on the bracket side of the separation plate (Item 29). Line up the locating pin on the back of the bushing block with the groove in the spacer (Item 24). **NOTE: The bushing block may not be flush with face of the bracket. The gasket will be compressed when the fasteners are tightened.**
13. Install the separation plate (Item 29) onto the dowel pins using the soft head hammer to tap into place.
14. Ensure to match the engraving for rotation on the sides of the bracket and separation plate. See "Figure 14" on page 13.

FIGURE 14



15. Use nickel grade anti-seize on threads of capscrew. Use 15/16" socket to tighten capscrews (Item 20) at bracket (Item 1) end. The capscrews will be torqued to a final value later.
16. Lightly coat the bushings in oil. Install the head side bushing block (Item 22) into the separation plate (Item 29). Support the bottom of the separation plate to help line up the bushing block with the bore. Line up the locating pin on the back of the bushing block with the groove in the spacer (Item 24). **NOTE: The bushing block may not be flush with face of the bracket. The gasket will be compressed when the fasteners are tightened.**

17. Install the casing (Item 19) using the alignment pins (Item 17). Lightly hammer the alignment pins into place with metal hammer.
18. Install the drive pin (Item 15) into the driver shaft (Item 12) keyway. Install the driver gear onto the driver shaft. Ensure gear and shaft are lightly coated in oil prior to assembly.
19. Install one side of the driven shaft (Item 13) and gear assembly into the lower bracket bushing. **NOTE: It is important to keep casing and their gear sections together, as they are match ground assemblies. Serial numbers can be found on face of gears.**
NOTE: If building a GB-41445, GB-41455, or GB-41460 repeat STEPS 11-19 to assemble non-ported separation plate.

20. Lightly coat the bushings in oil. Install the bushing block (Item 22) into the head (Item 27). Line the pin on the back of the bushing block with the groove in the bottom of the pocket. **NOTE: The bushing block may not be flush with face of the bracket. The gasket will be compressed when the fasteners are tightened.**
21. Install the pump head (Item 27) onto the rest of the pump assembly.
22. Ensure that the match engravings for rotation on side of the housing components all match. See "Figure 14" on page 13.
23. Use nickel grade anti-seize on threads of capscrews, use 15/16 socket to tighten capscrews (Item 20) at head (Item 27) end. **NOTE: If building a GB-41415 or GB-41420 the capscrews will be installed at the bracket end.**
24. Torque all capscrews (Item 20) in a crisscross pattern to approximately 75 Ft-lbs. (or 50% of final torque). Next torque to 115 Ft-lbs. (or 75% final torque) in same crisscross tightening pattern. Final torque in crisscross pattern to 150 ft-lbs. of torque.
25. Install the foot (Item 27A) onto the head (Item 27)
26. If needed, install mechanical seal (Item 8) using seal installation instructions for the seal type of the pump (pages 7-10).

TRUBLESHOOTING

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.

TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE**VIKING
PUMP®**SPUR GEAR PRODUCT LINE: **DUCTILE IRON**

GB-414 SERIES™

HIGH PRESSURE EXTERNAL GEAR PUMPS
FOR PIPELINE INJECTION

TSM 1655

Page 15 of 15

Issue D

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®**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#information). 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.

THIS WARRANTY IS AND SHALL BE VIKING'S SOLE AND EXCLUSIVE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT, ALL OF WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED.

THE RIGHTS AND REMEDIES UNDER THIS WARRANTY ARE AND SHALL BE THE SOLE AND EXCLUSIVE RIGHTS AND REMEDIES AGAINST VIKING. EXCEPT FOR THE SPECIFIC LIABILITIES AND OBLIGATIONS PROVIDED UNDER THIS WARRANTY, VIKING SHALL HAVE NO LIABILITY OR OBLIGATION WITH RESPECT TO ANY PRODUCT CLAIMED TO BE DEFECTIVE IN ANY MANNER.

UNDER NO CIRCUMSTANCES SHALL VIKING BE LIABLE UNDER THIS WARRANTY OR OTHERWISE FOR SPECIAL, INCIDENTAL, INDIRECT, CONSEQUENTIAL OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, LOST OR UNREALIZED SALES, REVENUES, PROFITS, INCOME, COST SAVINGS OR BUSINESS, LOST OR UNREALIZED CONTRACTS, LOSS OF GOODWILL, DAMAGE TO REPUTATION, LOSS OF PROPERTY, LOSS OF INFORMATION OR DATA, LOSS OF PRODUCTION, DOWNTIME, OR INCREASED COSTS, IN CONNECTION WITH ANY PRODUCT, EVEN IF VIKING HAS BEEN ADVISED OR PLACED ON NOTICE OF THE POSSIBILITY OF SUCH DAMAGES AND NOTWITHSTANDING THE FAILURE OF ANY ESSENTIAL PURPOSE OF ANY PRODUCT.