

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

GB-410 SERIES™

HIGH PRESSURE EXTERNAL GEAR PUMPS
FOR TEG DEHYDRATION & PIPELINE INJECTION

TSM 1654

Page 1 of 14

Issue A

TABLE OF CONTENTS

Model Number Chart.....	1
Introduction	1
Safety Information & Instructions.....	2
Component & Unit Lifting Features	3
<i>Foundation</i>	3
Special Information	3
<i>Drain</i>	3
Installation	4
<i>General</i>	4
<i>Pressure Protection</i>	4
<i>Mounting</i>	4
<i>Alignment</i>	5
<i>Piping/Hose</i>	5
<i>Start Up</i>	5
Maintenance.....	6
<i>Cleaning Pump</i>	6
<i>Storage</i>	6
<i>Suggested Seal Replacement & Pump Rebuild Tools</i>	6
Type 2 Mechanical Seal.....	8
<i>Seal Removal</i>	8
<i>Seal Installation</i>	9
Repair Parts	9
Pump Repair.....	9
<i>Repair Tools</i>	9
Disassembly.....	10
Reassembly	11
Troubleshooting	12
<i>Vacuum Gauge - Suction Port</i>	12
<i>Pressure Gauge - Discharge Port</i>	12
<i>Miscellaneous</i>	13
Do's & Don'ts	13
<i>Installation</i>	13
<i>Operation</i>	13
<i>Maintenance</i>	13

MODEL NUMBER CHART

Clockwise	Counter-Clockwise
GB-41005-*00	GB-41005-*10
GB-41007-*00	GB-41007-*10
GB-41009-*00	GB-41009-*10
GB-41013-*00	GB-41013-*10
GB-41018-*00	GB-41018-*10
GB-41022-*00	GB-41022-*10
GB-41026-*00	GB-41026-*10

* G = Type 1 Mechanical Seal

* K = Type 8B5 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-41013****FIGURE 2:
GB-41026****FIGURE 3:
GB-41039**

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.

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

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

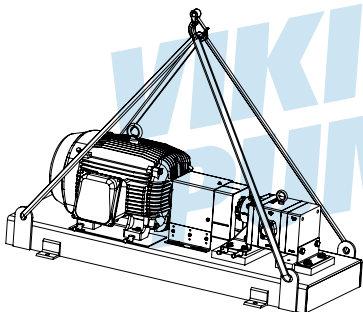
Viking will leave all removable lifting features, such as threaded eye bolts and hoist rings, installed in components (pumps, reducers, motors, etc.) and baseplates. These features are used to safely lift and move the individual components.

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.

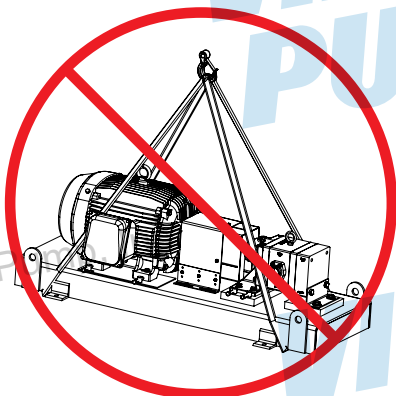
Following are general guidelines for lifting Viking Pump Units.

FIGURE 4: EXAMPLE OF PROPER LIFTING METHOD



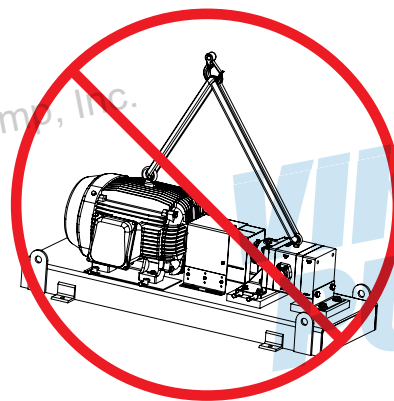
NOTE: Units should be lifted by the base lifting features using two or more lifting slings.

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

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.

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-410 Series pumps are rotation specific (viewed from end of shaft). Viking GB series external gear pumps can be offered in clockwise (-G00 & K00) or counter-clockwise (-G10 & K10) 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-410 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 & flat.
2. Standard GB-410 Series pumps are designed to be used with jaw-type couplings (M-Drive) or spacer-type couplings (D-Drive) that do not induce axial thrust on the pump shaft. If an improper type of coupling is used, internal damage may result.

NOTE: Steps 3 – 9 pertain to motor mounted (M-drive) units. For long coupled direct drive (D-drive) units, refer to steps 10 - 12.

3. For NEMA Motor Mounting (M-Drive), use SAE Grade 5 or better capscrews to mount the pump.
4. Mount the pump to the motor mounting bracket, see “Figure 7” on page 4. Please follow the guideline torque values for capscrews found below in “Table 2” on page 4 and the coupling gap dimensions in “Table 3” on page 4.

TABLE 2: CAPSCREW TORQUES

Series	Motor Frame Size	Capscrew Torque between Bracket & Pump	Capscrew Torque between Bracket & Motor
GB-410	182TC/184TC	40-45 FT-LBS.	40-45 FT-LBS.
GB-410	213TC/215TC	40-45 FT-LBS.	40-45 FT-LBS.
GB-410	254TC/256TC	40-45 FT-LBS.	40-45 FT-LBS.
GB-410	284TC/286TC	40-45 FT-LBS.	40-45 FT-LBS.
GB-410	324TC/326TC	40-45 FT-LBS.	85-90 FT-LBS.
GB-410	364TC/365TC	40-45 FT-LBS.	85-90 FT-LBS.

5. Place coupling half on pump shaft, following the illustration in “Figure 7” on page 4 and coupling gap dimensions in “Table 3” on page 4. Tighten coupling hub setscrews.

FIGURE 7

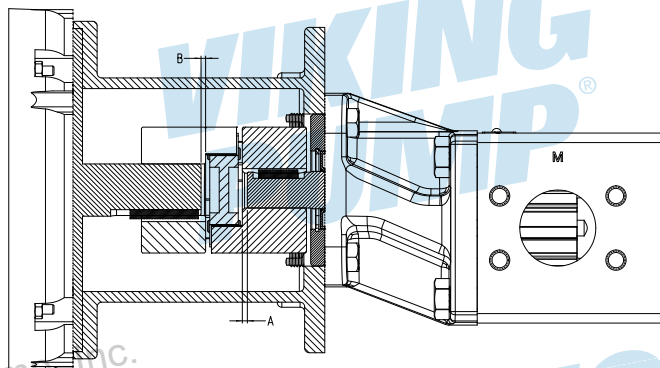


TABLE 3: COUPLING GAP DIMENSIONS

Series	Motor Frame Size	Motor Shaft "B" Gap	Pump Shaft "A" Gap
GB-410	182TC/184TC	.00"	.06"
GB-410	213TC/215TC	.00"	.14"
GB-410	254TC/256TC	.00"	-0.06
GB-410	284TC/286TC	.00"	.25"
GB-410	324TC/326TC	.00"	.60"
GB-410	364TC/365TC	.00"	1.00"

6. Place the coupling hytrel spider on seat of the coupling hub that has been secured to the pump shaft.
7. Place coupling half on motor shaft, following the illustration in “Figure 7” on page 4 and coupling gap dimensions in “Table 3” on page 4. Tighten coupling hub setscrews.
8. Mount drive bracket to motor face, spin shafts to align motor coupling hub with hytrel spider through slot on bracket, per “Figure 7” on page 4, and tighten capscrews to the applicable value in “Table 2” on page 4.
9. 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.
10. GB-410 Pumps can also be direct driven and are designed to be used with spacer type couplings (5" spacer coupling recommended) that do not induce axial thrust on the pump shaft. If an improper type of coupling is used, internal damage may result.
11. 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.
12. 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.

NOTE: To reduce the pipe strain on the pump ports, Viking Pump recommends the use of flexible hose to be connected to the suction and discharge ports. Pump design is not acceptable for rigid piping, unless piping is custom cut specifically for the Viking Pump Glycol unit and the piping adequately supported with pipe hangers and/or supports.

NOTE: Viking recommends using a liquid pipe sealant/dope for the piping that is threaded into the NPT ports on the pump. **DO NOT USE PTFE TAPE**, as this alters the pipe OD and

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.

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-410 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. Each of the Viking GB-410 pump models can withstand a start-up thermal-shock delta of 225°F (differential between pump temperature and glycol temperature). Before starting each pump, operators should ensure that the pump, and the anticipated inlet glycol temperature, are within the 225°F differential.

NOTE: The following start-up procedures are in place for situations where the pump and glycol temperature differential exceeds 225°F for the GB-410 pump design. In order to achieve the maximum temperature differential, follow the steps below:

11. Run the pump for 3 seconds to introduce initial system glycol to the pump. Stop for minimum of 60-90 seconds.
12. Repeat Step #11 a second time, then measure pump temperature. Repeat Step #11 until temperature reaches required maximum delta.
13. Run pump continuously and slowly bring up the system pressure. Once this is done, the pump can now run continuously at desired speed.

NOTE: If the pump has been running but stopped for a brief intermission, check pump temperature via the Pump Temperature monitor or infrared temperature gun, and depending on pump construction and allowable temperature delta, follow steps 11-13 for re-starting the pump.

14. 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 12** 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

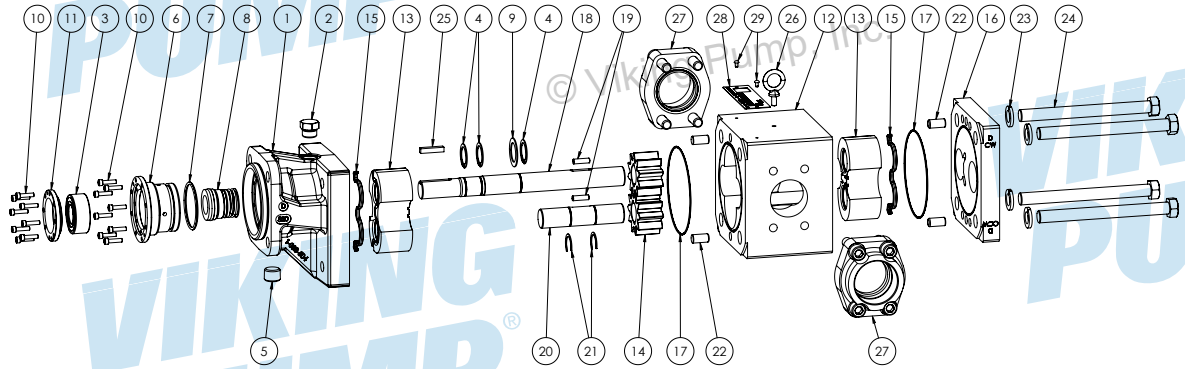
The following tools must be available to properly replace the seals in these external gear pumps. These tools are in addition to standard mechanics' tools such as open-end wrenches, pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house or automobile tool supplier. 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 1); GB-410 pumps
3/16", 3/8" (Type 8B5); GB-410 pumps
3. Hex driver sockets for use with torque wrench: *
3/8" (Type 1); GB-410 pumps
3/8" (Type 8B5); GB-410 pumps
4. Snap ring pliers
5. Picks
6. PVC pipe *
1" ID x 6" long (Type 1); GB-410 pumps
7. Mechanical seal installation sleeve (provided with seal)

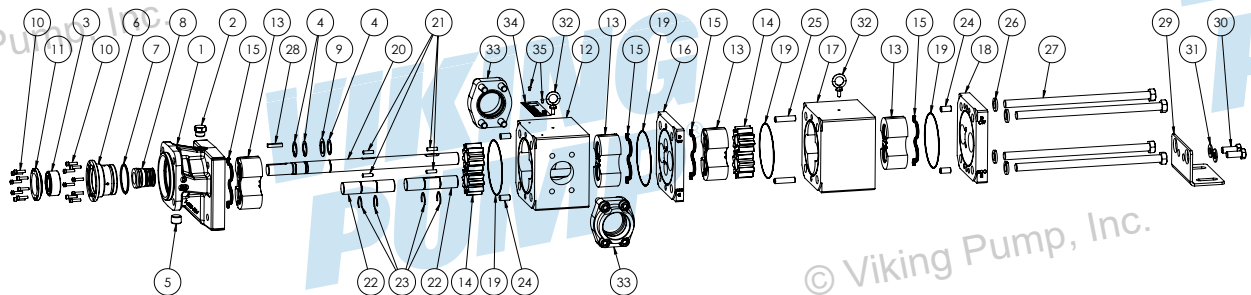
*(Seal type designation)

FIGURE 8: EXPLODED VIEW - GB-41005, GB-41007, GB-41009, GB-41013 TYPE 1 MECHANICAL SEAL PUMPS



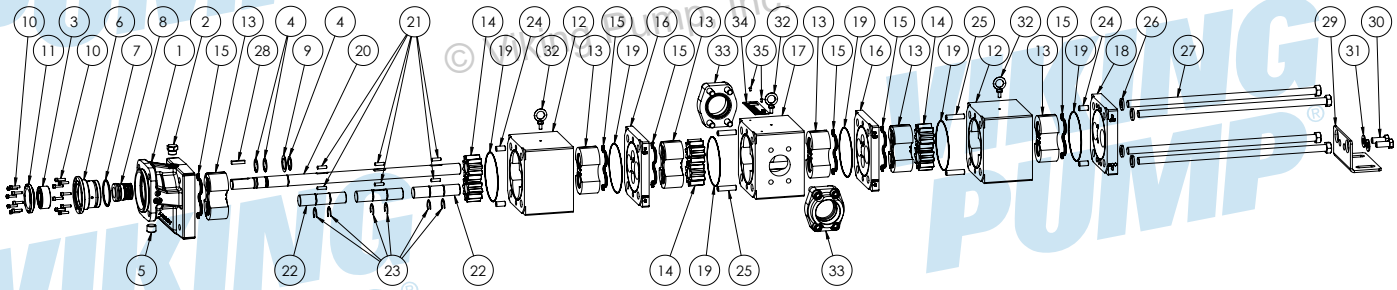
Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
1	Bracket	11	Bearing End Cap	21	External Retaining Ring
2	Plug	12	Casing with 2" SAE Port	22	Dowel Pin
3	Double Row Ball Bearing	13	GABB & Bushing Assembly	23	Lockwasher
4	External Retaining Ring	14	Gear	24	Capscrew
5	Socket Head Pipe Plug	15	GABB Gasket	25	Square Key
6	Seal Holder	16	Head	26	Eyebolt
7	Seal Holder O-Ring	17	Section O-Ring	27	2" NPT Flange Assembly
8	Mechanical Seal	18	Driver Shaft	28	Nameplate
9	Seal Washer	19	Dowel Pin	29	Drive Screw
10	Capscrew	20	Driven Shaft		

FIGURE 9: EXPLODED VIEW - GB-41018, GB-41022, GB-41026 TYPE 1 MECHANICAL SEAL PUMPS



Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
1	Bracket	13	PBBB & Bushing Assembly	25	Dowel Pin
2	Plug	14	Gear	26	Lockwasher
3	Double Row Ball Bearing	15	PBBB Gasket	27	Capscrew
4	External Retaining Ring	16	Separation Plate	28	Square Key
5	Socket Head Pipe Plug	17	Non-Ported Casing	29	Foot Bracket
6	Seal Holder	18	Head	30	Capscrew
7	Seal Holder O-Ring	19	Section O-Ring	31	Flat Washer
8	Mechanical Seal	20	Driver Shaft	32	Eyebolt
9	Seal Washer	21	Dowel Pin	33	Flange Assembly
10	Capscrew	22	Driven Shaft	34	Nameplate
11	Bearing End Cap	23	External Retaining Ring	35	Drive Screw
12	Casing with 2" SAE Port	24	Dowel Pin		

FIGURE 10: EXPLODED VIEW - GB-41039 TYPE 1 MECHANICAL SEAL PUMPS



Item	Name Of Part	Item	Name Of Part	Item	Name Of Part
1	Bracket	13	PBBB & Bushing Assembly	25	Dowel Pin
2	Plug	14	Gear	26	Lockwasher
3	Double Row Ball Bearing	15	PBBB Gasket	27	Capscrew
4	External Retaining Ring	16	Separation Plate	28	Square Key
5	Socket Head Pipe Plug	17	Casing with 2" SAE Port	29	Foot Bracket
6	Seal Holder	18	Head	30	Capscrew
7	Seal Holder O-Ring	19	Section O-Ring	31	Flat Washer
8	Mechanical Seal	20	Driver Shaft	32	Eyebolt
9	Seal Washer	21	Dowel Pin	33	Flange Assembly
10	Capscrew	22	Driven Shaft	34	Nameplate
11	Bearing End Cap	23	External Retaining Ring	35	Drive Screw
12	Non-Ported Casing	24	Dowel Pin		

⚠ 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 component seal in the GB-410 Pumps in the field, be sure to have seal kit P/N 3-464-SEAL-K510 or the Full Rebuild Kit for the specific pump model you are working on.

Included in your SEAL or REBUILD kit, you will find:

A mechanical seal, thrust bearing, seal washer, seal holder o-ring, snap rings, seal holder capscrews, and bearing end cap capscrews.

SEAL REMOVAL

1. See "Figure 8" on page 7, "Figure 9" on page 7 and "Figure 10" on page 8 for the names of parts for the specific pump model you are working on.
2. Remove the pump's drive coupling and drive key.
3. To begin, using snap ring pliers, remove the snap ring.
4. Next, use a 3/16" allen wrench to remove and discard the bearing end cap capscrews. Also with a 3/16" allen wrench, remove and discard the seal holder capscrews.
5. To aid with seal removal, thread bearing end cap capscrews into the jackbolt holes located on the seal holder assembly. Alternate tightening these jackbolts to gently push the seal holder out.
6. To break the grip of the mechanical seal, place a nylon block between the seal holder and the bracket. Then with a soft-headed hammer, tap the shaft until the seal holder assembly is released. It is possible that the stationary seal face and retaining ring will remain on the shaft after removing the seal holder.

7. Next, remove the thrust bearing from the seal holder.
8. Remove the seal holder o-ring.
NOTE: Retain the seal holder assembly and bearing endcap for reassembly – you may discard the other seal components.
9. Using snap ring pliers, remove the retaining ring.
10. Remove the stationary seal face.

NOTE: It is possible that the rotary seal face will be removed with the stationary seal face.

11. Use a pair of picks to remove the mechanical seal. It is possible to break the grip of the seal by placing a length of tubing over the shaft and tapping it until it is released.
12. Remove the spring. Remove the spring guide and seal washer.
13. Finally, inspect the end bore snap ring for any corrosion or damage and replace if necessary.

SEAL INSTALLATION

NOTE: Before seal installation, thoroughly clean and inspect the seal chamber and shaft. Clean and inspect the bearing end cap and seal holder assembly.

1. Lubricate and install the seal holder o-ring.
2. Next, apply assembly lubricant to the stationary seal face and the seal holder assembly. Install the seal face into the seal holder with the lapped side facing up. Ensure that it is fully seated.
3. Install the seal washer.
4. Install the spring guide.
5. Install the spring – make sure it is fully seated on the spring guide.
6. Next, lubricate the shaft and rotary seal face with assembly lubricant and place on the shaft. You can use the seal holder assembly to press it into position – ensure that it is fully engaged with the spring.

⚠ CAUTION !

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

7. Rinse the seal faces with brake cleaner and install the seal holder assembly. Ensure that the slots on the seal holder are at the 3, 6, 9, and 12 positions.
8. Apply anti-seize to the seal holder capscrews and install.
9. Using snap ring pliers, install the retaining ring in the groove on the shaft. It may be necessary to pull on the shaft to make sure that the snap ring is fully seated in the groove.

⚠ CAUTION !

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

10. Next, lubricate the shaft and thrust bearing with light oil. Install the thrust bearing.

NOTE: Make sure the text on the outer race of the bearing is facing out.

11. Install the bearing end cap. Apply anti-seize to the bearing end cap capscrews and install.
12. Torque both the seal holder capscrews and bearing end cap capscrews in a criss-cross pattern to 60 inch pounds.
13. Install the final snap ring into the groove on the shaft. It may be necessary to pull on the shaft to make sure the snap ring is fully seated in the groove.
14. Finally, turn the shaft manually, to ensure the pump rotates smoothly. Because of the tight clearances, a spanner wrench may be required.

Your Viking Pump GB-410 Series pump has a new mechanical seal and is ready to be put back into service.

REPAIR PARTS

The revolutionary GB-410 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-41005 Pumps: Kit P/N 3-464-GB41005-FULL-1
- GB-41007 Pumps: Kit P/N 3-464-GB41007-FULL-1
- GB-41009 Pumps: Kit P/N 3-464-GB41009-FULL-1
- GB-41013 Pumps: Kit P/N 3-464-GB41013-FULL-1
- GB-41018 Pumps: Kit P/N 3-464-GB41018-FULL-1
- GB-41022 Pumps: Kit P/N 3-464-GB41022-FULL-1
- GB-41026 Pumps: Kit P/N 3-464-GB41026-FULL-1
- GB-41039 Pumps: Kit P/N 3-464-GB41039-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-41005, GB-41007, GB-41009, GB-41013), see "Figure 8" on page 7 and STEPS #1-8 & STEPS #15-22 below.

Included in your Single Pump Rebuild kit, you will find:

1 driver gear, 1 driven gear, 2 bushing blocks, driver shaft, 1 driven shaft, external retaining rings, O-Rings, alignment pins, drive pins, bushing block gaskets, head end capscrews, mechanical seal, thrust bearing, seal washer, seal holder O-ring, snap rings, seal holder capscrews, and bearing end cap capscrews.

For Double Pumps (Models GB-41018, GB-41022, GB-41026) see "Figure 9" on page 7 and STEPS # 1-11 & STEPS #15-22 below.

Included in your Double Pump Rebuild kit, you will find:

2 driver gears, 2 driven gears, 4 bushing blocks, driver shaft, 2 driven shafts, external retaining rings, O-Rings, alignment pins, drive pins, bushing block gaskets, head end capscrews, mechanical seal, thrust bearing, seal washer, seal holder O-Ring, snap rings, seal holder capscrews, and bearing end cap capscrews.

For Triple Pumps (Models GB-41039) see "Figure 10" on page 8 and STEPS #1-22 below.

Included in your Triple Pump Rebuild kit, you will find:

3 driver gears, 3 driven gears, 6 bushing blocks, driver shaft, 3 driven shafts, external retaining rings, O-Rings, alignment pins, drive pins, bushing block gaskets, head end capscrews, mechanical seal, thrust bearing, seal washer, seal holder O-Ring, snap rings, seal holder capscrews, and bearing end cap capscrews.

NOTE: Tools required include impact drivers, torque wrenches, soft headed hammer, Allen wrenches, O-Ring pick, small screw driver, snap ring pliers, hook nose spanner wrench, brake cleaner, degreaser, O-Ring lubricant, P-80® assembly lubricant, and a scratch pad.

1. Before you begin disassembly, place a supporting block underneath the pump. First, using a $\frac{3}{4}$ " socket, remove the head mounting foot on Double & Triple Pumps.

2. Use a 15/16" socket to loosen and remove the capscrews on the head end of the pump. Discard these capscrews.
3. Remove the pump head and set aside for reassembly.
4. Remove and discard the first bushing block and gasket.
5. Remove and discard the first driven gear, driven shaft, driver gear, and drive pins.
6. Remove the casing.
7. Remove and discard the bushing block, gasket, and casing O-Ring.

8. Remove the separation plate

For Single Pumps (GB-41005, GB-41007, GB-41009, and GB-41013) jump to STEP #15 below.

9. Remove the second bushing block, gasket, driven gear, driven shaft, drive gear, and drive pins.
10. Remove the ported casing section.
11. Remove and discard the next bushing block, gasket, and O-Ring

For Double Pumps (GB-41018, GB-41022, and GB-41026)® jump to STEP #15 below.

12. Remove the final casing and separation plate. A soft-headed hammer may be needed to break the seal with the bracket.
13. Remove and discard the next bushing block, gasket, driven gear, and driven shaft.
14. Remove and discard the final bushing block, gasket, drive gear.
15. To remove the drive shaft and seal, begin by removing the outer snap ring using the snap ring pliers.
16. Next, using a 5/32" Allen wrench, remove the bearing end cap capscrews. Set the bearing end cap aside for reassembly.
17. Next remove the seal holder capscrews using the same 5/32" Allen wrench.
18. Now, thread two of the seal holder capscrews into the threaded jackbolt holes on the seal holder.
19. Tighten the jackbolts, alternating back and forth to remove the seal and shaft.
20. Remove the seal holder assembly from the shaft. Discard the drive shaft and seal components.
21. Remove and discard the thrust bearing, jack screws, and O-Ring. **Set the seal holder aside for reassembly.**
22. **Prior to reassembly, ensure the pump head, casings, separation plates, bracket, seal holder, and bearing end cap are clean and free of debris. Remove and discard any remaining O-Rings or alignment pins.**

REASSEMBLY

NOTE: For reassembly of Single Pumps (Models GB-41005, GB-41007, GB-41009, GB-41013), see “Figure 8” on page 7 and STEPS # 1-12 & STEPS # 27-43

For Double Pumps (Models GB-41018, GB-41022, GB-41026) see “Figure 9” on page 7 and STEPS # 1-19 & 27-43

For Triple Pumps (Models GB-41039) see “Figure 10” on page 8 and STEPS # 1-43

NOTE: It is recommended to complete all subassemblies before starting to rebuild the pump, to ensure all components are in place.

1. Begin by applying O-Ring grease to each of the bushing block gaskets and insert them into the grooves of the bushing blocks. Applying o-ring grease over the installed gaskets will help hold them in place during reassembly. Do this for all bushing blocks and gaskets.
2. Install each driven gear and drive pin onto their corresponding driven shaft and insert an external retaining ring on each side in the grooves. Apply light oil to the driven gear and shaft, then install. Do this for all driven gear & shaft assemblies.
3. Next, lubricate and install the O-rings into the O-ring grooves in each casing, each separation plate, and the pump head.
4. Finally, lubricate and install the seal holder O-Ring onto the seal holder assembly

It is now time to begin rebuilding the pump.

5. Install the alignment pins into the head.
6. For Clockwise rotation pumps (G0B, K0B) the grooves in the head will be closest to you, with the top of the pump on your left. Double check this orientation to ensure each pump component is oriented correctly. See “Figure 11” on page 11.

FIGURE 11



NOTE: To aid with assembly, the pump may be built vertically.

7. Install the first casing. Apply light oil to the bushing block and casing bores. When installing, make sure to line up the bushing block pin with the groove in the head. See “Figure 12” on page 11.

FIGURE 12



8. Next, lubricate the drive shaft with light oil and install the drive key and driver gear.
9. Install the drive shaft into the top, or eye bolt side of the pump.
10. Apply light oil and install the driven gear and shaft assembly.
11. Install the next pair of alignment pins into the casing.
12. Next, lubricate and install the next bushing block, ensuring that the bushing block pin is facing up – allowing for the proper installation of the separation plate.

NOTE: Ensure that the groove in the separation plate lines up with the bushing block pin. See “Figure 13” on page 11.

FIGURE 13



For Single Pumps (GB-41005, GB-41007, GB-41009, and GB-41013) jump to STEP #27.

13. Install the separation plate.
14. Install the ported casing section.
15. Lubricate and install the next bushing block. Ensuring that the pin lines up with the groove in the separation plate.
16. Install the second drive key and driver gear onto the shaft. Lubricate with light oil.
17. Lubricate and install the second driven gear and shaft assembly.
18. Lubricate and install the next bushing block, with the pin facing up.

19. Install the next pair of alignment pins

For Double Pumps (GB-41018, GB-41022, and GB-41026) jump to STEP # 27.

20. Ensure that the groove in the second separation plate lines up with the bushing block pin. Install the separation plate.

21. Install the final casing section.

22. Lubricate and install the next bushing block with the pin facing down to align with the groove in the separation plate.

23. Install the final drive key and driver gear onto the shaft. Lubricate with light oil.

24. Lubricate and install the final driven gear and shaft assembly.

25. Lubricate and install the final bushing block with the pin facing up.

26. Install the last pair of alignment pins.

27. Ensure the groove in the bracket aligns with the pin of the bushing block. Install the bracket.

28. Place the pump flat to install the head capscrews – place a block under the pump to aid with final assembly. Apply anti-seize to the capscrews and install.

29. The head capcrew torque procedure involves three rounds. First, torque in a criss-cross pattern to 50 foot-pounds, then 75 foot-pounds, then finally 100 foot-pounds.

30. For Triple & Double Pumps, Reinstall the head mounting foot. Torque to 75 foot-pounds.

31. Next, using snap ring pliers, install the snap ring into the groove on the shaft. Make sure it is fully seated in the groove.

32. Install the seal washer.

33. Install the spring guide.

34. Ensure the seal holder assembly is clean and free of debris, then install the stationary seal face, with the lapped side facing up. Apply assembly lubricant and press into place – ensuring it is fully seated.

35. Next, lubricate the shaft and rotary seal face with assembly lubricant and place on the shaft with the spring. You can use the seal holder assembly to press it into position – ensure that it is fully engaged with the spring.

36. Install the seal holder assembly. Ensure that the slots on the seal holder are at the 3, 6, 9, and 12 positions.

37. Apply anti-seize to the seal holder capscrews and install.

38. Using snap ring pliers, install the retaining ring in the groove on the shaft. Pull out on the shaft to make sure that the snap ring is fully seated in the groove.

39. Next, lubricate and install the thrust bearing. Make sure the text on the outer race of the bearing is facing out.

40. Install the bearing end cap. Apply anti-seize to the bearing end cap capscrews and install.

41. Next, install the final snap ring into the groove on the shaft. Pull out on the shaft to make sure that the snap ring is fully seated in the groove.

42. Torque the seal holder and bearing end cap capscrews to 60 inch-pounds.

43. Finally, turn the shaft manually, to ensure the pump rotates smoothly. Because of the tight clearances, a hook nose spanner wrench may be required.

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 unit is 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.

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

GB-410 SERIES™

HIGH PRESSURE EXTERNAL GEAR PUMPS
FOR TEG DEHYDRATION & PIPELINE INJECTION**TSM 1654****Page 14 of 14****Issue A****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.