# TECHNICAL SERVICE MANUAL: INSTALLATION, OPERATION & MAINTENANCE

VIKING PUMP®

**UNIVERSAL PRODUCT LINE: *STEEL EXTERNALS***
**4223AX SERIES™, 4323AX SERIES™**
**SIZES: HL, KK, LS, Q, QS, N, R**



## TABLE OF CONTENTS



## MODEL NUMBER CHART

| Jacketed, Mechanical Seal |
|---|
| HL4223AX |
| KK4223AX |
| LS4223AX |
| Q4223AX |
| QS4223AX |
| N4323AX |
| R4323AX |

## 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: HL SIZE**

**FIGURE 2: KK, LS, Q, QS SIZES**

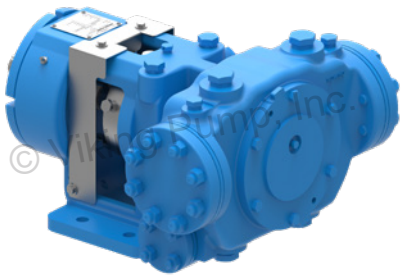

**FIGURE 3: N, R SIZES**

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# 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.



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# SPECIAL INFORMATION

## ROTATION

Viking pumps can operate equally well in a clockwise or counter-clockwise rotation; however, some constructions may require modifications. Consult your Viking Pump® representative if unsure. Shaft rotation determines which port is suction and which is discharge. Suction port is where pumping elements (gear teeth) come out of mesh.

If pump rotation is reversed during operation, pressure protection must be provided on both sides of pump.

Relief valve adjusting screw cap must always point towards suction side of pump. If pump rotation is reversed, remove pressure relief valve and turn end for end.

## PRESSURE RELIEF VALVES

1. Viking pumps are positive displacement 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.
2. If pump rotation is reversed during operation, pressure protection must be provided on ***both*** sides of pump.

Jacketing of the bracket & head provide large chambers at both ends of the pumping chamber and around the stuffing box for temperature control of the product in the pump. Check the pump to be sure it is heated to operating temperature prior to startup.

## MECHANICAL SEALS

Extra care should be taken in repair of pumps with mechanical seals. Be sure to read and follow all special instructions supplied with your pump.

# MAINTENANCE

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

## LUBRICATION

Grease all grease fittings every 2000 hours of operation. If service is severe, grease more often. Grease must be applied slowly with a hand gun until the grease exiting the lip seal or relief plug is similar in consistency and color to the new grease.

Use a NLGI #2 polyurea base grease for normal applications. For hot or cold applications, use appropriate grease. Consult your Viking Pump® representative with specific lubrication questions.

## CLEANING PUMP

Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent overlooking a dirt covered grease fitting.

## LIFTING

There is a lift eye on the bracket behind the casing for HL-QS size pumps. This is intended for the pump only, not the entire unit.

## STORAGE

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

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

## SUGGESTED REPAIR TOOLS

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

1. Soft Headed hammer
2. Allen wrenches
3. See TR-813 for locknut tools. Commercially available adjustable hook spanner wrenches are available for locknut removal, below:
   #471 J. H. Williams & Co. or equal; HL-KK pumps
   #472 J. H. Williams & Co. or equal; LS-QS pumps
   #474 J. H. Williams & Co. or equal; N pumps
   #474A J. H. Williams & Co. or equal; R pumps
4. Spanner wrench, adjustable face spanner pin type for use on bearing housing endcap
   Source: #482 J. H. Williams & Co. or equal; HL-LS pumps
   #483 J. H. Williams & Co. or equal; Q-R pumps
5. Brass or plastic bar
6. Arbor press

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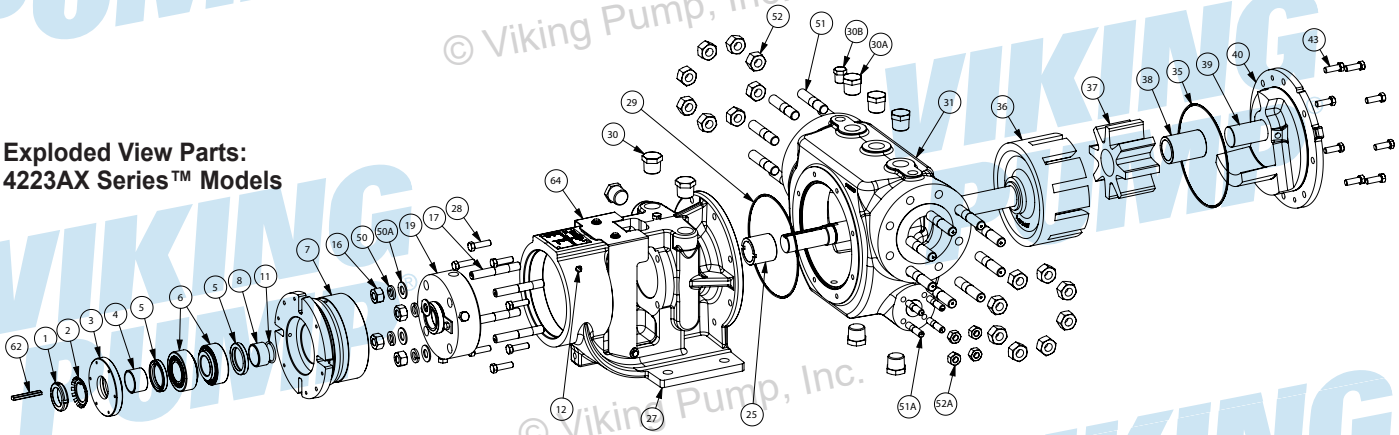
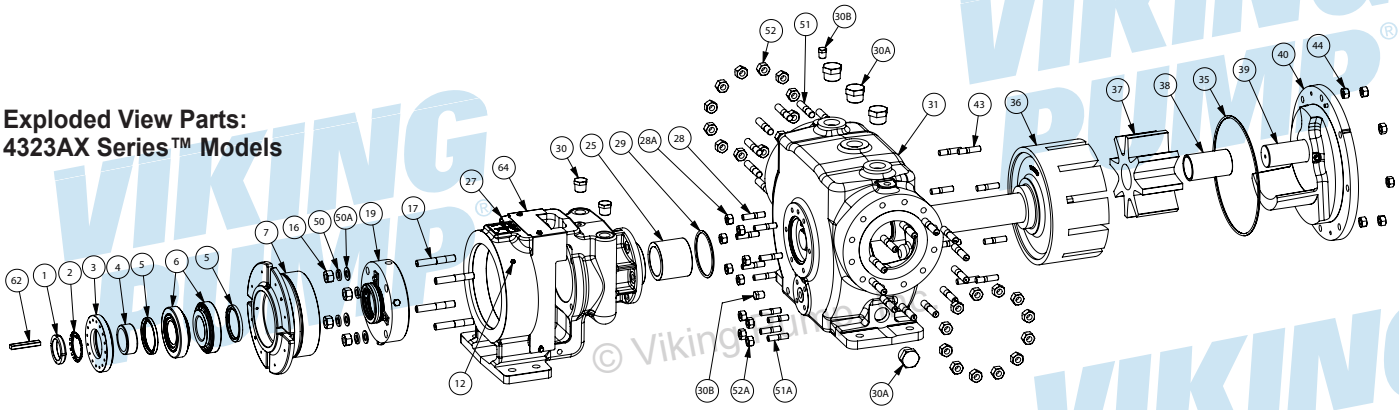
## FIGURE 4: EXPLODED VIEW

**Exploded View Parts:**
**4223AX Series™ Models**



**Exploded View Parts:**
**4323AX Series™ Models**



| Item | Name Of Part | Item | Name Of Part | Item | Name Of Part |
|---|---|---|---|---|---|
| 1 | Locknut | 25 | Bracket Bushing | 39 | Idler Pin |
| 2 | Lockwasher | 27 | Bracket and Bushing Assembly | 40 | Head and Idler Pin Assembly |
| 3 | End Cap | 28 | Capscrew/Studs for Bracket | 43 | Capscrew/Studs for Head |
| 4 | Bearing Spacer Collar (Outer) | 28A | Nuts for Bracket | 44 | Nuts for Head |
| 5 | Lip Seals | 29 | Bracket Gasket | 50 | Lockwashers |
| 6 | Tapered Roller Bearings | 30 | Pipe Plug | 50A | Washers |
| 7 | Bearing Housing | 30A | Pipe Plug | 51 | Studs for Flanges |
| 8 | Bearing Spacer Collar (Inner) (HL-QS) | 30B | Pipe Plug | 51A | Studs for Drain Port |
| 11 | Rings, Half Round (KK, LS) | 31 | Casing (Flanged) | 52 | Nuts for Flanges |
| 12 | Grease Fitting | 35 | Head Gasket | 52A | Nuts for Drain Port |
| 16 | Seal Nuts | 36 | Rotor and Shaft Assembly | 62 | Rectangular Key for Shaft |
| 17 | Seal Studs | 37 | Idler and Bushing Assembly | 64 | Guard |
| 19 | Cartridge Seal | 38 | Idler Bushing | | |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## ⚠ DANGER !

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

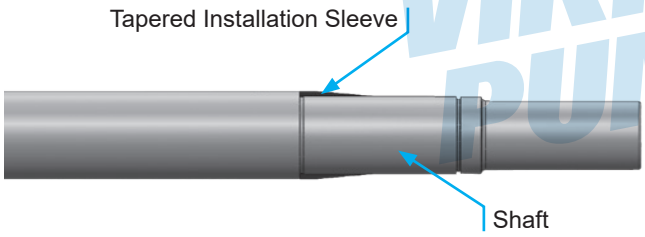
1. **That any pressure in the chamber has been completely vented through the suction or discharge lines, or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational, so that it cannot be started while work is 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.**

## REMOVAL: CARTRIDGE MECHANICAL SEAL

1. Insert brass or plastic bar into one of the pump ports and into the space between rotor teeth to prevent rotor and shaft from spinning. If removing the seal while pump is installed, lock shaft to prevent spinning. Bend up tang of lockwasher (Item 2) with flat bladed screw driver or small flat punch and a hammer. With a spanner wrench, remove locknut (Item 1) from shaft (Item 36). Remove lockwasher from shaft.
2. Loosen two set screws in the face of the bearing housing (Item 7), see **"Figure 7" on page 6**, and turn the bearing housing CCW to remove the bearing housing assembly from the bracket (Item 27).
3. Remove bracket guard (Item 64).
4. Remove the pair of half round rings (Item 11) under the inner spacer collar (Item 8) from the shaft for KK and LS size pumps. There are no half round rings on all other size pumps.
5. If flush plan or barrier fluid tubes are connected to the seal gland (Item 19), 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 out through bearing housing opening.

**FIGURE 5:**




**NOTE:** Coat rotor shaft, tapered installation sleeve and inner diameter of mechanical seal with P-80® or equivalent before assembly.

## INSTALLATION: CARTRIDGE MECHANICAL SEAL

1. **NOTE:** Burrs left on shaft can damage O-rings on seal sleeve during installation. Inspect shaft for burrs and remove any found with a fine grade of emery cloth.
2. Clean rotor shaft and face of seal chamber.
3. Place tapered installation sleeve on shaft. Coat rotor shaft, tapered installation sleeve, and O-rings in the inside diameter of cartridge seal sleeve with a generous amount of P-80® or equivalent. See **"Figure 5" on page 5**.
4. Slide cartridge seal over installation sleeve on shaft until it contacts the seal chamber face. Be sure the flush port opening on the seal gland is at the twelve o'clock position. Remove tapered installation sleeve from shaft.
5. Secure seal gland to bracket face using nuts (Item 16), flat washers (Item 50A) and lock washers (Item 50) onto studs (Item 17). **NOTE:** Tighten nuts on studs tight enough to compress seal gland gasket. Tighten only enough to contain leakage and not to distort seal gland.
6. For KK and LS sizes, place pair of half round rings in groove on shaft. For all sizes, turn bearing housing assembly CW into bracket until flange on bearing housing is 1/2" from bracket. Do not turn the bearing housing into the bracket completely.
7. Place lockwasher and locknut on shaft, see **"Figure 7" on page 6** for orientation. Tighten locknut per **"Table 1" on page 5** and bend one tang of lockwasher into slot of locknut.

**TABLE 1: LOCKNUT TORQUE**

| Pump Size | Torque (Ft.-Lbs.) | Torque (N-m) |
|---|---|---|
| HL | 50-70 | 70-95 |
| KK | 100-130 | 140-175 |
| LS | 120-150 | 165-200 |
| Q, QS, N | 170-190 | 235-255 |
| R | 250-270 | 340-365 |

8. Adjust pump end clearance per **"Thrust Bearing Adjustment" on page 8**.
9. Tighten setscrews on cartridge seal drive collar to shaft and remove or turn seal centering clips so as to clear the seal drive collar.
10. Turn shaft by hand or jog motor to check seal drive collar for runout.
11. Connect flush plan or barrier fluid lines or vent stuffing box, if no flush plan, until liquid is present in stuffing box. Install pipe plugs in any seal gland openings that are not being utilized.

    **NOTE:** For maximum seal life, flush plan should be used.
12. Replace bracket window guard.

## ⚠ 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.**

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## ⚠ 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.**

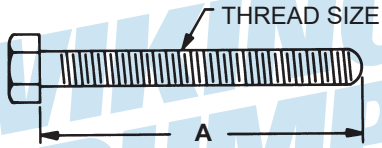
**Failure to follow above listed precautionary measures may result in serious injury or death.**

## PUMP DISASSEMBLY

1. Mark head (Item 40) and casing (Item 31) before disassembly to ensure proper reassembly.

   Remove nuts from head for Q, QS, N and RS sizes. Sizes HL, KK and LS remove capscrews. Remove head from pump For N and R sizes; use jackscrew holes in head, if needed. Proper size and length of jackscrews for pump size are shown in **"Figure 6" on page 6**. The use of a hoist to support head will facilitate its removal. A lifting hook will provide adequate connection for hoisting head. If a hoist is not available, cribbing or blocking can be used to support head. This will eliminate having to lift head into position when reassembling pump.

**FIGURE 6: MINIMUM LENGTH OF JACK SCREWS**




| Pump Size | No. Screws Used | A | Thread Size (Inch) |
|---|---|---|---|
| N | 2 | 3.25 | 0.50" - 13 NC |
| R | 2 | 4.00 | 0.63" - 11 NC |

   Do not allow idler (Item 37) to fall from idler pin. Tilt top of head back when removing to prevent this. Avoid damaging head gasket (Item 35).

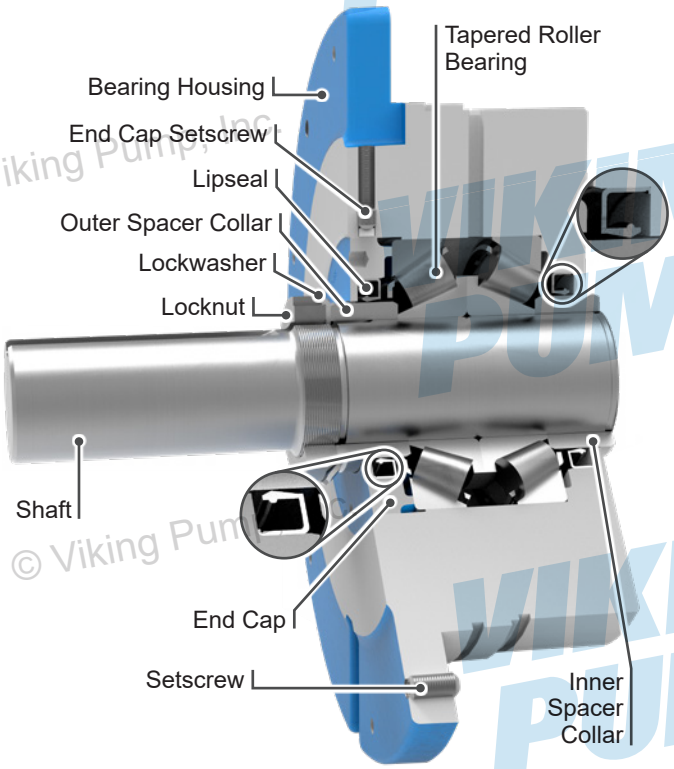
   If pump has jacketed head plate (not illustrated), it will separate from head when it is removed. Avoid damaging the gasket between the jacketed head plate and pump head.

2. Remove idler and bushing assembly.
3. Insert brass or plastic bar into one of the pump ports and into the space between rotor teeth to prevent rotor and shaft from spinning. Bend up tang of lockwasher with flat bladed screw driver or small flat punch and a hammer. With a spanner wrench, remove locknut from shaft. Remove lockwasher from shaft.
4. Loosen two set screws in the face of the bearing housing, see **"Figure 7" on page 6**, and turn the bearing housing CCW to remove the bearing housing assembly from the bracket.
5. Remove bracket window guard from bracket.
6. Remove the pair of half round rings under the inner spacer collar from the shaft for KK and LS size pumps. There are no half round rings on all other size pumps.
7. If flush plan or barrier fluid tubes are connected to the seal gland, turn off and disconnect before removing seal. Remove all pipe plugs from seal gland. Loosen the set screws on the cartridge seal collar to free the cartridge seal from the shaft. Remove nuts and washers from studs. Slide cartridge seal out through bearing housing opening.
8. Carefully remove rotor and shaft to avoid damaging bracket bushing (Item 25).
9. Loosen two radial setscrews in flange of bearing housing. With a spanner wrench remove the outer end cap (Item 3) with lip seal (Item 5) and outer bearing spacer collar (Item 4) see **"Figure 7" on page 6**.
10. Remove both tapered roller bearings (Item 6), and inner bearing spacer collar from the bearing housing.
11. Clean all parts thoroughly and examine for wear and damage. Check lip seals, roller bearings, bushings, and idler pin and replace if necessary. Check all other parts for nicks, burrs, excessive wear and replace if necessary.

    Wash bearings in clean solvent. Blow out bearings with compressed air. Do not allow bearings to spin; turn them slowly by hand. Spinning bearings will damage race and rollers. Make sure bearings are clean, then lubricate with light oil and check for roughness. Roughness can be determined by turning outer race by hand.

12. Casing inner diameter can be checked for wear or damage while mounted on bracket.

**FIGURE 7: BEARING HOUSING ASSEMBLY**



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## PUMP ASSEMBLY

1. If the pump has carbon graphite bushings, Refer to **"Installation: Carbon Graphite Bushings" on page 8**. If the bracket bushing is worn, replace. If bracket bushing has a lubrication groove, install bushing with groove at 12 o'clock position in bracket.
2. Coat shaft of rotor shaft assembly with light oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor into casing.
3. If replacing carbon graphite idler bushing, Refer to **"Installation: Carbon Graphite Bushings" on page 8**. Coat idler pin with light oil and place idler and bushing on idler pin in head.
4. Inspect head O-ring for damage. If damaged, use a new head O-ring, install head and idler assembly on casing. Pump head and casing were marked before disassembly to ensure proper reassembly. If not, be sure idler pin, which is offset in pump head, is positioned equal distance between port connections to allow for proper flow of liquid through pump. If pump is equipped with jacketed headplate, install at this time along with new gasket.

   Tighten head capscrews or nuts evenly per TR-804 Capscrew Torques.
5. Install seal, refer to **"Installation: Cartridge Mechanical Seal" on page 5**.
6. Slide inner spacer collar over shaft for HL, KK, LS, Q and QS sizes. N and R sizes do not have an inner spacer collar. For KK and LS size pumps, the recessed end of the collar should be facing head of pump. HL, Q and QS size bearing spacer collars are not recessed.

   Place pair of half round rings on shaft, if applicable, and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on the HL, Q, QS and R size pumps.
7. Turn the bearing housing CW into the bracket until the flange on the bearing housing is 1/2" from the face of the bracket.
8. If damaged, replace and install lip seal into bearing housing. See **"Figure 7" on page 6** for lip seal orientation.
9. Pack tapered roller bearings with grease and press or push bearings into housing with large end of inner races together. It is possible to install bearings incorrectly. For proper assembly see **"Figure 7" on page 6**.
10. If damaged, replace and install the lip seal in the end cap. See **"Figure 7" on page 6** for lip seal orientation. Thread the end cap into the bearing housing along with outer bearing spacer collar and tighten against the bearing.

    Tapered roller bearings require preload to operate properly. To set preload tighten end cap so that inner races of bearings cannot be rotated by hand. Make a mark on the outside diameter of the bearing housing and a corresponding mark on the bearing housing end cap. Rotate the bearing housing end cap in a counter clockwise direction until the mark on the outside diameter of the bearing housing is past the mark on the bearing housing end cap by 5/16". This will provide the correct end play for the bearings.
11. Lock end cap in place with two end cap setscrews in the flange of the bearing housing, see **"Figure 7" on page 6.**
12. Put lockwasher and locknut on shaft. Insert length of plastic or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut per **"Table 1" on page 5**. Bend one tang of lockwasher into slot of locknut. If tang does not line up with slot, tighten locknut until it does. Failure to tighten locknut or engage lockwasher tang could result in early bearing failure and cause damage to pump.

    Remove length of plastic or brass from port opening.
13. Adjust pump end clearance per **"Thrust Bearing Adjustment" on page 8**.
14. Lubricate all grease fittings with multi-purpose polyurea grease, NLGI #2.
15. Replace guard on bracket.

**⚠ 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.**

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## ⚠ 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.**

## THRUST BEARING ADJUSTMENT

1. Seal design varies from manufacturer to manufacturer. Consult seal supplier instructions or representative for recommendations on disengaging the seal from the shaft prior to end clearance adjustment.
2. Loosen the two set screws in the outer face of the bearing housing, see **"Figure 7" on page 6** and turn the thrust bearing assembly clockwise until it can no longer be turned by hand. Turn the bearing housing counter-clockwise until the rotor and shaft can be turned by hand, but with a noticeable drag.
3. Make an axial mark across both the bearing housing and bracket. For standard end clearance, turn the thrust bearing assembly CCW the required length measured on the outside diameter of the bearing housing from the mark on the bracket, refer to **"Table 2" on page 8** and see **"Figure 8" on page 8**.

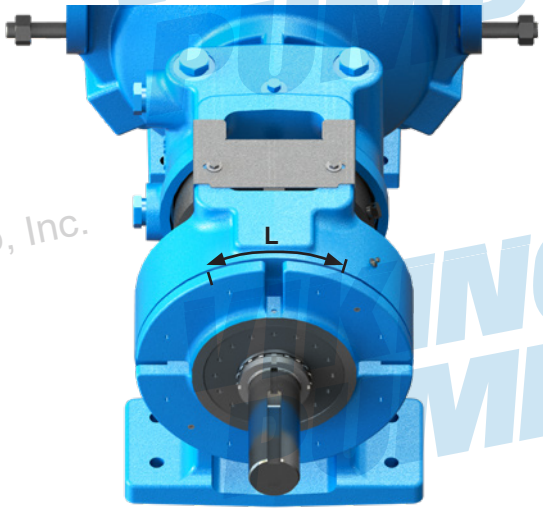
**TABLE 2: BEARING HOUSING ADJUSTMENT FOR END CLEARANCE FOR AA PUMPS**

| Size | Standard End Clearance (Inches) | Turn Bearing Housing CCW Length on OD (Inches) | Additional Length on OD Bearing Housing for .001" End Clearance (Inches) |
|---|---|---|---|
| H, HL | 0.007 | 2.2 | 0.3 |
| K, KK | 0.01 | 3.2 | 0.3 |
| LQ, LL, LS | 0.01 | 3.2 | 0.3 |
| Q, QS | 0.015 | 6.8 | 0.5 |
| N | 0.015 | 7.4 | 0.5 |
| R, RS | 0.02 | 10.5 | 0.5 |

4. Tighten the two set screws, in the outboard face of the bearing housing, with equal force against the bracket.

   **NOTE:** Be sure the shaft can rotate freely. If not, either perform the end clearance adjustment again or disassemble the pump and look for damage to the pump components.
5. Engage seal to shaft per seal manufacturers instructions.
6. High viscosity and high temperature liquids require additional end clearances. The amount of extra end clearance depends on the viscosity of the liquid pumped. For specific recommendations, please consult your local distributor.

**FIGURE 8**




## INSTALLATION: CARBON GRAPHITE BUSHINGS

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

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

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

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

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

**NOTE:** Bronze and hardened cast iron bushings can be pressed into the mating part. Use steps 1 and 2 above.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# APPENDIX (FORMERLY TSM 000)

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

# GENERAL INSTALLATION NOTES

Before installation is started, a few items of a general nature should be considered.

1. **Location** - always locate the pump as close as possible to the supply of liquid to be pumped. Locate it below the liquid supply if at all practical. Viking pumps are self priming but the better the suction conditions the better the performance.
2. **Accessibility** - the pump should be located where it is accessible for inspection, maintenance, and repair. For large pumps, allow room to remove the rotor and shaft without removing the pump from the base.
3. **Port Arrangement** - since the pumps have different port arrangements depending on the model, port location should be checked before starting the installation. The ports may be upright, opposite or at right angles to each other, see **Figure A1**. The right angle ports are normally right-hand, see **Figure A2**; some models are available with left-hand arrangements; still other models are available with the right angle ports located in any one of eight positions including right-hand and left-hand.
4. **Suction/Discharge** - shaft rotation will determine which port is suction and which is discharge. A look at **Figure A3** will show how rotation determines which port is which. As the pumping elements (gears) come out of mesh, point "A" on **Figure A3**, liquid is drawn into the suction port. Then at point "B" the gears come into mesh, and the liquid is forced out the discharge port. Reversing the rotation reverses the flow through the pump. When determining shaft rotation, always look from the shaft end of the pump. Unless otherwise specified, rotation is assumed to be clockwise (CW), which makes the suction port on the right side of the pump. The idler pin, which is offset in the pump head, should be properly positioned toward and an equal distance between the port connections. See **Figure A3** for correct idler pin location in relation to pump ports.

**FIGURE A1**

**FIGURE A2**


**FIGURE A3**

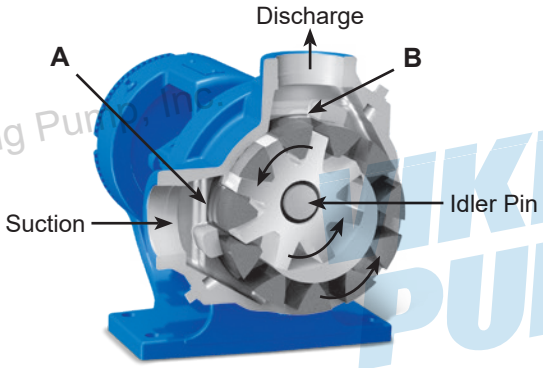


**FIGURE A4:**
**CUTAWAY OF VIKING INTERNAL PRESSURE RELIEF VALVE**

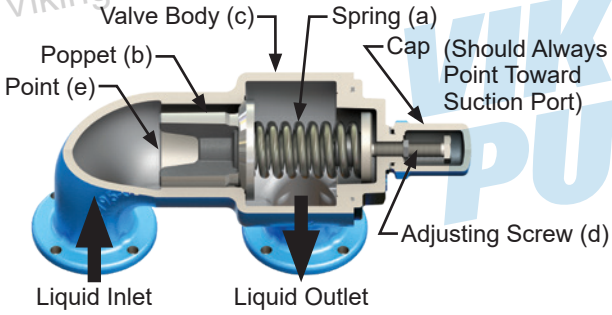


**FIGURE A5-A:**
**INTERNAL PRESSURE RELIEF VALVE**

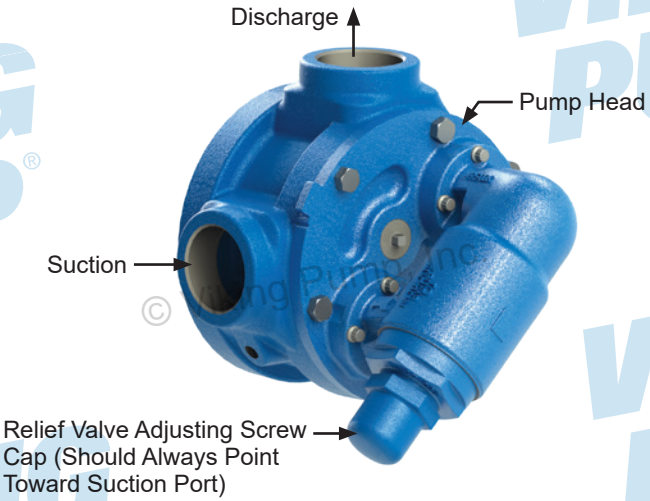


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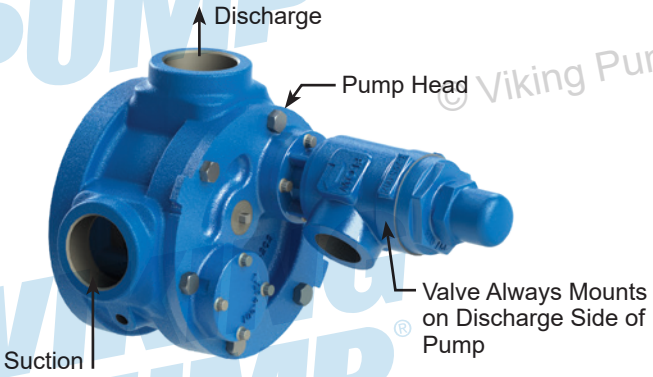
**FIGURE A5-B:**
**RETURN-TO-TANK PRESSURE RELIEF VALVE**




**⚠ CAUTION !**

**Internal type relief valves mounted on Viking pumps should always have the cap or bonnet pointed toward the suction side of the pump. Return-to-tank type relief valves should always be mounted on the discharge side of the pump. If pump rotation is reversed, change the relief valve. Turn the internal type end for end; move the return-to-tank type to the other port. If on a particular installation rotation is reversed, e.g., using one pump to fill a tank, and then by use of a reversing switch or other means of changing the rotation to permit the same pump to circulate the liquid through a heater or to load out, then pressure protection must be provided on both sides of the pump for both rotations. This may be a combination of relief valves, torque limiting devices or rupture disks.**

**⚠ CAUTION !**

**Pumps or systems without relief valves should have some form of pressure protection, e.g. torque limiting devices or rupture disks.**

5. **Pressure Protection** - Viking pumps are positive displacement pumps. This means that when the pump is rotated, liquid will be delivered to the discharge side of the pump. If there is no place for this liquid to go, i.e. the discharge line is blocked or closed, pressure can build up until the motor stalls, the drive equipment fails, a pump part breaks or ruptures, or the piping bursts. Because of this, some form of pressure protection must be used with a positive displacement pump. This may be a relief valve mounted directly on the pump, an inline relief valve, a torque limiting device or a rupture disk.

   The pressure relief valve mounted on most Viking pumps and most in-line valves are of the spring-loaded poppet design. See **Figure A4**. The spring (a) holds poppet (b) against the seat in the valve body (c) with a given force determined by the spring size and by how tightly it is compressed by the adjusting screw (d). The pump discharge pressure pushes against the underside of the poppet at point (e). When the force exerted by the liquid under the poppet exceeds that exerted by the spring, the poppet lifts and liquid starts to flow through the valve.

   As the discharge pressure builds up, more and more of the liquid flows through until a pressure is reached at which all of the liquid being pumped is going through the valve. This pressure is the relief valve setting.

   Viking pumps can be furnished with either an internal pressure relief valve - one which directs the flow from the valve back to the suction side of the pump - or a return-to-tank valve - which directs the flow through piping back to the supply tank. See **Figure A5-A** and **Figure A5-B**. An inline relief valve mounted in the discharge piping also directs the flow back to the supply tank. This type of valve should be mounted close to the pump so that the pressure drop through the piping between the pump and the valve is at a minimum. Be sure there are no shutoff valves between the pump and relief valve. Piping from a return-to-tank or an in-line valve to the supply tank should also be as short and as large as possible.

   **NOTE:** On some models, the relief valve is mounted on the pump casing instead of the pump head.

   The spring-loaded poppet-type valve is strictly a differential valve, sensing only those pressures on each side of the poppet. It should not be used as a pressure or flow control device. It is intended strictly as a relief valve.

   The pressure at which either the return-to-tank or internal relief valve bypasses can be changed by turning the adjusting screw. Do not back the adjusting screw all the way out. Stop when spring tension is off the screw (the screw starts to turn easily). For details on maintenance of the relief valve, refer to the Technical Service Manual covering your model series.

6. **Motor** - follow local electrical codes when hooking up motors.

## FOUNDATION

Every pump should have a solid foundation. It may be any structure sufficiently strong 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.

## COMPONENT & UNIT LIFTING FEATURES

Removable lifting features, such as threaded eye bolts and hoist rings, installed in components (pumps, reducers, motors, etc.) and baseplates should be left on the components. These features are used to safely lift and move the individual components. Following are general guidelines for lifting Viking Pump® units.


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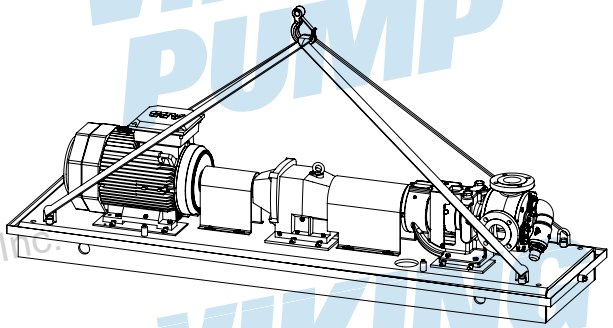
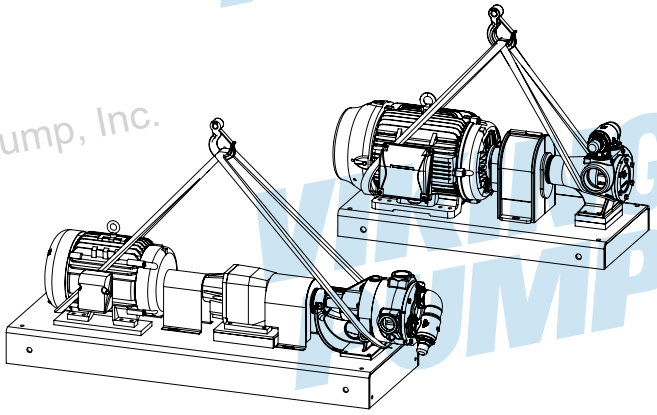
**FIGURE A6:**
**EXAMPLE OF PROPER LIFTING METHOD**



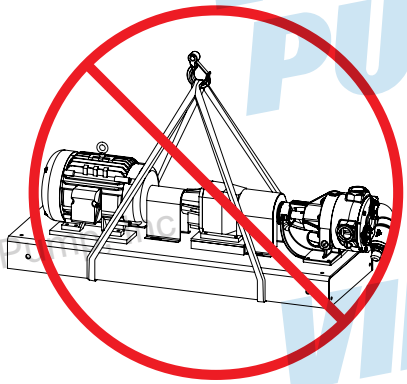
**NOTE:** Units should be lifted by the base lifting features using two or more lifting slings.

**FIGURE A7:**
**EXAMPLES OF PROPER LIFTING METHOD**



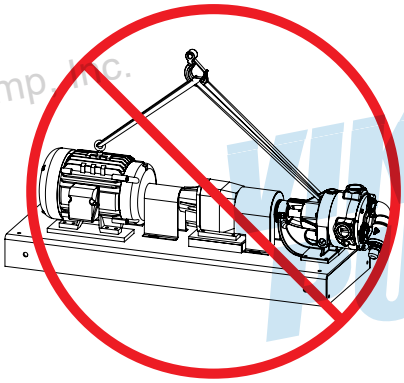
**NOTE:** Use two or more lifting slings around the pump and the motor when the base does not have lifting features. Make sure the slings are secure and the load is balanced before attempting to lift.

**FIGURE A8:**
**EXAMPLE OF IMPROPER LIFTING METHOD**



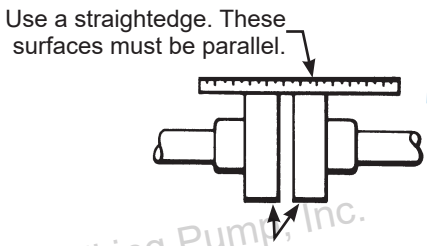
**NOTE: NEVER** lift the unit with slings unsecured under the base. The slings can slide, allowing the unit to tip and/or fall. Improper lifts can result in personal injury and/or damage to the unit.

**FIGURE A9**
**EXAMPLE OF IMPROPER LIFTING METHOD**



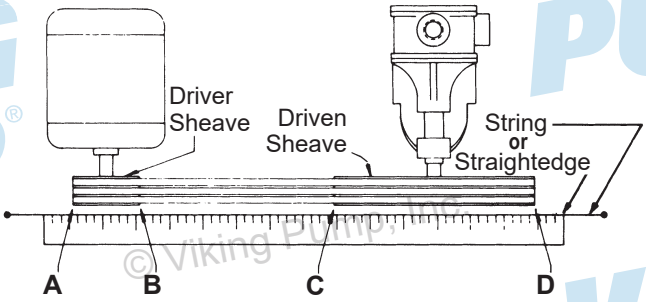
**NOTE: NEVER** lift the unit with slings connected to the component lifting features. The lifting features are designed for the individual component and are not rated to lift the entire unit. Improper lifts can result in personal injury and/or damage to the unit.

**FIGURE A10-A**




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

**FIGURE A10-B**




When sheaves are properly aligned, all points A, B, C, D will touch string or straightedge.

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## ALIGNMENT

### CHECK ALIGNMENT AFTER MOUNTING

***For detailed coupling alignment procedures see coupling manufacturers' recommendations.***

The pump, drive, and motor were properly aligned at the time they were assembled. During shipping and mounting the alignment is often disturbed. **BE SURE TO RECHECK ALIGNMENT AFTER THE PUMP UNIT IS INSTALLED!**

1. Check pump ports to be sure they are square and in the proper position; shim or move the pump as required. Do not force piping to line up with the ports.
2. If the pump is driven by a flexible coupling(s) either directly connected to the motor or through a reducer, remove any coupling guards or covers and check alignment of the coupling halves. At a minimum, a straightedge (such as a piece of key stock) across the coupling must rest evenly on both rims at the top, bottom, and sides. See **Figure A10-A**.
3. If the pump is driven by V-belts, check the alignment by using a long straightedge or tightly drawn string across the face of the sheaves. See **Figure A10-B**.
4. Make a final check on alignment after piping is hooked up. Refer to item 13 in **Piping** section.

   **Figure A11** and **Figure A12** show typical direct drive and gear reducer drive units.
5. For high temperature applications (those above 300°F) allow the pump to reach operating temperature, then recheck alignment.

**FIGURE A11: DIRECT DRIVE**

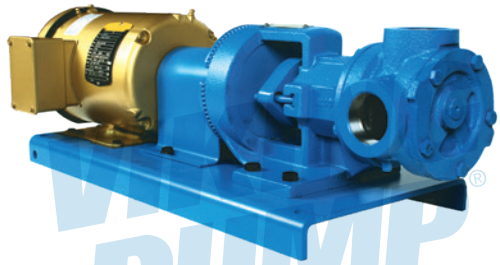
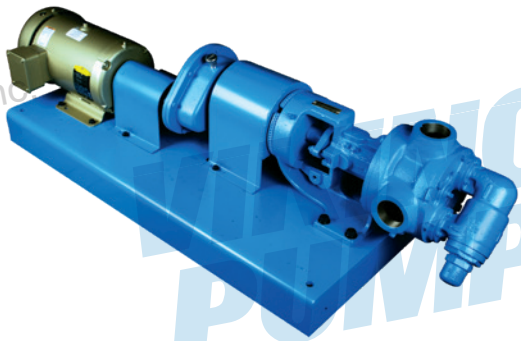


**FIGURE A12: REDUCER DRIVE**



## PIPING

The cause of many pumping problems can be traced to suction piping. It should always be as large and short as practical. For help in selecting the proper size suction and discharge piping, refer to **Viking General Catalog Section 510**.

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

1. Never use piping smaller than the pump port connections.
2. Be sure the inside of the pipe is clean before hooking it to the pump.
3. **FOOT VALVE** - When pumping a light liquid with a suction lift, a foot valve at the end of the suction piping or a check valve in the first horizontal run will hold the liquid in the line and make it easier for the pump to prime. Be sure the foot or check valve is big enough so that it doesn't cause excessive line loss.
4. When approaching an obstacle in the suction or discharge line, go around the obstacle instead of over it. Going over it creates an air pocket. See **Figure A13**.
5. 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.
6. For a suction line with a long horizontal run, keep the horizontal portion below the liquid level if possible. This keeps the pipe full of liquid and reduces the amount of air the pump must evacuate at startup. This is most helpful when there is no foot valve. See **Figure A14**.
7. When piping a hot or cold system (liquid being handled is at a temperature different from the air surrounding the pump), be sure allowance is made for expansion and contraction of the piping. Loops, expansion joints, or unsecured (this does not mean unsupported) runs should be used so the pump casing is not distorted.
8. **STRAINER** - It is always good practice to consider a strainer on the suction side of a positive displacement pump. The strainer will keep foreign objects from going into the pump. Without a strainer objects can lock the pump, and damage the internals and drive. The strainer basket mesh or perforation size should be big enough so that it does not cause excessive pressure drop, but it should be fine enough to protect the pump. When in doubt as to the proper size, check with the manufacturer, giving pipe size, flow rate, and viscosity involved. Provision should be made for cleaning the strainer. If the pump operates continuously, a bypass should be built around the strainer, or two strainers should be put in parallel with proper valving so they can be isolated for cleaning. Use of a strainer is particularly important at start up to help clean the system of weld beads, pipe scale, and other foreign objects. For additional information, refer to **TSM 640**.
9. If the pump is not equipped with a relief valve, consideration should be given to mounting one in the discharge line. Refer to discussion on pressure protection under item 5 in **General Installation Notes** section.
10. The pump should not be used to support the piping. The weight of the piping should be carried by hangers, supports, stands, etc.
11. When fastening the piping to the pump it should not be necessary to impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will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cause distortion, possible misalignment, and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.

12. All joints of the piping system should be tight; pipe sealer will help assure leak-free threaded joints. Leaks in the suction line permitting air to be drawn in may cause a noisy pump or a reduction in capacity. It is not recommended to use PTFE tape on NPT ports as a pipe sealer. This action can result in cracks in the pump.

13. **ALIGNMENT** - Check the alignment of the drive after the piping is hooked up. As a final check on pump alignment, remove the head of the pump and with a feeler gauge determine if there is clearance all the way around between the rotor and casing. Because of manufacturing tolerances, bushing clearances, etc., the rotor may not be centered in the casing, but it should not drag; dragging would indicate unit misalignment or casing distortion from piping strain. Making this check is most desirable on installations involving Q, M and N size general purpose pumps.

14. The auxiliary piping hooked to jackets, glands, etc. for heating, cooling, quenching, or for other purposes should receive the same attention as the piping handling the pumped liquid.

15. Provide a pressure relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. This is particularly important:

    a. When handling a cold liquid such as refrigeration ammonia that can warm up to ambient temperatures when the pump is shut off.

    b. When handling a liquid such as asphalt or molasses that has to be heated before it can be pumped.

    The rise in temperature causes the 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.

**FIGURE A13**

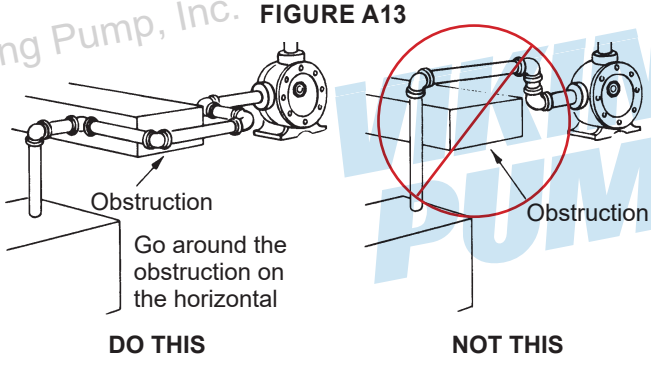
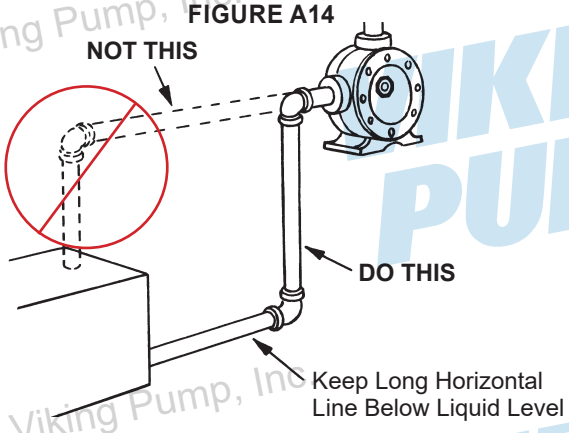



**FIGURE A14**




## START UP

Before starting the pump, check the following:

1. Are there vacuum and pressure gauges on or near the pump? These gauges are the quickest and most accurate way of finding out what is happening in the pump.
2. Check alignment - See suggestions in the Alignment section of this manual.
3. Check piping to be sure there is no strain on the pump casing.
4. Rotate the pump shaft by hand to be sure it turns freely. **MAKE SURE THE PUMP DRIVER IS LOCKED OUT OR CANNOT BE ENERGIZED BEFORE DOING THIS.**
5. Jog motor to be sure it is turning in the right direction; refer to discussion on pump rotation under item 4 in **General Installation Notes** section.
6. Check any relief valves to be sure they are installed correctly. Refer to discussion on relief valves in **General Installation Notes** section.
7. Check suction piping to be sure:
    a. It is all connected and tight
    b. Valves are open
    c. End of pipe is below liquid level
8. Check discharge piping to be sure:
    a. It is all connected and tight
    b. Valves are open
    c. There is a place for the liquid to go
9. Lubricate any grease fitting on the pump using a #2 NLGI polyurea grease. Check any gear reducer, motor, coupling, etc. for instructions and lubricate as recommended. Contact your Viking Pump® representative for **Engineering Service Bulletin ESB-515**.
10. For packed pumps, loosen packing gland nuts so gland can be moved slightly by hand. Adjust gland to reduce leakage only after pump has run long enough to reach constant temperature. Packing should weep a little to keep it cool and lubricated.
11. Do not use the Viking pump to flush, pressure test or prove the system with water. Either remove the pump or run piping around it while flushing or testing. Pumping water, dirty or otherwise, can do more damage in a few minutes than months of normal service.
12. Check to be sure all guards are in place.
13. Check the pump to be sure it is heated to operating temperature (if jacketed or heat traced).

If the pump begins to deliver liquid within 60 seconds, it can continue to be operated. If liquid is not leaving the discharge port, stop the pump. Running the pump longer than one minute without liquid inside it can damage the pump. Review the steps just outlined, consider what the suction and discharge gauges indicate, and see **Troubleshooting** section. If everything appears to be in order, put some liquid in the pump. This will help it prime.

The pump can be restarted. If nothing is flowing within two minutes, stop the pump. The pump is not a compressor; it will not build up much air pressure. It may be necessary to vent the discharge line until liquid begins to flow.

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If the pump still does not deliver flow, the cause may be one or more of the following:

1. Suction line air leaks. Vacuum gauge reading should help determine if this is the problem.
2. End of suction pipe not submerged deep enough in liquid.
3. 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 it still does not pump, review again all points under **START UP**. Read through **Troubleshooting** in this manual and try again. If it still does not pump, contact your Viking Pump® representative.

## TROUBLESHOOTING

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

**NOTE:** Before making any pump adjustment or opening the pump liquid chamber in any manner, make sure that:

1. Any pressure in the pumping chamber has been vented through the suction or discharge lines or other openings provided for this purpose.
2. The driver has been "locked out" so that it cannot inadvertently be started while work is being done on the pump.
3. The pump has been allowed to cool down to the point where there is no chance of anyone being burned.

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

### *VACUUM GAUGE - SUCTION PORT*

1. **High reading would indicate:**
   - **a.** Suction line is blocked by a stuck foot valve, stuck gate valve, or plugged strainer.
   - **b.** Liquid is too viscous to flow through the piping.
   - **c.** Lift is too high.
   - **d.** Line is too small.
2. **Low reading would indicate:**
   - **a.** Air leak in suction line.
   - **b.** End of pipe is not in liquid.
   - **c.** Pump is worn.
   - **d.** Pump is dry - should be primed.
3. **Fluttering, jumping, or erratic reading:**
   - **a.** Liquid is vaporizing.
   - **b.** Liquid is coming to pump in slugs, possibly an air leak, insufficient liquid above the end of the suction pipe.
   - **c.** Vibrating from cavitation, misalignment, or damaged parts.

### *PRESSURE GAUGE - DISCHARGE PORT*

1. **High reading would indicate:**
   - **a.** High viscosity, small diameter discharge line or long discharge line.
   - **b.** Gate valve is partially closed.
   - **c.** Filter is plugged.
   - **d.** Vertical head did not consider a high specific gravity liquid.
   - **e.** Line is partially plugged from build up on inside of pipe.
   - **f.** Liquid in the pipe is not up to temperature.
   - **g.** Liquid in the pipe has undergone a chemical reaction and has solidified.
   - **h.** Relief valve is set too high.
2. **Low reading would indicate:**
   - **a.** Relief valve is set too low.
   - **b.** Relief valve poppet is not seating properly.
   - **c.** Bypass around the pump is partially open.
   - **d.** Too much extra clearance.
   - **e.** Pump is worn.
3. **Fluttering, jumping, or erratic reading:**
   - **a.** Cavitation.
   - **b.** Liquid is coming to the pump in slugs.
   - **c.** Air leak is in the suction line.
   - **d.** Vibrating from misalignment or mechanical problems.

**Some of the following may also help pinpoint the problem:**

**A. Pump does not pump.**

1. Pump has lost its prime due to air leak, low level in tank, foot valve stuck.
2. Suction lift is too high.
3. Rotating in wrong direction.
4. Motor does not come up to speed.
5. Suction and discharge valves not open.
6. Strainer is clogged.
7. Bypass valve open, relief valve set too low, relief valve poppet stuck open.
8. Pump is worn out.
9. Any changes in the liquid system or operation that would help explain the trouble, e.g. new source of supply, added more lines, inexperienced operators, etc.
10. Too much end clearance.
11. Head position is incorrect. See **Figure A3**.
12. Temperature changes either in the liquid or environment.
13. **Mag Drive pumps ONLY:** The magnetic coupling is decoupling. Changes in application (temperature, pressure, viscosity, etc.) may require torque beyond coupling capabilities.

**B. Pump starts, then loses its prime.**

1. Supply tank is empty.
2. Liquid is vaporizing in the suction line.
3. Air leaks or air pockets in the suction line; leaking air through packing or mechanical seal.
4. Pump is worn out.


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**C. Pump is noisy.**

1. Pump is being starved (heavy liquid cannot get to pump fast enough). Increase suction pipe size or reduce length.
2. Pump is cavitating (liquid vaporizing in the suction line). Increase suction pipe size or reduce length. If pump is above the liquid, raise the liquid level closer to the pump. If the liquid is above the pump, increase the head of liquid.
3. Check alignment.
4. May have a bent shaft or rotor tooth. Straighten or replace.
5. Relief valve chatter. Increase pressure setting.
6. May have to anchor base or piping to eliminate or reduce vibration.
7. May be a foreign object trying to get into the pump through the suction port.
8. **Mag Drive pumps ONLY:** The magnetic coupling has decoupled. Shut off and let cool, then restart.

**D. Pump not up to capacity.**

1. Starving or cavitating. Increase suction pipe size or reduce length.
2. Strainer partially clogged.
3. Air leak in suction piping or along pump shaft.
4. Running too slowly. Check the motor is running at the correct speed and that it is wired correctly.
5. Bypass line around pump partially open.
6. Relief valve set too low or stuck open.
7. Pump is worn out.
8. Too much end clearance.
9. Head position incorrect. See **Figure A3**.

**E. Pump takes too much power.**

1. Running too fast. Verify the motor speed, reducer ratio, sheave size, and other drive components are correct for the application?
2. The liquid is too viscous for the size of the unit. Heat the liquid to reduce viscosity, increase the pipe size, slow down the pump, or use a larger motor.
3. Discharge pressure higher than calculated. Verify with a pressure gauge. Increase size or reduce length of pipe, reduce speed (capacity), or get bigger motor.
4. Packing gland drawn down too tight.
5. Pump misaligned.
6. Extra clearance on pumping elements may not be sufficient for operating conditions. Check parts for evidence of drag or contact in pump and increase clearance where necessary.
7. System pressure relief valve is set too high.
8. Bushings have locked to shaft or pin, or the liquid has set up in the pump.

**F. Rapid Wear.**

On most applications the pump will operate for many months or years before it gradually loses its ability to deliver capacity or pressure. Examination of such a pump would show a smooth wear pattern on all parts. Rapid wear, occurring in a few minutes, hours or days, shows up as heavy grooving, galling, twisting, breaking or similar severe signs of trouble. See **Rapid Wear Table**.

## RAPID WEAR

**RAPID WEAR TABLE**

| CAUSE | | EVIDENCE | POSSIBLE SOLUTION |
|---|---|---|---|
| 1 | ABRASIVES | Gouges or marks made by large, hard particles; a rapid wearing away of bushings from very small abrasives; or anything in between. | Flush the system with the pump removed. Install strainer in suction line. Most abrasive objects and particulate is removed after a few cycles (or days) of flushing. |
| 2 | CORROSION | Rust, pitting or metal appears to be "eaten" away. | Check the Viking General Catalog Liquid List for materials of construction recommendation. Consider whether all of the materials used in pump construction were attacked; consider other materials used in the system to determine how they resisted the liquid. Check to see whether or not the liquid has been contaminated to make it more corrosive than anticipated. |
| 3 | EXCEEDING OPERATING LIMITS | Noisy operation, broken bushings, twisted shaft, parts show evidence of high heat (discoloration). | Review General Catalog for operating limits on particular model involved. |
| 4 | INSUFFICIENT EXTRA CLEARANCE | Pump may stall. Evidence of heavy contact between end of rotor teeth and head or other parts. | Increase end clearance and/ or contact your Viking Pump® representative with details of the application, so that information regarding proper extra clearance may be provided. |
| 5 | LACK OF LUBRICATION | Noisy bearings, localized heating at bearings or lip seal, smoke, rapid bushing wear. | Be sure all grease fittings are greased before starting, and instructions for lubrication of drive equipment are followed; consider use of auxiliary lubricating equipment. |
| 6 | MISALIGNMENT | Wear on only one part of a surface, e.g., one side of the casing, one side of the packing gland, only a portion of the face of the head. | Double check alignment of drive equipment and piping. Check the alignment under conditions as close to operating conditions as possible. |
| 7 | RUN DRY | Pump stalls because parts have uneven expansion caused by frictional heat; galling between surfaces having relative motion; seal seats and idler pins changing color because of high heat. | Be sure there is liquid in the system at the time of start up. Provide some kind of automatic alarm or shut-off if supply tank runs dry. |

## PREVENTATIVE MAINTENANCE

Performing a few preventative maintenance procedures will extend the life of your pump and reduce the overall cost of ownership.

**A. Lubrication** - Grease all grease fittings after every 2000 hours of operation. If service is severe, grease more often. Do it gently with a hand gun until the grease exiting the lip seal or relief plug is similar in consistency and color to the new grease.

Use a NLGI #2 polyurea grease for normal applications. For hot or cold applications, use appropriate grease.

**B. Packing Adjustment** - Occasional packing adjustment may be required to keep leakage to a slight weep. If impossible to reduce leakage by gentle tightening, replace packing or use different type. *Refer to Technical Service Manual on particular model series for details on repacking.*

**C. End Clearance Adjustment** - After long service, the running clearance between the end of the rotor teeth and the head may have increased through wear. This wear may cause a loss of capacity or pressure. Resetting end clearance will normally improve pump performance. *Refer to TSM on particular model series for procedure on adjusting end clearance for pump involved.*

**D. Examine Internal Parts** - Periodically remove the head, examine idler and bushing and head and pin for wear. Replacing a relatively inexpensive idler bushing and idler pin after only moderate wear will eliminate the need to replace more expensive parts at a later date. *Refer to TSM on particular model series for procedure in removing head of the pump.* Be sure idler does not slide off the idler pin as the head is removed. If it does slide off the idler can cause personal injury or damage the part.

**E. Cleaning the Pump** - A clean pump is easier to inspect, lubricate, adjust, and runs cooler.

**F. Storage** - If pump is to be stored or not used for six months or more, pump must be drained, and a light coat of non-detergent SAE 30 weight oil must be applied to all internal pump parts. Lubricate fittings and apply grease to pump shaft extension. Viking suggests rotating pump shaft by hand one complete revolution every 30 days to circulate the oil. Retighten all gasketed joints before using the pump.

## 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 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 piping.
4. **DO** install a strainer in the suction line.
5. **DO** double check alignment after the unit is mounted and piping is hooked up.
6. **DO** provide a pressure relief valve for the discharge side of the pump.
7. **DO** cut out the center of gaskets used as port covers on flanged port pumps.
8. **DO** record pump model number and serial number and file for future reference.

### *OPERATION*

1. **DON'T** run pump at speeds faster than shown in the catalog for your model.
2. **DON'T** require pump to develop pressures higher than those shown in the catalog for your model.
3. **DON'T** operate pumps at temperatures above or below limits shown in the catalog for your pump.
4. **DON'T** operate pumps without all guards being in place.
5. **DON'T** operate pump without a relief valve on the pump or in the discharge piping. Be sure valve is mounted and set correctly.
6. **DON'T** exceed catalog limits for temperature and pressures of fluids in jacketed areas of pump.
7. **DON'T** use the pump in a system which includes a steam, air, or vapor blow or purge **without** provision for over-speed shutdown, in case the pump starts to act as a turbine and over-speeds the drive.
8. **DON'T** operate the pump with all of the liquid bypassing through a pump mounted internal type relief valve, or without any flow of liquid going through the pump for more than a couple of minutes. Operation under either of these conditions may result in a heat build-up in the pump, which could cause hazardous conditions or happenings.


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## *MAINTENANCE*

1. **DO** make sure any pump that has residual system pressure in it, or that has handled high vapor pressure liquids, such as LP-gas, ammonia, Freons, etc., has been vented through the suction or discharge lines or other openings provided for this purpose.
2. **DO** make sure that if the pump is still hooked to the driver while maintenance is being performed that the driver has been “locked out”, so that it cannot be inadvertently started while work is being done on the pump.
3. **DO** make sure any pump that has handled a corrosive, flammable, hot, or toxic liquid has been drained, flushed, vented and/or cooled before it is disassembled.
4. **DO** remember that a few simple preventative maintenance procedures such as periodic lubrication, adjustment of end clearance, examination of internal parts, etc., will extend the service life of your pump.
5. **DO** obtain, read and keep maintenance instructions furnished with your pump.
6. **DO** have spare parts, pumps or standby units available, particularly if the pump is an essential part of a key operation or process.
7. **DON’T** drop parts during disassembly, e.g., idler can slip from the pin as the head is removed from the pump. It may cause personal injury or damage the part.
8. **DON’T** stick fingers in the ports of a pump. Serious injury may result.
9. **DON’T** spin the idler on the idler pin. Fingers may be jammed between teeth and crescent.

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VIKING PUMP®

## WARRANTY

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

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