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## INTRODUCTION

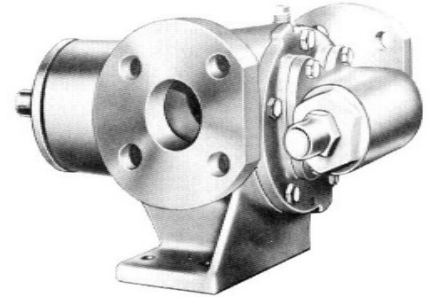
The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking® representative. Always give complete name of part, part number and material with model number and serial number of pump when ordering repair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

In the Viking model number system, basic size letters are combined with series number (4193 & 493) indicating both unmounted or mounted pump unit.

### Model Number Chart

UNMOUNTED PUMP	UNITS
Foot Mounted	Units are designated by the unmounted pump model numbers followed by a letter(s) indicating drive style.  D-Direct Drive
GG4193	
HJ4193	
HL4193	
AS4193	
AK4193	
AL4193	
Flange Mounted	M-Horizontal Direct Drive  IM-Vertical In-Line Direct Drive
GG493	
HJ493	
HL493	
AS493	
AK493	
AL493	

This manual deals only with Series 4193 & 493 Heavy-Duty Pumps. Refer to figures 1 thru 14 for general configuration & nomenclature used in the manual. Pump specifications and recommendations are listed in Catalog section 154, Series 4193 & 493 Heavy-Duty Pumps.



**FIGURE 1**  
**GG, HJ & HL 4193 SERIES**  
Foot Type Unmounted Pump with Flanged Ports



**FIGURE 2**  
**AS, AK & AL 4193 SERIES**  
Foot Type Unmounted Pump with Flanged Ports



**FIGURE 3**  
**GG, HJ & HL 493 SERIES**  
Unmounted Pump with Flanged Ports



**FIGURE 4**  
**AS, AK & AL 493 SERIES**  
Unmounted Pump with Flanged Ports

## 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 CHAMBER HAS BEEN COMPLETELY VENTED THROUGH 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.

**ROTATION:** Viking pumps operate equally well in a clockwise or counterclockwise rotation. Shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

### PRESSURE RELIEF VALVES:

1. Viking pumps are positive placement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. There are relief valve options available on these pumps. Relief Valve options include an internal relief valve and a return to tank relief valve.
3. If pump rotation is to be reversed during operation, pressure protection must be provided on *both* sides of pump.
4. 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.
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

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

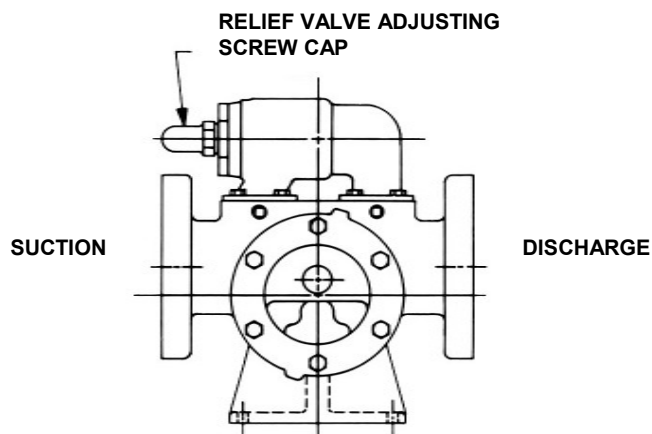


FIGURE 5

### SPECIAL MECHANICAL SEALS

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

## MAINTENANCE

Series 4193 & 493 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.

**CLEANING PUMP:** Keep pump as clean as possible. This will facilitate inspection; adjustment and repair work and help prevent over looking a dirt covered grease fitting.

**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 oil.

**SUGGESTED REPAIR TOOLS:** The following tools must be available to properly repair Series 4193 and 4936 pumps. These tools are in addition to standard mechanics' tools such as, open end wrenches, pliers, screw drivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed hammer
2. Allen wrenches (set screw & special mechanical seals)
3. Snap ring pliers  
INTERNAL – Viking P/N 2-810-047-999  
GG-HJ-HL 4193-493  
EXTERNAL - Viking P/N 2-810-029-375  
GG-HJ-HL 4193-493
4. Mechanical seal installation sleeve  
2-751-001-900 for 3/4 inch seal; GG-HJ-HL 4193-493  
2-810-004-900 for 1 1/4 inch seal; AS-AL- 4193-493
5. Bearing locknut spanner wrench  
Source: #471 J.H. Williams & Co. or equal)
6. Spanner wrench, adjustable pin type for use on bearing housing end cap  
(Source: #482 J.H. Williams & Co. or equal)
7. Brass bar
8. Arbor press

# DISASSEMBLY

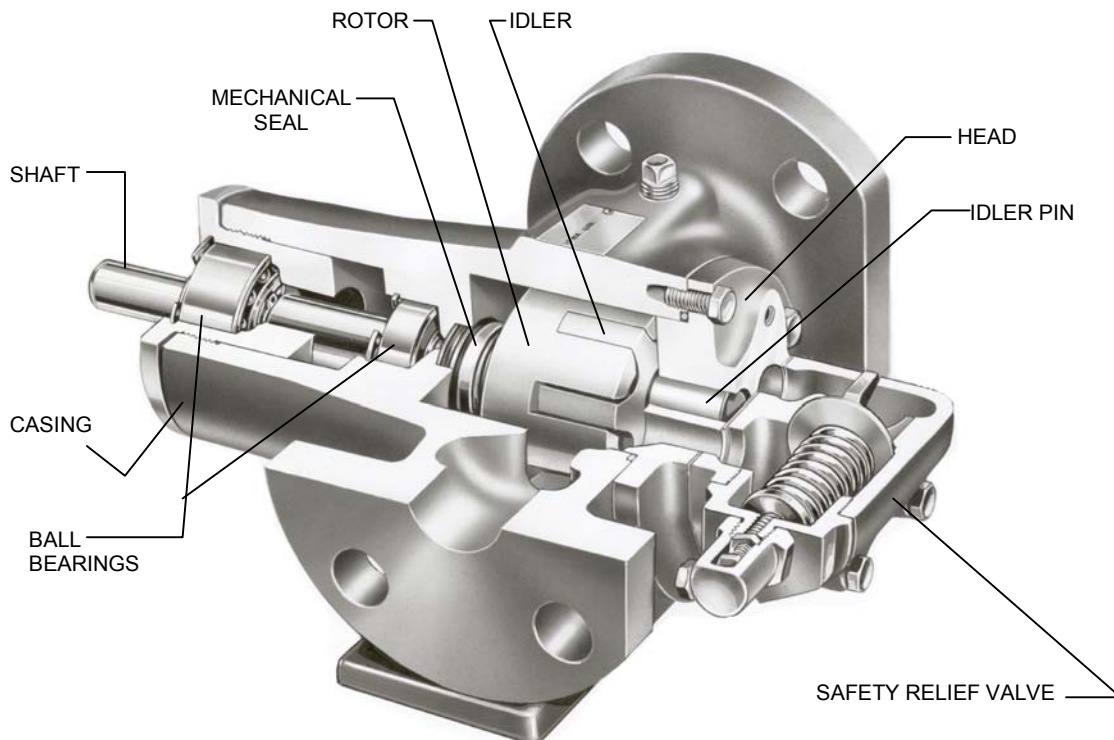
## DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

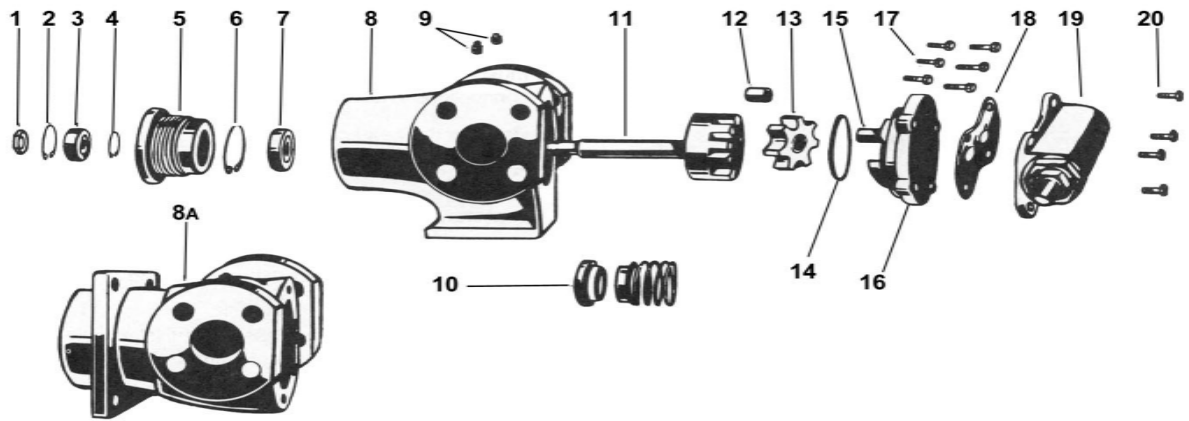
1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
3. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
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.

1. Refer to figure 7 & 8 page 4 for model to be disassembled and name of parts. Models 4193 & 493 are disassembled and assembled the same. The difference between these models is the casing.
2. Mark head and casing before disassembly to ensure proper reassembly. The idler pin, which is offset in pump head, must be positioned toward and equal distance between port connections to allow for proper flow of liquid through the pump.
3. Remove the head capscrew.  
**NOTE:** The four valve capscrews, valve and gasket must be removed from the GG 4193-493 models before the six head capscrews are removed.
4. Remove head from pump. Do not allow idler to fall from idler pin. Tilt top of head back when removing to prevent this. Avoid damaging head gasket.
5. Remove idler and bushing assembly. If idler bushing needs replacing, see "Installation of Graphite Bushings" page 7.
6. Remove locknut from shaft. See figure 9 or 10. A piece of brass or hardwood inserted in port opening and between rotor teeth will keep shaft from turning.
7. Loosen two setscrews in face of bearing housing and turn thrust bearing assembly counter clockwise and remove from casing. See figure 9 or 10.
8. Remove snap ring from shaft for GG, HJ, or HL size pumps, see figure 9.
9. Remove bearing spacer from shaft for AS, AK & AL size pumps, see figure 10.
10. Remove piece of brass or hardwood from port opening.

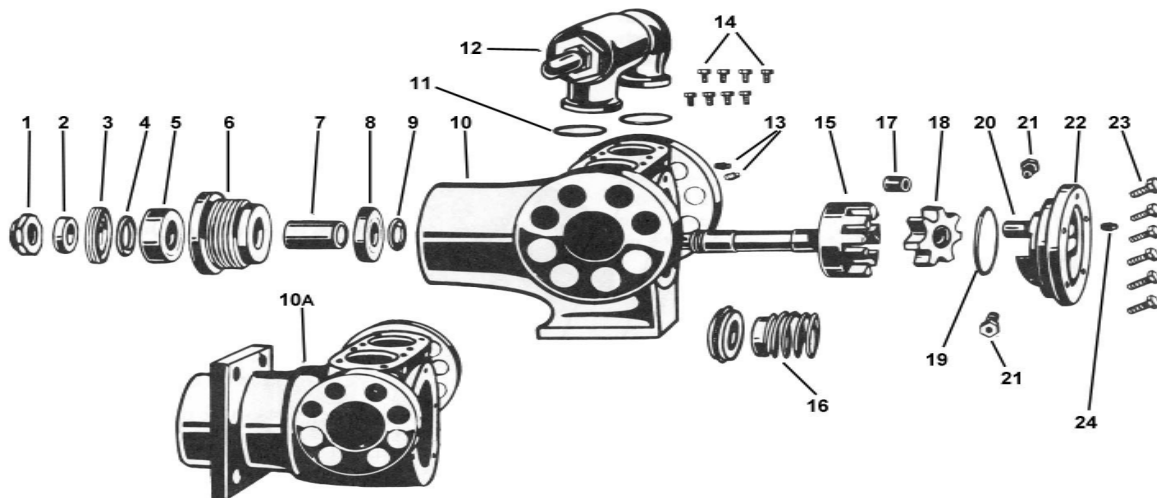


CUTAWAY OF MODELS GG, HJ or HL 4193  
FIGURE 6



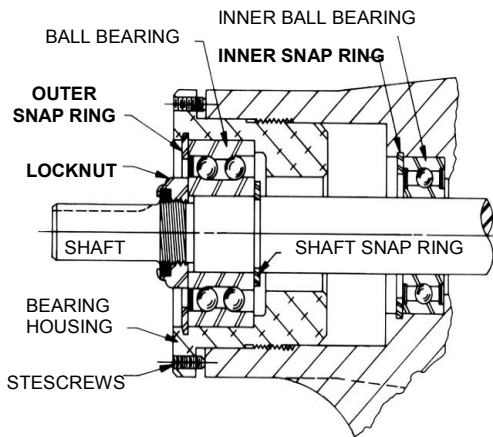
**EXPLODED VIEW MODELS GG, HJ and HL 493 and 4193  
FIGURE 7**

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1.	Locknut	7.	Ball Bearing	12.	Idler Bushing	18.	Gasket for Relief Valve
2.	Snap Ring, Outer	8.	Casing (4193)	13.	Idler and Bushing	19.	Relief Valve
3.	Ball Bearing, Outer	8A	Casing (493)	14.	Head Gasket	20.	Capscrew for Valve
4.	Snap Ring for Shaft	9.	Pipe Plug	15.	Idler Pin		
5.	Bearing Housing	10.	Mechanical Seal	16.	Head and Idler Pin		
6.	Snap Ring, Inner	11.	Rotor	17.	Capscrew for Head		

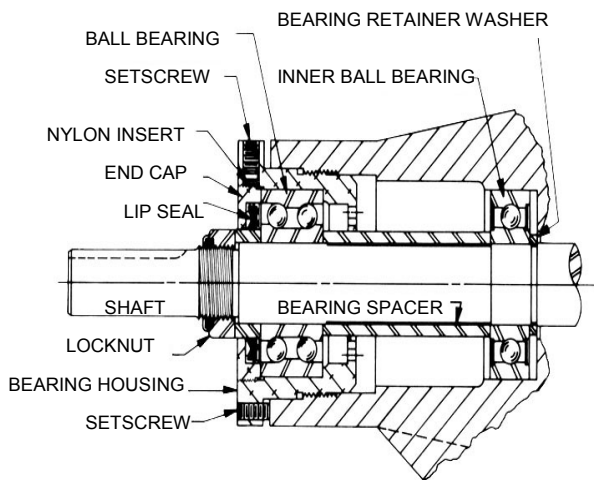


**EXPLODED VIEW MODELS AS, AK and AL 493 and 4193  
FIGURE 8**

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1.	Lockout	7.	Bearing Spacer	13.	Relief Valve	18.	Idler and Bushing
2.	Bearing Spacer Collar	8.	Ball Bearing Inner	14.	Pipe Plug	19.	Head Gasket
3.	End Cap of Bearing Housing	9.	Bearing Washer Retainer	15.	Capscrew for Valve	20.	Idler Pin
4.	Lip Seal for Bearing Housing	10.	Casing (4193)	16.	Rotor and Shaft	21.	Head and Idler Pin
5.	Ball Bearing, Outer	10A	Casing (493)	17.	Mechanical Seal	22.	Capscrew for Head
6.	Bearing Housing	11.	Gasket for Relief Valve	18.	Idler Bushing	23.	Capscrew for Valve



**THRUST BEARING ASSEMBLY GG, HJ, HL SIZES  
FIGURE 9**



**THRUST BEARING ASSEMBLY AS, AK, AL SIZES  
FIGURE 10**

11. The rotor shaft can now be removed by tapping on end of shaft with a lead hammer or, if using a regular hammer, use a piece of hardwood between shaft and hammer. The spring and rotary member of the seal will come out with rotor and shaft.
12. Remove inner snap ring and single row ball bearing from casing. See figure 9. The AS, AK & AL size pumps do not have this snap ring.
13. Remove bearing retainer washer from the AS, AK or AL size pumps. See figure 10.
14. Remove the seal seat or stationary part of seal from casing.
15. Disassemble thrust bearing assembly. Remove outer snap ring from bearing housing for GG, HJ or HL size pumps and ball bearing can be removed. See figure 9.
16. The AS, AK and AL thrust bearing assembly has an lip cap and end seal that can be removed after loosening two set screws in flange of bearing housing. Remove ball bearing. See figure 10.

The casing should be examined for wear, particularly in the area between ports. All parts should be checked for wear before pump is put together.

When making major repairs, such as replacing a rotor and shaft; it is advisable to also install a new mechanical seal, head and idler pin and bushing. See "Installation of Carbon Graphite Bushings" page 7.

Clean all parts thoroughly and examine for wear or damage. Check lip seals, ball bearings, bushing 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 balls. Make sure bearings are clean, then lubricate with non-detergent SAE 30 weight oil and check for roughness. Roughness can be determined by turning outer race by hand. Replace bearings if bearings have roughness.

Be sure shaft is free from nicks, burrs and foreign particles that might damage mechanical seal. Scratches on shaft in seal area will provide leakage paths under mechanical seal.

## ASSEMBLY

### Standard Mechanical Seal (Synthetic Rubber Bellows Type)

The seal used in this pump simple to install and good performance will result if care is taken during installation.

The principle of mechanical seal is contact between the rotary and stationary members. These parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

Prior to installing rotating portion of mechanical seal, prepare rotor shaft, head and idler assemblies and appropriate gaskets for quick assembly.

Once rotating pressure of mechanical seal is installed on rotor shaft, it is necessary to assemble parts as quickly as possible to ensure the seal does not stick to shaft in wrong axial position. The seal should be expected to stick to the shaft after several minutes setting time.

Never touch sealing faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.

1. Coat idler pin with non-detergent SAE 30 weight oil and place idler and bushing in idler pin on head. If replacing a carbon graphite bushing, refer to installation of Carbon Graphite Bushings page 7.
2. Clean rotor, hub and casing seal housing bore. Make sure both are free from dirt and grit. Coat outer diameter of seal seat and inner diameter of seal housing bore with non-detergent SAE 30 weight oil.
3. Start seal seat in seal housing bore. If force is necessary, protect seal face with a clean cardboard disc and gently tap it in place with a piece of wood.

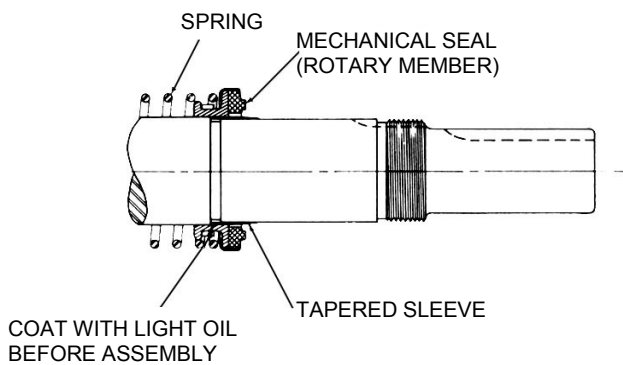


FIGURE 11

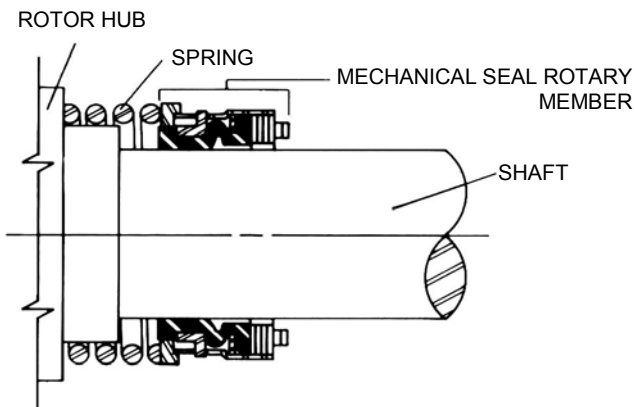


FIGURE 12

4. Place tapered installation sleeve on shaft, refer to figure 11. Sleeve is furnished with GG, AS, AK and AL size replacement mechanical seals. Coat rotor shaft, tapered installation sleeve and inner diameter of mechanical seal rotary member with a generous amount of non-detergent SAE 30 weight oil. Petrolatum may be used but grease is not recommended.
5. Place seal spring on shaft against rotor hub. Refer to figure 12.
6. Slide rotary member, lapped contact surface facing away from spring, over installation sleeve on shaft until it is against spring.
7. Do not compress spring.
8. Coat rotor shaft with non-detergent SAE 30 weight oil. Start end of shaft in bracket bushing and turn from right to left, slowly pushing until the ends of the rotor teeth are just below the face of the casing.
9. Leave the rotor in this position. Withdrawal of rotor and shaft may displace the carbon seal rotating face and result in damage to the seal.
10. Place O-ring gasket on head and install head and idler assembly on pump. Pump head and casing were marked before disassembly to insure proper reassembly. If not be sure idler pin, which is offset in pump head, is positioned toward or equal distance between port connections to allow for proper flow of liquid through pump.

11. Tighten head capscrews evenly.
12. If pump was equipped with a relief valve and was removed during disassembly, install on head with new gaskets. Relief valve adjusting screw cap must always point towards suction port. Refer to figure 5 page 2. For relief valve repair or adjustments, see PRESSURE RELIEF VALVE INSTRUCTIONS, page 7.
13. Pack ball bearing with multi-purpose grease, NLGI # 2, and install with casing with sealed side towards end of pump. Install inner snap ring in GG, HJ and HL size pumps. See figure 9.

**NOTE:** AS, AK and AL size pumps do not have a snap ring, a bearing retainer washer must be assembled over end of shaft before the bearing is assembled. See figure 10.

14. Place bearing spacer over shaft and against single row ball bearing in casing (AS, AK and AL size pumps). See figure 10.  
Install snap shaft ring in groove in the shaft (GG, HJ and HL size pump. See figure 8.
15. Pack lubrication chamber between inner ball bearing and double row ball bearing in the thrust bearing assembly approximately half full with multi-purpose grease, NLGI#2. See figures 9 and 10.
16. Pack double row ball bearing with multi-purpose grease, NLGI#2 and press into bearing housing with shield side toward coupling end of shaft. See Figure 9. (AS, AK and AL size pumps do not use a shielded bearing). Install snap ring to hold bearing in place on GG, HJ and HL size pumps.

**NOTE:** On AS, AK and AL size pumps, install lip seal in bearing house end cap. The lip should face towards end of shaft. Put bearing spacer sleeve in lip seal and install in bearing housing and tighten setscrews securely. See figure 20.

17. Insert a piece of brass or hard wood through port opening between rotor teeth to keep shaft from turning.
18. Start thrust bearing assembly into casing. Turn by hand until tight. This forces rotor against head. Replace and tighten locknut on shaft.
19. Remove brass piece or hardwood from port opening.  
Adjust pump end clearance refer to page 7.

### 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.

## BEARING ADJUSTMENT THRUST

See figures 9 and 10.

Loosen two screws in face of thrust bearing assembly.

If shaft cannot be rotated freely, turn thrust bearing assembly counter clockwise until shaft cannot be turned easily.

To set end clearance:

1. While turning rotor shaft, rotate thrust bearing assembly clockwise until noticeable drag occurs (this is zero end clearance).
2. Mark position of bearing housing with respect to the casing.
3. Rotate thrust bearing assembly counter clockwise the distance listed below as measured on outside of bearing housing.
4. Tighten two setscrews in face of bearing housing after adjustment is made to secure thrust bearing assembly position.

For viscosities above 2500 SSU, add additional end clearance (0.005" for GG, HJ and HL size pumps and 0.007" for AS, AK and AL size pumps).

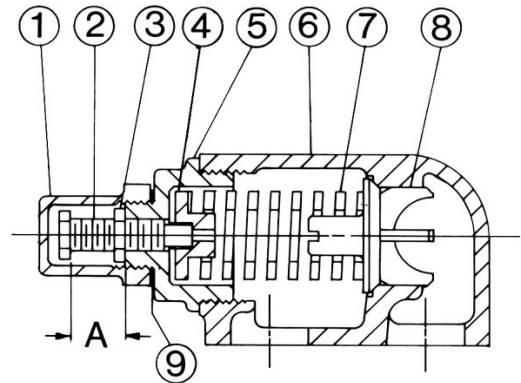
PUMP SIZE	Distance in Inches on O.D. of Bearing Housing	END CLEARANCE
GG	11/16"	.005
HJ, HL	15/16"	.005
AS, AK, AL	11/4"	.008

## INSTALLATION OF CARBON GRAPHITE BUSHINGS

When installing 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 sure bushing is started straight.
3. Do not stop pressing operation until bushing is in proper position, starting and stopping will result in cracked bushing.
4. Check bushing for cracks after installation.

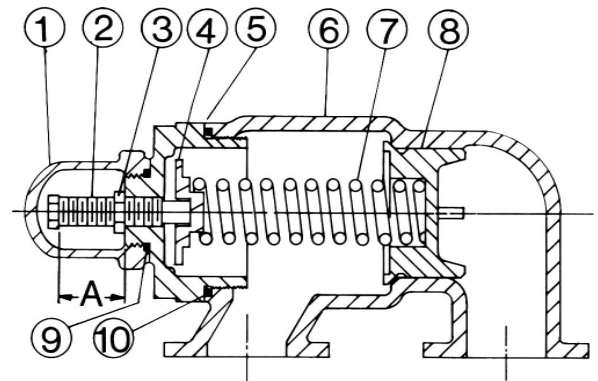
## PRESSURE RELIEF VALVE INSTRUCTIONS



VALVE - GG, HJ and HL SIZE

LIST OF PARTS	
1. Valve Cap	6. Valve Body
2. Adjusting Screw	7. Valve Spring
3. Locknut	8. Poppet
4. Spring Guide	9. Cap Gasket
5. Bonnet	

FIGURE 13



VALVE - GG, HJ and HL SIZE

LIST OF PARTS	
1. Valve Cap	6. Valve Body
2. Adjusting Screw	7. Valve Spring
3. Locknut	8. Poppet
4. Spring Guide	9. Cap Gasket
5. Bonnet	10. Bonnet Gasket

FIGURE 14

## DISASSEMBLY

Mark valve and head before disassembly to ensure proper reassembly.

1. Remove valve cap.
2. Measure a record length of extension of adjusting screw.
3. Refer to "A" on Figure 23.

## DISASSEMBLY

### DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH 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.

Mark valve and head before disassembly to ensure proper reassembly.

1. Remove valve cap.
2. Measure a record length of extension of adjusting screw. Refer to "A" on Figure 23.
3. Loosen locknut and back out adjusting screw until spring pressure is being released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear and damage and replace as necessary.

## ASSEMBLY

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

### 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.

## PRESSURE ADJUSTMENT

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

1. Carefully remove valve cap, which covers adjusting screw.  
Loosen locknut, which locks adjusting screw so pressure setting will not change during operation of pump.
2. Install pressure gauge in discharge line for actual adjustment operation.
3. Turn adjusting screw to increase pressure and out to decrease pressure.
4. With discharge line closed at a point beyond pressure gauge, gauge will show maximum pressure valve will allow while pump is in operation.

## IMPORTANT

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





# TECHNICAL SERVICE MANUAL

HEAVY-DUTY BRACKET MOUNTED PUMPS  
SERIES 4193 & 493  
SIZES GG - AL

SECTION TSM 154  
PAGE 9 OF 9  
ISSUE B



## WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources, which are incorporated into any Viking product, are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

**THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.



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