VIKING PUMP

TECHNICAL SERVICE MANUAL

HEAVY-DUTY BRACKET MOUNTED PUMPS
SERIES 225 AND 4225
SIZES H, HL, K, KK, L, LQ, LL

CONTENTS

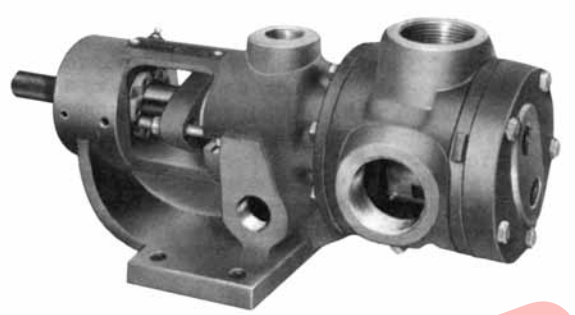


FIGURE 1
Sizes H and HL

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 (225 and 4225) and used to indicate either an unmounted pump or mounted pump unit.

FIGURE 2
Sizes K and KK

UNMOUNTED PUMP		UNITS
PACKED	MECH. SEAL	
H225	H4225	Units are designated by the unmounted pump model numbers followed by a letter indicating drive style.
HL225	HL4225	**V** = V-belt
K225	K4225	**D** = Direct Connected
KK225	KK4225	**R** = Viking Speed Reducer
L225	L4225	**P** = Commercial Speed Reducer
LQ225	LQ4225	
LL225	LL4225	

This manual deals only with Series 225 and 4225 Heavy Duty Bracket Mounted Pumps. **Refer to Figures 1 through 16** for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalog Section 141, Series 225 and 4225 Heavy Duty Bracket Mounted Pumps.

FIGURE 3
Sizes LQ and LL

SAFETY INFORMATION AND INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol Legend :

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

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

⚠ **BEFORE** opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that :

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

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

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

⚠ **DO NOT** place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shafts being rotated.

⚠ **WARNING** **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.

⚠ **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.

⚠ **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 Viking Pump's Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.

⚠ **WARNING** **THE PUMP** must be installed in a matter that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

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.

JACKETING of the bracket and 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.

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 displacement 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 those pump models designed to accept a relief valve. Options may include a return to tank relief valve and a jacketed relief valve. Pumps equipped with a jacketed head plate are generally not available with a relief valve.
3. If pump rotation is 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. **Refer to Figures 1, 2 and 3.**
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

SPECIAL MECHANICAL SEALS can be installed either next to rotor hub or in an altered stuffing box.

Extra care must be taken in repair of pumps with mechanical seals. Read and follow all special information supplied with pump.

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

MAINTENANCE

Series 225 and 4225 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.

LUBRICATION: External lubrication must be applied slowly with a hand gun to all lubrication fittings every 500 hours of operation with multi-purpose grease, NLGI #2. Do not over-grease. Applications involving very high or low temperatures will require other types of lubrication. **Refer to Engineering Service Bulletin ESB-515.** Consult factory with specific lubrication questions.

PACKING ADJUSTMENT: New packed pumps require initial packing adjustment to control leakage as packing "runs in". Make initial adjustments carefully and do not over-tighten packing gland. After initial adjustment, inspection will reveal need for packing gland adjustment or packing replacement. **Refer to instructions under Disassembly, page 4, and Assembly, page 5,** regarding repacking pump.

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.

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.

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair Series 225 and 4225 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 (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)

   Small for 0.25 inch and 0.31 inch cross section packing

   Large for 0.38 inch and up cross section packing
4. Mechanical seal installation sleeve

   Viking Part No. 2-751-002-900 for 1.125 inch seal;

   H & HL4225

   Viking Part No. 2-751-003-900 for 1.44 inch seal;

   K - LL4125
5. Bearing locknut spanner wrench

   (Source: #471 J. H. Williams & Co. or equal)
6. Spanner wrench, adjustable pin type for use on double end caps (Source: #482 J. H. Williams & Co. or equal)
7. Brass bar
8. Arbor press
9. Standard 5/16" 12 point socket.

PACKED PUMPS

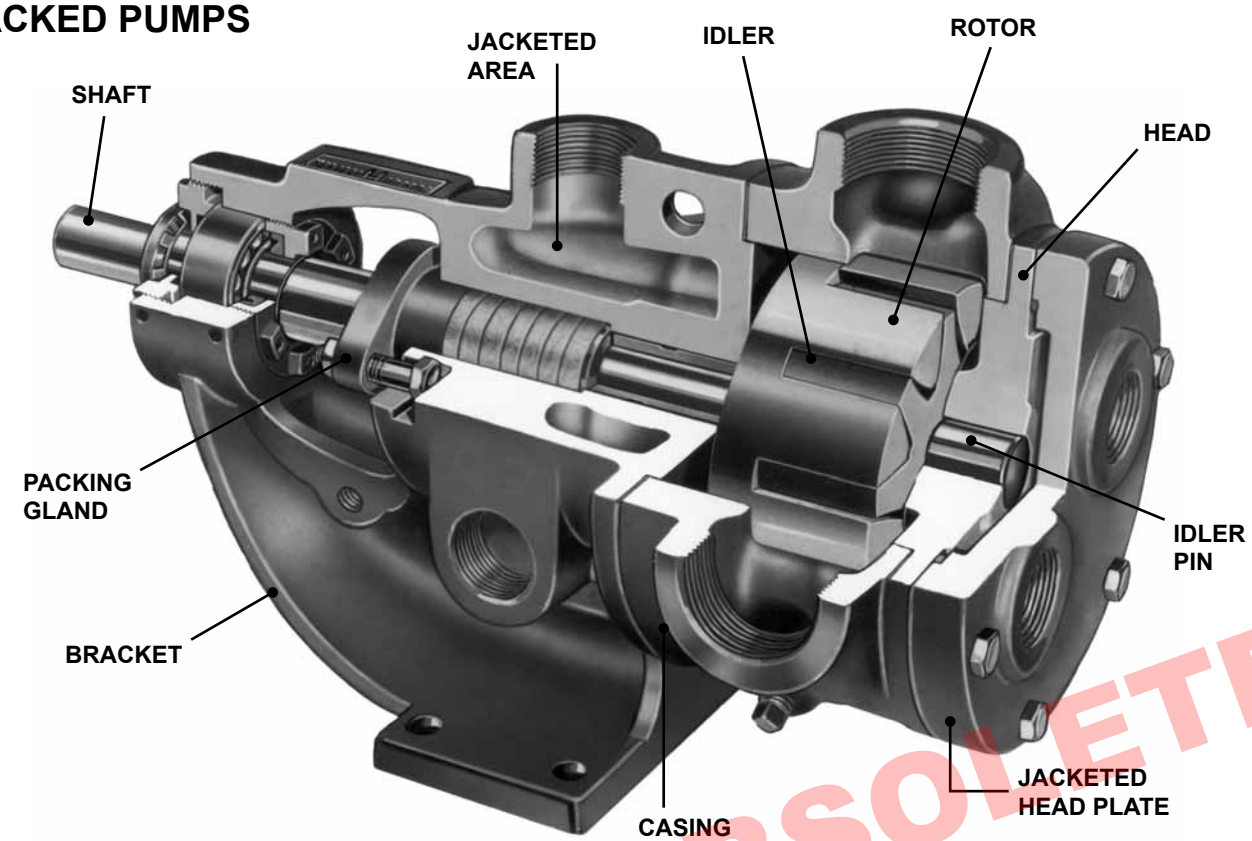
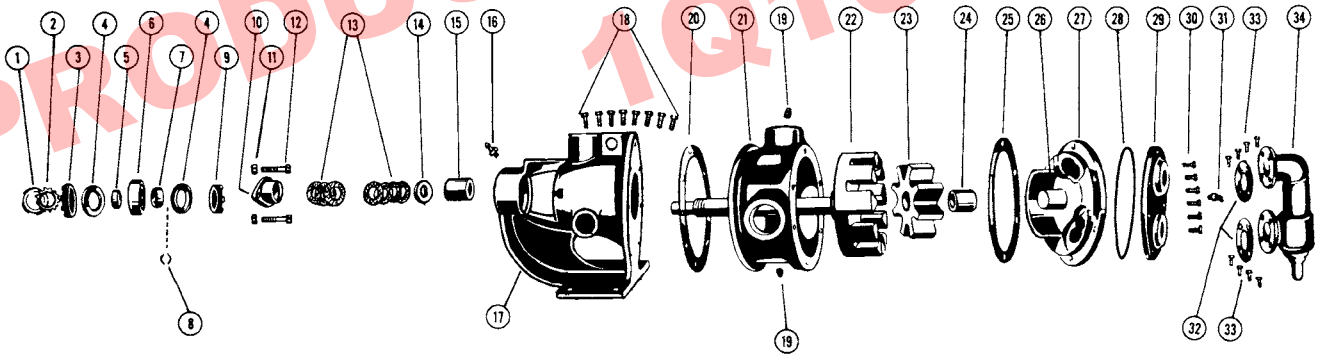


FIGURE 4
Cutaway View Of KK225 with Callouts



EXPLODED VIEW FOR MODELS H225, HL225, K225, KK225, L225, LQ225 AND LL225 (MODEL KK225 SHOWN)

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	10	Packing Gland	19	Pipe Plug	28	Gasket for Jacketed Head Plate
2	Lockwasher	11	Packing Gland Nut	20	Bracket Gasket	29	Jacketed Head Plate
3	End Cap (Outer)	12	Packing Gland Capscrew	21	Casing	30	Capscrew for Head
4	Lip Seal for End Cap	13	Packing	22	Rotor and Shaft	31	Grease Fitting
5	Bearing Spacer Collar (Outer)	14	Packing Retaining Washer	23	Idler and Bushing	32	Relief Valve Gasket
6	Ball Bearing	15	Bracket Bushing	24	Idler Bushing	33	Capscrew for Valve
7	Bearing Spacer Collar (Inner)	16	Grease Fitting	25	Head Gasket	34	Internal Relief Valve
8	Ring, Half Round (Not H, HL)	17	Bracket and Bushing	26	Idler Pin		
9	End Cap (Inner)	18	Capscrew for Bracket	27	Head and Idler Pin		

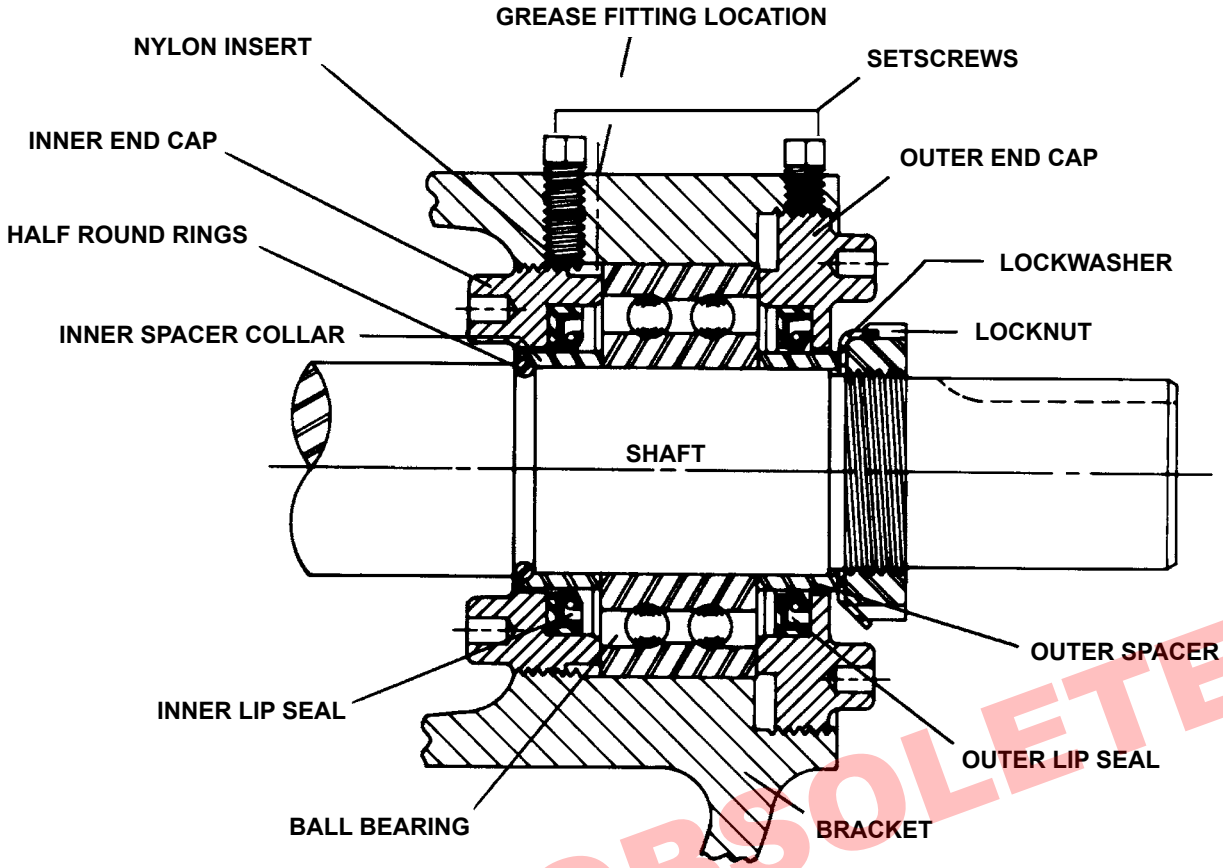


FIGURE 5

DISASSEMBLY

1. Mark head and casing before disassembly to insure 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 pump.

   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. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. **Refer to Pressure Relief Valve Instructions,** page 12.

   If pump has jacketed head plate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.

2. Remove idler and bushing assembly.
3. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Bend up tang of lockwasher and with a spanner wrench remove locknut and lockwasher from shaft.
4. Remove packing gland nuts.

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.

5. Tap shaft forward approximately 0.5 inch and remove pair of half round rings under inner bearing spacer collar. There is no pair of half round rings on H and HL size pumps.
6. Carefully remove rotor and shaft to avoid damaging bracket bushing.
7. Remove packing gland from side of bracket.
8. Loosen setscrews. Two on H and HL size pumps, four on all other sizes. With a spanner wrench, remove both end caps with lip seals. Remove ball bearing. **Refer to Figure 5.**
9. Remove packing and packing retainer washer.
10. Clean all parts thoroughly and examine for wear and damage. Check lip seals, ball bearing, 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 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.

    If bearings have roughness, bearings will need to be replaced.
11. Casing can be checked for wear or damage while mounted on bracket.

ASSEMBLY

1. Install bracket bushing. If bracket bushing has a lubrication groove, install bushing with groove at 6:00 o'clock position in bracket. If carbon graphite, **Refer to Installation of Carbon Graphite Bushings,** page 11.
2. Coat shaft of rotor shaft assembly with non-detergent SAE 30 weight oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.
3. Place packing retainer washer in bottom of packing chamber and pack pump with new packing. Use packing suitable for liquid being pumped. Install packing, staggering the joints from one side of shaft to other. Lubricate packing rings with oil, grease or graphite to aid assembly. A length of pipe will help to seat each packing ring.
4. Install packing gland, capscrews and nuts. Back rotor and shaft out of casing just far enough to insert packing gland through side opening of bracket over end of shaft. Make sure gland is installed square and nuts are tightened evenly. Tighten nuts wrench tight then back off until gland is slightly loose**.**
5. Coat idler pin with non-detergent SAE 30 weight oil and place idler and bushing on idler pin in head. If replacing with carbon graphite bushing, **Refer to Installation of Carbon Graphite Bushings,** page 13.
6. Using a .010 to .015 inch head gasket, 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 and equal distance between port connections to allow for proper flow of liquid through pump.

    If pump is equipped with jacketed head plate, install at this time along with new gasket.

    Tighten head capscrews evenly.

    If pump was equipped with a relief valve and it was removed during disassembly, install on head with new gaskets. Relief valve adjusting screw cap must always point toward suction port. **Refer to Figures 1, 2 and 3** on page 1. For relief valve repair or adjustments, **Refer to Pressure Relief Valve Instructions,** Page 11.
7. Slide inner spacer collar over shaft with recessed end facing rotor. H and HL size bearing spacer collars are not recessed.

    Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on H and HL size pumps. **Refer to Figure 5,** page 4.
8. Press lip seal, lip facing end of shaft, in inner end cap and insert end cap through shaft end of bracket. Turn end cap clockwise, looking at shaft end, until it engages threads. End cap spanner wrench holes must be facing rotor. Turn end cap with spanner wrench until it projects slightly from opening on side of bracket. End cap must not be turned so far that lip seal drops off end of spacer collar on shaft or end cap becomes disengaged from threads. **Refer to Figure 5,** page 4.

    If this happens, remove inner spacer collar, half round rings and end cap and start over at Step 7.
9. Pack ball bearing with multi-purpose grease, NLGI #2. Place on shaft and push or gently drive in place in bracket.
10. Press lip seal, lip facing end of shaft, in outer end cap and insert end cap in bracket. Turn end cap in bracket until it is tight against bearing. **Refer to Figure 5,** page 4.
11. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 100 ft.-lbs. torque. This is equal to a 100 lb. load applied at a 1' distance from locknut. 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 rest of pump.

    Remove length of hardwood or brass from port opening.
12. Adjust pump end clearance. **Refer to Thrust Bearing Adjustment,** page 11.
13. Lubricate all grease fittings with multi-purpose grease, NLGI #2.

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.

MECHANICAL SEAL PUMPS

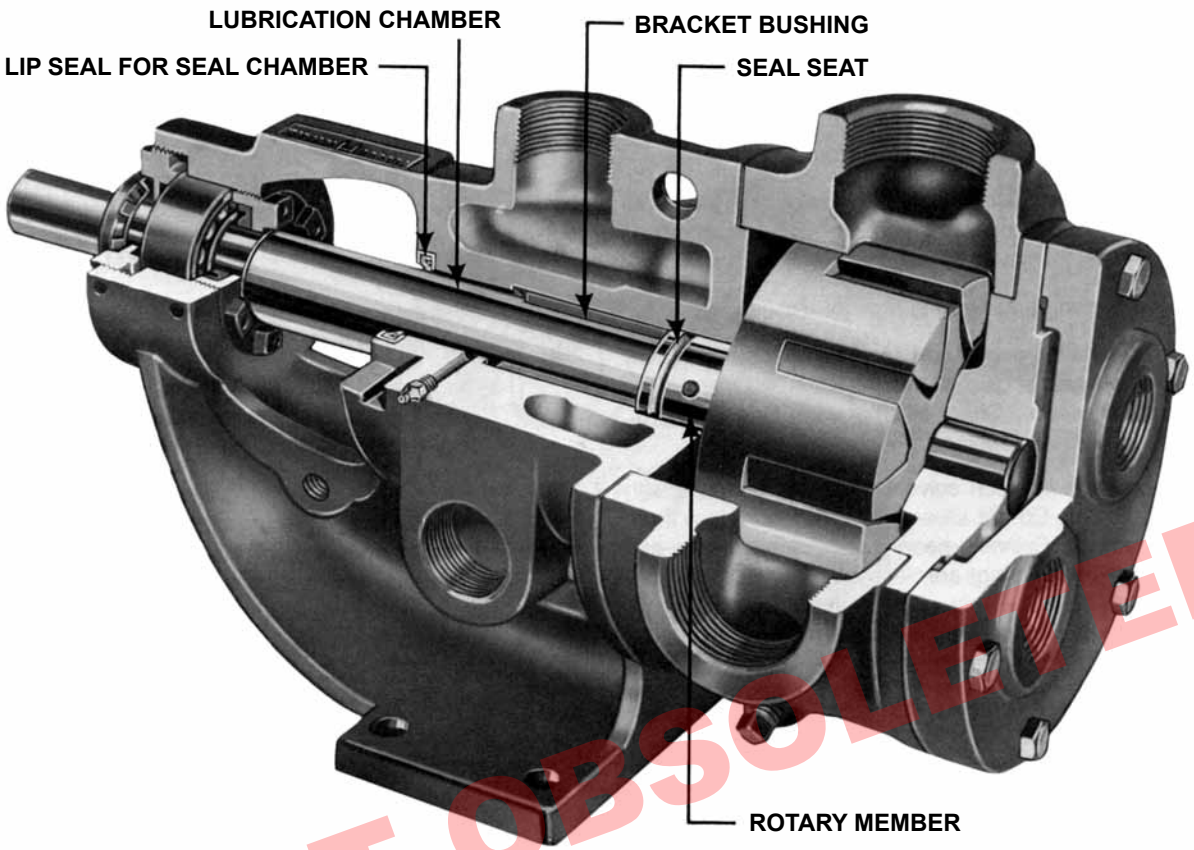
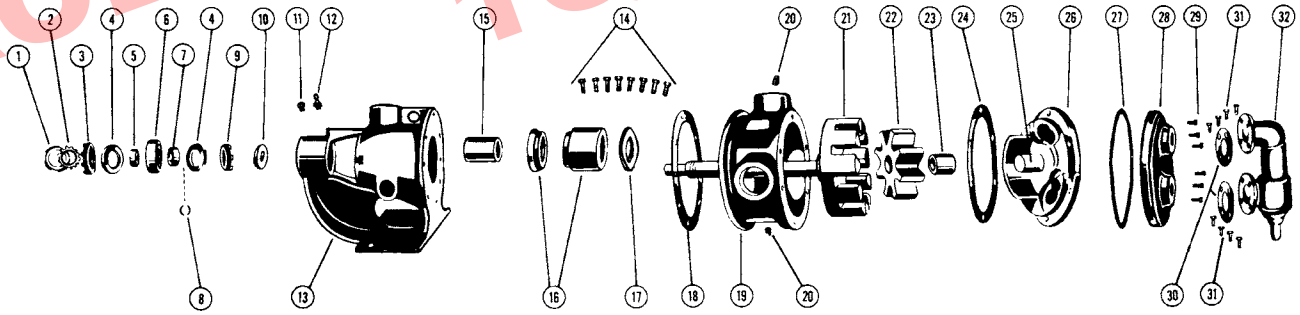


FIGURE 6
Cutaway View of KK4225 with Callouts



EXPLODED VIEW FOR MODELS H4225, HL4225, K4225, KK4225, L4225, LQ4225 AND LL4225
(MODEL KK4225 SHOWN)

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	9	End Cap (Inner)	17	Spacer (K size)	25	Idler Pin
2	Lockwasher	10	Lip Seal for Seal Chamber	18	Bracket Gasket	26	Head and Idler Pin
3	End Cap (Outer)	11	Pressure Relief Plug	19	Casing	27	Gasket for Jacketed Head Plate
4	Lip Seal for End Cap	12	Grease Fitting	20	Pipe Plug	28	Jacketed Head Plate
5	Bearing Spacer Collar	13	Bracket and Bushing	21	Rotor and Shaft	29	Capscrew for Head
6	Ball Bearing	14	Capscrew for Bracket	22	Idler and Bushing	30	Relief Valve Gasket
7	End Cap (Inner)	15	Bracket Bushing	23	Idler Bushing	31	Capscrew for Relief Valve
8	Ring, Half Round (Not H, HL)	16	Mechanical Seal	24	Head Gasket	32	Internal Relief Valve

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 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.

1. Mark head and casing before disassembly to insure 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 pump.

   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. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. **Refer to Pressure Relief Valve Instructions,** page 11.

   If pump has jacketed head plate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.

2. Remove idler and bushing assembly.
3. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Bend up tang of lockwasher and with a spanner wrench remove locknut and lockwasher from shaft.
4. Tap shaft forward approximately 0.5 inch and remove pair of half round rings under inner spacer collar. There is no pair of half round rings on H and HL size pumps.
5. Carefully remove rotor and shaft to avoid damaging bracket bushing.
6. Mechanical Seal (Type 9): If the mechanical seal in your pump ever fails, it can easily be replaced with a new seal. There are two basic parts to this seal. They are the rotary member and the seal seat (See Figure 6). To remove the mechanical seal loosen set screws holding rotary member on the shaft. Remove rotary member from shaft and stationary seal seat from bracket. Viking furnishes a number of heavy-duty pumps with special mechanical seals installed in the packing end of the pump. These special seals are not discussed in TSM 142.1. Information is available by contacting the factory. When requesting special seal information, be sure to give pump model number and serial number.
7. Loosen setscrews. Two for H and HL size pumps, four for all other sizes. With spanner wrench remove both end caps and lip seals. Remove ball bearing and spacer collars. **Refer to Figure 5,** page 4.
8. Examine seal chamber lip seal and remove if it shows wear or damage. Lip seal must be removed if bracket bushing needs to be replaced. (Cataloged pump has a Viton lip seal).
9. Clean all parts thoroughly and examine for wear or damage. Check lipseals, ball bearing, 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.

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

10. Casing can be checked for wear or damage while mounted on bracket.

ASSEMBLY

Standard Mechanical Seal

(PTFE Fitted Type)

The seal type shown in Figures 8, 9, 10 are setscrew driven and the stationary seats have anti-rotation pins which mate with slots in the end of the bracket bushing.

1. Install bracket bushing. If bracket bushing has a lubrication groove, install bushing with groove at 6:00 o'clock position in bracket. If carbon graphite, **refer to Installation of Carbon Graphite Bushings,** page 11.
2. Install lip seal in bracket. **Refer to Figure 7.**
3. Clean rotor hub and bracket seal housing bore. **Refer to Figure 8.** Make sure both are free from dirt and grit. Coat outer diameter of seal seat gasket and inner diameter of seal housing bore with non-detergent SAE 30 weight oil.
4. Start seal seat in seal housing bore. Make sure seat anti-rotation pins are aligned to engage slots in end of bracket bushing. **Refer to Figure 8.**
5. Using a cardboard disc to protect lapped face of seal seat, press seal seat assembly to bottom of seal housing bore using a piece of wood. An arbor press can also be used to install the seal seat. Seal seat must be started square and carefully pressed to bottom of seal housing bore.

   K size pumps require a 0.25 inch spacer between seal and rotor hub to properly position seal on shaft.
6. Place tapered installation sleeve (furnished with H, HL, K, KK, L, LQ and LL size replacement mechanical seals) on shaft. **Refer to Figure 9.** Coat inner diameter of seal rotary member, tapered installation sleeve and the shaft with a generous quantity of non-detergent SAE 30 weight oil. Place rotary member on shaft over sleeve and against hub of rotor. **Refer to Figure 10.**

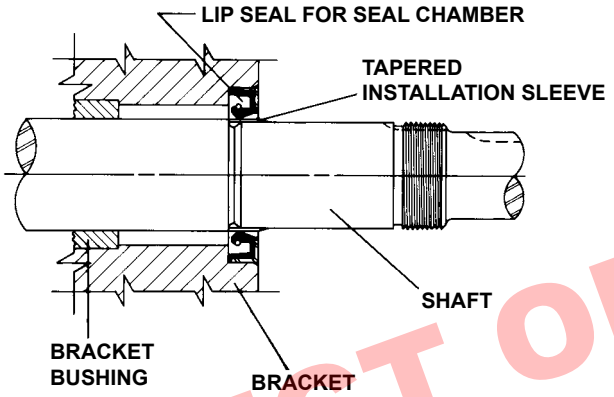


FIGURE 7

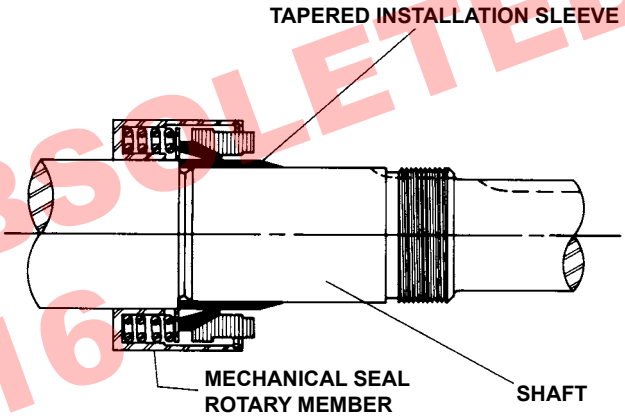
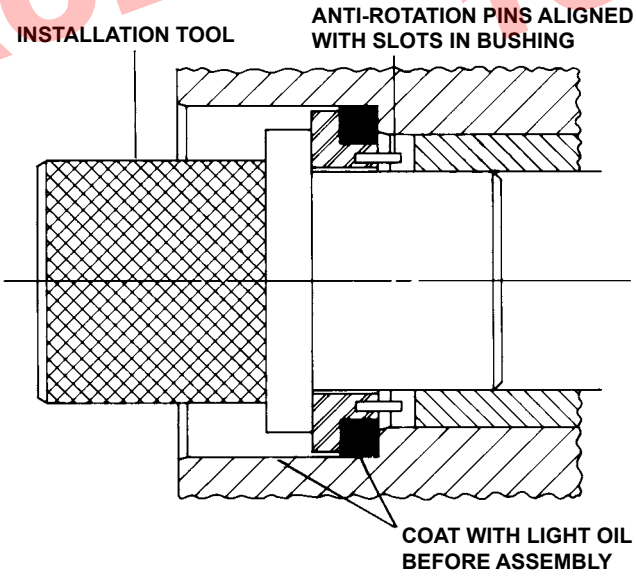


FIGURE 9



BRACKET SEAL HOUSING BORE WITH SEAL SEAT INSTALLED. NOTE SPECIAL INSTALLATION TOOL USED FOR FACTORY ASSEMBLY.

FIGURE 8

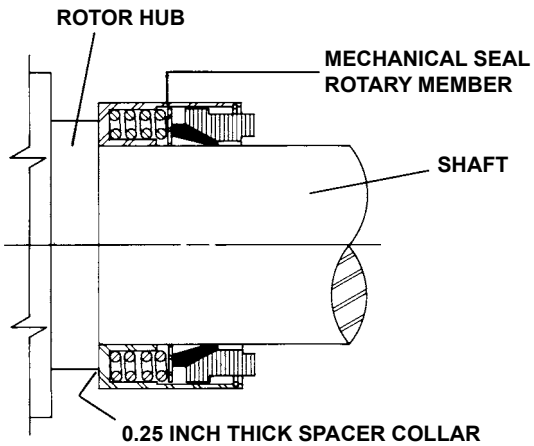


FIGURE 10

7. Remove tapered sleeve from shaft.

8. Some PTFE seals are equipped with holding clips which compress the seal springs. Remove holding clips to release springs after seal is installed on shaft. Tighten all drive setscrews securely to shaft.

9. 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.

   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. Using a.010 to .015 inch head gasket, 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 and equal distance between port connections to allow for proper flow of liquid through pump.

    If pump is equipped with jacketed head plate, install at this time along with new gasket.

    Tighten head capscrews evenly.

    If pump was equipped with a relief valve and it was removed during disassembly, install on head with new gaskets. Relief valve adjusting screw cap must always point toward suction port. **Refer to Figures 1, 2 and 3** on page 1. For relief valve repair or adjustments, **refer to Pressure Relief Valve Instructions,** page 11.

11. Slide inner spacer collar over shaft with recessed end facing rotor. H and HL size bearing spacer collars are not recessed. Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on H and HL size pumps. **Refer to Figure 5,** page 4.

12. Press lip seal, lip facing end of shaft, in inner end cap and insert end cap through shaft end of bracket. Turn end cap clockwise, looking at shaft end, until it engages threads. End cap spanner wrench holes must be facing rotor. Turn end cap with spanner wrench until it projects slightly from opening on side of bracket. End cap must not be turned so far that lip seal drops oft end of spacer collar on shaft or end cap becomes disengaged from threads. **Refer to Figure 5,** page 4. If this happens, remove inner spacer collar, half round rings and end cap and start over at Step 11.

13. Pack ball bearing with multi-purpose grease, NLGI #2. Place on shaft and push or gently drive in place in bracket.

14. Press lip seal, lip facing end of shaft, in outer end cap and insert end cap in bracket. Turn end cap in bracket until it is tight against bearing. **Refer to Figure 5,** page 4.

15. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 100 ft.-lbs. torque. This is equal to a 100 lb. load applied at a 1' distance from locknut. 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 hardwood or brass from port opening.

16. Adjust pump end clearance. **Refer to Thrust Bearing Adjustment,** page 11.

17. Lubricate the grease fitting over the seal chamber with petroleum jelly, petrolatum (Vasoline) or other similar low melting point lubricant. Lubricate all other grease fittings with multi-purpose grease, NLGI #2.

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.

ASSEMBLY

Optional Mechanical Seal

(Synthetic Rubber Bellows Type)

Synthetic rubber bellows mechanical seals, the style shown in **Figures 11, 12, 13,** may be installed as alternate to the standard PTFE seal as the application warrants. These seals are dependent upon friction to drive them and, therefore, there are no setscrews to tighten. No spacer is used on Model “K” between rotor and synthetic rubber bellows seal.

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

Once rotating portion of mechanical seal is installed on rotor shaft, it is necessary to assemble parts as quickly as possible to insure that 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. Clean rotor hub and bracket 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.
2. Start seal seat in seal housing bore, **refer to Figure 11.** If force is necessary, protect seal face with a clean cardboard disc and gently tap it in place with a piece of wood.

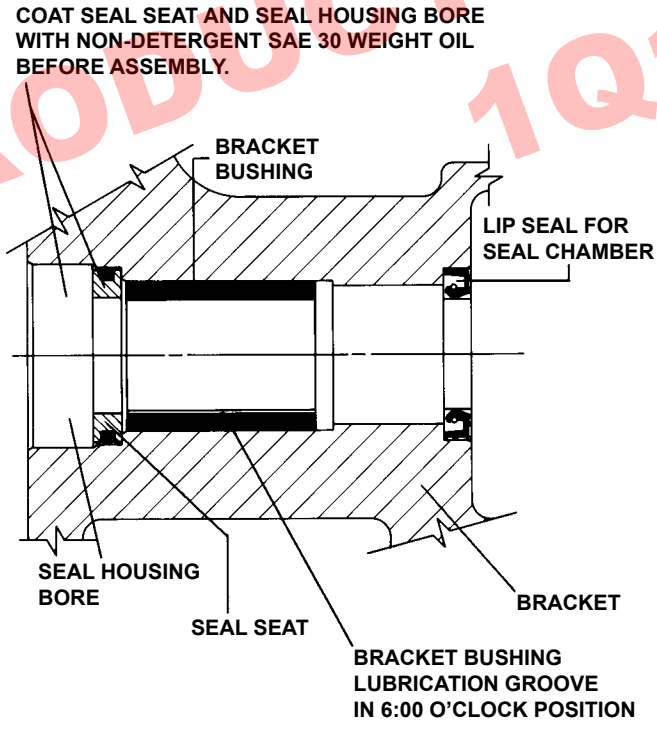


FIGURE 11

3. Place tapered installation sleeve on shaft, **refer to Figure 12.** Sleeve is furnished with H, HL, K, KK, L, LQ and LL 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.

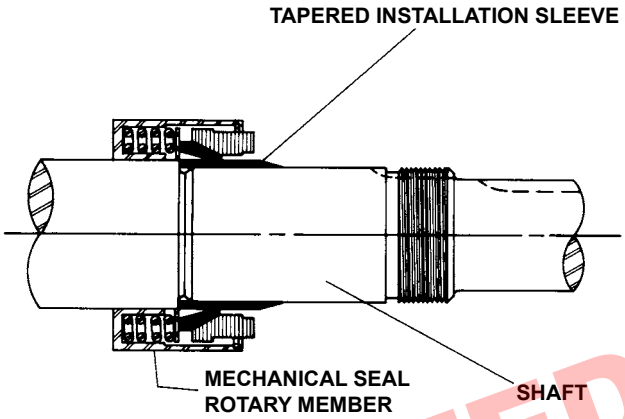


FIGURE 12

4. Place seal spring on shaft against rotor hub. **Refer to Figure 13.**
5. Slide rotary member, lapped contact surface facing away from spring, over installation sleeve on shaft until it is against spring.

   Do not compress spring.
6. 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.

   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.

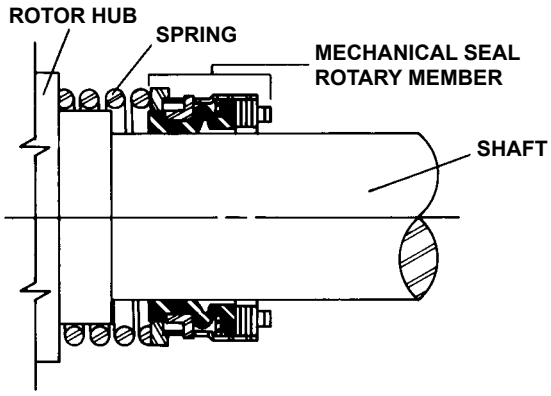


FIGURE 13

AT THIS POINT, FINISH ASSEMBLY PROCEDURES STARTING AT STEP 10, PAGE 9.

THRUST BEARING ADJUSTMENT

1. Loosen setscrews over outer and inner end caps. Two for H and HL size pumps, four for all other sizes.
2. Turn inner end cap clockwise, viewed from shaft end, until it projects slightly from bracket exposing approximately three threads.
3. Turn outer end cap clockwise until rotor is tight against head and rotor shaft cannot be turned.
4. Make a reference mark on bracket end, opposite a notch on outer end cap. Back off outer end cap required number of notches. **Refer to Figure 14.**

   Each 0.25 inch travel on circumference of end cap is equivalent to approximately .0015 inch for all sizes.
5. End clearances set per Step 4 are adequate for viscosities up to 750 SSU (SAE20 lube oil at room temperature). Higher viscosity liquids require additional end clearances.

   As a general guideline, for viscosities between 750 and 7500 SSU (heavier lube oils) double the amount of end clearance indicated in Step 4; for viscosities between 7500 and 75,000 SSU (e.g., resins) triple the amount and for viscosities greater than 75,000 SSU (e.g., black strap molasses) use 4 times the amount.

   For specific recommendations for end clearances for viscosity or for operating temperatures above 225 °F, check with your Viking representative or consult the factory.
6. Tighten inner end cap with a spanner wrench. Tap spanner wrench lightly but **DO NOT OVER TIGHTEN** as it will only damage the threads.
7. Tighten all setscrews that hold inner and outer end caps to prevent their turning in the bracket.
8. Rotor and shaft should turn smoothly by hand one complete revolution. If rotor and shaft doesn't turn smoothly, go back and repeat **Thrust Bearing Adjustment Steps 1 thru 8.**

TOTAL END CLEARANCE CHART		
PUMP SIZE	**TURN OUTER END CAP COUNTER-CLOCKWISE NO. OF NOTCHES**	**TOTAL END CLEARANCE***
H & HL	5	.007
K - LL	8	.010

*** Total End Clearance includes extra clearance for temperatures of 450°F.**

FIGURE 14

INSTALLATION OF 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 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 bushings 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 bushing.

Consult factory with specific questions on high temperature applications. **Refer to Engineering Service Bulletin ESB-3.**

PRESSURE RELIEF VALVE INSTRUCTIONS

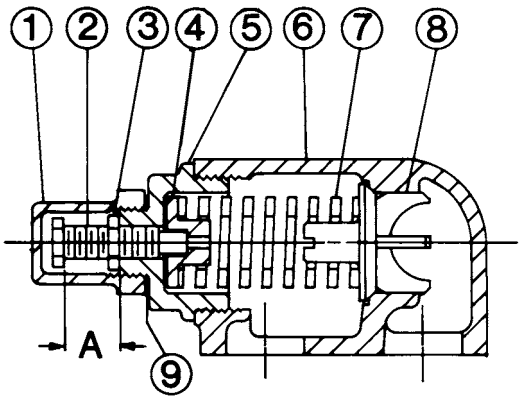


FIGURE 17
VALVE - H and HL SIZES

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

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.

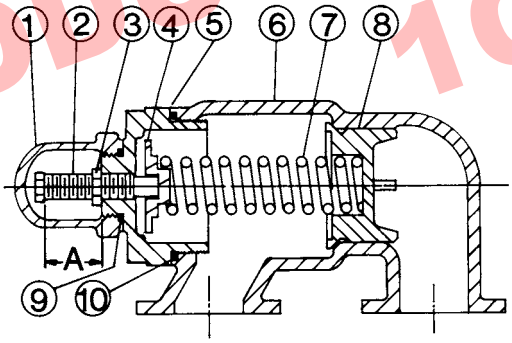


FIGURE 19
VALVE - K, KK, L, LQ and LL SIZES

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

Mark valve and head before disassembly to insure proper reassembly.

1. Remove valve cap.
2. Measure and record length of extension of adjusting screw. **Refer to "A" on Figures 15 and 16.**
3. Loosen locknut and back out adjusting screw until spring pressure is released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or 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 side of pump. If pump rotation is reversed, remove relief valve and turn end for end. **Refer to Figures 1, 2 and 3,** page 1.

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 a pressure gauge in discharge line for actual adjustment operation.
3. Turn adjusting screw in to increase pressure and out to decrease pressure.
4. With discharge line closed at a point beyond pressure gauge, gauge will show maximum pressure the 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 setting desired.

VIKING PUMP

IDEX CORPORATION

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. The warranty period for Universal Seal series pumps ONLY (Universal Seal models listed below) is three (3) years from date of startup, provided that in no event shall this warranty extend more than forty-two (42) months from the date of shipment from Viking.

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.

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