



TECHNICAL SERVICE MANUAL

HEAVY DUTY PUMPS
SERIES 4195 and 495
SERIES GG - AL

SECTION TSM 144
PAGE 1
ISSUE B

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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 Sentinel® 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 secured to the pump.

In the Sentinel model number system, basic size letters are combined with series number (4195 and 495), indicating both the unmounted or mounted pump units.

Model Number Chart

UNMOUNTED PUMP	UNITS
Foot Mounted	Units Are Designed By The Un-Mounted Pump Model Numbers Followed By A Letter(s) Indicating Drive Style. D = Direct Drive
GG 4195	
HJ 4195	
HL 4195	
AS 4195	
AK 4195	
AL 4195	
Flange Mounted	M = Horizontal Direct Drive IM = Vertical In Line Direct Drive
GG 495	
HJ 495	
HL 495	
AS 495	
AK 495	
AL 495	

This manual deals only with Series 4195 and 495 Heavy Duty Pumps. Refer to Figures 1 thru 14 for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalog Section 144, Series 4195 and 495 Heavy Duty Pumps.



FIGURE 1
GG, HJ and HL 4195 SERIES
Foot Type Unmounted Pump with Tapped



FIGURE 2
AS, AK and AL 4195 SERIES
Foot Type Unmounted Pump with Tapped Ports



FIGURE 3
GG, HJ and HL SIZE 495 SERIES
Unmounted Pump with Tapped Ports



FIGURE 4
AS, AK and AL SIZE 495 SERIES
Unmounted Pump with Tapped Ports

SPECIAL INFORMATION

DANGER

BEFORE OPENING ANY SENTINEL 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: Sentinel pumps operate equally well in a clockwise or counterclockwise rotation. Shaft rotation determines which port is suction and which is discharge. Suction Port is where pumping elements (gear teeth) come out of mesh.

PRESSURE RELIEF VALVES:

1. Sentinel 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 Figure 5.
5. Pressure relief valves should not be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, refer to Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.

SPECIAL MECHANICAL SEALS

This bulletin illustrates the mechanical seal which is standard in the catalog pump. A Seal Installation Drawing will be furnished with a pump fitted with a non-standard mechanical seal. Consult this Seal Installation Drawing before disassembling pump.

Modifications are required to install Teflon seals in these pumps. Contact factory for specific information.

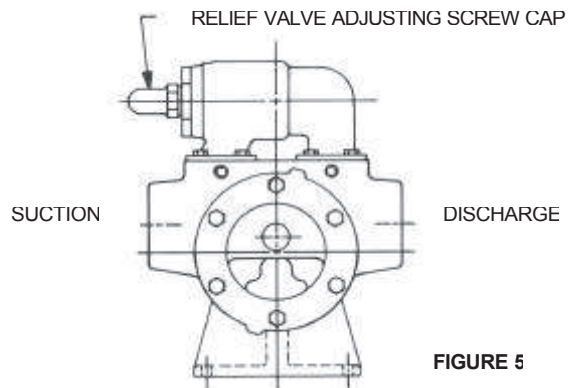


FIGURE 5

MAINTENANCE

Series 4195 and 495 pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The points listed below will help provide long service life.

CLEANING PUMP: Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work 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. Sentinel 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 4195 and 495 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 screws & special mechanical seals)
3. Snap Ring Pliers

INTERNAL – Sentinel Part No. 2-810-047-999
GG-HJ-HL 4195-495

EXTERNAL – Sentinel Part No. 2-810-029-375
GG-HJ-HL 4195-495

4. Mechanical Seal Installation Sleeve
2-751-001-900 for 0.75 inch seal; GG 4195-495
2-751-004-900 for 1.25 inch seal; AS-AL 4195-495
5. Bearing Locknut Spanner Wrench
(Source: #471 J.H. Williams & Co. or equal)
6. Spanner Wrench, adjustable pin type for use on bearing
(Source: #482 J.H. Williams & Co. or equal)
7. Brass bar
8. Arbor press

DISASSEMBLY

DANGER

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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.

1. Refer to figures 7 & 8 page 4 for model to be disassembled and name of parts. Models 4195 & 495 are disassembled and assembled the same. The difference between these models is the casings.

2. Mark head and casing before disassembly to insure proper reassembly. The idler pin, which is offset in the pump head, must be positioned up an equal distance between port connections to allow for proper flow of liquid through the pump.

3. Remove the head capscrews.

NOTE: The four valve capscrews, valve and gasket must be removed from the GG 4195-495 model before the six head capscrews are removed.

4. Tilt top of head back when removing to prevent idler from falling off idler pin.
5. Remove idler and bushing assembly. If idler bushing needs replacing, see "Installation of Carbon Graphite Bushings", page 7.
6. Insert a brass bar or piece of hardwood in the port opening and between the rotor teeth to keep the shaft from turning. Turn the locknut counterclockwise and remove locknut. See Figure 9 or 10.
7. Loosen two setscrews in face of bearing housing and turn thrust bearing assembly counterwise and remove from casing. See Figure 9 or 10.
8. **GG, HJ, HL:** Remove snap ring from shaft. See Figure 9.
AS, AK, AL: Remove bearing spacer from shaft. See Figure 10.
9. Remove brass bar or piece of hardwood from port opening.

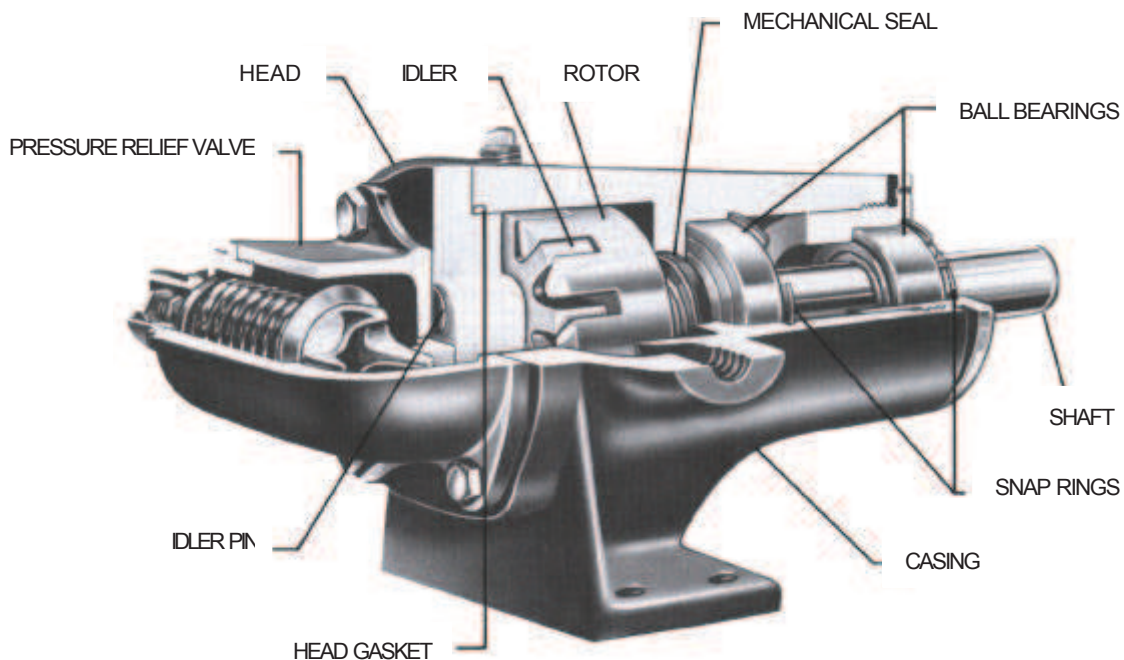


FIGURE 6 - CUTAWAY OF MODELS GG, HJ, or HL 4195

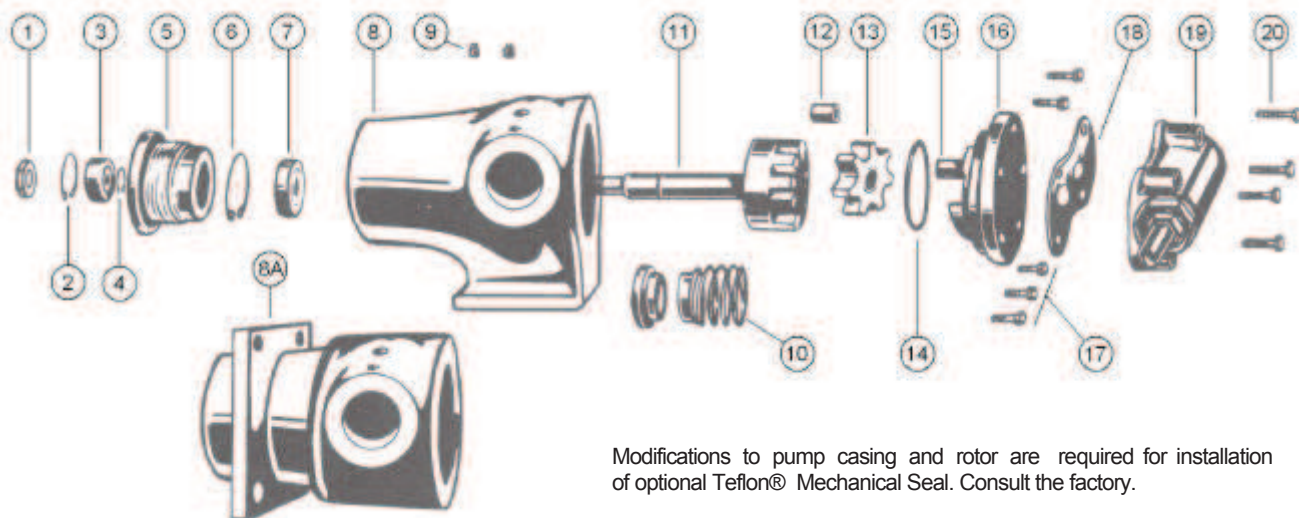


FIGURE 7 – EXPLODED VIEW MODELS GG, HJ and HL 4195 and 495

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	7	Ball Bearing, Inner	12	Idler Bushing	18	Gasket for Relief Valve
2	Snap Ring, Outer	8	Casing (4195)	13	Idler and Bushing	19	Relief Valve
3	Ball Bearing, Outer	8A	Casing (495)	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 and Shaft	17	Capscrew for Head		

* NOT USED ON "GG" SIZE PUMPS

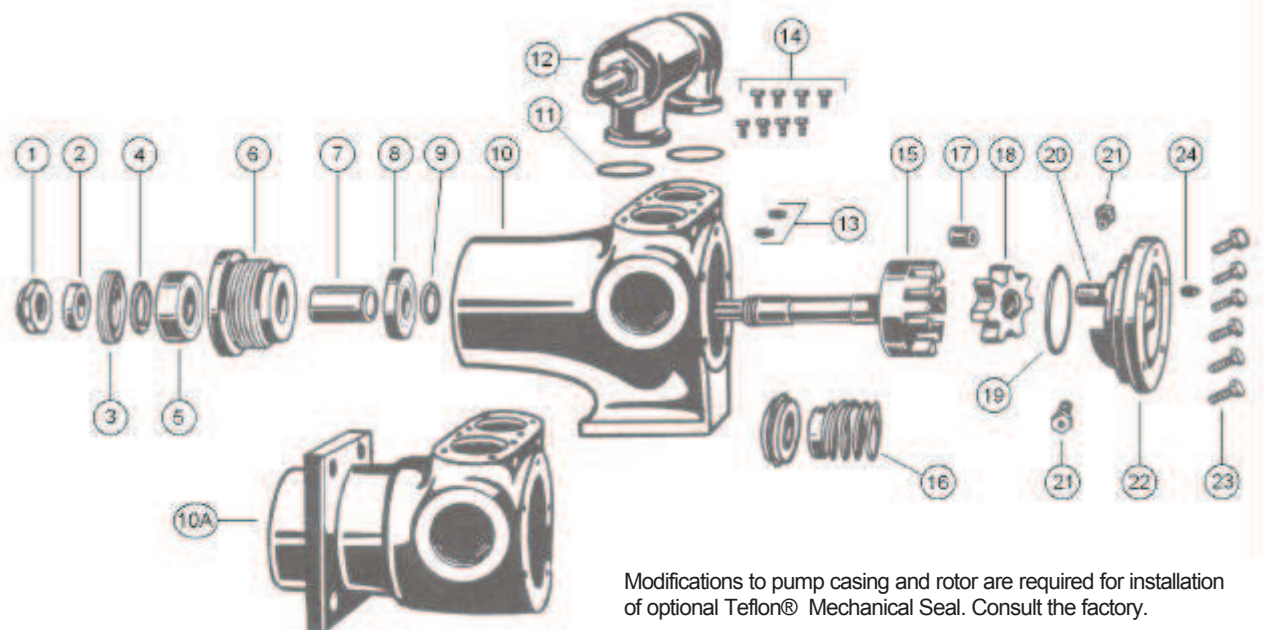


FIGURE 8 – EXPLODED VIEW MODELS AS, AK and AL 4195 and 495

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	7	Bearing Spacer	12	Relief Valve	18	Idler and Bushing
2	Bearing Spacer Collar	8	Ball Bearing, Inner	13	Pipe Plug	19	Head Gasket
3	End Cap for Bearing Housing	9	Bearing Retainer Washer	14	Capscrew for Valve	20	Idler Pin
4	Lip Seal for Bearing Housing	10	Casing (4195)	15	Rotor and Shaft	21	Check Valve
5	Ball Bearing, Outer	10A	Casing (495)	16	Mechanical Seal	22	Head and Idler Pin
6	Bearing Housing	11	Gasket for Relief Valve	17	Idler Bushing	23	Capscrew for Head

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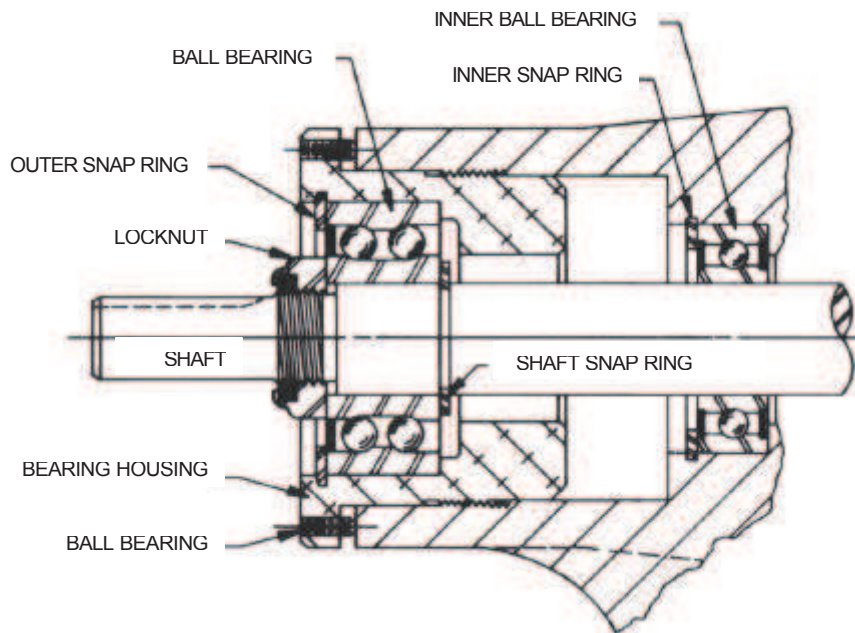


FIGURE 9 – THRUST BEARING ASSEMBLY GG, HJ and HL SIZES

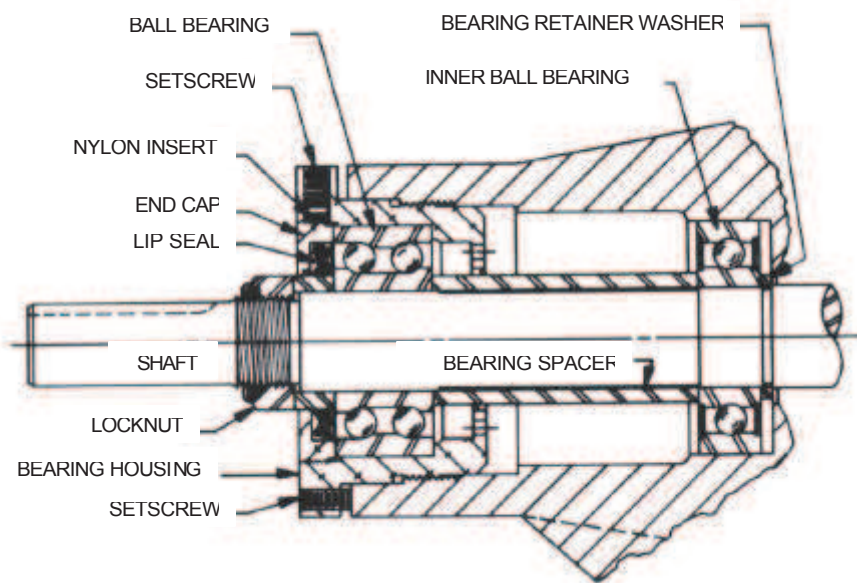


FIGURE 10 – THRUST BEARING ASSEMBLY AS, AK and AL SIZES

10. The rotor and 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 rotary member of the seal will come out with rotor and shaft.
11. **AS,AK,AL:** Remove bearing retainer washer. The washer may have stayed with Rotor and Shaft when removed or is against ball bearing. See Figure 10.
12. Remove the mechanical seal rotary member and spring from rotor and shaft assembly.
13. **GG, HJ, HL:** Remove inner snap ring and single row ball bearing from casing.
AS, AK, AL: Remove single row ball bearing from casing.
14. Remove seal seat or stationary part of seal from casing.
15. Disassemble thrust bearing assembly.
GG, HJ, HL: Remove outer snap ring from bearing housing and remove ball bearing. See Figure 9.
AS, AK, AL: Loosen two set screws in flange outside diameter. Rotate end cap and lip seal counterclockwise and remove. 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, idler 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. Use fine emery cloth to remove scratches or sharp edges.

ASSEMBLY

Assembly Notes On Standard Mechanical Seal (Synthetic Rubber Bellows Type)

READ CAREFULLY BEFORE REASSEMBLING PUMP

The seal used in this pump is 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 rotary portion of mechanical seal, prepare and organize rotor shaft, head and idler assemblies and appropriate gaskets for quick assembly.

Once rotary portion of mechanical seal is installed on rotor shaft, it is necessary to assemble parts as quickly as possible to insure the seal does not stick to shaft in wrong axial position. The seal will 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 on idler pin in 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. Be sure seal seat is completely seated in the bore.

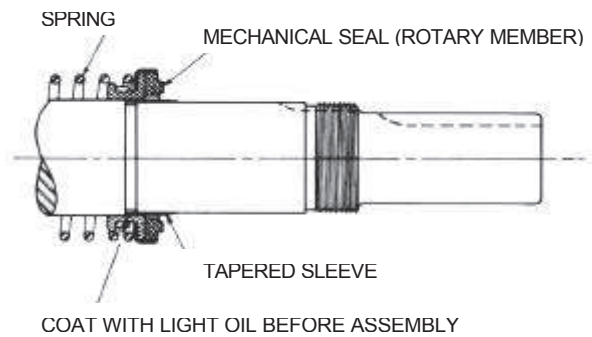


FIGURE 11

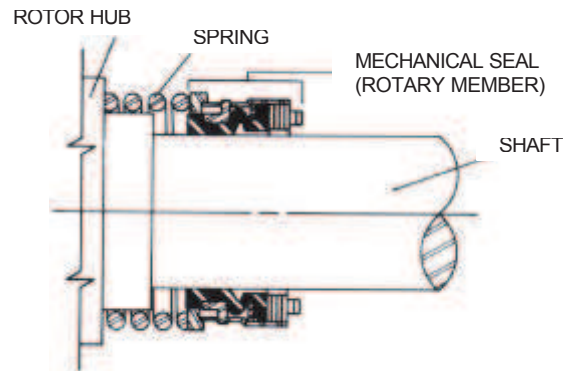


FIGURE 12

4. Place tapered installation sleeve on shaft, refer to Figure 11. Sleeve is furnished with GG, AS, AK and AL 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 just contacting the spring. Do not compress spring. Remove installation sleeve.
7. Coat rotor shaft with non-detergent SAE 30 weight oil. Install shaft slowly pushing until the ends of rotor teeth are just below the face of the casing.
8. 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.
9. 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 up and equal distance between port connections to allow for proper flow of liquid through pump.
10. Tighten head capscrews evenly.
11. 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.

12. Pack inner ball bearing with multi-purpose grease, NLGI #2.

GG, HJ, HL: Install bearing in casing with sealed side towards head end of pump. Drive the bearing into the bore. Tap the inner race with a brass bar and lead hammer to position bearing. Install inner snap ring.

AS, AK, AL: Install bearing retainer washer over the shaft before installing ball bearing. Install ball bearing in casing with sealed side towards head end of pump. Drive the bearing into the bore. Tap the inner race with a brass bar and lead hammer to position bearing.

13. **GG, HJ, HL:** Install shaft snap ring in groove in the shaft. See Figure 9.

AS, AK, AL: Install bearing spacer over shaft and against single row ball bearing. See Figure 10.

14. Pack lubrication chamber between inner ball bearing and double row ball bearing in the thrust bearing assembly approximately one-half full of multi-purpose grease, NLGI #2. The thrust bearing assembly will take the remaining space. See Figure 9 and 10.

15. Pack double row ball bearing with multi-purpose grease, NLGI #2.

GG, HJ, HL: Install ball bearing into bearing housing with shield side toward coupling end of shaft. See Figure 9. Install snap ring into bearing housing to retain ball bearing. This snap ring has a tapered edge to fit tapered groove in bearing housing. The tapered edge is located away from ball bearing.

AS, AK, AL: Install ball bearing into bearing housing. Install lip seal in bearing housing end cap. The lip should face towards end of shaft. Put bearing spacer collar in lip seal and install in bearing housing and tighten set screws securely. See Figure 10.

16. Insert brass bar or hardwood through port opening between rotor teeth to keep shaft from turning.
17. Start thrust bearing assembly into casing. Turn by hand until tight. This forces rotor against head. Replace and tighten locknut or shaft.
18. Remove brass bar or hardwood from port opening.
19. 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.

THRUST BEARING ADJUSTMENT

See Figures 9 and 10.

Loosen two screws in face of thrust bearing assembly.

If shaft cannot be rotated freely, turn thrust bearing assembly counterclockwise until shaft can 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 counterclockwise 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 (0.004" for GG, HJ and HL size pumps and 0.005" for AS, AK and AL size pumps).

Pump Size	Distance In Inches On O.D. Of Bearing Housing	End Clearance
GG	0.44"	.003
HJ, HL	0.56"	.003
AS, AK, AL	0.5"	.003

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.

PRESSURE RELIEF VALVE INSTRUCTIONS

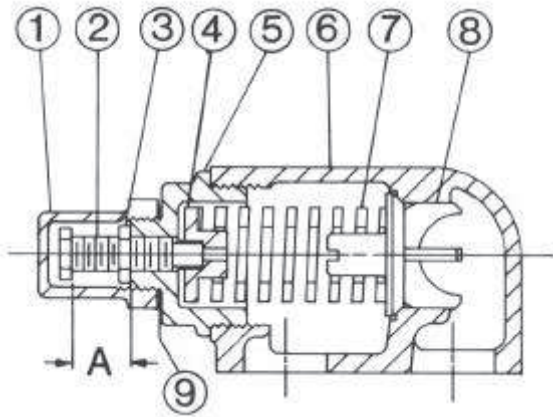


FIGURE 13
VALVE - GG, HJ, and HL SIZES

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	

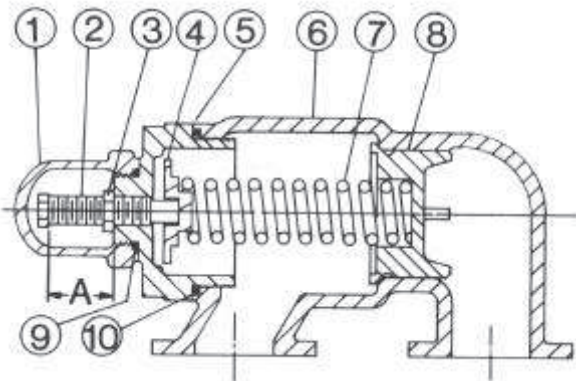


FIGURE 14
VALVE – AS, AK and AL SIZES

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	10. Bonnet

DISASSEMBLY

DANGER

BEFORE OPENING ANY SENTINEL 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 insure proper reassembly.

1. Remove valve cap.
2. Measure and record length of extension of adjusting screw. Refer to "A" on Figures 13 and 14.
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 5, page 2.

TECHNICAL SERVICE MANUAL

HEAVY DUTY PUMPS
SERIES 4195 and 495
SERIES GG - AL

SECTION TSM144
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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 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.