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**MODELS**

**HSV3A1-HYD  
HSV3B31-HYD**

**HYDRAULIC SUBMERSIBLE PUMPS**

**MANUAL  
PART 3 of 3**

**MAINTENANCE  
AND  
REPAIR  
WITH  
TROUBLESHOOTING**

**THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO**

**GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA**

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## INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp HS or HSV Series Hydraulic Submersible Pump. **Read this manual** carefully to learn how to safely maintain and service your pump. Failure to do so could result in personal injury or damage to the pump.

A set of three manuals accompanies your pump. The Installation/Operation Manual contains essential information on installing and operating the pump. The Parts List Manual provides a performance curve, a pump model cross-section drawing, and parts list for your pump.

This Maintenance and Repair Manual provides troubleshooting and maintenance instructions required to properly diagnose operational problems, and to service the pump hydraulic components. Pump hydraulic motor maintenance is not covered in this manual. The hydraulic motor is typically

maintenance-free for the life of the pump. However, if hydraulic motor repair is required, contact the factory for the motor manufacturer's repair facility closest to you.

If there are any questions regarding the pump which are not covered in this manual or in other literature accompanying the unit, please contact your Gorman-Rupp distributor or the Gorman-Rupp Company:

**The Gorman-Rupp Company**  
**P.O. Box 1217**  
**Mansfield, Ohio 44901-1217**  
 or:  
**Gorman-Rupp of Canada Limited**  
**70 Burwell Road**  
**St. Thomas, Ontario N5P 3R7**

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## RECORDING MODEL AND SERIAL NUMBERS

Please record the model and serial number for your hydraulic submersible pump in the spaces provided below. Your Gorman-Rupp distributor needs this information when you require parts or service.

Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

The following are used to alert personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



**Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.**



**Hazards or unsafe practices which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury which could result from failure to follow the procedure.**

## WARRANTY INFORMATION

The warranty provided with your pump is part of Gorman-Rupp's support program for customers who operate and maintain their equipment as described in this and the other accompanying literature. Please note that should the equipment be abused or modified to change its performance beyond the original factory specifications, the warranty will become void and any claim will be denied.



Hazards or unsafe practices which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage which could result from failure to follow the procedure.

### NOTE

*Instructions to aid in installation, operation, and maintenance or which clarify a procedure.*

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## SAFETY - SECTION A

This information applies to the Gorman-Rupp HS and HSV Series hydraulic submersible pumps covered in this manual.



Before attempting to service the hydraulic power unit or pump:

1. Familiarize yourself with this manual.
2. Shut down the power source ignition and remove the key, or take other precautions to ensure that the power unit and pump will remain inoperative.
3. Allow the hydraulic oil to cool before attempting to disconnect or service the either the power unit or pump.



This pump may be used to handle materials which could cause serious illness or injury through direct exposure or emitted fumes. Wear protective clothing, such as rubber gloves, face mask and rubber apron, as necessary, before disconnecting or servicing the pump or piping.



Do not attempt to lift the pump by the hy-

draulic hoses or the piping. Hydraulic hoses to the power source must be removed before lifting.



After the unit has been installed, make certain that the pump and all piping or hose connections are tight, properly supported and secure before operation.



Do not operate an internal combustion engine in an explosive atmosphere. When operating internal combustion engines in an enclosed area, make certain that exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless, and odorless.



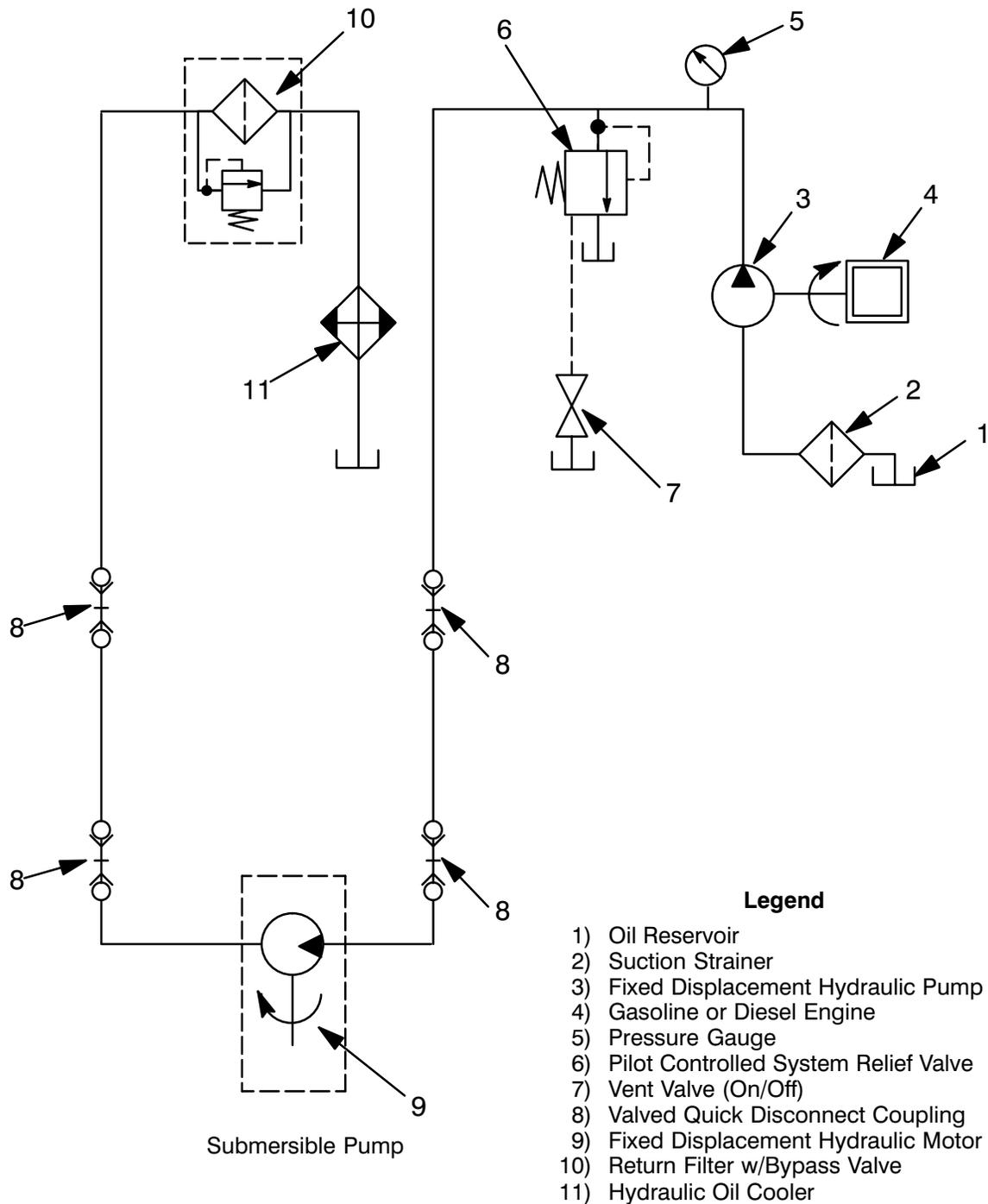
Fuel used by internal combustion engines presents an extreme explosion and fire hazard. Make certain that all fuel lines are securely connected and free of leaks. Never refuel a hot or running engine. Avoid overfilling the fuel tank, and clean up any fuel spills immediately. Always use the correct type of fuel.

## TROUBLESHOOTING – SECTION B (Including Hydraulic Power Source)

Review all SAFETY information in Section A.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
<p>PUMP NOT PUMPING (HYDRAULIC PRESSURE BELOW 1000 PSI OR 70 KG/CM<sup>2</sup>)</p>	<p>Hydraulic oil level low.</p> <p>Hydraulic power unit malfunctioning.</p> <p>Lack of liquid in pump (pump inlet obstructed).</p> <p>Lack of liquid in pump (pump not properly submerged).</p> <p>Air trapped in pump volute.</p> <p>Air trapped in pump volute.</p> <p>Air trapped in pump volute.</p> <p>Hydraulic motor worn.</p> <p>Impeller worn excessively.</p>	<p>Check level, add oil as required.</p> <p>Check unit with submersible pump disconnected to be sure unit is functioning properly.</p> <p>Check and clear debris from inlet or strainer.</p> <p>Check pump submergence. Minimum submergence to oil fill plug on bearing housing.</p> <p>Check vent screw (if so equipped) to be sure it is not plugged.</p> <p>Lay pump on its side with the discharge directed up to allow air to escape.</p> <p>Check for collapsed discharge hose</p> <p>Check and replace as required.</p> <p>Check and replace worn parts.</p>
<p>PUMP NOT PUMPING (HYDRAULIC PRESSURE ABOVE 1000 PSI OR 70 KG/CM<sup>2</sup>)</p>	<p>Submersible pump won't run.</p> <p>Submersible pump won't run.</p> <p>Submersible pump runs.</p> <p>Submersible pump runs.</p>	<p>Hydraulic motor seized. Check and replace as required.</p> <p>Impeller clogged. Check and clear debris from impeller.</p> <p>Discharge hose kinked, plugged or collapsed. Check and clear or replace discharge hose with rigid hose or pipe.</p> <p>Discharge head too high for pump. Consult pump performance curve for maximum discharge head.</p>

**SCHEMATIC DRAWING**



**Figure 1. Hydraulic Power Source Schematic  
(Including Hydraulic Pump)**

## PUMP MAINTENANCE AND REPAIR – SECTION C

### GENERAL INFORMATION

Review all SAFETY information in Section A.



**Do not attempt to service the pump unless the power source has been shut off, the hydraulic oil has been allowed to cool, and the hoses disconnected from the pump; otherwise, serious personal injury could result.**

The maintenance and repair instructions in this manual are keyed to the sectional view, Figure 1, and the corresponding parts identification list. Refer to the separate Parts List Manual for replacement parts.

Select a suitable location, preferably indoors, to perform required maintenance. All work must be performed by qualified personnel.

This Maintenance and Repair Manual provides troubleshooting and maintenance instructions required to properly diagnose operational problems, and to service the pump hydraulic components. Pump hydraulic motor maintenance is not covered in this manual. Except for sealing components, the hydraulic motor is typically maintenance-free for

the life of the pump. If motor sealing components require replacement, follow the instructions supplied with the parts.

Check **TROUBLESHOOTING**, Section B to determine causes and remedies of pump problems. Disassemble the pump only as far as required.

#### Lifting

These pumps are designed to be lightweight and portable, so lifting equipment is not normally required. Customer-installed equipment such as discharge piping **must** be removed before attempting to lift. Refer to Table 1 for the approximate weight of your pump.

**Table 1. Approximate Pump Weights**

PUMP MODEL	WEIGHT POUNDS (KG)
HSV3A1-HYD	25 (11)
HSV3B31-HYD	28 (13)



**Do not attempt to lift the pump by the hydraulic hoses or the piping. Hydraulic hoses to the power source must be removed before lifting.**

SECTION DRAWING

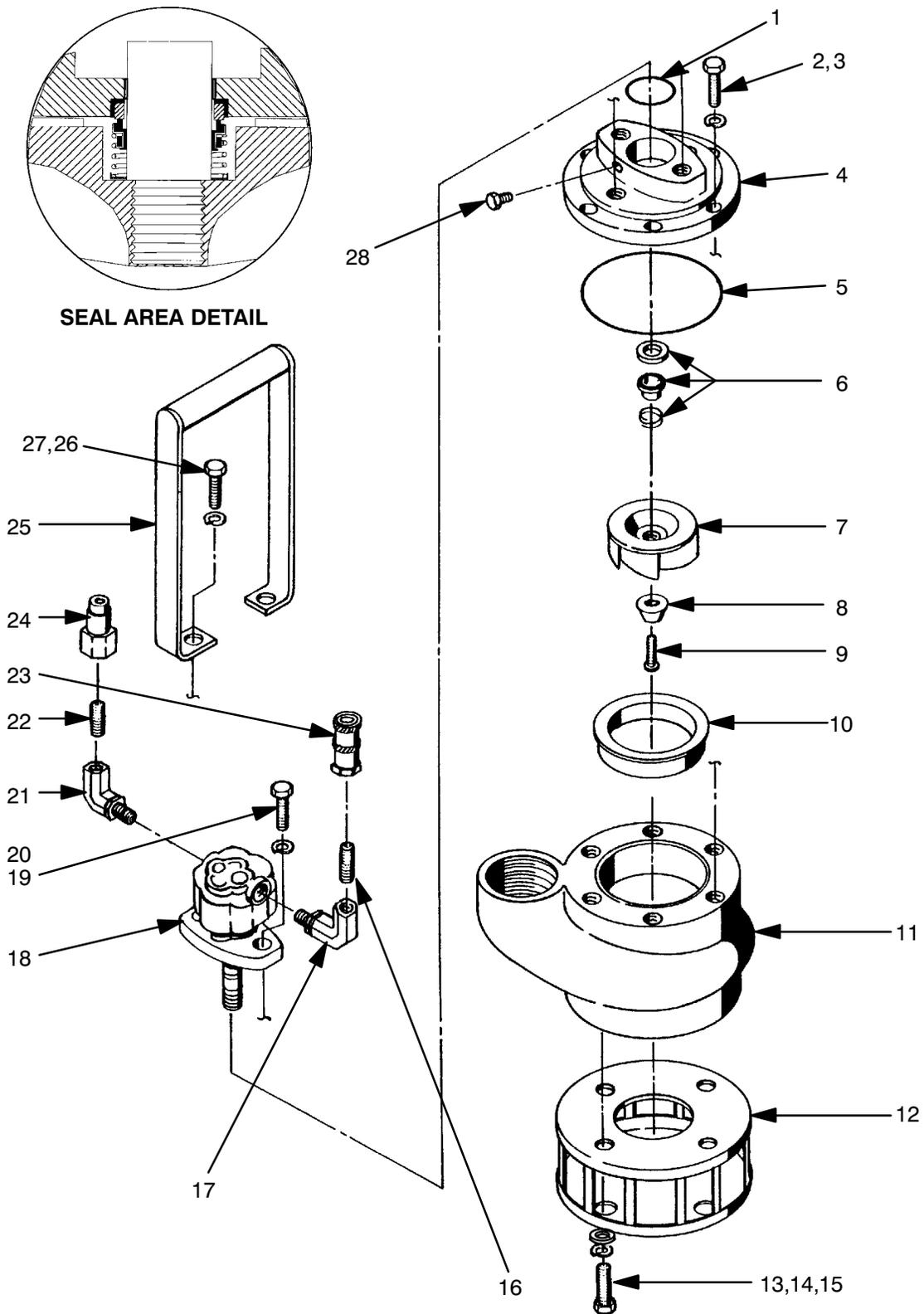


Figure C-1. Typical HS and HSV Series Hydraulic Submersible Pump

### Typical HS and HSV Series Hydraulic Submersible Pump Part Identification List

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME
1	O-RING
2	HEX HD CAPSCREW
3	LOCKWASHER
4	TOP COVER
5	O-RING
6	SHAFT SEAL ASSEMBLY
7	IMPELLER
8	CONE WASHER
9	SOCKET HD CAPSCREW
10	WEAR RING
11	VOLUTE
12	STRAINER
13	HEX HD CAPSCREW
14	LOCKWASHER
15	FLAT WASHER
16	PIPE NIPPLE
17	PIPE ELBOW
18	HYDRAULIC MOTOR
19	HEX HD CAPSCREW
20	LOCKWASHER
21	PIPE ELBOW
22	PIPE NIPPLE
23	FEMALE HYDRAULIC COUPLING
24	MALE HYDRAULIC COUPLING
25	HANDLE
26	HEX HD CAPSCREW
27	LOCKWASHER
28	PIPE PLUG

## PUMP DISASSEMBLY

This Maintenance and Repair Manual provides troubleshooting and maintenance instructions required to properly diagnose operational problems, and to service the hydraulic pump components. Because of its extremely long life, close tolerances and high efficiency, the hydraulic motor is typically maintenance-free for the life of the pump. Also, due to its relatively low replacement cost, it is more economical to replace than to rebuild. Therefore, pump hydraulic motor maintenance is not covered in this manual. However, if hydraulic motor repair is desired, contact the factory for the motor manufacturer's repair facility closest to you.

Use a suitable lifting device to move the pump to a suitable location, preferably indoors, to perform required maintenance.

References are to Figure C-1.

### Removing Pump From Strainer

1. Position the pump vertically and remove the hardware (13, 14 and 15) securing the pump casing (11) to the strainer (12). Lift the pump off the strainer and position it horizontally on a work bench or other suitable surface for further disassembly.

### Removing Pump Casing

1. Remove the hardware (2 and 3) securing the top cover (4) and motor assembly (18) to the volute casing (11). Lift the pump out of the pump casing, and position it horizontally on a work bench or other suitable surface for further disassembly.
2. Inspect the wear ring (10) for excessive wear or scoring. If replacement is required, position the pump casing with the suction opening facing up. Use a hammer and punch through the suction opening to tap the wear ring out of the pump casing.
3. Remove the O-ring (5).

### Removing Impeller

1. Block impeller rotation and remove the impeller screw (8) and washer (9).

2. Use a hex key wrench or hex key socket with and impact wrench to unscrew the impeller (7) in a counterclockwise direction. Use caution when removing the impeller; tension on the seal spring will be released as the impeller is unscrewed.

### Removing Seal Assembly

References are to Figures C-1 and C-2.



To maintain peak operating efficiency, it is **strongly** recommended that the seal be replaced any time the pump is disassembled. In the event that the seal will be reused, handle seal parts with extreme caution to prevent damage. Use care not to contaminate the precision-finished faces; even fingerprints on the faces can shorten seal life.

1. Remove the spring centering washer and seal spring.
2. Apply oil to the shaft and work it up under the bellows. Slide the rotating portion of the seal off the shaft.
3. Slide a pair of stiff wires with hooked ends between the shaft and the stationary element, and hook the element from the back side. Pull the element and stationary seat from the bearing housing.

If no further disassembly is required, refer to **INSPECTION AND CLEANING**, followed by **PUMP REASSEMBLY**.

### Removing Motor Assembly

1. Remove the motor mounting hardware (19 and 20) and carefully remove the motor assembly (18).
2. Remove the O-ring (1) and replace as required.
3. Check the top cover (4) for wear and replace as required.

### NOTE

*Disassembly of the hydraulic motor assembly (18)*

is not normally required except for replacement of sealing components. If the lip seal or O-rings require replacement, follow the instructions supplied with the parts.

## INSPECTION AND CLEANING



**Most cleaning solvents are toxic and flammable. Use them only in a well-ventilated area free from flame, sparks, and excessive heat. Read and follow all precautions printed on solvent containers.**

1. Thoroughly clean all reusable parts (except the seal assembly) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.
2. Inspect all mating surfaces for nicks or burrs and restore to original contours with emery cloth or a fine file. If the surface cannot be restored, replace the part.
3. Carefully inspect all O-ring seating areas to determine if they formed a proper seal. If sealing was faulty, determine the cause before reassembling the pump. After inspection, remove and discard all O-rings.

### Cleaning Seal Assembly



Seal faces are precision-finished and subject to wear patterns which cannot be realigned during assembly. The seal assembly should be replaced completely at each overhaul to ensure trouble-free operation. If necessary to use an old seal in an emergency, **never** mix old and new seal parts; seal performance will be severely affected.

1. Inspect the seal assembly for wear, scoring, grooves, and other damage that might cause leakage.

2. Wash all seal parts in fresh cleaning solvent and allow to dry thoroughly. Re-inspect the parts after cleaning.
3. If needed, clean the seal faces with a clean, lint-free cloth. Wipe lightly in a concentric pattern to avoid scratching the faces.

## PUMP REASSEMBLY

### Installing Motor Assembly

1. Replace the O-ring (1) and secure the motor assembly (18) to the top cover (4) with the hardware (19 and 20).

### Installing Seal Assembly

References are to Figures C-1 and C-2.

1. Clean the seal cavity and shaft as indicated in **INSPECTION AND CLEANING**.



**Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.**

2. Inspect the impeller shaft for damage. Small scratches or nicks may be removed with a fine file or emery cloth. If excessive wear exists, the motor will have to be replaced.
3. The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in **fresh** cleaning solvent and allow to dry thoroughly.
4. Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

5. Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

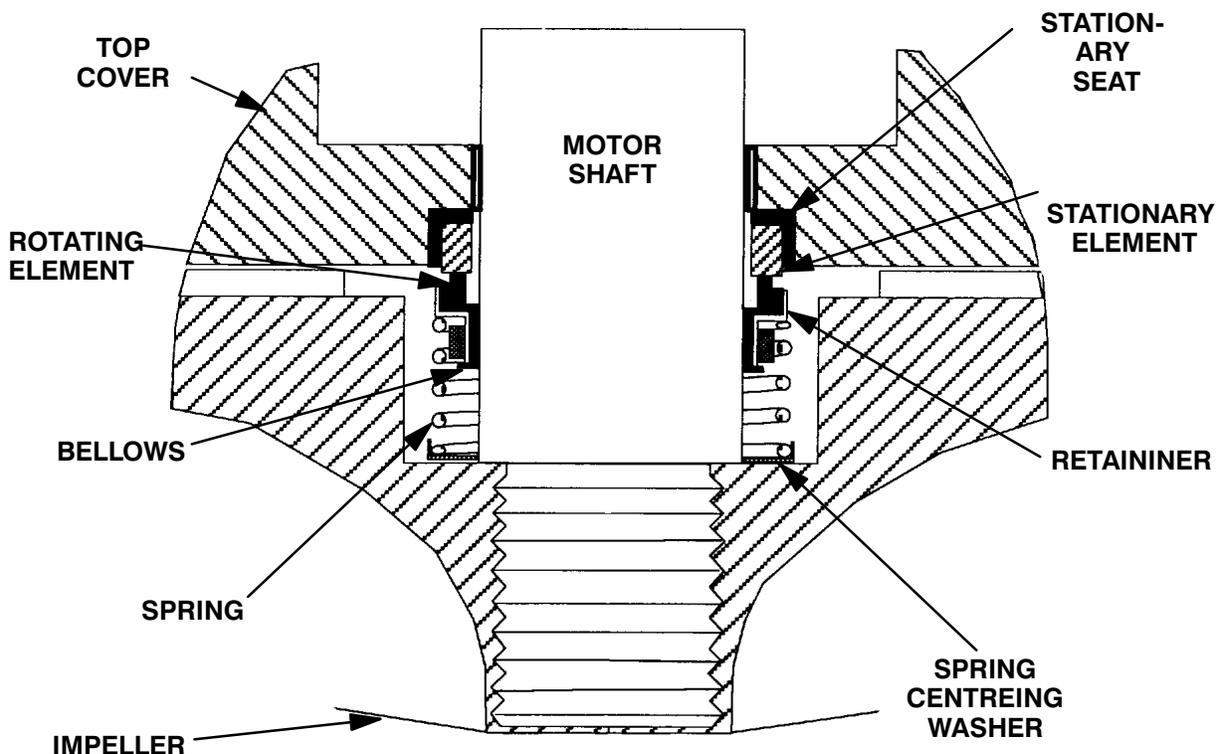


If a new seal is being installed, do not unwrap it until ready to install; seal components **must** be kept clean. Handle seal parts with extreme caution to prevent damage. Use care not to contaminate the precision-finished faces; even fingerprints on the faces can shorten seal life.

6. If a replacement seal is being used, remove it from the container just before installation and inspect the precision-finished faces to ensure that they are free of any foreign matter.
7. To ease installation of the seal, lubricate the bellows and stationary seat with water or a very **small** amount of oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure C-2).

#### NOTE

*Use hand pressure only to install seal components. A push tube cut from plastic pipe approximately the same O.D. as the stationary seat is a useful aid when installing these components. It is recommended that the bearing housing be inverted during seal assembly.*



**Figure C-2. Seal Assembly**

8. Position the motor assembly with the impeller side up. Press the stationary seat into the motor cover until fully seated. Press the stationary element into the stationary seat.
9. Slide the rotating subassembly (consisting of the rotating element, retainer and bellows) onto the lubricated shaft until the seal elements con-

tact. Use caution not to damage the bellows on the shaft threads.

10. Install the seal spring and centering washer.

#### Installing Impeller

References are to Figure C-1.

1. Check the impeller (21) for broken vanes, cracks, or excessive wear, and replace as necessary.
2. Screw the impeller onto the shaft until fully seated. **Be sure** the spring centering washer and spring seat squarely in the recess in the back of the impeller.
3. Install the impeller washer (8) and the impeller capscrew (9). Immobilize the impeller and tighten the capscrew.

### Installing Pump Casing

1. If the wear ring (10) was removed, press a new wear ring into the volute until fully seated. The wear ring **must** seat squarely in the pump casing or binding and excessive wear will occur.
2. Install a new O-ring (5). Position the rotating portion of the pump in the pump casing. Use caution not to damage the O-ring and to make sure it is squarely seated. Align the mounting holes and secure the rotating portion of the pump to the pump casing with the hardware (2 and 3).

### Installing Pump on Strainer

1. Lower the pump assembly onto the strainer (12) and secure with the hardware (13, 14 and 15).
2. Test the pump for leaks before returning the pump to service.

### Installing Pump on Strainer

1. Lower the pump assembly onto the strainer (12) and secure with the hardware (13, 14 and 15).

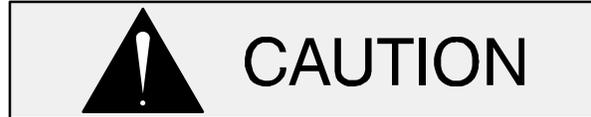
### Final Assembly

1. If removed, make sure the male and female quick disconnect fittings (23 and 24) are properly installed in the hydraulic motor ports. **This is critical to ensure proper rotation and prevent damage to the pump.** The female fitting **must** be positioned in the opening marked "IN".



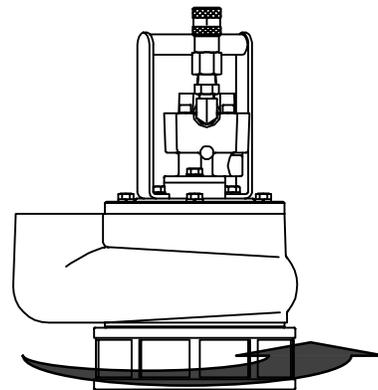
The quick disconnect fittings on the hydraulic motor must be properly installed; otherwise, severe damage to the pump will occur.

2. After lubricating the pump and before putting the pump back into service, check pump rotation.



While checking impeller rotation, secure the pump to prevent rolling.

3. Suspend the pump by the lifting handle. **Quickly** apply power and note the direction of pump kickback. **As viewed from the top**, the pump should kickback in a **counterclockwise** direction (see Figure 2); this will indicate that impeller rotation is correct.



DIRECTION OF KICKBACK

Figure 2. Kickback Direction

4. If the pump kicks back in a clockwise direction, impeller rotation is incorrect. Make sure pressure is supplied to the hydraulic motor port marked "IN".

### LUBRICATION

All references are to Figure C-1.

Before removing or installing the plug (28), always clean the area around the plug to prevent contamination of the oil.

The seal assembly (6) is lubricated by the reservoir of oil in the top cover (4).

**Draining Oil**

1. Lay the pump on a work surface with the plug (28) in the top cover (4) facing up and remove the plug.
2. Place a clean container under the plug, and roll the pump on its side to drain the housing.

**Condition Of Oil**

1. Check the condition of the oil drained from the pump.

2. If the oil is clear, the motor cover may be refilled and pump put back into service.
3. If the oil is milky, this indicates that the seal is leaking, and the seal should be replaced before putting the pump back into service.

**Adding Oil**

1. With the pump positioned vertically on a flat surface, add approximately 1 oz. (30 cc) of Penzoil AW46 or equivalent 20W hydraulic oil through the hole for the plug (28). Apply "Never-Seez" or equivalent compound to the plug before re-installing it in the bearing housing.

**For U.S. and International Warranty Information,  
Please Visit [www.grpumps.com/warranty](http://www.grpumps.com/warranty)  
or call:  
U.S.: 419-755-1280  
International: +1-419-755-1352**

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