



RS AND RD SERIES PUMPS

**MANUAL
PART 3 of 3**

**MAINTENANCE
AND
REPAIR
WITH
TROUBLESHOOTING**

GORMAN-RUPP PUMPS

www.grpumps.com

INTRODUCTION

Thank You for purchasing a Gorman-Rupp RS or RD Series Roto-Prime® 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, and on making electrical connections. The Parts List Manual provides performance curve(s), 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. Contact the factory for the authorized repair facility closest to you.

This pump is a Roto-Prime® self-priming centrifugal petroleum pump, designed to handle **petroleum products only**. It incorporates an integral variable-capacity vane pump which automatically evacuates air and vapor from the suction line. The pump is designed to be driven by an explosion-proof motor with a maximum full load speed of either 1750 RPM (RS Series) or 3450 RPM (RD Series). This pump should **not** be used to handle water or other non-petroleum liquids. For specific service, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

As described on the following page, this manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

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
Phone: (419) 755-1011
or:
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631-2870

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RECORDING MODEL AND SERIAL NUMBERS

Please record the pump model and serial number in the spaces provided in the separate Installation/Operation Manual and Parts List Manual accompanying your pump. Your Gorman-Rupp distributor needs this information when you require parts or service.

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:

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.



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 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.



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.

NOTE

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

SAFETY – SECTION A

The following information applies throughout this manual to Gorman-Rupp Roto-Prime® Series basic pumps.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed instructions and precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that only safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed only after establishing that neither personal safety nor pump integrity are compromised by such practices.



Before attempting to install, operate, or service this pump, familiarize yourself with this manual, and with all other literature shipped with the pump. Unfamiliarity with all aspects of pump operation covered in this manual could lead to destruction of equipment, injury, or death to personnel.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.

2. Shut off the incoming power to the motor and lock it out, or take other action to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Suction and discharge hoses and piping must be removed from the pump before lifting. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.



This pump is designed to handle petroleum products or other similar hydrocarbon liquids. Do not attempt to pump water, corrosive materials, or any liquids which may damage the pump or endanger personnel as a result of pump failure.



If this pump is used with volatile and/or flammable liquids, be certain proper safety practices are followed before operating or servicing the pump. Provide adequate ventilation, prohibit smoking, wear static-resistant clothing and shoes. Clean up all fuel spills immediately after occurrence.



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.



If this pump is used with volatile and/or flammable liquids, overheating may produce dangerous fumes. Take precautions to ensure the area surrounding the pump is adequately ventilated. Allow the pump to completely cool and use extreme caution when venting the pump, or when removing covers, plates, plugs, or fittings.



Overheated pumps can cause severe

burns and injuries, and produce explosive fumes. If overheating of the pump occurs:

1. Stop the pump immediately.
2. Ventilate the area.
3. Allow the pump to completely cool.
4. Check the temperature before opening any covers, plates, gauges, or plugs.
5. Vent the pump slowly and cautiously.
6. Refer to instructions in this manual before restarting the pump.



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



Do not install and operate a non-explosion proof motor in an explosive atmosphere. Install, connect, and operate the motor in accordance with The National Electric Code and all local codes. If there is a conflict between the instructions in the manual accompanying the unit and The National Electric Code or the applicable local code, The National or local code shall take precedence. All electrical equipment supplied with this pump conformed to applicable federal regulations and national codes in effect on the date of manufacture.

TROUBLESHOOTING – SECTION B

Review all SAFETY information in Section A.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut off the incoming power to the motor and lock it out, or take other action to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Air leak in suction line. Leaking or worn seal or pump gasket. Suction lift too high. Product vapor pressure too high. Pump speed too slow. Pump running backwards. Priming pump vanes worn; rotor clogged or stuck. Strainer clogged.	Correct leak. Check pump vacuum. Replace leaking or worn seal or gasket. Measure lift with vacuum gauge. Reduce lift and/or friction losses in suction line. Cool pump and product suction line. Check driver output; check belts or couplings for slippage. Check direction of rotation and correct by interchanging any two motor leads at control box. (See Pump Rotation , Section C, Installation And Operation Manual). Check slide and replace vanes. Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Air leak in suction line. Leaking or worn seal or pump gasket.	Correct leak. Check pump vacuum. Replace leaking or worn seal or gasket.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (CONT'D)	<p>Strainer clogged.</p> <p>Suction intake not submerged at proper level or sump too small.</p> <p>Pump speed too slow.</p> <p>Suction lift or discharge head too high.</p> <p>Low or incorrect voltage.</p>	<p>Check strainer and clean if necessary</p> <p>Check installation and correct submergence as needed.</p> <p>Check driver output; check belts or couplings for slippage.</p> <p>Check piping installation and reduce suction lift and/or discharge head.</p> <p>Measure control box voltage, both when pump is running and when shutoff.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Pump speed too high.</p> <p>Discharge head too low.</p> <p>Impeller or other wearing parts worn or damaged.</p> <p>Bearing(s) frozen.</p>	<p>Check driver output; check that sheaves or couplings are correctly sized.</p> <p>Adjust discharge valve.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Disassemble pump and check bearing(s).</p>
EXCESSIVE NOISE	<p>Cavitation in pump.</p> <p>Pumping entrained air.</p> <p>Pump or drive not securely mounted.</p> <p>Impeller or other wearing parts worn or damaged.</p>	<p>Reduce discharge pressure and/or pump speed.</p> <p>Locate and eliminate source of air bubble.</p> <p>Secure mounting hardware.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p>
PUMP CLOGS FREQUENTLY	<p>Solids or debris jamming impeller or priming pump.</p>	<p>Check suction line and storage tank for foreign matter. Install or clean strainer screen.</p>
BEARINGS RUN TOO HOT	<p>Bearing temperature is high, but within limits.</p> <p>Suction and discharge lines not properly supported.</p> <p>Low or incorrect lubricant.</p> <p>Drive misaligned; piping improperly installed.</p>	<p>Check bearing temperature regularly to monitor any increase.</p> <p>Check piping installation for proper support.</p> <p>Check for proper type and level of lubricant.</p> <p>Realign drive and piping at operating temperature. Add expansion joints if required.</p>

PREVENTIVE MAINTENANCE

Since pump applications are seldom identical, and pump wear is directly affected by such things as the abrasive qualities, pressure and temperature of the liquid being pumped, this section is intended only to provide general recommendations and practices for preventive maintenance. Regardless of the application however, following a routine preventive maintenance schedule will help assure trouble-free performance and long life from your Gorman-Rupp pump. For specific questions concerning your application, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For units designed for clear liquid applications, regular inspection of pump components for wear and abrasion is not normally necessary due to the lubricating qualities of the liquid being pumped. The pump should only be taken out of service if unusual noise or a drop in performance is noticed during operation.

Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		I			R
V-Belts (If So Equipped)			I		
Air Release Valve Plunger Rod (If So Equipped)			I	C	
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve					I
Pressure Relief Valve (If So Equipped)					C
Pump and Driver Alignment					I
Shaft Deflection					I
Bearings					I
Bearing Housing					I
Piping					I
Driver Lubrication – See Mfgr's Literature					I
Legend: I = Inspect, Clean, Adjust, Repair or Replace as Necessary C = Clean R = Replace * Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually. Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.					

PUMP MAINTENANCE AND REPAIR – SECTION C

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, label and decals attached to the pump.



Do not attempt to service the pump assembly unless all power to the pump motor has been shut off and locked out, or other action taken to ensure that the pump will remain inoperative; otherwise, injury or death could result.



Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Suction and discharge hoses and piping must be removed from the pump before lifting. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.

The maintenance and repair instructions in this manual are keyed to the sectional views and the individual part descriptions on the following pages. 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.

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

Lifting

Use lifting equipment with a capacity of **at least five times the weight of the pump**, including the weight of any options or customer-installed accessories. Suction and discharge hoses or piping **must** be removed before attempting to lift the pump.

For the approximate weight of your pump, refer to the pump specification data sheet or contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

SECTION DRAWING

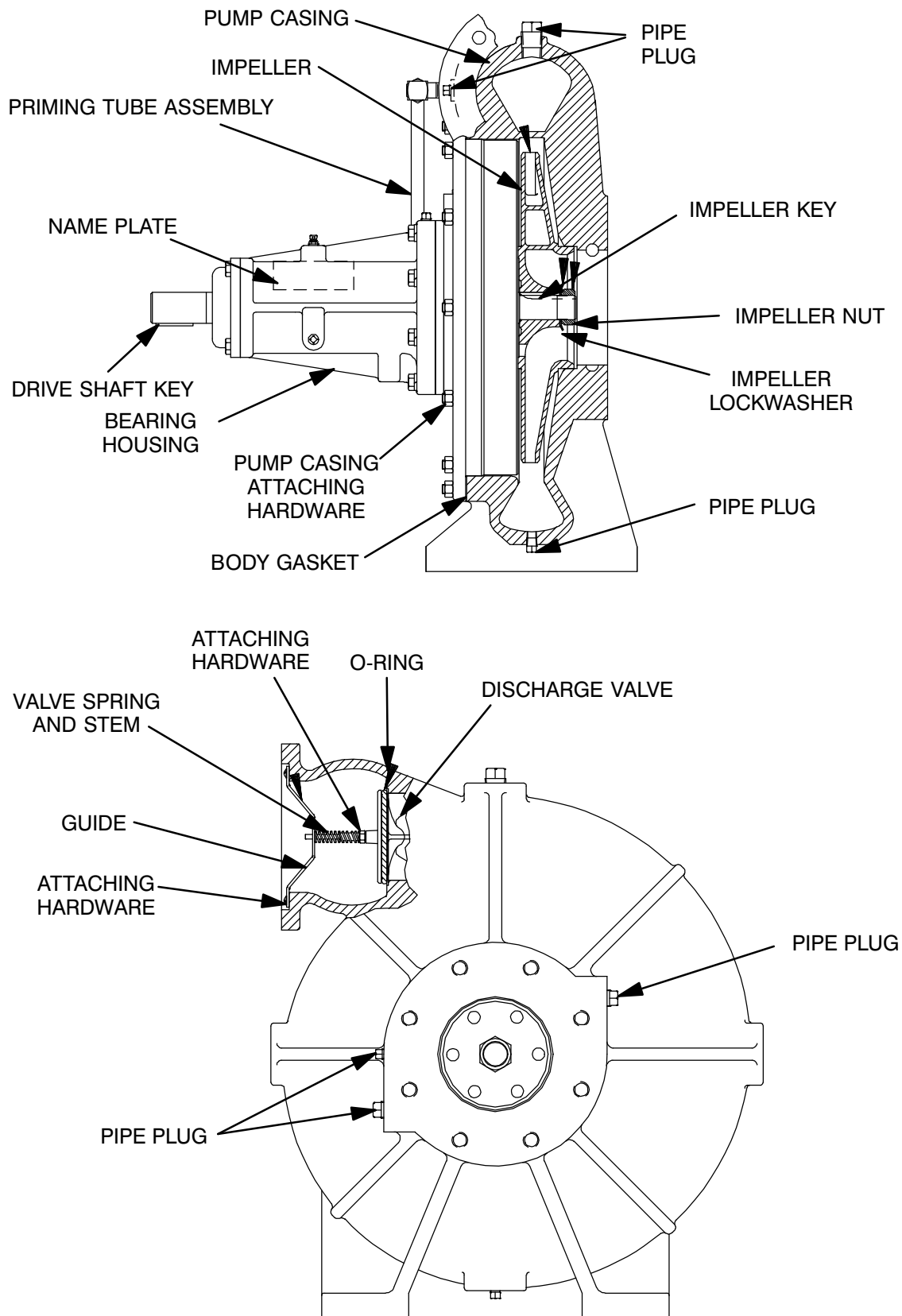


Figure C-1. Typical RS Basic Model Pump Assembly

SECTION DRAWING

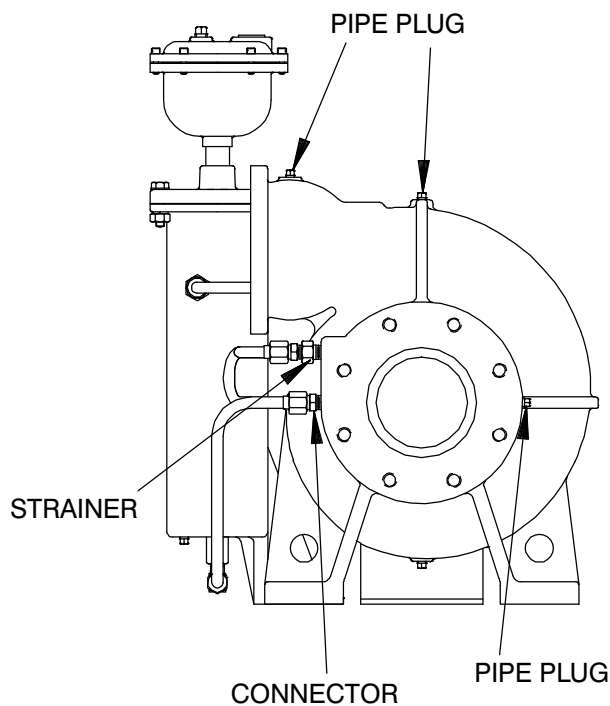
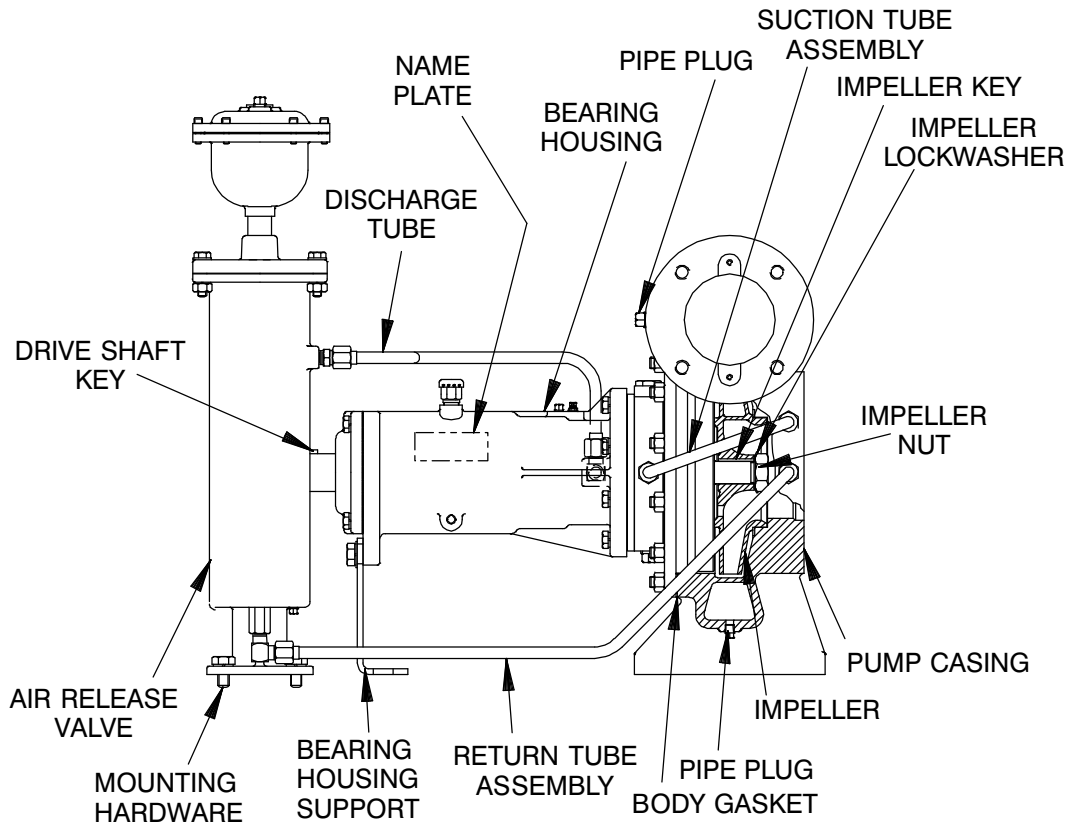


Figure C-2. Typical RD Model Pump Assembly ("BAR" Version)

SECTION DRAWING

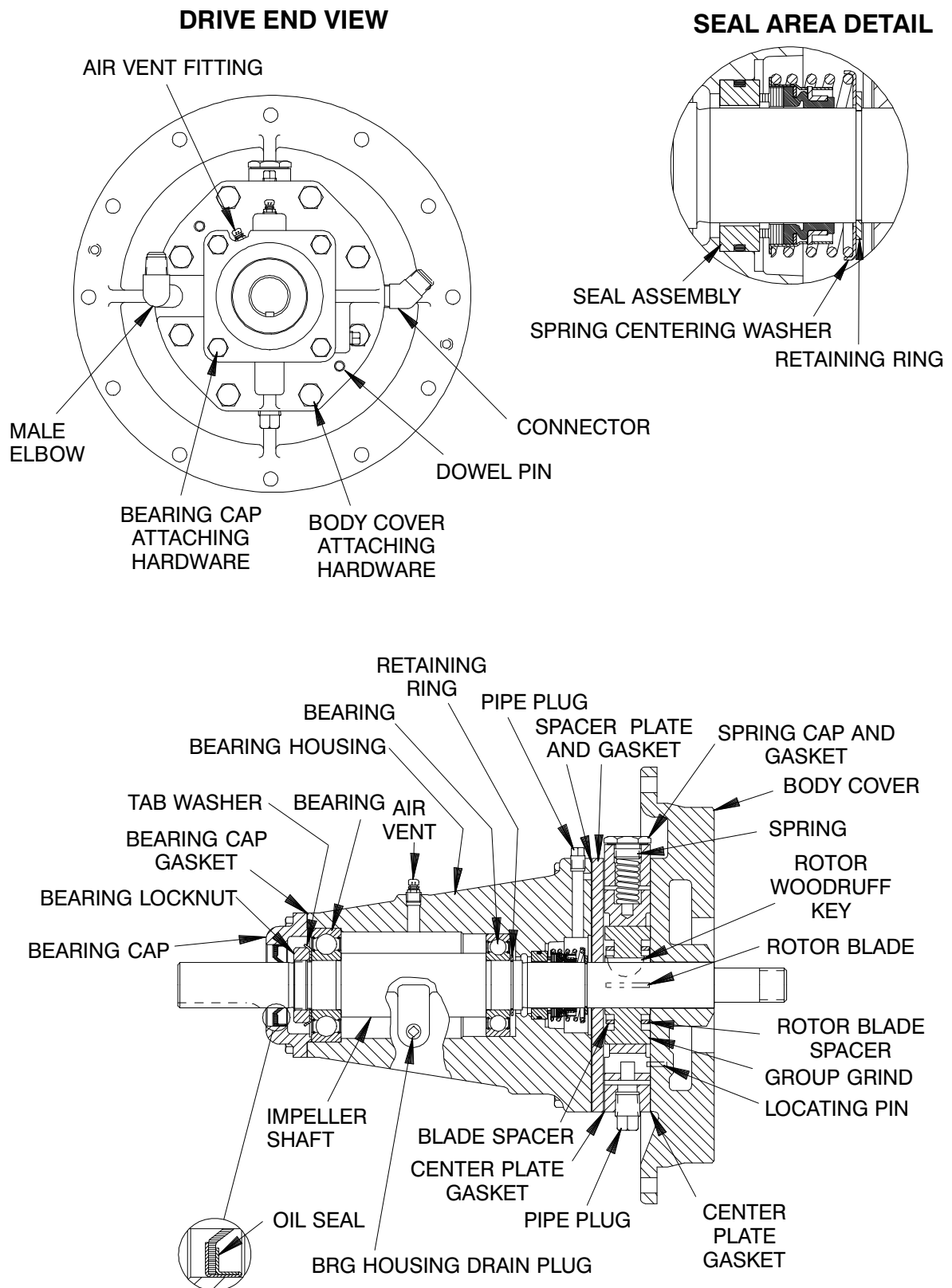


Figure C-3. Typical RS Series Bearing Housing Assembly

SECTION DRAWING

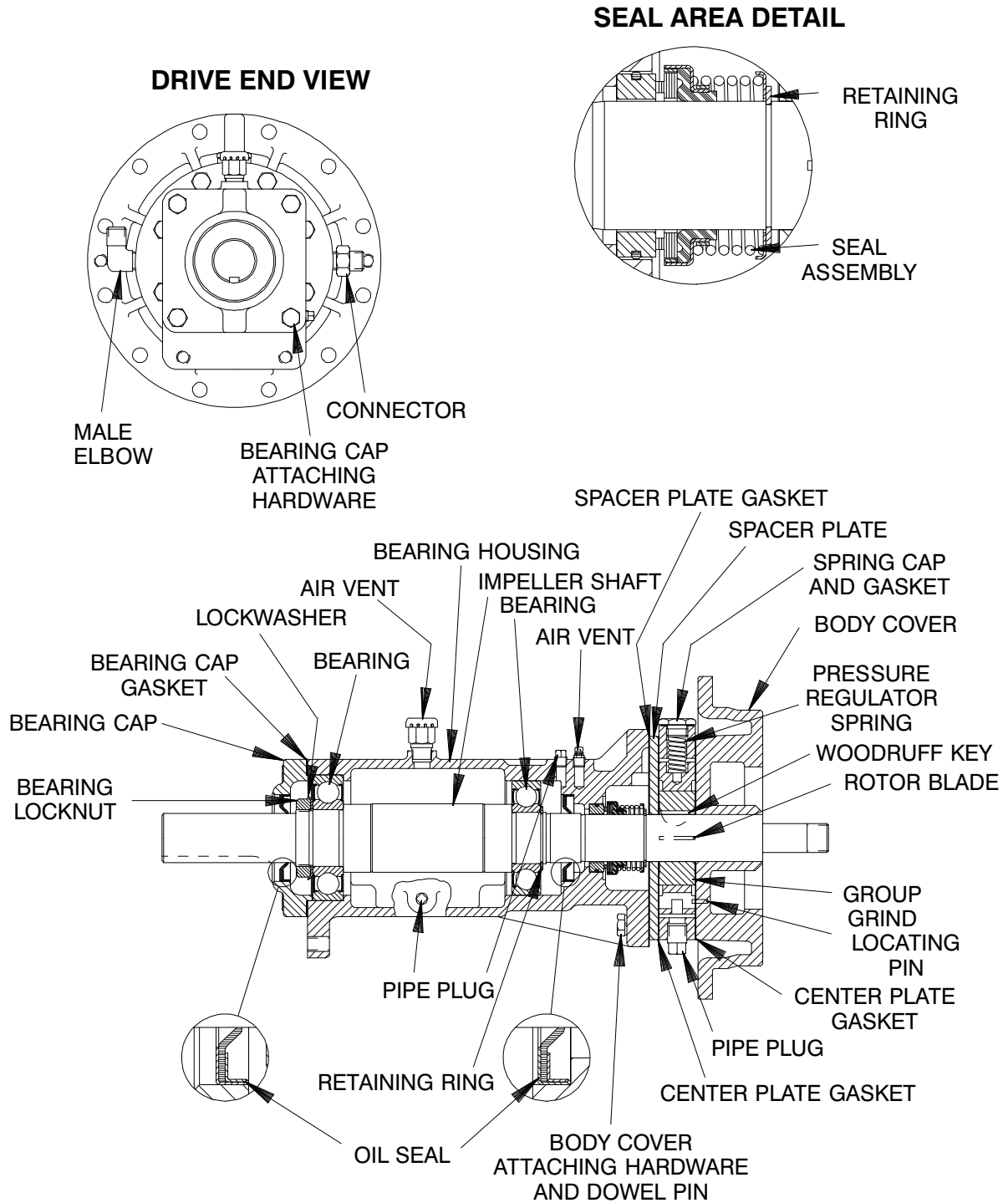


Figure C-4. Typical RD Series Bearing Housing Assembly

SECTION DRAWING

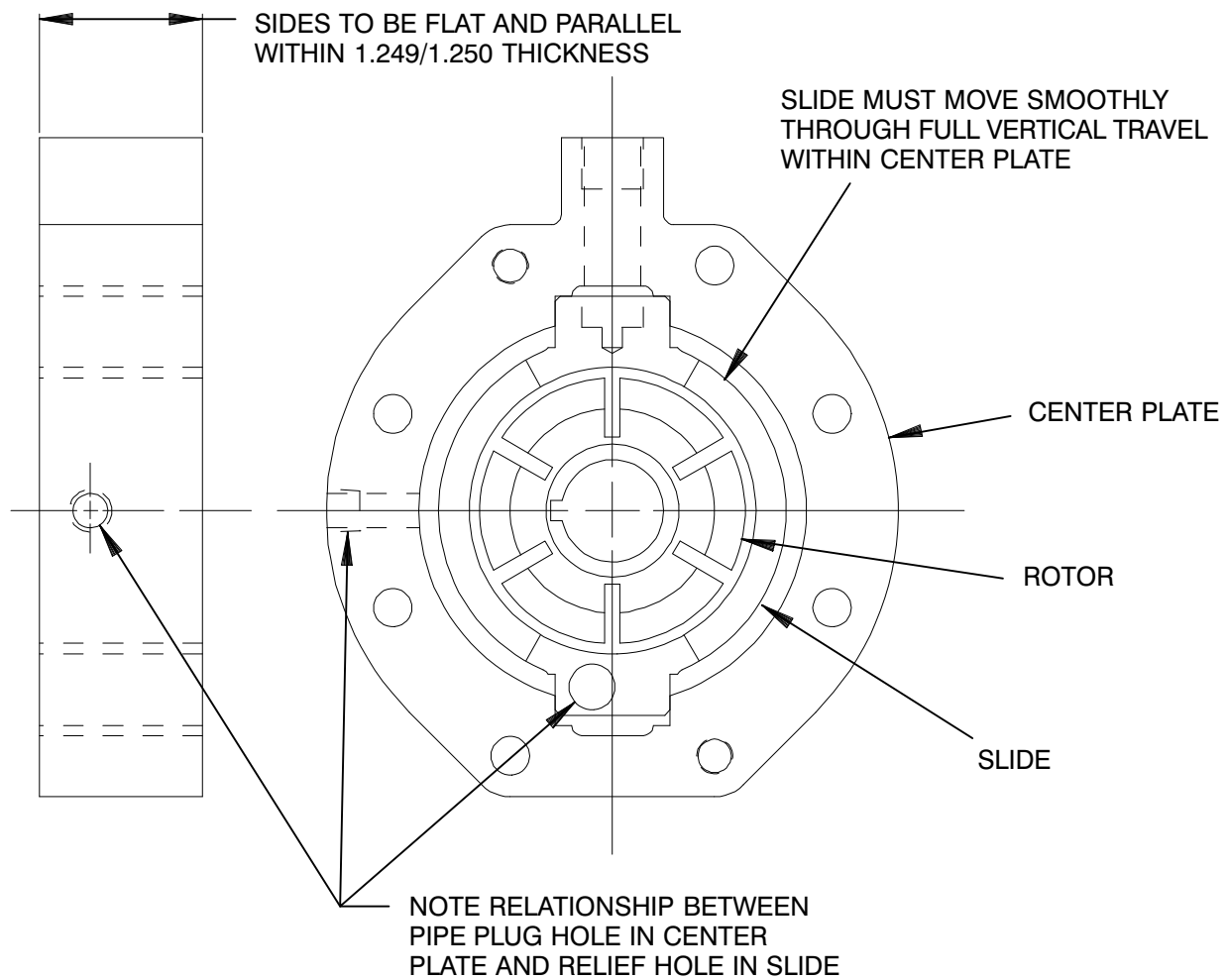


Figure C-5. Typical Group Grind

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, label and decals attached to the pump.

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional views (see Figures 1, 2, 3, 4 and 5). If your pump is equipped with an Air Release Valve Assembly ("BAR" Models), maintenance and repair instructions for the Air Release Valve are covered separately in the specific literature shipped with the unit.

As described on the following pages, this manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

For part numbers, quantities, suction, discharge and return tube positioning for your specific pump, refer to the separate Parts List manual accompanying your pump.

All parts of this pump except the pump casing may be serviced without removing suction and discharge lines. However, the following instructions assume complete disassembly is required.

Before attempting to service the pump, shut off the incoming power to the motor and lock it out, or take other action to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pump casing and group grind by removing the drain plugs. Clean and reinstall the drain plugs.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut off the incoming power to the motor and lock it out, or take other action to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is designed to be used with volatile and/or flammable liquids. Be certain proper safety practices are followed before operating or servicing the pump. Provide adequate ventilation, prohibit smoking, wear static-resistant clothing and shoes. Clean up all fuel spills immediately after occurrence.

Separating Pump From Motor

(Figure 1 or 2)

Remove the coupling guard and loosen the coupling on the pump drive shaft. Separate the motor and drive components from the pump, and remove the drive shaft key.

Air Release Valve Removal (“BAR” Models Only)

(Figure 2)

Disconnect the air release valve discharge tube assembly from the bearing housing. Disconnect the return tube assembly from the pump casing.

If exterior venting tubing has been installed, disconnect the tubing at the air release valve. Remove the connecting hardware and remove the air release valve.

See the accompanying literature for individual parts, maintenance and repair of the Air Release Valve.

Pump Disassembly

(Figure 1 or 2)

Disconnect the suction and discharge tube assemblies from the bearing housing and pump casing.

Use a suitable hoist and sling to support the bearing housing. Remove the nuts securing the casing to the body cover (Figure 3 or 4). Install two jacking screws (RS Models, 3/8–16 UNC; RD Models, 1/2–13 UNC, not supplied) in the tapped holes in the body cover. Tighten the screws evenly to prevent binding, and pull the bearing housing, body cover and assembled parts straight out of the pump casing.

Discharge Check Valve Disassembly (RS Versions Only)

(Figure 1)

If the discharge check valve (RS Versions only) requires replacement, disconnect the suction and discharge piping from the pump casing. Disengage the hardware securing the pump casing to the base and remove the casing. Tie and tag any leveling shims used under the casing.

Remove the attaching hardware securing the discharge check valve guide to the pump casing. Use caution when disengaging the hardware; tension on the discharge check valve spring will be released.

Pull the guide, spring and check valve assembly from the discharge port.

Remove the spring and disengage the attaching hardware from the stem to replace the O-ring.

Impeller Removal

(Figure 1 or 2)

Immobilize the impeller by inserting a brass rod between the impeller vanes. **Be careful** not to damage the impeller vanes. Straighten the tabs on the impeller tabwasher, and remove the impeller nut and tabwasher.

Remove the brass rod. Install two 3/8–16 UNC capscrews (not supplied) in the tapped holes in the impeller, and use a suitable puller to remove the impeller from the shaft. Retain the impeller key.

NOTE

An alternate method of removing the impeller is to carefully pry on the back side of the impeller (directly against two opposing vanes) with equal pressure until the impeller comes off the shaft.

Some impellers are fitted with wear rings. If the wear rings are badly worn, the entire impeller must be replaced or returned to the factory for wear ring replacement.

Group Grind Disassembly

(Figure 3 or 4)

Remove the spring cap, gasket and spring.



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.

Remove the body cover attaching hardware, and use a soft-faced mallet to tap around the outside diameter of the body cover until it separates from the bearing housing and group grind. Remove the outboard center plate gasket(s), and use solvent to

clean the mating surfaces. **Be careful** not to scratch or mar the surfaces.

NOTE

*Use an ink marker to match mark the center plate, rotor and slide of the group grind assembly. These parts are ground as an assembly, and their relative locations **must** be maintained.*

If group grind replacement is necessary, slide the group grind assembly, blade spacers and rotor blades off the shaft. Retain the rotor woodruff key. Tap the group grind dowel pins out of the bearing housing.

Remove the inboard center plate gasket, spacer plate and spacer plate gasket. Clean any gasket adhesive from the mating surfaces using solvent. **Be careful** not to scratch or mar the surfaces.

Seal Removal

(Figure 3 or 4)

Remove the seal retaining ring with caution; tension on the seal spring will be released. Remove the spring centering washer. Slide the rotating portion of the seal off the shaft, and use a pair of stiff wires with hooked ends to remove the stationary seat. **Be careful** not to damage the seal faces.

If no further disassembly is required, see **Seal Installation**.

Shaft and Bearing Removal and Disassembly

(Figure 3 or 4)

When the pump is properly operated and maintained, the bearing housing should not require disassembly. Disassemble the shaft and bearings **only** when there is evidence of wear or damage.



Shaft and bearing disassembly in the field is not recommended. These operations should be performed only in a properly equipped shop by qualified personnel.

There are no provisions for draining or flushing the bearing housing lubricant. Place a drip pan under the bearing housing before removing the shaft and bearings.

NOTE

If your pump is equipped with optional oil-lubricated bearings, remove the oil cup and drain the bearing cavity before removing the shaft and bearings.

Disengage the attaching hardware and remove the bearing cap and gasket. Use an arbor (or hydraulic) press to remove the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft, and tap the shaft and assembled bearings from the bearing housing.

If your pump is equipped with an oil seal in the bearing housing between the bearing and seal cavity (RD Model pumps), use a screwdriver or other suitable tool to remove the oil seal from the bearing housing.

After removing the shaft and bearings, clean and inspect the bearings **in place** as follows.



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and bearings are removed.

Clean the bearing housing, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.



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.

Clean the bearings thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil.



Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. **Do not** spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

Rotate the bearings by hand to check for roughness or binding and inspect the bearing balls. If rotation is rough or the bearing balls are discolored, replace the bearings.

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the bearing housing. Replace the bearings, shaft, or bearing housing if the proper bearing fit is not achieved.

If bearing replacement is required, remove the snap ring from the impeller shaft, and use a bearing puller to remove the inboard bearing from the shaft.

Straighten the tabs on the bearing washer and remove the bearing lock nut and washer. Use a bearing puller to remove the outboard bearing from the shaft.

Shaft and Bearing Reassembly and Installation

(Figure 2)

Inspect the shaft for distortion, nicks or scratches, or for thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is

strongly recommended that the bearings be replaced **any** time the shaft and bearings are removed.

The bearings may be heated to ease installation. An induction heater, hot oil bath, electric oven, or hot plate may be used to heat the bearings. Bearings should **never** be heated with a direct flame or directly on a hot plate.

NOTE

*If a hot oil bath is used to heat the bearings, both the oil and the container must be **absolutely** clean. If the oil has been previously used, it must be **thoroughly** filtered.*



Use caution when handling hot bearings to prevent burns.

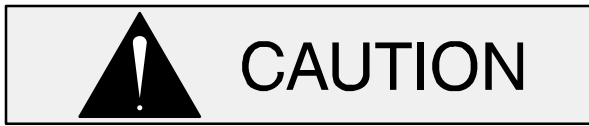
Heat the bearings to a uniform temperature **no higher than 250°F (120°C)**, and slide the bearings onto the shaft, one at a time, until they are fully seated. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

NOTE

*If optional oil-lubricated bearings are used, position the bearings on the shaft with the shielded sides facing **away** from each other. It is recommended that two buna or viton slinger rings (not supplied) be pressed onto the shaft between the bearings. Position the rings approximately 1/2 inch from each bearing to ensure sufficient lubrication and prevent premature bearing failure.*

After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If movement has occurred, use a suitable sized sleeve and a press to reposition the bearings against the shaft shoulders.

If heating the bearings is not practical, lubricate the bearings with light oil, and use a suitable sized sleeve, and an arbor (or hydraulic) press to install the bearings on the shaft.



When installing the bearings onto the shaft, **never** press or hit against the outer race, balls, or ball cage. Press **only** on the inner race.

Secure the inboard bearing on the shaft with the bearing retaining ring. Secure the outboard bearing with the tab washer and lock nut.

If your pump is equipped with an inboard oil seal (RD Model Pumps), lubricate the seal with light oil, and position it in the bearing housing with the lip positioned as shown in Figure 4. Press the oil seal into the bearing housing until fully seated.



When installing the shaft and bearings into the bearing bore, push against the outer race. **Never** hit the balls or ball cage.

Slide the shaft and assembled bearings into the bearing housing until the outboard bearing seats against the bearing housing shoulder. **Be careful** not to cut or roll the lip of the oil seal (RD Model Pumps).

Press the oil seal into the bearing cap with the lip positioned as shown in Figures 3 or 4. Replace the bearing cap gasket, and secure the bearing cap with the attaching hardware. **Be careful** not to cut the oil seal lip on the shaft keyway, or roll the lip during installation.

NOTE

*Impeller shaft endplay should be between .002 and .010 inch (.051 to .254 mm). Tighten the bearing cap hardware tight enough to prevent leakage and obtain the correct endplay. **Do not** over-tighten.*

Lubricate the bearing housing as indicated in **LUBRICATION**.

Seal Reassembly And Installation

(Figures 3 or 4 and 6)

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent.



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.

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.

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.

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 replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the shaft, bellows and stationary seat O-ring 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 6).

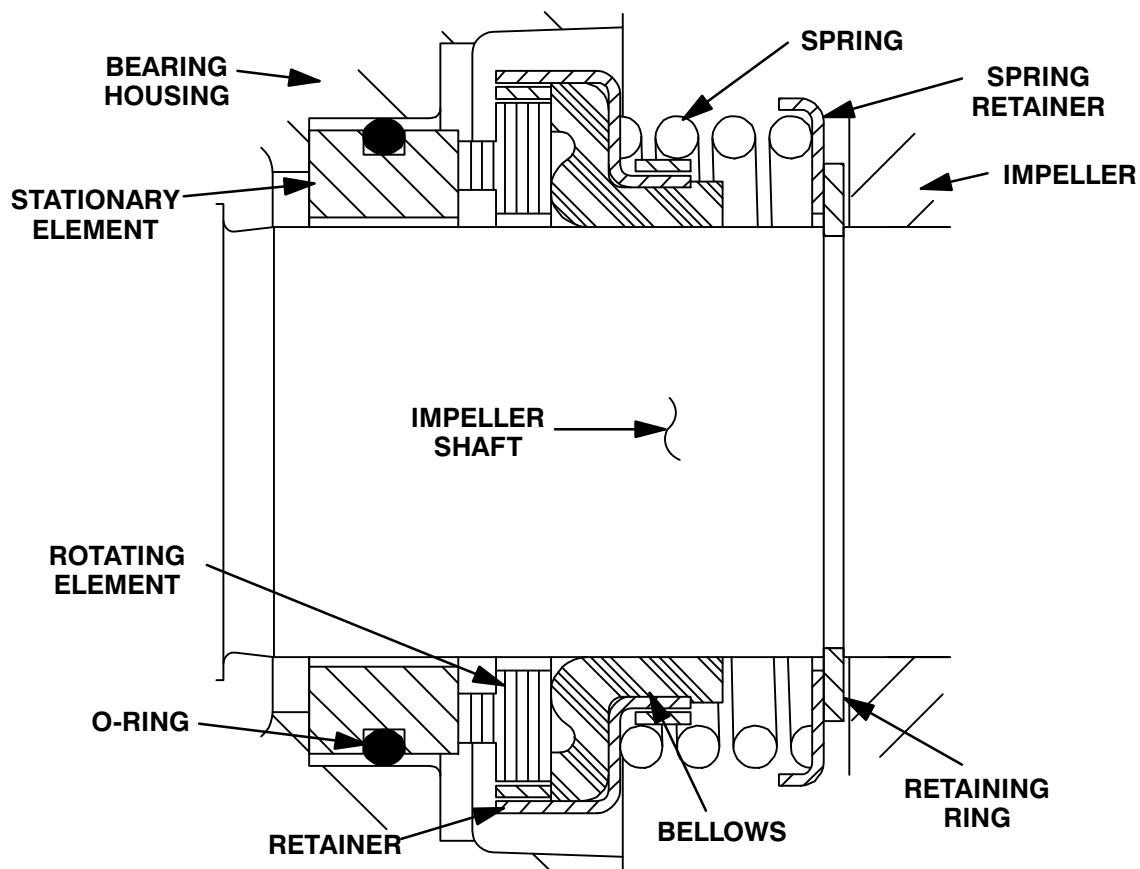


Figure 6. Seal Assembly



This seal is not designed for operation at temperatures above 160° F (71° C). Do not use at higher operating temperatures.

Inspect the impeller shaft for distortion, nicks, scratches, or damage to the shaft threads. Dress small nicks and burrs with a fine file or emery cloth. If the shaft is defective, refer to **Shaft and Bearing Removal and Disassembly** and replace the shaft.

Lubricate the O-ring with a light coat of oil and install it in the stationary seat. Press the seat and O-ring into the bearing housing until fully seated. A push tube cut from a length of plastic pipe would aid this installation. The I.D. of the tube should be slightly larger than the O.D. of the shaft. Be careful not to damage the seal face. After installation, wipe the seal face in a concentric pattern with a clean, lint-free cloth.

NOTE

It is recommended that a tapered sleeve (see Fig-

ure 7) be installed over the shaft keyway to ease installation of the rotating portion of the seal. This tool can be made from steel tubing or black pipe.

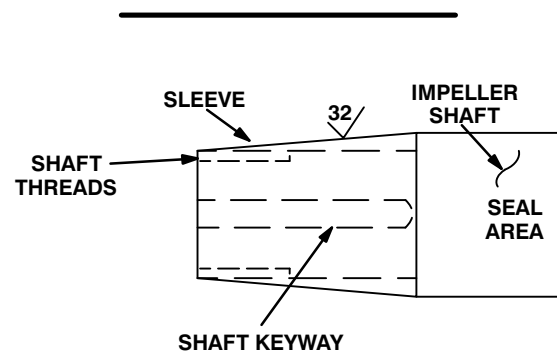


Figure 7. Seal Installation Sleeve

Lubricate the tapered sleeve and position it on the shaft. Position the rotating portion of the seal (consisting of the retainer, bellows and rotating element) on the sleeve, and apply even pressure against the shoulder of the seal retainer until the rotating subassembly slides onto the shaft and the seal faces contact. A push tube cut from a piece of plastic tubing would aid this installation. The I.D. of

the tube should be approximately the same diameter as the I.D. of the seal spring.

Remove the tapered sleeve and install the seal spring and spring centering washer. Secure the seal with the retaining ring.

Group Grind Reassembly

NOTE

*If any component in the group grind assembly requires replacement, the entire group grind assembly must be replaced as a unit. Refer to the special instructions in **Group Grind Replacement** at this time.*

(Figure 3 or 4)

Install a new spacer plate gasket, the spacer plate and inboard center plate gasket. Be sure the oval hole in the spacer plate matches up with the tubing hole.

Inspect the group grind rotor (Figure 5) for wear or damage. If replacement is necessary, refer to the specific instructions in **Group Grind Replacement**. If the group grind is not being replaced, proceed as follows.

Center the inboard blade spacer on the shaft (RS Models only) and install the rotor woodruff key.

(Figure 5)

If removed, install the dowel pins in the bearing housing. Install the center plate, and install the slide in the center plate, making sure the recessed hole in the slide faces toward the impeller. Check for free movement of the slide in the center plate.

Coat both ends of the rotor with "Anti-Wear Lubricating And Hydraulic Oil SAE 10, Energol HLP-HD 32" or equivalent lubricant, and install it on the shaft. Check the rotor for free movement.

(Figure 3 or 4)

Inspect the rotor blades for wear or damage and replace as required. Align the blades with the rotor slots and install the blades. Install the outboard blade spacer on the rotor (RS Models only).

Install one outboard center plate gasket.

NOTE

If the thickness of the rotor or slide is greater than the thickness of the center plate, install a second center plate gasket. To check thickness, temporarily secure the center plate by installing two 7/16-20 UNC by 2-inch long bolts (not supplied) through the bearing housing and spacer plate, and into the tapped holes in the center plate. Place a straight edge across the center plate and rotate the shaft. If the rotor or blades touch the straight edge at any point, add a second center plate gasket and re-check. The clearance should be no more than .001 inch (0,025 mm) from the rotor to the straight edge. No more than two gaskets should be required. Remove the temporary bolts.

Inspect the locating pin and replace it if required. Align the pin in the recessed hole in the slide, and use a soft-faced mallet to tap the body cover into place on the dowel pins. Secure the body cover with the attaching hardware. Be sure the dowel pins are fully seated into the body cover.

Group Grind Check

(Figure 3 or 4)

Remove the spring cap and pressure regulating spring. Insert a screwdriver or other suitable tool into the drain plug hole, and move the slide up and down. The slide should travel 1/8 inch (3,2 mm) from the full priming position to the neutral position. If it does not, flush the group grind with penetrating oil, and check the slide travel again. The slide should move freely.

After checking the group grind, install the pressure regulating spring, spring cap gasket and spring cap. Clean and reinstall the drain plug.

Refer to **Impeller Installation**.

Group Grind Replacement

(Figure 3 or 4)



If the group grind requires replacement, it is **strongly** recommended that the pump be returned to the factory. Fitting proce-

dures involve extremely close tolerances which are critical to efficient operation. These procedures are difficult to accomplish outside the factory.

If the group grind **must** be replaced in the field, dowel holes in the center plate must be drilled and reamed after the group grind, body cover and impeller have been fully reassembled.

Install the spacer plate gaskets, spacer plate, blade spacers (RS Models only), and group grind parts (including the outboard blade spacer, RS Models only) as described in **Group Grind Installation**.

Before installing the body cover, position the group grind slide in full priming position (in contact with the bottom of the center plate). To check rotor concentricity, rotate the shaft until the highest point on the rotor comes in contact with the slide. Move the center plate and slide until a .002 inch (0,05 mm) feeler gauge can be inserted between the rotor and slide at the point of contact. Secure the center plate in this position with two 7/16-20 UNF by 2 inch long capscrews (not supplied) inserted through the bearing housing and into the tapped holes in the center plate.

NOTE

*The pressure regulating spring **must** be removed during this procedure; otherwise, spring tension on the slide could cock the assembly and prevent accurate measurements.*

Remove the feeler gauge and install one outboard center plate gasket.

NOTE

If the thickness of the rotor or slide is greater than the thickness of the center plate, install a second center plate gasket. To check thickness, place a straight edge across the center plate and rotate the shaft. If the rotor or blades touch the straight edge at any point, add a second center plate gasket and recheck. The clearance should be no more than .001 inch (0,025 mm) from the rotor to the straight edge. No more than two gaskets should be required. Remove the temporary bolts.

Inspect the locating pin and replace it if required. Align the pin in the recessed hole in the slide, and position the body cover on the shaft. **Be careful** not to disturb the position of the center plate. Secure the body cover with the hardware, but **do not** fully tighten the capscrews at this time.

Install the impeller as described in **Impeller Installation**. **Do not** bend the tabs over on the impeller washer (Figure 1 or 2) until the shaft is rotated to check for rubbing of the impeller or inboard impeller wear ring (if so equipped) against the body cover. If the impeller or wear ring (if so equipped) rubs, tap the body cover with a mallet until the impeller rotates freely. Now tighten the hardware securing the body cover.

NOTE

Fully tighten six of the capscrews before replacing the two capscrews used to temporarily hold the group grind.

After fully securing the body cover, bend the tabs of the impeller washer over the impeller nut.

Measure the length of the dowel pins. Use the existing dowel pin holes in the bearing housing as guides to drill and ream two new dowel pin holes (.312 inch [7,9 mm] finished diameter) through the center plate. The holes should be just deep enough so the pins will be **flush** with the bearing housing when installed. **Do not** drill through the body cover. Be careful not to damage the holes in the bearing housing or body cover with the drill bit or reamer. Install the dowel pins in the new holes.

Group Grind Check

(Figure 3 or 4)

Remove the spring cap and pressure regulating spring. Insert a screwdriver or other suitable tool into the drain plug hole, and move the slide up and down. The slide should travel 1/8 inch (3,2 mm) from the full priming position to the neutral position. If it does not, flush the group grind with penetrating oil, and check the slide travel again. The slide should move freely. Reinstall the pressure regulating spring and spring cap, and clean and reinstall the drain plug.

After checking the group grind, install the pressure regulating spring, spring cap gasket and spring cap.

Refer to **Impeller Installation**.

Impeller Installation

(Figure 1 or 2)

Inspect the impeller and replace it if cracked or badly worn. Some impellers are equipped with wear rings. If the wear rings that are badly worn, the entire impeller must be replaced or returned to the factory for wear ring replacement.

Install the impeller key, and slide the impeller onto the shaft. Immobilize the impeller, and secure it with the tab washer and impeller nut. Bend the tabs on the washer over the impeller nut.

Before operation, lubricate the group grind as indicated in **LUBRICATION**.

Discharge Check Valve Reassembly (RS Versions Only)

(Figure 1)

If the discharge check valve (RS Versions only) was removed, install a new check valve O-ring, and secure the valve stem with the attaching hardware.

Position the check valve assembly in the discharge port. Install the spring on the stem. Compress the spring with the guide, and secure the guide to the casing with the attaching hardware.

Install the casing on the base. Be sure to reinstall any leveling shims used under the casing feet. Secure the casing to the suction and discharge piping. Secure the casing to the base with the previously removed hardware.

Pump Reassembly

(Figure 1 or 2)

Install the pump casing gasket. Install the bearing housing assembly in the pump casing, and secure it with the attaching hardware.

Final Assembly

(Figure 1 or 2)

Connect the suction and discharge tube assemblies to the bearing housing and pump casing. For part numbers, quantities, suction, discharge and return tube positioning for your specific pump, refer to the separate Parts List manual accompanying your pump.

Install the drive shaft key, and connect the coupling and motor. Install the coupling guards.

Air Release Valve Installation (“BAR” Models Only)

(Figure 2)

Secure the air release valve with the mounting hardware. Connect the return tube assembly to the pump casing.

LUBRICATION

Seal Assembly

The seal assembly is lubricated by the medium being pumped. No additional lubrication is required.

Group Grind

Before starting the pump for the first time or if the pump has not been used for a long period of time, remove the 1/8-inch NPT pipe plug (located in the bearing housing, above the seal area when viewed from the drive end). Pour approximately 8 ounces (0,24 liter) of SAE 10 or 20 non-detergent oil into the housing to lubricate the shaft seal and group grind rotor blades. Reinstall the plug.

Standard Bearings

(Figure 3 or 4)

Standard bearings used in this pump are permanently sealed and lubricated by the manufacturer, and no additional lubrication is required. However, to minimize the danger of moisture contamination due to temperature changes, the bearing housing is also partially filled with grease.

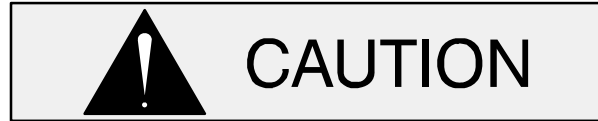
When overhauling the bearing housing, remove the air vent fitting, install a lubrication fitting, and fill the cavity with approximately 15 ounces (425 g) of grease (approximately one-third full).

Optional Oil Lubricated Bearings

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly at the oil cup and maintain it at the top of the cup. When lubrication is required, remove the air vent and add SAE No. 30 non-detergent oil through the hole. **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

Under normal conditions, drain the bearing housing once each year and refill with clean oil. Change

the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the gearbox lubricant regularly for evidence of rust or moisture condensation. This is especially important in areas where variable hot and cold temperatures are common.

For cold weather operation, consult the factory or a lubricant supplier for the recommended grade of oil.

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