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# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

## RD SERIES PUMPS



MODELS
RD4A3-BAR RD4A32-BAR

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

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## INTRODUCTION

This Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is a Roto-Prime<sup>®</sup> 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. 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.

The basic pump is not furnished with a mounting base and power source, however, these items are available from the factory as optional equipment. The pump is designed to be driven by an explosion-proof motor with a maximum full load speed of 3450 RPM.

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

**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

For information or technical assistance on the power source, contact the power source manufacturer's local dealer or representative.

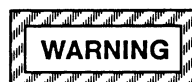
The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:

### NOTE

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



INSTRUCTIONS WHICH MUST BE FOLLOWED TO AVOID CAUSING DAMAGE TO THE PRODUCT OR OTHER EQUIPMENT INCIDENTAL TO THE INSTALLATION. THESE INSTRUCTIONS DESCRIBE THE REQUIREMENTS AND THE POSSIBLE DAMAGE WHICH COULD RESULT FROM FAILURE TO FOLLOW THE PROCEDURES.



THESE INSTRUCTIONS MUST BE FOLLOWED TO AVOID CAUSING INJURY OR DEATH TO PERSONNEL, AND DESCRIBE THE PROCEDURE REQUIRED AND THE INJURY WHICH COULD RESULT FROM FAILURE TO FOLLOW THE PROCEDURE.



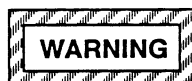
## WARNINGS – SECTION A

THESE WARNINGS APPLY TO ROTO-PRIME® SERIES BASIC PUMPS. GORMAN-RUP HAS NO CONTROL OVER OR PARTICULAR KNOWLEDGE OF THE POWER SOURCE WHICH WILL BE USED. REFER TO THE MANUAL ACCOMPANYING THE POWER SOURCE BEFORE ATTEMPTING TO BEGIN OPERATION.



BEFORE ATTEMPTING TO OPEN OR SERVICE THE PUMP:

1. FAMILIARIZE YOURSELF WITH THIS MANUAL.
2. SHUT OFF THE INCOMING POWER AND LOCK IT OUT OR TAKE OTHER ACTION TO ENSURE THAT THE PUMP WILL REMAIN INOPERATIVE.
3. ALLOW THE PUMP TO 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 HANDLE PETROLEUM PRODUCTS OR OTHER SIMILAR HYDRO-CARBON 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 CLOTH-

ING 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.

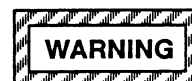


IF THIS PUMP IS USED WITH VOLATILE AND/OR FLAMMABLE LIQUIDS, OVERHEATING MAY PRODUCE DANGEROUS FUMES. TAKE PRECAUTIONS TO ENSURE THE AREA SURROUNDING THE PUMP IS ADEQUATELY VENTILATED. ALLOW THE PUMP TO COOL AND USE EXTREME CAUTION WHEN VENTING THE PUMP, OR WHEN REMOVING COVERS, PLATES, PLUGS, OR FITTINGS.



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 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 PIP-

ING 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.



## INSTALLATION - SECTION B

### Review all WARNINGS in Section A.

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

Most of the information pertains to a standard **static lift application**, where the pump is positioned above the free level of the liquid to be pumped.

If installed in a **flooded suction application**, where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the spe-

cific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to 50% of the maximum permissible operating pressure shown on the pump performance curve.

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

### Pump Dimensions

See Figure 1 for the approximate physical dimensions of this pump.

### OUTLINE DRAWING

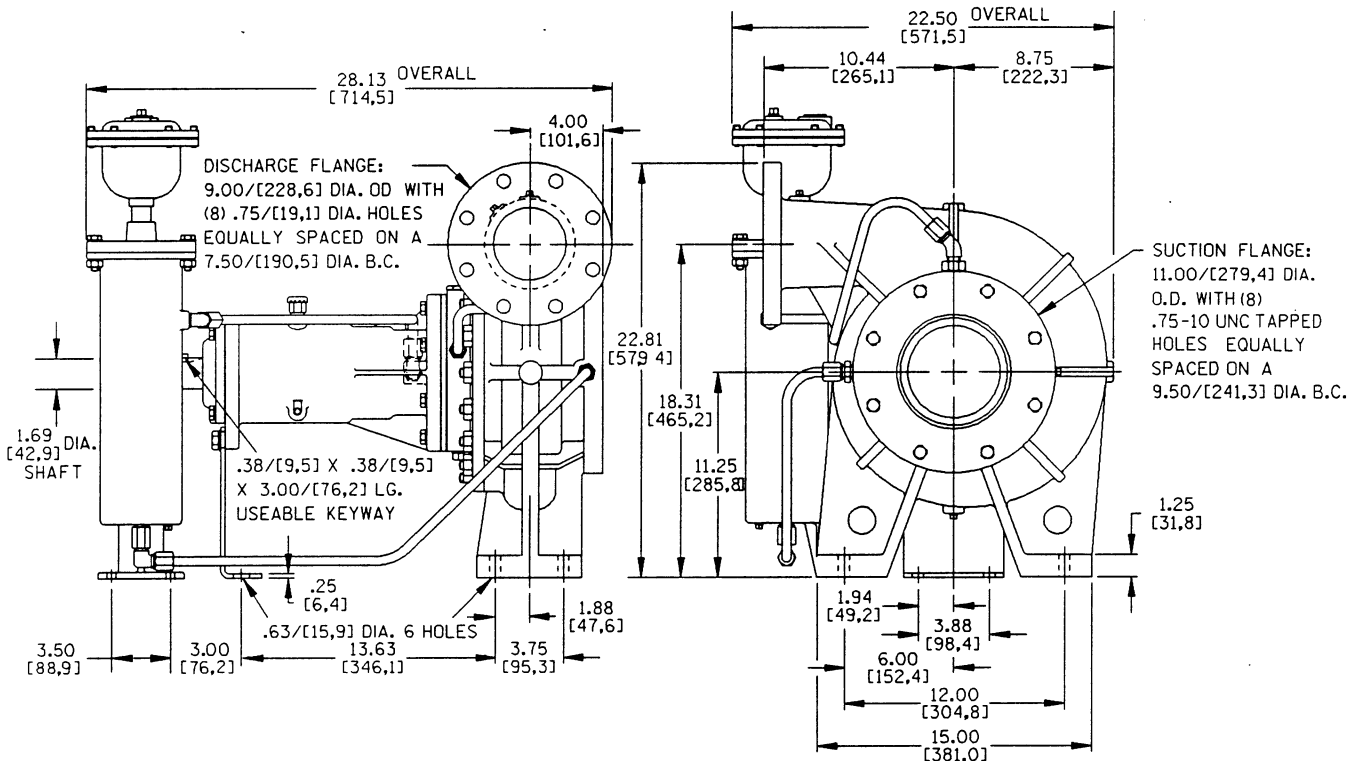


Figure 1. Pump Models RD4A3-BAR and RD4A32-BAR (Shown Without Base or Power Source)

## PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

- a. Inspect the pump for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- c. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates in the required direction.



ONLY OPERATE THIS PUMP IN THE DIRECTION INDICATED ON THE PUMP BODY AND/OR THE ACCOMPANYING DECAL. REVERSE ROTATION OF THE SHAFT WILL ADVERSELY EFFECT PUMP PERFORMANCE, AND THE PUMP COULD BE SERIOUSLY DAMAGED.

- d. Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- e. If the pump and power source have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

## POSITIONING PUMP

### Lifting

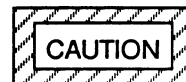
Use lifting equipment with a capacity of at least **2,000 pounds (904 kg)**. This pump weighs approximately **400 pounds (181 kg)**, not including the weight of suction and discharge piping, accessories, base or power source. Customer installed equipment such as suction and discharge piping and fittings **must be removed** before attempting to lift.



THE PUMP ASSEMBLY CAN BE SERIOUSLY DAMAGED IF THE CABLES OR CHAINS USED TO LIFT AND MOVE THE UNIT ARE IMPROPERLY WRAPPED AROUND THE PUMP.

### Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation.



WHEN THE PUMP IS INSTALLED UNDER UNUSUAL CONDITIONS, THE PRIMING TUBE(S) MAY VIBRATE ABNORMALLY. IF THIS OCCURS AFTER THE PUMP AND PIPING ARE PROPERLY SECURED, CONTACT THE FACTORY TO OBTAIN OPTIONAL SPRINGS FOR THE PRIMING PUMP GROUP GRIND. IF THE VIBRATION IS NOT CORRECTED, THE TUBING COULD FATIGUE AND RUPTURE, SPILLING THE LIQUID BEING PUMPED AND RESULTING IN A FIRE HAZARD.

## GROUNDING

To eliminate electrostatic build-up by the liquid being pumped, it is recommended that the pump be grounded by attaching the ground wire assembly to a ground rod. Install the ground rod in accordance with the National Electrical Code and all local codes. Be sure the clamp or fastener has made a tight electrical connection with the rod.



INSPECT AND TEST THE GROUND WIRE ASSEMBLY FOR CONDUCTIVITY. REPLACE BROKEN OR FRAYED WIRE BEFORE RESUMING OPERATION.

## SUCTION AND DISCHARGE PIPING



**DAMAGE TO THE PUMP RESULTING FROM DEBRIS IN THE SUCTION LINE WILL NOT BE COVERED BY THE PUMP WARRANTY. BEFORE CONNECTING THE SUCTION AND DISCHARGE PIPING, CAREFULLY CHECK THE STORAGE TANK AND PIPING FOR CONSTRUCTION DEBRIS SUCH AS NUTS, BOLTS, WIRE, WELD SLAG, AND OTHER FOREIGN MATERIAL. INSTALL A COMMERCIALY AVAILABLE 80 MESH SCREEN AND A FILTER IN THE SUCTION LINE TO PREVENT DEBRIS FROM ENTERING THE PUMP.**

Pump performance is adversely effected by increased suction lift, discharge elevation, and friction losses. See the performance curve and operating range shown on Page E-1 to be sure your overall application allows pump to operate within the safe operation range.

### Materials

Either pipe or hose maybe used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

### Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

### Connections to Pump

Before tightening a connecting flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

### Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches (457,2 mm) from the suction and discharge ports and install the lines. Installation closer to the pump may result in erratic readings.

## SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

Refer to Figure 2 for the recommended configuration of the suction line.

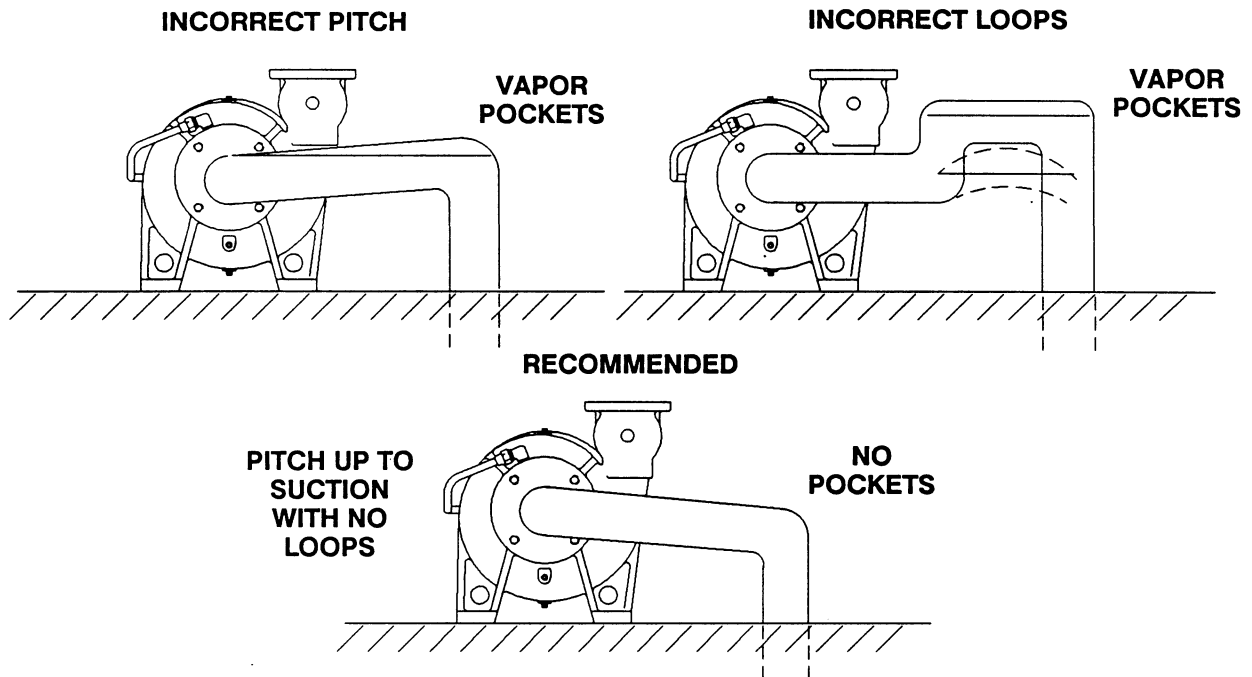


Figure 2. Suction Line Configuration

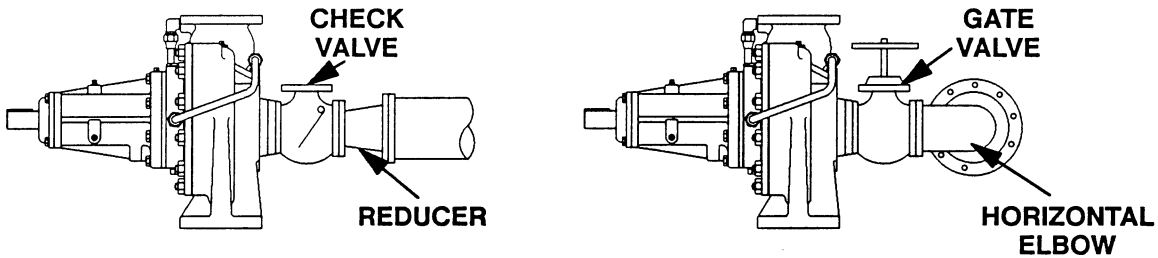
**Fittings**

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to

avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

Refer to Figure 3 for the recommended entrance conditions using fittings.

**POOR ENTRANCE CONDITIONS**



**RECOMMENDED ENTRANCE CONDITIONS**

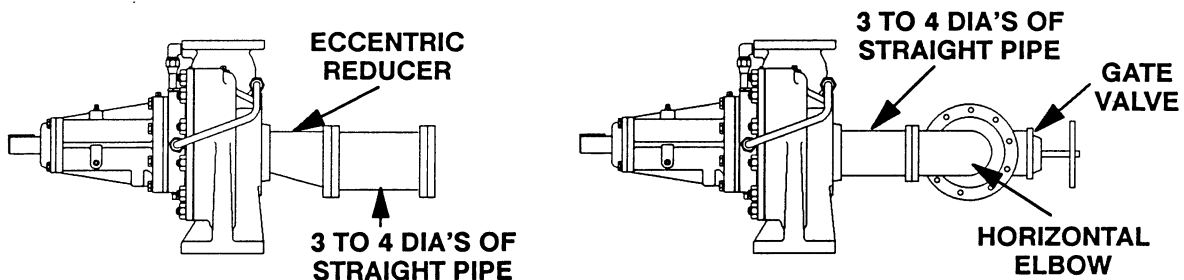


Figure 3. Entrance Conditions Using Fittings

## Strainers

A suction strainer was not furnished with this pump since it is **not** designed to handle liquids containing solids. However, to protect the pump from accidental damage a commercially available 80 mesh screen should be installed in the suction line. Make certain that the total open area of the screen is at least three or four times the cross section of the suction line to ensure an adequate supply of liquid to the pump.



**DAMAGE TO THE PUMP RESULTING FROM DEBRIS IN THE SUCTION LINE WILL NOT BE COVERED BY THE PUMP WARRANTY. BEFORE CONNECTING THE SUCTION AND DISCHARGE PIPING, CAREFULLY CHECK THE STORAGE TANK AND PIPING FOR CONSTRUCTION DEBRIS SUCH AS NUTS, BOLTS, WIRE, WELD SLAG, AND OTHER FOREIGN MATERIAL. INSTALL A COMMERCIALY AVAILABLE 80 MESH SCREEN AND A FILTER IN THE SUCTION LINE TO PREVENT DEBRIS FROM ENTERING THE PUMP.**

## Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

## Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a

distance equal to 1 1/2 times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance 1 1/2 times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least 3 times the diameter of the suction pipe.

## Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 4 shows recommended minimum submergence vs. velocity.

## NOTE

*The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).*

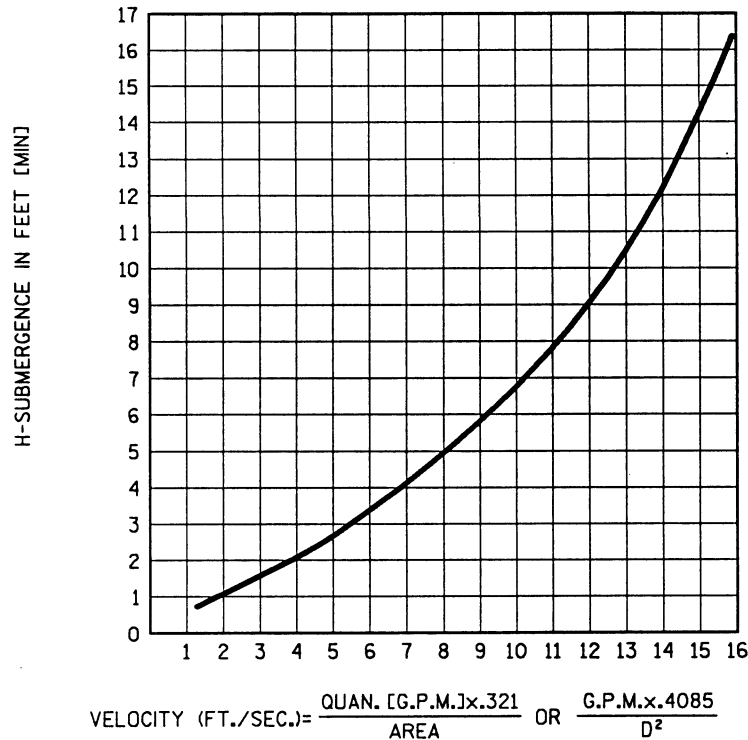


Figure 4. Recommended Minimum Suction Line Submergence vs. Velocity

**DISCHARGE LINES**

**Siphoning**

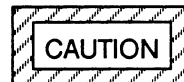
Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

**Valves**

This pump is provided with an Air Release Valve which works in conjunction with the integral priming pump to expel and prevent recirculation of air or vapor ejected during the priming cycle. The Air Release Valve will **not** serve as a throttling valve or check valve in the system piping. If the application involves static discharge head or suction pressure, system check valve **must** be installed to prevent siphoning or loss of prime through the pump.

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.



IF THE APPLICATION INVOLVES A HIGH DISCHARGE HEAD, GRADUALLY CLOSE THE DISCHARGE THROTTLING VALVE BEFORE STOPPING THE PUMP.

**Air Release Valve Venting**

When ordered as a factory installed option, the Air Release Valve is shipped mounted on the pump base with the valve tubing connected. If the Air Release Valve is shipped separately, refer to the installation instructions accompanying the Valve.

Remove the shipping plug in the head of the Air Release Valve so that normal operation and venting can take place. It is suggested that a length of 3/4 inch tubing be installed in the shipping plug opening so that hazardous vapors can be carried away from the immediate vicinity of the pump.

**NOTE**

When two pumps equipped with Air Release Valves are installed in parallel, a check valve must be installed in the venting lines.



IF THE PUMP IS INSTALLED WITHIN A CLOSED BUILDING SUCH AS A PUMP HOUSE, VENTING LINES TO THE OUTSIDE OF THE BUILDING SHOULD BE INSTALLED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

**Bypass Lines**

The integral Roto-Prime<sup>™</sup> priming pump and Air Release Valve work in conjunction with three tube assemblies. One tube assembly draws vapor from the suction flange of the centrifugal pump to the suction port of the priming pump. Another assembly discharges the vapor to the air release. The third tube assembly returns any accumulated liquid from the bottom of the cylindrical air release chamber back into the suction flange of the centrifugal pump.

**ALIGNMENT**

The alignment of the pump and its power source is critical for trouble-free mechanical operation. In either a flexible coupling or V-belt driven system, the driver and pump must be mounted so that their shafts are aligned with and parallel to each other. It is imperative that alignment be checked after the pump and piping are installed, and before operation.

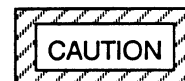
**NOTE**

Check **Rotation**, Section C, before final alignment of the pump.

When mounted at the Gorman-Rupp factory, driver and pump are aligned before shipment. Misalignment will occur in transit and handling. Pumps must be checked and realigned before operation. Before checking alignment, tighten the foundation bolts. The pump casing feet and/or pedestal feet, and the driver mounting bolts should also be tightly secured.



**WHEN CHECKING ALIGNMENT, DISCONNECT THE POWER SOURCE TO ENSURE THAT THE PUMP WILL REMAIN INOPERATIVE.**

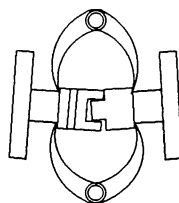


ADJUSTING THE ALIGNMENT IN ONE DIRECTION MAY ALTER THE ALIGNMENT IN ANOTHER DIRECTION. CHECK EACH PROCEDURE AFTER ALTERING ALIGNMENT.

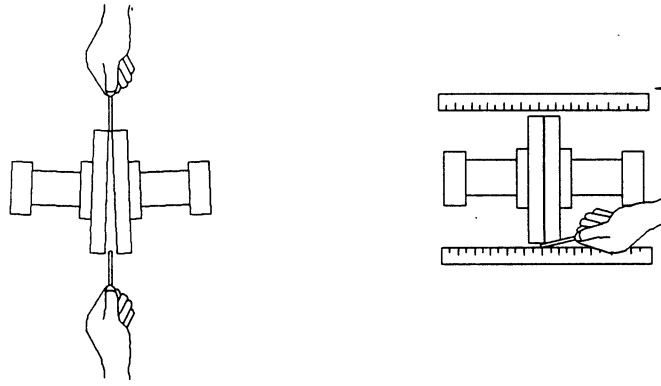
**Coupled Drives**

When using couplings, the axis of the power source must be aligned to the axis of the pump shaft in both the horizontal and vertical planes. Most couplings require a specific gap or clearance between the driving and the driven shafts. Refer to the coupling manufacturer's service literature.

Align spider insert type couplings by using calipers to measure the dimensions on the circumference of the outer ends of the coupling hub every 90 degrees. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 5A).



**Figure 5A. Aligning Spider-Type Couplings**



**Figure 5B. Aligning Non-Spider Type Couplings**

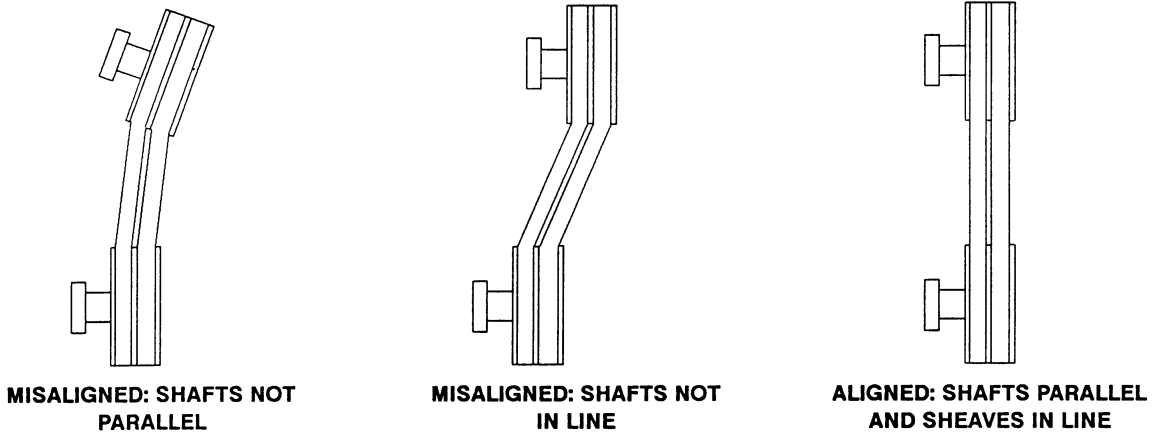
Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90 degrees. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 5B).

straightedge to measure the amount of misalignment.

**V-Belt Drives**

Check parallel adjustment by laying a straightedge across both coupling rims at the top, bottom, and side. When the straightedge rests evenly on both halves of the coupling, the coupling is in horizontal parallel alignment. If the coupling is misaligned, use a feeler gauge between the coupling and the

When using V-belt drives, the power source and the pump must be parallel. Use a straightedge along the sides of the pulleys to ensure that the pulleys are properly aligned (see Figure 5C). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.



**Figure 5C. Alignment of V-Belt Driven Pumps**

Tighten the belts in accordance with the belt manufacturer's instructions. If the belts are too loose, they will slip; if the belts are too tight, there will be excessive power loss and possible bearing failure. Select pulleys that will match the proper speed ratio; overspeeding the pump may damage both pump and power source.



**DO NOT OPERATE THE PUMP WITHOUT THE GUARD IN PLACE OVER THE ROTATING PARTS. EXPOSED ROTATING PARTS CAN CATCH CLOTHING, FINGERS, OR TOOLS, CAUSING SEVERE INJURY TO PERSONNEL.**



## OPERATION – SECTION C

Review all warnings in Section A.

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



**THIS PUMP IS DESIGNED TO HANDLE PETROLEUM PRODUCTS OR OTHER SIMILAR HYDRO-CARBON 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.**



PUMP SPEED AND OPERATING CONDITION POINTS MUST BE WITHIN THE CONTINUOUS PERFORMANCE RANGE SHOWN ON THE CURVE. (SEE SECTION E, PAGE 1.)

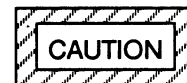
### PRIMING

Install the pump and piping as described in **INSTALLATION**. Make sure that the piping connections are tight, and that the pump is securely mounted. Check

that the pump is properly lubricated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).



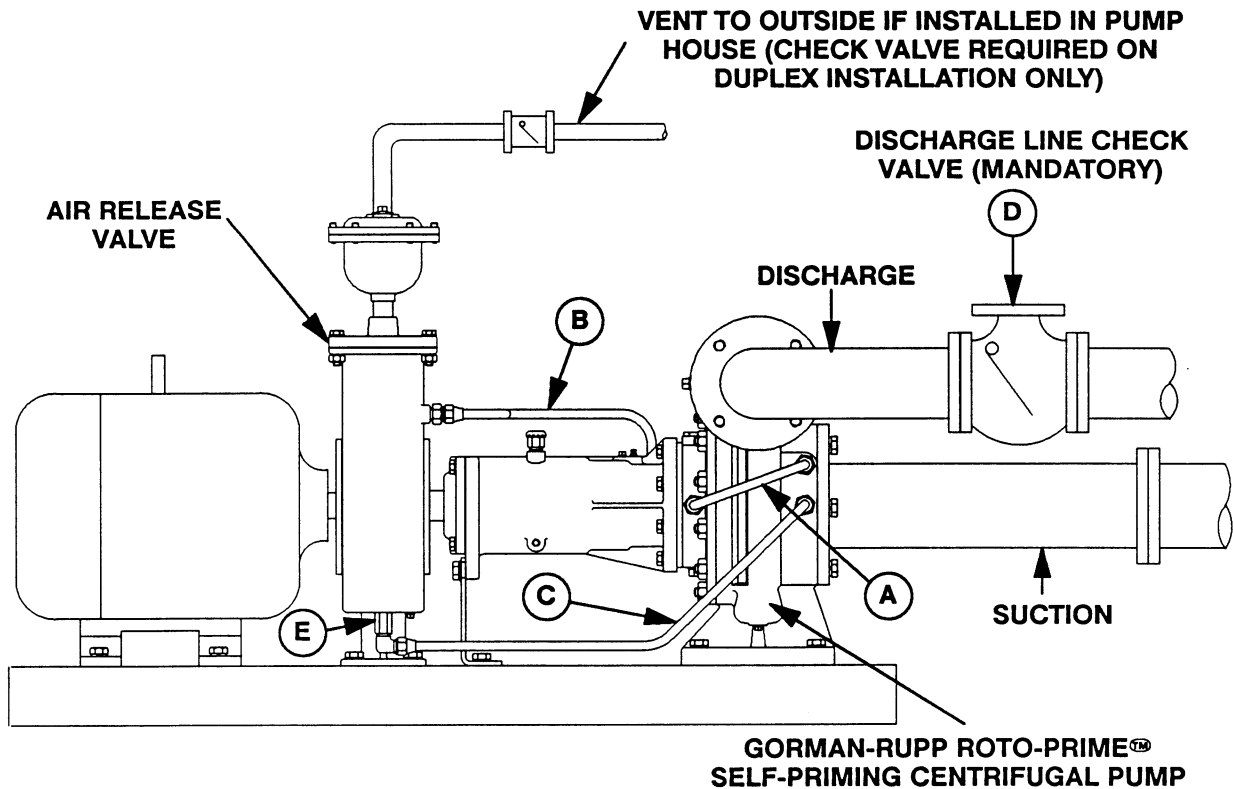
**NEVER OPERATE THIS PUMP UNLESS THERE IS LIQUID IN THE PUMP CASING. THE PUMP WILL NOT PRIME WHEN DRY. EXTENDED OPERATION OF A DRY PUMP WILL DESTROY THE SEAL ASSEMBLY.**



IF THE PUMP IS INSTALLED WITHIN A CLOSED BUILDING SUCH AS A PUMP HOUSE, VENTING LINES TO THE OUTSIDE OF THE BUILDING SHOULD BE INSTALLED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

### Air Release Valve

When properly installed, the Air Release Valve allows the integral Roto-Prime<sup>®</sup> priming pump to overcome relatively high static discharge heads or back pressure during the priming cycle. Figure 1 shows a schematic configuration of the valve and is keyed to the following description of operation.



**Figure 1. Gorman-Rupp Air Release Valve Connected To Roto-Prime™ Pump**

The Air Release Valve is designed with an air valve in the head of the assembly and a sump valve in the base of the assembly. These valves are controlled by a common rod which is moved vertically by an attached float.

When the pump is first installed, there is air in the suction line, the Air Release Valve is open, and there is back pressure against the discharge line check valve "D".

When the pump is started, air is drawn from the suction line into the priming pump through the priming tube "A", compressed by the priming pump, and discharged through the discharge tube "B" to the Air Release Valve. This air and vapor is then vented to the atmosphere through the valve head.

With the float down, sump valve "E" is closed; air cannot re-enter the suction piping through the return tube assembly "C".

As product fills the pump casing, the impeller develops pressure, opening check valve "D" in the discharge piping. The priming pump will deliver product, filling the float chamber. The float will rise, opening sump valve "E", and closing the air valve.

**VENT TO OUTSIDE IF INSTALLED IN PUMP HOUSE (CHECK VALVE REQUIRED ON DUPLEX INSTALLATION ONLY)**

**DISCHARGE LINE CHECK VALVE (MANDATORY)**

**DISCHARGE**

**SUCTION**

**GORMAN-RUPP ROTO-PRIME™  
SELF-PRIMING CENTRIFUGAL PUMP**

The product recirculates through the return tube assembly "C" to the pump suction flange. The liquid pressure equalizes the priming pump spring pressure and the priming pump slides into neutral. At this point the pump is fully primed.

In neutral position the priming pump circulates a small amount of liquid through the discharge tube to the float chamber through the return tube and back into the suction flange.

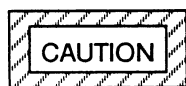
If air or vapor enters the suction piping during the pumping operation, again the discharge line check valve will close, and the priming pump will again evacuate the air through the Air Release Valve.

#### **Priming Pump**

Before starting the pump for the first time, remove the 1/8-inch NPT pipe plug (located at the 10 o'clock position in the priming pump housing, above the seal area when viewed from the drive end). Pour approximately 8 ounces of SAE 10 or 20 non-detergent oil into the housing to lubricate the shaft seal and group grind rotor blades. Reinstall the plug.

Whenever air or vapor is present in the suction line, whether at start-up or during pumping operation, the

spring located on top of the rotor forces the group grind into its maximum eccentric position to automatically evacuate the air vapor through the priming tube and into the pump discharge.



WHEN THE PUMP IS INSTALLED UNDER UNUSUAL CONDITIONS, THE PRIMING TUBE(S) MAY VIBRATE ABNORMALLY. IF THIS OCCURS AFTER THE PUMP AND PIPING ARE PROPERLY SECURED, CONTACT THE FACTORY TO OBTAIN OPTIONAL SPRINGS FOR THE PRIMING PUMP GROUP GRIND. IF VIBRATION IS NOT CORRECTED, THE TUBING COULD FATIGUE AND

SPILL THE LIQUID BEING PUMPED, RESULTING IN A FIRE HAZARD.

As air and vapor is evacuated and the main centrifugal pump begins to deliver liquid, the resulting priming pump discharge pressure builds up against the underside of the slide and moves it toward the neutral (centered) position. After all the air and vapor is removed and the centrifugal pump reaches full capacity, the priming pump discharge pressure overcomes the spring pressure on the slide and moves it towards the neutral position where it remains until air or vapor enters the system. While in the neutral position, the priming pump operates at minimum capacity and circulates only a small amount of liquid. See Figure 2 for the theory of priming pump operation.

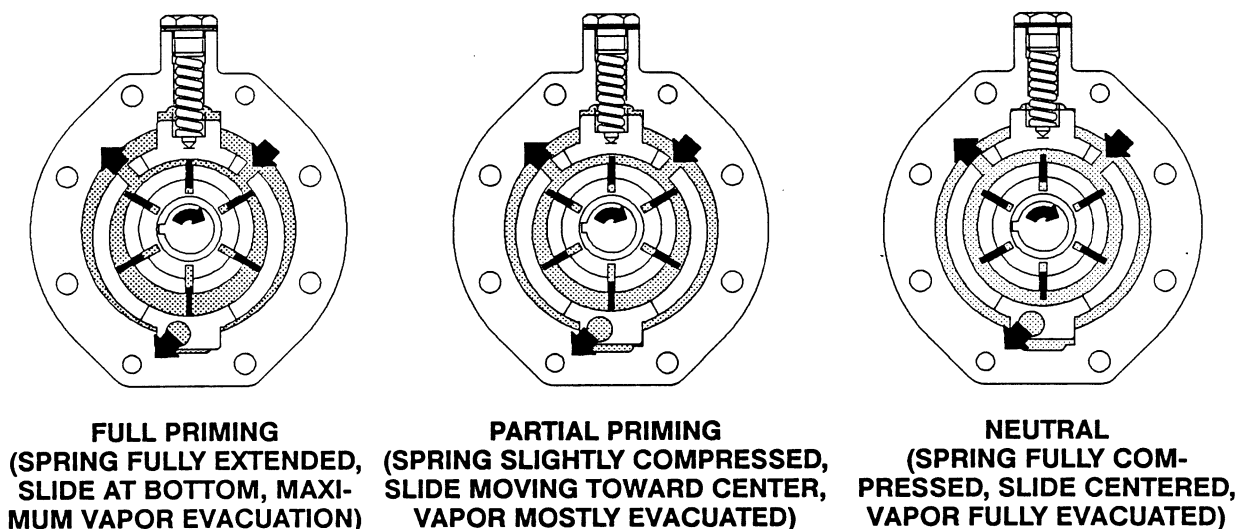


Figure 2. Automatic Priming Sequence

Priming is rapid, but not instantaneous. The priming pump will prime an absolutely dry line of four inch diameter in approximately two seconds per foot of suction pipe. Thus, if the suction line is 10 feet long, the pump will prime in approximately 20 seconds. If the pump continually handles dry liquids, such as gasoline or solvents, priming pump vane wear may result, causing a loss of priming vacuum. If priming time increases significantly over a period of time, check the priming pump vanes for excessive wear.

#### NOTE

A special seal is available for pumps which are to handle solvents. When ordering a pump or replacement parts, specify what solvent the pump is to handle.

#### Priming Pump Group Grind Check

With the pump inoperative, remove the group grind drain plug and drain any liquid from the group grind. 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.

## STARTING

Consult the operations manual furnished with the power source.

Before connecting a motor to the incoming power, check that the electrical service available matches the pump motor requirements stamped on the motor nameplate. Check that the motor speed meets pump specifications. This pump is designed to be driven at a maximum full load speed of 3450 RPM.

### Rotation

The correct direction of pump rotation is indicated by an arrow on the pump body or accompanying decal. The pump could be damaged and performance adversely affected by incorrect rotation. If pump performance is not within the specified limits (see the curve on page E-1), check the direction of rotation before further troubleshooting.

Consult the operating manual furnished with the power source before attempting to start the power source.

If an electric motor is used to drive the pump, remove V-belts, couplings, or otherwise disconnect the pump from the motor before checking motor rotation. Operate the motor independently while observing the direction of the motor shaft, or cooling fan.

If rotation is incorrect on a three-phase motor, have a qualified electrician interchange any two of the three phase wires to change direction. If rotation is incorrect on a single-phase motor, consult the literature supplied with the motor for specific instructions.

## OPERATION

### Leakage

No leakage should be visible at pump mating surfaces, or at pump connections or fittings. Keep all line connections and fittings tight to maintain maximum pump efficiency.

### Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 160°F (71°C). Do not apply it at a higher operating temperature.

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.



**ALLOW AN OVER-HEATED PUMP TO COOL BEFORE SERVICING. DO NOT REMOVE PLATES, COVERS, GAUGES, OR FITTINGS FROM AN OVER-HEATED PUMP. LIQUID WITHIN THE PUMP CAN REACH BOILING TEMPERATURES, AND VAPOR PRESSURE WITHIN THE PUMP CAN CAUSE PARTS BEING DISENGAGED TO BE EJECTED WITH GREAT FORCE. AFTER THE PUMP COOLS, DRAIN THE LIQUID FROM THE PUMP BY REMOVING THE CASING DRAIN PLUG. USE CAUTION WHEN REMOVING THE PLUG TO PREVENT INJURY TO PERSONNEL FROM HOT LIQUID.**

### Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

### Pump Vacuum Check

#### NOTE

*Petroleum products are very sensitive to changes in temperature. Warmer temperatures elevate the product vapor pressure resulting in low vacuum readings. Do not mistake temperature problems for faulty pump installation or performance.*

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block

the suction line and start the pump. At operating speed the pump should pull a vacuum of 15 to 17 inches (381 to 432 mm) or more of mercury for petroleum. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

## STOPPING

Never halt the flow of liquid suddenly. If the liquid being pumped is stopped abruptly, damaging shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly.



IF THE APPLICATION INVOLVES A HIGH DISCHARGE HEAD, GRADUALLY CLOSE THE DISCHARGE THROTTLING VALVE BEFORE STOPPING THE PUMP.

After stopping the pump, shut off the incoming power and lock it out, or take other action to ensure that the pump will remain inoperative.

### Cold Weather Preservation

Since the application of this pump is limited to petroleum products, normal freezing conditions will not

damage the pump. However, during extremely severe conditions care should be exercised during start-up, especially if the pump has been idle for more than a few hours.

## BEARING TEMPERATURE CHECK



MONITOR THE CONDITION OF THE BEARING LUBRICANT REGULARLY FOR EVIDENCE OF RUST OR MOISTURE CONDENSATION. THIS IS ESPECIALLY IMPORTANT IN AREAS WHERE VARIABLE HOT AND COLD TEMPERATURES ARE COMMON.

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160°F (71°C) are considered normal for bearings, and they can operate safely to at least 180°F (82°C).

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION** in Section E). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.



## TROUBLESHOOTING – SECTION D

Review all WARNINGS in Section A.



### BEFORE ATTEMPTING TO OPEN OR SERVICE THE PUMP:

1. FAMILIARIZE YOURSELF WITH THIS MANUAL.
2. SHUT OFF THE INCOMING POWER AND LOCK IT OUT OR TAKE OTHER ACTION TO ENSURE THAT THE PUMP WILL REMAIN INOPERATIVE.
3. ALLOW THE PUMP TO 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.	Correct leak.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift too high.	Measure lift with vacuum gauge. Reduce lift and/or friction losses in suction line.
	Product vapor pressure too high.	Cool pump and product suction line.
	Pump speed too slow.	Check driver output; check belts or couplings for slippage.
	Pump running backwards.	Check direction of rotation and correct by interchanging any two motor leads at control box. (See <b>Pump Rotation</b> , Section C).
	Priming pump vanes worn; rotor clogged or stuck.	Check slide and replace vanes.
Strainer clogged.	Check strainer and clean if necessary	

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	<p>Air leak in suction line.</p> <p>Leaking or worn seal or pump gasket.</p> <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>Correct leak.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</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 shut-off.</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	Solids or debris jamming impeller or priming pump.	Check suction line and storage tank for foreign matter. Install or clean strainer screen.

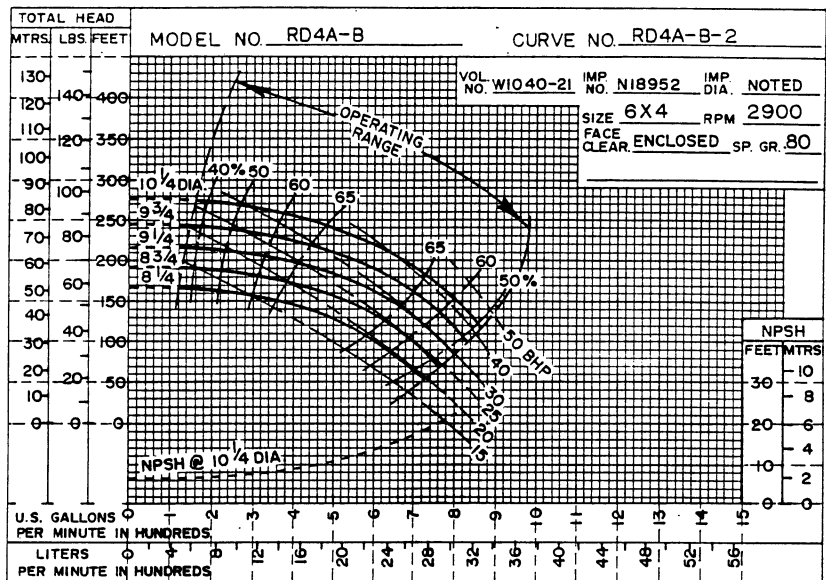
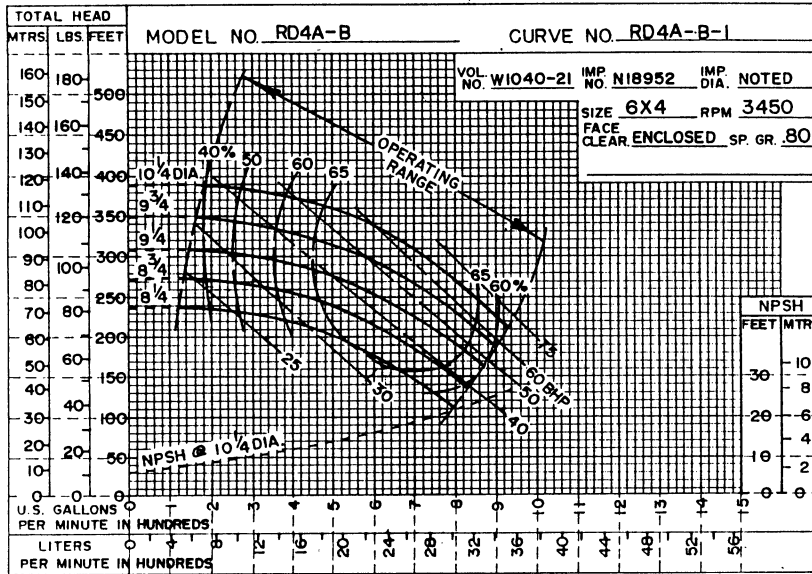


TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.  Suction and discharge lines not properly supported.  Low or incorrect lubricant.  Drive misaligned; piping improperly installed.	Check bearing temperature regularly to monitor any increase.  Check piping installation for proper support.  Check for proper type and level of lubricant.  Realign drive and piping at operating temperature. Add expansion joints if required.



# PUMP MAINTENANCE AND REPAIR - SECTION E

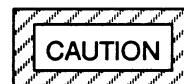
MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



**\* STANDARD PERFORMANCE FOR PUMP MODELS RD4A3-BAR AND RD4A32-BAR**

\* Based on 70° F (21 ° C) clear water at sea level, corrected to 0.80 specific gravity, with minimum suction lift. Since pump installations are seldom identical, your performance may be difference due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

Contact the Gorman-Rupp Company to verify performance or part numbers.



If your pump serial number is followed by an "N", your pump is **NOT** a standard production model.

PUMP SPEED AND OPERATING CONDITION POINTS MUST BE WITHIN THE CONTINUOUS PERFORMANCE RANGE SHOWN ON THE CURVE.

SECTION DRAWING

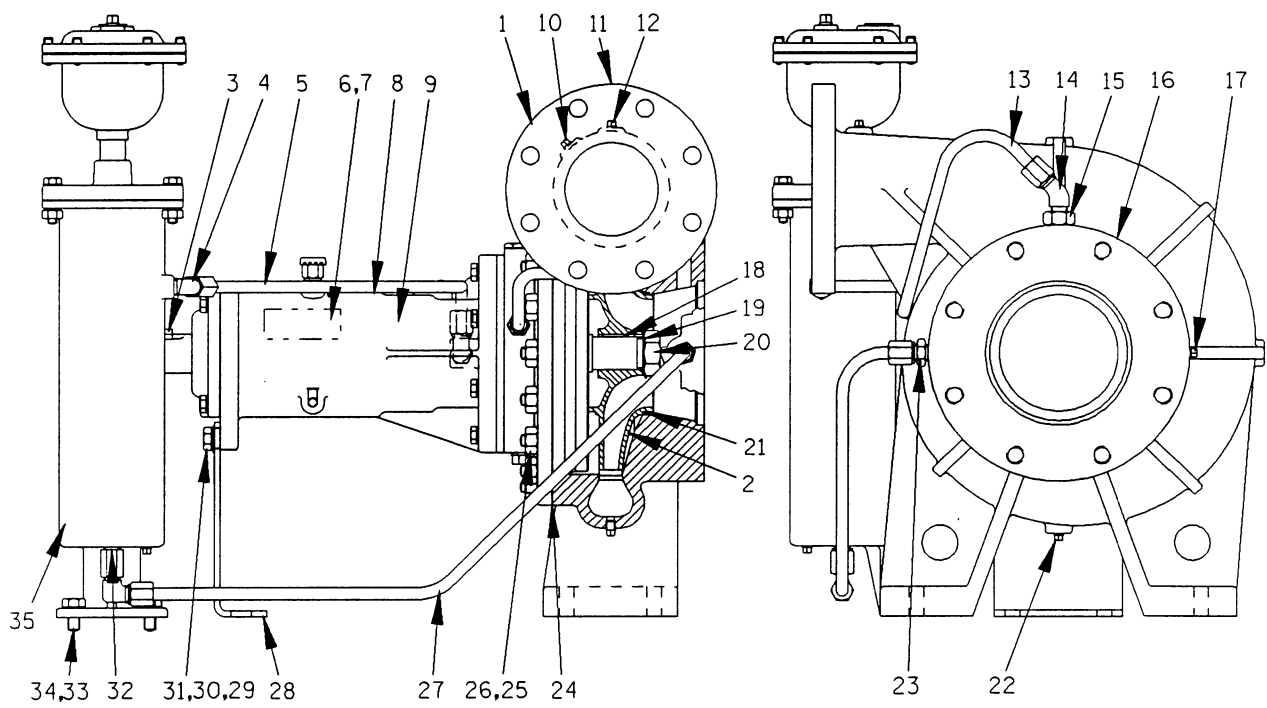


Figure 1. Pump Models RD4A3-BAR and RD4A32-BAR

**PARTS LIST**  
**Pump Models RD4A3-BAR and RD4A32-BAR**  
 (From S/N 946734N up)

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify part numbers.

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING (RD4A3-BAR) (RD4A32-BAR)	W01040-21	10020	1	22	PIPE PLUG	P02	11990	1
2 *	IMPELLER	N18952	13040	1	23	CONNECTOR	25812-214	-----	1
3 *	SHAFT KEY	N0611	15990	1	24 *	PUMP CASING GASKET	R11618	20000	1
4	MALE ELBOW	25812-161	-----	1	25	STUD	C0807	15991	18
5	DISCH TUBE ASSY	R12175	-----	1	26	HEX NUT	D08	15991	18
6	NAME PLATE	2613DZ	13990	1	27	RETURN TUBE ASSY	T07256	-----	1
7	DRIVE SCREW	BM#04-03	15990	2	28	BEARING HSG SUPPORT	R12852-02	15990	1
8	LUBE DECAL	38816-074	-----	1	29	HEX HD CAPSCREW	B0805	15991	2
9	BRG HOUSING ASSY (RD4A3-BAR) (RD4A32-BAR)	44143-106 44143-107	----- -----	1 1	30	LOCKWASHER	J08	15991	2
10	PIPE PLUG	P02	11990	1	31	FLAT WASHER	K08	15991	2
11	DISCHARGE STICKER	6588BJ	-----	1	32	MALE ELBOW	25812-011	-----	1
12	PIPE PLUG	P02	11990	1	33	HEX HD CAPSCREW	B0805	15991	2
13	SUCT TUBE ASSY	R11643	-----	1	34	LOCKWASHER	J08	15991	2
14	MALE ELBOW	25812-161	-----	1	35 ●	AIR RELEASE VALVE	GRPP33-06A	-----	1
15	STRAINER	26841-074	-----	1	NOT SHOWN:				
16	SUCTION STICKER	6588AG	-----	1	* SUCT FLANGE GSKT	1679G	18000	1	
17	PIPE PLUG	P02	11990	1	* DISCH FLANGE GASKET	N14147	18000	1	
18 *	IMPELLER KEY	K79330-23	15990	1	INSTRUCTION TAG				
19	LOCKWASHER	S302	-----	1	OPTIONAL:				
20	IMPELLER NUT	K76645	15111	1	DISCHARGE CHECK VALVE				
21 †	WEAR RING	NOT AVAILABLE		2	-CHECK VALVE	26642-205	-----	1	
					-CHECK VALVE GSKT	K79206-29	-----	1	
					-HEX HD CAPSCREW	B1011	15991	8	
					-HEX NUT	D10	15991	8	
					BRONZE IMPELLER	N18952	14150	1	

\* INDICATES PARTS RECOMMENDED FOR STOCK

Above Serial Numbers Do Not Apply To Pumps Made In Canada.

CANADIAN SERIAL NO. .... AND UP

† ALL ROTO-PRIME® IMPELLERS ARE TRIMMED AND INCLUDE WEAR RINGS AND GROOVE PINS. WEAR RINGS ARE NOT SOLD SEPARATELY.

● SEE ACCOMPANYING LITERATURE FOR INDIVIDUAL PARTS, MAINTENANCE AND REPAIR.

SECTION DRAWING

SEAL AREA DETAIL

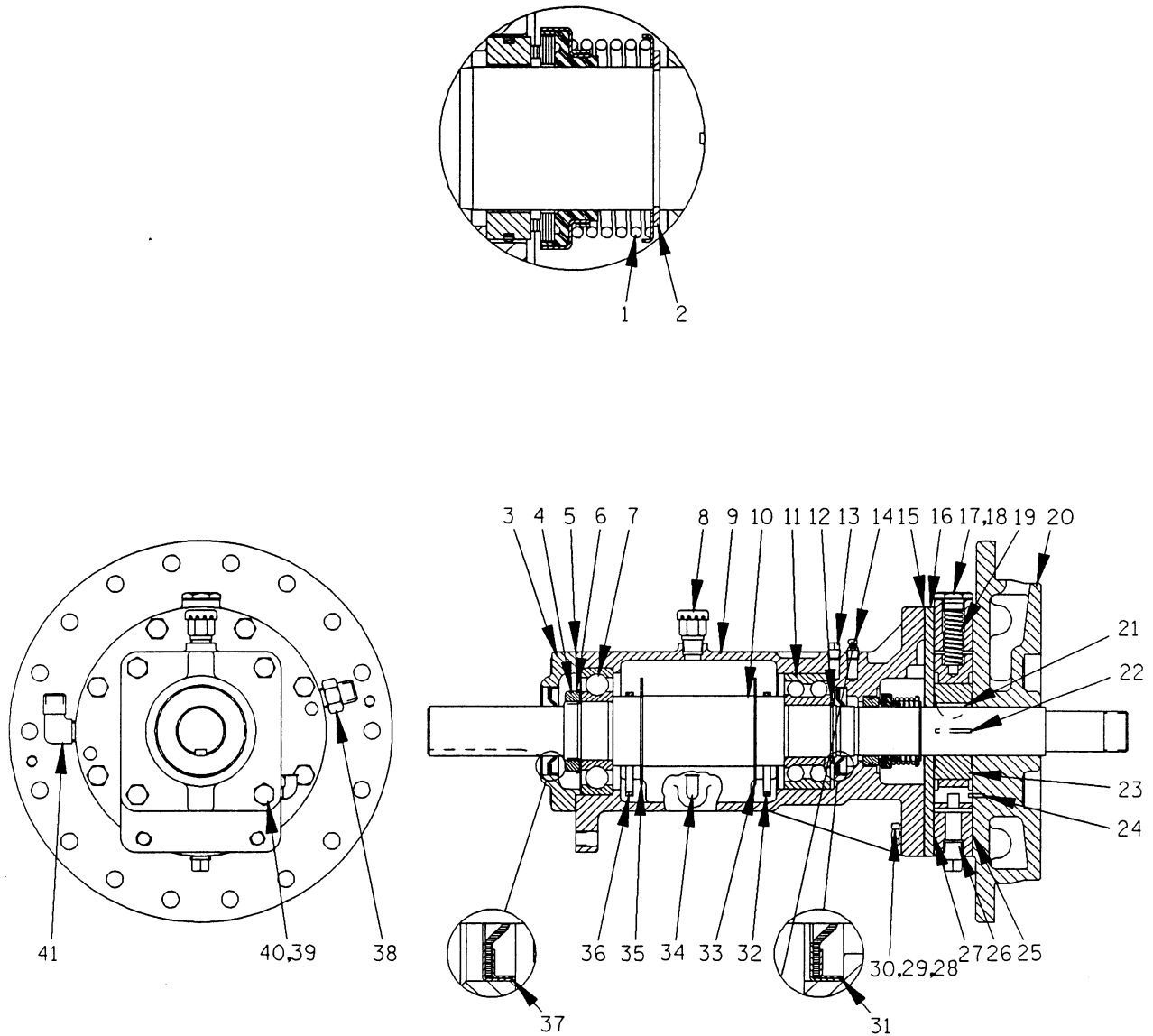


Figure 2. 44143-106 and 44143-107 Bearing Housing Assemblies

**PARTS LIST**  
**44143-106 and 44143-107 Bearing Housing Assemblies**

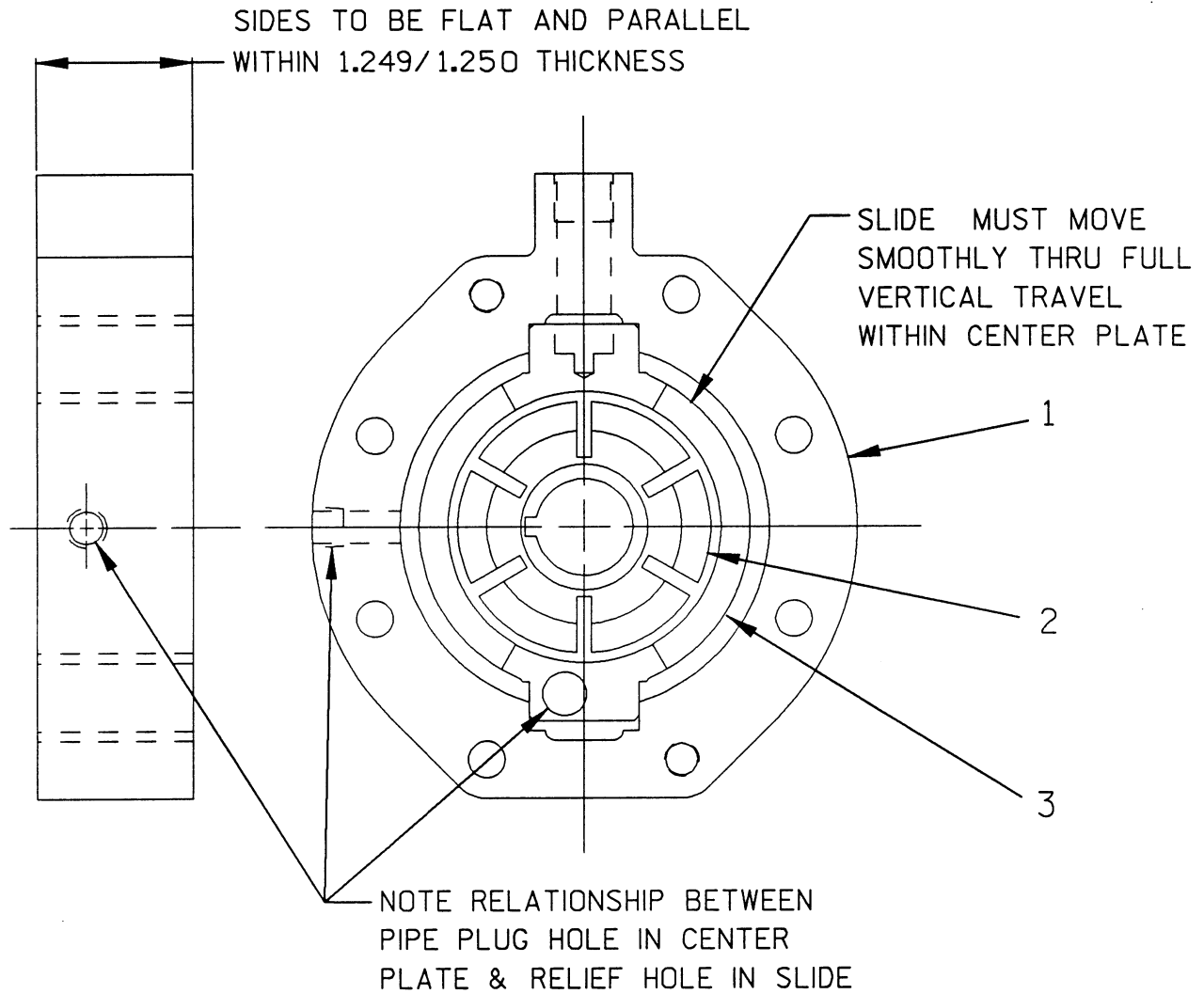
ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1 *	SEAL ASSEMBLY	25271-921	-----	1		(RD4A32-BAR)	LK5268	-----	1
2	SEAL RETAINING RING	24124-243	-----	1	24 *	LOCATING PIN	21154-666	-----	1
3	BEARING CAP	R12770-02	10010	1	25 †	CENTER PLATE GASKET	R10150	18010	1
4	BEARING LOCK NUT	23962-011	-----	1	26	PIPE PLUG	P06	11990	1
5 *	BEARING CAP GASKET	N18938-01	18000	1	27 *	CENTER PLATE GASKET	R10150	18010	1
6	TAB WASHER	23962-511	-----	1	28	HEX HD CAPSCREW	21632-611	-----	8
7 *	OUTBOARD BEARING	23275-211	-----	1	29	LOCKWASHER	J06	15991	8
8	AIR VENT	S1703	-----	1	30	DOWEL PIN	21133-113	-----	2
9	BEARING HOUSING	W01172-04	10020	1	31 *	OIL SEAL	25227-240	-----	1
10 *	IMPELLER SHAFT	T08623-02	15010	1	32	SLINGER RING	K86483	15030	1
11 *	BALL BEARING	23421-410	-----	1	33	SLINGER RING STOP	K76632-01	-----	1
12	BEARING RET RING	24124-245	-----	1	34	OILER	26713-054	-----	1
13	PIPE PLUG	P02	11990	1	35	SLINGER RING STOP	K76632-01	-----	1
14	AIR VENT	S2162	-----	1	36	SLINGER RING	K86483	15030	1
15 *	SPACER PLATE GASKET	R12923	18000	1	37 *	OIL SEAL	25227-240	-----	1
16	SPACER PLATE	R12771-02	10020	1	38	CONNECTOR	25812-214	-----	1
17	PRESS REG SPRING CAP	K68064	15991	1	39	HEX HD CAPSCREW	21632-597	-----	4
18 *	SPRING CAP GASKET	K86067	-----	1	40	LOCKWASHER	J06	15991	4
19 *	PRESS REG SPRING	K82659	-----	1	41	MALE ELBOW	25812-011	-----	1
20	BODY COVER	T06762-21	10020	1	OPTIONAL:				
21 *	ROTOR WOODRUFF KEY	K61559	15990	1		SST IMPELLER SHAFT	T08623-02	17080	1
22 *	ROTOR BLADE	K79300-22	-----	6		TEFLON SEAL ASSY	25271-743	-----	1
23	GROUP GRIND (RD4A3-BAR)	42212-015	-----	1		GROUP GRIND WITH C.I. ROTOR (RD4A3-BAR ONLY)			
						-C.I. GROUP GRIND	LK5411	-----	1

\* INDICATES PARTS RECOMMENDED FOR STOCK

† 2 GASKETS REQUIRED WHEN ROTOR OR SLIDE IS THICKER THAN CENTER PLATE.

● ALL OTHER COMPONENTS SAME AS STANDARD BEARING HOUSING ASSEMBLY.

**SECTION DRAWING**



**PARTS LIST**

**42212-015 (RD4A3-BAR) AND LK5268 (RD4A32-BAR) Group Grind**

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	CENTER PLATE	NOT AVAILABLE	----	1
2	ROTOR	NOT AVAILABLE	----	1
3	SLIDE	NOT AVAILABLE	----	1

**NOTE: THE GROUP GRIND MUST BE REPLACED AS A COMPLETE UNIT: INDIVIDUAL PIECE PARTS ARE NOT SOLD SEPARATELY.**



## PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

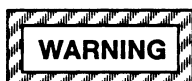
Review all warnings in Section A.

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 and 3) and the accompanying parts lists. Maintenance and repair instructions for the Air Release Valve Assembly are covered separately in the specific literature shipped with the unit.

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

Before attempting to service the pump, shut off the incoming power 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 (22, Figure 1 and 26, Figure 2). 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 AND LOCK IT OUT, OR TAKE OTHER ACTION ENSURE THAT THE PUMP WILL REMAIN INOPERATIVE.
3. ALLOW THE PUMP TO 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.



**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.**

### Power Source and Air Release Valve Removal

(Figure 1)

Remove the coupling guard and loosen the coupling on the pump drive shaft. Separate the power source and drive components from the pump and remove the drive shaft key (3).

Disconnect the air release valve discharge tube assembly (5) from the bearing housing. Disconnect the return tube assembly (27) from the pump casing (1).

If exterior venting tubing has been installed, disconnect the tubing at the air release valve. Remove the hardware (33 and 34) 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)

Disconnect the suction tube assembly (13) from the bearing housing and pump casing.

Use a suitable hoist and sling to support the bearing housing. Remove the nuts (26) and install two 3/8-16 UNC jacking screws (not supplied) in the tapped holes in the body cover (20, Figure 2). Tighten the screws evenly to prevent binding, and pull the bearing housing, body cover and assembled parts straight out of the pump casing.

Remove the pump casing gasket (24).

## Impeller Removal

### (Figure 1)

Immobilize the impeller (2) by inserting a brass rod between the impeller vanes. **Be careful** not to damage the impeller vanes. Straighten the tabs on the impeller tabwasher (19), and remove the impeller nut (20) and washer.

Remove the brass rod. Install two 1/2-13 UNC cap-screws (not supplied) in the tapped holes in the impeller, and use a suitable puller to remove the impeller from the shaft. Retain the shaft key (18).

### 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.*

## Group Grind Disassembly

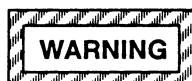
### (Figure 2)

Remove the spring cap, gasket and spring (17, 18 and 19).

Remove the hardware (28 and 29) and use a soft-faced mallet to tap around the outside diameter of the body cover (20) until it separates from the bearing housing (9) and group grind (23). Remove the outboard center plate gasket(s) (25), 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.*



**MOST CLEANING SOLVENTS ARE TOXIC AND FLAMMABLE. USE THEM ONLY IN A WELL-VENTILATED AREA FREE FROM EXCESSIVE HEAT, SPARKS, AND FLAME. READ AND FOL-**

## LOW ALL PRECAUTIONS PRINTED ON SOLVENT CONTAINERS.

If group grind replacement is necessary, tap out the group grind dowel pins (30). Slide the group grind assembly and rotor blades (22) off the shaft. Retain the rotor woodruff key (21).

Remove the inboard center plate gasket (27), spacer plate (16) and spacer plate gasket (15). Clean any gasket adhesive from the mating surfaces using solvent. **Be careful** not to scratch or mar the surfaces.

## Seal Removal

### (Figure 2)

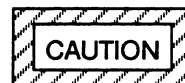
Remove the seal retaining ring (2) with caution; tension on the seal spring will be released. Remove the spring centering washer. Slide the rotating portion of the seal off the shaft, and use a stiff wire with a hooked end to remove the stationary seat. **Be careful** not to damage the seal faces.

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

## Shaft and Bearing Removal and Disassembly

### (Figure 2)

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.**

Before attempting to disassemble the bearing housing assembly, remove the oil cup (34) and drain the bearing cavity.

Disengage the hardware (39 and 40), and remove the bearing cap (3) and gasket (5). Use an arbor (or hydraulic) press to remove the oil seal (37) from the bearing cap.

Place a block of wood against the impeller end of the shaft, and tap the shaft and assembled bearings (7 and 11) from the bearing housing.

Use a screwdriver or other suitable tool to remove the inboard oil seal (31) 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.



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Clean the bearings thoroughly in **fresh** cleaning solvent.

Rotate the bearings by hand to check for roughness or binding, and inspect the bearing balls. If rotation is rough, or the 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 (12) from the impeller shaft, and use a bearing puller to remove the inboard bearing from the shaft.

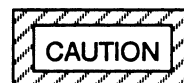
Straighten the tabs on the bearing washer (6) and remove the bearing lock nut (4) and washer. Use a bearing puller to remove the outboard bearing (7) from the shaft.

Remove the oil rings (32 and 36) and stops (33 and 35).

### 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.

Before installing the bearings, install the oil rings (32 and 36) and stops (33 and 35) on the shaft.

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.

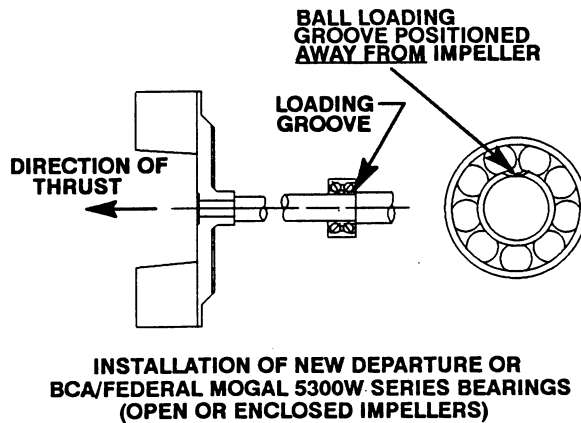
### NOTE

*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.*

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.



USE CAUTION WHEN HANDLING HOT BEARINGS TO PREVENT BURNS.



**NOTE**  
Position the inboard bearing (11) on the shaft as indicated by the following illustrations.

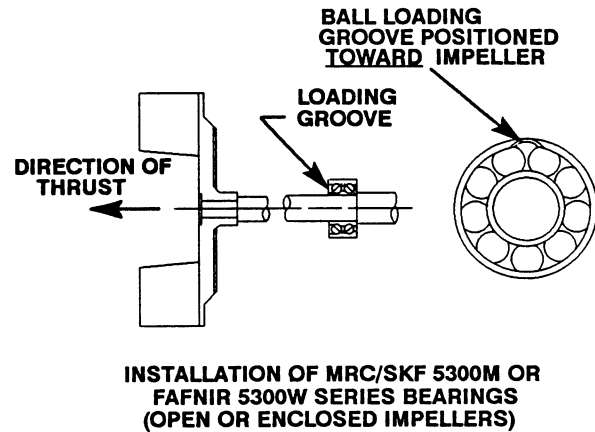
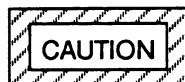


Figure 4. Bearing Installation

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.

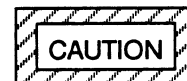


WHEN INSTALLING THE BEARINGS ONTO THE SHAFT, NEVER PRESS OR HIT AGAINST THE OUTER RACE, BALLS, OR BALL CAGE. PRESS ONLY ON THE INNER RACE.

Secure the inboard bearing on the shaft with the bearing retaining ring (12). Secure the outboard bearing (7) with the tab washer (6) and lock nut (4).

Lubricate the oil seal (31) with light oil, and position it in the bearing housing with the lip positioned as shown in Figure 2. Press the oil seal into the bearing housing until fully seated.

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 (31).



WHEN INSTALLING THE SHAFT AND BEARINGS INTO THE BEARING BORE, PUSH AGAINST THE OUTER RACE. NEVER HIT THE BALLS OR BALL CAGE.

Press the oil seal (37) into the bearing cap (3) with the lip positioned as shown in Figure 2. Replace the bearing cap gasket (5), and secure the bearing cap with the hardware (39 and 40). **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 2 and 5)

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



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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 5).

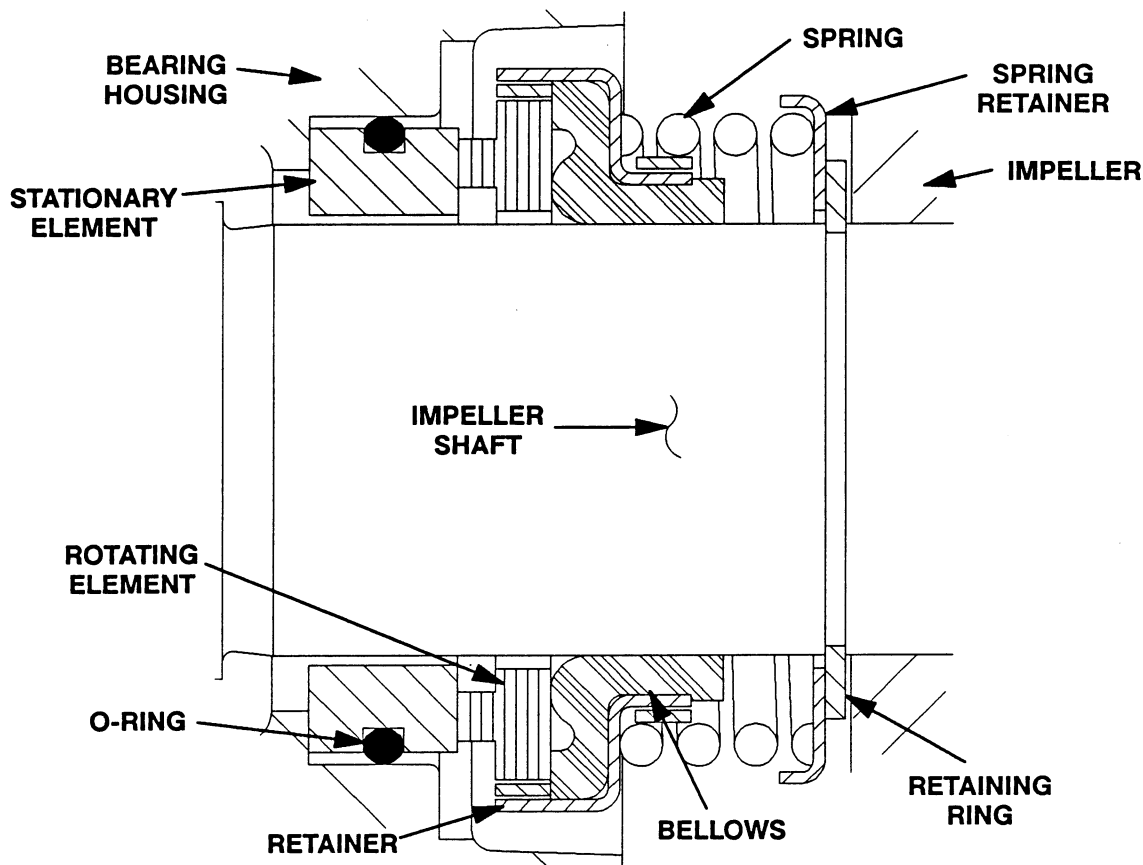


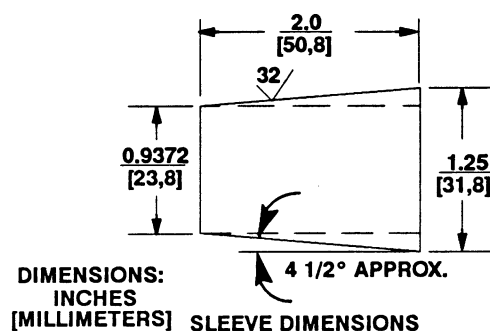
Figure 5. 25271-921 Seal Assembly



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 **GEARBOX 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 Figure 6) 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.*

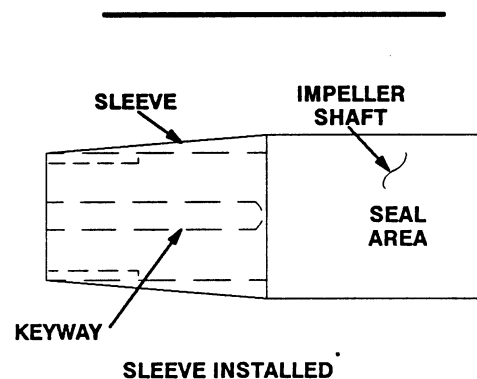


Figure 6. Seal Installation Sleeve

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 (2).

### Group Grind Reassembly

(Figure 2)

### 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.*

Install a new spacer plate gasket (15), the spacer plate (16) and inboard center plate gasket (27). Be sure the oval hole in the spacer plate matches up with the tubing hole.

Inspect the group grind rotor (2, Figure 3) 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.

Install the rotor woodruff key (21).

Install the center plate (1, Figure 3), and dowel pins (30). Install the slide (3, Figure 3) 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 (2, Figure 3) with "Hercules Moly Duo-Lube, Style 96" or equivalent lubri-

cant, and install it on the shaft. Check the rotor for free movement.

Inspect the rotor blades (22) for wear or damage and replace as required. Align the blades with the rotor slots and install the blades.

Install one outboard center plate gasket (25).

### 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 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 (24) 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 hardware (28 and 29). Be sure the dowel pins are fully seated into the body cover.

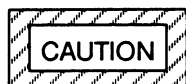
Refer to **Priming Pump Group Grind Check** in Section C, and check operation.

Install the pressure regulating spring, spring cap gasket, and spring cap (17, 18 and 19).

Refer to **Impeller Installation**.

### Group Grind Replacement

(Figure 2)



IF THE GROUP GRIND REQUIRES REPLACEMENT, IT IS **STRONGLY** RECOMMENDED THAT THE PUMP BE RETURNED TO THE FACTORY. FITTING PROCEDURES 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, and group grind parts as described in **Group Grind Installation**.

Before installing the body cover (20), 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 (19) 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 (25).

### 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 (24) 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 do disturb the position of the center plate. Secure the body cover with the hardware (28 and 29), 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 (17, Figure 1) until the shaft is rotated to check for rubbing of the inboard impeller wear ring against the body cover. If the wear ring rubs, tap the body cover with a mallet until the impeller rotates freely. Now tighten the hardware (28 and 29) securing the body cover.

### NOTE

*Fully tighten six of the capscrews (28) before replacing the two 7/16-20 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 (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 (30) in the new holes.

Refer to **Priming Pump Group Grind Check** in Section C, and check operation.

Install the pressure regulating spring, spring cap gasket, and spring cap (17, 18 and 19).

### Impeller Installation

#### (Figure 1)

Inspect the impeller (2) and replace it if cracked or badly worn. The wear rings (21) are an integral part of the impeller. If the wear rings are badly worn, the entire impeller must be replaced or returned to the factory for wear ring replacement.

Install the impeller key (18) and slide the impeller onto the shaft. Immobilize the impeller, and secure it with the tab washer (19) and impeller nut (20). Bend the tabs on the washer over the impeller nut.

Before operation, lubricate the rotor blades as indicated in **PRIMING**, Section C.

### Final Pump Assembly

#### (Figure 1)

Install the pump casing gasket (24). Install the bearing housing assembly in the pump casing, and secure it with the nuts (26).

Connect the priming tube assembly (13) to the bearing housing and pump casing.

Secure the air release valve (35) with the hardware (33 and 34). Connect the return tube assembly (27) to the pump casing, and the discharge tube assembly (5) to the bearing housing.

Install the drive shaft key (3), and reconnect the coupling and power source. Install the coupling guards.

### LUBRICATION

#### Seal Assembly

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

#### Group Grind

When starting the pump for the first time or if the pump has not been used for a long period of time, refer to **PRIMING**, Section C. In normal operation, the group grind is lubricated by the medium being pumped.

#### Bearings

#### (Figure 2)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly at the oil cup (34) and maintain it at the top of the cup. When lubrication is required, remove the air vent (8) 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.





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

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.

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