OM-03339-OB01
September 28, 1994

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

0 SERIES PUMP

MODEL

04B3D–B

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA Printed in U.S.A.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

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 an 0 Series, closed impeller, self-priming centrifugal, basic pedestal mounted model, designed with straigh-in suction, without a suction check valve. The pump's double seal design allows it to handle petroleum products and/or industrial hydrocarbons where product vapors cannot be allowed to escape into the atmosphere.

The basic material of construction for wetted parts is gray iron, with bronze impeller and gray iron wear rings.

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

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:

DANGER!

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.

WARNING!

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.

CAUTION

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

NOTE

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

SAFETY - SECTION A

This information applies to 0 Series basic pumps. Gorman-Rupp 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.

WARNING!

Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Disconnect or lock out the power supply, or take other precautions 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.

WARNING!

This pump is designed to handle petroleum products and/or industrial hydrocarbons where product vapors cannot be allowed to escape into the atmosphere. Do not attempt to pump any liquids which may damage the pump or endanger personnel as a result of pump failure.

WARNING!

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

WARNING!

Do not operate the pump without shields and/or guards in place over rotating parts. Exposed rotating parts can catch clothing, fingers or tools, causing severe injury to personnel.

WARNING!

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.

WARNING!

Overheated pumps can cause severe burns and injuries. 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.

WARNING!

Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to cool before servicing.

INSTALLATION – SECTION B

Review all SAFETY information 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 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 specific 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 as 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

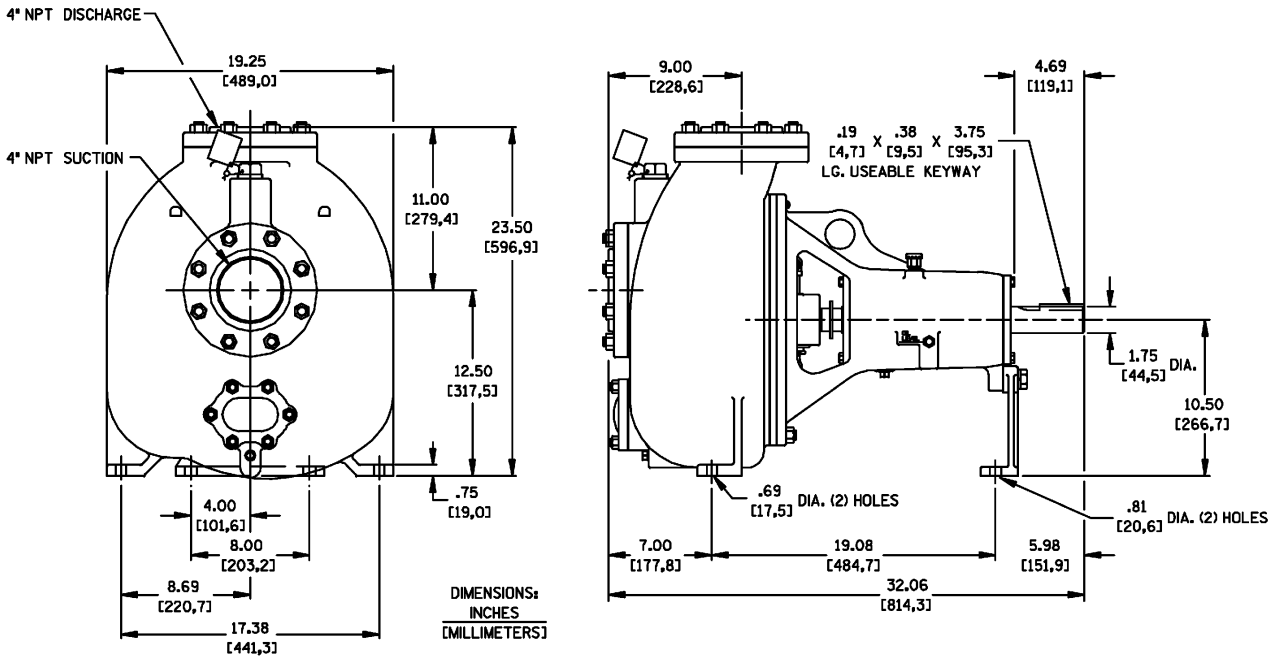


Figure 1. Pump Model 04B3D--B

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.

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

WARNING!

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. The bail is intended for use in lifting the pump assembly only. Suction and discharge hoses and piping must be removed from the pump before lifting.

Lifting

Use lifting equipment with a capacity of at least **2,175 pounds (985 kg.)**. The pump weighs approximately **435 pounds (197 kg.)**, not including the weight of any customer installed options. Customer installed equipment such as suction and discharge piping **must** be removed before attempting to lift.

CAUTION

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.

The pump may have to be supported or shimmed to provide for level operation or to eliminate vibration.

Seal Flush Lines

The seal plate is equipped with fittings for connection to an external source of liquid for flushing and cooling the seal assembly. If flushing the seal is necessary, be sure the liquid used is compatible with the liquid being pumped and that all connections are tight to avoid leakage.

SUCTION AND DISCHARGE PIPING

Pump performance is adversely effected by increased suction lift, discharge elevation, and friction losses. Contact the factory 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 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.

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.

Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 1/2-inch diameter spherical solids.

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 air-tight 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 2 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).

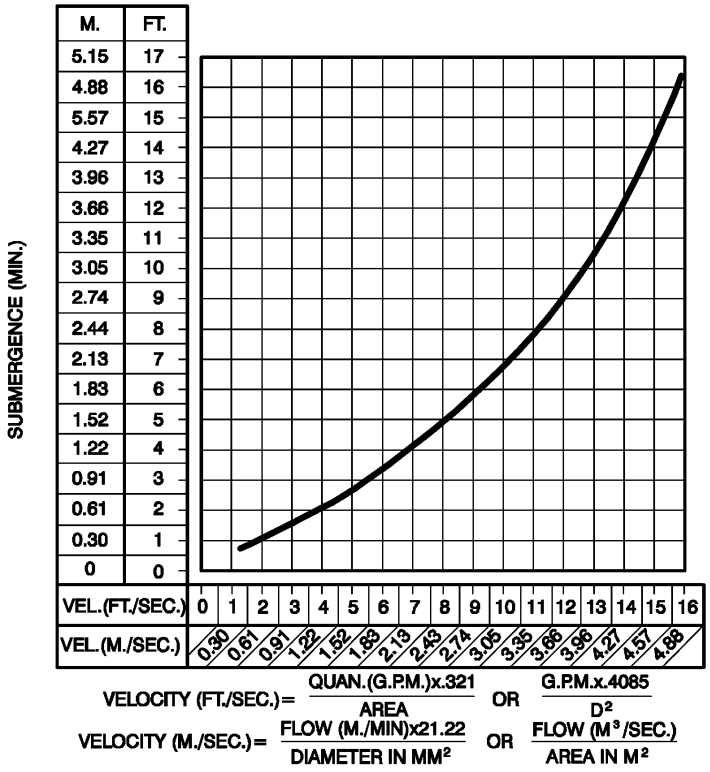


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

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

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.

CAUTION

If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

Bypass Lines

If it is necessary to vent trapped vapors from the top of the pump during initial priming or in the re-priming cycle, install a bypass line from the top of the pump, back to the source of the liquid. The end of the bypass line must be submerged. The line must be large enough to prevent clogging, but not so large as to affect pump discharge capacity.

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.

WARNING!

When checking alignment, disconnect the power source to ensure that the pump will remain inoperative.

CAUTION

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°. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 3A).

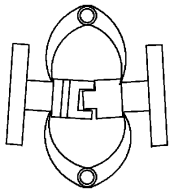


Figure 3A. Aligning Spider-Type Couplings

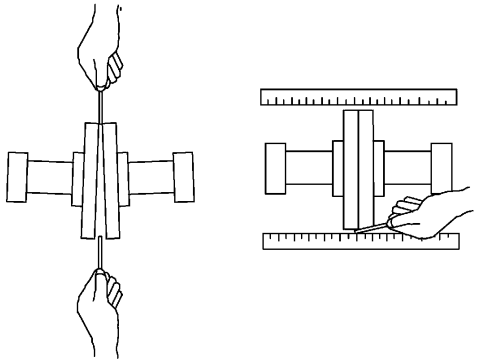


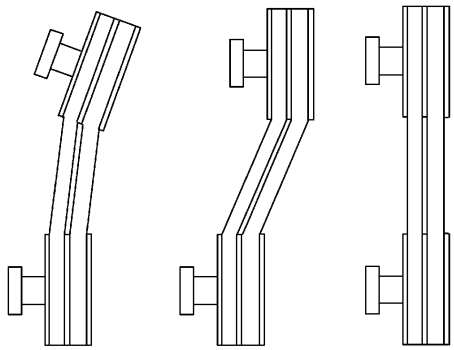
Figure 3B. Aligning Non-Spider Type Couplings

Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 3B).

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 straightedge to measure the amount of misalignment.

V-Belt Drives

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 3C). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.



MISALIGNED: SHAFTS NOT PARALLEL | MISALIGNED: SHAFTS NOT IN LINE | ALIGNED: SHAFTS PARALLEL AND SHEAVES IN LINE

Figure 3C. 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.

WARNING!

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 SAFETY information in Section A.

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

WARNING!

This pump is designed to handle petroleum products and/or industrial hydrocarbons where product vapors cannot be allowed to escape into the atmosphere. Do not attempt to pump any liquids which may damage the pump or endanger personnel as a result of pump failure.

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**).

This pump is self priming, but the pump should never be operated unless there is liquid in the pump casing.

CAUTION

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.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

When installed in a flooded suction application, simply open the system valves and permit the incoming liquid to evacuate the air. After the pump and piping system have completely filled, evacuate any remaining air pockets in the pump or suction line by loosening pipe plug or opening bleeder valves.

Once the pump casing has been filled, the pump will prime and reprime as necessary.

WARNING!

After filling the pump casing, reinstall and tighten the fill plug. Do not attempt to operate the pump unless all connecting piping is securely installed. Otherwise, liquid in the pump forced out under pressure could cause injury to personnel.

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump.

STARTING

Consult the operations manual furnished with the power source.

Rotation

The correct direction of pump rotation is clockwise when facing the drive end of the impeller shaft. 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 power source rotation before further troubleshooting.

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

Lines With a Bypass

Close the discharge throttling valve (if so equipped) so that the pump will not have to prime against the weight of the liquid in the discharge line. Air from the suction line will be discharged through the bypass line back to the source of the liquid during the priming cycle. When the pump is fully primed and liquid is flowing steadily from the bypass line, open the discharge throttling valve. Liquid will then continue to circulate through the bypass line while the pump is in operation.

Lines Without a Bypass

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pressure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

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.

WARNING!

Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to cool before servicing.

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

Since this pump does not have a suction check valve, the discharge line must be fitted with a check valve if a pump vacuum reading is to be taken.

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 when pumping 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

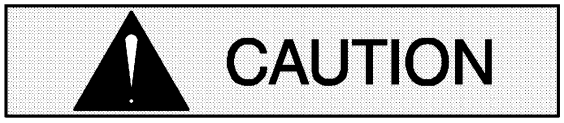
lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

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.

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, lock out or disconnect the power source or take other precautions to ensure that the pump will remain inoperative.

Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts.

If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining solids by flushing with a hose.

BEARING TEMPERATURE CHECK

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 SAFETY information in Section A.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Lock out or disconnect the power source 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	Not enough liquid in casing.	Add liquid to casing. See **PRIMING**.
	Suction check valve contaminated or damaged.	Clean or replace check valve.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See **INSTALLATION**.
	Strainer clogged.	Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Strainer clogged.	Check strainer and clean if necessary.
	Suction intake not submerged at proper level or sump too small.	Check installation and correct submergence as needed.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Impeller or other wearing parts worn or damaged.	Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.
	Impeller clogged.	Free impeller of debris.
	Pump speed too slow.	Check driver output; check belts or couplings for slippage.
	Discharge head too high.	Install bypass line.
	Suction lift too high.	Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line.
PUMP REQUIRES TOO MUCH POWER	Pump speed too high.	Check driver output; check that sheaves or couplings are correctly sized.
	Discharge head too low.	Adjust discharge valve.
	Liquid solution too thick.	Dilute if possible.
	Bearing(s) frozen.	Disassemble pump and check bearing(s).
PUMP CLOGS FREQUENTLY	Liquid solution too thick.	Dilute if possible.
	Discharge flow too slow.	Open discharge valve fully to increase flow rate, and run power source at maximum governed speed.
	Suction check valve or foot valve clogged or binding.	Clean valve.
EXCESSIVE NOISE	Cavitation in pump.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.
	Pumping entrained air.	Locate and eliminate source of air bubble.
	Pump or drive not securely mounted.	Secure mounting hardware.
	Impeller clogged or damaged.	Clean out debris; replace damaged parts.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.	Check bearing temperature regularly to monitor any increase.
	Low or incorrect lubricant.	Check for proper type and level of lubricant.
	Suction and discharge lines not properly supported.	Check piping installation for proper support.
	Drive misaligned.	Align drive properly.

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 new applications, a first inspection of wearing parts at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at the intervals shown on the chart below. Critical applications should be inspected more frequently.

Preventive Maintenance Schedule

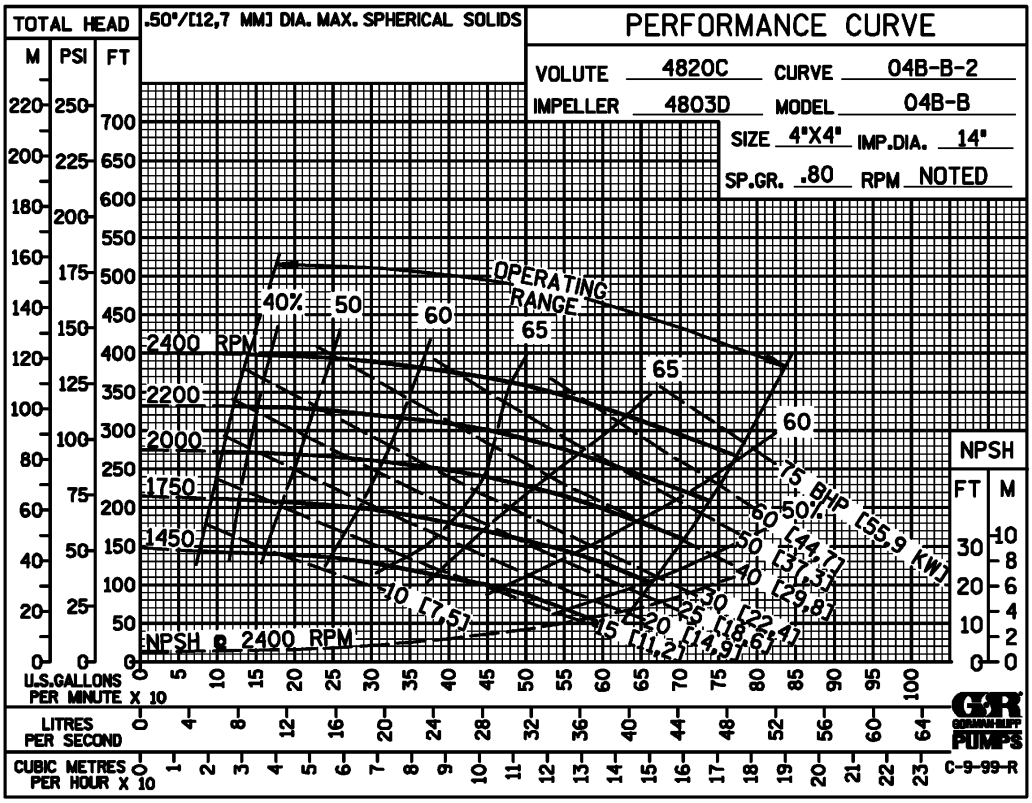
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		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					

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 E

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



✳ **STANDARD PERFORMANCE FOR PUMP MODEL 04B3D--B**

✳ 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 different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

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 performance or part numbers.

CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the curve.

SECTION DRAWING

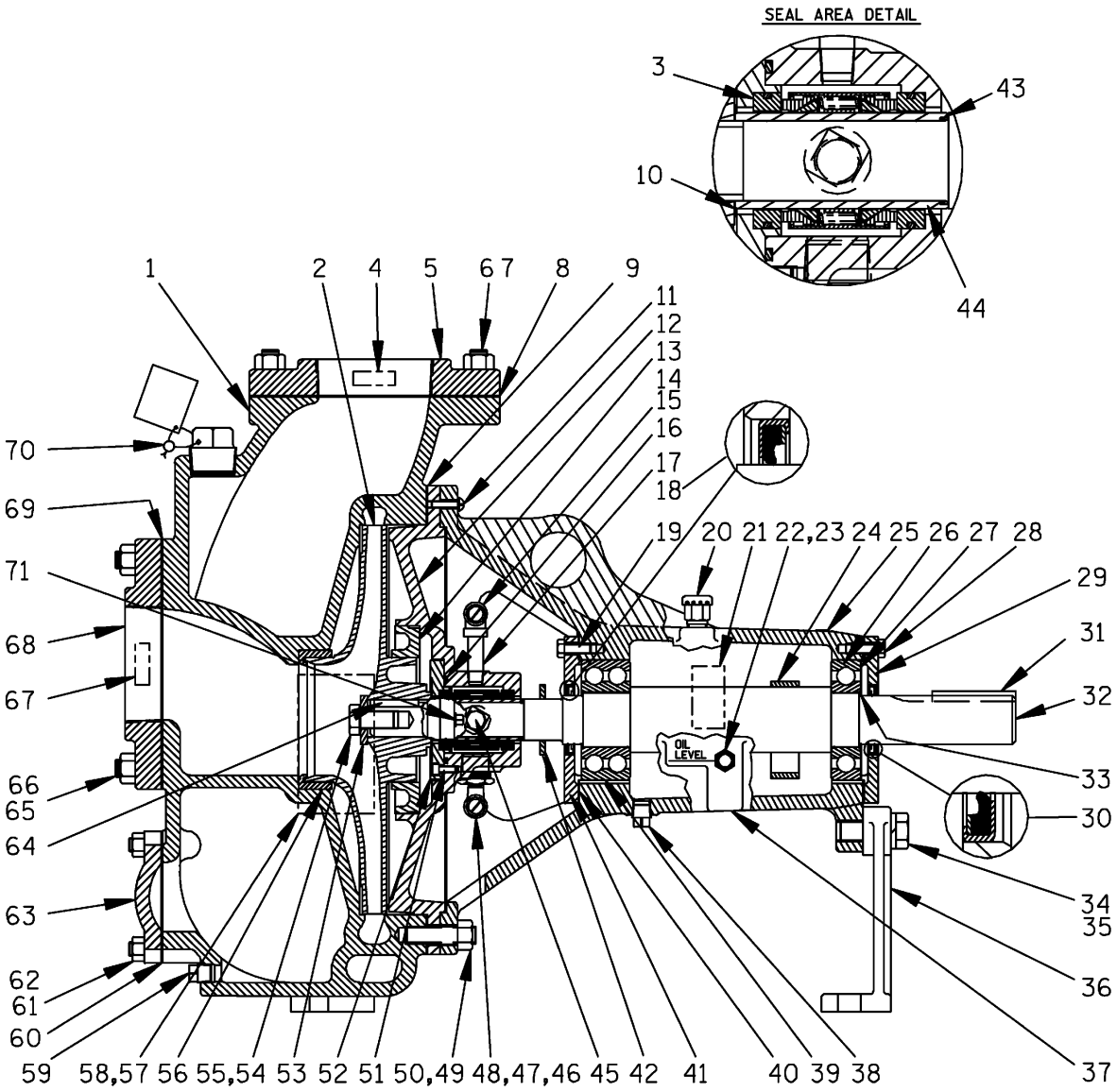


Figure 1. 04B3D–B Pump Model Assembly

PARTS LIST
Pump Model 04B3D–B
(From S/N 1104900 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
1	PUMP CASING	4820C	10010	1
2 ✳	IMPELLER	4803D	14000	1
3 ✳	SEAL ASSY	25271–757	– – –	1
4	DISCHARGE STICKER	6588BJ	– – –	1
5	DISCHARGE FLANGE	1756	10010	1
6	STUD	C1010	15991	8
7	HEX NUT	D10	15991	8
8 ✳	DISCH FLANGE GASKET	1676GB	20000	1
9 ✳	PUMP CASING GASKET	4820G	20000	1
10 ✳	IMP ADJ SHIM SET	37J	17090	1
11	RD HD MACH SCREW	X0404	17090	2
12	SEAL PLATE	38272–612	11000	1
13 ✳	WEAR RING	6902	10010	1
14	PLASTIC ENCLOSURE	25141–004	– – –	1
15	PIPE ELBOW	R04	11999	1
16 ✳	SEAL PLATE O-RING	25154–232	– – –	1
17	PIPE NIPPLE	T0408	15079	1
18 ✳	OIL SEAL	S1262	– – –	1
19	HEX HD CAPSCREW	B0604	15991	4
20	AIR VENT	S1703	– – –	1
21	BRG LUB DECAL	38816–079	– – –	1
22	PIPE PLUG	P06	15079	1
23	OIL LVL SIGHT GAUGE	26714–011	– – –	1
24	SLINGER RING	31144–031	23000	1
25	ROTATION DECAL	2613M	– – –	1
26 ✳	BALL BEARING	S1077	– – –	1
27 ✳	BEARING CAP GSKT	5413G	18000	1
28	HEX HD CAPSCREW	B0604	15991	4
29	BEARING CAP	5413A	10010	1
30 ✳	OIL SEAL	S1262	– – –	1
31	IMP SHAFT KEY	N0612	15990	1
32 ✳	IMPELLER SHAFT	38515–580	16000	1
33	BRG SHIM SET	8546	15990	1
34	HEX HD CAPSCREW	B1208	15991	1
35	LOCKWASHER	J12	15991	1
36	PEDESTAL FOOT	5801	10010	1
37	PEDESTAL BODY	5402A	10010	1
38	BRG CVTY DRAIN PLUG	P06	15079	1
39 ✳	BALL BEARING	23421–461	– – –	1
40 ✳	BEARING CAP GSKT	5413G	18000	1
41	BEARING CAP	5413A	10010	1
42	DEFLECTOR	2352	19120	1
43 ✳	SHAFT O-RING	25154–026	– – –	1
44	SEAL SLEEVE	31441–014	16000	1
45	PIPE PLUG	P12	15079	1
46	RED PIPE BUSHING	AP1204	15079	1
47	STREET ELBOW	RS04	11999	1
48	PLASTIC ENCLOSURE	25141–004	– – –	1
49	STUD	C1010	15991	12
50	HEX NUT	D10	15991	12
51	SOC HD CAPSCREW	BD0402 1/2	15991	4
52	SEAL RETAINER CAP	38322–608	10000	1
53	IMPELLER WASHER	5718	15990	1
54	T-TYPE LOCKWASHER	AK10	15991	1
55	HEX HD CAPSCREW	B1005S	15991	1
56 ✳	WEAR RING	3765A	10010	1
57	NAME PLATE	38818–018	13990	1
58	DRIVE SCREW	BM#04–03	17000	4
59	CASING DRAIN PLUG	P06	15079	1
60 ✳	COVER PLATE GASKET	4822G	20000	1
61	STUD	C0807	15991	6
62	HEX NUT	D08	15991	6
63	COVER PLATE	4822	10010	1
64 ✳	IMPELLER KEY	N0407	15990	1
65	HEX HD CAPSCREW	C1010	15991	8
66	HEX NUT	D10	15991	8
67	SUCTION STICKER	6588AG	– – –	1
68	SUCTION FLANGE	1756	10010	1
69 ✳	SUCT FLANGE GASKET	1676GB	20000	1
70	FILL PLUG ASSY	48271–064	– – –	1
71	FILL PLUG ASSY	P02	15079	1
NOT SHOWN:				
	LUBRICATION TAG	38816–174	– – –	1
OPTIONAL:				
	CI IMPELLER	4803D	10010	1
	ALL IRON CONSTRUCTION:			
	–IMPELLER	4803J	10010	1
	–SEAL	25284–961	– – –	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

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.

WARNING!

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.

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 view (see Figure 1) and the accompanying parts lists.

Before attempting to service the pump, disconnect or lock out the power source or take other precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines.

For power source disassembly and repair, consult the literature supplied with the power source, or contact your local power source representative.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power supply, or take other precautions 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.**

Pump Disassembly

Before attempting to service the pump, remove the pump casing drain plug (59) and drain the pump. Clean and reinstall the drain plug.

Disconnect the power source and retain the shaft key (31).

To service the wear rings (13 and 56), impeller (2), seal assembly (3), or seal plate (12), the pump casing (1) must be separated from the base and pedestal (37).

Remove the suction and discharge lines. Remove the hardware securing the casing to the base. Remove the nuts (50) and use a suitable hoist and sling to separate the pump casing and gasket (9) from the seal plate and pedestal.

WARNING!

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

Tie and tag any leveling shims used under the casing feet to ease reassembly.

Inspect the wear ring (7) for excessive wear or scoring. The wear ring is secured in the pump casing by a press fit. If replacement is required, use a small bit to drill two holes through the ring horizontally, 180° apart. Use a saw or chisel to complete the cuts through the ring, and remove it from the pump casing. **Use caution** not to damage the pump casing bore when removing the wear ring.

CAUTION

Use caution not to damage the pump casing bore when removing the wear ring.

Impeller Removal

To remove the impeller (2), disengage the hardware (53, 54 and 55). Install 3/8–16 UNC by 4 inch long capscrews in the tapped holes in the impeller. Use the capscrews and a suitable puller to remove the impeller from the shaft. Retain the impeller key (64).

Remove the impeller adjusting shims (10). Tie and tag the shims or measure and record their thickness for ease of reassembly.

Seal Removal and Disassembly

(Figures 1 and 3)

Remove the seal retainer cap (52). Use caution when removing the cap; tension on the seal will be released as it is removed. Apply oil to the shaft and work it up under the rubber bellows. Slide the rotating portion of the seal off the shaft.

Remove the round head machine screws (11) and slide the seal plate and stationary element off the impeller shaft as a unit. Press the stationary seal element out of the seal plate from the back side.

Inspect the wear ring (26) for excessive wear or damage. If replacement is required, use a suitable puller to remove it from the seal plate.

Shaft and Bearing Removal and Disassembly

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

CAUTION

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

Remove the deflector (42) from the impeller shaft. Remove the hardware (19 and 28) and remove the bearing caps (29 and 41) from the pedestal. Discard the bearing cap gaskets (27 and 40).

Remove the bearing shims (33). Tie and tag the shims or measure and record their thickness for ease of reassembly.

Place a block of wood against the impeller end of the shaft (20) and tap the shaft, slinger ring (24) and bearings (26 and 39) from the bearing bore.

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

CAUTION

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

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

WARNING!

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

CAUTION

The bearing must be kept free of all dirt and foreign material. Failure to do so will great-

ly shorten bearing life. **Do not** spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

Rotate the bearing 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 bearing.

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

If replacement is required, us an arbor (or hydraulic) press to remove the bearings from the shaft.

Shaft and Bearing Reassembly and Installation

Clean and inspect the bearings as indicated in **Shaft and Bearing Removal and Disassembly**.

CAUTION

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

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

Slide the slinger ring (24) on the shaft (32).

NOTE

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

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 bearing. Bearings should **never** be heated with a direct flame or directly on a hot plate.

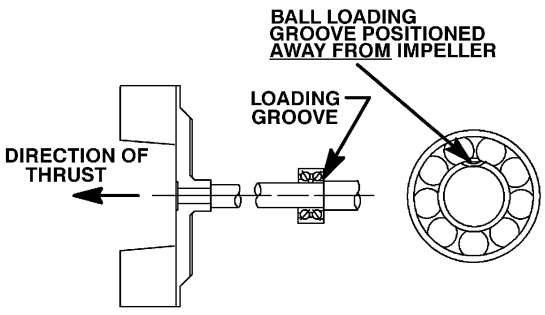
NOTE

Position the bearing (39) on the shaft as indicated in Figure 2.

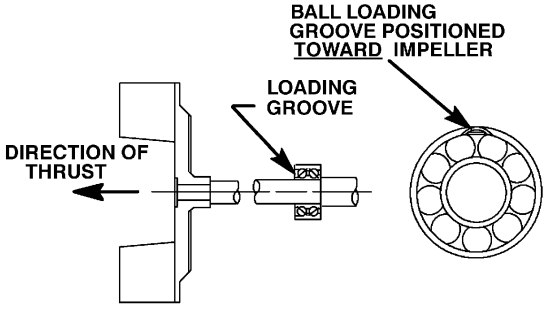
Heat the bearings to a uniform temperature **no higher than** 250°F (120°C), and slide the bearing onto the shaft until fully seated against the bearing spacer. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

WARNING!

Use caution when handling hot bearings to prevent burns.



INSTALLATION OF NEW DEPARTURE OR BCA/FEDERAL MOGAL 5300W SERIES BEARINGS (OPEN OR ENCLOSED IMPELLERS)



INSTALLATION OF MRC/SKF 5300M OR FAFNIR 5300W SERIES BEARINGS (OPEN OR ENCLOSED IMPELLERS)

Figure 2. Bearing Positioning

After the bearing has been installed and allowed to cool, check to ensure that it has not moved in shrinking. If movement has occurred, use a suit-

able sized sleeve and a press to reposition the bearing.

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

CAUTION

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

Slide the shaft and assembled bearing into the pedestal bore from the drive end until the bearings seat squarely against the bore shoulder.

CAUTION

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

Position the oil seals (18 and 30) in the bearing caps with the lips positioned as shown in Figure 1. Press the oil seals into the caps until they are fully seated.

Secure the bearing caps (29 and 41) and gaskets (27 and 40) on the pedestal (37) with the hardware (19 and 28).

Check the shaft endplay. Adjust the bearing shims (33) to establish the correct endplay.

NOTE

Impeller shaft endplay should be between .002 and .010 inch (0,05 mm to 0,25 mm). Add or subtract bearing shims to obtain the correct endplay.

Install the shaft key (31) in the shaft keyway.

Seal Reassembly and Installation

(Figures 2 and 5)

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

WARNING!

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. Clean and polish the shaft sleeve, or replace it if there are nicks or cuts on either end. 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 bellows and O-rings with water or a very **small** amount of light lubricating oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 3).

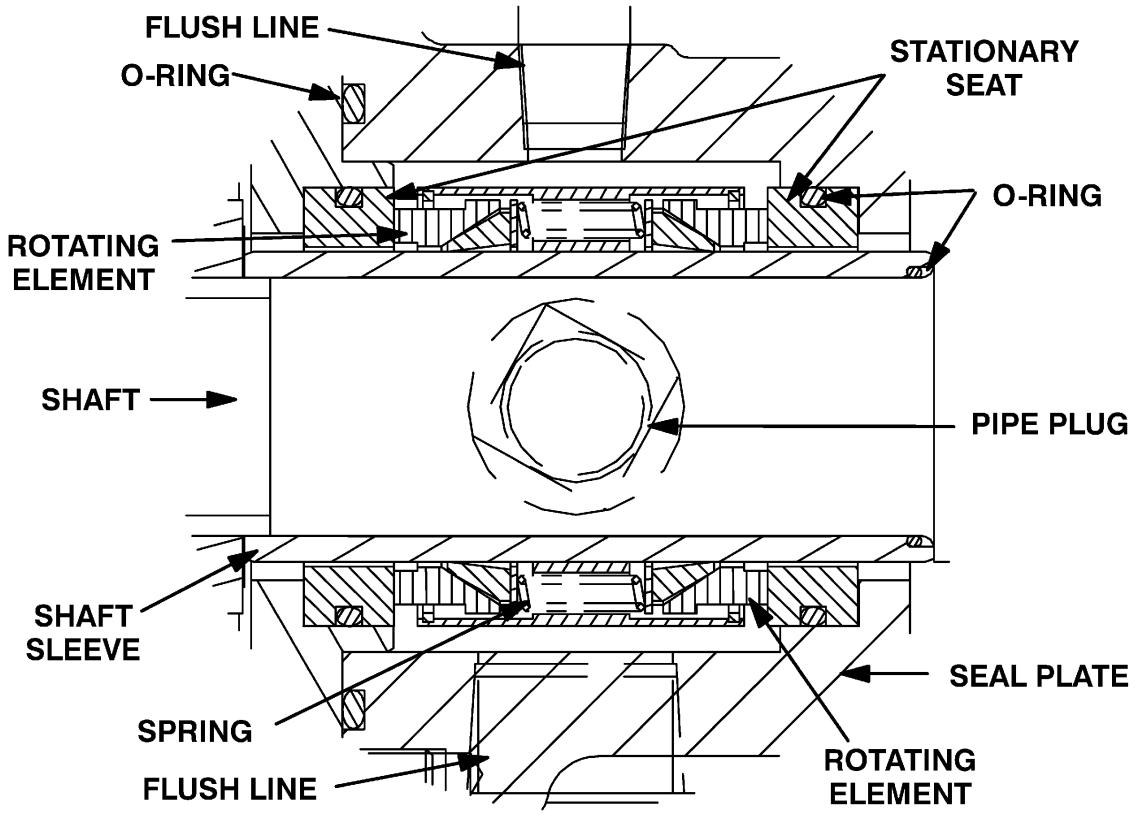


Figure 3. 25271--757 Seal Assembly

CAUTION

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

Lay the seal plate (12) on a flat surface with the impeller side facing up. If the wear ring (13) was removed, press the replacement ring into the seal plate until it seats squarely against the bore shoulder.

CAUTION

The wear ring **must** seat squarely in the seal plate bore or binding and/or excessive wear will result.

Lubricate the stationary seat O-rings with water or light oil, and install them in the stationary seat. Install the stationary seal element in the stationary seat. Press this stationary subassembly into the seal plate until it seats squarely against the bore shoulder.

Install the deflector (42) on the shaft. Lubricate the O-ring (43) with water or light oil. and install it on the shaft. The O-ring seals the sleeve (44) to the shaft shoulder.

Carefully slide the assembled seal plate and stationary seat over the shaft. Secure the seal plate to the pedestal with the hardware (11). **Be careful** not to damage the stationary element on the shaft keyway.

Lubricate the seal sleeve with a **small** amount of light oil and slide the rotating subassembly onto the sleeve until the rotating element is **just flush** with the **undercut** end of the sleeve.

WARNING!

New seal assemblies are equipped with spring holding clips for storage purposes. Remove and discard theses clips before proceeding with the seal

reassembly. When removing the clips, use caution so that they do not pop off abruptly and cause personal injury. Failure to remove these clips can result in seal failure and pump damage.

Slide the sleeve and subassembled seal onto the shaft until the seal faces contact. Continue to push the sleeve through the seal until the undercut end seats against the O-ring and shaft shoulder.

NOTE

It is recommended that a tapered sleeve be installed over the end of the impeller shaft to ease installation of the rotating seal components.

Lubricate the seal plate O-ring (16) with water or light oil, and install it in the seal plate. Install the seal retainer cap (52) and secure with the hardware (51). Tighten the hardware in an alternating pattern.

Impeller Installation

Inspect the impeller, and replace it if cracked or badly worn.

For maximum pump efficiency, the impeller should be centered within the volute scroll.

To verify the impeller positioning, measure the pump casing and impeller as shown in Figure 4. Use these measurements to calculate the required impeller location (dimension E). Add or remove impeller adjusting shims (10) until dimension E is obtained.

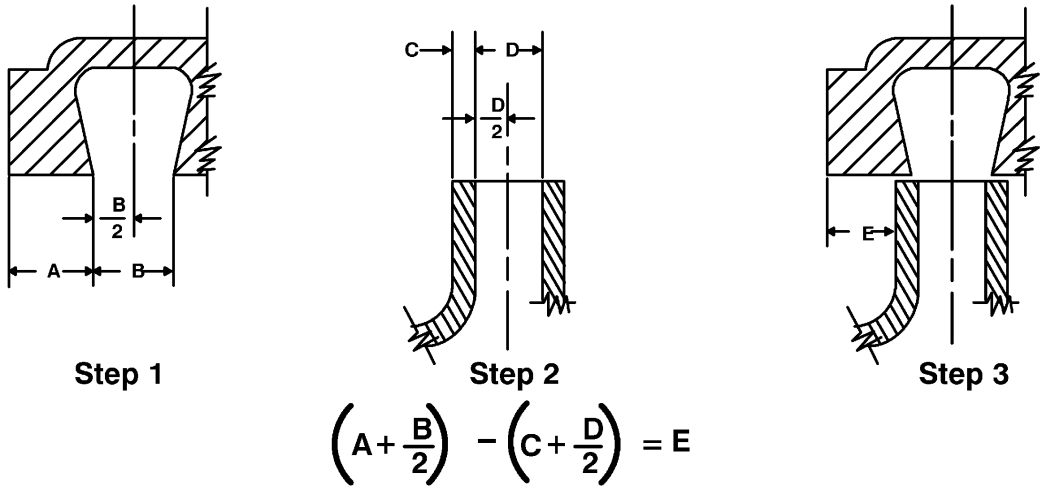


Figure 4. Centering Impeller Within Volute Scroll

Install the correct thickness of impeller shims, and install the impeller key (64) in the shaft keyway. Align the impeller keyway with the key, and slide the impeller onto the shaft until fully seated.

NOTE

After the impeller has been properly positioned, check for free rotation. Correct any scraping binding before further reassembly.

When the impeller is properly positioned, secure it with the hardware (53, 54 and 55).

Pump Reassembly

If removed at disassembly, press the replacement wear ring (56) into the pump casing until it seats squarely against the shoulder bore.

CAUTION

The wear ring **must** seat squarely in the casing bore or binding and/or excessive wear will result.

Install the casing gasket (9) and secure the casing to the seal plate and pedestal with the nuts (50). Reinstall any leveling shims under the casing

mounting feet, and secure the casing to the base with the previously removed hardware.

Final Pump Assembly

Be sure the pump and power source are securely mounted to the base.

Install the suction and discharge lines and open all valves. Make certain that all piping connections are tight, properly supported and secure.

Be sure the pump, pedestal and power source have been properly lubricated, see **LUBRICATION**.

Fill the pump casing with clean liquid. Reinstall the fill plug (70) and tighten it.

Refer to **OPERATION**, Section C, before putting the pump back into service.

LUBRICATION

Seal Assembly

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

Bearing

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (23) and maintain it at the middle of the gauge. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (20). **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

Under normal conditions, drain the pedestal 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.

CAUTION

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.

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

Power Source

Consult the literature supplied with the power source, or contact your local power source representative.

For U.S. and International Warranty Information,
Please Visit www.grpumps.com/warranty
or call:
U.S.: 419—755—1280
International: +1—419—755—1352

For Canadian Warranty Information,
Please Visit www.grcanada.com/warranty
or call:
519—631—2870

THE GORMAN-RUPP COMPANY ● MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED ● ST. THOMAS, ONTARIO, CANADA