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INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

PA SERIES PUMP

MODEL

PA12A60–B

GORMAN-RUPP PUMPS

www.grpumps.com

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Register your new
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Valid serial number and e-mail address required.

RECORD YOUR PUMP MODEL AND SERIAL NUMBER

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

Pump Model: _____

Serial Number: _____

TABLE OF CONTENTS

INTRODUCTION ..... PAGE I – 1

SAFETY - SECTION A ..... PAGE A – 1

INSTALLATION – SECTION B ..... PAGE B – 1

PREINSTALLATION INSPECTION ..... PAGE B – 1
POSITIONING PUMP ..... PAGE B – 1
Lifting ..... PAGE B – 1
Mounting ..... PAGE B – 2
SUCTION AND DISCHARGE PIPING ..... PAGE B – 2
Materials ..... PAGE B – 2
Line Configuration ..... PAGE B – 2
Connections to Pump ..... PAGE B – 2
Gauges ..... PAGE B – 2
SUCTION LINES ..... PAGE B – 2
Fittings ..... PAGE B – 2
Strainers ..... PAGE B – 2
Sealing ..... PAGE B – 3
Suction Lines In Sumps ..... PAGE B – 3
Suction Line Positioning ..... PAGE B – 3
DISCHARGE LINES ..... PAGE B – 4
Siphoning ..... PAGE B – 4
Valves ..... PAGE B – 4
ALIGNMENT ..... PAGE B – 4
Coupled Drives ..... PAGE B – 5
Drive Belts ..... PAGE B – 5
DRIVE BELT TENSIONING ..... PAGE B – 6
General Rules of Tensioning ..... PAGE B – 6
COLD WEATHER INSTALLATION ..... PAGE B – 6

OPERATION – SECTION C ..... PAGE C – 1

STARTING ..... PAGE C – 1
Rotation ..... PAGE C – 1
PRIMING ..... PAGE C – 1
OPERATION ..... PAGE C – 1
Leakage ..... PAGE C – 1
Pump Vacuum Check ..... PAGE C – 1
Liquid Temperature And Overheating ..... PAGE C – 2
Strainer Check ..... PAGE C – 2
STOPPING ..... PAGE C – 2
BEARING TEMPERATURE CHECK ..... PAGE C – 2
COLD WEATHER PRESERVATION ..... PAGE C – 3

TROUBLESHOOTING – SECTION D ..... PAGE D – 1

PREVENTIVE MAINTENANCE ..... PAGE D – 3

PUMP MAINTENANCE AND REPAIR - SECTION E ..... PAGE E – 1

STANDARD PERFORMANCE CURVE ..... PAGE E – 1

TABLE OF CONTENTS
(continued)

PARTS LISTS:

- Pump Model ..... PAGE E – 3
- Pump End Assembly ..... PAGE E – 5
- Priming Chamber Assembly ..... PAGE E – 8

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY ..... PAGE E – 9

- Priming Chamber Removal And Disassembly ..... PAGE E – 10
- Discharge Check Valve Removal and Disassembly ..... PAGE E – 10
- Suction Head And Wear Ring Removal ..... PAGE E – 10
- Pump Casing Removal ..... PAGE E – 11
- Impeller Removal ..... PAGE E – 11
- Seal Removal ..... PAGE E – 11
- Pedestal Assembly Removal ..... PAGE E – 11
- Shaft and Bearing Removal and Disassembly ..... PAGE E – 11
- Bearing Cleaning And Inspection ..... PAGE E – 12
- Shaft and Bearing Reassembly and Installation ..... PAGE E – 12
- Seal Reassembly and Installation ..... PAGE E – 14
- Impeller Installation ..... PAGE E – 15
- Pump Casing Installation ..... PAGE E – 16
- Suction Head And Wear Ring Installation ..... PAGE E – 16
- Discharge Check Valve Assembly and Installation ..... PAGE E – 16
- Priming Chamber Assembly And Installation ..... PAGE E – 16

LUBRICATION ..... PAGE E – 17

- Seal Assembly ..... PAGE E – 17
- Bearings ..... PAGE E – 17

INTRODUCTION

Thank You for purchasing a Gorman-Rupp pump. **Read this manual** carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump.

This pump is a PA Series, priming-assisted centrifugal model. The unit is designed for handling non-volatile, non-flammable liquids containing specified entrained solids. The basic material of construction is ductile iron with stainless steel shaft and ductile iron wearing parts.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for every aspect of each specific application. Therefore, it is the responsibility of the owner/installer of the pump to ensure that applications not addressed in this manual are performed **only** after establishing that neither operator safety nor pump integrity are compromised by the installation. Pumps and related equipment **must** be installed and operated according to all national, local and industry standards.

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

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901—1217
Phone: (419) 755—1011
or:
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631—2870

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 personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:

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

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

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 Prime Aire® Series 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.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power source 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 most non-volatile, non-flammable liquids containing specified entrained solids. Do not attempt to pump volatile, corrosive, or flammable materials which may damage the pump or endanger personnel as a result of pump failure.

WARNING!

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

WARNING!

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

WARNING!

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

WARNING!

Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disen-

gaged to be ejected with great force. Allow the pump to cool before servicing.

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!

Do not attempt to disengage any part of an overheated pump unit. Vapor pressure within the pump casing can eject these parts with great force when they are disengaged. Allow the pump to completely cool before servicing it.

CAUTION

Pumps and related equipment must be installed and operated according to all national, local and industry standards.

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.

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 that the pump shaft rotates in the required direction.

CAUTION

Only operate this pump in the direction indicated by the arrow on the pump body and on the accompanying decal. Otherwise, the impeller could become loosened from the shaft and seriously damage the pump.

d. Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **Maintenance and Repair Manual** and perform duties as instructed.

e. If the pump has 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

WARNING!

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

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.

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.

SUCTION AND DISCHARGE PIPING

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

The pump is drilled and tapped for installing discharge pressure and vacuum suction gauges. It is recommended that gauges be installed to monitor pump performance. Seal the gauge threads 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

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

A strainer or other device should be used to filter solids larger than the pump's capacity to avoid damage or decreased performance. Information about solids size handling can be found on the performance curve for your specific pump. When selecting or installing a strainer, 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 the openings will not permit passage of solids larger than the solids handling capability of 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 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 1 shows recommended minimum submergence vs. velocity.

Although not recommended, the vacuum assisted priming feature allows the pump to be operated temporarily in a "slurping" application with varying water levels.

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).

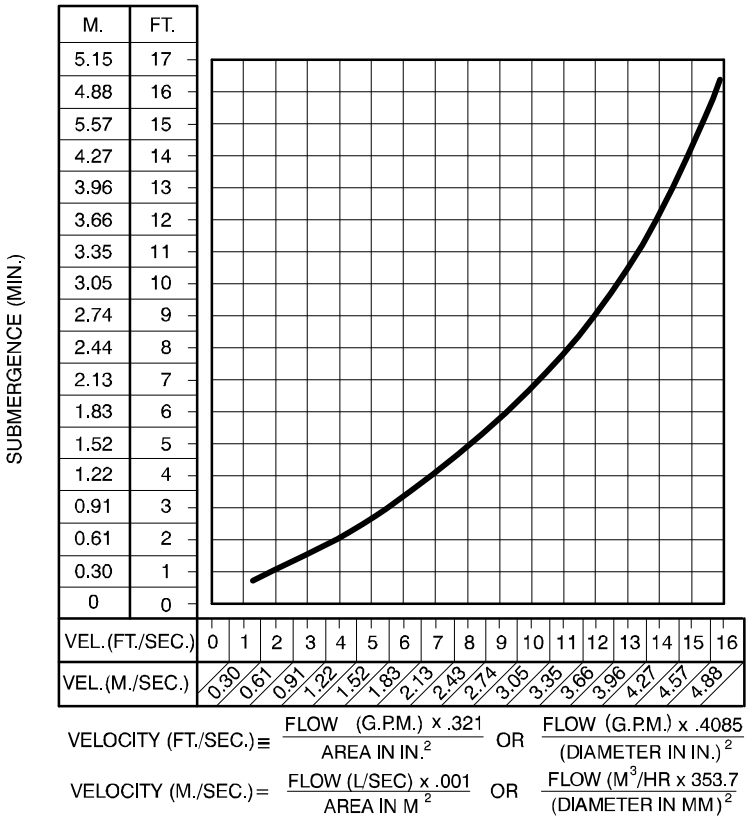


Figure 1. Recommended Minimum Suction Line Submergence vs. Velocity

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 designed with a check valve in the discharge line.

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 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.

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 2).

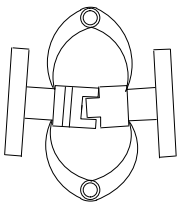


Figure 2. Aligning Spider-Type Couplings

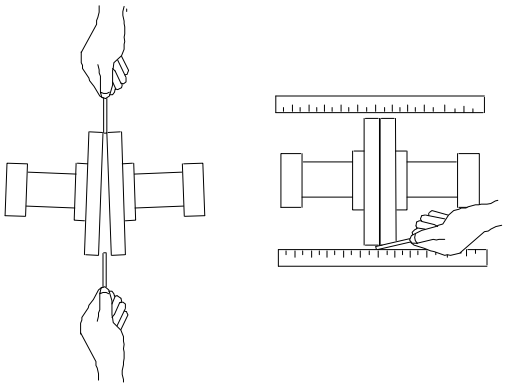


Figure 3. Aligning Non-Spider Type Couplings

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 3).

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.

Drive Belts

When using drive belts, 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 4). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.

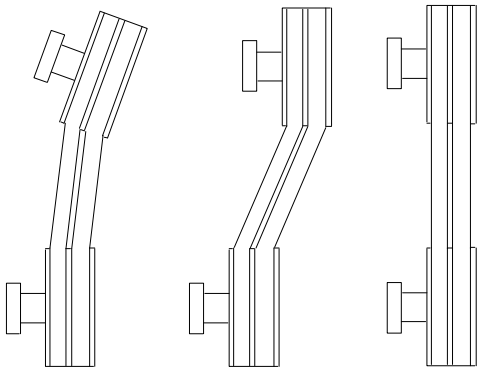


Figure 4. Alignment of V-Belt Driven Pumps

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.

DANGER!

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.

DRIVE BELT TENSIONING

General Rules of Tensioning

For new drive belts, check the tension after 5, 20 and 50 hours of operation and re-tension as required (see the following procedure for measuring belt tension). Thereafter, check and re-tension if required monthly or at 500 hour intervals, whichever comes first.

Ideal drive belt tension is the **lowest** tension at which the belt will not slip under peak load conditions. Do not over-tension drive belts. Over-tensioning will shorten both drive belt and bearing life. Under-tensioning will cause belt slippage. Always keep belts free from dirt, grease, oil and other foreign material which may cause slippage.

COLD WEATHER INSTALLATION

If the pump is to be installed in an environment where sub-freezing temperatures will occur during operation, consideration must be given to prevent the pump and components from freezing when the pump is idle between pumping cycles. With Gorman-Rupp priming assisted pumps, there are two methods of accomplishing this.

One method is through the use of an optional heated priming chamber, which is available as a factory-installed option or as a retrofit kit for most models (consult the factory). This method pumps heated liquid from the engine cooling system through the priming chamber to heat the chamber and its contents. This method is particularly effective where pumping cycles are short enough to ensure that the liquid in the priming chamber never fully freezes.

The second method involves configuring the pumping system to drain both the priming chamber and pump casing after each pumping cycle. With no liquid remaining in the system, freezing cannot occur.

To configure the pump to drain between pumping cycles, the first step is to remove the check valve from the line that runs between the top of the priming hopper and the priming venturi. This check valve is located close to the venturi end of the line. Remove the check valve, then reconnect the line directly to the venturi. This will allow air to enter the pump through the top of the priming hopper when the pump shuts off, providing for complete drainage of the pump and priming hopper.

Next, install a drain line between the pump drain and the wet well or sump. This line must remain submerged in the liquid below the pump down level of the liquid level control device; otherwise, the pump may not prime. If the application involves liquids that could clog the drain line, make sure to check the line periodically to ensure it remains open; otherwise, liquid could remain in the casing, resulting in freezing and potential damage to the pumping system.

Configuring the system to drain between cycles will help ensure that the pump will not freeze during cold weather applications. **However, it should be noted that the time required for the pump to begin to discharge liquid will increase, as the pump will have to fully re-prime at the beginning of each pumping cycle.**

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 liquids containing large entrained solids and slurries. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.

CAUTION

Pump speed and operating conditions must be within the performance range shown on page E-1.

STARTING

Consult the operations manual furnished with the power source.

Rotation

The correct direction of pump rotation is counterclockwise when facing the impeller. 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.

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**).

The pump will begin to prime upon startup. The air in the suction line will be discharged from the eductor discharge line. Complete priming is indicated by a positive discharge pressure reading.

If full priming is not achieved, the discharge check valve may be malfunctioning. If this occurs, shut down the pump and consult **Maintenance and Repair,** Section E for further details.

OPERATION

Leakage

Once the pump is fully primed, 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.

Pump Vacuum Check

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.

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 immediately and allow it to completely cool before servicing it. **Approach any over-heated pump cautiously**.

WARNING!

Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an overheated 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.

As a safeguard against rupture or explosion due to heat, this pump is equipped with a pressure relief valve which will open if vapor pressure within the pump casing reaches a critical point. If over-heating does occur, stop the pump immediately and allow it to cool before servicing it. **Approach any over-heated pump cautiously**. It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump casing over-heats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

Strainer Check

Check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. Monitor and record the vacuum suction gauge readings regularly to detect strainer blockage.

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, **liquid pressure** must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve.

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.

CAUTION

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 to ensure that the pump will remain inoperative.

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 the Maintenance and Repair Manual). 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.

COLD WEATHER PRESERVATION

If the pump will be idle for an extended period of time in below freezing conditions, drain the pump and priming hopper 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.

If the pump is to be installed in an environment where sub-freezing temperatures will occur during operation, consideration must be given to prevent the pump and components from freezing when the pump is idle between pumping cycles. Refer to **COLD WEATHER INSTALLATION** in the **Installation** section of this manual for details.

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 completely cool if overheated.**
4. **Check the temperature and make sure pump is cool 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	Discharge check valve contaminated, damaged, or unable to seat.	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**.
	Air compressor damaged or belts broken.	Check and repair/replace.
	Strainer clogged.	Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Eductor clogged.	Check and clean eductor.
	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.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Strainer clogged.	Check strainer and clean if necessary.
	Discharge check valve clogged.	Check and clean check valve.
	Suction intake not submerged at proper level or sump too small.	Check installation and correct submergence as needed.
	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.
	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 speed too slow.	Check driver output; check belts or couplings for slippage.
	Belt or flexible coupling broken.	Check and replace as necessary.
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.
	Pump or jack shaft bearing(s) frozen.	Disassemble, check and replace bearing(s) as required..
PUMP CLOGS FREQUENTLY	Discharge flow too slow.	Open discharge valve fully to increase flow rate, and run engine at maximum governed speed.
	Suction check valve or foot valve clogged or binding.	Clean valve.
	Liquid solution too thick.	Dilute if possible.
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.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
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.
	Excessive tension on drive belt.	Check belt tension. Adjust as required.

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

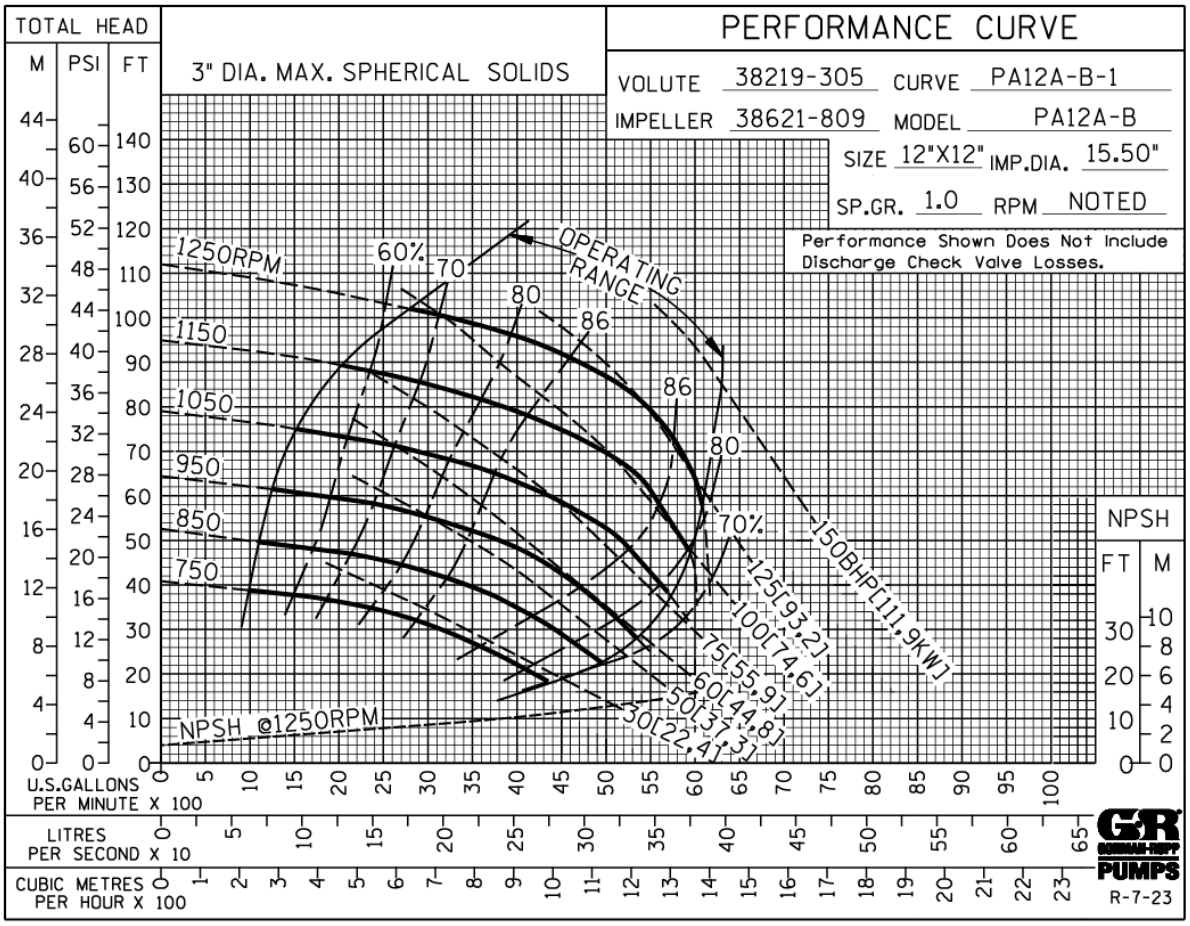
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		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 PA12A60—B**

✳ Based on 70°F (21°C) clear water at sea level 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.

ILLUSTRATION

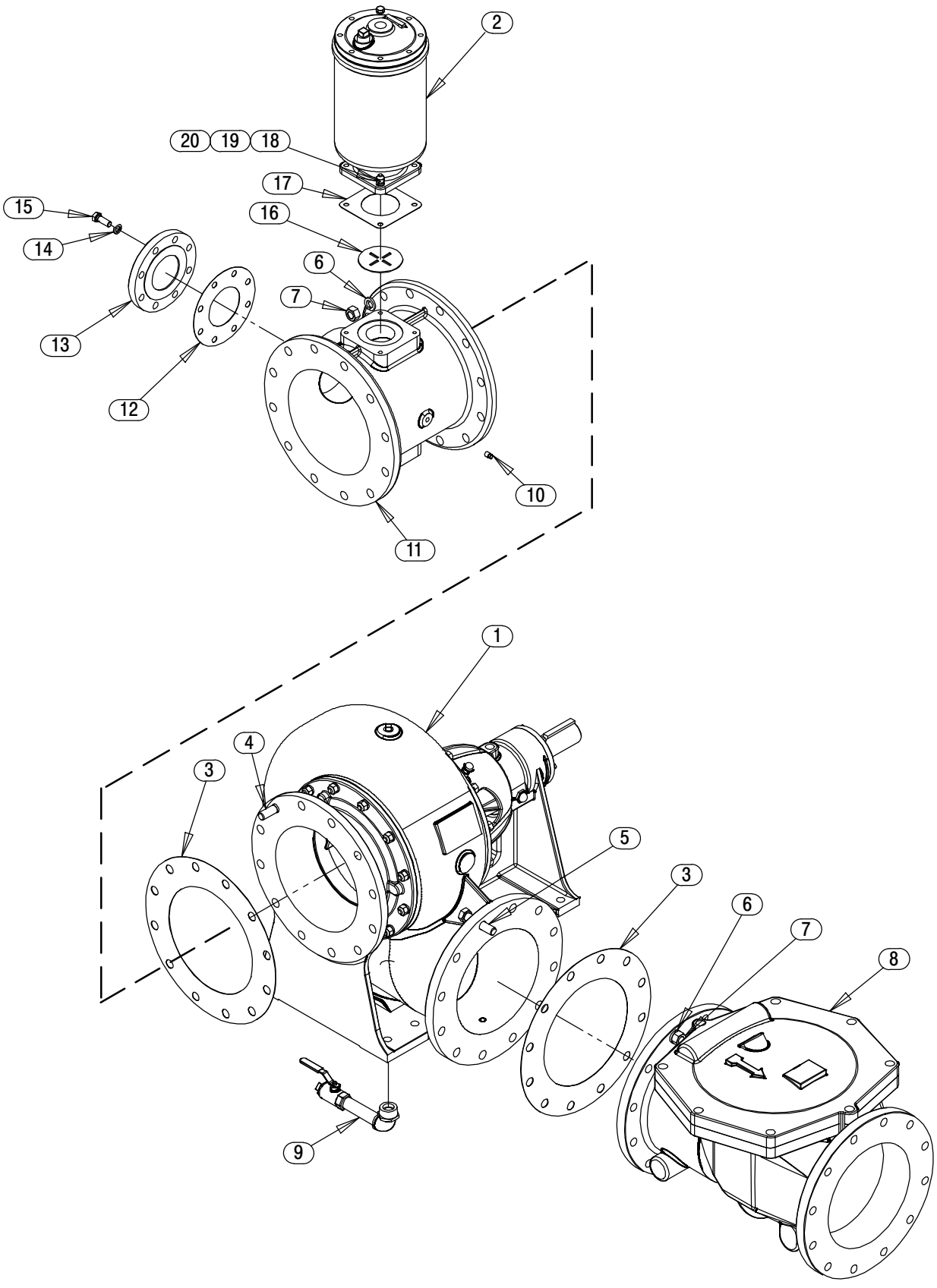


Figure 1. PA12A60–B Pump Model Assembly

PARTS LIST
Pump Model PA12A60–B
(From S/N 1650474 Up)

ITEM NO.		PART NAME	PART NUMBER	QTY
1		PUMP END ASSEMBLY	46133–640	1
2		PRIMING CHAMBER ASSEMBLY	46112–709	1
3	✳	GASKET	4991G 18000	2
4		HEX HEAD CAP SCREW	B1413 15991	12
5		HEX HEAD CAP SCREW	B1416 15991	12
6		LOCK WASHER	J14 15991	24
7		HEX NUT	D14 15991	24
8		CHECK VALVE 12”	26642–128	1
	✳	–FLAPPER	26688–003	1
		–GASKET	26688–004	1
	✳	–O-RING	25152–469	1
9		DRAIN VALVE ASSY	46346–262	1
10		PIPE PLUG	P04 15079	1
11		12” SPOOL	38642–622 10000	1
12	✳	GASKET	25113–034	1
13		4” BLIND FLANGE ASSEMBLY	42111–358	1
14		LOCK WASHER	J10 15991	8
15		HEX HEAD CAP SCREW	B1007 15991	8
16		BAFFLE	31113–011 17000	1
17	✳	GASKET	38687–053 19060	1
18		LOCK WASHER	J08 15991	4
19		STUD	C0809 15991	4
20		HEX NUT	D08 15991	4

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

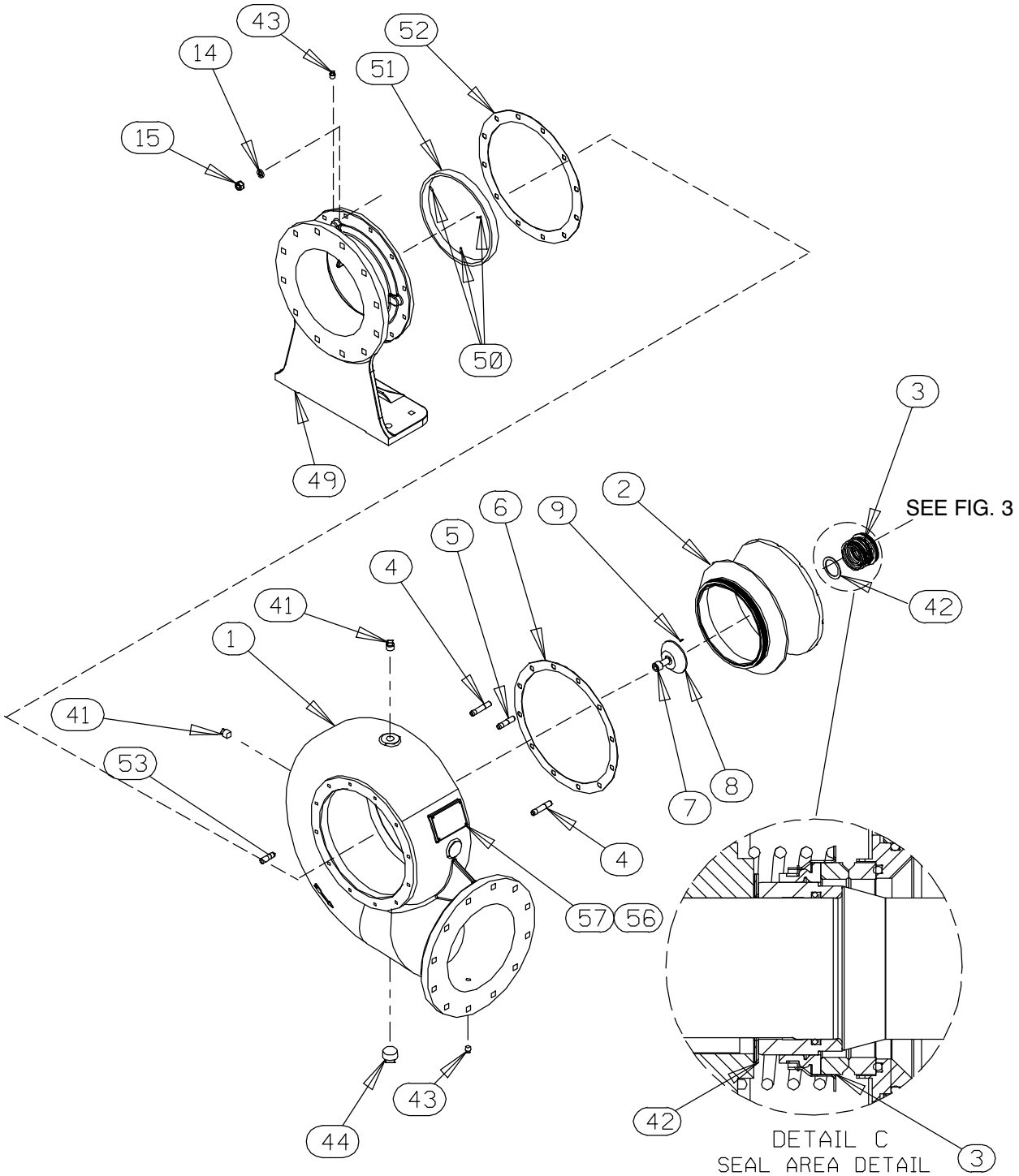


Figure 2. Pump End Assembly

PARTS LIST
Pump End Assembly

ITEM NO.		PART NAME	PART NUMBER	QTY
☞ 1		PUMP CASING	SEE NOTE BELOW	1
2	✳	IMPELLER	38621–809 11010	1
	✳	–WEAR RING	4182A 11030	1
3	✳	SEAL ASSEMBLY	46512–109	1
☞ 4		STUD	C1013 15991	3
☞ 5		STUD	C1011 15991	9
6	✳	GASKET	38674–434 18000	1
7	✳	SCKT HD CAP SCREW	BD1206 15990	1
8	✳	IMPELLER WASHER	31167–012 15030	1
9	✳	ROLL PIN	S2197	1
10		HOSE CLAMP	26518–642	2
11		MALE CONNECTOR	26523–409	2
12		BOT OILER BRCKT ASSY	41881–811 24150	1
13		FLAT WASHER	K10 15991	1
14		LOCK WASHER	J10 15991	22
15		HEX NUT	D10 15991	24
16		MACHINE SCREW	X0405 15991	2
17		LOCK WASHER	J04 15991	2
18		SIGHT GAUGE	S1471	2
19		VENTED PIPE PLUG	38649–009 15079	1
20		PEDESTAL	38257–520 10000	1
21		PIPE PLUG	P04 15079	1
22		HEX HEAD CAP SCREW	B0605 15991	12
23	✳	OIL SEAL	25258–845	3
24		BEARING CAP	38322–429 10000	1
25	✳	O-RING	25152–249	1
26		SHIM SET	48261–055	1
27		BEARING LOCKNUT	23962–015	1
28		BEARING LOCK WASHER	23962–515	1
29		BEARING CAP GASKET	4184G 18000	1
30	✳	BALL BEARING	23413–015	2
31	✳	KEY	N1016 15990	1
32		IMPELLER SHAFT	38512–522 17040	1
33	✳	KEY	N0809 15990	1
34	✳	ROLLER BEARING	23528–005	1
35		BEARING CAP	38322–425 10010	1
36		AIR VENT	S1703	1
37	✳	O-RING	25151–266	1
38		PIPE CPLG 3/8	AE06 15079	1
39		PIPE NIPPLE	T0608 15079	1
40		SEAL PLATE	38272–717 10000	1
☞ 41		PIPE PLUG	P12 15079	2
42		SHIM SET	48261–033	REF
43		PIPE PLUG	P06 15079	2
☞ 44		PIPE PLUG	P24 10009	1
45		SEAL PLATE COVER	38242–708 10000	1
46		HEX HEAD CAP SCREW	B0503–1/2 15991	6
47		LOCK WASHER	J05 15991	6
48		.38 I.D. x 11" LG HOSE	18513–054	1
49		SUCTION HEAD	4180 10010	1
50		SPIRAL PIN	21137–123	3
51	✳	WEAR RING	4181A 14000	1
52	✳	GASKET	4180G 18000	1
☞ 53		STUD	C1009 15991	12
54		BOTTLE OILER	26713–004	1
55		SNAP RING	24124–057	1
56		DRIVE SCREW	BM#04–03 17000	4
57		NAMEPLATE BLANK	38819–002 13000	1
NOT SHOWN:				
		SUCTION STICKER	6588AG	1
		ROTATION DECAL	2613M	1
		G-R DECAL	GR–06	1
		WARNING DECAL	2613FE	1
		INSTRUCTION TAG	38817–024	1
		LUBRICATION DECAL	38816–079	1
		INSTRUCTION TAG	38817–011	1
		OIL LEVEL DECAL	38816–123	1
		DISCHARGE STICKER	6588BJ	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

☞ INCLUDED WITH REPAIR PUMP CASING ASSY 46474–902 1

ILLUSTRATION

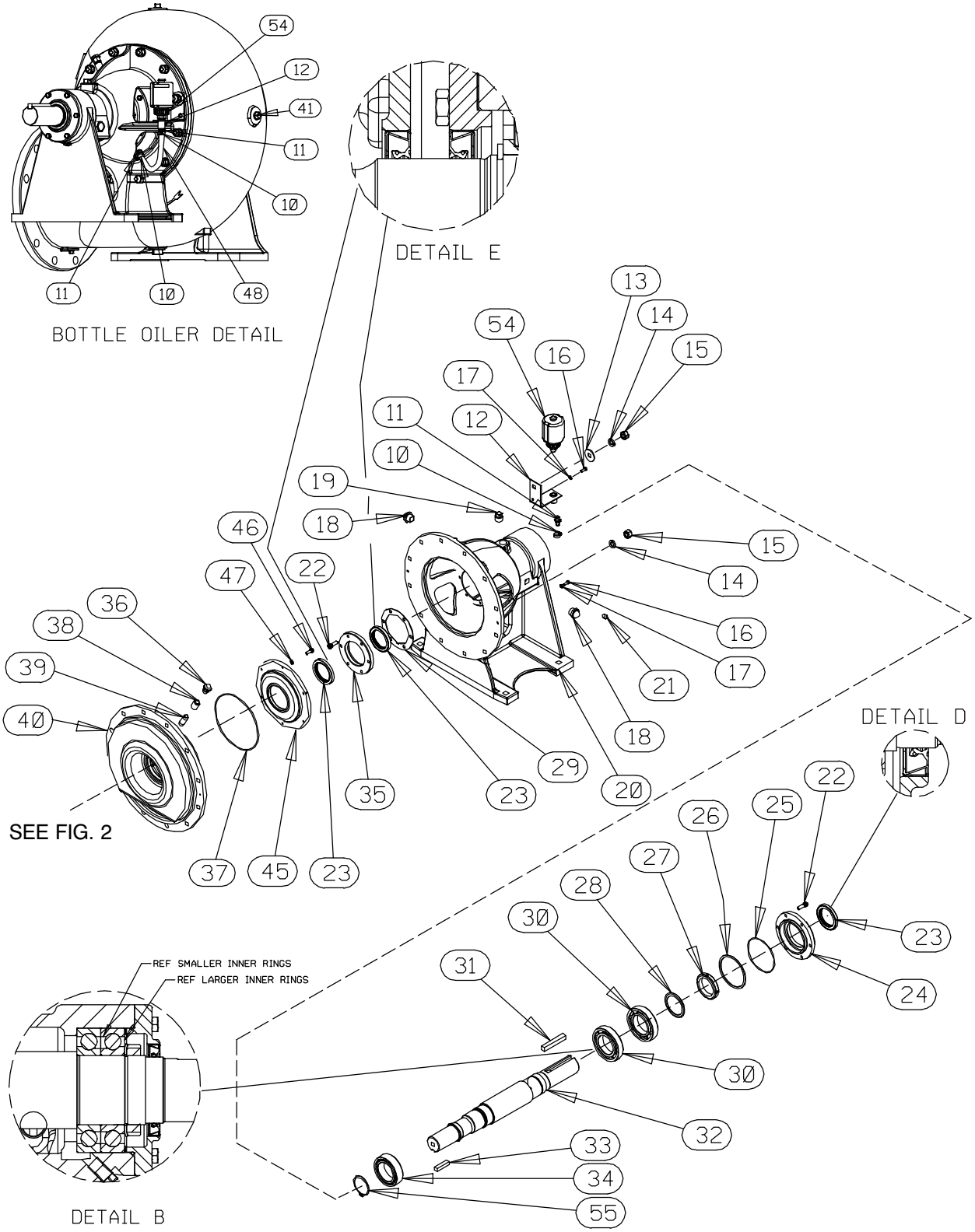


Figure 3. Pump End Assembly (Cont'd)

PARTS LIST
Pump End Assembly (Cont'd)

ITEM NO.		PART NAME	PART NUMBER	QTY
☞ 1		PUMP CASING	SEE NOTE BELOW	1
2	✳	IMPELLER	38621–809 11010	1
	✳	–WEAR RING	4182A 11030	1
3	✳	SEAL ASSEMBLY	46512–109	1
☞ 4		STUD	C1013 15991	3
☞ 5		STUD	C1011 15991	9
6	✳	GASKET	38674–434 18000	1
7	✳	SCKT HD CAP SCREW	BD1206 15990	1
8	✳	IMPELLER WASHER	31167–012 15030	1
9	✳	ROLL PIN	S2197	1
10		HOSE CLAMP	26518–642	2
11		MALE CONNECTOR	26523–409	2
12		BOT OILER BRCKT ASSY	41881–811 24150	1
13		FLAT WASHER	K10 15991	1
14		LOCK WASHER	J10 15991	22
15		HEX NUT	D10 15991	24
16		MACHINE SCREW	X0405 15991	2
17		LOCK WASHER	J04 15991	2
18		SIGHT GAUGE	S1471	2
19		VENTED PIPE PLUG	38649–009 15079	1
20		PEDESTAL	38257–520 10000	1
21		PIPE PLUG	P04 15079	1
22		HEX HEAD CAP SCREW	B0605 15991	12
23	✳	OIL SEAL	25258–845	3
24		BEARING CAP	38322–429 10000	1
25	✳	O-RING	25152–249	1
26		SHIM SET	48261–055	1
27		BEARING LOCKNUT	23962–015	1
28		BEARING LOCK WASHER	23962–515	1
29		BEARING CAP GASKET	4184G 18000	1
30	✳	BALL BEARING	23413–015	2
31	✳	KEY	N1016 15990	1
32		IMPELLER SHAFT	38512–522 17040	1
33	✳	KEY	N0809 15990	1
34	✳	ROLLER BEARING	23528–005	1
35		BEARING CAP	38322–425 10010	1
36		AIR VENT	S1703	1
37	✳	O-RING	25151–266	1
38		PIPE CPLG 3/8	AE06 15079	1
39		PIPE NIPPLE	T0608 15079	1
40		SEAL PLATE	38272–717 10000	1
☞ 41		PIPE PLUG	P12 15079	2
42		SHIM SET	48261–033	REF
43		PIPE PLUG	P06 15079	2
☞ 44		PIPE PLUG	P24 10009	1
45		SEAL PLATE COVER	38242–708 10000	1
46		HEX HEAD CAP SCREW	B0503–1/2 15991	6
47		LOCK WASHER	J05 15991	6
48		.38 I.D. x 11" LG HOSE	18513–054	1
49		SUCTION HEAD	4180 10010	1
50		SPIRAL PIN	21137–123	3
51	✳	WEAR RING	4181A 14000	1
52	✳	GASKET	4180G 18000	1
☞ 53		STUD	C1009 15991	12
54		BOTTLE OILER	26713–004	1
55		SNAP RING	24124–057	1
56		DRIVE SCREW	BM#04–03 17000	4
57		NAMEPLATE BLANK	38819–002 13000	1
NOT SHOWN:				
		SUCTION STICKER	6588AG	1
		ROTATION DECAL	2613M	1
		G-R DECAL	GR–06	1
		WARNING DECAL	2613FE	1
		INSTRUCTION TAG	38817–024	1
		LUBRICATION DECAL	38816–079	1
		INSTRUCTION TAG	38817–011	1
		OIL LEVEL DECAL	38816–123	1
		DISCHARGE STICKER	6588BJ	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

☞ INCLUDED WITH REPAIR PUMP CASING ASSY 46474–902 1

ILLUSTRATION

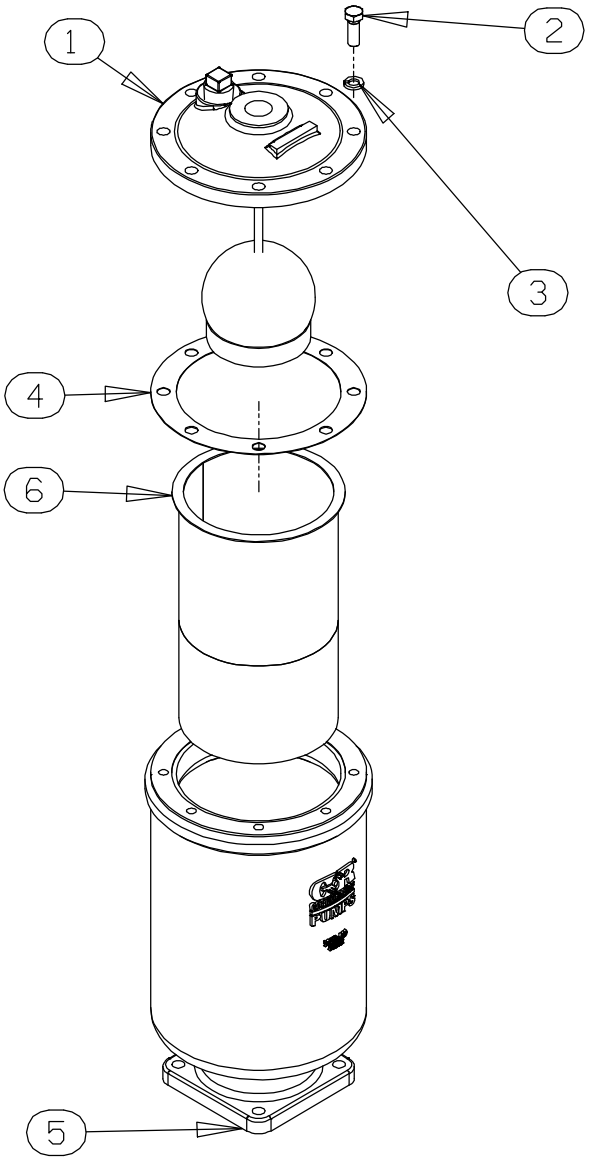


Figure 4. Priming Chamber Assembly

PARTS LIST

ITEM NO.	PART NAME	PART NUMBER	QTY
1	PRIMING VALVE	26664−007	1
	−ORIFICE BUTTON	26688−021	1
2	HEX HD CAPSCREW	B0806 15991	8
3	LOCKWASHER	J08 15991	8
4	PRIMING VALVE GASKET	38683−657 19060	1
5	PRIMING CHAMBER	38343−020 10000	1
6	STRAINER ASSY	46641−222 17000	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.

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 illustrations (see Figures 1 through 4) and the accompanying parts lists.

WARNING!

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

Before attempting to service the pump, disconnect or lock out the power source to ensure that the pump 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 source 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 may be used to handle materials which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.

WARNING!

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

necessary and keep personnel away from suspended objects.

CAUTION

Use **Only Genuine Gorman—Rupp** replacement parts. Failure to do so may create a hazard and damage the pump or diminish optimal pump performance. Any such hazard, damage or diminished performance is not covered by the warranty.

NOTE

When appropriate recycling facilities are available, the user should recycle components and fluids when doing any routine maintenance / repairs and also at the end of the pump's useful life. All other components and fluids shall be disposed of according to all applicable codes and regulations.

Priming Chamber Removal And Disassembly

(Figure 1)

Disconnect both the suction piping and the air discharge tubing from the priming chamber assembly (2). Support the priming chamber assembly using a sling and a suitable lifting device. Remove the hardware (21 and 22) and separate the priming chamber assembly, baffle (18) and gasket (19) from the pump assembly.

(Figure 4)

Remove the hardware (2 and 3) securing the priming valve (1) to the priming chamber (5). Carefully lift the valve components from the priming chamber. Remove the gasket (4) and clean the mating surfaces.

If the priming valve float is stuck or the strainer (6) is clogged, it can usually be cleaned without further disassembly.

The only serviceable part of the priming valve is the orifice button (not shown). If liquid continues to bypass through the priming chamber after adjusting the orifice button (see **Priming Chamber Reassembly and Installation** for adjustment), the button may require replacement. To replace the orifice button, remove one of the "e-clips" from the pivot pin closest to the orifice button and remove the pivot pin. This will allow the linkage to be raised high enough to access the orifice button.

Remove the hex nut and lock washer securing the orifice button to the linkage bar and unscrew the orifice button from the linkage bar.

Discharge Check Valve Removal and Disassembly

(Figure 1)

Support the discharge check valve assembly (10) using a sling and a suitable lifting device. Remove the hardware (7, 8 and 9) and separate the discharge check valve assembly and gasket (3) from the pump assembly (1).

The flapper and gasket are the only serviceable parts of the check valve. If the flapper requires replacement, remove the hardware securing the cover. Separate the valve cap and remove the flapper and gasket.

Suction Head And Wear Ring Removal

(Figure 2)

Unless replacement of the spool gasket (3, Figure 1) is required, the suction head (49) may be removed without separating it from the spool. However, if the spool gasket must be replaced, support the spool with a suitable hoist and sling, remove the hardware (8 and 9, Figure 1) and separate the suction spool and gasket from the suction head.

Remove the hardware securing the suction head (49) to the base. Support the suction head using a suitable hoist and sling. Disengage the hardware (14 and 15) and separate the suction head and wear ring (51) from the pump casing. Remove the suction head gasket (52) and clean the mating surfaces.

Inspect the wear ring for excessive wear or scoring. The wear ring is a press fit into the suction head and is additionally secured with the spiral pins (50). If replacement is required, use a small bit to drill three holes horizontally, 180° apart, through the wear ring between each of the spiral pins. Use a chisel or other suitable tool to complete the cuts through the wear ring. **Use caution** not to damage the suction head bore. Remove the wear ring sec-

tions from the suction head. Pull the spiral pins from the suction head.

If no further disassembly is required, see **Suction Head and Wear Ring Installation**.

Pump Casing Removal

(Figure 2)

Support the pump casing using a suitable hoist and sling.

NOTE

When removing the pump casing, use a wire to secure the assembled bottle oiler (54, Figure 3) and bracket (12, Figure 3) above the level of the oil in the seal cavity. This will prevent oil from leaking out of the oiler during disassembly.

If the impeller (2) is to be removed, the impeller screw (7) should be loosened before removing the pump casing. Immobilize the impeller by inserting a wood block through the pump discharge and into the impeller vanes. Remove the impeller screw and washer (8). Remove the wood block from the pump discharge.

Remove the hardware (13, 14 and 15, Figure 3) securing the pump casing and bottle oiler bracket to the pedestal (20, Figure 3).

Pull the pump casing straight away from the pedestal to prevent binding on the impeller. Remove the casing gasket (6) and clean the contacting surfaces.

Impeller Removal

(Figure 2)

Before removing the impeller, loosen the hose clamp (10, Figure 3) and remove the hose (48, Figure 3) from the lower connector (11, Figure 3). Remove the bottle oiler and bracket assembly and drain the seal cavity. This will prevent the oil in the oiler from escaping when the impeller is removed.

With the impeller screw and washer removed as described in **Pump Casing Removal**, insert a pair of wedges 180° apart between the impeller and the seal plate (40, Figure 3). Tap the wedges alternately to force the impeller off the shaft. Retain the impeller key (33, Figure 3).

Inspect the impeller wear ring for excessive wear or scoring.

Seal Removal

(Figures 2 and 6)

This pump is designed with two seals; a primary mechanical seal (3) located directly behind the impeller and a secondary oil seal (23, Figure 3) located in the seal plate cover (45, Figure 3). If the liquid being pumped leaks past the oil seal, both seals should be replaced immediately.

Remove the impeller shims (42). Tie and tag the shims for ease of reassembly. Remove the seal spring. Slide the rotating portion of the seal (consisting of the shaft sleeve and O-ring, bellows and retainer, and rotating element) off the shaft as a unit.

Apply oil to the sleeve and work it up under the rubber bellows. Slide the bellows and retainer off the sleeve. Remove the sleeve O-ring.

Remove the hardware (16 and 17) and slide the seal plate and remaining seal components off the shaft. Disengage the hardware (46 and 47, Figure 3) and separate the seal plate cover and O-ring (37, Figure 3) from the seal plate.

Use a suitably sized dowel to press the stationary portion of the seal out of the seal plate. Press the oil seal out of the seal plate cover.

If no further disassembly is required, refer to **Seal Installation**.

Pedestal Assembly Removal

(Figure 3)

Disassembly of the pedestal requires separation of the pump and driver.

Remove the hardware securing the pedestal to the base. Use a suitable hoist and sling to remove the pedestal assembly.

Shaft and Bearing Removal and Disassembly

(Figure 3)

When the pump is properly operated and maintained, the pedestal should not require disassem-

bly. Disassemble the shaft and bearings **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.

Before disassembling the pedestal, remove the pedestal drain plug (21) and drain the oil from the pedestal. Clean and reinstall the pipe plug.

Disengage the capscrews (22) and and remove the outboard bearing cap (24), O-ring (25) and oil seal (23). Remove the bearing shims (26). Press the oil seal from the bearing cap.

Straighten the tab on the washer (28) securing the bearing lock nut (27). Use a spanner wrench to remove the lock nut. Remove the tab washer.

Disengage the capscrews (22) and remove the inboard bearing cap (35) and oil seal (23). Remove the bearing cap gasket (29) and clean the mating surfaces. Press the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft (32) and tap the shaft and assembled bearings (30 and 34) out of the pedestal.

After removing the shaft and bearings, clean and inspect the bearings **in place** as described in **Bearing Cleaning And Inspection**.

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

If bearing replacement is required, remove the retaining ring (55) and use a bearing puller to remove the inboard and outboard bearings from the shaft.

Bearing Cleaning And Inspection

(Figure 3)

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.

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

CAUTION

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

Rotate the bearings by hand to check for roughness or binding. Inspect the bearing balls (or rollers) on open-type bearings. If rotation is rough or the balls or rollers are discolored, replace the bearings.

Shaft and Bearing Reassembly and Installation

(Figure 3)

Inspect the impeller shaft (32) for distortion, nicks or scratches, or damaged keyways. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

CAUTION

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

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

CAUTION

Use caution when handling hot bearings to prevent burns.

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). Position the roller bearing (34) on the shaft with the internal snap ring positioned away from the impeller end of the shaft. Slide the roller bearing onto the shaft until fully seated against the shaft shoulder. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

After the bearing has been installed and allowed to cool, check to ensure that it has not moved away from the shaft shoulder in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearing against the shaft shoulder.

Secure the roller bearing on the shaft with the bearing retaining ring (55).

Slide the heated outboard bearings (30) onto the shaft, one at a time, with the larger inner races of each bearing positioned away from each other as shown in Detail E, Figure 3.

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

CAUTION

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.

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 suitably sized sleeve and a press to reposition the bearings against the shaft shoulder.

Secure the assembled shaft and bearings by clamping on the surface between the bearings. Use caution not to scratch or mar the part number etched into the shaft in this area. Install the tab washer (28) and bearing lock nut (27). Torque the lock nut to 150 ft. lbs. (1800 in. lbs. or 20,7 m. kg.). Locate the tab on the lock washer that aligns with a slot in the lock nut, and bend the tab over into the slot.

Slide the shaft and assembled bearings into the pedestal from the drive end until the outer race on the inboard ball bearing (30) seats against the pedestal bore.

CAUTION

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 (23) into the bearing cap (24) with the lip positioned as shown in Figure 3. Lubricate and install a new bearing cap O-ring (25) and secure the bearing cap with the capscrews (22). Use caution not to cut or roll the lip of the oil seal when installing the bearing cap.

Press the oil seal (23) into the bearing cap (35) with the lip positioned as shown in Figure 3. Replace the bearing cap gasket (29) and secure the bearing cap with the capscrews (22). Use caution not to cut or roll the lip of the oil seal when installing the bearing cap.

Lubricate the pedestal as indicated in **LUBRICATION**.

Seal Reassembly and Installation

(Figures 2 and 5)

Clean the bore of the seal plate (40), the seal plate cover (45) and the shaft (32) 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.

Lay the seal plate cover on a flat surface with the inner side facing up. Press the oil seal (23) into the seal plate cover with the lip positioned as shown in Detail E, Figure 3.

Install a new O-ring (37) in the groove in the seal plate and secure the seal plate cover to the seal plate with the hardware (46 and 47).

Since the mechanical seal is the primary seal in the pump, special consideration should be given to ensure proper installation.

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 stationary seat O-rings 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).

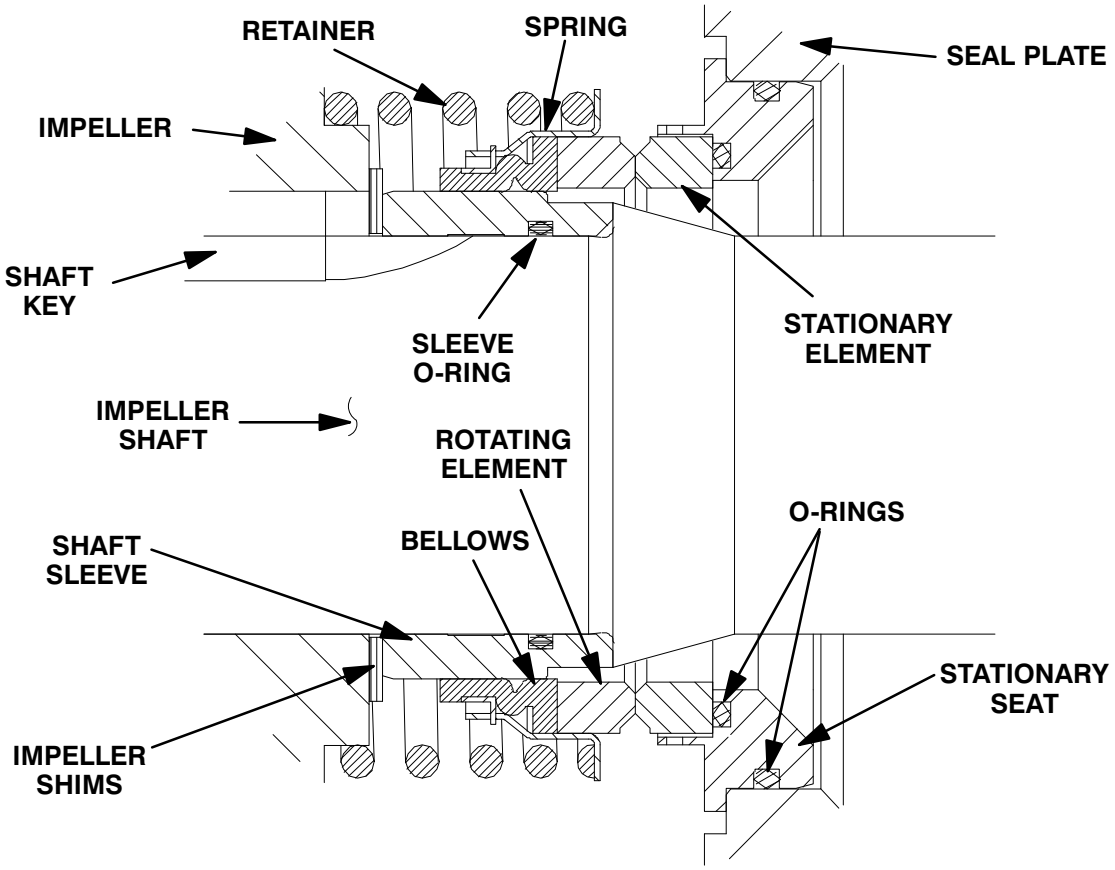


Figure 5. Seal Assembly

CAUTION

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

Lubricate the outboard stationary seat O-ring with water or light oil. Position the seal plate with the impeller side up and press the stationary subassembly (consisting of the stationary seat, O-rings and stationary element) into the front of the seal plate until it seats squarely against the bore shoulder.

Slide the seal plate and stationary portion of the seal over the shaft until it is seated against the pedestal (20). **Be careful** not to damage the stationary element or roll or cut the lip of the oil seal (23) on the shaft keyway. Secure the seal plate to the pedestal with the previously removed hardware (16 and 17).

Lubricate the seal sleeve O-ring with a **small** amount of light oil and install it in the groove in the I.D. of the sleeve.

Lubricate the seal sleeve with a **small** amount of light oil and slide the rotating subassembly (consisting of rotating element, bellows and retainer), onto the sleeve until the rotating element is **just flush** with the **turned** end of the sleeve.

Slide the sleeve and subassembled seal onto the shaft until the seal faces contact and the sleeve seats against the shaft shoulder.

Install the seal spring. Lubricate the seal as indicated in **LUBRICATION** after the impeller, remaining pump components, bottle oiler and piping are installed.

Impeller Installation

(Figure 2)

Inspect the impeller, and replace it if cracked or badly worn. If the impeller wear ring was removed, chill the impeller by refrigeration and use an induc-

tion heater or oven to heat the new wear ring. Slide the wear ring onto the impeller until fully seated against the shoulder and allow it to cool.

CAUTION

The wear ring **must** seat squarely on the impeller; otherwise binding and/or excessive wear will occur. Use caution when handling hot parts to prevent burns.

Install the same thickness of impeller adjusting shims (42) as previously removed. Install the shaft key (33, Figure 3) and press the impeller assembly onto the shaft until fully seated.

A clearance of approximately .015 inch (0,38 mm) between the impeller and the seal plate is recommended for maximum pump efficiency. Measure this clearance, and add or remove impeller adjusting shims as required.

After the impeller clearance has been set, align the pin (9) in the impeller washer (8) with the hole in the impeller and install the washer. Apply “Never-Seez” or equivalent compound on the threads of the impeller capscrew (7). Immobilize the shaft and secure the the impeller by torquing the capscrew to 225 ft. lbs. (2700 in. lbs. or 31 m. kg.).

Pump Casing Installation

(Figure 2)

Install the casing gasket (6) over the pump casing studs (4 and 5). Remove the hardware temporarily securing the seal plate to the pedestal. Use a suitable hoist and sling to position the volute over the impeller and slide the studs through the seal plate and pedestal mounting holes.

(Figure 3)

Install the bottle oiler bracket (12) over the volute studs. Secure the bracket and pump casing with the hardware (13, 14,and 15). Reconnect the hose (48) to the connector (11) in the seal plate and secure it with the hose clamp (10).

Suction Head And Wear Ring Installation

(Figure 2)

If the wear ring (51) was removed, chill the wear ring by refrigeration and heat the suction head. Slide the wear ring into the suction head until fully seated and allow it to cool.

CAUTION

The wear ring **must** seat squarely in the suction head; otherwise binding and/or excessive wear will occur. Use caution when handling hot parts to prevent burns.

The wear ring is secured to the suction head with the spiral pins (50). Drill three evenly spaced 3/16-inch diameter x 3/4-inch deep holes through the wear ring and into the suction head. Tap the spiral pins into the holes until fully seated.

Install the suction head gasket (52). Position the suction head over the studs (53) and secure it with the hardware (14 and 15).

Turn the impeller shaft by hand and check for any scraping or binding and correct it before putting the pump into service.

Discharge Check Valve Assembly and Installation

(Figure 1)

The flapper and gasket are the only serviceable parts of the check valve. If the flapper requires replacement, remove the hardware securing the cover and gasket. Separate the valve cap and replace the flapper.

Install the valve cap gasket and secure the cap with the previously removed hardware.

Support the discharge check valve assembly (5) using a sling and a suitable lifting device. Secure the discharge check valve assembly and gasket (6) to the pump assembly (1) using the hardware (2, 3 and 4).

Priming Chamber Assembly And Installation

(Figure 4)

Clean and inspect the components of the priming valve (1). Inspect the linkage and ensure the orifice

button (not shown) squarely engages the valve seat. Replace the orifice button if required (see **Priming Chamber Removal and Disassembly** for orifice button removal).

If the orifice button was removed, screw the new orifice button into the linkage bar until fully seated. Align the hole in the linkage bar with the holes in the bracket and reinstall the pivot pin. Secure the pivot pin with the previously removed “e-clip”.

Adjust the orifice button seating as necessary by screwing the orifice button into or out of the linkage bar. Proper adjustment is achieved when the orifice button fully seats against the orifice before the linkage bar on the float bottoms against the threads on the orifice button. When adjustment is complete, install and tighten the lock washer and hex nut securing the orifice button.

Install the strainer (6) and priming valve gasket (4).

Lower the float into the priming chamber (5) and secure the priming valve with the previously removed hardware (2 and 3).

(Figure 1)

Install the baffle (18) and gasket (19) and use a sling and suitable lifting device to position the priming chamber assembly on the hopper spool (13). Secure the priming chamber assembly with the hardware (21 and 22).

Reconnect the suction piping to the hopper spool and the air discharge tubing to the priming chamber assembly.

LUBRICATION

Seal Assembly

(Figure 3)

Fill the bottle oiler (54) and seal cavity with approximately 85 ounces (2,5 liter) SAE No. 30 non-detergent oil. Check the oil level regularly and refill as required.

Bearings

(Figure 3)

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauges (18) and maintain it at the midpoint of the gauges. When lubrication is required, remove the vented plug (19) and add SAE No. 30 non-detergent oil through the opening. Clean and reinstall the vented plug. **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 approximately 14 ounces (0,4 liter) of 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.

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