
**INSTALLATION, OPERATION,
AND MAINTENANCE MANUAL**
WITH PARTS LIST



PA SERIES PUMP

MODEL
PAV3A60C-B

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

www.grpumps.com

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Gorman-Rupp pump online at
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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: _____

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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.

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

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

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 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

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:



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 PA 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.

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 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.



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.



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



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.



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.



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.



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.



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.



This pump may be used to handle mate-

rials which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.



This pump may be equipped with an optional automatic starting system, and therefore subject to automatic restart. Keep hands and clothing away from the unit to prevent injury during automatic operation. Disconnect the positive battery cable before performing any maintenance. Failure to do so may result in serious personal injury.



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.

Pump Dimensions

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

OUTLINE DRAWING

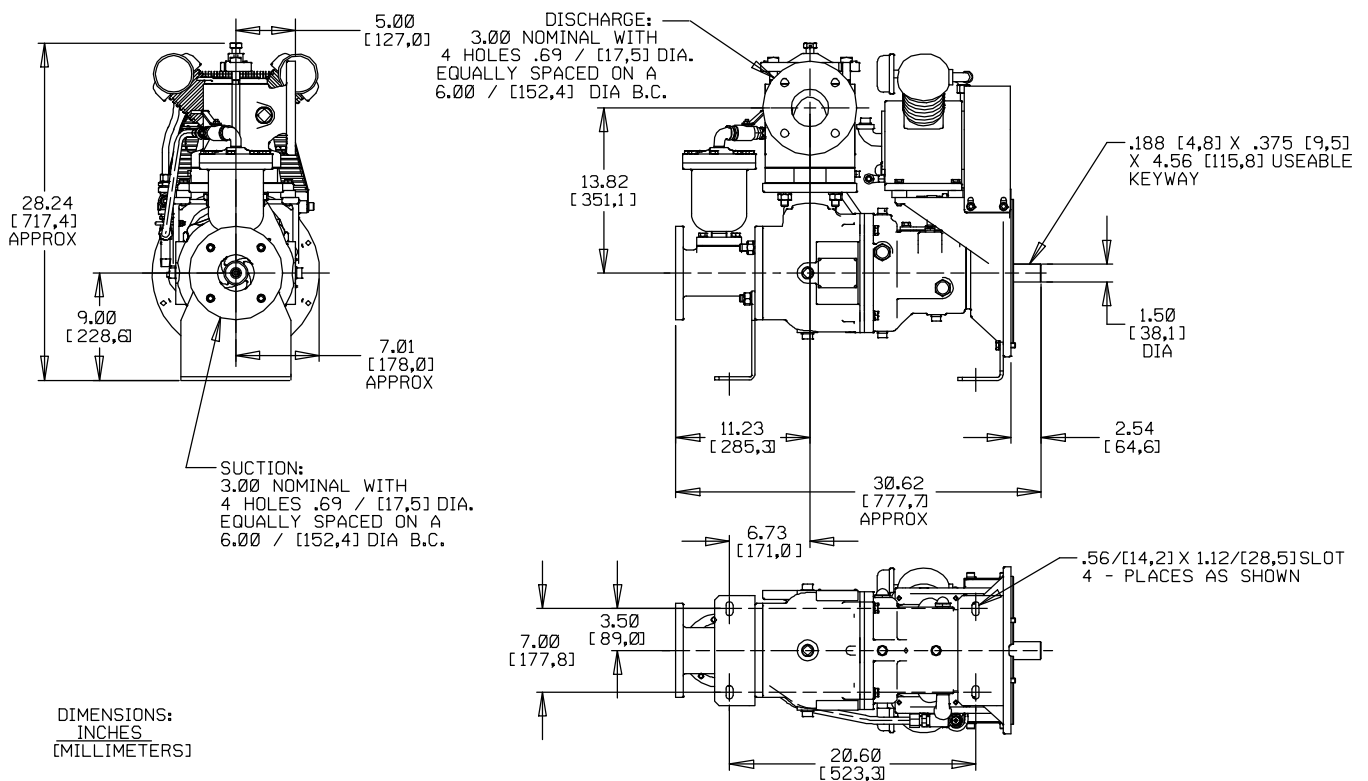
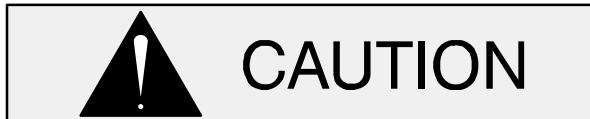


Figure 1. Pump Model PAV3A60C-B

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 warnings and cautions contained in this manual or affixed to the pump, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates counter-clockwise when facing the impeller.



Only operate this pump in the direction indicated by the arrow on the pump body or on the accompanying decal. Refer to **ROTATION** in **OPERATION**, Section C.

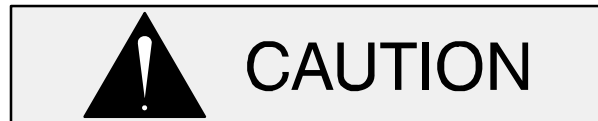
- d. Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- e. If the pump and power source have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum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

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

POSITIONING PUMP

Lifting

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.



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.

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

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

SUCTION LINES

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

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 3 inch (76,2 mm) 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 airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to 1 1/2 times the diameter of the suction line.

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

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

air to escape from the liquid before it is drawn into the suction inlet.

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

Suction Line Positioning

The depth of submergence of the suction line is

critical to efficient pump operation. Figure 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).

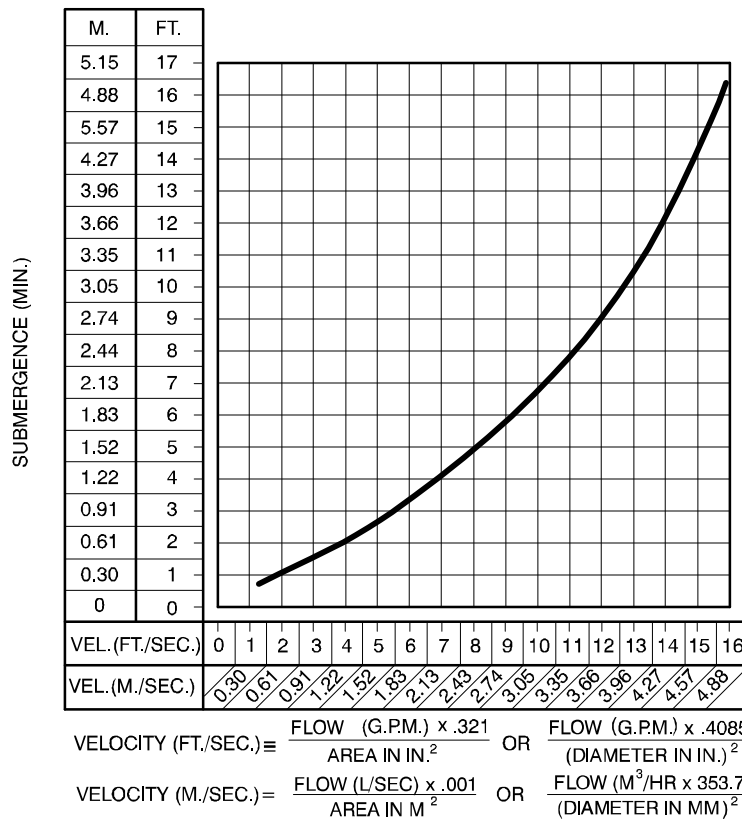


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

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.



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.



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



Adjusting the alignment in one direction may alter the alignment in another direction. Check each procedure after altering alignment.

Coupled Drives

When using couplings, the axis of the power source must be aligned to the axis of the pump shaft in both the horizontal and vertical planes. Most couplings require a specific gap or clearance

between the driving and the driven shafts. Refer to the coupling manufacturer's service literature.

Align spider insert type couplings by using calipers to measure the dimensions on the circumference of the outer ends of the coupling hub every 90°. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 3).

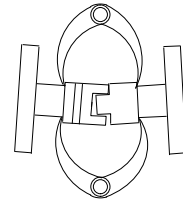


Figure 3. Aligning Spider-Type Couplings

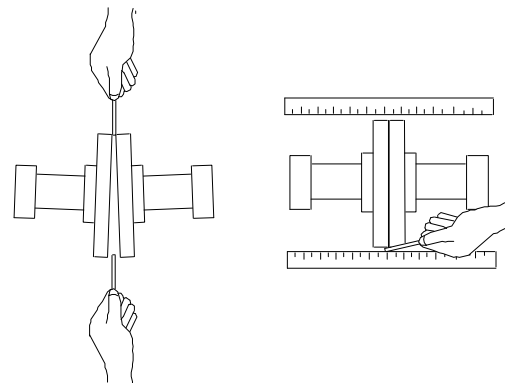


Figure 4. Aligning Non-Spider Type Couplings

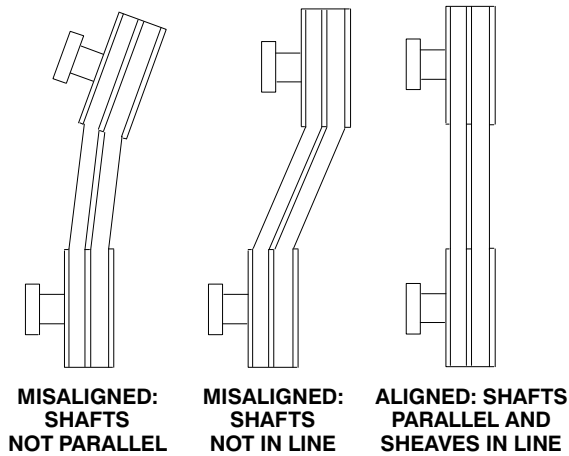
Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 4).

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 5). 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 5. Alignment of V-Belt Driven Pumps

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



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

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.

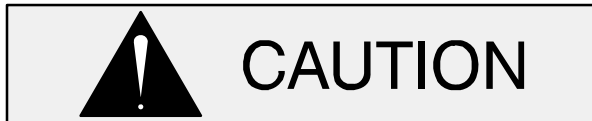
OPERATION – SECTION C

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

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



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 liquids which may damage the pump or endanger personnel as a result of pump failure.



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

STARTING

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**).

Consult the operations manual furnished with the power source.

Rotation

The correct direction of pump rotation is counter-clockwise 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

The pump will begin to prime upon startup. The air in the suction line will be discharged from the priming chamber 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 the **Maintenance and Repair** section of this manual for further details.

OPERATION

Leakage

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

Liquid Temperature And Overheating

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

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating

against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.



Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely 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 overheating 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 overheats 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

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.

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.

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.

Priming Chamber Discharge Line

Check the priming chamber discharge line for liquid bypass. If bypass occurs, shut down the pump. Refer to the **Maintenance and Repair** section of this manual and disassemble and clean the float and valve assembly inside the priming chamber.

STOPPING

Consult the operations manual furnished with the power source.

After stopping the pump, lock out or disconnect the power source to ensure that the pump will remain inoperative.



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

PERIODIC CHECKS

Seal And Bearing Cavity Lubrication

Both the seal and bearing cavities were fully lubricated at the factory. Check the lubrication levels before startup, and regularly thereafter as indicated in the **Maintenance and Repair** section of this manual. When lubrication is required, use **only** SAE No. 30 non-detergent oil.

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 temperature 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 **MAINTENANCE AND REPAIR**). 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.



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 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. Air leak in suction line. Lining of suction hose collapsed. Leaking or worn seal or pump gasket. Suction lift or discharge head too high. Air compressor damaged/belts broken. Strainer clogged.	Clean or replace check valve. Correct leak. Replace suction hose. Check pump vacuum. Replace leaking or worn seal or gasket. Check piping installation and install bypass line if needed. See INSTALLATION . Check and repair/replace. Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Eductor clogged. Air leak in suction line. Lining of suction hose collapsed. Leaking or worn seal or pump gasket.	Check and clean eductor. Correct leak. Replace suction hose. Check pump vacuum. Replace leaking or worn seal or gasket.

Pump Troubleshooting (Cont'd)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Strainer clogged. Discharge check valve clogged. Suction intake not submerged at proper level or sump too small. Impeller or other wearing parts worn or damaged. Impeller clogged. Discharge head too high. Suction lift too high. Pump speed too slow. Belt or flexible coupling broken.	Check strainer and clean if necessary. Check and clean check valve. Check installation and correct submergence as needed. Replace worn or damaged parts. Check that impeller is properly centered and rotates freely. Free impeller of debris. Install bypass line. Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line. Check driver output; consult driver operation manual. Check and replace as necessary.
PUMP REQUIRES TOO MUCH POWER	Pump speed too high. Extreme ambient temperature. Discharge head too low. Liquid solution too thick. Bearing(s) frozen.	Check driver output; check that sheaves or couplings are correctly sized. Reduce pump output. Adjust discharge valve. Dilute if possible. Disassemble, check and replace bearing(s) as required..
PUMP CLOGS FREQUENTLY	Discharge flow too slow. Suction check valve or foot valve clogged or binding. Liquid solution too thick.	Open discharge valve fully to increase flow rate, and run power source at maximum speed. Clean valve. Dilute if possible.
EXCESSIVE NOISE	Cavitation in pump. Pumping entrained air. Pump or drive not securely mounted. Impeller clogged or damaged.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory. Locate and eliminate source of air bubble. Secure mounting hardware. Clean out debris; replace damaged parts.

Pump Troubleshooting (Cont'd)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits. Low or incorrect lubricant. Suction and discharge lines not properly supported. Drive misaligned. Excessive tension on drive belt.	Check bearing temperature regularly to monitor any increase. Check for proper type and level of lubricant. Check piping installation for proper support. Align drive properly. Check belt tension. Adjust as required.

PUMP 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.

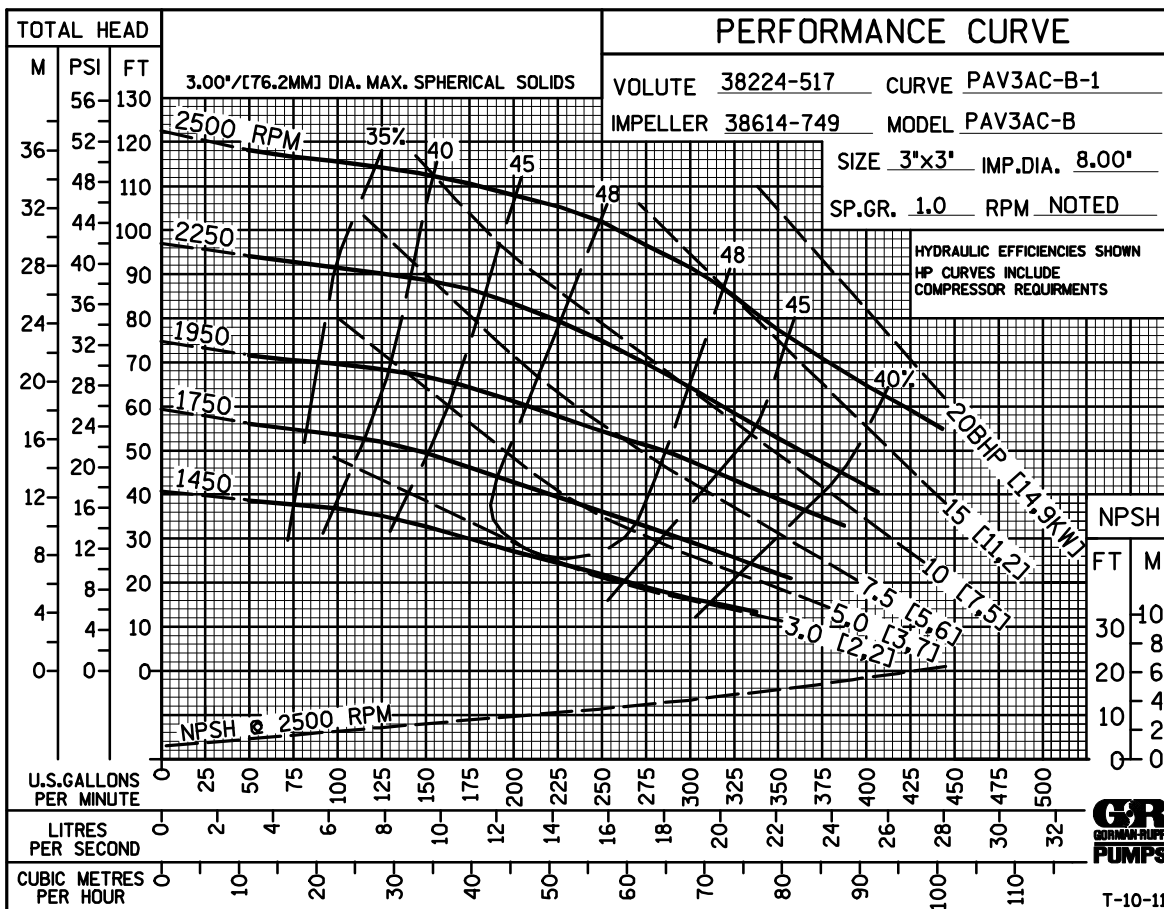
Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication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

Legend:
 I = Inspect, Clean, Adjust, Repair or Replace as Necessary
 C = Clean
 R = Replace

* Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually. Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.

PUMP MAINTENANCE AND REPAIR – SECTION E

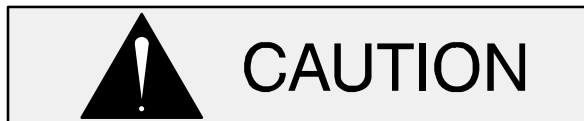
MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



* **STANDARD PERFORMANCE FOR PUMP MODEL PAV3A60C-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.

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



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

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

ILLUSTRATION

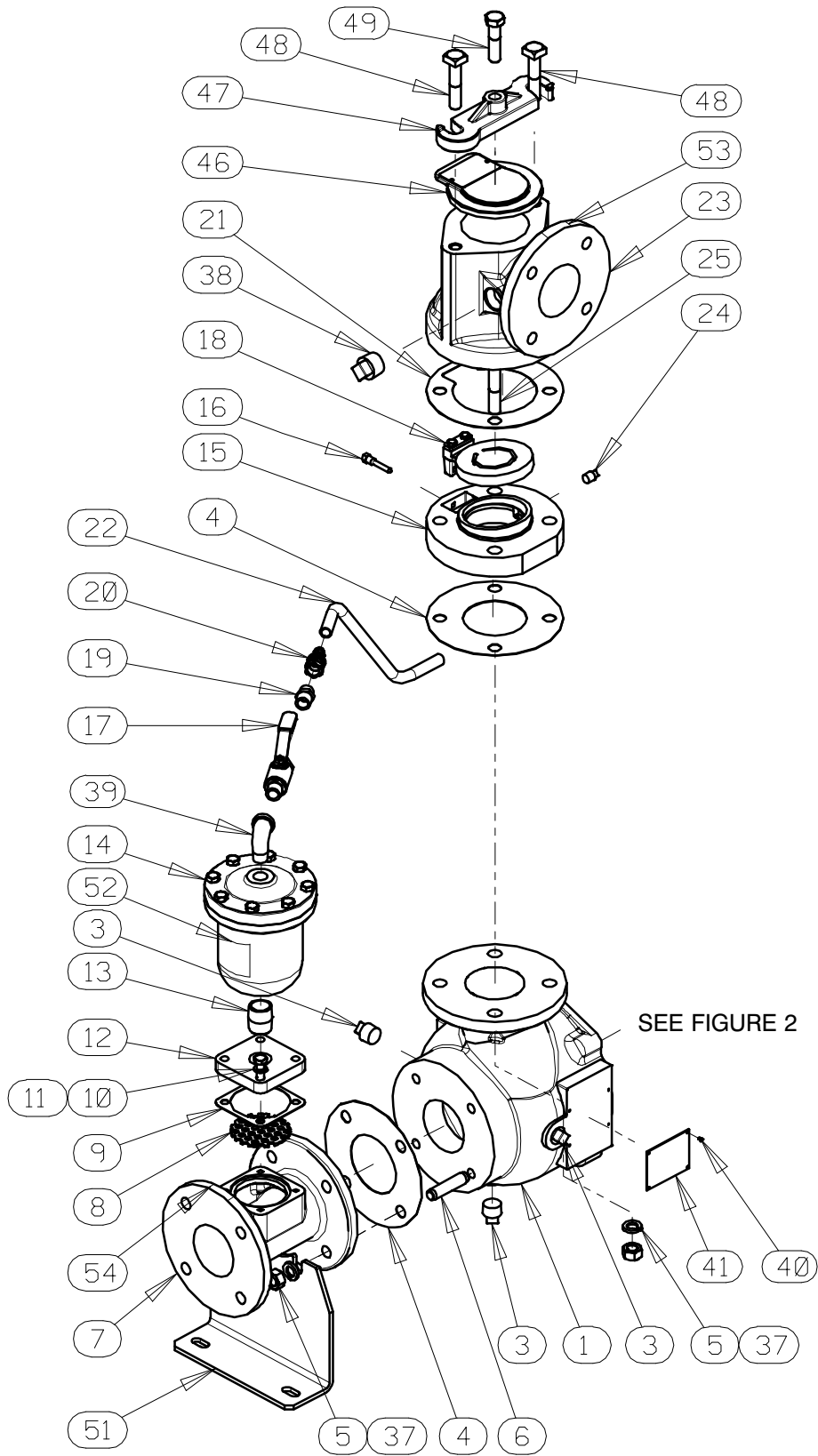


Figure 1. Pump Model PAV3A60C-B

PARTS LIST
Pump Model PAV3A60C-B
 (From S/N 1511107 Up)

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

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	38224-517	10000	1	30	HEX HEAD CAP SCREW	22645-168	----	4
2	REPAIR ROTATING ASSY	44163-534	----	1	31	U-BOLT	21751-019	----	1
3	PIPE PLUG	P12	15079	3	32	LOCK WASHER	J04	15991	2
4 *	GASKET	25113-033	----	2	33	HEX NUT	D04	15991	2
5	LOCK WASHER	21171-514	----	8	34	LOCK WASHER	21171-512	----	4
6	STUD	MC1670	15991	4	35	HEX HEAD CAP SCREW	22644-224	----	4
7	SUCTION SPOOL	38642-013	10000	1	36 *	O-RING	S1874	----	1
8	STRAINER SCREEN	38661-205	17040	1	37	HEX NUT	22647-012	----	8
9 *	HOPPER GASKET	38687-581	18000	1	38	PIPE PLUG	P16	10009	1
10	LOCK WASHER	21171-511	----	12	39	STREET ELBOW	RS08	11999	1
11	HEX HEAD CAP SCREW	22645-166	----	4	40	DRIVE SCREW	BM#04-03	17000	4
12	HOPPER CAP	33282-033	15080	1	41	NAMEPLATE	38818-155	13000	1
13	CLOSE PIPE NIPPLE	T16	15079	1	42	SPACER	31131-098	15000	4
14	PRIMING VALVE	26664-009	----	1	43	SPROCKET	24271-118	----	1
15	SUCTION FLANGE	11412	10010	1	44	BUSHING	24131-211	----	1
16	CHECK VALVE PIN	11557A	17010	1	45 *	KEY	N0404	15990	REF
17	BALL VALVE	26631-052	----	1	46	COVER PLT ASSY	42111-344	----	1
18 *	FLAP VALVE ASSY	46411-060	----	1	47	CLAMP BAR	38111-004	11010	1
19	CONNECTOR	S1598	----	1	48	MACHINE BOLT	A1012	15991	2
20	HOSE BARB FTG	26523-047	----	1	49	HEX HD CAPSCREW	B1010S	15991	1
21 *	SUCT FLANGE GASKET	11412G	19370	1	50	FLANGE SUPPORT	34265-054	15080	1
22	1/2" I.D. X 18" LG HOSE	18513-113	----	1	51	SUCTION SUPPORT	34265-055	15080	1
23	DISCHARGE ELBOW	38647-641	10000	1	52	G-R DECAL	GR-03	----	1
24	PIPE PLUG	P04	15079	1	53	DISCHARGE STICKER	6588BJ	----	1
25	STUD	22641-023	----	4	54	SUCTION STICKER	6588AG	----	1
26	AIR COMPRESSOR ASSY	46181-908	----	1	55	OIL LEVEL DECAL	38816-123	----	1
27 *	BELT	24186-011	----	1	56	LUBRICATION DECAL	38816-074	----	1
28	FAN GUARD	42381-510	2415X	1	57	GUARD WARNING DECAL	38816-063	----	1
29	SOCKET HD CAP SCREW	22644-215	----	4	58	INSTRUCTION TAG	38817-085	----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

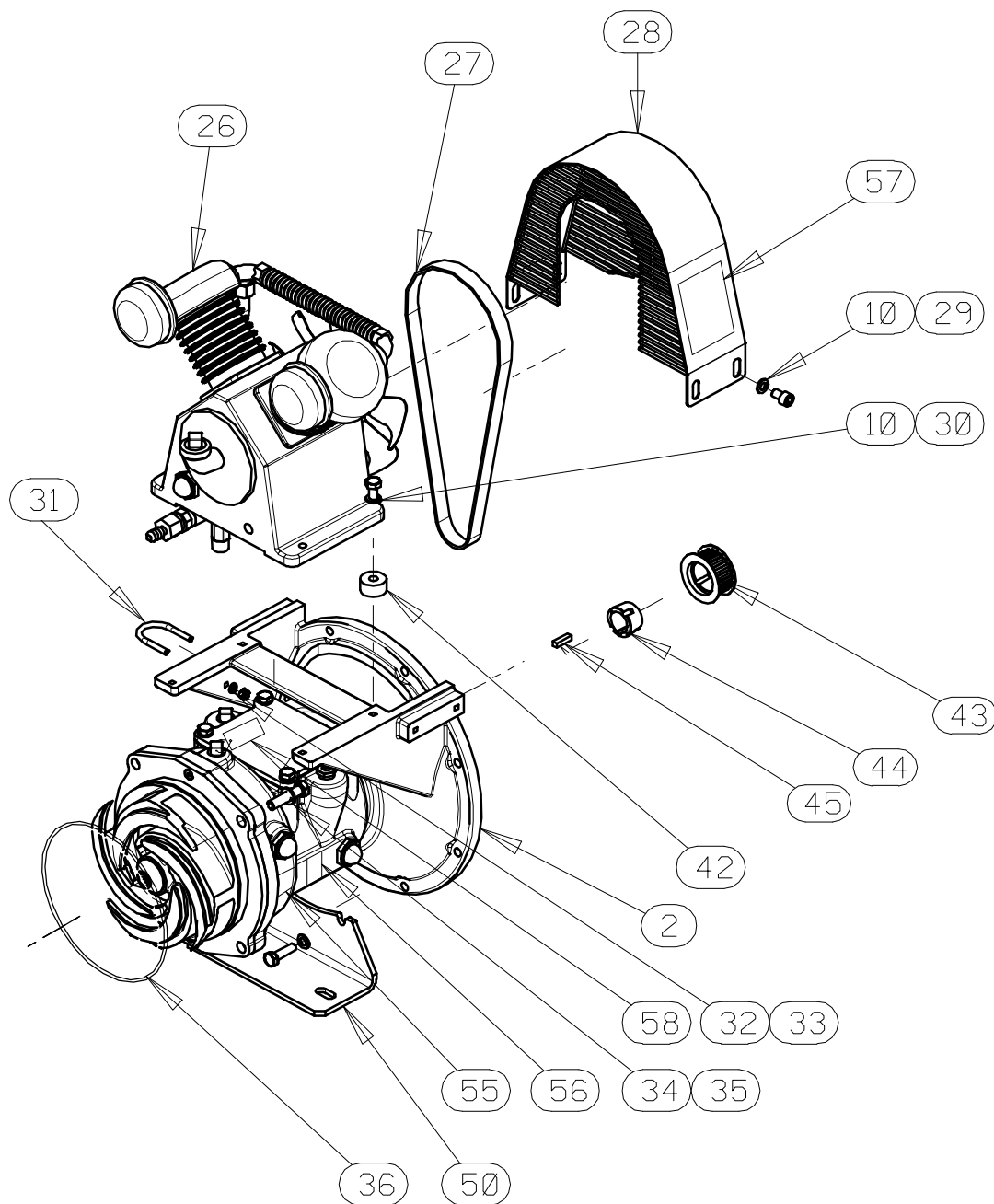


Figure 2. Pump Model PAV3C60C-B (Cont'd)

PARTS LIST

Pump Model Pump Model PAV3C60C-B (Cont'd)

(From S/N Up)

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

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	38224-517	10000	1	30	HEX HEAD CAP SCREW	22645-168	----	4
2	REPAIR ROTATING ASSY	44163-534	----	1	31	U-BOLT	21751-019	----	1
3	PIPE PLUG	P12	15079	3	32	LOCK WASHER	J04	15991	2
4 *	GASKET	25113-033	----	2	33	HEX NUT	D04	15991	2
5	LOCK WASHER	21171-514	----	8	34	LOCK WASHER	21171-512	----	4
6	STUD	MC1670	15991	4	35	HEX HEAD CAP SCREW	22644-224	----	4
7	SUCTION SPOOL	38642-013	10000	1	36 *	O-RING	S1874	----	1
8	STRAINER SCREEN	38661-205	17040	1	37	HEX NUT	22647-012	----	8
9 *	HOPPER GASKET	38687-581	18000	1	38	PIPE PLUG	P16	10009	1
10	LOCK WASHER	21171-511	----	12	39	STREET ELBOW	RS08	11999	1
11	HEX HEAD CAP SCREW	22645-166	----	4	40	DRIVE SCREW	BM#04-03	17000	4
12	HOPPER CAP	33282-033	15080	1	41	NAMEPLATE	38818-155	13000	1
13	CLOSE PIPE NIPPLE	T16	15079	1	42	SPACER	31131-098	15000	4
14	PRIMING VALVE	26664-009	----	1	43	SPROCKET	24271-118	----	1
15	SUCTION FLANGE	11412	10010	1	44	BUSHING	24131-211	----	1
16	CHECK VALVE PIN	11557A	17010	1	45 *	KEY	N0404	15990	REF
17	BALL VALVE	26631-052	----	1	46	COVER PLT ASSY	42111-344	----	1
18 *	FLAP VALVE ASSY	46411-060	----	1	47	CLAMP BAR	38111-004	11010	1
19	CONNECTOR	S1598	----	1	48	MACHINE BOLT	A1012	15991	2
20	HOSE BARB FTG	26523-047	----	1	49	HEX HD CAPSCREW	B1010S	15991	1
21 *	SUCT FLANGE GASKET	11412G	19370	1	50	FLANGE SUPPORT	34265-054	15080	1
22	1/2" I.D. X 18" LG HOSE	18513-113	----	1	51	SUCTION SUPPORT	34265-055	15080	1
23	DISCHARGE ELBOW	38647-641	10000	1	52	G-R DECAL	GR-03	----	1
24	PIPE PLUG	P04	15079	1	53	DISCHARGE STICKER	6588BJ	----	1
25	STUD	22641-023	----	4	54	SUCTION STICKER	6588AG	----	1
26	AIR COMPRESSOR ASSY	46181-908	----	1	55	OIL LEVEL DECAL	38816-123	----	1
27 *	BELT	24186-011	----	1	56	LUBRICATION DECAL	38816-074	----	1
28	FAN GUARD	42381-510	2415X	1	57	GUARD WARNING DECAL	38816-063	----	1
29	SOCKET HD CAP SCREW	22644-215	----	4	58	INSTRUCTION TAG	38817-085	----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

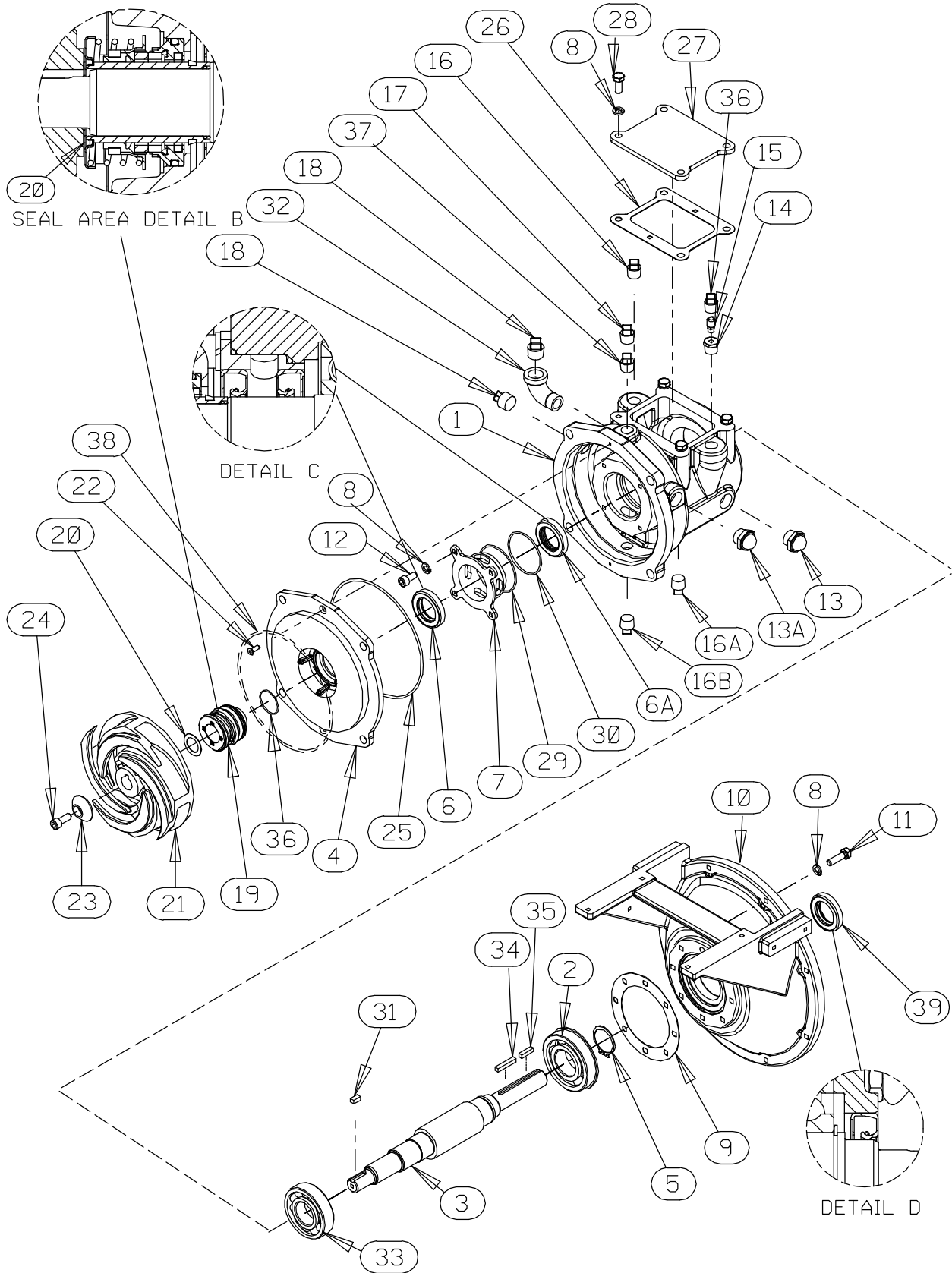


Figure 3. 44163-534 Repair Rotating Assembly

PARTS LIST
44163-534 Repair Rotating Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	BEARING HOUSING	38251-426	10000	1
2	* BALL BEARING	23287-009	----	1
3	* IMPELLER SHAFT	38514-842	16000	1
4	SEAL PLATE	38272-425	11010	1
5	RETAINING RING	S442	----	1
6	* OIL SEAL	S1452	----	1
6A	* OIL SEAL	S1452	----	1
7	LIP SEAL HOLDER	38242-709	11010	1
8	LOCK WASHER	21171-511	----	16
9	* GASKET	38683-480	18000	1
10	MOUNTING FLANGE	38545-014	10000	1
11	HEX HEAD CAP SCREW	22645-382	----	8
12	SOCKET HEAD CAP SCREW	22644-216	----	4
13	BEARING CAVITY SIGHT GAUGE	S1471	----	1
13A	SEAL CAVITY SIGHT GAUGE	S1471	----	1
14	REDUCER PIPE BUSHING	AP0802	15079	1
15	AIR VENT	S1530	----	1
16	PIPE PLUG	P08	15079	1
16A	BEARING CAVITY DRAIN PLUG	P08	15079	1
16B	SEAL CAVITY DRAIN PLUG	P08	15079	1
17	VENTED PIPE PLUG	4823A	15079	1
18	PIPE PLUG	P12	15079	2
19	* CART SEAL ASSEMBLY	46513-151	----	1
20	ADJ SHIM SET	2X	17090	REF
21	* IMPELLER	38614-749	11010	1
22	FLAT HEAD CAP SCREW	22644-166	----	2
23	IMPELLER WASHER	31514-016	17000	1
24	SOCKET HEAD CAP SCREW	22644-217	----	1
25	* O-RING	25152-265	----	1
26	* GASKET	38687-582	18000	1
27	COVER	33659-062	15080	1
28	HEX HEAD CAP SCREW	22645-162	----	4
29	* O-RING	25154-151	----	1
30	* O-RING	25154-148	----	1
31	* KEY	24113-601	----	1
32	STREET ELBOW	RS12	11999	1
33	BALL BEARING	S1080	----	1
34	* SHAFT KEY	N0607	15990	1
35	* SHAFT KEY	N0607	15990	1
36	SHAFT SLEEVE O-RING	25154-022	----	REF
37	SHIPPING PLUG	11495B	15079	2
38	* O-RING	S1874	----	1
39	* OIL SEAL	25227-485	----	1
NOT SHOWN:				
	INSTRUCTION TAG	6588U	----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

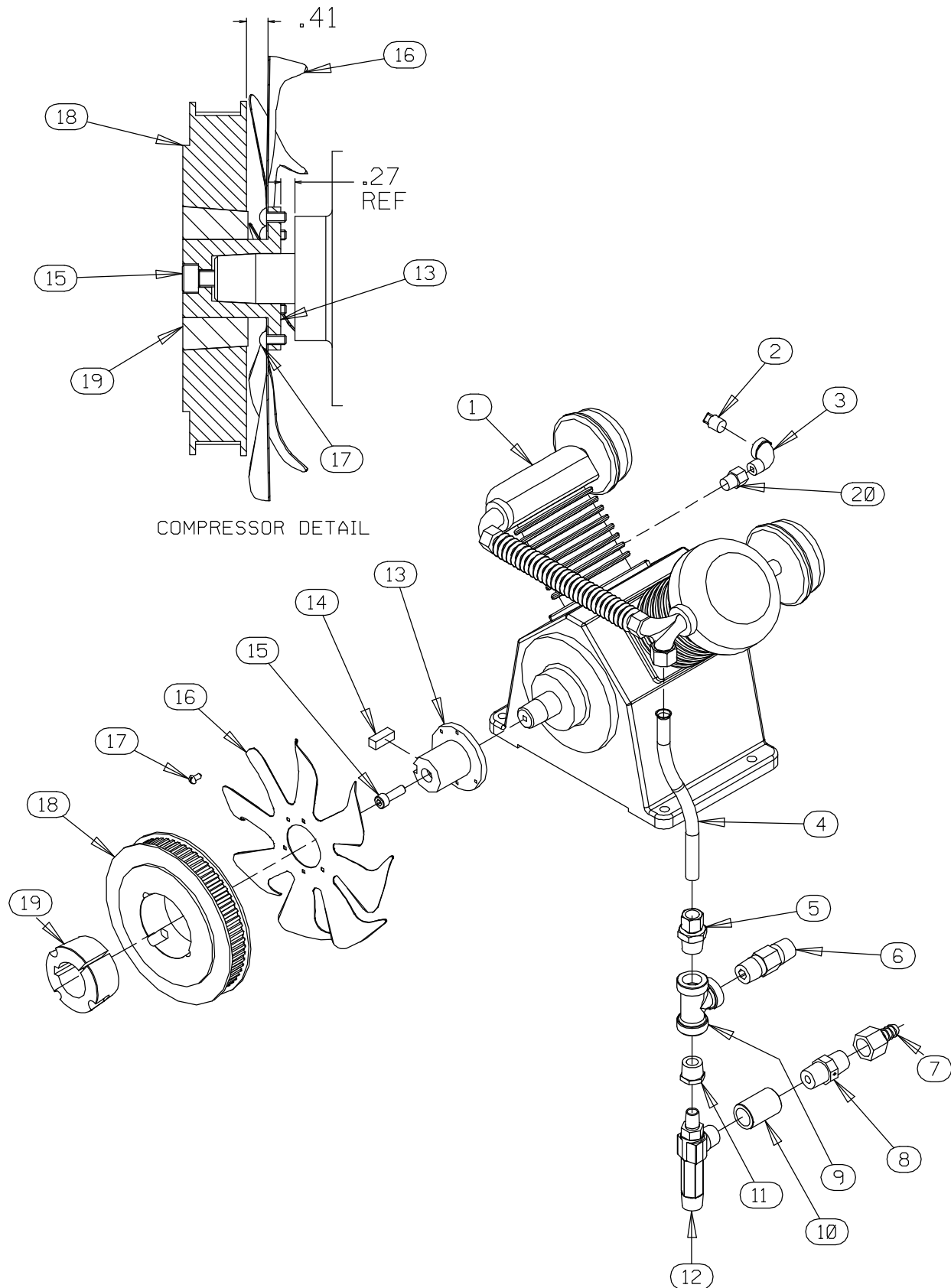


Figure 4. 46181-908 Air Compressor Assembly

PARTS LIST
46181-908 Air Compressor Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	AIR COMPRESSOR	26813-113	---	1
2	PIPE PLUG	P04	15079	1
3	STREET ELBOW	RS04	11999	1
4	TUBE	31962-001	14090	1
5	COMPRESSION FITTING	26311-067	---	1
6	PRESSURE RELIEF VALVE	26662-028	---	1
7	HOSE BARB FITTING	26523-446	---	1
8	CHECK VALVE	26641-092	---	1
9	PIPE TEE	U08	11999	1
10	PIPE COUPLING	AE08	15079	1
11	REDUCER PIPE BUSHING	AP0804	15079	1
12	VENTURI	26817-003	---	1
13	ADAPTER HUB	31531-023	16000	1
14	* KEY	N0604	15990	1
15	SOCKET HEAD CAP SCREW	22644-211	---	1
16	FAN	26813-951	---	1
17	MACHINE SCREW	X#10-01-1/2	15991	5
18	SPROCKET	24271-117	---	1
19	BUSHING	24131-039	---	1
20	HYD HOSE ADAPTER	26813-952	---	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 corresponding Parts Lists. Maintenance and repair instructions for the air compressor are covered separately in specific literature available from the manufacturer.

Before attempting to service the pump, lock out and tag out incoming power to the control box and take precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pump casing by removing the casing drain plug (3, Figure 1). Clean and reinstall the drain plug.



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 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 and make sure it is cool before opening any covers, plates, gauges, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



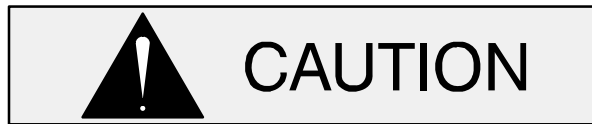
This pump may be equipped with an optional automatic starting system, and therefore subject to automatic restart. Keep hands and clothing away from the unit to prevent injury during automatic operation. Lock out the power from the control box to ensure that the pump will remain inoperative. Failure to do so may result in serious personal injury.



Use only replacement parts provided or approved by Gorman-Rupp. Use of non-authorized parts may result in damage to the equipment and/or injury to personnel and will invalidate the warranty.

Priming Valve Removal And Disassembly

(Figure 1)



Liquid within the priming hopper may be pressurized. When draining liquid from the priming hopper, use caution to avoid contact with the liquid. Otherwise, injury to service personnel may occur.

Disconnect the air discharge hose (22) from the priming valve (14). Liquid will remain in the priming valve. To drain the liquid, slowly remove the pipe plug (not shown) in the valve body.

If draining is slow or difficult, the orifice in the valve may be clogged (valve requires service).

Remove the hardware (10 and 11) and separate the priming valve and hopper cap (12) from the suction spool (7). Remove the gasket (9) and strainer (8) from the suction spool and clean the strainer as necessary.

It is not necessary to separate the priming valve from the hopper cap unless complete replacement of the priming valve is required. If replacement is required, unscrew the priming valve from the nipple (13).

(Figure 5)

Remove the hardware securing the priming valve cover to the priming valve body. Carefully lift the valve cover and components from the priming valve. Remove the priming valve gasket and clean the mating surfaces.

If the priming valve float is stuck, it can usually be cleaned without further disassembly.

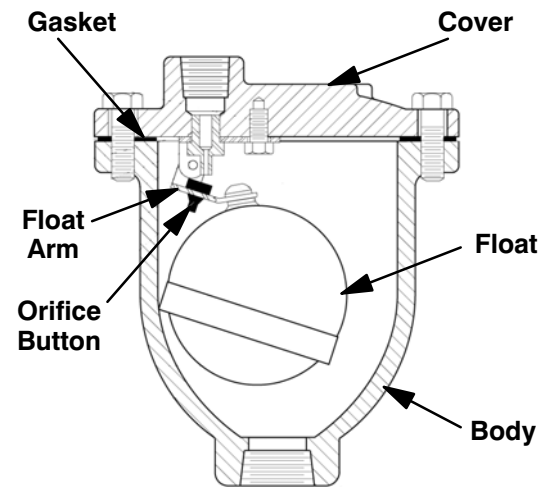


Figure 5. Priming Valve

If excessive liquid continues to bypass through the priming valve after the pump is fully primed, the orifice button may require replacement. Remove the old orifice button from the hole in float arm and install a new one.

Flap Valve Removal

(Figure 1)

Remove the discharge piping from the discharge elbow (23).

Disengage the hardware (5 and 37) and remove the discharge elbow (it may be necessary to tap on the flange (15) with a soft-faced mallet in order to separate the discharge elbow from the flange).

With the discharge elbow removed, remove the gasket (21). Unscrew the pin (16) from the flange. Lift the flap valve assembly (18) out of the flange.

NOTE

Further disassembly of the flap valve is not required since it must be replaced as a complete unit. Individual parts are not sold separately.

Remove the flange if the gasket (4) requires replacement.

Pump Casing Removal

(Figures 1 and 2)

Support the pump casing using a suitable hoist and sling. Use caution to not to damage the pump casing.



Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. If slings or chains are used to move the pump or components, make sure that the load is balanced; otherwise serious personal injury or death could result. Suction and discharge hoses and piping must be removed from the pump before lifting.

Disengage the hardware (34 and 35, Figure 2) securing the pump casing (1, Figure 1) to the rotating assembly (2, Figure 2). Separate the pump casing from the rotating assembly by pulling the casing straight away. Use a soft-faced mallet to tap on the pump casing as necessary to separate the components. Remove and discard the O-ring (36).

Draining Oil From Seal Cavity

(Figure 3)

If any further disassembly is to be performed on the pump, the seal oil cavity must be drained to prevent the oil in the seal cavity from escaping as the impeller is removed.

Position a large, **clean** container under the seal cavity drain plug (16B). Remove the plug and drain the oil from the seal cavity into the container. For shorter drain time, remove the vented plug (17). Clean and reinstall the drain plug and vent plug. Inspect the oil for water, dirt or a cloudy condition which could indicate seal failure.

Impeller Removal

(Figure 3)

Immobilize the impeller (21) with a strap wrench and use an impact wrench to remove the impeller screw and washer (23 and 24). Use caution not to damage the impeller with the strap wrench.

Position two wedges opposite each other behind the impeller, and tap the wedges carefully in turn

until the impeller comes free of the shaft. Retain the impeller key (31).

Remove the impeller adjusting shims (20); tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal

(Figure 3)

Slide the integral shaft sleeve and rotating portion of the seal off the shaft as a unit.

Use a pair of stiff wires with hooked ends to remove the stationary element and seat.

An alternate method of removing the stationary seal components is to remove the flat head cap-screws (22) and slide the seal plate off the shaft (3). Remove the O-ring (38) from the seal plate shoulder.

Position the seal plate on a flat surface with the impeller side Use a wooden dowel or other suitable tool to press on the back side of the stationary seat until the seat, O-rings, and stationary element can be removed.

Remove the shaft sleeve O-ring (36).

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

Removing Air Compressor Assembly

(Figure 2)

Further pump disassembly requires removal of the air compressor assembly (26). Disengage the hardware (10 and 29) and remove the guard (28).

Remove the hardware (10 and 30) and use a pry bar to raise the air compressor high enough to remove the spacers (42). Remove the belt (27) from the air compressor drive pulley (18, Figure 4).

Disengage the hardware (32 and 33) and remove the U-bolt (31).

Disconnect all hoses and fittings from the air compressor and use a suitable hoist and sling to remove the air compressor assembly.

Separating Rotating Assembly From Driver

(Figures 1, 2 and 3)

The rotating assembly must be separated from the driver before further disassembly.

Support the rotating assembly using a hoist and sling. Disengage the coupling from the driver and remove the coupling components and drive key from the impeller shaft.

See Figure 2 and remove the air compressor drive belt (27). Remove the hardware securing the drive flange (10, Figure 3) to the flange support (50, Figure 1) and move the rotating assembly to a clean, well equipped shop area for further disassembly.

Loosen the setscrews in the bushing (44) and slide the sprocket (43), bushing and key (45) off the shaft.

Shaft and Bearing Removal and Disassembly

(Figure 5)

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



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

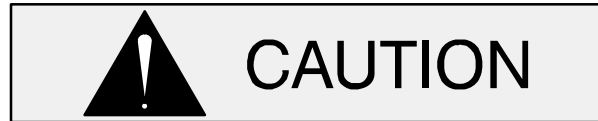
Remove the bearing housing drain plug (16A) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (8 and 11) and remove the mounting flange (20), gasket (9) and oil seal (6B). Press the oil seal from the mounting flange.

Disengage the hardware (8 and 12) and pull the lip seal holder (7) out of the bearing housing (1). Remove the O-rings (29 and 30) from the shoulders on the seal holder. Pry or press the oil seals (6 and 6A) from the seal holder.

Place a block of wood against the impeller end of the shaft (3) and tap the shaft and assembled bearings (5 and 33) from the bearing housing.

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



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

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



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

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



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

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

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the bearing

housing. Replace the bearings, shaft, or bearing housing if the proper bearing fit is not achieved.

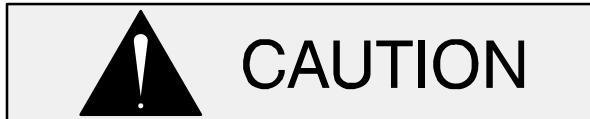
If bearing replacement is required, remove the snap ring (5) and use a bearing puller to remove the inboard and outboard bearings from the shaft.

Shaft and Bearing Reassembly and Installation

(Figure 5)

Inspect the shaft (29) for distortion, nicks or scratches, or for thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

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



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

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

NOTE

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

NOTE

*Position the outboard bearing (35) on the shaft with the retaining ring on the bearing O.D. **toward the drive end of the shaft**.*

Heat the bearings to a uniform temperature **no higher than 250°F (120°C)** and slide the bearings onto the shaft, one at a time, until they are fully seated against the shaft shoulders. This should be

done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

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 shoulders.

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.



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

Secure the outboard bearing to the shaft with the snap ring (5)



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

Slide the shaft and assembled bearings into the bearing housing until the retaining ring on the outboard bearing seats against the bearing housing.

Apply a light coating of oil to the lip of the oil seal (6B) and press it into the mounting flange (10) with the lip positioned as shown in Figure 3. The face of the oil seal should be flush with the chamfer on the mounting flange bore.

Install the mounting flange gasket (9) and secure the mounting flange to the bearing housing with the hardware (8 and 11). **Be careful** not to damage the lip of the oil seal on the shaft keyway. Torque the capscrews (11) to 41 ft. lbs. (5,6 m. kg.).

Apply a light coating of oil to the lip of the oil seals (6 and 6A) and press them into the lip seal holder (7) with the lips positioned as shown in Figure 3.

Slide the assembled lip seal holder and lip seals over the shaft, using caution not to roll the lip of the

inboard oil seal on the shaft shoulder. Secure the lip seal holder to the bearing housing with the hardware (8 and 12).

Lubricate the bearings as indicated in **LUBRICATION** at the end of this section.

Securing Rotating Assembly to Driver

(Figures 1, 2 and 3)

See Figure 3 and install the key (34) in the shaft keyway, making sure to leave room in the keyway for the drive key (35). Install the sprocket (43, Figure 2) and bushing (44, Figure 2) on the shaft to the dimension shown in Figure 6.

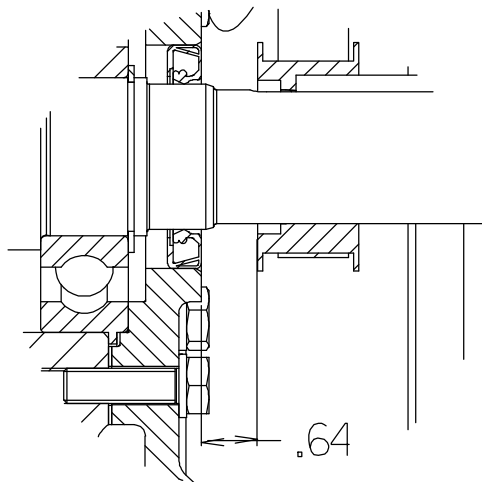


Figure 6. Drive Sprocket Positioning

Secure the bushing and sprocket to the shaft by torqueing the bushing screws to (55 in. lbs. or 6,3 m. kg.). Install the belt (27) over the sprocket and up through the slot in the mounting flange (25, Figure 3).

Install the drive key (35, Figure 3) in the shaft keyway.

Using a suitable lifting device, position the rotating assembly on the base and secure the flange to the support (50, Figure 1) with the previously removed hardware. Reinstall and align the coupling.

Installing Air Compressor Assembly

(Figure 2)

Use a suitable hoist and sling to position the air compressor assembly (26) on the mounting flange

(25, Figure 3). Slide the belt (27) over the air compressor sprocket (43). Use a pry bar to raise the compressor high enough to install the spacers (42) between the compressor and the mounting flange. Secure the compressor to the mounting flange with the hardware (10 and 30).

Reinstall the U-bolt and hardware (31, 32 and 33).

Install the coupling guard (28) and secure it with the previously removed hardware (10 and 29).

Seal and Impeller Installation

(Figures 3, 7, 8 and 9)



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 seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the stationary seat bore in the seal plate for dirt, nicks and burrs, and remove any that exist. The stationary seat bore **must** be completely clean before installing the seal.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

To ease installation of the seal, lubricate the shaft sleeve O-ring and the external stationary seat O-ring with a very **small** amount of light lubricating oil. See Figure 7 for seal part identification.

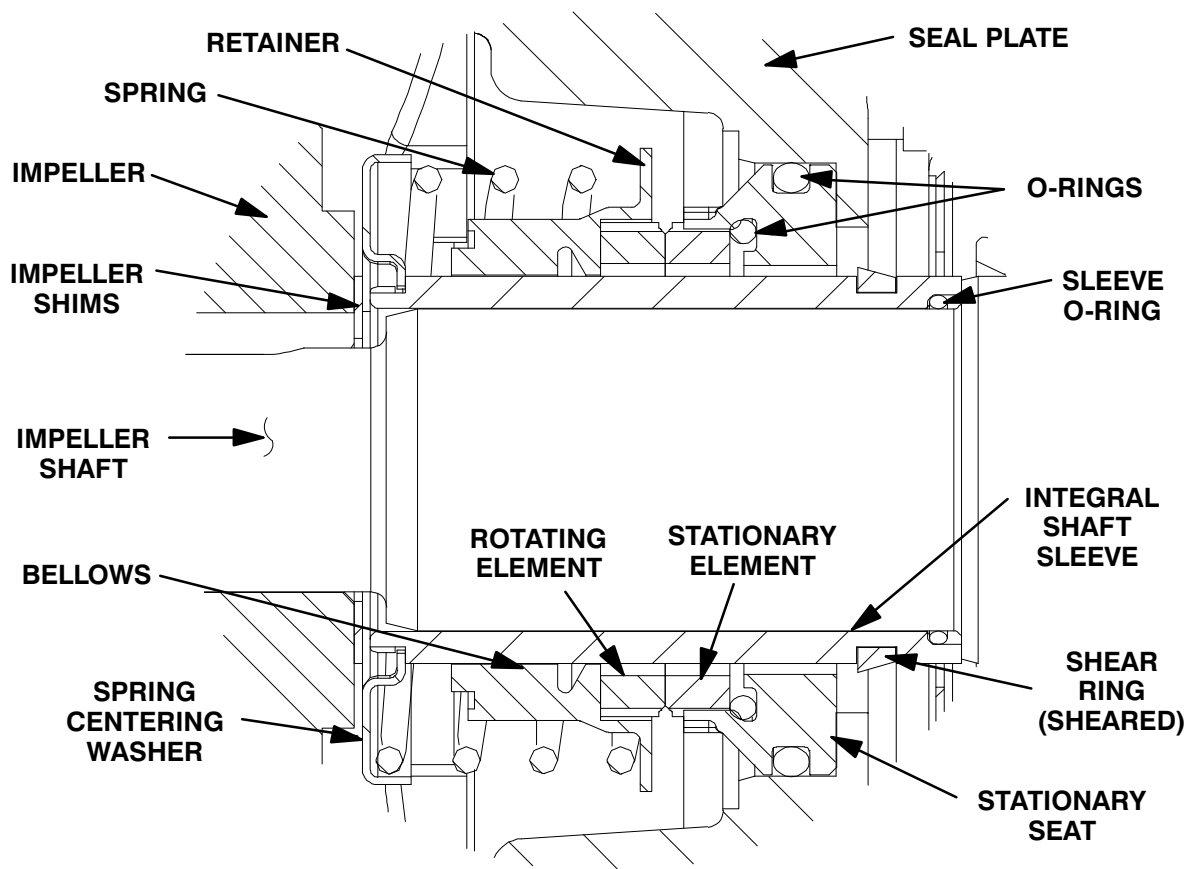
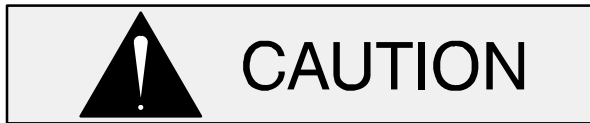


Figure 7. Cartridge Seal Assembly



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

If the seal plate (4) was removed, install the seal plate O-ring (25) and lubricate it with oil. Position the seal plate over the shaft and secure it to the bearing housing with the flat head capscrews (22).

To prevent damaging the shaft sleeve O-ring (36) on the shaft threads, cover the threads with electrical or duct tape. Slide the O-ring over the shaft until it seats against the shaft shoulder. Remove the tape covering the threads. Check to ensure that

the shaft threads are free of any tape residue and clean as required before proceeding with seal installation.

Lubricate the external stationary seat O-ring with light oil. Slide the seal assembly onto the shaft until the external stationary seat O-ring engages the bore in the seal plate.

Inspect the impeller, and replace it if cracked or badly worn. Inspect the impeller screw (24) and shaft threads for dirt or damage, and clean or dress the threads as required.

Install the set of impeller shims (20) provided with the seal and install the impeller key (31) in the shaft keyway. Position the impeller keyway over the impeller key and press the impeller onto the shaft until it is seated against the seal (see Figure 8).

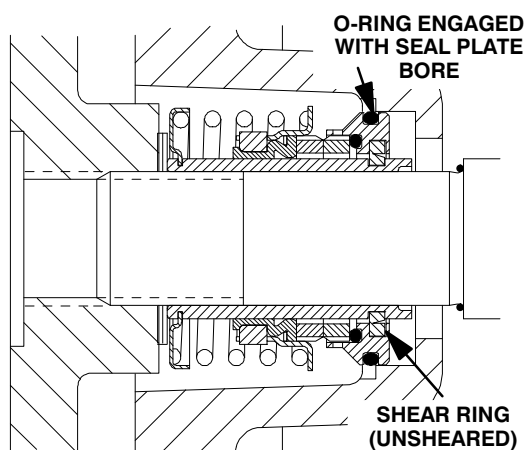


Figure 8. Seal Partially Installed

Immobilize the impeller shaft by wedging a block of wood between one of the impeller vanes and the ground.

Install the impeller washer (23). Apply a small amount of 'Never-Seez' or equivalent anti-lock compound on the threads of the impeller screw (23) and use the impeller screw to press the impeller onto the shaft. This action will press the stationary seat into the seal plate bore.

NOTE

A firm resistance will be felt as the impeller presses the stationary seat into the seal plate bore.

As the stationary seat becomes fully seated, the seal spring compresses, and the shaft sleeve will break the nylon shear ring. This allows the sleeve to slide down the shaft until seated against the shaft shoulder. Continue to use the impeller screw to press the impeller onto the shaft until the impeller, shims and sleeve are fully seated against the shaft shoulder (see Figure 9).

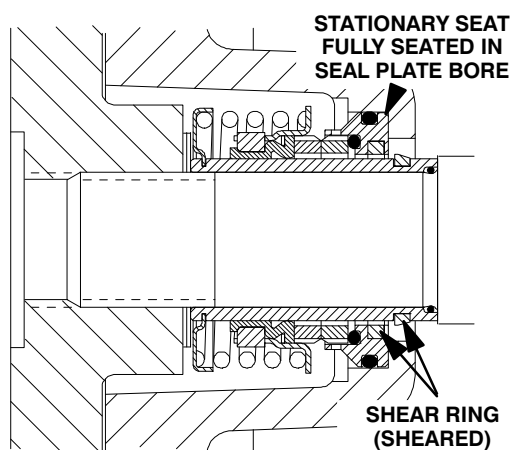


Figure 9. Seal Fully Installed

A clearance of .025 to .040 inch (0,64 to 1,02 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.

Torque the impeller screw to 90 ft. lbs. (12,4 m. kg.).

Remove the wood block used to prevent shaft rotation.

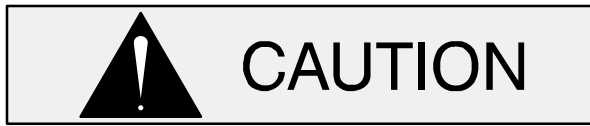
If necessary to reuse an old seal in an emergency, carefully separate the rotating and stationary seal faces from the bellows retainer and stationary seat.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

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.

Carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.



Do not attempt to separate the rotating portion of the seal from the shaft sleeve when reusing an old seal. The rubber bellows will adhere to the sleeve during use, and attempting to separate them could damage the bellows.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Inspect the integral shaft sleeve for nicks or cuts on either end. If any components are worn, or the sleeve is damaged, replace the complete seal; **never mix old and new seal parts.**

Install the stationary seal element in the stationary seat. Press this stationary subassembly into the seal plate bore until it seats squarely against the bore shoulder. A push tube made from a piece of plastic pipe would aid this installation. The I.D. of the pipe should be slightly larger than the O.D. of the shaft sleeve.

Slide the rotating portion of the seal (consisting of the integral shaft sleeve, spring centering washer, spring, bellows and retainer, and rotating element) onto the shaft until the seal faces contact.

Install the impeller as previously described, then proceed with **Pump Casing Installation.**

Pump Casing Installation

(Figures 1 and 2)

Lubricate the O-ring (36, Figure 2) with light grease and install it over the shoulder on the seal plate (4, Figure 3). Use a suitable lifting device to position the pump casing against the seal plate. **Be careful** not to damage the O-ring.

Secure the pump casing to the rotating assembly with the hardware (34 and 35, Figure 1).

See Figure 1. If the suction spool (7) was removed, replace the gasket (4) and position the spool against the pump casing. Secure the spool to the pump casing and suction support (51) with the hardware (3 and 57).

Flap Valve Installation

(Figure 1)

Inspect the flap valve assembly (18) and replace it if badly worn.

NOTE

The flap valve assembly must be replaced as a complete unit. Individual parts are not sold separately.

If the gasket (4) was removed, clean the mating surfaces of the casing (1) and flange (15). Install the new gasket and the flange against the pump casing.

Position the flap valve adaptor in the mounting slot in the flange and secure the assembly with the check valve pin (16).

Install a new flange gasket (21). Apply "Loctite No. 242 Threadlocker" or equivalent compound on the threads of the the studs (25) in the discharge elbow. Lower the discharge elbow over the flange and pump casing and slide the studs down through the holes. Secure the parts with the hardware (5 and 37).

Priming Valve Reassembly And Installation

(Figures 1 and 5)

Clean and inspect the components of the priming valve. Inspect the linkage and ensure the orifice button squarely engages the valve seat. Replace the orifice button if required (see **Priming Valve Removal and Disassembly** for orifice button removal).

Gorman-Rupp provides replacement parts for the cover gasket and the orifice button. If any of the other priming valve components are worn or damaged, they must be replaced before reinstalling the priming valve. For additional parts and service instructions for the valve, Contact the **Val-Matic Valve and Manufacturing Corporation**, or go to **www.valmatic.com** on the World Wide Web. Reference Val-Matic Model Number 25.5.

After servicing the priming valve components, reinstall the priming valve cover gasket and secure the cover to the valve body with the previously removed hardware.

If the complete priming valve is being replaced, screw the replacement valve onto the nipple (13) in the priming hopper cap (12).

Clean the strainer screen (8) and install it in the suction spool. Install the priming hopper gasket (9) and secure the priming valve and priming hopper cap to the suction spool with the previously remove hardware (10 and 11).

Reconnect the air discharge tubing to the priming chamber assembly.

LUBRICATION

(Figure 3)

Seal Assembly

Before starting the pump, remove the vented plug (17) and fill the seal cavity with approximately 36 ounces (1 liter) of SAE No. 30 non-detergent oil or to the center of the sight gauge (13A). Clean and reinstall the vented plug. Maintain the oil level at the middle of the sight gauge.

NOTE

The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.

Bearings

(Figure 3)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regu-

larly through the sight gauge (13) and maintain it at the midpoint of the gauge. When lubrication is required, remove the pipe plug (18) from the elbow (32) and add SAE No. 30 non-detergent oil through the opening. When lubricating a dry (overhauled) bearing housing, fill the bearing cavity with approximately 15 ounces (0,44 liter) of oil, or to the middle of the sight gauge (13). Clean and reinstall the pipe plug. **Do not** over-lubricate the bearing housing. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

NOTE

The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.

Under normal conditions, drain the bearing housing once each year and refill with clean oil. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the 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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