

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



PA SERIES PUMP

MODEL
PAV3B60C-3TNV70

GORMAN-RUPP PUMPS

www.grpumps.com

Register your new
Gorman-Rupp pump online at
www.grpumps.com

Valid serial number and e-mail address required.



The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

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.

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 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

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

HAZARD AND INSTRUCTION DEFINITIONS

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 Prime Aire[®] Series pumps. Refer to the manual accompanying the engine or 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.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut down the engine and disconnect the positive battery cable to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature and make sure the 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.



The pump may be equipped with an 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.



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 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.



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.



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



Do not operate the pump against a closed discharge valve. 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. Momentary closure of a discharge valve is acceptable only when required for startup or shutdown procedures.



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 completely before servicing.

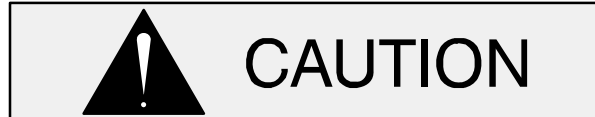


This pump may be used to handle materials which could cause illness through direct exposure or emitted fumes. Wear

adequate protective clothing when working on the pump or piping.



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



Make sure the pump is level. Lower jack stands and chock the wheels, if so equipped. Use caution when positioning the skid-mounted unit to prevent damage to the fuel tank.



Do not operate an internal combustion engine in an explosive atmosphere. When operating an internal combustion engine in an enclosed area, make sure exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless and odorless.



Fuel used by internal combustion engines presents an extreme explosion and fire hazard. Make certain that all fuel lines are securely connected and free of leaks. Never refuel a hot or running engine. Avoid overfilling the fuel tank. Always use the correct type of fuel.

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

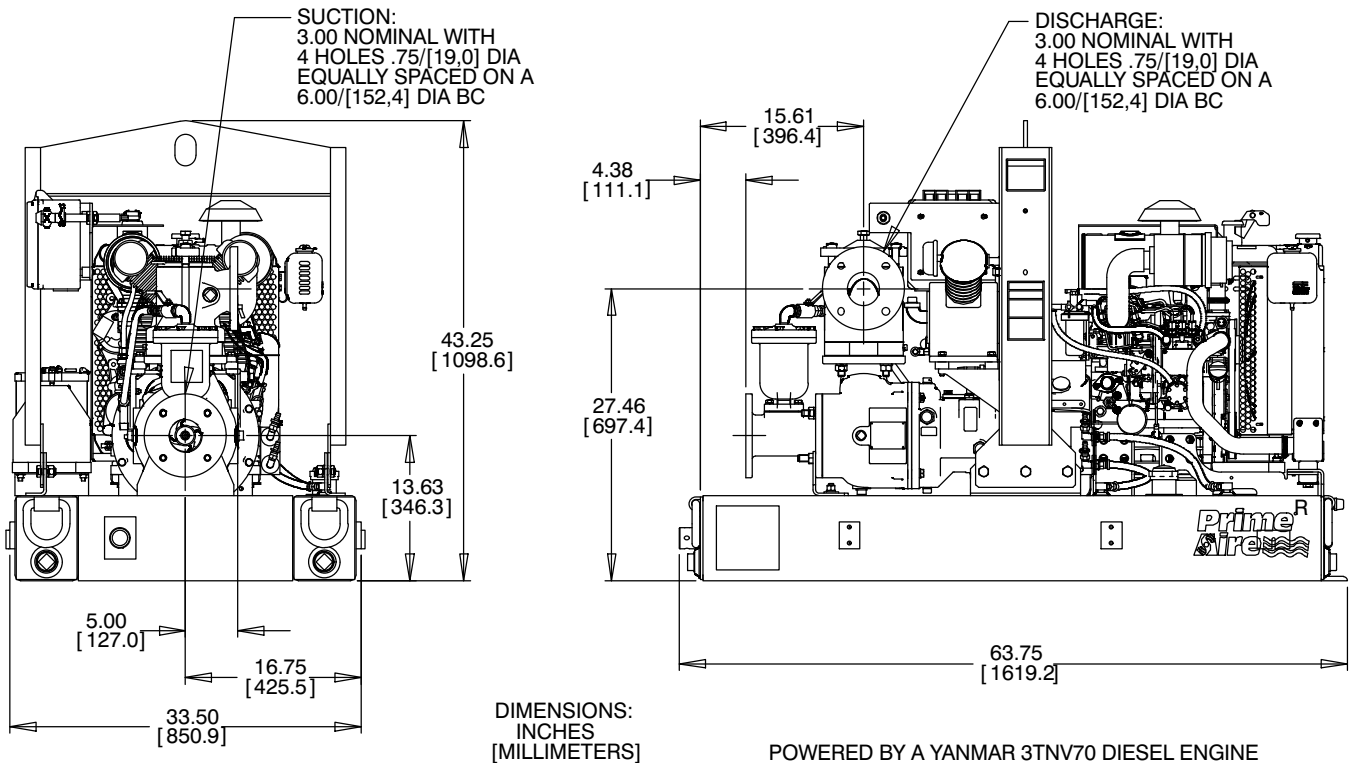


Figure 1. Pump Model PAV3B60C-3TNV70 shown

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.



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



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.

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.

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 and eliminate vibration.

For engine driven units, the pump **must** be positioned as level as possible to ensure sufficient lubrication and fuel supply to the engine.

If the pump has been mounted on a moveable base, make certain the base is stationary by setting the brake and blocking the wheels before attempting to operate the pump.



If the pump has been mounted on a mov-

able base, do not attempt to operate the pump unless the unit is level. Be sure the leveling stands are positioned on a solid surface, and the wheels are chocked.

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 may be 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

Be certain to use the strainer furnished with the pump; any spherical solids which pass through the strainer will also pass through the pump itself.

If a strainer not furnished with the pump 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 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.

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 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.

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.

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).

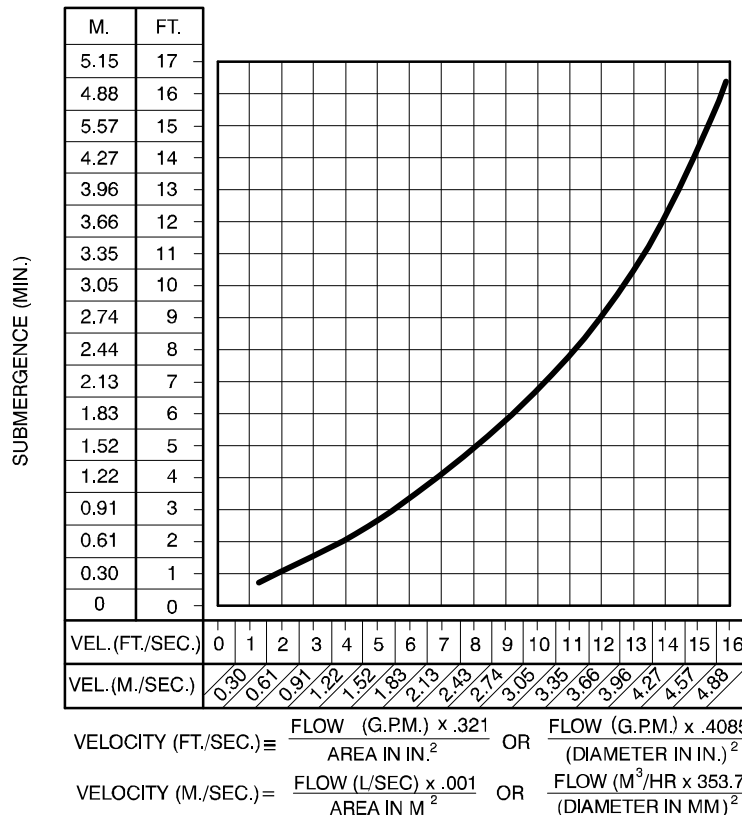


Figure 1. Recommended Minimum Suction Line Submergence vs. Velocity

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.



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 engine is critical for trouble-free mechanical operation. See Section E, **Securing Drive Assembly and Bearing Housing To Engine** in **MAINTENANCE AND REPAIR**, for details.

AUTO-START

The pump may be equipped with an auto-start control system which allows the pump to start and stop as the liquid level in the wet well or sump rises and falls.

Refer to the information accompanying the original pump for installation and operating details for the liquid level sensing system.

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.



Do not operate an internal combustion engine in an explosive atmosphere. When operating an internal combustion engine in an enclosed area, make sure exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless and odorless.

OPERATION



This pump is designed to handle most non-volatile, non-flammable liquids containing specified entrained solids and corrosives. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.

PRIMING

Install the pump and piping as described in **INSTALLATION**. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).

The pump will begin to prime upon startup. The air in the suction line will be discharged from the educator 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.

STARTING

Check the fuel level and oil levels in the engine, air compressor, pump bearings and seal housing.

Make sure the pump is level. Lower the jack stands and chock the wheels, if so equipped.



Make sure the pump is level. Lower jack stands and chock the wheels, if so equipped. Use caution when positioning the skid-mounted unit to prevent damage to the fuel tank.



The pump may be equipped with automatic liquid level controls, 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.

Consult the engine operations manual and the manual accompanying the original unit before attempting to start the unit.

Priming

The pump will begin to prime upon startup. The air in the suction line will be discharged from the educator 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 engine and drain the pump. Remove the cleanout cover plate (see the **Maintenance and Repair** section of this manual for identification) and

check for debris which may be preventing the check valve for seating, or for damage to the check valve itself. If the check valve requires replacement, refer to the **Maintenance and Repair** section of this manual for further details.

Routine Operation



Do not operate an internal combustion engine in an explosive atmosphere. When operating an internal combustion engine in an enclosed area, make sure exhaust fumes are piped to the outside. These fumes contain carbon monoxide, a deadly gas that is colorless, tasteless and odorless.

Adjust the engine speed to achieve the desired output. Do not exceed the factory set engine speed and system operating pressure. Do not operate below the recommended operating speed (if applicable).

OPERATIONAL CHECKS

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.**



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.

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.

Reduce the throttle speed slowly and allow the engine to idle briefly before stopping.

Consult the engine operations manual and the manual accompanying the original unit before stopping the unit.

After stopping the pump, switch off the engine ignition and remove the key to ensure that the pump will remain inoperative.

PERIODIC CHECKS

Seal Cavity And Bearing 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 Section E, **Maintenance and Repair**. When lubrication is required, use **only** SAE No. 30 non-detergent oil.

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 cor-

rect level (see **LUBRICATION** in Section E, **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.

Air Compressor

Consult the manual accompanying the air compressor and perform all duties and checks as indicated.

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.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut down the engine and disconnect the positive battery cable 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.



The pump may be equipped with an 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.

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 or 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.

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

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

PREVENTIVE MAINTENANCE

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

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so

equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For 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.

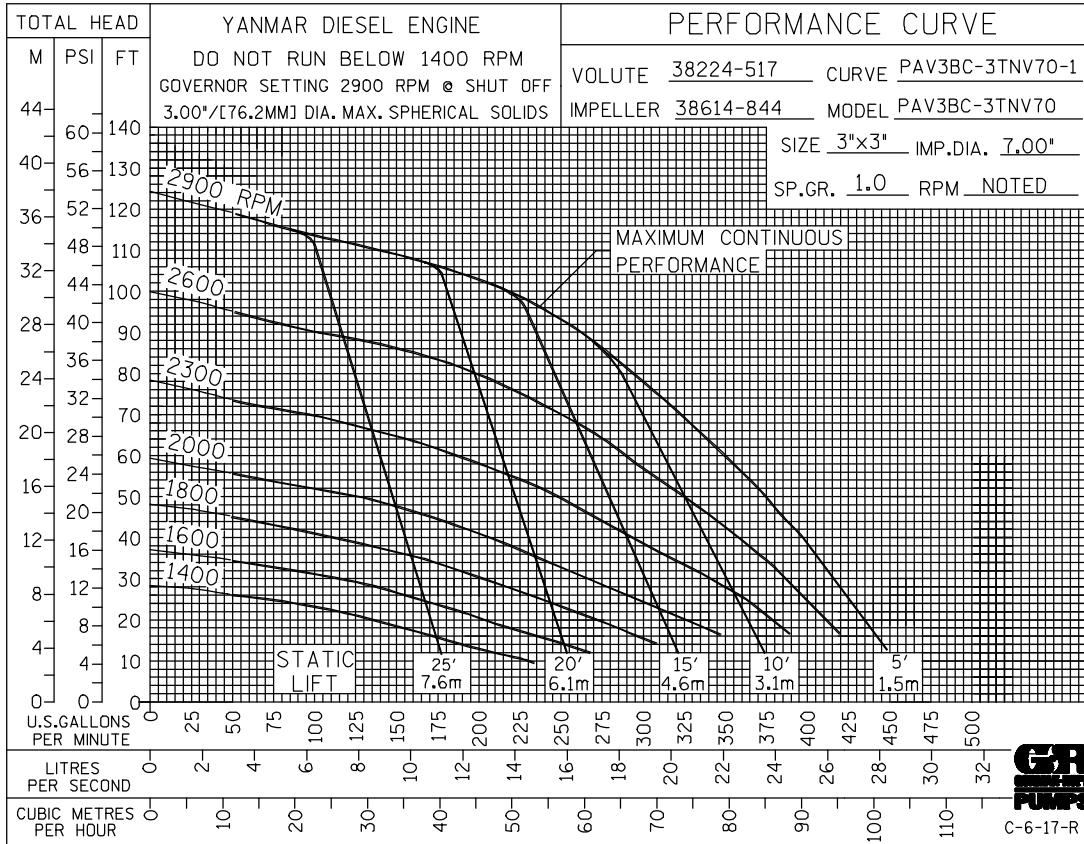
Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (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 PAV3B60C-3TNV70**

* 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 difference due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

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



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

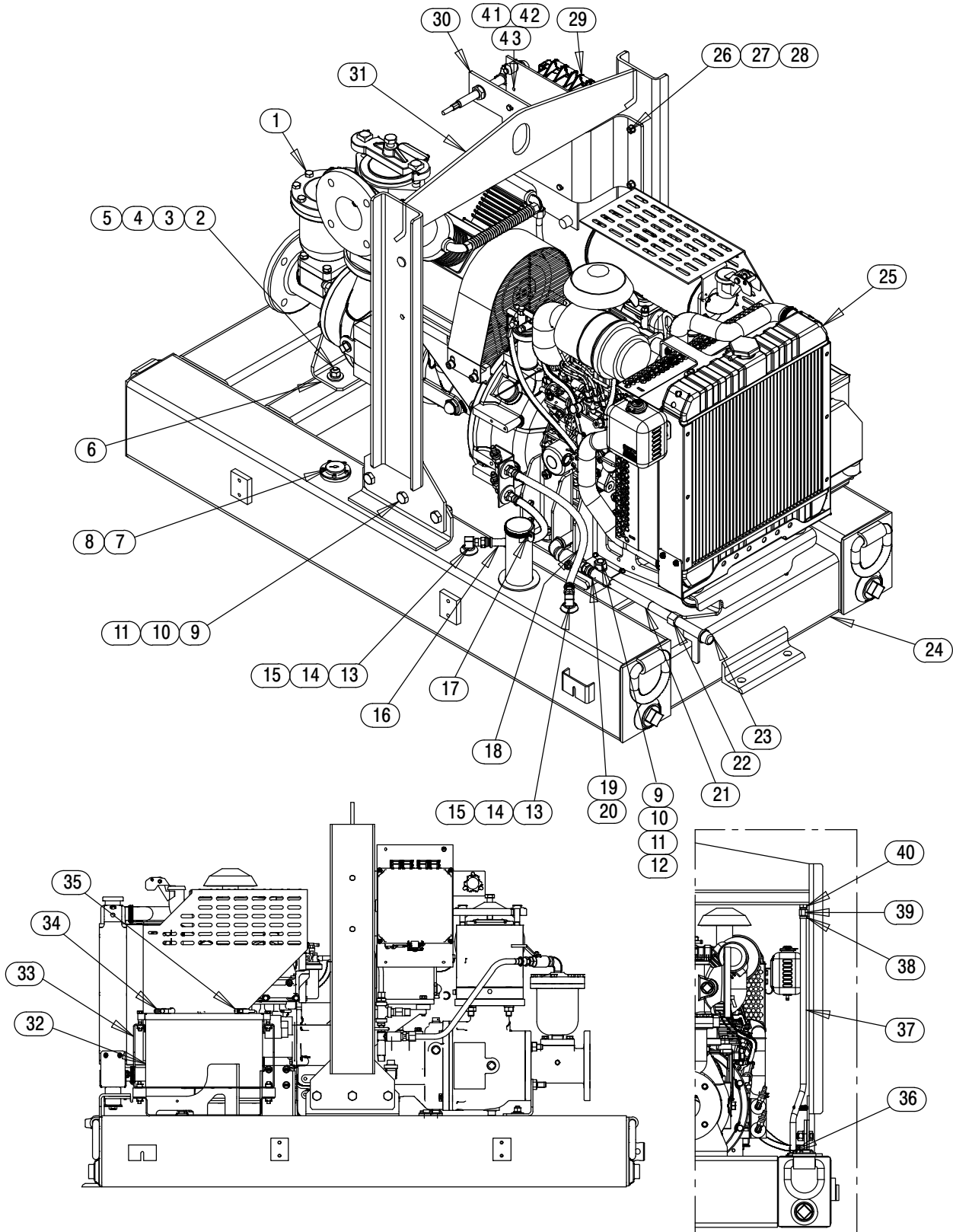


Figure 1. Pump Model PAV3B60C-3TNV70

Pump Model PAV3B60C-3TNV70

PARTS LIST

(From S/N 1638437 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	QTY	ITEM NO.	PART NAME	PART NUMBER	QTY
1	PUMP END ASSEMBLY	46183-133	1	31	LIFT BAIL ASSEMBLY	44715-043 24150	1
2	HEX HEAD CAP SCREW	B0806 15991	2	32	BATTERY 12V	SEE OPTIONS	REF
3	HEX NUT	D08 15991	2	33	BATTERY BOX ASSY	42432-005	1
4	LOCK WASHER	J08 15991	2	34	#4 CABLE SUB-ASSY	47311-404	1
5	FLAT WASHER	K08 15991	4	35	BATTERY GRND CABLE	5795AC 24040	1
6	PUMP SUPPORT BRKT	34266-059 15080	1	36	HOSE BARB FITTING	26523-389	1
7	MECH FUEL GAUGE	29332-172	1	37	HOSE .37 ID X 30" LG	18513-302	1
8	SOC HD CAP SCREW	BD#10-03S 15991	5	38	CABLE TIE	27111-218	1
9	HEX HEAD CAP SCREW	B1006 15991	10	39	HOSE BARB FITTING	26523-447	1
10	LOCK WASHER	J10 15991	10	40	AIR VENT	S1703	1
11	HEX NUT	D10 15991	10	41	HEX NUT	D04 15991	4
12	FLAT WASHER	K10 15991	4	42	LOCK WASHER	J04 15991	4
13	FUEL PICKUP	29332-147	2	43	STUD MOUNT	24631-014	4
14	CONNECTOR	S1447	2	NOT SHOWN:			
15	HOSE BARB FTG	26523-015	2		ENGINE START-UP TAG	38816-269	1
16	HOSE .37 ID X 14" LG	18513-302	1		WARNING DECAL	2613FE	1
17	LOCKING FUEL CAP	29332-111	1		WARNING DECAL	38817-101	2
18	HOSE .37 ID X 18.5" LG	18513-302	1		PRIME AIRE DECAL	38812-078	2
19	HOSE BARB FTG	26523-047	1		CAUTION DECAL	2613FJ	1
20	CONNECTOR	S1598	1		OIL DRAIN LABEL	38816-323	1
21	HOSE .50 ID X 14" LG	18513-056	1		G-R DECAL 6 IN	GR-06	2
22	HOSE BARB FITTING	26523-446	1		FUEL DECAL	38816-196	1
23	PIPE CAP	V08 15079	1		FLOAT SWITCH KIT	48312-980	1
24	BASE/FUEL TANK ASSY	41553-039 24150	1		STRAINER	4917D 24000	1
25	YANMAR ENGINE	29239-071	1	OPTIONAL:			
26	HEX HEAD CAP SCREW	B0604 15991	2		12V BATTERY - DRY	29331-517	1
27	LOCK WASHER	J06 15991	2		12V BATTERY - WET	29331-527	1
28	HEX NUT	D06 15991	2		DUAL FLOAT SWITCH KIT	48312-981	1
29	CNTRL PNL INSTALL KIT	48122-543	1		WHEEL KIT	GRP30-268	1
30	CNTRL PANEL BRACKET	34518-025 15080	1		3" NPT FLANGE KIT	48274-202	1

ILLUSTRATION

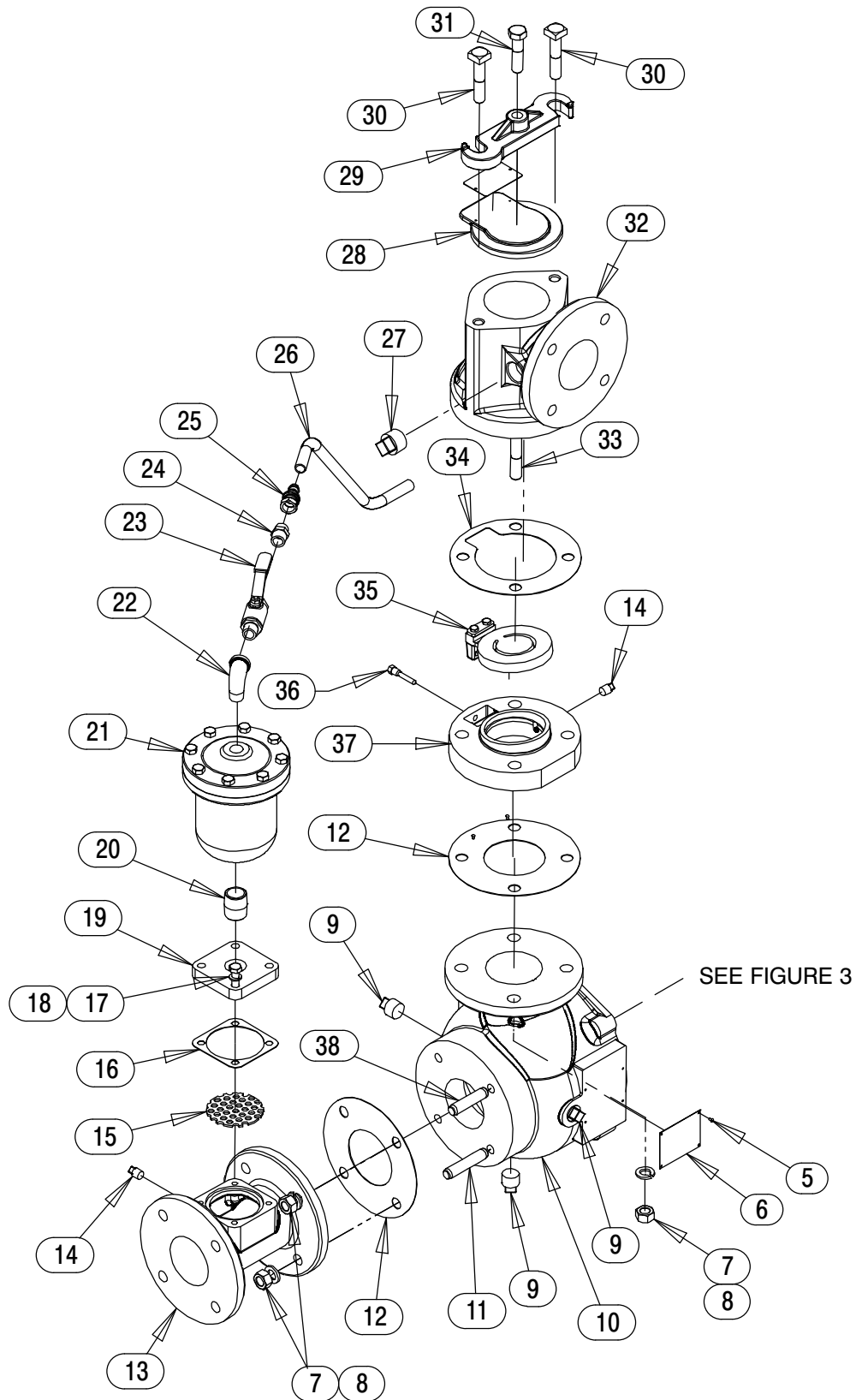


Figure 2. Pump End PAV3B60C-(SAE 5/7.5)

Pump End PAV3B60C--(SAE 5/7.5) PARTS LIST

ITEM NO.	PART NAME	PART NUMBER	QTY	ITEM NO.	PART NAME	PART NUMBER	QTY
1	REPAIR ROTATING ASSY	44163-733	1	31	HEX HEAD CAP SCREW	B1010S 15991	1
2	LOCK WASHER	21171-512	4	32	DISCHARGE ELBOW	38647-641 10000	1
3	HEX HEAD CAP SCREW	22644-224	4	33	STUD	22641-023	4
4 *	O-RING	25152-265	1	34 *	SUCT FLANGE GASKET	11412G 19370	1
5	DRIVE SCREW	BM#04-03 17000	4	35	3" FLAP VALVE ASSY	46411-060	1
6	NAMEPLATE BLANK	38819-004 13000	1		-FLAP VALVE ADAPTER	33291-006 11060	1
7	HEX NUT	22647-012	8		-BACK-UP PLATE	33461-004 15020	1
8	LOCK WASHER	21171-514	8		-NYLOCK CAP SCREW	BT0405 15991	2
9	PIPE PLUG	P12 15079	3		-SPACER SLEEVE	31411-088 15990	2
10	PUMP CASING	SEE NOTE BELOW	1	*	FLAP VALVE	46411-059 24010	1
11	STUD	MC1680 15991	2	36	CHECK VALVE PIN	11557A 17010	1
12 *	GASKET	25113-033	2	37	SUCTION FLANGE	11412 10010	1
13	SUCTION SPOOL	38642-013 10000	1	38	STUD	MC1670 15991	2
14	PIPE PLUG	P04 15079	2	39	LOCK WASHER	J04 15991	2
15	STRAINER SCREEN	38661-205 17040	1	40	HEX NUT	D04 15991	2
16	HOPPER GASKET	38687-581 18000	1	41	UBOLT	21751-019	1
17	LOCK WASHER	21171-511	12	42	AIR COMP ASSEMBLY	46181-908	1
18	HEX HEAD CAP SCREW	22645-166	4	43 *	BELT	24186-011	1
19	HOPPER CAP	33282-033 15080	1	44	FAN GUARD	42381-510 2415X	1
20	CLOSE PIPE NIPPLE	T16 15079	1	45	SOC HD CAP SCREW	22644-215	4
21	PRIMING VALVE	26664-009	1	46	COUPLING KIT	48112-022	1
	* -ORIFICE BUTTON	26688-031	1	47 *	KEY	N0406 15990	1
	* -GASKET	26688-032	1	48	SPROCKET	24271-118	1
22	STREET ELBOW	RS08 11999	1	49	BUSHING 1108 X 1-1/8	24131-211	1
23	BALL VALVE 1/2"	26631-052	1	50	KEY	N0404 15990	REF
24	CONNECTOR	S1598	1	51	HEX HEAD CAP SCREW	22645-168	4
25	HOSE BARB FTG	26523-047	1	52	SPACER	31141-032 13000	4
26	HOSE .50 ID X 18" LG	18513-113	1	NOT SHOWN:			
27	PIPE PLUG	P16 10009	1		OIL LEVEL DECAL	38816-123	1
28	COVER PLATE ASSY	42111-344	1		LUBRICATION DECAL	38816-074	1
	-COVER PLATE	38241-005 10010	1		WARNING DECAL	38817-102	1
	-GASKET	50G 19210	1		DISCHARGE STICKER	6588BJ	1
	-WARNING PLATE	38816-097 13990	1		SUCTION STICKER	6588AG	1
	-DRIVE SCREW	BM#04-03	2		G-R DECAL	GR-03	1
29	CLAMP BAR	38111-004 11010	1		WARNING DECAL	2613FE	1
30	SQUARE HEAD BOLT	A1012 15991	2		INSTRUCTION TAG	38817-085	1

* INDICATES PARTS RECOMMENDED FOR STOCK

☞ INCLUDED WITH REPAIR 46474-906 1
PUMP CASING ASSY

ILLUSTRATION

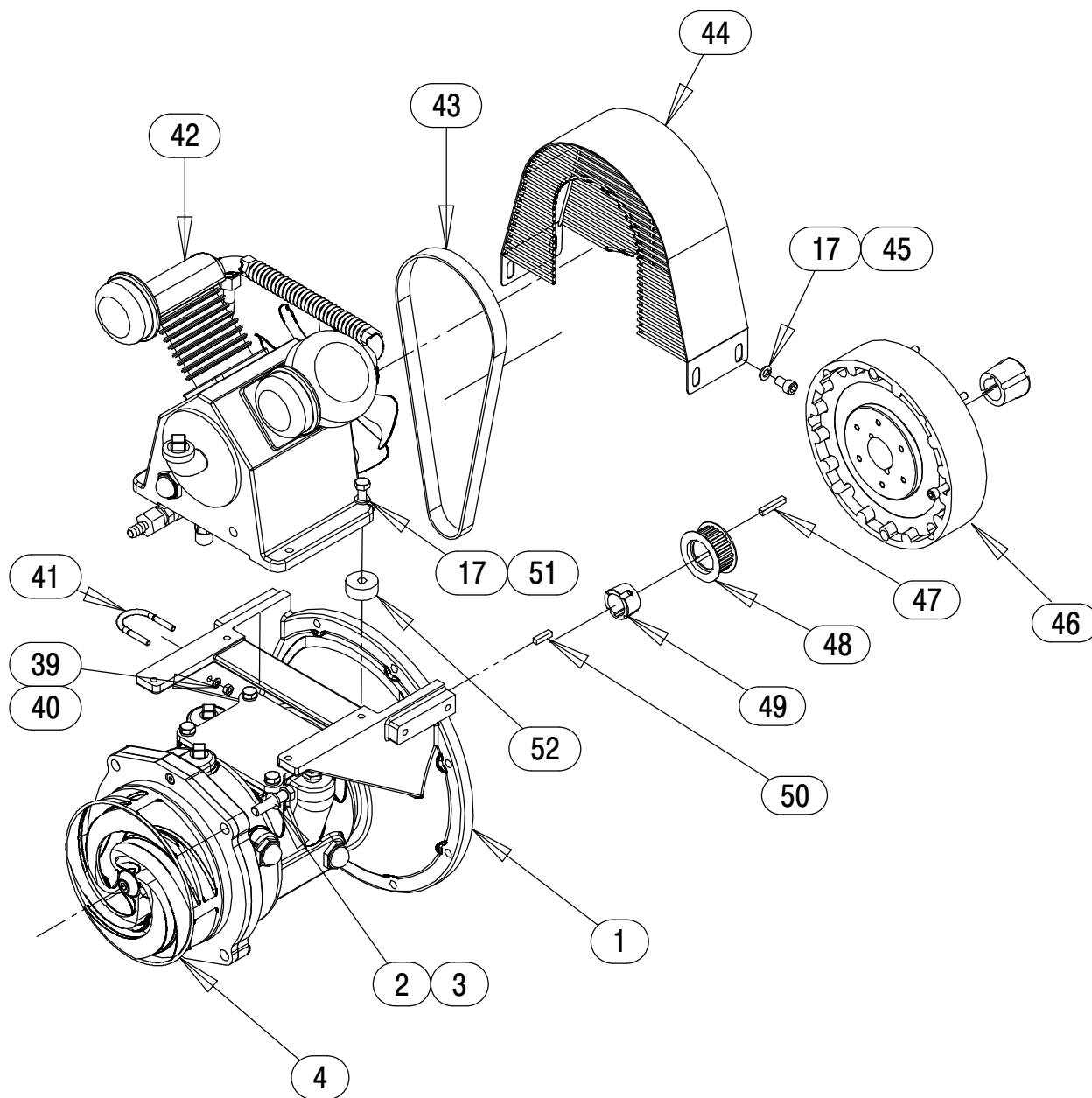


Figure 3. Pump End PAV3B60C-(SAE 5/7.5) Continued

Pump End PAV3B60C--(SAE 5/7.5)
PARTS LIST Continued

ITEM NO.	PART NAME	PART NUMBER	QTY	ITEM NO.	PART NAME	PART NUMBER	QTY
1	REPAIR ROTATING ASSY	44163-733	1	31	HEX HEAD CAP SCREW	B1010S 15991	1
2	LOCK WASHER	21171-512	4	32	DISCHARGE ELBOW	38647-641 10000	1
3	HEX HEAD CAP SCREW	22644-224	4	33	STUD	22641-023	4
4 *	O-RING	25152-265	1	34 *	SUCT FLANGE GASKET	11412G 19370	1
5	DRIVE SCREW	BM#04-03 17000	4	35	3" FLAP VALVE ASSY	46411-060	1
6	NAMEPLATE BLANK	38819-004 13000	1		-FLAP VALVE ADAPTER	33291-006 11060	1
7	HEX NUT	22647-012	8		-BACK-UP PLATE	33461-004 15020	1
8	LOCK WASHER	21171-514	8		-NYLOCK CAP SCREW	BT0405 15991	2
9	PIPE PLUG	P12 15079	3		-SPACER SLEEVE	31411-088 15990	2
10	PUMP CASING	SEE NOTE BELOW	1	*	FLAP VALVE	46411-059 24010	1
11	STUD	MC1680 15991	2	36	CHECK VALVE PIN	11557A 17010	1
12 *	GASKET	25113-033	2	37	SUCTION FLANGE	11412 10010	1
13	SUCTION SPOOL	38642-013 10000	1	38	STUD	MC1670 15991	2
14	PIPE PLUG	P04 15079	2	39	LOCK WASHER	J04 15991	2
15	STRAINER SCREEN	38661-205 17040	1	40	HEX NUT	D04 15991	2
16	HOPPER GASKET	38687-581 18000	1	41	UBOLT	21751-019	1
17	LOCK WASHER	21171-511	12	42	AIR COMP ASSEMBLY	46181-908	1
18	HEX HEAD CAP SCREW	22645-166	4	43 *	BELT	24186-011	1
19	HOPPER CAP	33282-033 15080	1	44	FAN GUARD	42381-510 2415X	1
20	CLOSE PIPE NIPPLE	T16 15079	1	45	SOC HD CAP SCREW	22644-215	4
21	PRIMING VALVE	26664-009	1	46	COUPLING KIT	48112-022	1
	* -ORIFICE BUTTON	26688-031	1	47 *	KEY	N0406 15990	1
	* -GASKET	26688-032	1	48	SPROCKET	24271-118	1
22	STREET ELBOW	RS08 11999	1	49	BUSHING 1108 X 1-1/8	24131-211	1
23	BALL VALVE 1/2"	26631-052	1	50	KEY	N0404 15990	REF
24	CONNECTOR	S1598	1	51	HEX HEAD CAP SCREW	22645-168	4
25	HOSE BARB FTG	26523-047	1	52	SPACER	31141-032 13000	4
26	HOSE .50 ID X 18" LG	18513-113	1	NOT SHOWN:			
27	PIPE PLUG	P16 10009	1		OIL LEVEL DECAL	38816-123	1
28	COVER PLATE ASSY	42111-344	1		LUBRICATION DECAL	38816-074	1
	-COVER PLATE	38241-005 10010	1		WARNING DECAL	38817-102	1
	-GASKET	50G 19210	1		DISCHARGE STICKER	6588BJ	1
	-WARNING PLATE	38816-097 13990	1		SUCTION STICKER	6588AG	1
	-DRIVE SCREW	BM#04-03	2		G-R DECAL	GR-03	1
29	CLAMP BAR	38111-004 11010	1		WARNING DECAL	2613FE	1
30	SQUARE HEAD BOLT	A1012 15991	2		INSTRUCTION TAG	38817-085	1

* INDICATES PARTS RECOMMENDED FOR STOCK

☞ INCLUDED WITH REPAIR 46474-906 1
PUMP CASING ASSY

ILLUSTRATION

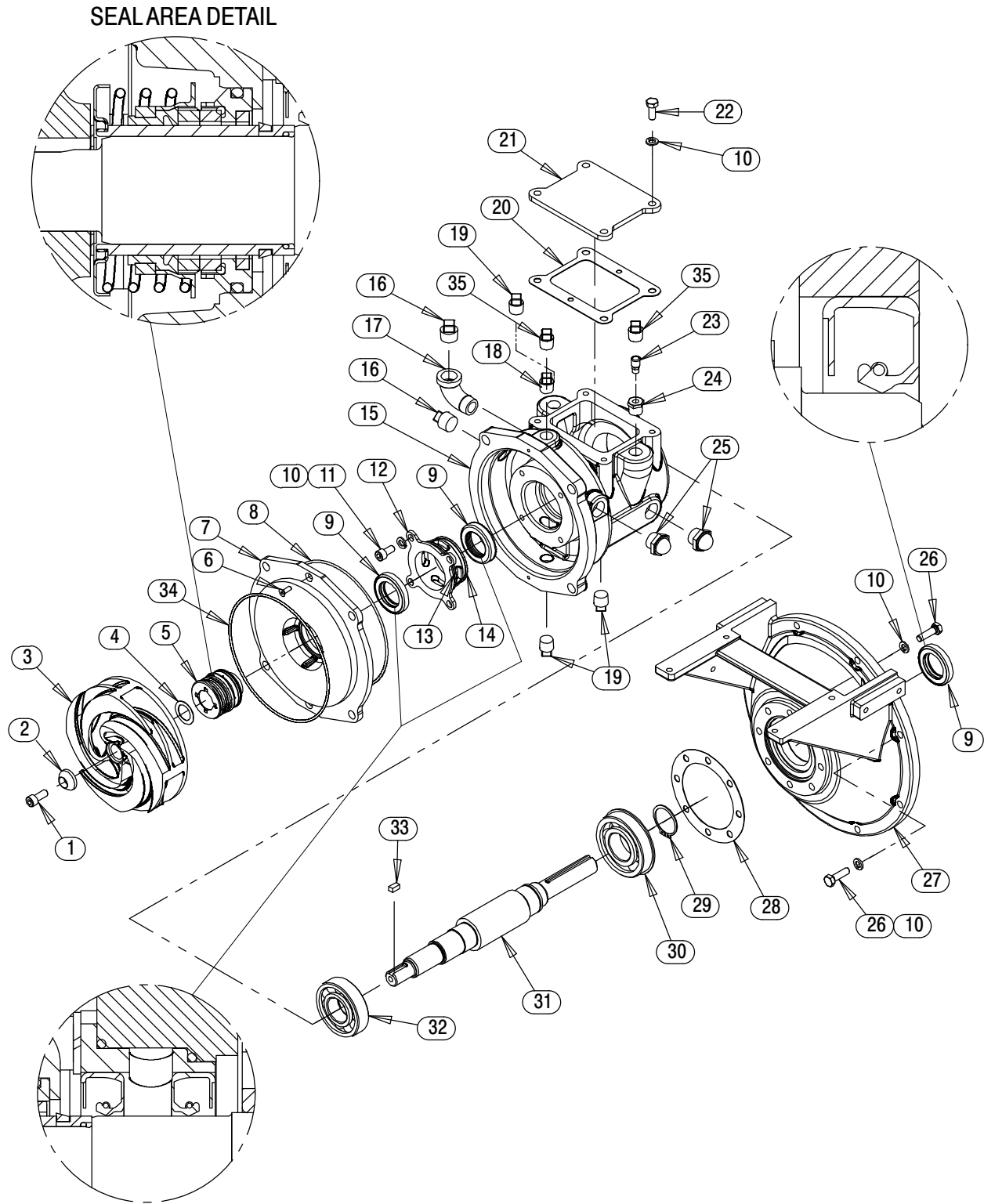


Figure 4. Repair Rotating Assembly

PARTS LIST
Repair Rotating Assembly

ITEM NO.	PART NAME	PART NUMBER	QTY
1	SOCKET HEAD CAP SCREW	22644-217	1
2	IMPELLER WASHER	31514-019 17000	1
3	IMPELLER	38614-844 11010	1
4	* ADJ SHIM SET	2X 17090	REF
5	* SEAL ASSY	46513-171	1
6	FLAT HEAD CAP SCREW	22644-166	2
7	SEAL PLATE	38272-425 11010	1
8	* O-RING	25152-265	1
9	* OIL SEAL	S1452	3
10	LOCK WASHER	21171-511	24
11	SOCKET HEAD CAP SCREW	22644-216	4
12	LIPSEAL HOLDER	38242-709 11010	1
13	* O-RING	25154-151	1
14	* O-RING	25154-148	1
15	BEARING HOUSING	38251-426 10000	1
16	PIPE PLUG	P12 15079	2
17	STREET ELBOW	RS12 11999	1
18	VENTED PIPE PLUG	4823A 15079	1
19	PIPE PLUG	P08 15079	3
20	* GASKET	38687-582 18000	1
21	COVER	33659-062 15080	1
22	HEX HEAD CAP SCREW	22645-162	4
23	AIR VENT	S1530	1
24	REDUCER PIPE BUSHING	AP0802 15079	1
25	SIGHT GAUGE	S1471	2
26	HEX HEAD CAPSCREW	22645-382	16
27	MOUNTING FLANGE	38545-014 10000	1
28	* GASKET	38683-480 18000	1
29	RETAINING RING	S442	1
30	* BALL BEARING REAR	23287-009	1
31	* IMPELLER SHAFT	38514-835 16000	1
32	* BALL BEARING	S1080	1
33	* IMPELLER KEY	24113-601	1
34	O-RING	25152-265	1
35	SHIPPING PLUG	11495B 15079	2

* INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

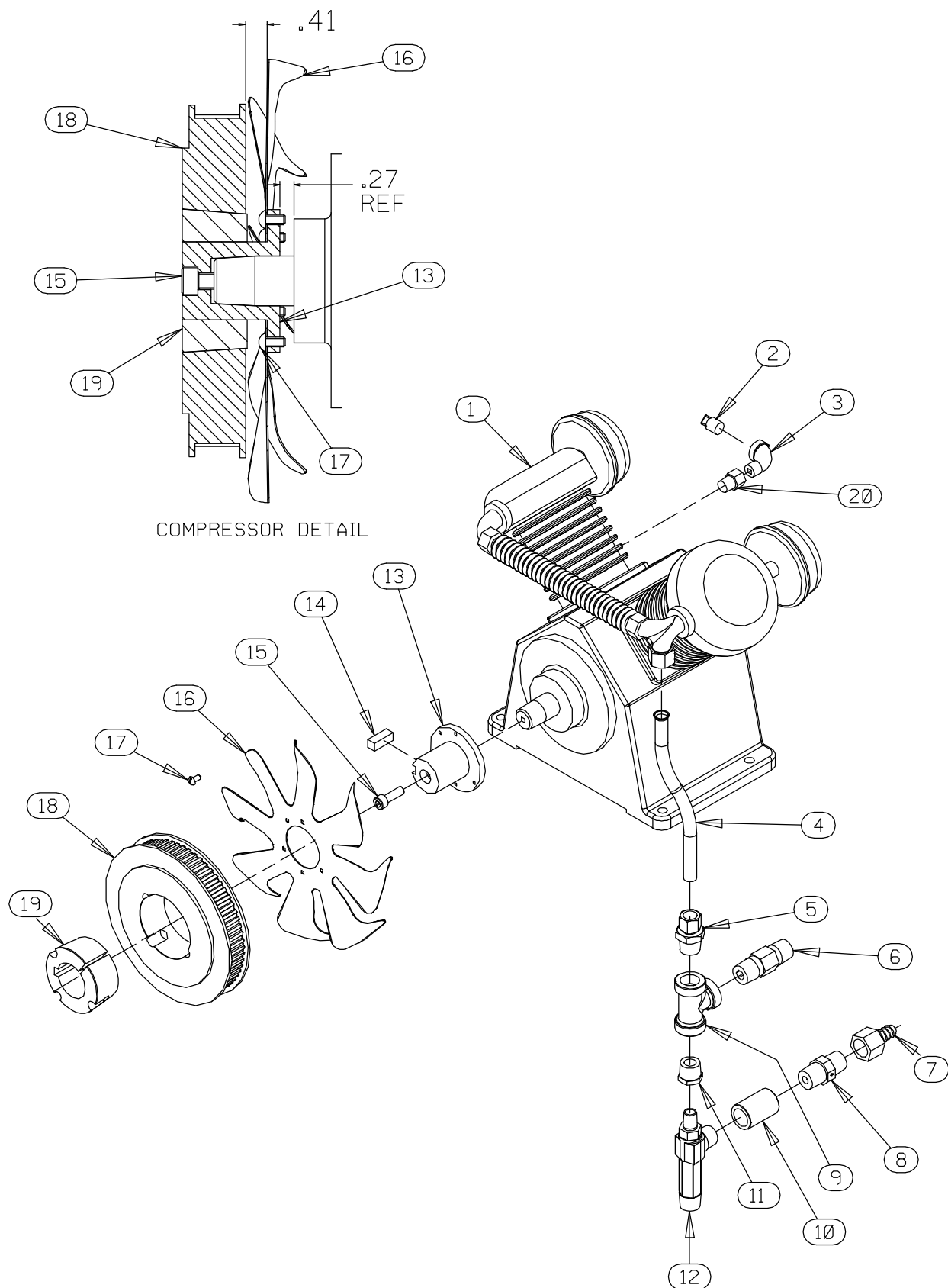


Figure 5. Air Compressor Assembly

PARTS LIST
Air Compressor Assembly

ITEM NO.	PART NAME	PART NUMBER	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	CF#10-01-1/2 17000	5
18	SPROCKET	24271-117	1
19	BUSHING	24131-039	1
20	HYD HOSE ADAPTER	26813-952	1
NOT SHOWN:			
	WARNING DECAL	38817-101	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 5) and the corresponding Parts Lists. Maintenance and repair instructions for the engine and air compressor are covered separately in specific literature available from the manufacturers.

Some pump service functions may be performed without separating the pump end assembly from the engine. However, the following instructions assume complete disassembly of the pump is required.

Before attempting to service the pump, shut down the engine 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 (9, Figure 2). 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. Shut down the engine and disconnect the positive battery cable 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 is designed to handle material which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.



The pump may be equipped with an 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.

**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 Valve Removal And Disassembly

(Figure 2)

**CAUTION**

Liquid within the priming hopper may be pressurized. When draining liquid from the priming hopper, use caution to avoid con-

tact with the liquid. Otherwise, injury to service personnel may occur.

Disconnect the air discharge tubing from the priming valve (21). Liquid will remain in the priming valve. To drain the liquid, slowly remove the pipe plug (not shown) in the valve body.

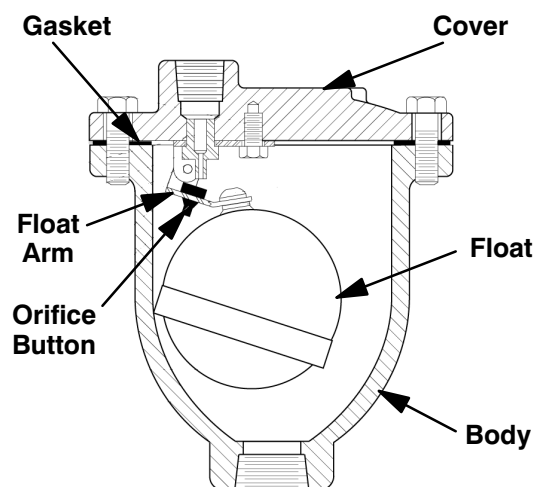
If draining is slow or difficult, the orifice in the may be clogged (valve requires service).

Remove the hardware (17 and 18) and separate the priming chamber and hopper cap (19) from the suction spool (13). Remove the gasket (16) and strainer (15) from the suction spool and clean the strainer as necessary.

(Figure 6)

Remove the hardware securing the priming valve cover to the priming chamber body. Carefully lift the valve cover and components from the priming chamber. 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 6. Priming Chamber**

If excessive liquid continues to bypass through the priming chamber 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 2)

Remove the discharge piping from the discharge elbow (32).

Remove the hardware (7 and 8) and remove the discharge elbow (it may be necessary to tap on the flange (37) with a soft-faced mallet in order to separate the discharge elbow from the flange).

With the discharge elbow removed, remove the gasket (12). Unscrew the pin (36) from the flange. Lift the flap valve assembly (35) out of the flange.

Inspect the flap valve parts for wear or damage. If replacement is required, remove the hardware securing the backup plate and flap valve adaptor to the flap valve, and remove the flap valve. Press the spacer sleeves out of the flap valve.

Remove the flange (37) and replace the gasket (34).

Pump Casing Removal

(Figure 2)

Support the pump casing using a suitable hoist and sling.

It is not necessary to remove the suction spool (13) from the pump casing unless the spool or gasket (12) requires replacement. To remove the spool, disengage the hardware (7 and 8). See Figure 1, disengage the hardware (2, 3, 4 and 5) and remove the pump support bracket (6). Separate the spool from the pump casing and remove the spool gasket.

Remove the hardware (2 and 3) securing the pump casing (10) to the rotating assembly (1). If the suction spool was not previously removed, remove the pump support bracket (6, Figure 1) as previously described. Use the lifting device to pull the pump casing away from the rotating assembly.

Remove the pump casing O-ring (4) from the shoulder on the rotating assembly.

Draining Oil From Seal Cavity

(Figure 4)

If any further disassembly is to be performed on the pump, the seal oil cavity must be drained to pre-

vent the oil in the seal cavity from escaping as the impeller is removed.

Position a **clean** container under the seal cavity drain plug (19). Remove the plug and drain the oil from the seal cavity into the container. For shorter drain time, remove the vented plug (18). 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 4)

Use a strap wrench to immobilize the impeller (3) and remove the impeller screw and washer (1 and 2). 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 (33).

Remove the impeller adjusting shims (4); tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal

(Figure 4)

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 (6) and slide the assembled seal plate (7) off the shaft (31). Remove the O-ring (8) from the seal plate shoulder.

Position the seal plate on a flat surface with the impeller side down. 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.

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

Removing Air Compressor Assembly

(Figure 3)

Further pump disassembly requires removal of the air compressor assembly (42). Disengage the hardware (17 and 45) and remove the guard (44).

Remove the hardware (17 and 51) and use a pry bar to raise the air compressor high enough to remove the spacers (52). Remove the belt (43) from the air compressor drive pulley (18, Figure 5).

Disengage the hardware (39 and 40) and remove the U-bolt (41).

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

Separating Pump and Drive Assembly From Engine

(Figures 2 and 3)

The pump and drive assembly must be separated from the engine before further disassembly of the rotating assembly.

Support the rotating assembly using a hoist and sling.

See Figure 4 and remove the hardware (10 and 26) securing the mounting flange (27) to the engine bellhousing. Separate the rotating assembly from the coupling (46) by pulling the rotating assembly straight away from the engine. The inner hub of the coupling will remain on the shaft. Loosen the setscrew in the hub and remove the hub and coupling key (50).

If the coupling requires replacement, disengage the hardware securing the flexible portion of the coupling to the engine flywheel.

Remove the air compressor drive belt (43). Loosen the setscrews in the bushing (49) and slide the sprocket (48), bushing and key (47) off the shaft.

Move the rotating assembly to a clean, well equipped shop area for further disassembly.

Shaft and Bearing Removal and Disassembly

(Figure 4)

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



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

Remove the bearing housing drain plug (19) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (10 and 26) and remove the mounting flange (27), gasket (28) and oil seal (9). Press the oil seal from the mounting flange.

Disengage the hardware (10 and 11) and pull the lip seal holder (12) out of the bearing housing (15). Remove the O-rings (13 and 14) from the shoulders on the seal holder. Pry or press the oil seals (9) from the seal holder.

Place a block of wood against the impeller end of the shaft (31) and tap the shaft and assembled bearings (30 and 32) 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 (29) and use a bearing puller to remove the inboard and outboard bearings from the shaft.

Shaft and Bearing Reassembly and Installation

(Figure 4)

Inspect the shaft (31) 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 (30) 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.

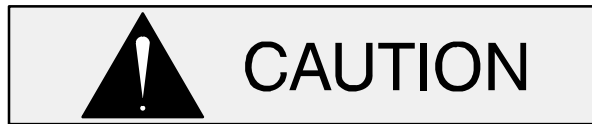
If heating the bearings is not practical, use a suitably sized sleeve and an arbor (or hydraulic) press to install the bearings on the shaft.



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 (29)



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 (9) and press it into the mounting flange (27) with the lip positioned as shown in Figure 4. The face of the oil seal should be flush with the chamfer on the mounting flange bore.

Install the mounting flange gasket (28) and secure the mounting flange to the bearing housing with the hardware (10 and 26). **Be careful** not to damage the lip of the oil seal on the shaft keyway. Torque the capscrews (26) to 41 ft. lbs. (5,6 m. kg.).

Apply a light coating of oil to the lip of the oil seals (9) and press them into the lip seal holder (12) with the lips positioned as shown in Figure 4.

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 (10 and 11).

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

Securing Drive Assembly and Bearing Housing to Engine

(Figure 2)

Install the key (50) in the shaft keyway, making sure to leave room in the keyway for the drive key (47). Install the sprocket (48) and bushing (49) on the shaft to the dimension shown in Figure 7.

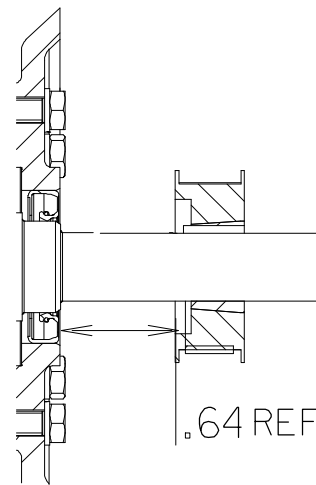


Figure 7. Drive Sprocket Positioning

Secure the bushing and sprocket to the shaft by torquing the bushing screws to (55 in. lbs. or 6,3 m. kg.). Install the belt (43) over the sprocket and up through the slot in the mounting flange (27, Figure 4).

Install the shaft key (50) in the shaft keyway. Position the inner hub of the coupling assembly (46) on the shaft with the hub setscrew toward the drive end of the shaft. The end of the hub should be just flush with the end of the shaft. Torque the hub setscrew to 7 ft. lbs. (1 m. kg.).

Align the keyway in the bushing (49) with the shaft key, and slide it onto the shaft until the face of the bushing is just flush with the end of the shaft. Rotate the flexible portion of the coupling until the tapped holes for the two setscrews align with those in the bushing, and install the setscrews.

If the flexible portion of the coupling was separated from the engine flywheel for replacement, secure the new coupling to the flywheel with the hardware. Torque the capscrews to 18 ft. lbs. (2,5 m. kg.).

Using a suitable lifting device, position the assembled drive and rotating assembly so the hub of the coupling seats inside the flexible outer ring attached to the engine flywheel.

Use a suitable hoist and sling to position the air compressor assembly (42) on the mounting flange (27, Figure 4). Slide the belt (43) over the air compressor sprocket (18, Figure 5). Use a pry bar to raise the compressor high enough to install the spacers (52) between the compressor and the mounting flange. Secure the compressor to the mounting flange with the hardware (17 and 51).

Reinstall the U-bolt and hardware (39, 40 and 41).

Reinstall the guard (44) and secure it with the hardware (17 and 45).

Seal and Impeller Installation

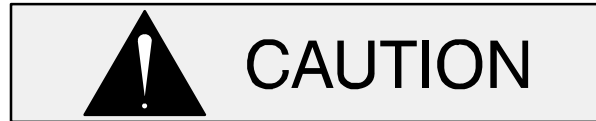
(Figures 3, 8, 9 and 10)



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 8 for seal part identification.

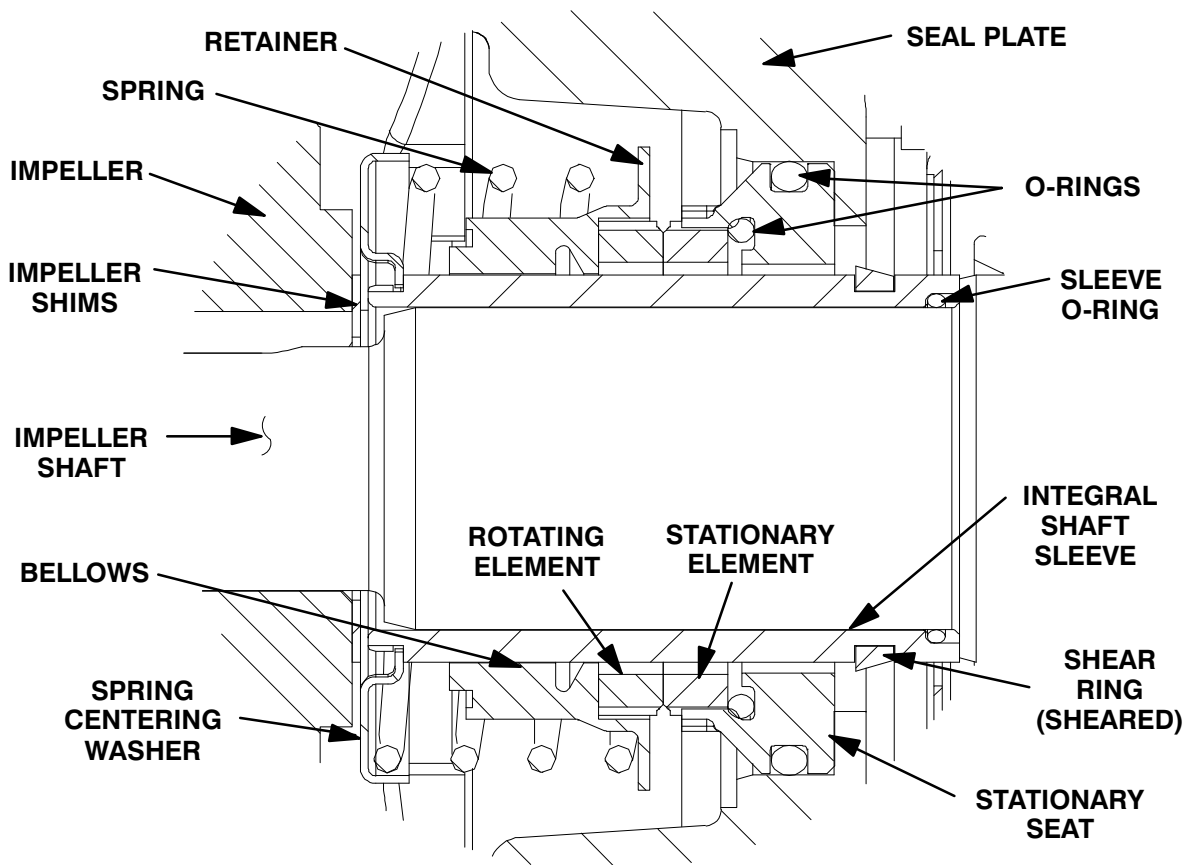


Figure 8. Seal Assembly



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 was removed, install the seal plate O-ring (8) and lubricate it with oil. Position the seal

plate over the shaft and secure it to the bearing housing with the flat head capscrews (6).

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.

Clean and inspect the impeller as described in **Impeller Installation and Adjustment**. Install the set of impeller shims (4) provided with the seal and install the impeller key (33) 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 9).

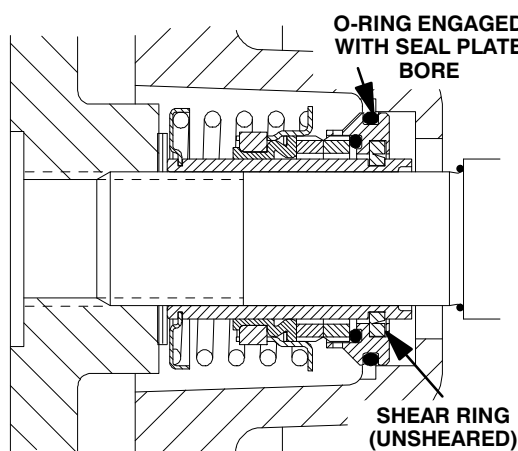


Figure 9. Seal Partially Installed

Install the impeller washer (2). Apply a small amount of 'Never-Seez' or equivalent anti-lock compound on the threads of the impeller screw (1) 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 10).

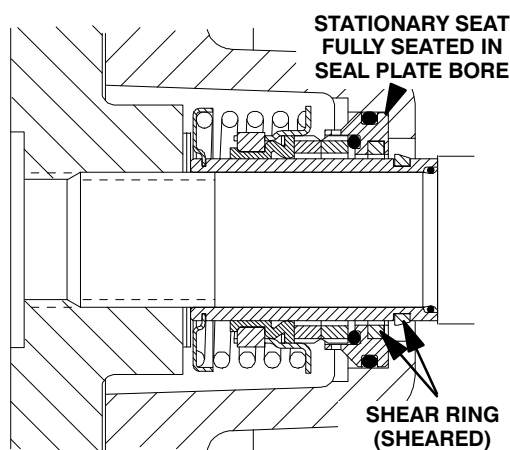


Figure 10. Seal Fully Installed

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

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.

Proceed with **Impeller Installation and Adjustment.**

Impeller Installation and Adjustment

(Figure 4)

Inspect the impeller (3) for cracks, broken vanes, or wear from erosion and replace it if damaged. Clean the threads in hole in the impeller shaft for the impeller screw (1).

Install the same thickness of adjusting shims (4) as previously removed. Install the impeller key (33) in the shaft keyway. Align the keyway of the impeller with the shaft key and push the impeller onto the shaft until seated firmly against the impeller shim set.

A clearance of .025 to .040 inch (0,63 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.

After the impeller is installed, coat the threads of the impeller screw with 'Never-Seeze' or equivalent compound. Install the impeller washer (2). Wedge a soft metal bar between the vanes of the impeller or use a strap wrench to prevent shaft rotation.

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

Remove the metal bar or strap wrench used to prevent shaft rotation and turn the impeller to check for free rotation.

Pump Casing Installation

(Figure 2)

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 (2 and 3).

If the suction spool (13) was removed, replace the gasket (12) and position the spool against the pump casing. See Figure 1, reinstall the pump support bracket (6) and secure it to the base with the previously removed hardware (2, 3, 4 and 5). Secure the spool to the pump with the hardware (7 and 8).

Flap Valve Installation

(Figure 2)

Inspect components of the check valve assembly (35) and replace as required. If separated at disassembly, press the spacer sleeves through the flap valve. Install the backup plate and flap valve adaptor and secure the components with the previously removed nylock capscrews.

If the gasket (12) was removed, clean the mating surfaces of the casing (10) and flange (37). 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 (36).

Reinstall a new flange gasket (34). Apply "Loctite No. 242 Threadlocker" or equivalent compound on the threads of the the studs (33) 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 (7 and 8).

Priming Hopper Reassembly And Installation

(Figures 2 and 6)

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 Chamber 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 chamber. 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.

Clean the strainer screen (15) and install it in the suction spool. Install the priming hopper gasket (16) and secure the priming hopper and hopper cap (19) to the suction spool with the previously removed hardware (17 and 18).

Reconnect the air discharge tubing to the priming chamber assembly.

LUBRICATION

(Figure 4)

Seal Assembly

Before starting the pump, remove the vented plug (18) 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 (25). Clean and reinstall the vented plug. Maintain the oil level at the middle of the sight gauge.

Bearings

(Figure 4)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (25) and maintain it at the midpoint of the gauge. When lubrication is required, remove the pipe plug (16) from the elbow (17) and add SAE No. 30 non-detergent oil through the opening. When lubricating a dry (overhauled) intermediate, fill the bearing cavity with approximately 15 ounces (0,44 liter) of oil, or to the middle of the sight gauge (25). 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.

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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