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INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

PAH SERIES® PUMP

MODEL

PAH10B60–6135H

GORMAN-RUPP PUMPS

www.grpumps.com

Printed in U.S.A.

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:

DANGER!

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

WARNING!

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

CAUTION

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

NOTE

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

SAFETY - SECTION A

This information applies to Prime Aire® Series engine driven pumps. Refer to the manual accompanying the engine 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.**

This pump is equipped with an automatic starting system, and is 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.

WARNING!

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.

WARNING!

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

WARNING!

This pump may be used to handle materials which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.

WARNING!

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.

CAUTION

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.

DANGER!

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.

WARNING!

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.

WARNING!

Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. Refer to the performance curve on page E—1 for the maximum continuous operating speed for this pump.

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

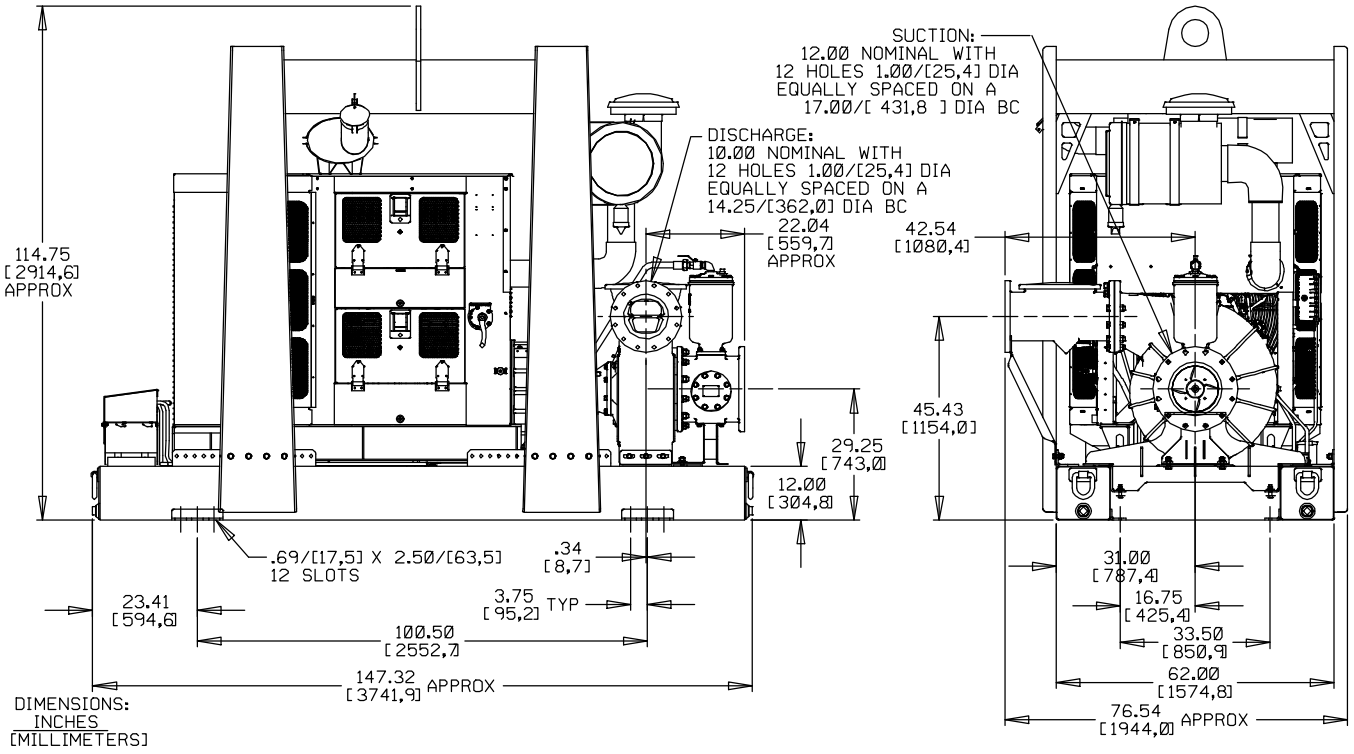


Figure 1. Pump Model PAH10B60–6135H

PREINSTALLATION INSPECTION

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

a. Inspect the pump for cracks, dents, damaged threads, and other obvious damage.

b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.

c. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated. Note that the pump shaft rotates in the required direction.

CAUTION

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

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

e. If the pump has been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

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

Battery Installation

Unless otherwise specified on the pump order, the engine battery is **not** included with engine driven units.

Refer to the information accompanying the battery and/or electrolyte solution for activation and charging instructions.

Before installing the battery, clean the positive and negative cable connectors, and the battery terminals. Secure the battery by tightening the holddown brackets. The terminals and clamps may be coated with petroleum jelly to retard corrosion. Connect and tighten the positive cable first, then the negative cable.

POSITIONING PUMP

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.

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.

WARNING!

If the pump has been mounted on a movable 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 maybe used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

Line Configuration

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

Connections to Pump

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

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

Gauges

The pump is drilled and tapped for installing discharge pressure and vacuum suction gauges. It is recommended that gauges be installed to monitor pump performance. Seal the gauge threads with pipe dope to ensure an airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

SUCTION LINES

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

Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

Strainers

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 2 inch (50,8 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.

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.

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).

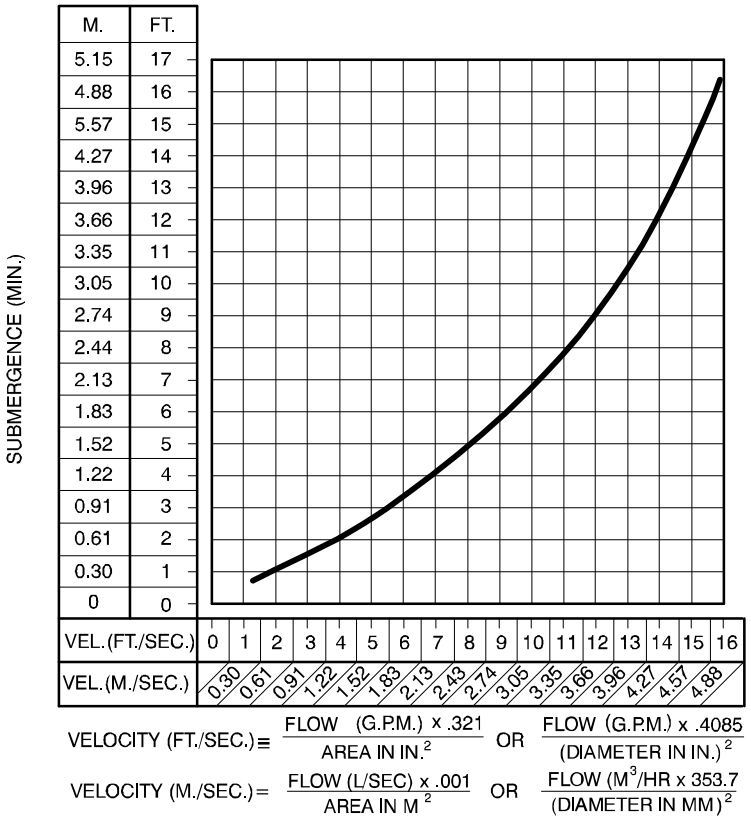


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

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

This pump is designed with a check valve in the discharge line.

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

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

CAUTION

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

ALIGNMENT

The alignment of the pump, air compressor and engine is critical for trouble-free mechanical operation. See Section E, **Securing Intermediate And Drive Assembly To Engine** in **MAINTENANCE AND REPAIR**, for details.

AUTO-START

The standard pump is 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 which follows for installation details for the liquid level sensing system provided with your pump.

Float Switch Installation

The Float Switch autostart system employs either a single or double float switch, where a bulb raises or lowers (floats) with the liquid level, thus activating an enclosed miniature switch. The floats are equipped with a socket type connector that plugs into a matching receptacle on the auto-start control box.

Standard floats are equipped with 50 feet (15,2 m) of cable.

When installing the floats, note the following:

a. **Be sure** to provide sufficient room in the wet well or sump so that floats do not get obstructed or drawn into the suction line. If a flexible suction hose is used, it may be extended to lay along the bottom of the wet well or sump and the float can be attached to the hose above the point where it bends along the bottom. Direct the suction line toward the flow, and the float(s) away from the flow. If a standpipe is available, attach the float switch cable to the standpipe in the sump at the approximate desired liquid level.

b. In a single float system, the cable can be tethered to the suction line or standpipe approximately 6 inches (152 mm) above the float. This setting allows approximately 9 inches (229 mm) of liquid rise between pump start/stop. The start/stop interval may be increased by extending the float end of the cable. The liquid level in the sump will increase approximately 8 inches (203 mm) between start/stop intervals for every 6 inches (152 mm) of cable increase.

c. If a double float switch system is used, position the “Start” float at the desired high water level in the sump, and the “Stop” float at the desired low water level in the pump.

d. Refer to Figure 3 for additional float switch data.

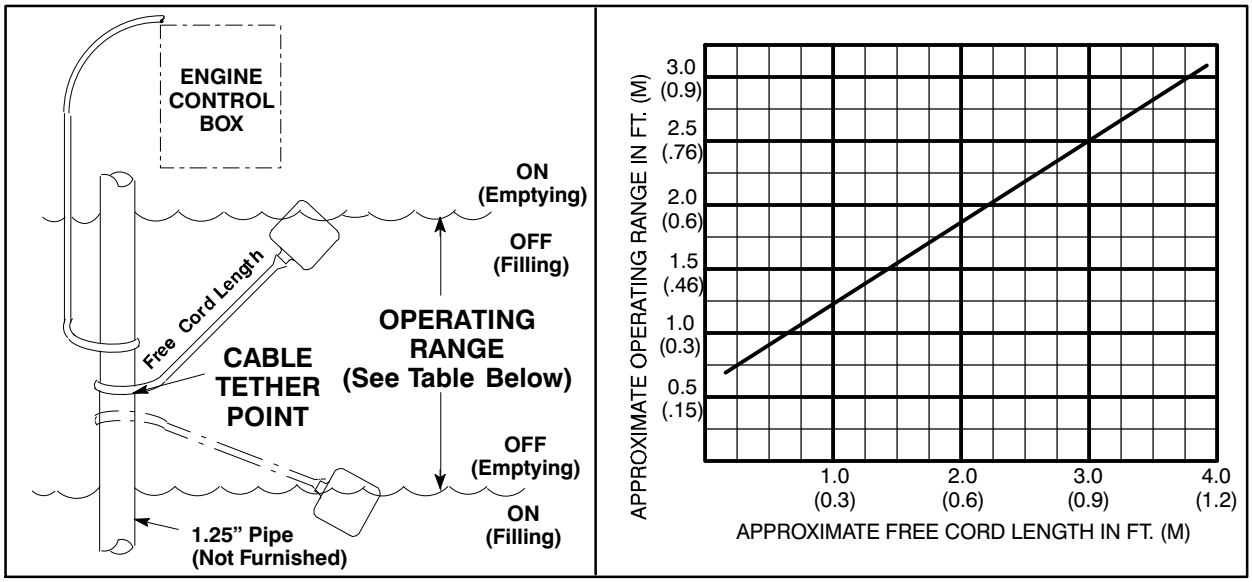


Figure 3. Float Switch Data

OPERATION – SECTION C

OPERATION

Review all SAFETY information in Section A.

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

DANGER!

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.

WARNING!

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.

CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the performance curve on page E–1.

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.

CAUTION

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.

WARNING!

This pump is equipped with automatic liquid level controls, and is 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 before attempting to start the unit.

Consult the manual accompanying the engine control box and start the pump.

PRIMING

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

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

ROUTINE OPERATION

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).

WARNING!

Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. Refer to the Performance Curve in Section E for the maximum continuous operating speed for this pump.

OPERATION IN EXTREME HEAT

The safety shutdown system will automatically stop the unit if engine operating temperature exceeds design limits. If engine over-temperature shutdown occurs, allow the unit to cool before restarting.

If engine overheating continues, check the engine lubricant level and viscosity. Consult the engine operation manual for the recommended lubricant for operation in extreme heat.

If the unit is being operated in the **automatic** mode, adjust the liquid level device(s) to allow shorter run and longer cooling periods, if possible.

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**.

WARNING!

Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an overheated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury to personnel from hot liquid.

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

Manual Stopping

In the manual mode, reduce the throttle speed slowly, and allow the engine to idle briefly before turning the keyswitch to 'OFF'.

CAUTION

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

Automatic Stopping

In the automatic mode, the pump will stop when the liquid in the wet well or sump lowers and activates the "Off" liquid level device(s). The pump will restart automatically when the liquid rises and activates the "On" liquid level device(s).

Safety Shutdown System

The unit is equipped with a safety system to automatically shut down the engine under certain conditions.

Displays on the control panel will indicate which of the safety features has caused the engine to shut down.

Should any of the safety features cause the engine to shut down, **the cause must be determined and corrected** before putting the unit back into service.

All safety shutdown features are pre-set at the factory for optimum performance and safety; **do not** attempt to adjust these settings.

WARNING!

Never disconnect any of the safety shutdown features; this will void the warranty and could result in serious damage to the unit and/or injury to personnel. Safety shutdown features are pre-set at the factory; do not attempt to adjust any of the settings. Determine the cause of shutdown before putting the unit back into service. Consult the factory for additional information.

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 correct 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.

Engine Fuel Filter

Consult the manual accompanying the engine, and change the fuel filter periodically as indicated. If operated under extremely dusty and/or humid conditions, change the filter more frequently. Irregular performance and loss of power usually indicate a dirty fuel filter.

Engine Oil

The engine was lubricated for test at the factory. However, **always** check the lubrication level before startup.

Consult the manual accompanying the engine, and change the oil filter periodically as indicated. If operated under extremely dusty conditions, change the filter more frequently.

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.

TROUBLESHOOTING — SECTION D

Review all SAFETY information in Section A.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **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.**

WARNING!

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

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

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

PREVENTIVE MAINTENANCE

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

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

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

Preventive Maintenance Schedule

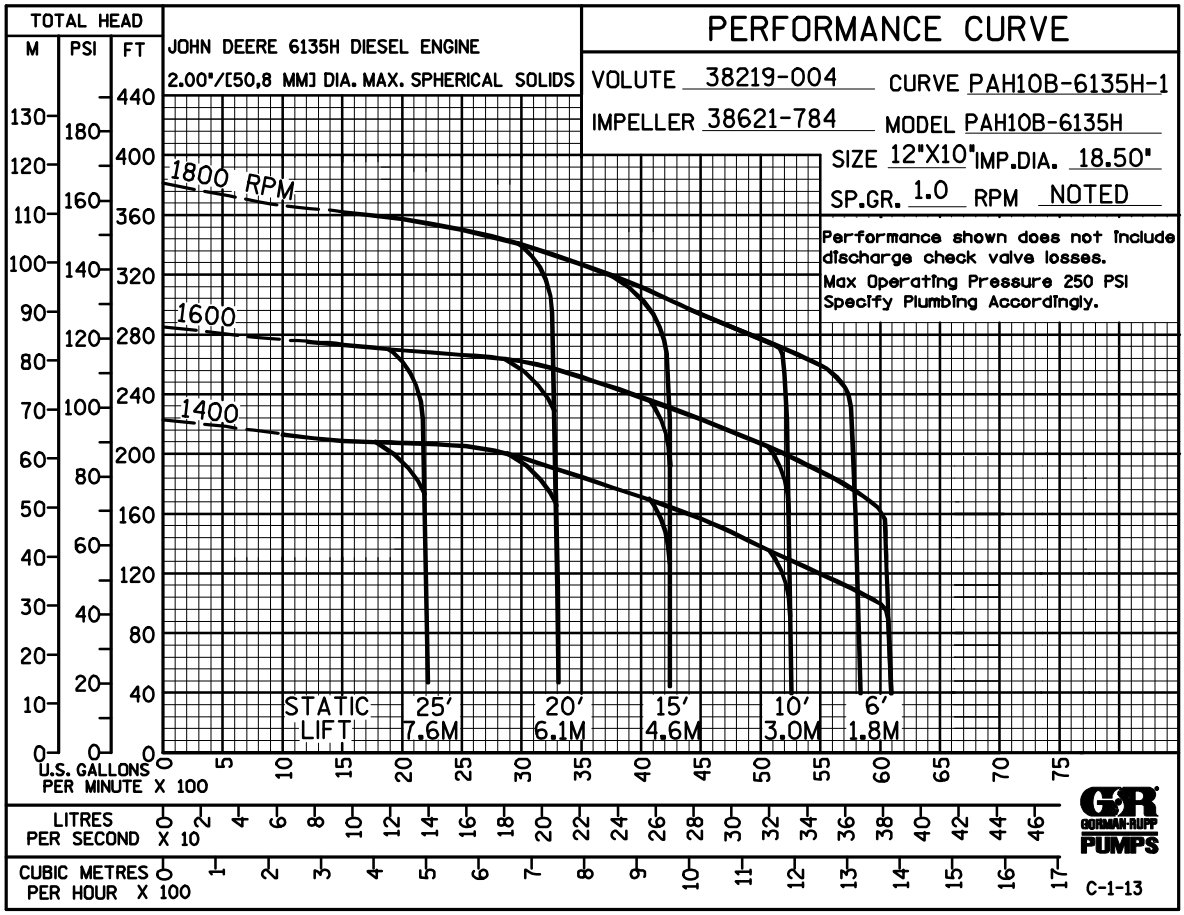
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		I			R
V-Belts (If So Equipped)			I		
Air Release Valve Plunger Rod (If So Equipped)			I	C	
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve					I
Pressure Relief Valve (If So Equipped)					C
Pump and Driver Alignment					I
Shaft Deflection					I
Bearings					I
Bearing Housing					I
Piping					I
Driver Lubrication – See Mfgr's Literature					

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

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

PUMP MAINTENANCE AND REPAIR – SECTION E

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



✳ **STANDARD PERFORMANCE FOR PUMP MODEL PAH10B60–6135H**

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

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

CAUTION

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

ILLUSTRATION

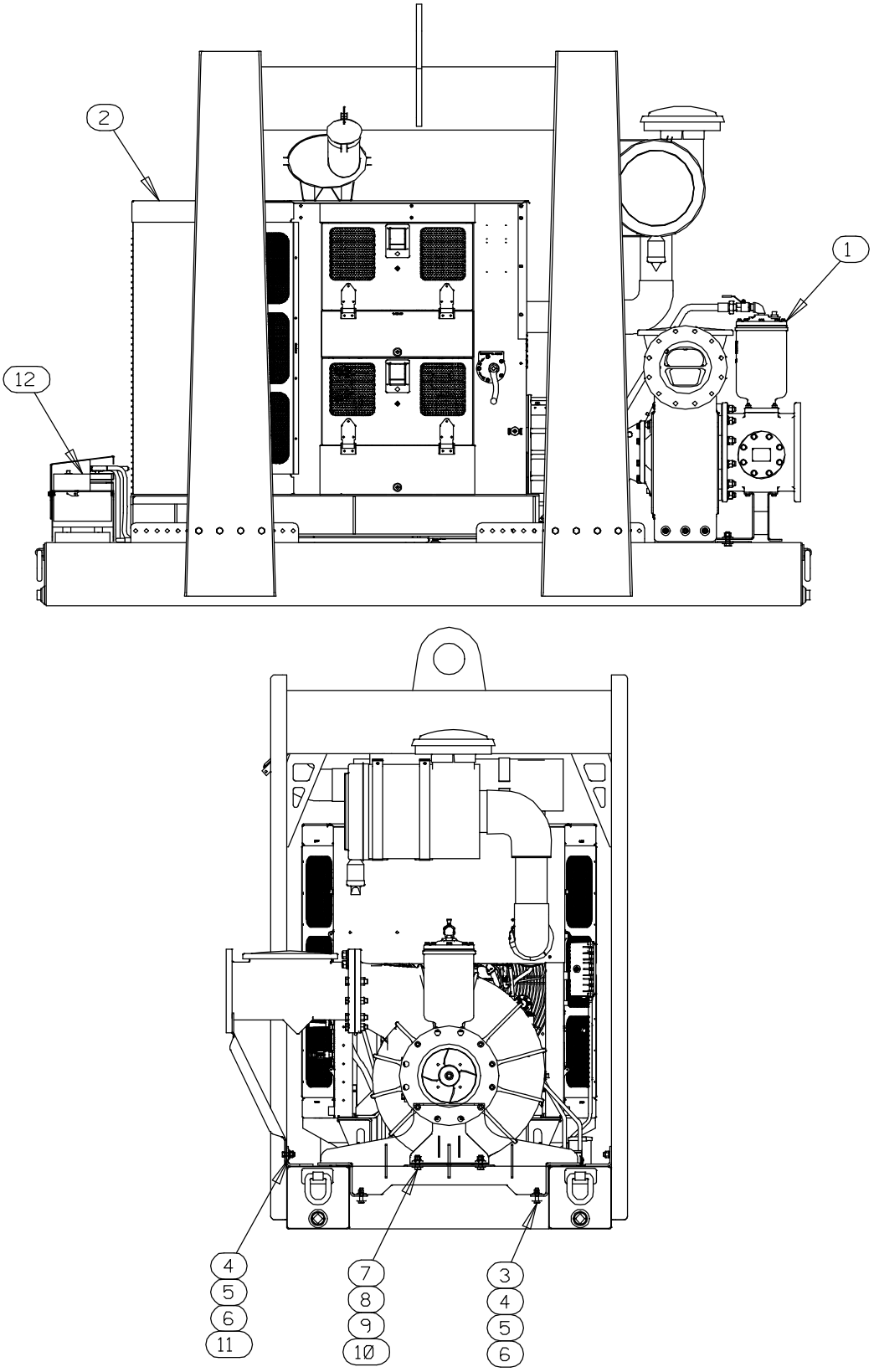


Figure 1. Pump Model PAH10B60–61358H

Pump Model PAH10B60–61358H

PARTS LIST

(From S/N 1551346 Up)

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP END ASSY	PAH10B60–(SAE 1/14)	–––	1
2	POWER UNIT	46143–168	–––	1
3	HEX HEAD CAP SCREW	B1010	15991	2
4	FLAT WASHER	K10	15991	7
5	LOCK WASHER	J10	15991	5
6	HEX NUT	D10	15991	5
7	HEX HEAD CAP SCREW	B1209	15991	2
8	FLAT WASHER	K12	15991	4
9	LOCK WASHER	J12	15991	2
10	HEX NUT	D12	15991	2
11	HEX HEAD CAP SCREW	B1008	15991	3
12	8D BATTERY	SEE OPTIONS	–––	2
NOT SHOWN:				
	G-R DECAL	GR–06	–––	2
	PRIME AIRE PLUS DECAL	38812–098	–––	2
	CAUTION DECAL	2613FJ	–––	1
OPTIONAL:				
	BATTERY	29331–528	–––	2

ILLUSTRATION

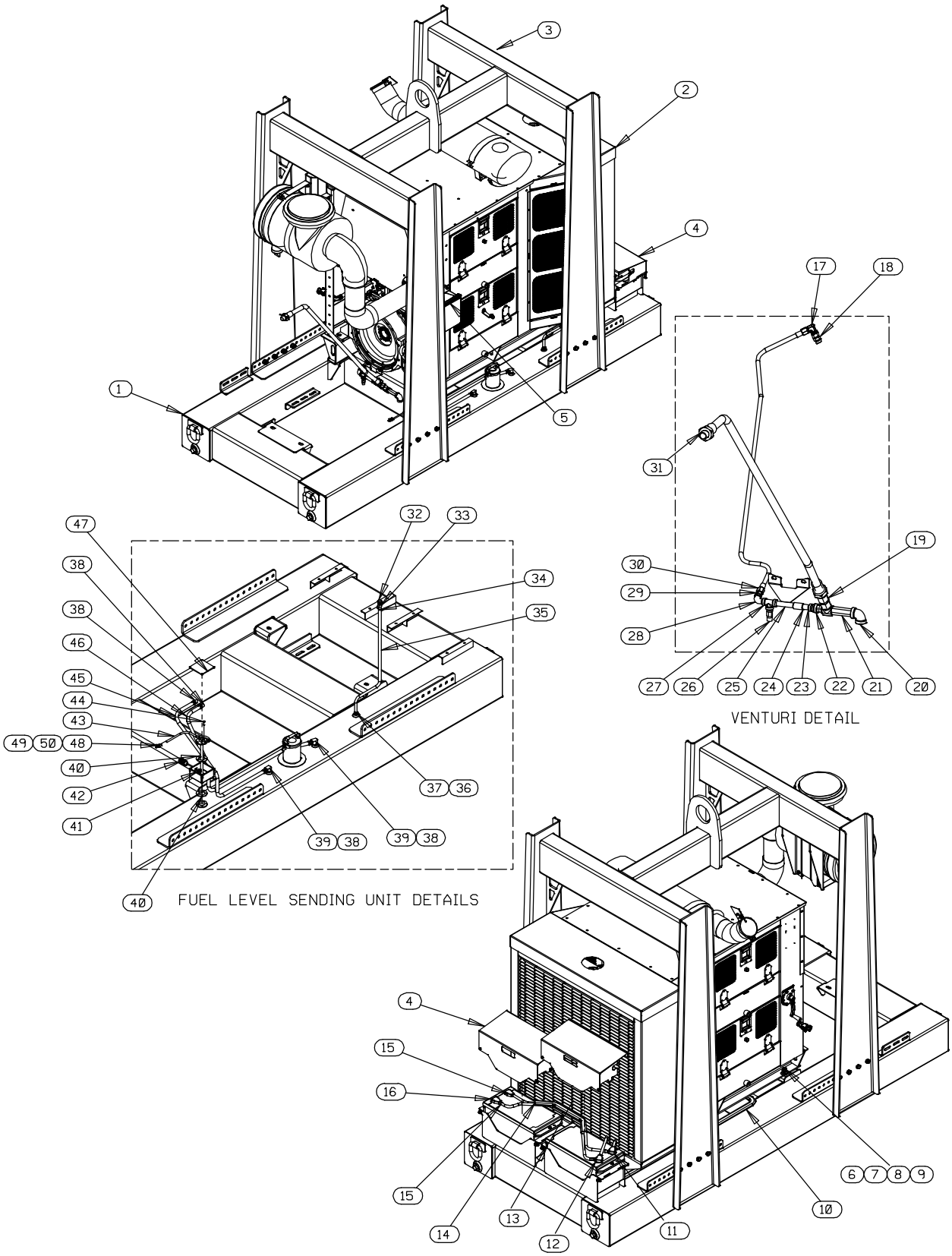


Figure 2. 46143—168 Power Unit Kit

PARTS LIST
46143–168 Power Unit Kit

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	BASE/FUEL TANK ASSY	41553–037	24150	1
2	ENGINE MODIFICATION	44311–027	–––	1
3	LIFT BAIL ASSY	44715–047	–––	1
4	BATTERY BOX ASSY	42432–011	–––	2
5	CONT PANEL INST KIT	48122–564	–––	1
6	HEX HEAD CAP SCREW	B1208	15991	4
7	FLAT WASHER	K12	15991	4
8	HEX NUT	D12	15991	4
9	LOCK WASHER	J12	15991	4
10	7" LG PROT SLEEVE	25141–263	–––	1
11	POS BATT CABLE	47311–701	–––	1
12	NEG BATT CABLE	47311–705	–––	1
13	8D BATTERY	29331–528	–––	2
14	4.5" LG PROT SLEEVE	25141–263	–––	1
15	POS BATT CABLE	47311–700	–––	1
16	NEG BATT CABLE	47311–703	–––	1
17	90° ELBOW	26571–051	–––	1
18	ADAPTER	26523–191	–––	1
19	CHECK VALVE	26641–093	–––	1
20	PIPE ELBOW	R16	15079	1
21	VENTURI	26817–001	–––	1
22	RED PIPE COUPLING	AE1208	15079	1
23	PIPE NIPPLE	T0808	15079	1
24	PIPE COUPLING	AE08	15079	1
25	VENTURI MTG BRACKET	41888–201	24150	1
26	PRESS RELIEF VALVE	26662–028	–––	1
27	PIPE TEE	U08	11999	1
28	STREET ELBOW	RS08	11999	1
29	CONNECTOR	26351–065	–––	1
30	HOSE ASSY	46341–422	–––	1
31	VACUUM HOSE ASSY	46341–021	–––	1
32	AIR VENT	S1703	–––	1
33	HOSE BARB FITTING	26523–447	–––	1
34	CABLE TIE	27111–218	–––	1
35	3/8" ID X 36" LG HOSE	18513–302	–––	1
36	HOSE BARB FITTING	26523–389	–––	1
37	RED PIPE BUSHING	AP0806	15079	1
38	HOSE BARB	26523–337	–––	4
39	FUEL PICKUP	29332–149	–––	2
40	GASKET	38683–481	20000	2
41	CONDUIT LOCKNUT	27185–002	–––	1
42	CORD GRIP	27112–017	–––	1
43	FUEL SENDING UNIT	29331–307	–––	1
44	PAN HD MACH SCREW	CJ#10–04S	15991	5
45	1/2" ID X 48" LG HOSE	18513–303	–––	1
46	1/2" ID X 66" LG HOSE	18513–303	–––	1
47	JUNCTION BOX	38382–501	–––	1
48	FEMALE TERMINAL	29331–415	–––	2
49	CABLE SEAL 18–16 GA	29331–411	–––	2
50	TOWER TERMINAL BODY	29331–413	–––	2
NOT SHOWN:				
	WARNING DECAL	2613FE	–––	1
	CAUTION DECAL	2613FJ	–––	1
	GUARD WARNING STICKER	38816–063	–––	1
	LOW SULFUR FUEL DECAL	38816–196	–––	1
	WARNING DECAL	38816–203	–––	4
	ENGINE START UP TAG	38816–269	–––	1
	WARNING DECAL	38816–345	–––	2
	INSTRUCTION TAG	38817–085	–––	1
	INSTRUCTION DECAL	38818–144	–––	1
	FLOAT SWITCH KIT	48312–980	–––	1
	G-R DECAL	GR–06	–––	2

ILLUSTRATION

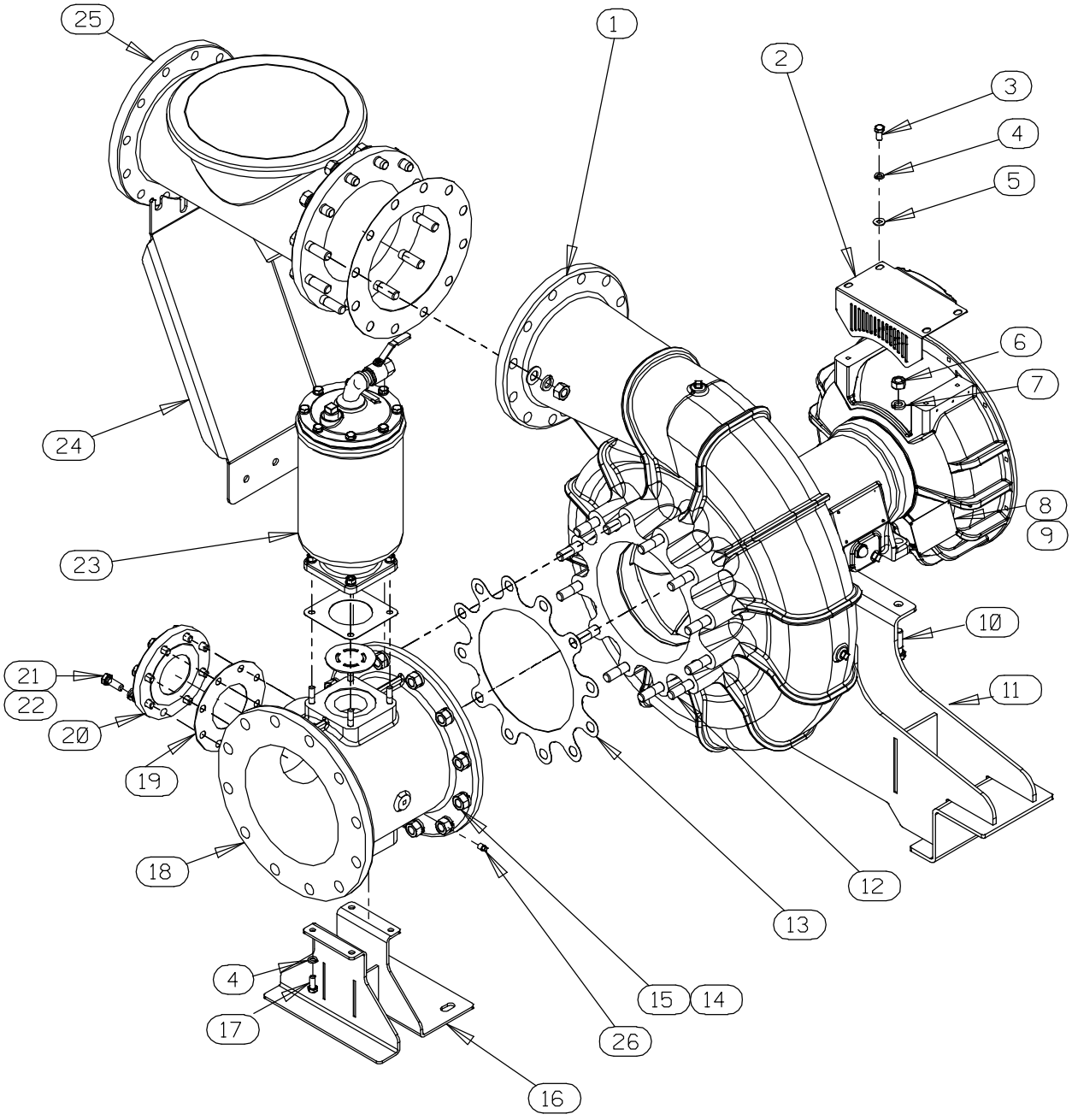


Figure 3. PAH10B60–(SAE 1/14) Pump End Assembly

PAH10B60–(SAE 1/14) Pump End Assembly

PARTS LIST

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		PUMP ASSY	46133–502	–––	1
2		GUARD PLATE	34518–050	15120	1
3		HEX HEAD CAP SCREW	B0804	15991	4
4		LOCK WASHER	J08	15991	8
5		FLAT WASHER	KE08	15991	4
6		HEX NUT	D12	15991	4
7		LOCK WASHER	J12	15991	4
8		DRIVE SCREW	BM#04–03	17000	4
9		NAMEPLATE	38818–156	13000	1
10		HEX HEAD CAP SCREW	B1210	15991	4
11		SUPPORT ASSY	41888–299	24150	1
12		STUD	C1414	15991	REF
13	✳	GASKET	38685–808	18000	1
14		LOCK WASHER	J14	15991	12
15		HEX NUT	D14	15991	12
16		SUCTION SUPPORT ASSY	41888–298	24150	1
17		HEX HEAD CAP SCREW	B0805	15991	4
18		12" SPOOL FLANGE	38642–622	10000	1
19	✳	GASKET	25113–034	–––	1
20		4" BLIND FLANGE ASSY	42111–358	–––	1
21		HEX HEAD CAP SCREW	B1007	15991	8
22		LOCK WASHER	J10	15991	8
23		PRIMING CHAMBER KIT	48275–006	–––	1
24		SUPPORT BRACKET	34778–029	15080	1
25		CHECK VALVE KIT 10"	48274–007	–––	1
		–CHECK VALVE 10"	26642–127	–––	1
	✳	–FLAPPER	26688–007	–––	1
	✳	–COVER O-RING	25152–463	–––	1
		–WASHER SAE 7/8	21161–450	–––	12
		–HEX NUT	D14	15991	12
		–LOCK WASHER	J14	15991	12
		–STUD	C1414	15991	4
		–HEX HEAD CAP SCREW	B1415	15991	8
	✳	–GASKET 10"	25113–040	–––	1
26		PIPE PLUG	P04	15079	1
NOT SHOWN:					
		OIL LEVEL DECAL	38816–123	–––	1
		SUCTION STICKER	6588AG	–––	1
		DISCHARGE STICKER	6588BJ	–––	1
		WARNING DECAL	2613FE	–––	1
		LUBRICATION DECAL	11421A	–––	1
		INSTRUCTION TAG	38817–085	–––	1
		PRIME AIRE PLUS DECAL	38812–099	–––	1
		G-R DECAL 6 IN	GR–06	–––	1
		STRAINER ASSY	4990A	–––	1
		SUCTION STICKER	6588AG	–––	1
		LUBRICATION DECAL	11421A	–––	1
		DISCHARGE STICKER	6588BJ	–––	1
		DRIVE ASSY – SAE 14	44162–183	–––	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

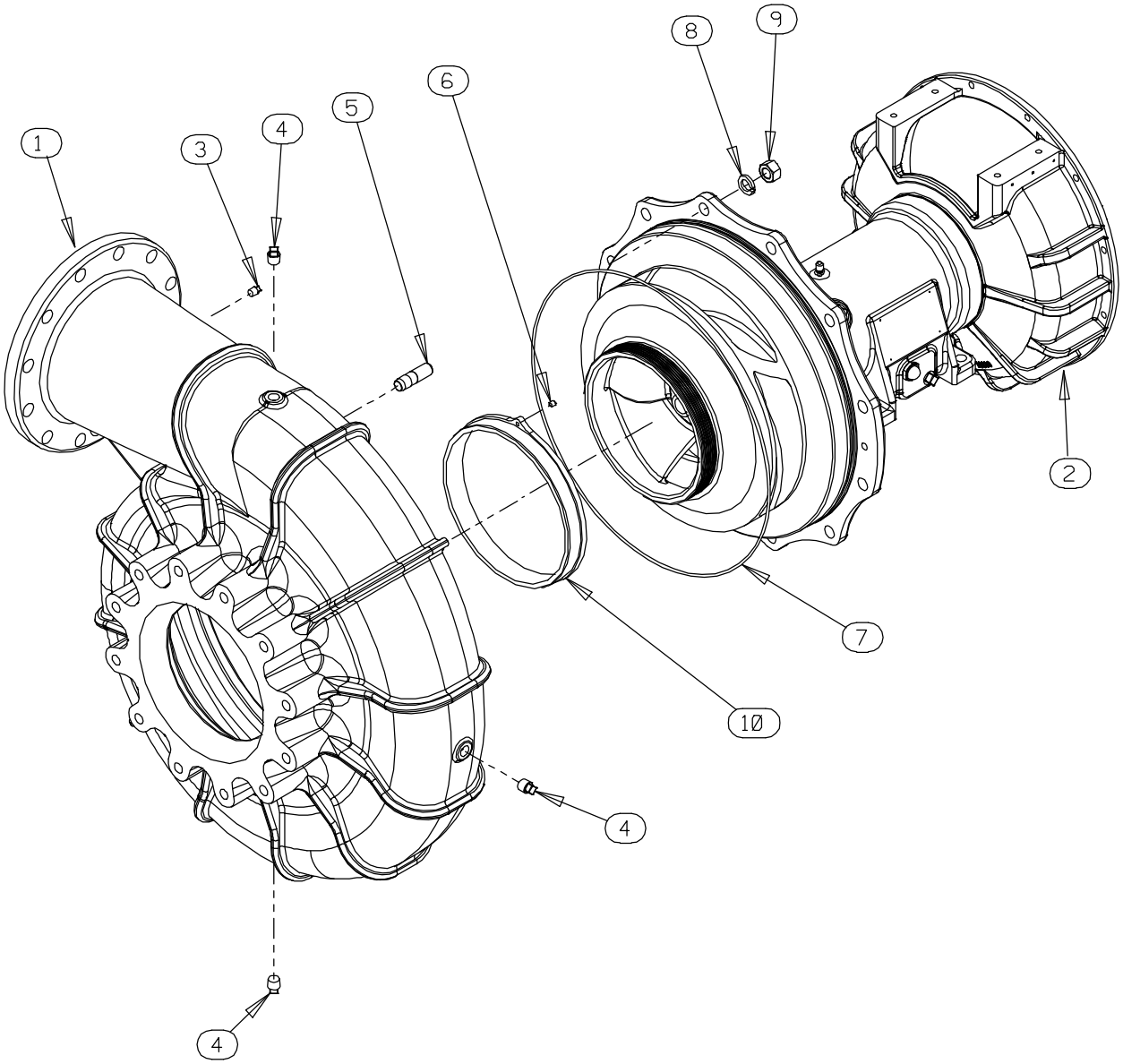


Figure 4. 46133—502 Pump End Assembly

PARTS LIST
46133–502 Pump End Assembly

	ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
☞	1		PUMP CASING	SEE NOTE BELOW	–––	1
	2		REPAIR ROTATING ASSY	44163–563	–––	1
☞	3		PIPE PLUG	P04	15079	1
☞	4		PIPE PLUG	P08	15079	3
☞	5		STUD	C1412	15991	12
☞	6		ALLEN HD SET SCREW	GA0601–1/2	17090	2
	7	✳	O-RING	25152–391	–––	1
	8		LOCK WASHER	J14	15991	12
	9		HEX NUT	D14	15991	12
☞	10	✳	WEAR RING	38691–639	11010	1
NOT SHOWN:						
☞			STUD	C1414	15991	12
			SUCTION STICKER	6588AG	–––	1
			LUBRICATION DECAL	11421A	–––	1
			DISCHARGE STICKER	6588BJ	–––	1
☞			INCLUDED W/REPAIR PUMP CASING ASSY	46474–357	–––	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

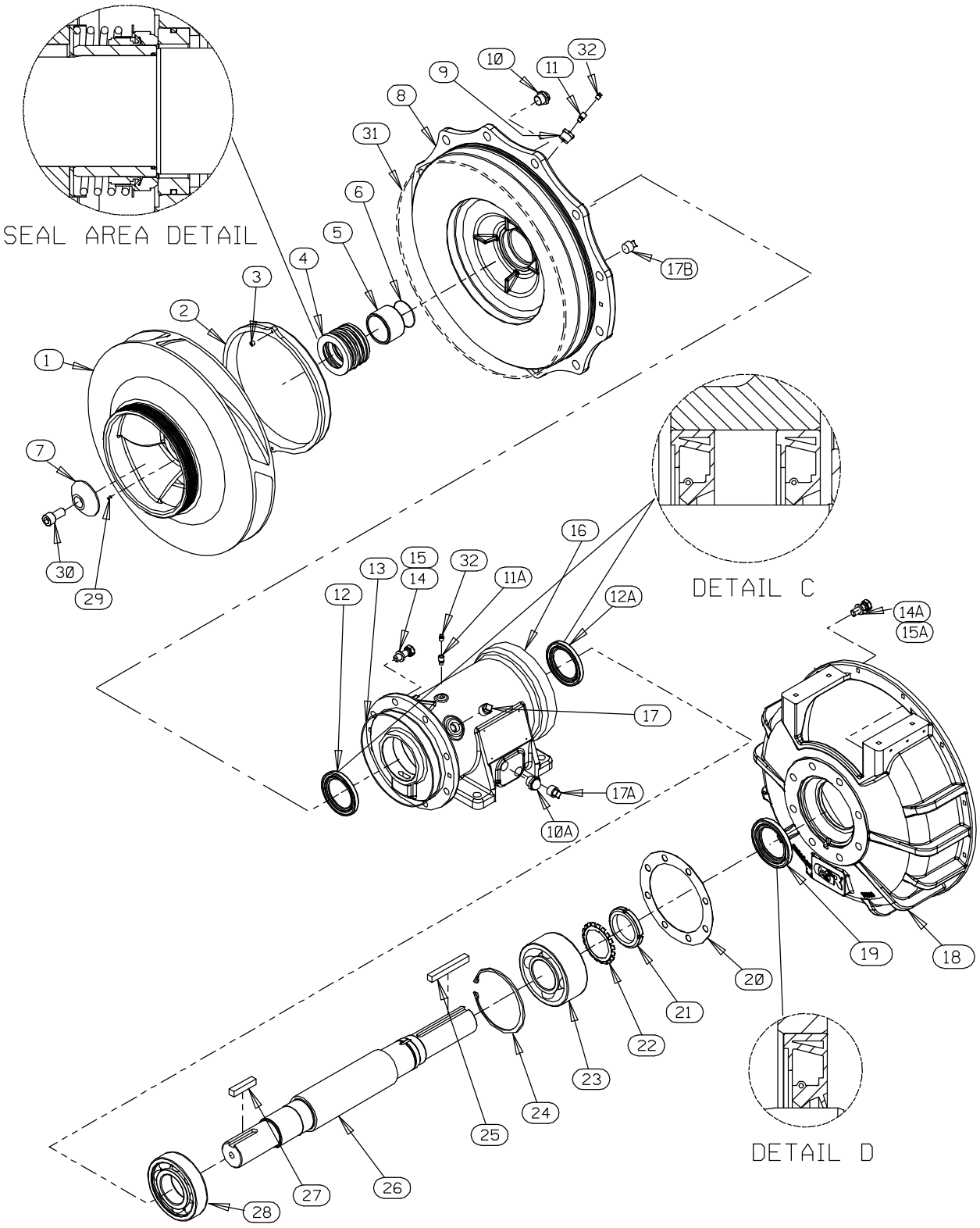


Figure 5. 44163—563 Repair Rotating Assembly

PARTS LIST
44163–563 Repair Rotating Assembly

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1	✳	IMPELLER	38621–784	11010	1
2	✳	WEAR RING	38691–638	11010	1
3		ALLEN HD SET SCREW	GA0601–1/2	17090	2
4	✳	MECH SEAL	25285–823	–––	1
5	✳	SHAFT SLEEVE	31163–023	17000	1
6	✳	O-RING	25152–036		1
7		IMPELLER WASHER	31167–041	17000	1
8		SEAL PLATE	38272–615	11010	1
9		REDUCER PIPE BUSHING	AP1202	15079	1
10		SIGHT GAUGE	S1471	–––	2
10A		SIGHT GAUGE	S1471	–––	2
11		SEAL CAVITY AIR VENT	S1530	–––	1
11A		BEARING CAVITY AIR VENT	S1530	–––	1
12	✳	OIL SEAL	25227–920	–––	1
12A	✳	OIL SEAL	25227–920	–––	1
13	✳	O-RING	25152–177	–––	1
14		LOCK WASHER	J10	15991	8
14A		LOCK WASHER	J10	15991	8
15		HEX HEAD CAP SCREW	B1007	15991	8
15A		HEX HEAD CAP SCREW	B1007	15991	8
16		PEDESTAL	38257–314	10000	1
17		BRG CAVITY FILL PLUG	P12	15079	2
17A		BRG CAVITY DRAIN PLUG	P12	15079	2
17B		SEAL CAVITY DRAIN PLUG	P12	15079	1
18		DRIVE FLANGE	38545–021	10000	1
19	✳	OIL SEAL	25227–862	–––	1
20	✳	GASKET	38683–668	19370	1
21		BEARING LOCKNUT	23962–017	–––	1
22		BEARING LOCK WASHER	23962–517	–––	1
23	✳	BALL BEARING	23421–417	–––	1
24		RETAINING RING	24121–088	–––	1
25	✳	DRIVE KEY	N1020	15990	1
26		IMPELLER SHAFT	38512–535	16000	1
27	✳	IMPELLER KEY	N1012	15990	1
28	✳	BALL BEARING	23275–017	–––	1
29	✳	ROLL PIN	S2197	–––	1
30	✳	IMPELLER SCREW	BD1206	15990	1
31	✳	O-RING	25152–391	–––	1
32		SHIPPING PLUG	11495C	15079	2
NOT SHOWN:					
		INSTRUCTION TAG	6588U	–––	1
OPTIONAL:					
		SEAL PUSHER	38838–014	19220	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

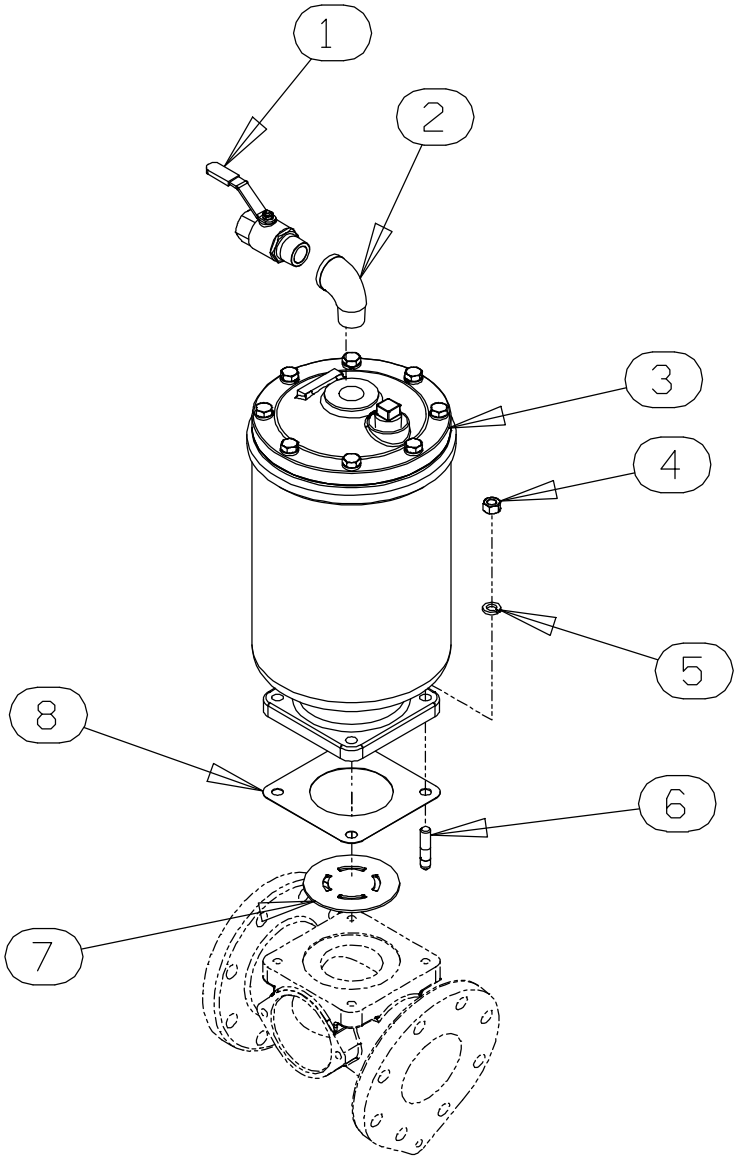


Figure 6. 48275−006 Priming Chamber Kit

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		BALL VALVE	26631−054	−−−	1
2		STREET ELBOW	RS16	11999	1
3		PRIMING CHAMBER ASSEMBLY	46112−709	−−−	1
4		HEX NUT	D08	15991	4
5		LOCK WASHER	J08	15991	4
6		STUD	C0809	15991	4
7		BAFFLE	31113−011	17000	1
8	✳	GASKET	38687−053	19060	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

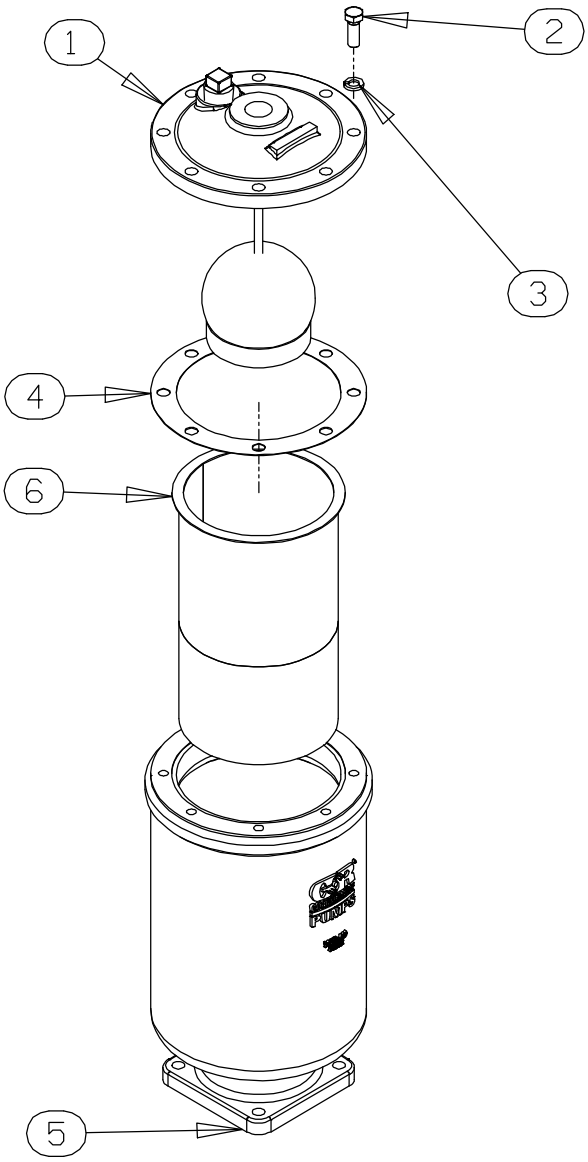


Figure 7. 46112–709 Priming Chamber Assembly

PARTS LIST

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

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

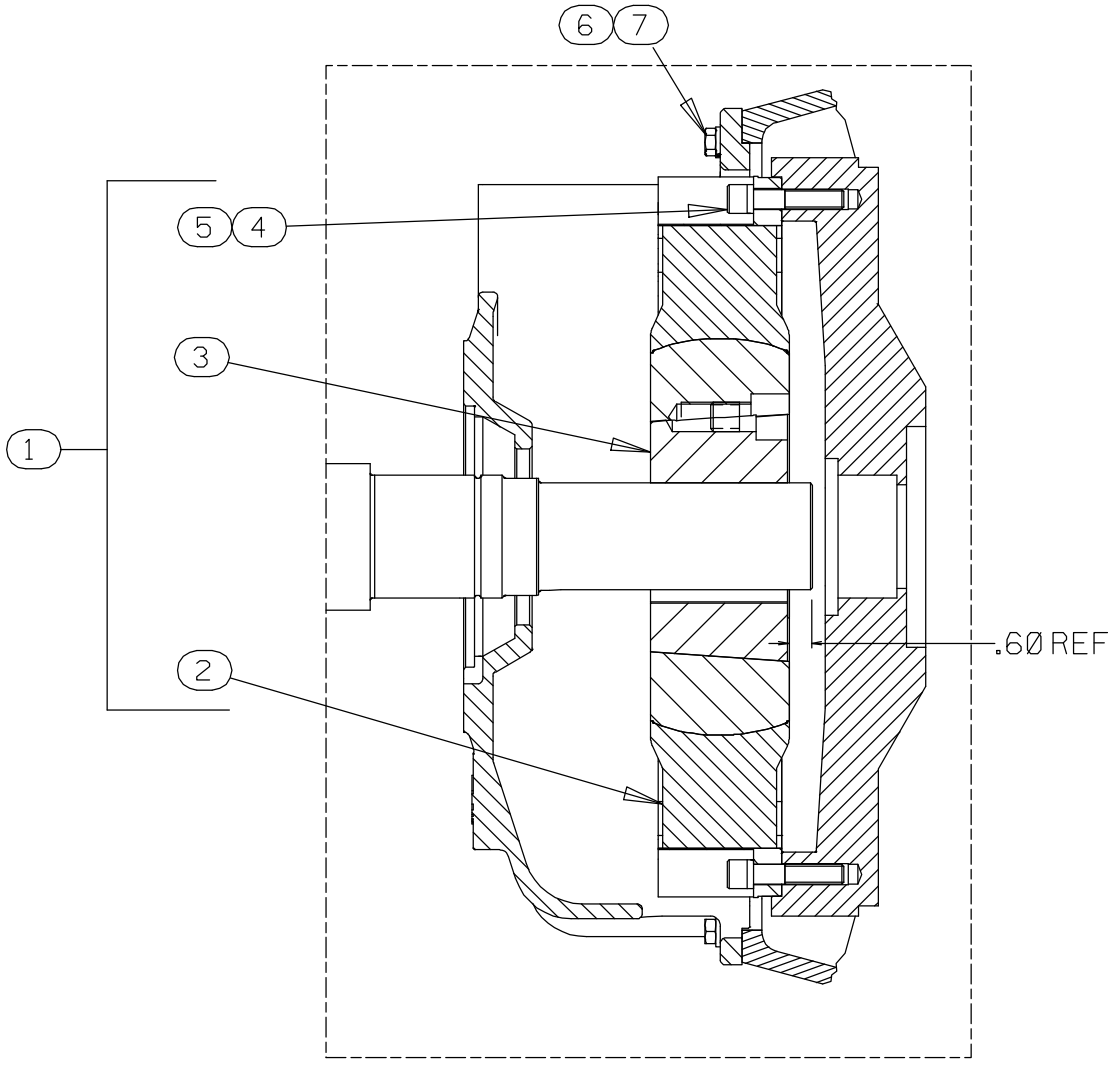


Figure 8. 44162–183 Drive Assembly

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		COUPLING KIT	48112–023	–––	1
2		–COUPLING	24391–117	–––	1
3		–BUSHING	24131–071	–––	1
4		–LOCKWASHER	21171–905	–––	8
5	☞	–SOCKET HEAD CAPSCREW	BD0810	15998	8
6	☞	HEX HEAD CAPSCREW	B0706	15991	12
7	☞	LOCKWASHER	J07	15991	12
5	◗	–SOCKET HEAD CAPSCREW	22645–226	–––	8
6	◗	HEX HEAD CAPSCREW	22645–166	–––	12
7	◗	LOCKWASHER	21171–511	–––	12

☞ USE FOR SAE APPLICATIONS
◗ USE FOR METRIC APPLICATIONS

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 8) and the corresponding Parts Lists. Maintenance and repair instructions for the engine are covered separately in specific literature available from the manufacturer.

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.

Some pump service functions may be performed without separating the pump end assembly from the engine. However, the priming chamber (23, Figure 3) and discharge check valve assembly (25, Figure 3) must be removed to service most pump components. 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 lowermost pipe plug (4, Figure 4). Clean and reinstall the plug.

WARNING!

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

WARNING!

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.**

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** 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 Chamber Removal and Disassembly

(Figure 6)

Disconnect both the suction piping and the air discharge tubing from the priming chamber assembly (23, Figure 3). Support the priming chamber assembly using a sling and a suitable lifting device. Remove the hardware (4 and 5) and separate the priming chamber assembly, gasket (8) and baffle (7) from the spool (18, Figure 3).

(Figure 7)

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

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

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

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

Discharge Check Valve Removal and Disassembly

(Figure 3)

Remove the hardware (not shown) securing the discharge check valve bracket to the base.

Support the discharge check valve assembly (25) using a sling and a suitable lifting device. Remove the hardware (not shown) securing the check valve to the pump assembly (1) and support bracket (24) and separate the discharge check valve assembly and gasket (not shown) from the pump assembly.

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

Pump Casing and Wear Ring Removal

(Figure 4)

The wear ring (10) may be serviced by removing the pump casing (2).

It is not necessary to remove the suction spool (18, Figure 3) from the pump casing unless replacement of the spool or gasket (13, Figure 3) is required. To remove the suction spool, disengage the hardware (14 and 15, Figure 3) securing it to the pump casing. Disengage the hardware (4 and 17) securing the suction spool to the suction support (16). Use a sling and suitable lifting device to remove the suction spool. Remove the gasket and clean the mating surfaces.

Disengage the hardware (8 and 9) and use a suitable lifting device to separate the pump casing from the rotating assembly (2).

Inspect the wear ring (10) for excessive wear or damage. The wear ring is secured in the pump casing by a press fit. If replacement is required, re-

move the set screws (6) and install two 3/8−16 UNC−2B capscrews (not supplied) at least 1−1/4 inches long in the holes in the wear ring. Tighten the capscrews in an alternating sequence to “jack” the wear ring from the pump casing.

Impeller and Wear Ring Removal

(Figure 5)

Before attempting to remove the impeller (1) position a **clean** container (2 gallons [8 liters] minimum capacity) under the seal cavity drain plug (17B). Remove the plug and drain the oil from the seal cavity into the container. Clean and reinstall the drain plug. Inspect the oil for water, dirt or a cloudy condition which could indicate seal failure.

Use an impact wrench and a suitably sized allen wrench to remove the impeller capscrew (30). Remove the impeller washer (7) from the shaft.

Install two 3/8−16 UNC−2B capscrews (not supplied) in the tapped holes in the impeller. Attach a suitable puller to the capscrews and use the puller to remove the impeller and key (27) from the shaft. Remove the puller and the screws from the impeller.

Inspect the wear ring (2) for excessive wear or damage. The wear ring is secured in the seal plate (8) by a press fit. If replacement is required, remove the set screws (3) and install two 3/8−16 UNC−2B capscrews (not supplied) at least 1−1/4 inches long in the holes in the wear ring. Tighten the capscrews in an alternating sequence to “jack” the wear ring from the seal plate.

Seal Removal

(Figures 5 and 9)

Carefully remove the spring retainer and seal spring. Slide the rotating portion of the seal assembly and shaft sleeve (5) off the shaft as a single unit. Remove the shaft sleeve O-ring (6). Apply oil to the shaft sleeve and work it up under the rubber bellows. Slide the rotating portion of the seal assembly off the shaft sleeve.

Slide a pair of stiff wires with hooked ends along the shaft and hook the stationary seat from the back side. Pull the stationary seat and O-ring from the seal plate (8).

An alternate method of removing the stationary seal components is to remove the hardware (14 and 15) and separate the seal plate from the pedestal (16). 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 and O-ring can be removed.

Remove the seal plate O-ring (31).

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

Separating Pedestal and Drive Assembly From Engine

(Figure 8)

Support the pedestal using a hoist and sling and remove the hardware (6 and 7) securing the drive flange (18, Figure 5) to the engine bellhousing. See Figure 3 and remove the hardware (6, 7 and 10) securing the pedestal to the support assembly (11).Separate the assemblies by pulling the pedestal straight away from the engine.

As the assemblies separate, the flexible portion of the coupling assembly (2) will remain on the shaft. To remove the coupling from the shaft, unscrew the allen head setscrew from the bushing (3). Screw the setscrew into the puller hole on the circumference of the bushing. As the coupling and bushing separate, remove the bushing and slide the coupling off the shaft. Remove the shaft key (25, Figure 5).

It is not necessary to remove the outer ring of the coupling from the engine flywheel unless the coupling must be replaced. To remove the ring, disengage the hardware (4 and 5) securing it to the flywheel.

Move the pump end to a clean, well equipped shop area for further disassembly.

Shaft And Bearing Removal And Disassembly

(Figure 5)

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

CAUTION

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

Before attempting to remove the shaft (26) and bearings (23 and 28), position a container (1 gallon [4 liters] minimum capacity) under one of the bearing cavity drain plugs (17A). Remove the plug and drain the oil from the bearing cavity into the container. Clean and reinstall the drain plug.

Remove the shaft key (25). Disengage the hardware (14A and 15A) and remove the drive flange (18) and gasket (20). Press the oil seal (19) from the drive flange.

Place a block of wood against the impeller end of the shaft, and tap the shaft until the outboard bearing (23) is free from the pedestal. Reach into the pedestal with a pair of snap ring pliers and remove the retaining ring (24) from the groove in the pedestal. Continue to slide the shaft and assembled bearing out of the pedestal until free.

Pry or press the oil seals (12 and 12A) from the bearing housing. Remove the pedestal O-ring (13).

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

CAUTION

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

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

WARNING!

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

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

CAUTION

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

Rotate the bearings by hand to check for roughness or binding 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 pedestal. Replace the bearings, shaft, or pedestal if the proper bearing fit is not achieved.

If bearing replacement is required, straighten the tab on the bearing lock washer (22) and use a suitable spanner wrench to remove the bearing lock nut (21). Use a bearing puller or a press to remove the bearings from the shaft.

Remove the retaining ring.

Shaft and Bearing Reassembly and Installation

(Figure 5)

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

CAUTION

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

Inspect the shaft (26) for distortion, nicks or scratches. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

The bearings may be heated to ease installation. An induction heater, hot oil bath, electric oven, or hot plate may be used to heat the bearing. The 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.*

Position the retaining ring (24) over the shaft prior to installing the second bearing.

Heat the bearings to a uniform temperature **no higher than** 250°F (120°C) and slide them one at a time onto the shaft until 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.

WARNING!

Use caution when handling hot bearings to prevent burns.

After the bearings have been installed and allowed to cool, check to ensure that they have not moved out of position in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings.

If heating the bearings is not practical, use a suitably sized sleeve and a press to install the bearings on the shaft.

CAUTION

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

Secure the assembled shaft and bearings by clamping on the surface between the bearings. Use caution not to scratch or mar the part number on the shaft in this area. Install the bearing lock washer (22) and bearing lock nut (21). Torque the lock nut to 150 ft. lbs. (20,7 m. kg.). Locate the tab on the lock washer that aligns with a slot in the lock nut and bend the tab over into the slot.

Install the oil seal (12A) in the pedestal with the lip positioned as shown in Figure 5. Make sure the oil seal is just flush with the machined face of the pedestal I.D.

Slide the shaft into the pedestal bore until the inboard bearing (28) is past the bore for the outboard bearing (23). Use a pair of snap ring pliers to install the retaining ring (24) in the groove in the pedestal I.D. Continue to slide the shaft and assembled bearings into the pedestal until the outboard bearing seats against the retaining ring. Use caution not to cut the lip of the oil seal (12A).

CAUTION

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

Apply a light coating of oil to the lip of the oil seal (19) and press it into the drive flange (18) with the lip positioned as shown in Figure 5. The face of the oil seal should be just flush with the outer face of the bearing cap. Inspect and remove any sealant shavings from the O.D. of the lip seal.

Install the drive flange gasket (20). Apply “Loctite Threadlocker No. 242” or equivalent compound to the capscrews (15A) and secure the bearing cap to the pedestal with the hardware (14A and 15A). Torque the capscrews (15A) in a criss-cross pattern to 80 ft. lbs. (11 m. kg.). Torque the capscrews again in a criss-cross pattern to 110 ft. lbs. (15 m. kg.), going around the bolt circle 1-1/2 times.

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

Securing Pedestal And Drive Assembly To Engine

(Figure 8)

Install the shaft key (28, Figure 5) in the shaft keyway. Position the flexible portion of the coupling assembly (3) on the shaft as shown in Figure 8.

NOTE

The flexible portion of the coupling must be properly positioned on the shaft. The heads of the capscrews in the center of the coupling ***must be positioned away from the pump****.*

Align the keyway in the bushing (2) 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.

CAUTION

Make certain that the flexible portion of the coupling is mounted as shown in Figure 8. **This is critical.** If the coupling is not properly positioned on the shaft, the coupling parts may not fully engage, or a pre-load condition can cause premature bearing failure.

The end of the shaft must extend 0.60 inch (15 mm) from the face of the bushing. This will allow the two portions of the coupling to fully engage when the engine bracket is secured to the engine bellhousing without pre-loading the bearings.

With the flexible portion of the coupling and the bushing properly positioned on the shaft, tighten the two setscrews in an alternating sequence until the bushing and coupling are fully secured. Torque the setscrews to 67 ft. lbs. (800 in. lbs. or 0,57 m. kg.).

If the complete coupling assembly is being replaced, apply 'Loctite Retaining Compound No. 242' or equivalent to the threads of the hardware (4 and 5) and secure the outer ring of the coupling to the engine flywheel by torquing the hardware to 50 ft. lbs. (6,9 m. kg.).

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

NOTE

To ease installation, ***lightly*** *lubricate the rubber portion of the coupling with a* ***non-petroleum based lubricant*** *such as vegetable oil or glycerin, or a silicon-based lubricant such as "WD40" or equivalent.* ***Do not*** *use petroleum-based lubricants, or any other substance which may soften or otherwise damage the rubber.*

Secure the drive flange (20, Figure 5) to the engine bellhousing with the previously removed hardware (6, 7 and 9).

Seal Reassembly and Installation

(Figures 5 and 9)

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.

WARNING!

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

CAUTION

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.

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

Remove the seal from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the stationary seat O-ring, the I.D. Of the bellows and the O.D. of the shaft sleeve (5) with "P–80® Emulsion" or water. **Do not** use oil or any substitute lubricant other than water. Apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 9).

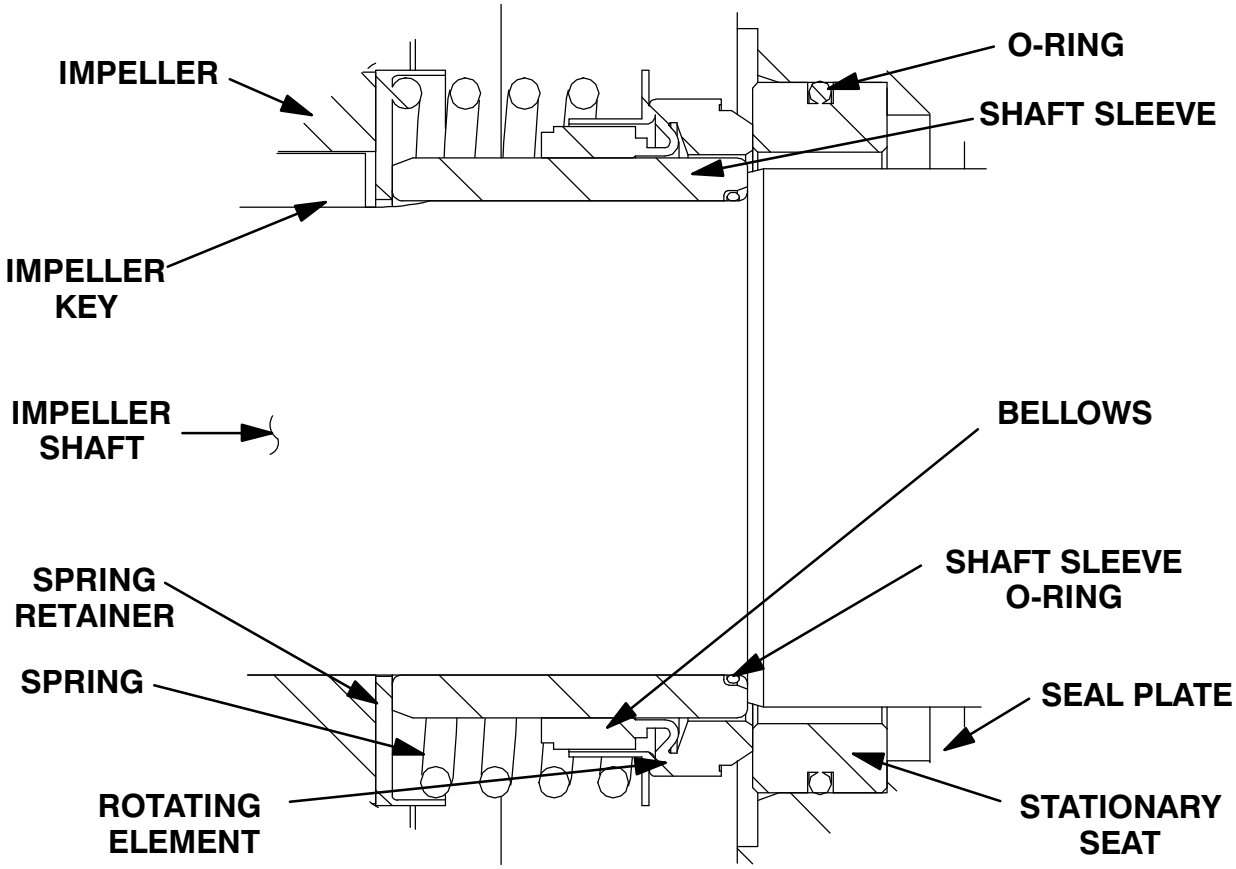


Figure 9. Seal Assembly

CAUTION

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

Inspect the seal plate (8), shaft sleeve (5) and the impeller shaft for burrs or sharp corners, and remove any that exist.

If the wear ring (2) was removed, press the replacement ring into the seal plate until fully seated. Apply "Loctite Threadlocker No. 243" or equivalent compound to the threads of the setscrews (3) and install them in the holes in the wear ring until snug.

CAUTION

The wear ring **must** seat squarely in the seal plate bore; otherwise binding and/or

excessive wear will occur as the shaft turns.

Apply a light coating of oil to the lip of the oil seal (12) and press into the seal plate bore with the lip positioned as shown in Figure 5. Make sure the oil seal is just flush with the outer face of the pedestal. Use caution not to cut the lip of the oil seal on the shaft keyway. Inspect and remove any sealant shavings from the O.D. of the lip seal.

Lubricate the O-ring (13) with light grease and install it in the groove in the pedestal.

Position the seal plate over the pedestal shoulder and press it onto the pedestal until fully seated. Secure the seal plate to the pedestal with the previously removed hardware (14 and 15).

Press the stationary seat and O-ring into the seal plate bore until fully seated. A push tube cut from a length of plastic pipe would aid this installation. The I.D. of the tube should be approximately the same as the I.D. of the seal spring.

To prevent damaging the shaft sleeve O-ring (6) 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.

Slide the rotating portion of the seal assembly onto the shaft sleeve until the rotating element is just flush with the undercut end of the sleeve. Slide the shaft and rotating portion of the seal onto the shaft until the sealing faces contact.

Install the seal spring and spring retainer.

After the impeller has been installed, lubricate the seal as indicated in **LUBRICATION**.

Impeller Installation

(Figure 5)

Inspect the impeller, and replace it if cracked or badly worn. If removed, install the roll pin (29) in the hole in the impeller hub.

Install the impeller key (27) in the shaft keyway. Align the keyway in the impeller with the impeller key and press the impeller onto the shaft until fully seated.

Use a piece of soft bar stock or a wood block to prevent impeller rotation. Align the hole in the impeller washer (7) with the roll pin in the impeller and install the washer. Apply “Loctite Threadlocker No. 243” or equivalent compound to the threads of the impeller screw (30). Install the impeller screw and torque the screw to 200 ft. lbs. (27,6 m. kg.). Remove the wood block or metal bar used to prevent impeller rotation.

Pump Casing and Wear Ring Installation

(Figure 4)

If the wear ring (10) was removed, press the replacement ring into the pump casing until fully seated. Apply “Loctite Threadlocker No. 243” or equivalent compound to the threads of the setscrews (6) and install them in the holes in the wear ring until snug.

CAUTION

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

Lubricate the O-ring (7) with light grease and install it in the groove in the O.D. of the seal plate.

Carefully position the pump casing over the impeller. Install the hardware (8 and 9) on the studs (5) and use the hardware to draw the pump casing over the seal plate shoulder until tight.

(Figure 3)

If removed at disassembly, install the gasket (13) over the studs (12) and secure the suction spool (18) to the pump casing with the previously removed hardware (14 and 15).

Secure the suction spool to the support assembly (16) with the previously removed hardware (4 and 17).

Discharge Check Valve Reassembly and Installation

(Figure 3)

If the discharge check valve (25) was disassembled to replace the flapper or cover O-ring, position the flapper in the valve body and check to ensure free movement.

Install the valve cover O-ring and secure the cover to the body with the previously removed hardware.

Apply a small amount of light grease to the discharge flange gasket to hold it in place and position it against the pump casing flange. Support the discharge check valve assembly using a sling and a suitable lifting device. Using the previously removed hardware, secure the discharge check valve assembly and flange gasket to the pump assembly (1). Secure the discharge check valve to its support bracket using the previously removed hardware.

Priming Chamber Assembly and Installation

(Figure 7)

Clean and inspect the components of the priming valve (1). Inspect the linkage and ensure the orifice button (not shown) squarely engages the valve seat. Replace the orifice button if required (see **Priming Chamber Removal and Disassembly** for orifice button removal).

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

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

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

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

(Figure 6)

Install the baffle and gasket (7 and 8) and use a sling and suitable lifting device to position the priming chamber assembly on the pump suction spool (18, Figure 3). Secure the priming chamber assembly with the hardware (4 and 5).

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

LUBRICATION

Seal Assembly

(Figure 5)

Before starting the pump, remove the air vent and reducer bushing (9 and 11) and fill the seal cavity with approximately 220 ounces (6,5 liters) of SAE No. 30 non-detergent oil to the middle of the sight gauges (10) and maintain it at the middle of the gauges. Clean and reinstall the air vent and bushing. Maintain the oil at this level.

Bearings

(Figure 5)

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauges (10A) and maintain it at the middle of the gauges. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (11A). **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

Under normal conditions, drain the pedestal once each year and refill with approximately 84 ounces (2,5 liters) of 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.

Engine

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

For Warranty Information, Please Visit
www.grpumps.com/warranty
or call:
U.S.: 419—755—1280
Canada: 519—631—2870
International: +1—419—755—1352