

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



80 SERIES PUMP

MODEL
84A2-4024T

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

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

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

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INTRODUCTION

This Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is an 80 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is designed for handling most non-volatile, non-flammable liquids containing specified entrained solids. It is powered by a John Deere diesel engine, model 4024T. The basic material of construction for all wetted parts is gray iron and steel.

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
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 engine, contact the engine manufacturer's local dealer or representative.

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 ac-

ording to all national, local and industry standards.

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 80 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 install, operate, or service this pump, familiarize yourself with this manual, and with all other literature shipped with the pump. Unfamiliarity with all aspects of pump operation covered in this manual could lead to destruction of equipment, injury, or death to personnel.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off the engine ignition 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.



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



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



After the pump has been positioned, 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 for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come

to a boil, build pressure, and cause the pump casing to rupture or explode.



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



Do not operate 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.



Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. The maximum continuous operating speed for this pump is 2300 RPM.

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. (See Section E, Page 1.) If the pump is fitted with a Gorman-Rupp double grease lubricated seal, the maximum incoming pressure must be reduced to 10 p.s.i.

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

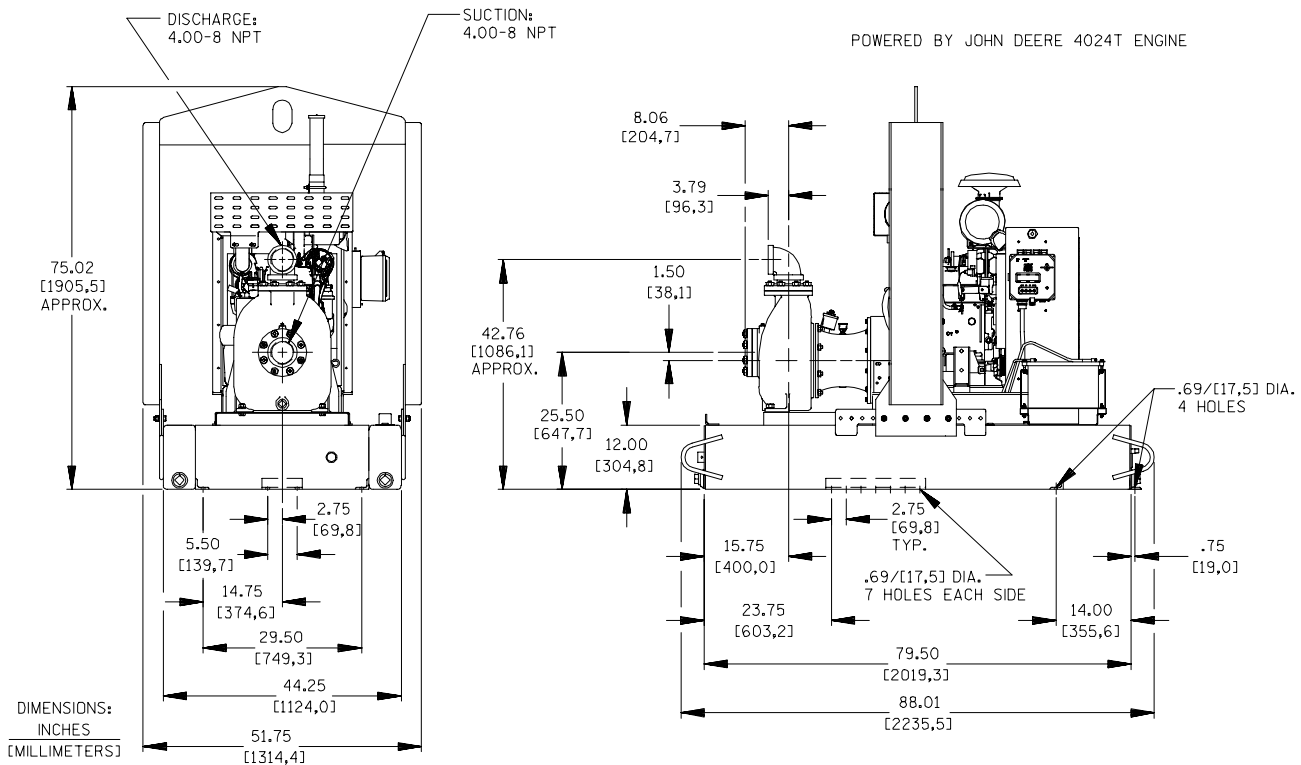


Figure 1. Pump Model 84A2-4024T

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 and engine for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after dry-

ing, check for loose hardware at mating surfaces.

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

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

Battery Specifications And Installation

Unless otherwise specified on the pump order, the engine battery was **not** included with the unit. Refer to the following specifications when selecting a battery.

Table 1. Battery Specifications

Voltage	Cold Crank Amps @ 0° F	Reserve Capacity @ 80° F (Minutes)	Amp/ Hr. Rating	Approx. Overall Dims. (Inches)
12 Volts	960-975	365	175	20.5L X 8.75W X 9.75H

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

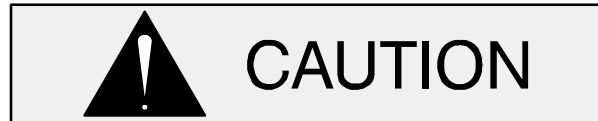


WARNING!

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

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.



CAUTION

The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation.

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

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.

To ensure sufficient lubrication and fuel supply to the engine, **do not** position the pump and engine more than 15° off horizontal for continuous operation. The pump and engine may be positioned up to 30° off horizontal for **intermittent operation only**; however, the engine manufacturer should be

consulted for continuous operation at angles greater than 15°.

SUCTION AND DISCHARGE PIPING

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

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches (457,20 mm) from the suction and discharge ports and install the lines. Installation closer to the pump may result in erratic readings.

SUCTION LINES

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

Fittings

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

This pump is designed to handle up to 1-1/8 inch (28,6 mm) diameter spherical solids.

Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 2 shows recommended minimum submergence vs. velocity.

NOTE

The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).

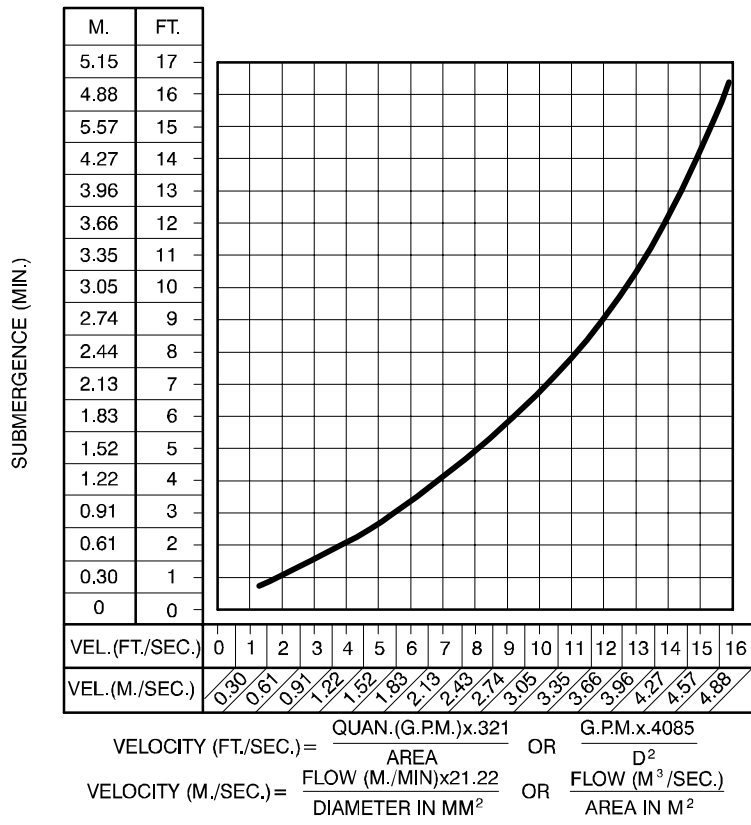


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

DISCHARGE LINES

Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

Valves

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

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

head, gradually close the discharge throttling valve before stopping the pump.

Bypass Lines

If a system check valve is used due to high discharge head, it may be necessary to vent trapped air from the top of the pump during the priming process. This may be accomplished by installing a bypass line from the top of the pump, back to the source of liquid. The end of the bypass line must be submerged. The line must be large enough to prevent clogging, but not so large as to affect pump discharge capacity.

ALIGNMENT

The alignment of the pump and engine is critical for trouble-free mechanical operation. The driver and pump must be mounted so that their shafts are aligned with and parallel to each other. Refer to **Securing Intermediate And Drive Assembly To Engine** in **MAINTENANCE AND REPAIR**, Section E for details.



If the application involves a high discharge

OPERATION – SECTION C

Review all SAFETY information in Section A.

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



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



Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. The maximum continuous operating speed for this pump is 2300 RPM.

PRIMING

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

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



Never operate this pump unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

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

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



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

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

STARTING

Consult the operations manual furnished with the engine.

On initial start-up, set the engine speed at the half-throttle position. Turn the keyswitch on the control panel to “RUN” and press the “ENTER” button on the engine control panel.

After the engine starts and the unit is fully primed, adjust the engine RPM until the desired flow rate is achieved.



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

OPERATION

A Gorman-Rupp automatic air release valve may be installed in a bypass line, or the bypass line may be left open.



A manual shut-off valve should not be installed in any bypass line. A manual shut-off valve may inadvertently be left closed during operation. A pump which has lost prime may continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. Personnel could be severely injured.

Lines With a Bypass

If a Gorman-Rupp Automatic Air Release Valve has been installed, the valve will automatically open to allow the pump to prime, and automatically close after priming is complete (see **INSTALLATION** for Air Release Valve operation).

If the bypass line is open, air from the suction line will be discharged through the bypass line back to the wet well during the priming cycle. Liquid will then continue to circulate through the bypass line while the pump is in operation.

Lines Without a Bypass

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

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



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

Leakage

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

Liquid Temperature And Overheating

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

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.



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

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

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

Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches (508 mm) or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

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.

On engine driven pumps, reduce the throttle speed slowly and allow the engine to idle briefly before stopping.

Reduce the throttle speed slowly, and allow the engine to idle briefly before turning the key switch to 'OFF'.



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

After stopping the pump, switch off the engine ignition and disconnect the positive battery cable to ensure that the pump will remain inoperative.

Safety Shutdown System

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

1. If the engine exceeds its safe operating temperature.
2. If the engine oil pressure drops below design limits.
3. If the engine fails to start within a pre-set period of time.
4. If the engine speed exceeds the safe operating range.

Lights 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. The engine **will not restart** until the keyswitch has been returned to the 'OFF' position for at least 10 seconds.

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



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.

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 completely 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 equipped with the optional auto-start control, the float(s) may need to be adjusted to allow shorter run and longer cooling periods, if possible.

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 ac-

curately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION** in Section E). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

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.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off engine ignition 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.

Table 1. Trouble Shooting Chart

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Not enough liquid in casing.	Add liquid to casing. See PRIMING .
	Suction check valve contaminated or damaged.	Clean or replace check valve.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See INSTALLATION .
	Strainer clogged.	Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Suction check valve or foot valve clogged or binding.	Repair priming device or check installation.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.

Table 1. Trouble Shooting Chart (cont.)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	<p>Leaking or worn seal or pump gasket.</p> <p>Suction intake not submerged at proper level or sump too small.</p> <p>Strainer clogged.</p> <p>Impeller or other wearing parts worn or damaged.</p> <p>Impeller clogged.</p> <p>Suction lift or discharge head too high.</p> <p>Pump speed too slow.</p>	<p>Check pump vacuum. Replace leaking or worn seal or gasket.</p> <p>Check installation and correct submergence as needed.</p> <p>Check strainer and clean if necessary.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Free impeller of debris.</p> <p>Check piping installation and install bypass line if needed. See INSTALLATION.</p> <p>Check engine output; consult engine operation manual.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Pump speed too high.</p> <p>Discharge head too low.</p> <p>Liquid solution too thick.</p> <p>Bearing(s) frozen.</p>	<p>Check engine output.</p> <p>Adjust discharge valve.</p> <p>Dilute if possible.</p> <p>Disassemble pump and check bearing(s).</p>
PUMP CLOGS FREQUENTLY	<p>Discharge flow too slow.</p> <p>Suction check valve or foot valve clogged or binding.</p> <p>Discharge line clogged or restricted; hose kinked.</p>	<p>Open discharge valve fully to increase flow rate, and run engine at maximum governed speed.</p> <p>Clean valve.</p> <p>Check discharge lines; straighten hose.</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>

Table 1. Trouble Shooting Chart (cont.)

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

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

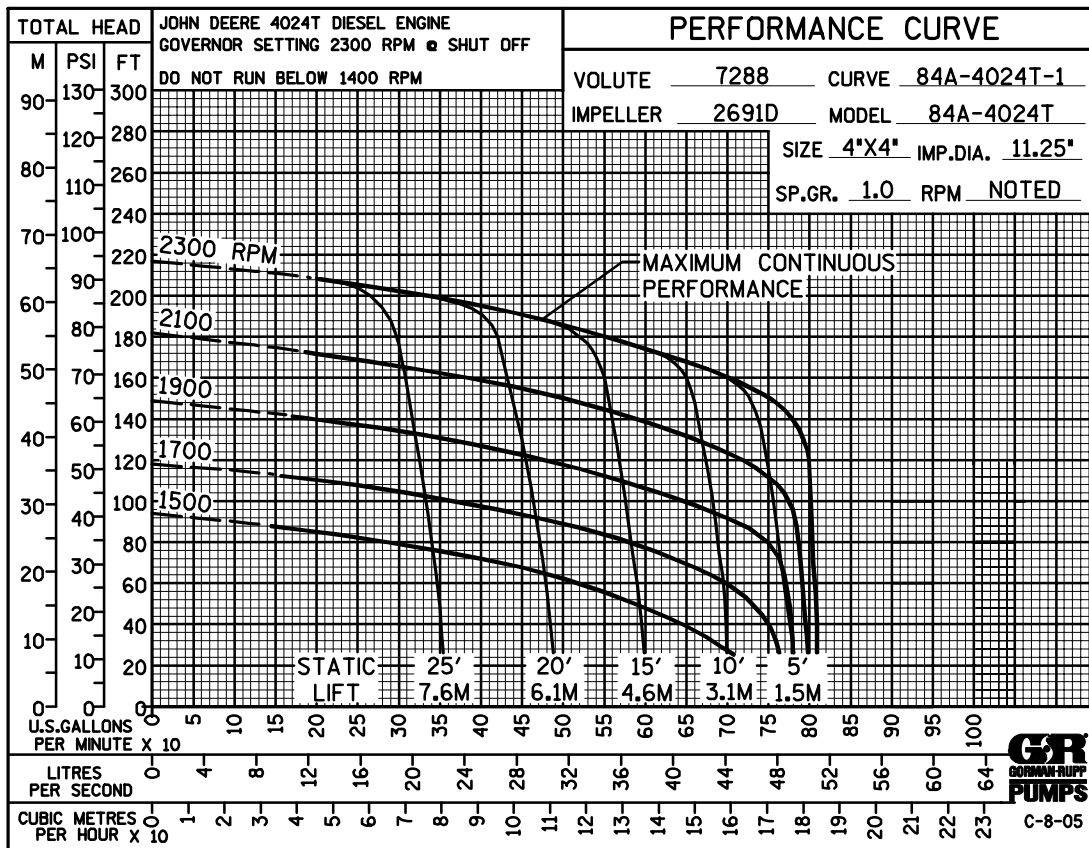
equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as 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
<p>Legend: I = Inspect, Clean, Adjust, Repair or Replace as Necessary C = Clean R = Replace</p> <p>* 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.</p>					

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 84A2-4024T**

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

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

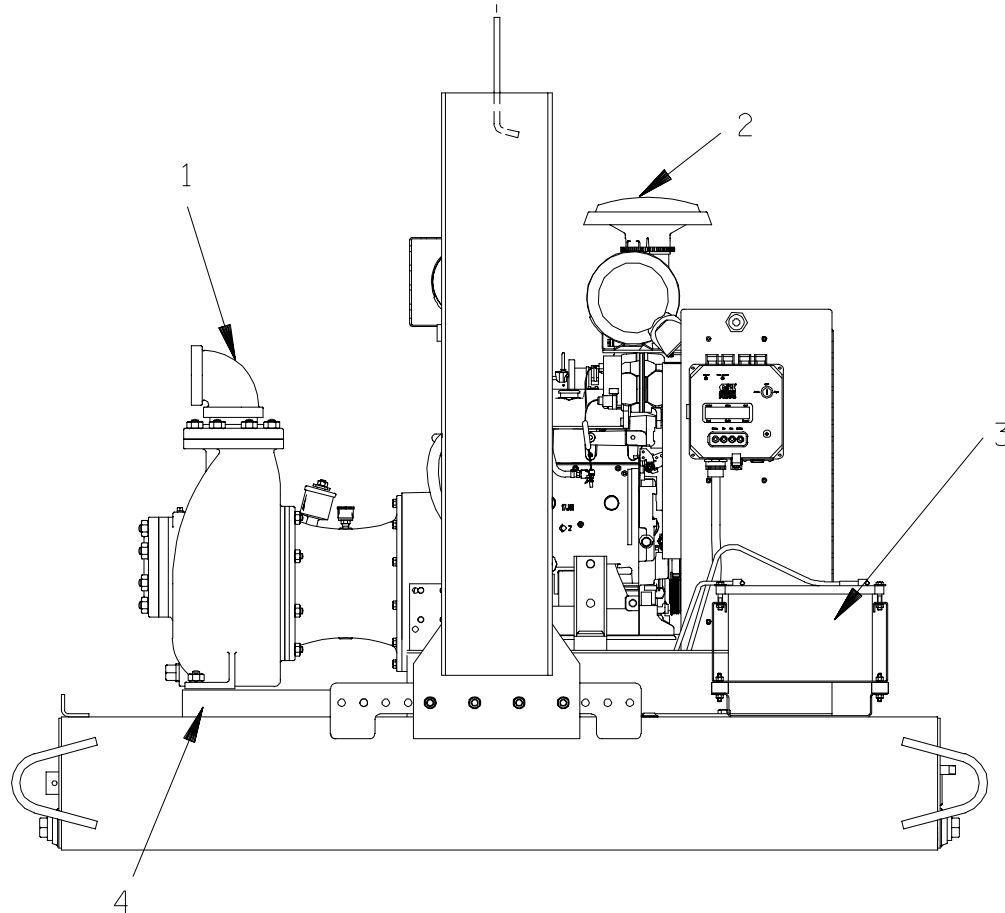


CAUTION

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.

SECTION DRAWING



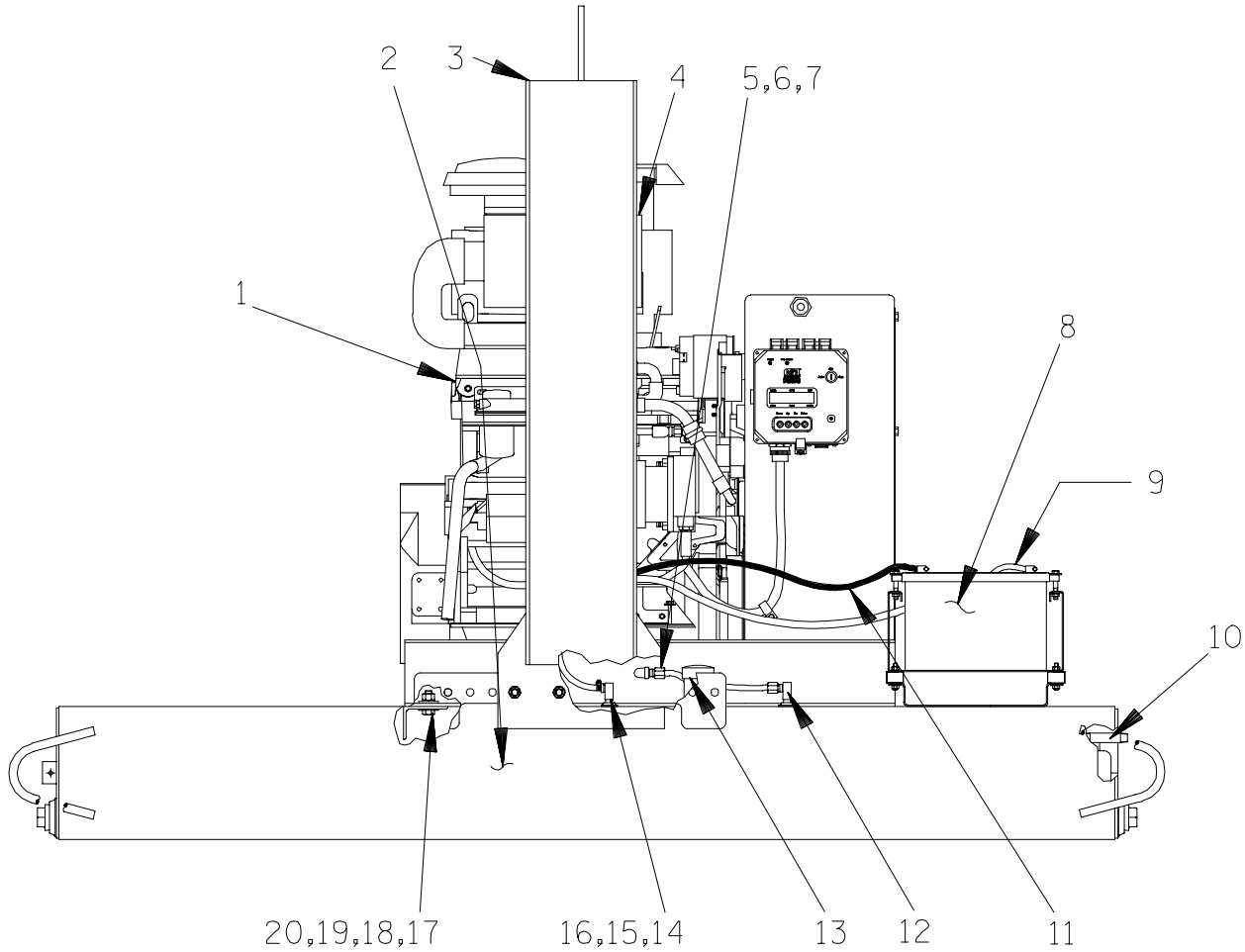
**Figure 1. Pump Model 84A2-4024T
PARTS LIST**

(From S/N 1322911 Up)

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

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP END ASSY	84A2-(SAE 4/10)	---	1
2	JOHN DEERE 4024T POWER UNIT KIT	46143-054	---	1
3	BATTERY	SEE OPTIONS		REF
4	PUMP MOUNTING KIT	48157-031	---	1
NOT SHOWN:				
	G-R DECAL	GR-06	---	2
	CAUTION DECAL	2613FJ	---	1
	STRAINER	S2003	---	1
OPTIONAL:				
	12V BATTERY	29331-517	---	1

SECTION DRAWING



NOTE: Generic John Deere Engine Shown

**Figure 2. 46143-054 John Deere Power Unit Kit
PARTS LIST**

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	JD 4024T ENGINE	29224-151	---	1	13	FUEL GAUGE	29332-135	---	1
2	BASE/FUEL TANK	41553-005	24150	1	14	HOSE BARB FITTING	26523-386	---	2
3	LIFTING BAIL	48274-803	---	1	15	HOSE	11308G	---	1
4	MUFFLER GUARD	34651-025	15120	1	16	HOSE CLAMP	26518-641	---	2
5	MALE ELBOW	26351-131	---	1	17	HEX HD CAPSCREW	B1007	15991	4
6	CONNECTOR	S1447	---	2	18	HEX NUT	D10	15991	4
7	HOSE ASSEMBLY	46341-789	---	1	19	LOCK WASHER	J10	15991	4
8	BATTERY BOX KIT	42432-005	---	1	20	FLAT WASHER	K10	15991	4
9	NEG. BATTERY CABLE	47311-184	---	1	NOT SHOWN:				
10	OIL DRAIN ASSY	46342-031	---	1		ENGINE STARTUP TAG	38816-269	---	1
11	POS. BATTERY CABLE	47311-143	---	1		INSTRUCTION DECAL	38818-144	---	1
12	FUEL PICKUP	29332-145	---	2		WARNING DECAL	38816-203	---	4

SECTION DRAWING

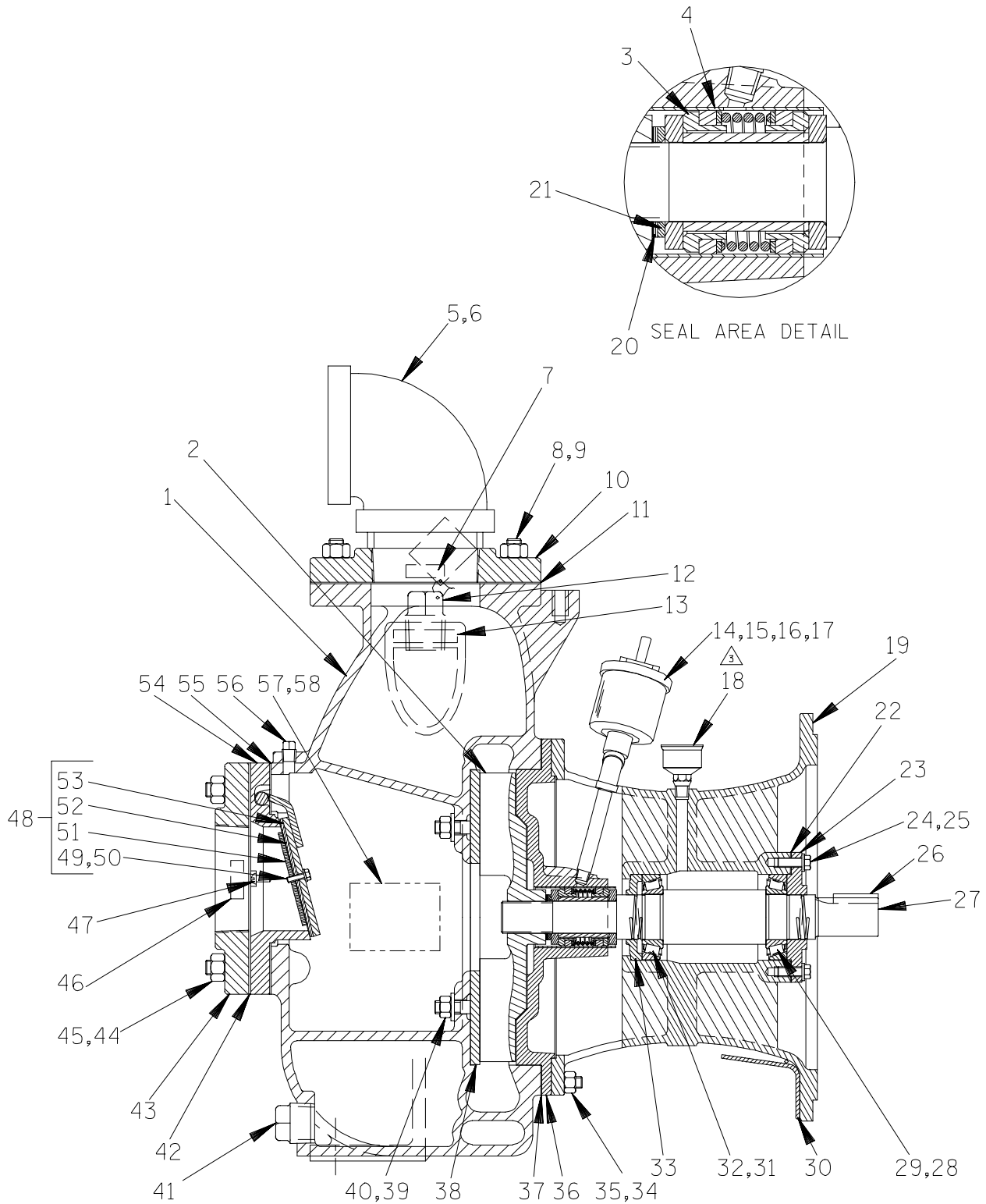


Figure 3. 84A2-(SAE 4/10) Pump End Assembly

PARTS LIST
84A2-(SAE 4/10) Pump End Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	7288	10010	1	33	BEARING CLOSURE	44	10010	1
2 *	IMPELLER	2691D	10010	1	34	STUD	C0809	15991	8
3 *	SEAL ASSY	GS1250	---	1	35	HEX NUT	D08	15991	8
4 *	SEAL LINER	2205	14080	REF	36	SEAL PLATE ASSY	2546	10010	1
5	DISCHARGE ELBOW	R64	11990	1	37 *	CASING GASKET SET	34G	18000	1
6	DISCHARGE NIPPLE	T64	15070	1	38 *	WEAR PLATE ASSY	2612A	15990	1
7	DISCHARGE STICKER	6588BJ	---	1	39	LOCKWASHER	J08	15991	2
8	STUD	C1010	15991	8	40	HEX NUT	D08	15991	2
9	HEX NUT	D10	15991	8	41	CASING DRAIN PLUG	P20	10009	1
10	DISCHARGE FLANGE	1756	10010	1	42 *	SUCTION FLANGE GSKT	1676G	18000	1
11 *	DISCH FLANGE GSKT	1676G	18000	1	43	SUCTION FLANGE	1756	10010	1
12	FILL PLUG ASSY	48271-067	---	1	44	STUD	C1013	15991	8
13	PRIMING STICKER	6588AH	---	1	45	HEX NUT	D10	15991	8
14	HEAVY PIPE NIPPLE	THA0416	15079	1	46	SUCTION STICKER	6588AG	---	1
15	PIPE ELBOW	AG04	11999	1	47	RD HD MACH SCREW	X0403	17090	2
16	SEAL GREASE CUP	S1509	---	1	48	CHECK VALVE ASSY	7340	---	1
17	GREASE CUP INSTR	6588BD	---	1	49	-HEX HD CAPSCREW	B0403	17000	2
18	GREASE CUP	S35	---	1	50	-LOCKWASHER	J04	17090	2
19	INTERMEDIATE	36	10010	1	51	-SMALL VALVE WEIGHT	7339	15990	1
20 *	IMP ADJ SHIM SET	37J	17090	REF	52 *	-CHECK VALVE GSKT	7341	19000	1
21	SEAL WASHER	3349	15990	1	53	-LARGE VALVE WEIGHT	7337	24000	1
22 *	BEARING ADJ SHIM SET	S114	---	1	54	CHECK VALVE SEAT	7336	10010	1
23	BEARING CAP	43X	10010	1	55 *	CHK VLV SEAT GASKET	7336G	18000	1
24	HEX HD CAPSCREW	B0604	15991	4	56	PIPE PLUG	P04	15079	1
25	LOCKWASHER	J06	15991	4	57	NAME PLATE	38818-022	13990	1
26 *	SHAFT KEY	N0607	15990	1	58	DRIVE SCREW	BM#04-03	17000	4
27 *	IMPELLER SHAFT	45	15010	1	NOT SHOWN:				
28 *	BEARING CUP	S1086	---	1	STRAINER	S2003	---	1	
29 *	BEARING CONE	S1087	---	1	DRIVE ASSY	44162-119	---	1	
30	INTERMEDIATE GUARD	42381-031	24152	2	INSTRUCTION TAG	38817-085	---	1	
31 *	BEARING CUP	S1086	---	1	LUBE DECAL	38816-075	---	1	
32 *	BEARING CONE	S1087	---	1	G-R DECAL	GR-03	---	1	

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

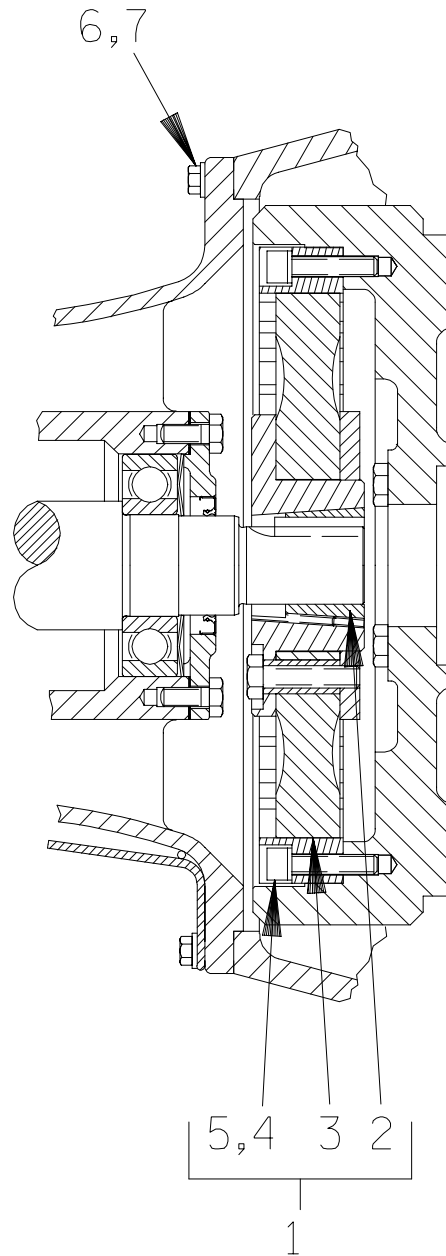


Figure 4. 84A2--(SAE 4/10) Drive Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	COUPLING KIT	48112-001	---	1
2	-BUSHING	24131-345	---	1
3	-COUPLING ASSEMBLY	44165-011	---	1
4	-LOCKWASHER	21171-536	---	8
5	-SOCKET HD CAPSCREW	22644-220	---	8
6	HEX HD CAPSCREW	22645-164	---	12
7	LOCKWASHER	21171-511	---	12

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 sectional views (see Figures 1, 2 and 3) and the accompanying parts lists.

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.

Before attempting to service the pump, switch off the engine ignition and disconnect the positive battery cable to ensure that the pump will remain inoperative. Close all valves in the suction and discharge lines.

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



Before attempting to open or service the pump:

- 1. Familiarize yourself with this manual.**
- 2. Switch off the engine ignition 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.**

Suction Check Valve Removal

(Figure 3)

Before attempting to service the pump, remove the pump casing drain plug (41) and drain the pump. Clean and reinstall the drain plug.

For access to the check valve, remove the suction piping. Remove the nuts (45) and separate the suction flange and gasket (42 and 43) from the pump casing (1). Replace the suction flange gasket as required.

Disengage the machine screws (47) and pull the check valve seat (54), gasket (55) and check valve assembly (48) from the suction port.

Inspect the check valve parts for wear or damage. If replacement is required, remove the hardware (49 and 50) and separate the check valve (52) and weights (51 and 53).

Separating Pump End And Drive Assembly From Engine

(Figure 4)

If the impeller or seal assembly require service, the pump end and drive assembly must be separated from the engine. Remove the hardware (not shown) securing the pump casing (1) to the base. Tie and tag any leveling shims used under the pump casing mounting feet to ease reassembly.

Support the intermediate using a hoist and sling, and remove the hardware (6 and 7) securing the intermediate (19, Figure 3) to the engine bellhousing. Remove the intermediate guards (30, Figure 3), and separate the assemblies by pulling the intermediate straight away from the engine.

As the assemblies separate, the flexible portion of the coupling assembly (3) will remain on the shaft. To remove the coupling from the shaft, unscrew the

two allen head setscrews from the bushing (2). Screw one of the setscrews 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 (26, Figure 3).

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.

Loosening Impeller

(Figure 3)

Before loosening the impeller, turn the cross arm on the automatic lubricating grease cup (16) clockwise until it rests against the cover (see Figure 7 in **LUBRICATION**). This will prevent the grease in the cup from escaping when the impeller is removed.

With the pump end separated from the engine and the suction check valve removed, reach through the suction port and wedge a block of wood between the vanes of the impeller and the pump casing to prevent rotation.

If removed, install the shaft key (26) in the shaft keyway. Install a lathe dog on the drive end of the shaft (27) with the “V” notch positioned over the shaft key.

With the impeller rotation still blocked, see Figure 5 and use a long piece of heavy bar stock to pry against the arm of the lathe dog in a counterclockwise direction (when facing the drive end of the shaft). **Use caution** not to damage the shaft or keyway. When the impeller breaks loose, remove the lathe dog, key and wood block.

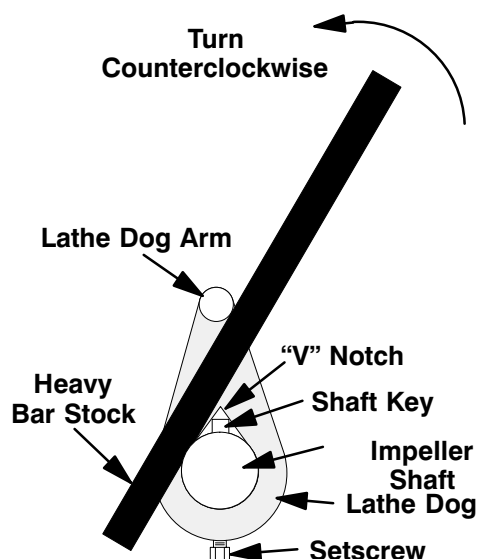


Figure 5. Loosening Impeller

Pump Casing and Wear Plate Removal

(Figure 3)

To service the impeller (2), seal assembly (3), or seal plate (36), the pump casing must be separated from the intermediate.

Install a standard 5/8–11 UNC lifting eye in the tapped hole in the top of the pump casing. **Be sure** to screw the eye into the casing until fully engaged. Remove the nuts (35) and use a hoist and sling of suitable capacity to separate the pump casing and gasket set (37) from the seal plate (36) and intermediate (19).



WARNING!

Do not attempt to lift the complete pump unit using the lifting eye. It is designed to facilitate removal or installation of individual components only. Additional weight may result in damage to the pump or failure of the eye bolt.

Inspect the wear plate (38) and replace if scored or worn. To remove the wear plate, disengage the hardware (39 and 40) from the wear plate studs, and pull the wear plate from the pump casing.

Impeller Removal

(Figure 3)

With the impeller loosened as previously described in **Loosening Impeller**, unscrew the im-

PELLER in a counterclockwise direction (when facing the impeller). Use caution when removing the impeller; tension on the seal spring will be released as the impeller is unscrewed. Inspect the impeller and replace it if cracked or badly worn.

Slide the impeller adjusting shims (20) off the shaft. For ease of reassembly, tie and tag the shims or measure and record their thickness.

Seal Removal and Disassembly

(Figure 3)

Make certain that the cross arm on the grease cup has been turned down against the cover before removing the seal assembly.

For ease of disassembly, the seal and seal plate (36) may be removed as a single unit. Before attempting to remove the seal plate, remove the seal grease cup and piping (14, 15 and 16).

Slide the seal plate and seal parts off the shaft as a unit. **Be careful** not to drop or damage any seal parts.

Carefully remove the stationary and rotating seal elements, packing rings, seal spring, and spacer sleeve from the seal plate. Use a stiff wire with a hooked end if necessary.

NOTE

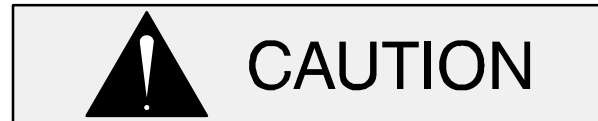
An alternate method of removing the seal without removing the seal plate is to remove the outer rotating element, and use two stiff wires with hooked ends to pull the remaining seal parts out of the seal plate.

Inspect the seal liner (4) for wear or grooves that could cause leakage or damage to the seal packing rings. The seal liner is a press fit in the seal plate (36) and does not normally require replacement. If replacement is required, see **Seal Installation**.

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

Shaft And Bearing Removal And Disassembly (Figure 3)

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.



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

Disengage the hardware (24 and 25), and remove the bearing cap (23) and shims (22). Tie and tag the bearing shims or measure and record their thickness for ease of reassembly.

NOTE

There are no provisions for draining the grease from the intermediate cavity. Place a drip pan under the intermediate before removing the shaft and bearing.

Place a block of wood against the impeller end of the shaft (27) and tap the shaft and assembled bearings out of the intermediate (19). **Be careful** not to damage the shaft.

Remove the outboard bearing cup (28) from the bearing cone (29).

Remove the bearing closure (33) and inboard bearing cup (31) from the impeller shaft.

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 intermediate, 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 rollers or roller cage and cause premature bearing failure.

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

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

If bearing replacement is required, use a bearing puller to remove the inboard and outboard bearing cones (29 and 32) from the shaft.

Shaft and Bearing Reassembly And Installation

(Figure 3)

Inspect the shaft 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.*

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

After the bearing cones 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 suitable sized sleeve and a press to reposition the bearings against the shaft shoulders.

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

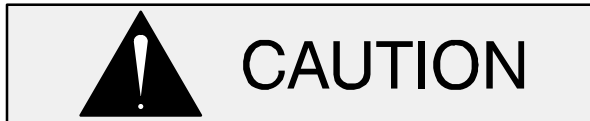


When installing the bearing cones onto the shaft, **never** press or hit against the outer race, rollers, or roller cage. Press **only** on the inner race.

Pack the bearing cups and cones with No 0 lithium base grease.

Press the bearing cup (31) onto the bearing cone (32) until the cone fully engages the bearing cup.

Slide the bearing closure (33) onto the impeller shaft (27).



When installing the bearing cups on the impeller shaft, push against the outer race. **Never** hit the rollers or roller cage.

Slide the shaft and assembled bearings into the intermediate bore from the drive end until the bearing closure is seated squarely against the intermediate shoulder. Press the outboard bearing cup (28) over the outboard bearing cone (29).

Install the same thickness of bearing adjusting shims (22) as previously removed and secure them with the bearing cap (23) and hardware (24 and 25). Check the shaft endplay.

NOTE

Shaft endplay should be between .003 and .005 inch (0,08 mm to 0,13 mm). Add or remove bearing shims to establish the correct endplay.

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

Securing Intermediate And Drive Assembly To Engine

(Figure 4)

Install the shaft key (26, Figure 3) in the shaft keyway. Position the flexible portion of the coupling assembly (3) on the shaft as shown in Figure 4.

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 toward the pump end of the shaft.***

Align the keyway in the bushing (2) with the shaft key and slide it onto the shaft until it 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.



Make certain that the flexible portion of the coupling is mounted as shown in Figure 3. **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 be **just flush** with the face of the bushing. This will allow the two portions of the coupling to fully engage when the intermediate 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 5.3 ft. lbs. (63 in. lbs. or 0,73 m. kg.).

If the complete coupling assembly is being replaced, apply 'Loctite Retaining Compound No. 242' or equivalent compound 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 45 ft. lbs. (540 in. lbs. or 6,2 m. kg.).

Using a suitable lifting device, position the assembled coupling, intermediate, shaft and bearings 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 compound. **Do not** use petroleum-based lubricants, or any other substance which may soften or otherwise damage the rubber.*

Install the intermediate guards (30, Figure 3) and secure the intermediate to the engine bellhousing with the previously removed hardware (6 and 7).

Seal Reassembly and Installation

(Figures 2 and 4)

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



WARNING!

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

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in **fresh** cleaning solvent and allow to dry thoroughly.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

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

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the packing rings and seal liner with water or a very **small** amount of oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 6).

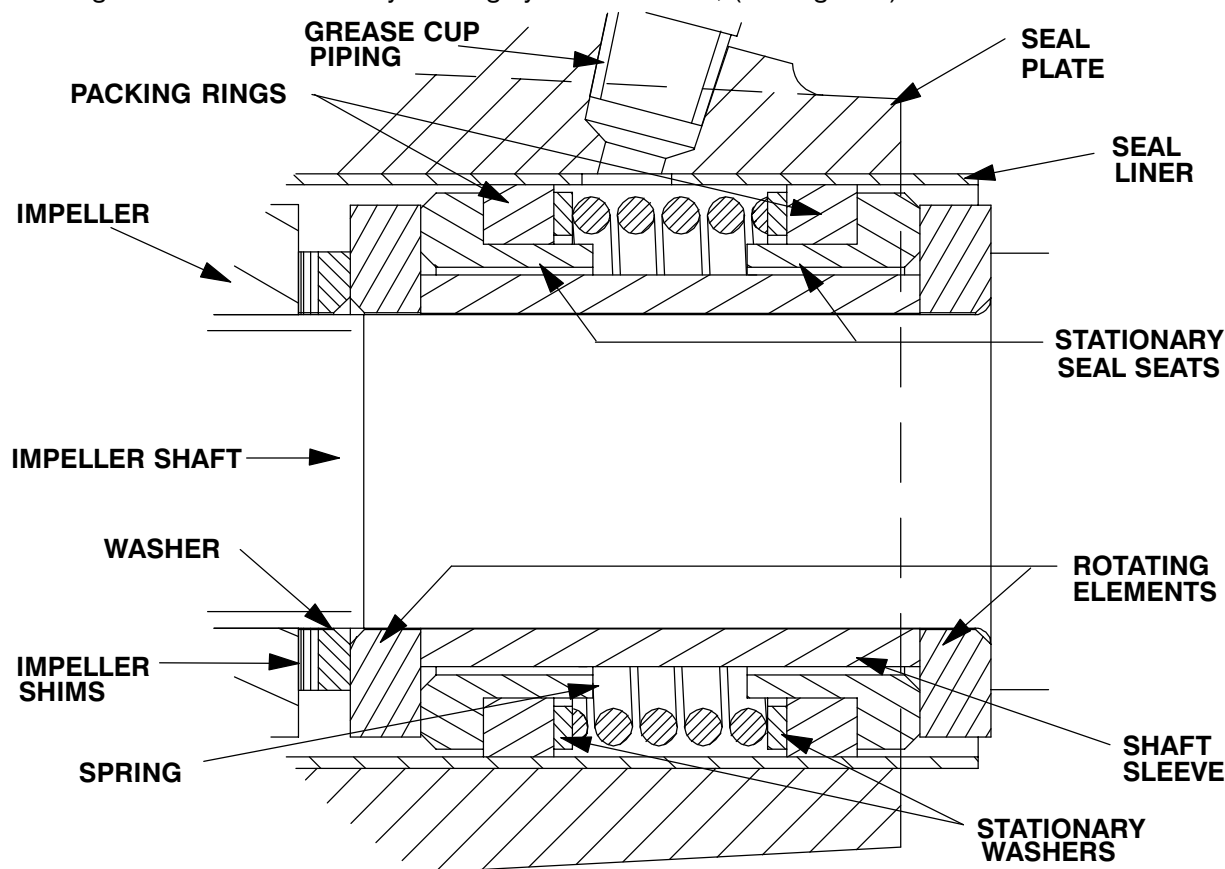
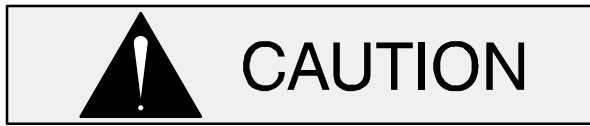


Figure 6. GS1250 Seal Assembly



This seal is not designed for operation at temperatures above 110°F (43°C). Do not use at higher operating temperatures.

Inspect the seal plate, seal liner, and the impeller shaft for burrs or sharp corners, and remove any that exist. Replace the seal liner (4) if wear or grooves exist which could cause leakage or damage to the seal packing rings.

To replace the seal liner, position the seal plate on the bed of an arbor (or hydraulic) press and use a new seal liner to press the old liner out. After the new liner is properly installed, a 1/4-inch diameter (6,35 mm) hole must be drilled through it to permit the flow of lubricant to the seal assembly. **Be careful** to center the drill in the threaded hole so not to damage the threads in the pump casing. Deburr the hole from the inside of the seal liner after drilling.

Slide the seal plate onto the shaft until fully seated against the intermediate. Align the threaded seal lubricant hole with the intermediate opening, and temporarily secure the seal plate to the intermediate with two capscrews and nuts (1/2 UNC by 1 1/2 inch long, not supplied).

Position the inboard rotating element on the shaft with the chamfered side facing the shaft shoulder and slide it on until fully seated.

Subassemble the inboard stationary seat, packing ring and spring washer. Press this subassembly into the lubricated seal liner. A push tube cut from a length of plastic pipe would aid in this installation. The O.D. of the pipe should be approximately the same diameter as the O.D. of the seal spring.

Install the spacer sleeve and spring.

Subassemble the outboard stationary seat, packing ring and spring washer. Press this subassembly into the lubricated seal liner. Install the outboard rotating element with the chamfered side facing the impeller.

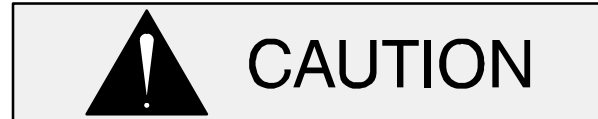
Slide the seal spacer washer (21) onto the shaft with the chamfered side facing the intermediate bracket.

Reinstall the automatic grease cup and piping (14, 15 and 16) in the seal plate. Lubricate the seal as indicated in **LUBRICATION**, after the impeller has been installed.

Impeller Installation

(Figure 3)

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



The shaft and impeller threads **must** be completely clean before reinstalling the impeller. Even the slightest amount of dirt on the threads can cause the impeller to seize to the shaft, making future removal difficult or impossible without damage to the impeller or shaft.

Install the same thickness of impeller shims (20) as previously removed and screw the impeller onto the shaft until tight.

NOTE

*At the slightest sign of binding, **immediately** back the impeller off and check the threads for dirt. **Do not** try to force the impeller onto the shaft.*

A clearance of .020 to .040 inch (0,51 to 1,0 mm) between the impeller and the seal plate is recommended for maximum pump efficiency. Measure this clearance and add or remove impeller shims until it is reached.

NOTE

The seal plate must be tight against the intermediate while setting the back impeller clearance.

Pump Casing and Wear Plate Installation

(Figure 3)

If the wear plate (38) was removed for replacement, secure the replacement wear plate to the pump casing with the hardware (39 and 40) at this time.

Remove the two capscrews temporarily securing the seal plate and install the same thickness of pump casing gaskets (37) as previously removed. Use the lifting device to position the pump casing over the impeller, and secure the pump casing and seal plate to the intermediate with the nuts (35). **Do not** fully tighten the nuts until the impeller face clearance has been set.

A clearance of .008 to .015 inch (0,20 to 0,38 mm) between the impeller and the wear plate is also recommended for maximum pump efficiency. This clearance can be obtained by removing gaskets from the casing gasket set until the impeller scrapes against the wear plate when the shaft is turned. After the impeller scrapes, add approximately .008 inch (0,20 mm) of gaskets.

NOTE

An alternate method of adjusting this clearance is to reach through the discharge port and measure the clearance with a feeler gauge. Add or subtract pump casing gaskets until the proper impeller clearance is attained.

Reinstall any leveling shims used under the pump casing mounting feet, and secure the casing to the base with the previously removed hardware (not shown).

If a lifting eye was used to move the pump casing, **be sure** to remove the lifting eye from the pump casing.



Do not attempt to lift the complete pump unit using the lifting eye. It is designed to facilitate removal or installation of individual components only. Additional weight may result in damage to the pump or failure of the eye bolt.

Suction Check Valve Installation

(Figure 3)

Inspect the check valve components and replace them as required. Subassemble the check valve weights (51 and 53) and gasket (52) using the attaching hardware (49 and 50).

Install the check valve assembly in the valve seat (54). Replace the seat gasket (55), and secure the valve seat to the suction port using the round head machine screws (47). Replace the suction flange gasket (42), and secure the suction flange (43) to the seat with the nuts (45).

Check the operation of the check valve to ensure proper seating and free movement.

Final Pump Reassembly

Be sure the pump and intermediate are secured to the base and engine.

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

Be sure the pump and engine have been properly lubricated, see **LUBRICATION**.

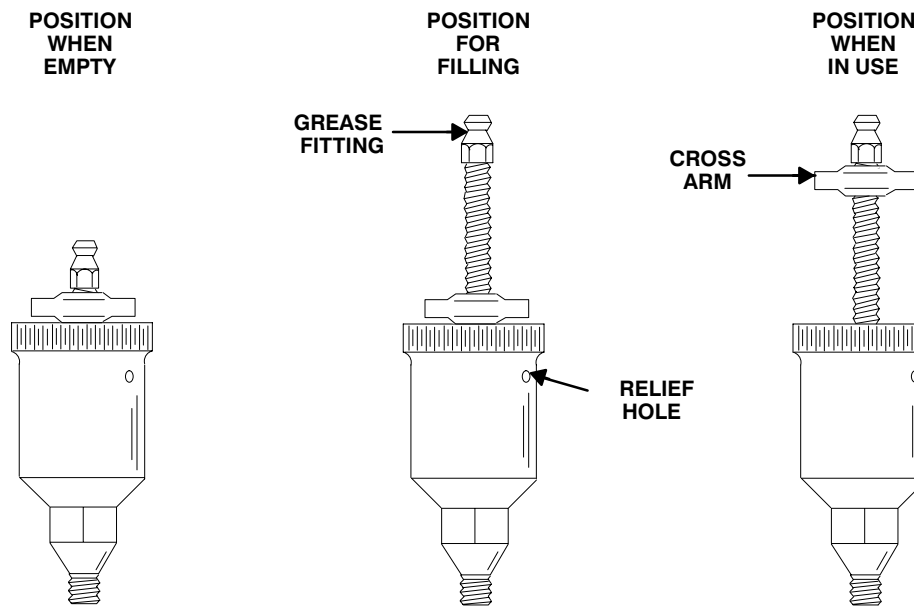
Before starting the pump, remove the fill plug assembly (12, Figure 2) and fill the pump casing with clean liquid. Reinstall and tighten the fill plug (see **OPERATION**, Section C).

LUBRICATION

Seal Assembly

(Figure 3)

Fill the grease cup (16) through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal (see Figure 7).

**NOTE:**

When installing a new grease cup, lubricate the cup as indicated on the installation tag furnished with the grease cup.

Figure 7. Automatic Lubricating Grease Cup

Bearings

(Figure 3)

The intermediate was fully lubricated when shipped from the factory. Under normal conditions, turn the cap on the grease cup (18) three complete turns to add No. 0 lithium base grease to the intermediate after each 250 hours of operation or once each month, whichever comes first. **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.



If grease is forced out around the shaft as new grease is added, the bearing cavity is full and should be disassembled and cleaned immediately.

There are no provisions in the bearing cavity to drain or flush the lubricant. The pump and interme-

diated must be disassembled to completely clean and maintain this cavity.

Under normal conditions, change the grease after each 5000 hours of operation, or at 12 month intervals, whichever comes first. Change the grease more frequently if the pump is operated continuously or installed in an environment where variable hot and cold temperatures are common.

When lubricating a dry (overhauled) intermediate, fill the cavity through the grease cup (18) with approximately one-third of a pound (151 grams) of grease (approximately one-third full).

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

Engine

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

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