



*PRIME-AIRE*® SERIES

PA6B Model Pumps

(Including Model 66B Pump End)

**MANUAL  
PART 3 of 3**

**MAINTENANCE  
AND  
REPAIR  
WITH  
TROUBLESHOOTING**

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.

## INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp Prime-Aire® Series priming-assisted pump. **Read this manual** carefully to learn how to safely maintain and service your pump. Failure to do so could result in personal injury or damage to the pump.

A set of three manuals accompanies your pump. The Installation/Operation Manual contains essential information on installing and operating the pump, and on making electrical connections. The Parts List Manual provides performance curve(s), a pump model cross-section drawing, and parts list for your pump.

This Maintenance and Repair Manual provides troubleshooting instructions required to properly diagnose operational problems. Maintenance instructions within this manual are limited to the pump hydraulic and drive components only. For maintenance and repair of the engine or air compressor, consult the separate literature provided by the manufacturers.

This manual covers high head PA Series priming-assisted models, which incorporate a 60 Series straight centrifugal pump end. The pump is designed for high pressure distribution of non-volatile, non-flammable liquids that do not contain large entrained solids. For specific service, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

As described on the following page, 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.

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

**The Gorman-Rupp Company**  
**P.O. Box 1217**  
**Mansfield, Ohio 44901--1217**  
 or  
**Gorman-Rupp of Canada Limited**  
**70 Burwell Road**  
**St. Thomas, Ontario N5P 3R7**

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**RECORDING MODEL AND SERIAL NUMBERS**

Please record the 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: \_\_\_\_\_

The following are used to alert personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



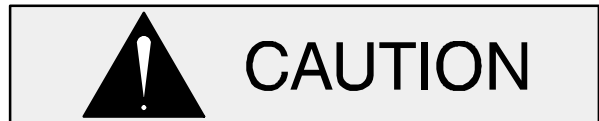
**Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.**



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

**WARRANTY INFORMATION**

The warranty provided with your pump is part of Gorman-Rupp's support program for customers who operate and maintain their equipment as described in this and the other accompanying literature. Please note that should the equipment be abused or modified to change its performance beyond the original factory specifications, the warranty will become void and any claim will be denied.



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

The following information applies throughout this manual to Gorman-Rupp Prime Aire® Series pumps.

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



Before attempting to 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. Shut down the engine and disconnect the positive battery cable or take other precautions 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 for high pressure distribution of most non-volatile, non-flammable liquids that do not contain large entrained solids. Do not attempt to pump volatile, flammable 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. Attach lifting equipment to the lifting device fitted to the pump. If chains or cable are wrapped around the pump to lift it, make certain that they are positioned so as not to damage the pump, and so that the load will be balanced. The bail is intended for use in lifting the pump assembly only. Suction and discharge hoses and piping must be removed from the pump before lifting.



After the pump has been installed, make certain that the pump and all piping or

hose connections are tight, properly supported and secure before operation.



Do not 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.



Overheated pumps can cause severe burns and injuries, and produce explosive fumes. If overheating of the pump occurs:

1. Stop the pump immediately.
2. Ventilate the area.
3. Allow the pump to completely cool.
4. Check the temperature and make sure it is cool before opening any covers, plates, gauges, or plugs.
5. Vent the pump slowly and cautiously.
6. Refer to instructions in the manuals accompanying the pump before restarting the pump.



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



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.



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



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



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



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

## TROUBLESHOOTING – SECTION B

Review all SAFETY information in Section A.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Shut down the engine and disconnect the positive battery cable or take other precautions to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature and make sure pump is cool before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Discharge check valve contaminated, damaged, or unable to seat. Air compressor head 180° out. Air leak in suction line. Lining of suction hose collapsed. Leaking or worn seal or pump gasket.  Eductor safety valve leaking. Suction lift or discharge head too high.  Pump speed too slow.  Eductor clogged. Air compressor damaged or belts broken. Strainer clogged.	Clean or replace check valve.  Consult factory. Correct leak. Replace suction hose. Check pump vacuum. Replace leaking or worn seal or gasket. Check and replace safety valve. Check piping installation and install bypass line if needed. See <b>INSTALLATION</b> . Check driver output; consult driver operation manual. Check and clean eductor. Check and repair/replace.  Check strainer and clean if necessary.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Eductor clogged. Air leak in suction line. Lining of suction hose collapsed. Leaking or worn seal or pump gasket. Strainer clogged. Discharge check valve clogged. Suction intake not submerged at proper level or sump too small. Impeller or other wearing parts worn or damaged. Impeller clogged. Discharge head too high. Suction lift too high. Pump speed too slow. Belt or flexible coupling broken.	Check and clean eductor. Correct leak. Replace suction hose. Check pump vacuum. Replace leaking or worn seal or gasket. Check strainer and clean if necessary. Check and clean check valve. Check installation and correct submergence as needed. Replace worn or damaged parts. Check that impeller is properly centered and rotates freely. Free impeller of debris. Install bypass line. Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line. Check driver output; consult driver operation manual. Check and replace as necessary.
PUMP REQUIRES TOO MUCH POWER	Pump speed too high. Extreme ambient temperature. Discharge head too low. Fuel filter clogged (engine driven units). Liquid solution too thick. Fuel contaminated (engine driven units). Pump or jack shaft bearing(s) frozen.	Check driver output. Reduce pump output. Adjust discharge valve. Check & replace often in extreme operating conditions. Dilute if possible. Check and replace as required. Disassemble, check and replace bearing(s) as required..
PUMP CLOGS FREQUENTLY	Discharge flow too slow. Suction check valve or foot valve clogged or binding. Liquid solution too thick.	Open discharge valve fully to increase flow rate, and run engine at maximum governed speed. Clean valve. Dilute if possible.



TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
EXCESSIVE NOISE	Cavitation in pump.  Pumping entrained air.  Pump or drive not securely mounted.  Impeller clogged or damaged.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.  Locate and eliminate source of air bubble.  Secure mounting hardware.  Clean out debris; replace damaged parts.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.  Low or incorrect lubricant.  Suction and discharge lines not properly supported.  Drive misaligned.  Excessive tension on drive belt.	Check bearing temperature regularly to monitor any increase.  Check for proper type and level of lubricant.  Check piping installation for proper support.  Align drive properly.  Check belt tension. Adjust as required.

## 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.

<b>Preventive Maintenance Schedule</b>					
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:</p> <p>I = Inspect, Clean, Adjust, Repair or Replace as Necessary</p> <p>C = Clean</p> <p>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 C

Review all SAFETY information in Section A.

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



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 operation or maintenance could lead to destruction of equipment, injury or death to personnel.



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

The maintenance and repair instructions in this manual are keyed to the sectional views and the corresponding parts identification lists on the following pages. Refer to the separate Parts List Manual for replacement parts.

This Maintenance and Repair Manual provides troubleshooting instructions required to properly diagnose operational problems. Maintenance instructions within this manual are limited to the

pump hydraulic, priming and drive components only. The pump assembly may be close-coupled to either a factory-supplied or customer-supplied engine. Maintenance of engines and factory-supplied air compressors are detailed in separate literature provided by the manufacturer(s).

Check TROUBLESHOOTING, Section B to determine causes and remedies of pump problems. Disassemble the pump only as far as required.

As described in the SAFETY Section, 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 shop 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.

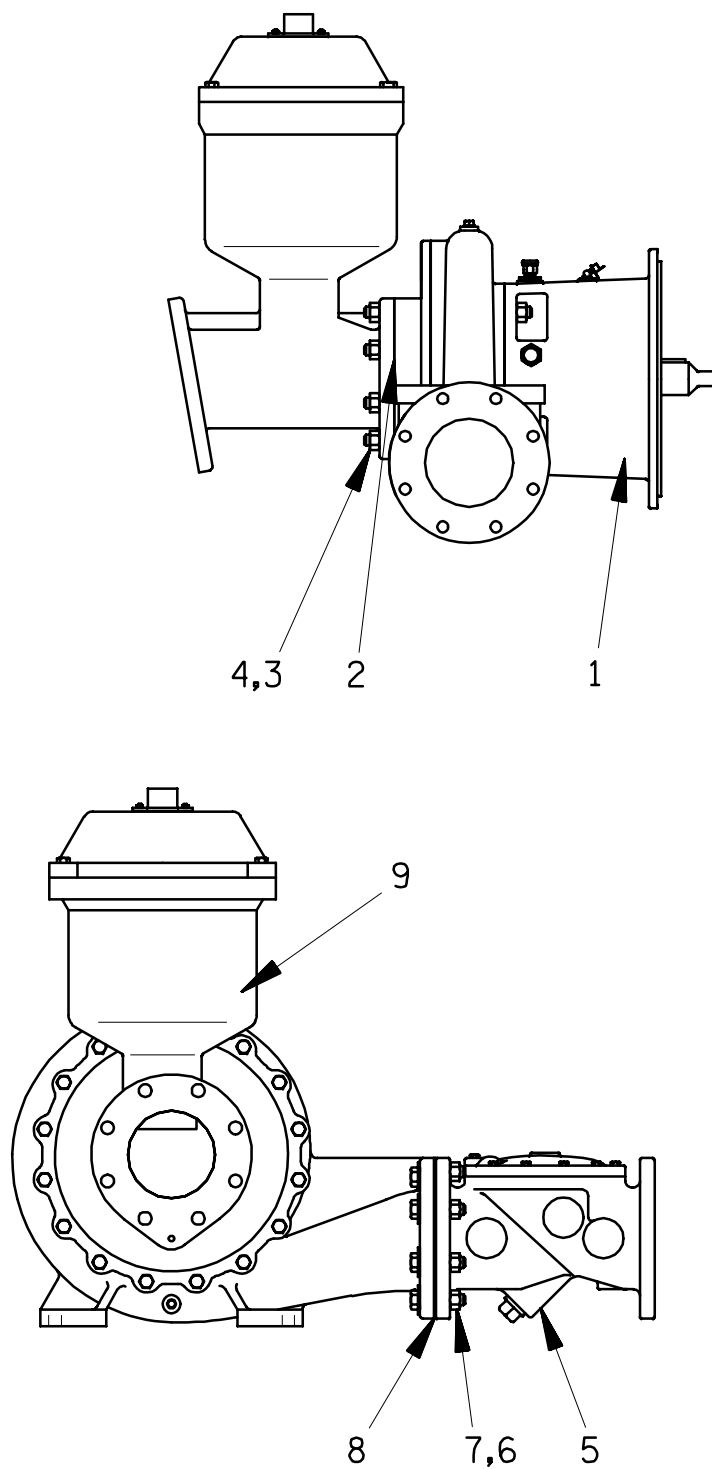
Select a suitable location, preferably indoors, to perform required maintenance. All work must be performed by qualified personnel.

### Lifting

Use lifting equipment with a capacity of **at least five times the weight of the component being lifted**. When lifting the complete unit, the lifting equipment must also be capable of lifting the weight of any options or customer-installed accessories. Suction and discharge hoses or piping **must** be removed before attempting to lift the pump.

For the approximate weight of your pump, refer to the pump specification data sheet or contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

SECTION DRAWING



C-1. PA6B60--(SAE 3/11.5) Pump Assembly

**PA4B60--(SAE 3/11.5) Pump Assembly  
Part Identification List**

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME
1	66B60--(SAE 3/11.5) PUMP END ASSEMBLY
2	GASKET
3	STUD
4	HEX NUT
5	CHECK VALVE ASSEMBLY
6	HEX HD CAPSCREW
7	HEX NUT
8	GASKET
9	PRIMING CHAMBER ASSEMBLY

NOTE: The PA6B60--(SAE 3/11.5) Pump Assembly may be close-coupled to either a factory-supplied or customer-supplied engine; therefore, maintenance instructions in this manual are limited to the pump hydraulic, priming and drive components only. Maintenance of engines and factory-supplied air compressors are detailed in separate literature provided by the manufacturer(s).

SECTION DRAWING

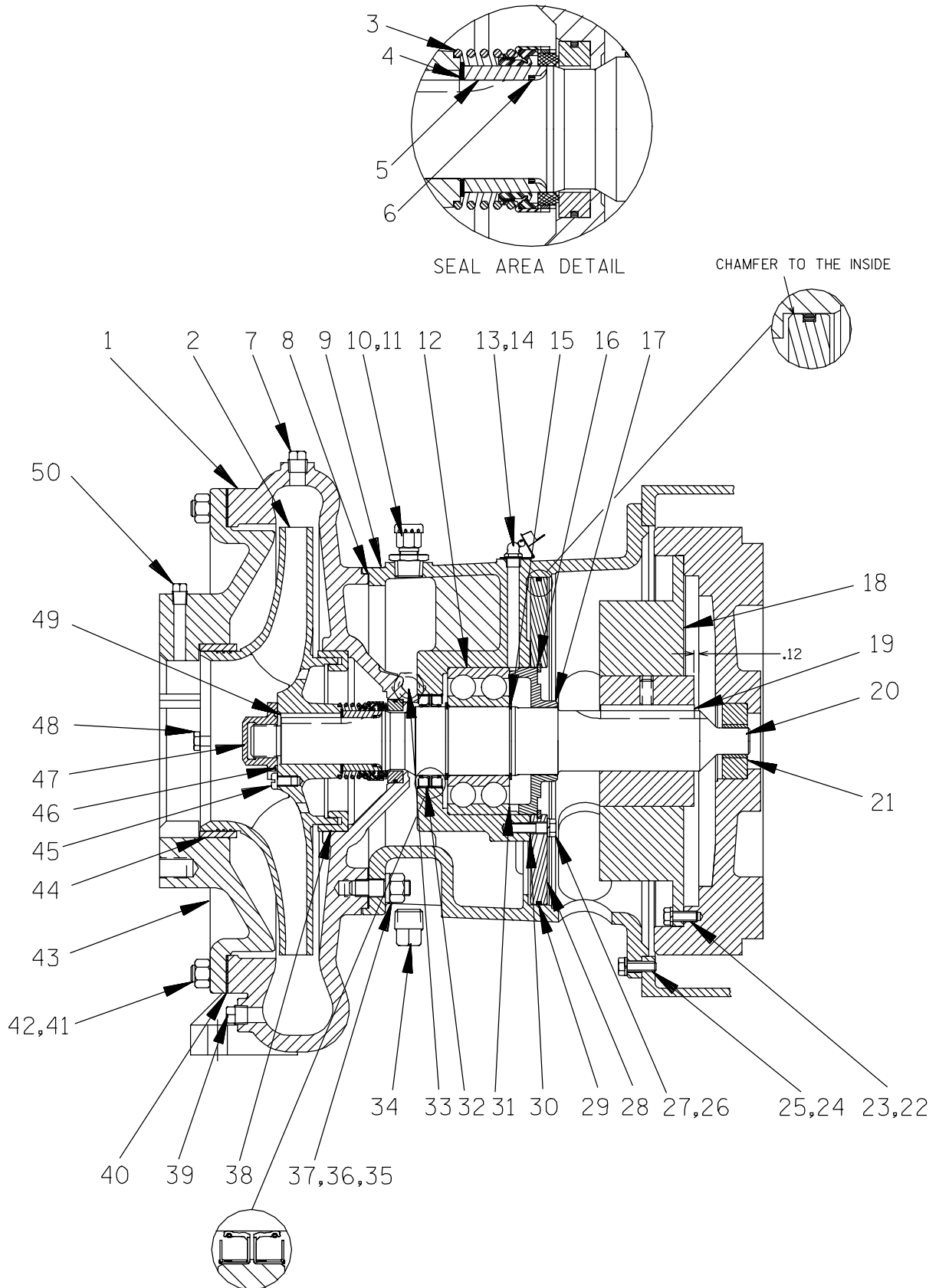


Figure C-2. 66B60-(SAE 3/11.5) Pump Assembly

## 66B60 – (SAE 3/11.5) Pump Assembly Part Identification List

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	PUMP CASING	26	HEX HD CAPSCREW
2	IMPELLER	27	LOCKWASHER
3	MECHANICAL SEAL	28	OIL CHAMBER PLATE
4	IMPELLER ADJ SHIM SET	29	OIL CHAMBER PLATE O-RING
5	SHAFT SLEEVE	30	OIL CHAMBER PLATE GASKET
6	SHAFT SLEEVE O-RING	31	BEARING SHIM SET
7	PIPE PLUG	32	INTERMEDIATE OIL SEAL
8	CASING GASKET	33	SIGHT GAUGE
9	INTERMEDIATE	34	PIPE PLUG
10	AIR VENT	35	STUD
11	REDUCER BUSHING	36	HEX NUT
12	BALL BEARING	37	LOCKWASHER
13	LUBE FITTING	38	BALANCE RING
14	CAP PLUG	39	PIPE PLUG
15	RETAINING RING	40	SUCTION COVER GASKET
16	RETAINING RING	41	STUD
17	BEARING RETAINER	42	HEX NUT
18	FLEX COUPLING	43	SUCTION COVER
19	SHAFT KEY	44	WEAR RING
20	IMPELLER SHAFT	45	FILLISTER HD SCREW
21	PILOT BUSHING	46	IMPELLER NUT RING
22	HEX HD CAPSCREW	47	IMPELLER NUT
23	LOCKWASHER	48	HEX HD CAPSCREW
24	HEX HD CAPSCREW	49	IMPELLER KEY
25	LOCKWASHER	50	PIPE PLUG

SECTION DRAWING

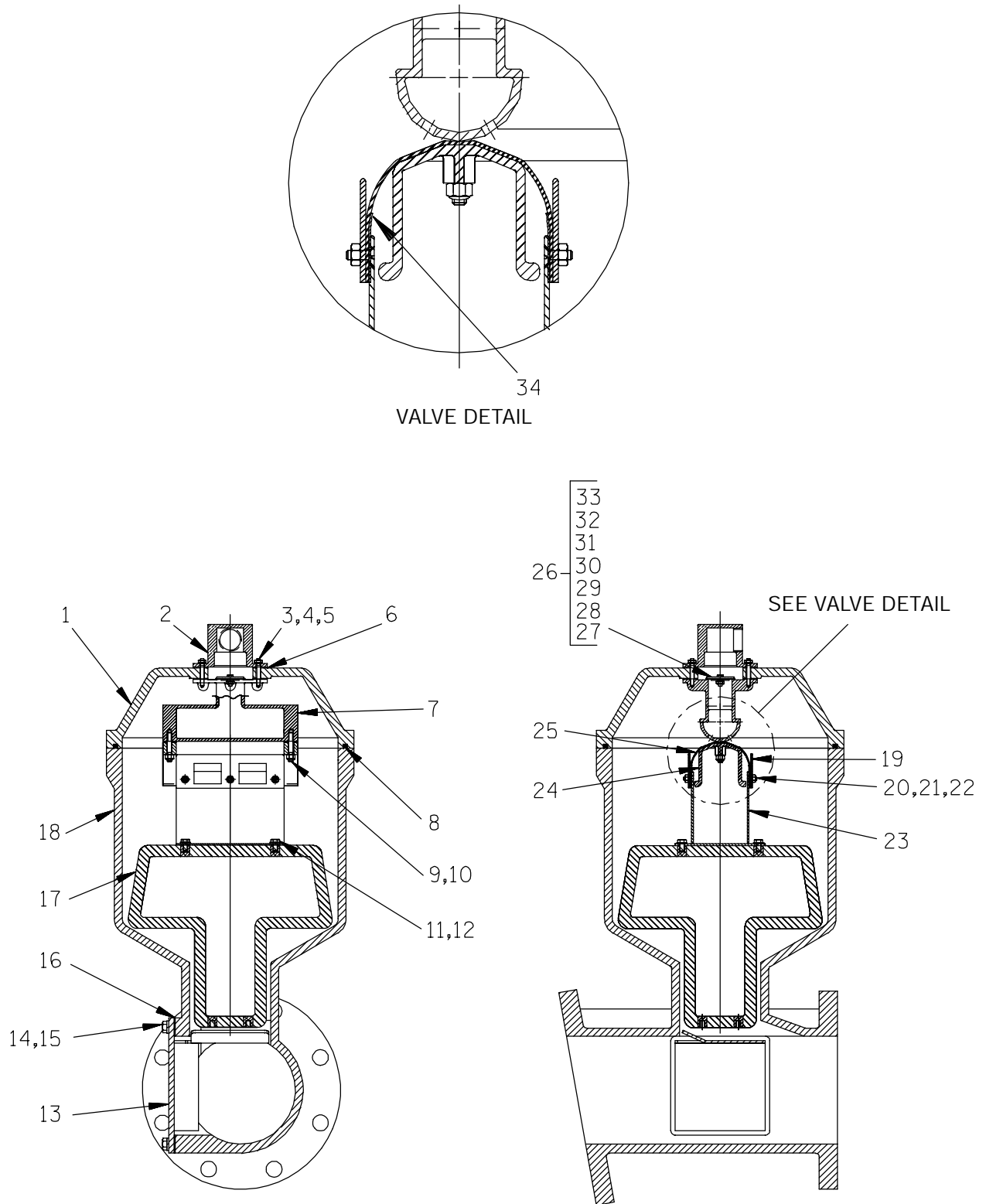


Figure C-3. Peeler Type Priming Valve



### Peeler Type Priming Valve Part Identification List

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	PRIMING CHAMBER LID	18	PRIMING CHAMBER
2	PEELER VALVE NECK	19	GUIDE PLATE
3	LOCKWASHER	20	FLAT HD CAPSCREW
4	HEX NUT	21	LOCKWASHER
5	STUD	22	HEX NUT
6	NECK GASKET	23	VALVE STRAP BRACKET ASSY
7	VALVE BODY	24	CLAMP PLATE
8	GASKET STRIP	25	VALVE STRAP
9	STUD	26	CHECK VALVE ASSY
10	HEX LOCK NUT	27	-CHECK VALVE
11	HEX HD CAPSCREW	28	-LOCKWASHER
12	LOCKWASHER	29	-HEX NUT
13	INDUCTOR GUARD ASSEMBLY	30	-SMALL VALVE WEIGHT
14	HEX HD CAPSCREW	31	-HEX HD CAPSCREW
15	LOCKWASHER	32	-LARGE VALVE WEIGHT
16	GASKET	33	-SEALING WASHER
17	PRIMING VALVE FLOAT	34	VALVE STRAP PROTECTOR

## 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 C-1, C-2 and C-3) and the corresponding Parts Identification Lists. Maintenance and repair instructions for the engine and air compressor are covered separately in the specific literature supplied by the manufacturers.

For part numbers and quantities for your specific pump, refer to the separate Parts List manual accompanying the pump.

Many pump service functions may be performed without separating the pump end assembly from the engine. However, the priming chamber assembly (9, Figure C-1) and discharge check valve assembly (5, Figure C-1) 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 disconnect the positive battery cable or take other precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pump casing by removing the casing drain plug (39, Figure C-2). Clean and reinstall the drain plug.



This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed instructions and precautions for every situation that might occur during maintenance of the

unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that only safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed only after establishing that neither personal safety nor pump integrity are compromised by such practices.

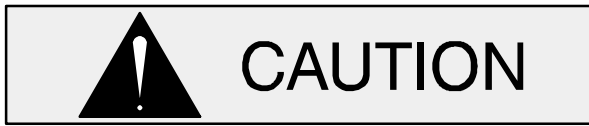


Before attempting to open or service the pump:

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



Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. The bail is intended for use in lifting the pump assembly only. Suction and discharge hoses and piping must be removed from the pump before lifting. If chains or cables are used to lift pump components, make certain that they are positioned so as not to damage the pump, and so that the load will be balanced.



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 C--1)

Disconnect both the suction piping and the air discharge tubing from the priming chamber assembly (9). Support the priming chamber assembly using a sling and a suitable lifting device. Remove the hardware (4) and separate the priming chamber assembly and gasket (2) from the pump assembly (1).

#### (Figure C--3)

Remove the capscrews (not shown) securing the priming chamber lid (1) to the priming chamber (18). Carefully lift the lid and valve components from the priming chamber. If the priming valve float (17) is stuck or the check valve assembly (26) is clogged, they can usually be cleaned without further disassembly.

Inspect the gasket strip (8) and, if replacement is required, remove the gasket and **all** of the old adhesive.

To remove the float (17), disconnect the hardware (11 and 12).

To replace the valve strap (25), disengage the hardware (20, 21 and 22) and separate the guide plate (19), clamp plate (24) and valve protector (34) from the valve strap. Disengage the hardware (9 and 10) and remove the valve strap.

To remove the check valve assembly (26), disengage the hardware (3 and 4). Remove the check valve assembly, gasket (6) and valve neck (2).

Inspect the check valve components. If the check valve (27) requires replacement, remove the hardware (28, 29, 31 and 33) securing the valve weights (30 and 32) to the check valve.

### Discharge Check Valve Removal and Disassembly

#### (Figure C--1)

Support the discharge check valve assembly (5) using a sling and a suitable lifting device. Remove the hardware (6 and 7) and separate the discharge check valve assembly and gasket (8) from the pump assembly (1).

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

### Suction Cover Removal

#### (Figure C--2)

Remove the suction and discharge piping. Before attempting to service the pump, remove the pump casing drain plug (39) and drain the pump. Clean and reinstall the drain plug.

Remove the nuts (42) and use the jacking screws (48) to force the suction cover (43) out of the pump casing. Turn the screws evenly to prevent binding. Remove the suction cover gasket (40).

Inspect the wear ring (44) for excessive wear or scoring. If replacement is required, use a small bit to drill two holes horizontally, 180° apart, through the wear ring. Use a chisel or other suitable tool to complete the cuts through the wear ring. **Use caution** not to damage the suction cover bore. Remove the wear ring from the suction cover.

### Impeller Removal

#### (Figure C--2)

Before attempting to remove the impeller (2), remove the pipe plug (34) and drain the seal cavity. This will prevent the seal lubricant from spilling as the impeller is removed.

To remove the impeller, secure the shaft from rotating by reaching through the discharge port and tightly wedging a soft-metal bar between the vanes of the impeller.

Remove the fillister head screw (45) and impeller nut (47). Install two 3/8–16 UNC by 3 inch long

capscrews in the tapped holes in the impeller and use a suitable puller to remove the impeller from the shaft. Use caution when removing the impeller; tension on the seal spring will be released when the impeller is removed. Retain the impeller key (49). Remove the metal bar from the impeller vanes.

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

### Seal Removal and Disassembly

#### (Figure C--2)

Carefully remove the spring retainer and seal spring. Slide the shaft sleeve (5) and rotating portion of the seal assembly off the shaft as a unit. Remove the shaft sleeve O-ring (6)

Apply oil to the sleeve and work it up under the bellows. Slide the rotating portion of the seal off the sleeve.

Use a pair of stiff wires with hooked ends to remove the stationary seat and O-ring from the pump casing bore.

#### NOTE

*An alternate method of removing the stationary portion of the seal is to remove the pump casing and then press the seal components out of the pump casing from the back side.*

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

### Pump Casing Removal

#### (Figure C--2)

Support the pump casing using a suitable hoist and sling and remove the hardware securing the casing to the base.

Remove the hardware (36 and 37) securing the casing to the intermediate (9). Separate the parts by pulling the casing straight away from the intermediate. Remove any leveling shims from under

the casing feet. Tie and tag the shims for ease of reassembly. Remove the casing gasket (8).

Inspect the balance ring (38) for excessive wear or scoring. If replacement is required, use a small bit to drill two holes horizontally, 180° apart, through the wear ring. Use a chisel or other suitable tool to complete the cuts through the wear ring. **Use caution** not to damage the pump casing.

#### NOTE

*An alternate method of removing the balance ring is to press the balance ring out of the pump casing from the back side.*

### Separating Intermediate and Drive Assembly From Engine

#### (Figure C--2)

To service the bearing (12) or drive components, the intermediate must be separated from the engine. Support the intermediate using a suitable hoist and sling and remove the hardware (24 and 25) securing the intermediate to the engine bellhousing. Separate the assemblies by pulling the intermediate straight away from the engine.

As the assemblies separate, the metal hub portion of the coupling assembly will remain on the shaft. To remove the hub from the shaft, loosen the allen head setscrew in the hub. Slide the hub off the shaft and remove the shaft key (19).

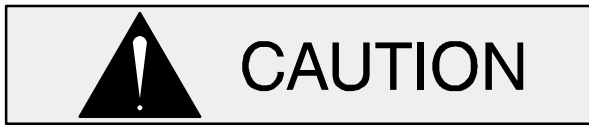
It is not necessary to remove the elastic element portion of the coupling from the engine flywheel unless the coupling must be replaced. To remove the element, disengage the hardware (22 and 23) securing it to the flywheel.

Inspect the pilot bushing (21) and, if replacement is required, use a suitable puller to remove it from the engine flywheel.

### Shaft And Bearing Removal And Disassembly

#### (Figure C--2)

When the pump is properly operated and maintained, the shaft and bearing should not require disassembly. Disassemble the shaft and bearing **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.

After removing the drive components from the impeller shaft, remove the hardware (26 and 27) securing the oil chamber plate (28) to the intermediate. Install three 3/8–16 UNC x 1–1/2 inch long jacking screws (not supplied) in the tapped holes in the plate. Turn the screws evenly in an alternating sequence until the plate comes free of the intermediate. Remove the jacking screws.

Remove the gasket (30). Remove the O-ring (29) and, if replacement is necessary, the retaining ring (16) from the oil chamber plate.

### 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 and tap the shaft (20), bearing (12), bearing retainer (17) and bearing adjusting shims (31) out of the drive end of the intermediate. **Be careful** not to damage the shaft. Remove the retainer.

Press the oil seals (32) from the intermediate bore.

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



## CAUTION

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

Clean the intermediate, shaft and all component parts (except the bearing) with a soft cloth soaked

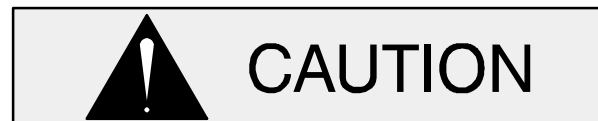
in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.



## 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 bearing thoroughly in **fresh** cleaning solvent. Dry the bearing 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 bearing by hand to check for roughness or binding and inspect the bearing balls. If rotation is rough or the balls are discolored, replace the bearing.

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

If bearing replacement is required, use snap ring pliers to remove the bearing retaining rings (15) from the shaft. Use an arbor (or hydraulic) press to remove the bearing from the shaft.

### Shaft and Bearing Reassembly and Installation (Figure C--2)

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



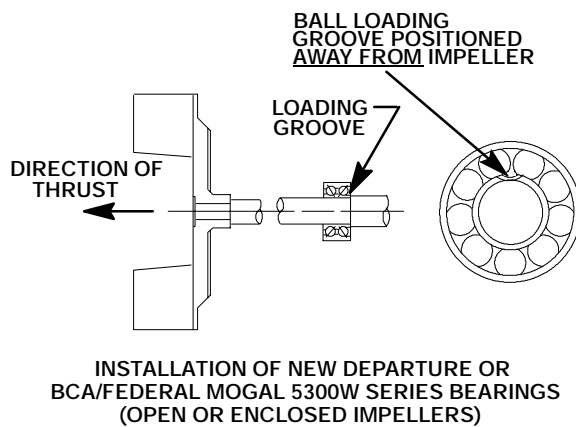
## CAUTION

To prevent damage during removal from

the shaft, it is recommended that the bearing be cleaned and inspected **in place**. It is **strongly** recommended that the bearing be replaced **any** time the shaft and bearing are removed.

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

The bearing 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 bearing should **never** be heated with a direct flame or directly on a hot plate.



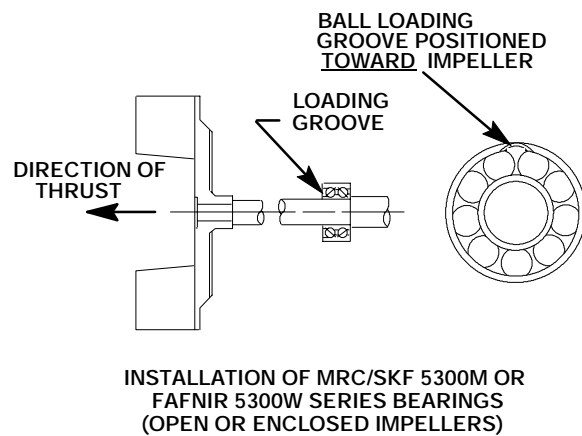
**NOTE**

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

If removed, install one of the bearing retaining rings (15) in the groove closest to the drive end of the shaft.

**NOTE**

*When installing the bearing, position it on the shaft as indicated by the following illustrations.*



**Figure C-4. Bearing Installation**

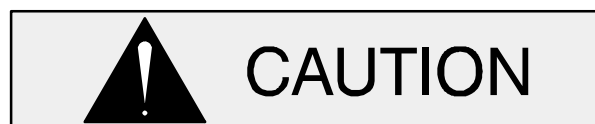
Heat the bearing to a uniform temperature **no higher than 250°F (120°C)**, and slide it onto the shaft until fully seated against the retaining ring. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.



**Use caution when handling hot bearings to prevent burns.**

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

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



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

After the bearing is installed on the shaft, pack the bearing by hand (or use a bearing packer if available) with No. 0 lithium base grease until the bearing balls are thoroughly lubricated. Secure the bearing on the shaft with the inboard bearing retaining ring (15).

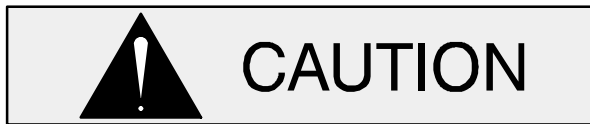
Position the intermediate with the impeller end down. Slide the shaft and assembled bearing into

the intermediate bore until the bearing seats squarely against the bore shoulder.

If removed, install the retaining ring (16) in the groove in the oil chamber plate (28). Install a new O-ring (29) in the groove in the oil chamber plate and lubricate it with light oil.

Install the same thickness of bearing adjusting shims (31) as previously removed. Pack the bearing retainer (21) approximately 1/2 full with No. 0 lithium base grease and position it against the bearing. Install a new gasket (30) and position the oil chamber plate in the intermediate with the chamfered edge **toward** the bearing. Press the oil chamber plate into the intermediate until the retaining ring (16) is fully seated against the bearing. Secure the oil chamber plate to the intermediate with the hardware (26 and 27).

Check the shaft endplay. Shaft endplay should be between .002 and .010 inch (0,05 and 0,25 mm). Add or remove shims from the bearing adjusting shim set until the correct endplay is achieved.



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

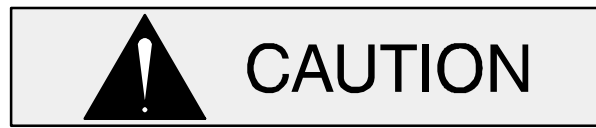
Position the intermediate with the impeller end up. Lubricate the lips of the oil seals (32) and press them, one at a time, into the intermediate bore with the lips positioned as shown in Figure C-2.

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

### Securing Intermediate And Drive Assembly To Engine

(Figure C--3)

Install the shaft key (19) in the shaft keyway. Position the metal hub portion of the coupling assembly (18) onto the shaft to the dimension shown in Figure C-2 and secure it by torquing the setscrew to 65 ft. lbs. (780 in. lbs or 9 m. kg.).



Make certain that the metal hub portion of the coupling is mounted as shown in Figure C-2. **This is critical.** If the coupling is not properly positioned on the shaft, the coupling parts will not fully engage.

If removed, apply 'Never-Seez' or equivalent compound to the I.D. of the pilot bushing (21) and press it into the engine flywheel until fully seated.

If the complete coupling assembly is being replaced, apply 'Loctite Threadlocker No. 242' or equivalent compound to the threads of the hardware (22 and 23) and secure the elastic element portion of the coupling to the engine flywheel by torquing the hardware to 50 ft. lbs. (600 in. lbs. or 6,9 m. kg.).

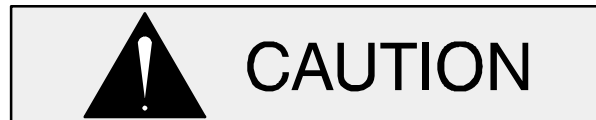
Using a suitable lifting device and sling, position the assembled coupling, intermediate, shaft and bearings so the metal hub portion of the coupling seats inside the elastic element portion attached to the engine flywheel.

Secure the intermediate to the engine bellhousing with the previously removed hardware (24 and 25).

### Pump Casing Installation

(Figure C--2)

If the balance ring (38) was removed, press the replacement ring into the casing until it seats squarely against the casing shoulder.



The balance ring **must** seat squarely in the suction head; otherwise binding and/or excessive wear will result.

### NOTE

*The stationary seat and O-ring for the shaft seal assembly may be installed in the pump casing before the casing is secured to the intermediate (see **Seal Reassembly and Installation**). If the stationary seat is installed, **be careful** not to damage it on the shaft threads.*

Install the casing gasket (8) over the studs (35). Position the pump casing over the shaft and against the intermediate. Secure the casing to the intermediate with the hardware (36 and 37).

Install any leveling shims used under the pump casing mounting feet and secure the pump casing to the base with the previously removed mounting hardware.

### Seal Reassembly and Installation

(Figures C--2 and C--5)

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



**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 shaft sleeve, or replace it if badly worn. 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 stationary seat O-ring, bellows and shaft sleeve 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 C-5).



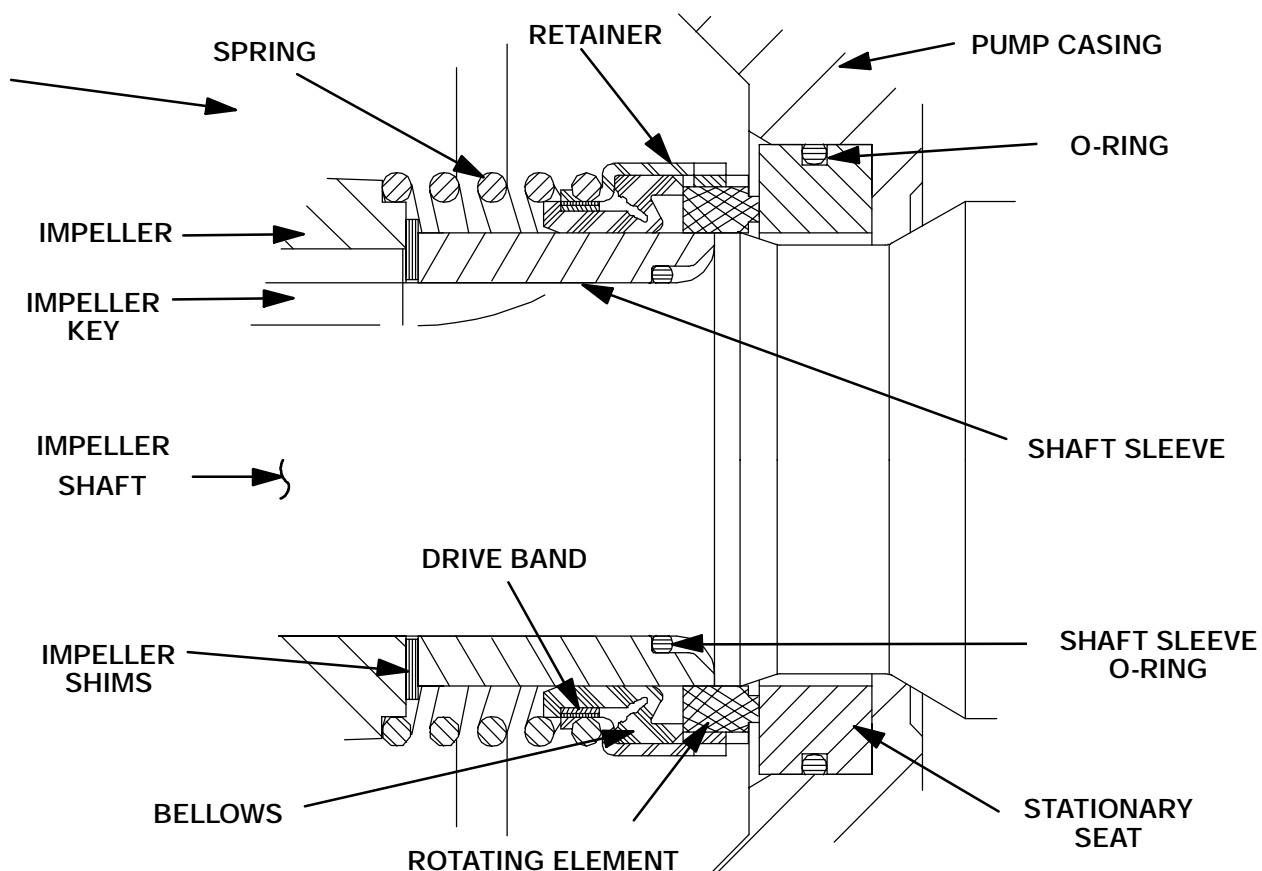


Figure C-5. 25271-984 Seal Assembly

 **CAUTION**

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

Inspect the pump casing and impeller shaft for burrs or sharp corners, and remove any that exist.

With the stationary seat O-ring lubricated and installed in the stationary seat, press the stationary seat into the pump casing until it seats squarely against the bore shoulder. A push tube cut from a length of plastic pipe would aid this installation. The O.D. of the pipe should be approximately the same diameter as the O.D. of the seal spring.

**NOTE**

*If the pump casing has not been installed, install the casing gasket (8) over the casing studs. Position the casing over the shaft and against the intermediate, using caution not to damage the seal stationary seat. Secure the casing to the intermediate with the*

*hardware (35 and 36).*

Lubricate the shaft sleeve O-ring (6) and slide it onto the shaft until it seats against the shaft shoulder.

Use even pressure to carefully press this rotating portion of the seal onto the lubricated sleeve (5) until the seal face is **just flush** with the chamfered end of the sleeve.

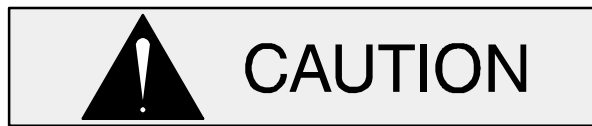
Slide the assembled sleeve and rotating portion of the seal onto the shaft until the seal faces contact. Continue to push the sleeve through the seal until it seats squarely against the shaft shoulder.

Install the seal spring.

**Impeller Installation**

**(Figure C--2)**

If the balance ring (38) was removed, press the replacement ring into the pump casing as described in **Pump Casing Installation**.



The balance ring **must** seat squarely in the suction head; otherwise binding and/or excessive wear will result.

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

For maximum pump efficiency, the impeller should be centered within the volute scroll.

To verify the impeller positioning, measure the pump casing and impeller as shown in Figure C-6. Use these measurements to calculate the required impeller location (dimension E). Add or remove impeller adjusting shims until dimension E is obtained.

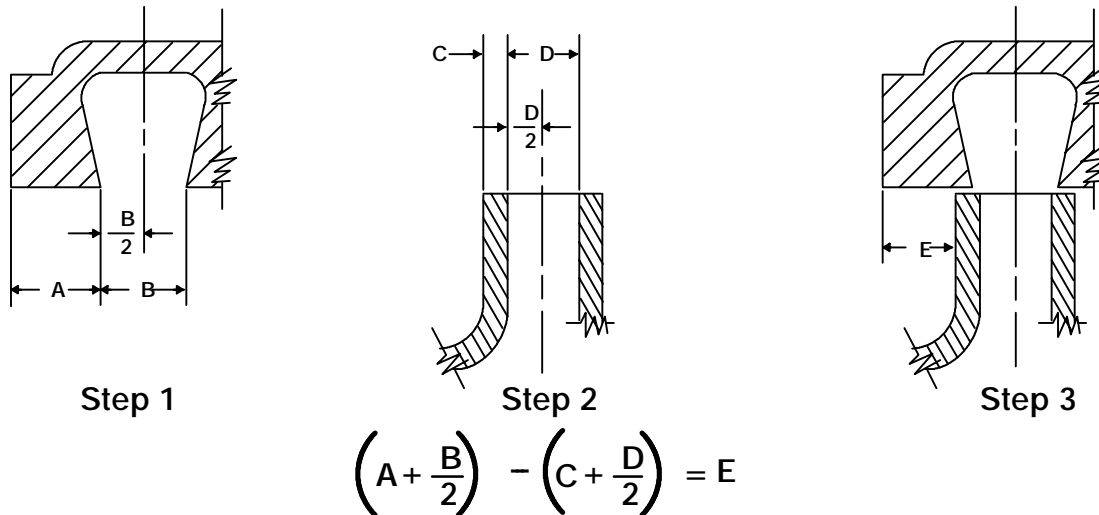


Figure C-6. Centering Impeller Within Volute Scroll

Install the calculated thickness of impeller shims (4). Install the impeller key (49) and slide the impeller onto the shaft until fully seated. Make sure the seal spring seats squarely over the step on the back of the impeller.

Secure the shaft from rotating by reaching through the discharge port and tightly wedging a soft-metal bar between the vanes of the impeller. Install the O-ring (46) in the groove in the impeller nut (47) and secure the impeller with the impeller nut and fillister head screw (45).

#### NOTE

*After the impeller has been properly positioned, check for free rotation. Correct any scraping binding before further reassembly.*

#### Suction Cover Installation

(Figure C--2)

If removed at disassembly, press the wear ring (44) into the suction cover (43) until it seats squarely against the bore shoulder.



The wear ring **must** seat squarely in the suction cover; otherwise binding and/or excessive wear will result.

Install the suction cover gasket (40) on the casing studs (41) and secure the suction cover to the pump casing with the nuts (42). Make sure the jacking screws (48) do not interfere with the suction cover seating.

## Discharge Check Valve Assembly And Installation

### (Figure C--1)

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

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

Support the discharge check valve assembly (5) using a sling and a suitable lifting device. Using the hardware (6 and 7) secure the discharge check valve assembly and gasket (8) to the pump assembly (1).

## Priming Chamber Assembly And Installation

### (Figure C--3)

If the check valve (26) was disassembled for replacement, install the valve weights (30 and 32) on either side of the check valve and secure with the hardware (28, 29, 31 and 33).

### NOTE

*The sealing washer (33) **must** be positioned against the head of the capscrew (31).*

If the valve strap (25) was removed, install the strap protector (34) and position the replacement strap over the valve body studs (9). Wrap the strap completely around the valve body (7) and secure with the nuts (10).

Position the strap between the guide plates (19) and clamp plate (24), and secure with the hardware (20, 21 and 22).

Position the valve neck (2) and gasket (6) over the hole in the top of the priming chamber lid. Position the check valve assembly over the studs (5) with the large weight (32) facing up. Slide the studs up through the holes in the priming chamber lid and secure with the hardware (3 and 4).

Apply "Loctite Threadlocker No. 242" or equivalent compound to the capscrews (11). Secure the float

(17) to the valve strap bracket assembly (23) with the hardware (11 and 12).

Apply 3-M Scotchgrip Adhesive No. 847" or equivalent compound to the gasket strip (8) and install it in the groove in the priming chamber lid (1).

### NOTE

*Cut the lap joint where the two ends of the gasket strip meet at a 45° angle.*

Lower the float into the priming chamber and secure the lid with the previously removed capscrews (not shown).

### (Figure C--1)

Install the gasket (2) and use a sling and suitable lifting device to position the priming chamber assembly against the pump suction flange. Secure the priming chamber assembly with the nuts (4).

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

## Final Pump Assembly

### (Figure C--2)

Turn the shaft to make sure that the impeller is not binding or scraping. If it does, check the installation of the wear ring and balance ring, or remove adjusting shims until the impeller rotates freely when the pump is fully assembled.

**Be sure** the pump and intermediate are secure to the engine and the base.

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**.

## LUBRICATION

### (Figure C--3)

#### Seal Assembly

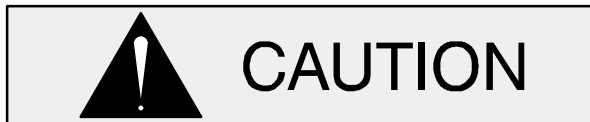
Check the oil level regularly through the sight gauge (33) and maintain it at the middle of the gauge. When lubrication is required, add SAE No.

30 non-detergent oil through the hole for the air vent (10). **Do not** over-lubricate..

### NOTE

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

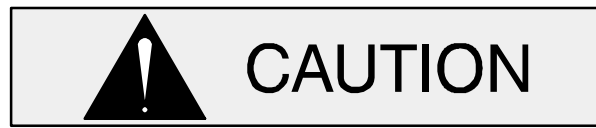
When lubricating a dry seal cavity, add approximately 6 quarts (5,7 L). Check the oil level regularly and refill as required.



To ensure lubrication of the seal assembly, do not allow the oil level to drop below the line on the sight gauge.

### Bearings

The intermediate was fully lubricated when shipped from the factory. Under normal conditions, add three shots of No. 0 lithium base grease from a grease gun through the grease fitting (13) after each 250 hours of operation or once each month, whichever comes first. **Do not** over-lubricate. Over-lubrication can cause the bearing to over-heat, resulting in premature bearing failure.



Observe the area between the shaft and bearing retainer (17) as grease is added. If old grease is forced out 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 intermediate 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 lubrication fitting with approximately one third pound (0,15 kg) 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 manual supplied with the engine or contact your local engine representative.

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