



***PRIME-AIRE*® SERIES**
PA4A Model Pumps
(Includes Model 64C60
Pump End)

MANUAL
PART 3 of 3

MAINTENANCE
AND
REPAIR
WITH
TROUBLESHOOTING

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

www.grpumps.com

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

Valid serial number and e-mail address required.



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

RECORD YOUR PUMP MODEL AND SERIAL NUMBER

Please record your pump model and serial number in the spaces provided below. Your Gorman-Rupp distributor needs this information when you require parts or service.

Pump Model: _____

Serial Number: _____

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 pump is a PA Series, priming-assisted centrifugal model. The unit is designed for handling non-volatile, non-flammable liquids containing specified 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:



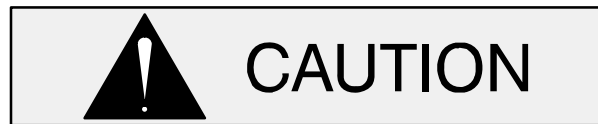
Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.



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, disconnect the positive battery cable and take

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



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, disconnect the positive battery cable and take 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 INSTALLATION . 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.

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:</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

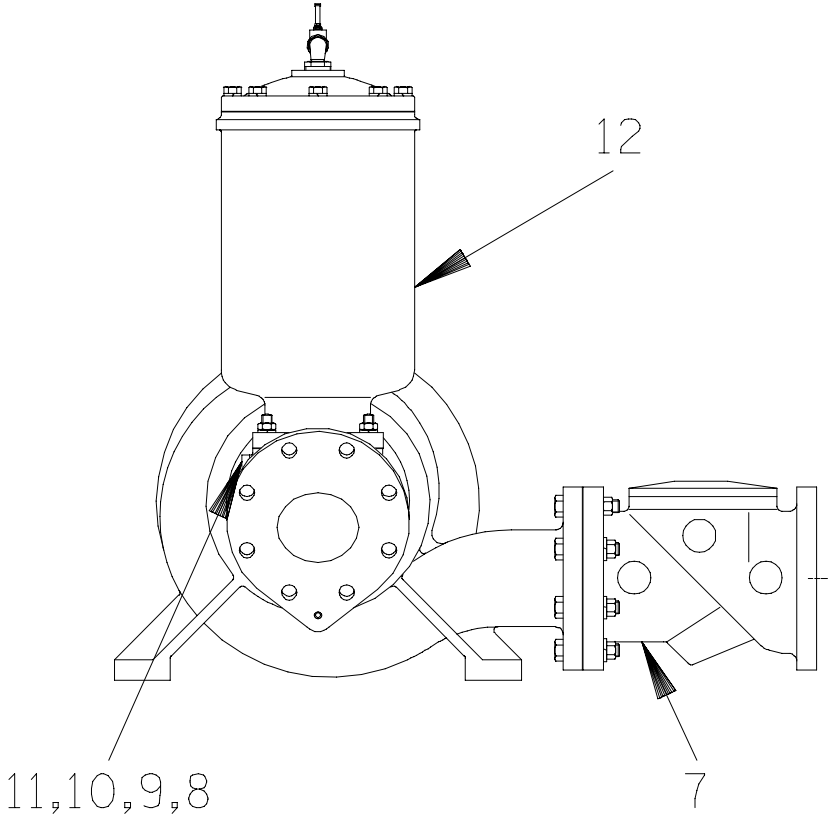
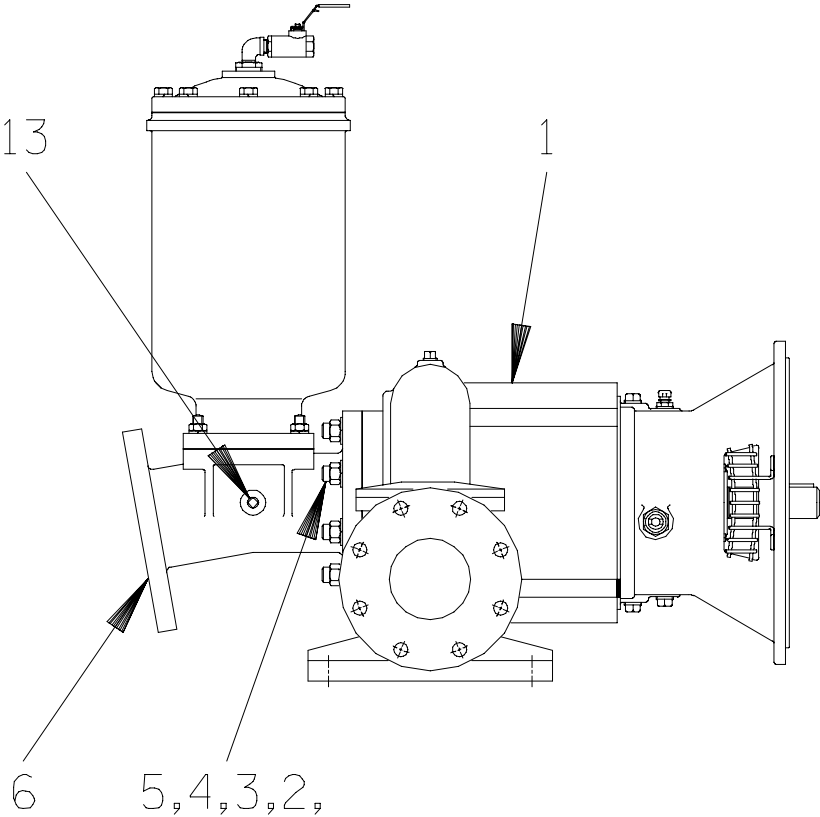


Figure C-1. PA4A60-(SAE 4/10) Pump Assembly

PA4A60—(SAE 4/10) Pump Assembly Part Identification List

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

ITEM NO.	PART NAME
1	64C60—(SAE 4/10) PUMP END ASSEMBLY
2	PUMP CASING GASKET
3	STUD
4	HEX NUT
5	LOCKWASHER
6	SPOOL FLANGE
7	CHECK VALVE KIT —CHECK VALVE —FLAPPER —COVER O-RING
8	COVER PLATE
9	COVER PLATE GASKET
10	HEX HD CAPSCREW
11	LOCKWASHER
12	PRIMING CHAMBER KIT
13	PIPE PLUG

NOTE: The PA4A60—(SAE4/10) 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

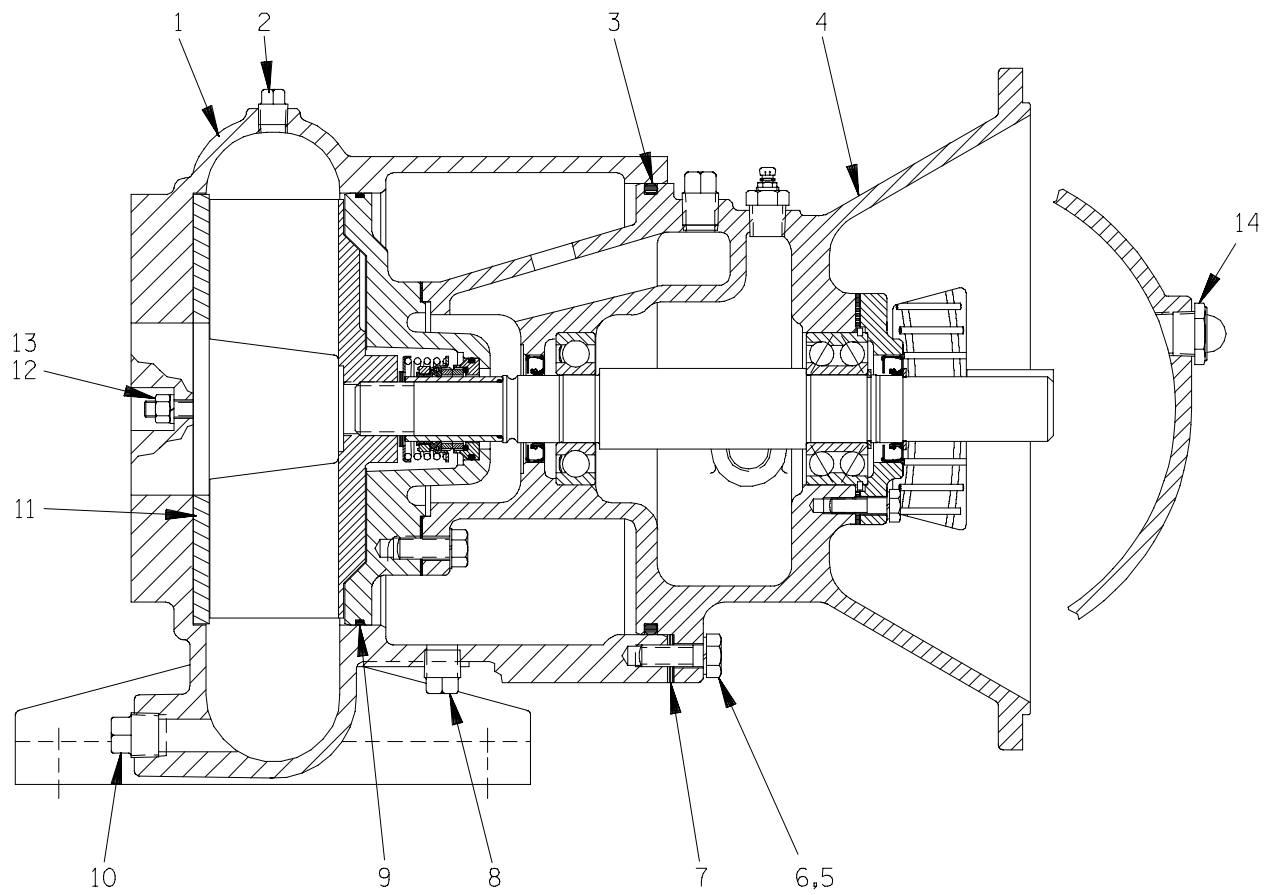


Figure C-2. 64C60-(SAE4/10) Pump End Assembly

**64C60—(SAE4/10) Pump End Assembly
Part Identification List**

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

ITEM NO.	PART NAME
1	PUMP CASING
2	PIPE PLUG
3	INTERMEDIATE O-RING
4	ROTATING ASSEMBLY
5	HEX HEAD CAPSCREW
6	LOCKWASHER
7	ROTATING ASSEMBLY SHIM SET
8	SEAL CAVITY DRAIN PLUG
9	SEAL PLATE O-RING
10	PUMP CASING DRAIN PLUG
11	WEAR PLATE
12	HEX NUT
13	LOCKWASHER
14	SIGHT GAUGE

SECTION DRAWING

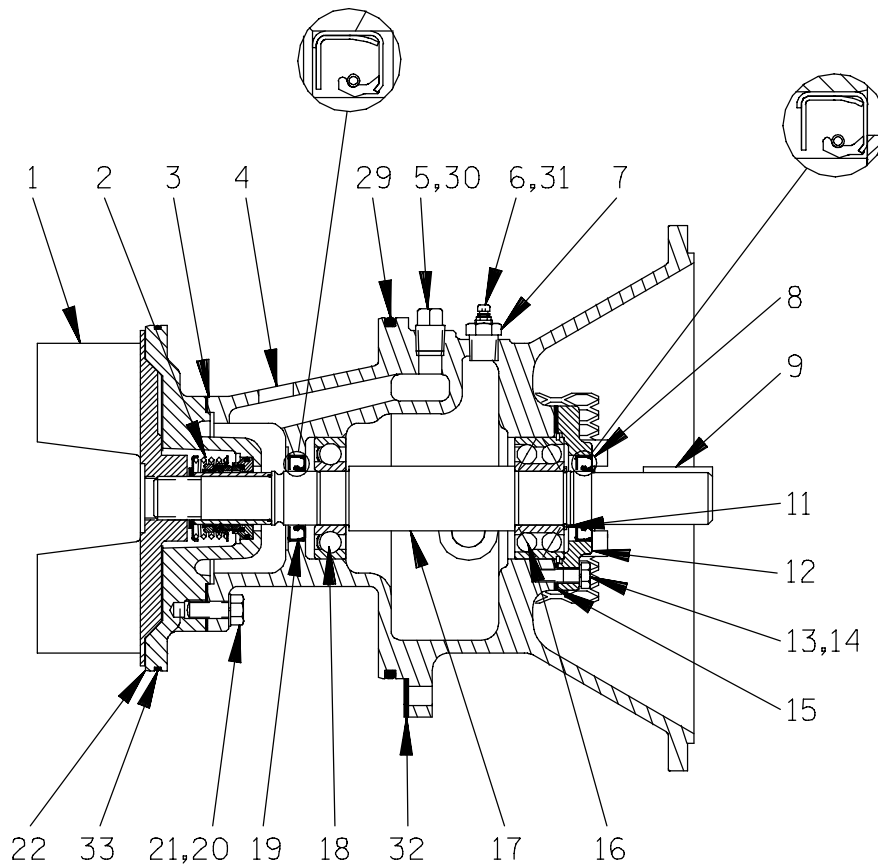
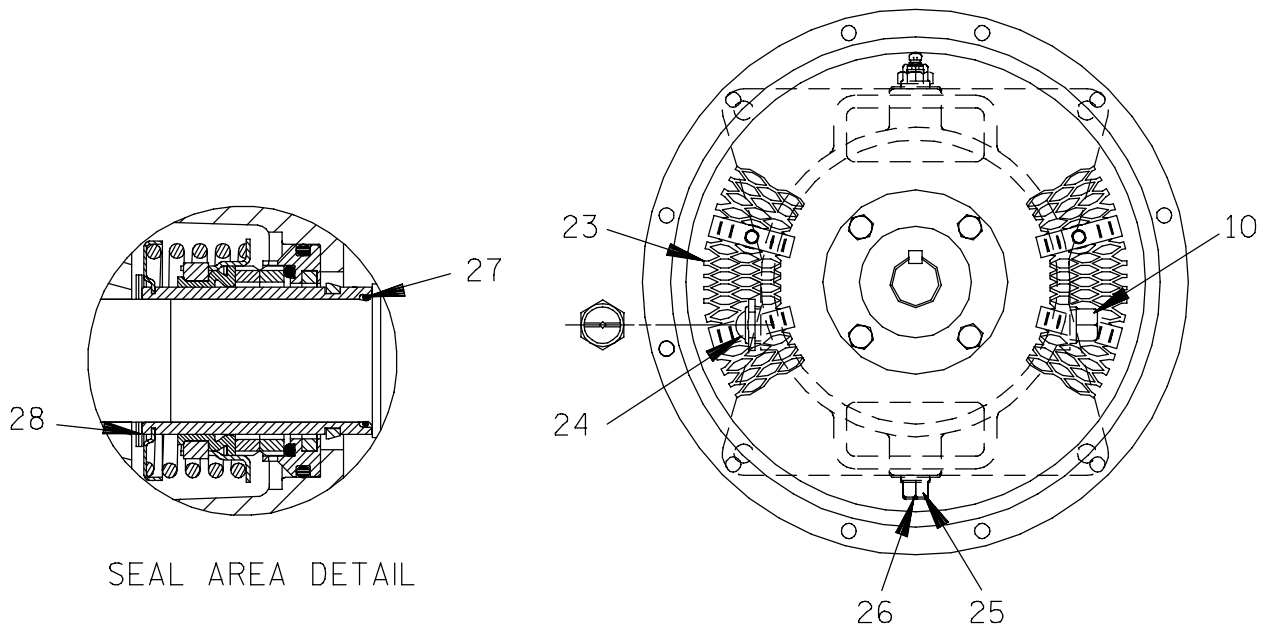


Figure C-3. Repair Rotating Assembly

Repair Rotating Assembly Part Identification List

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

ITEM NO.	PART NAME
1	IMPELLER
2	SEAL ASSEMBLY
3	SEAL PLATE GASKET
4	INTERMEDIATE BRACKET
5	VENTED PLUG
6	AIR VENT
7	REDUCER PIPE BUSHING
8	OIL SEAL
9	IMPELLER SHAFT KEY
10	PIPE PLUG
11	BEARING SNAP RING
12	BEARING CAP
13	HEX HEAD CAPSCREW
14	LOCKWASHER
15	BEARING CAP GASKET
16	INNER BALL BEARING
17	IMPELLER SHAFT
18	OUTER BALL BEARING
19	OIL SEAL
20	HEX HEAD CAPSCREW
21	LOCKWASHER
22	SEAL PLATE
23	INTERMEDIATE GUARD ASSEMBLY
24	OIL LEVEL SIGHT GAUGE
25	INTERMEDIATE DRAIN PLUG
26	SEAL CAVITY DRAIN PLUG
27	IMPELLER SHAFT O-RING
28	IMPELLER ADJUSTIVE SHIM SET
29	INTERMEDIATE O-RING
30	SHIPPING PLUG
31	SHIPPING PLUG
32	ROTATING ASSEMBLY SHIM SET
33	SEAL PLATE O-RING

SECTION DRAWING

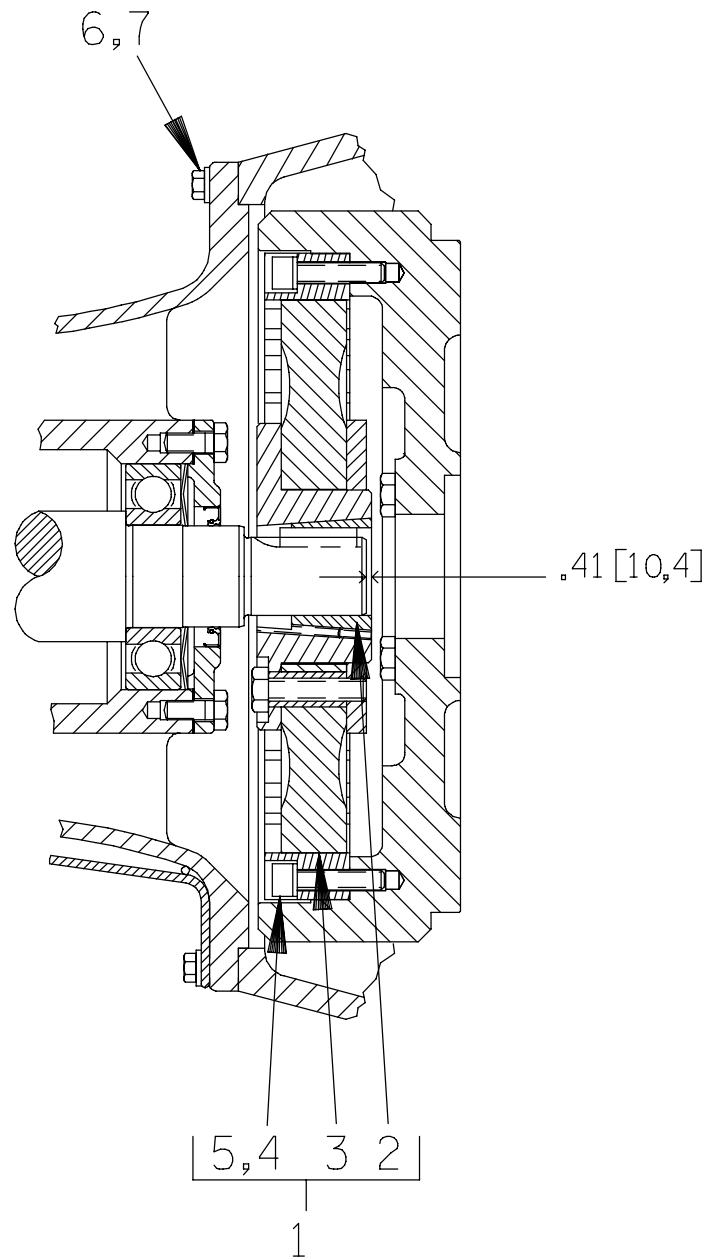


Figure C-4. Drive Assembly

**Drive Assembly
Part Identification List**

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

ITEM NO.	PART NAME
1	COUPLING KIT
2	-BUSHING
3	-COUPLING ASSEMBLY
4	-LOCKWASHER
5	-SOCKET HEAD CAPSCREW
6	HEX HEAD CAPSCREW
7	LOCKWASHER

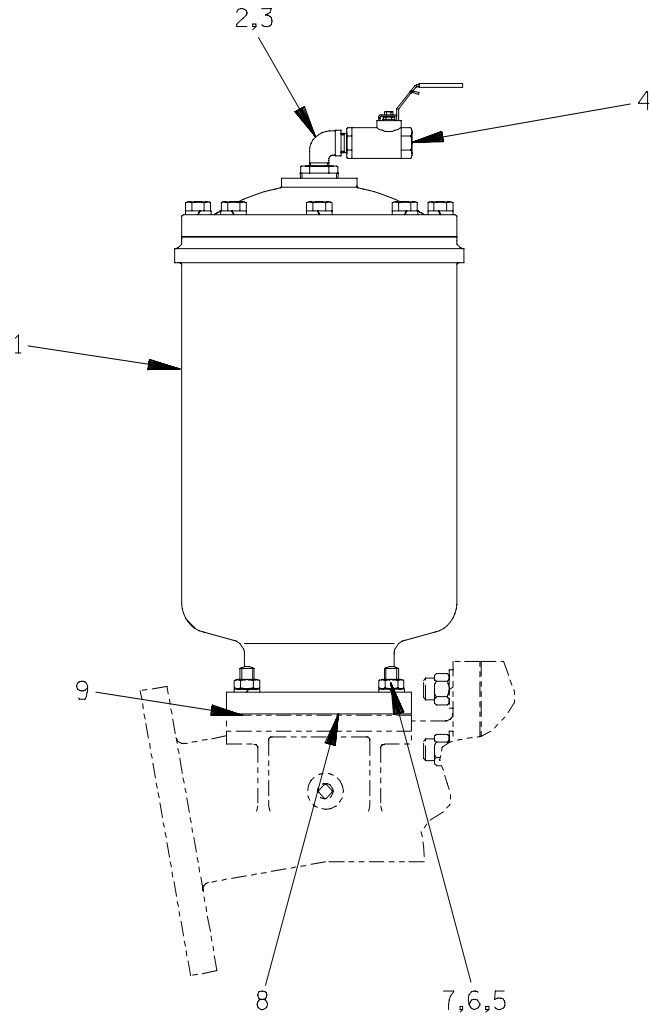


Figure C-5 Priming Chamber Kit

Priming Chamber Kit Part Identification List

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

ITEM NO.	PART NAME
1	PRIMING HOPPER ASSEMBLY
2	PIPE BUSHING
3	STREET ELBOW
4	BALL VALVE
5	STUD
6	HEX NUT
7	LOCK WASHER
8	GASKET
9	BAFFLE

SECTION DRAWING

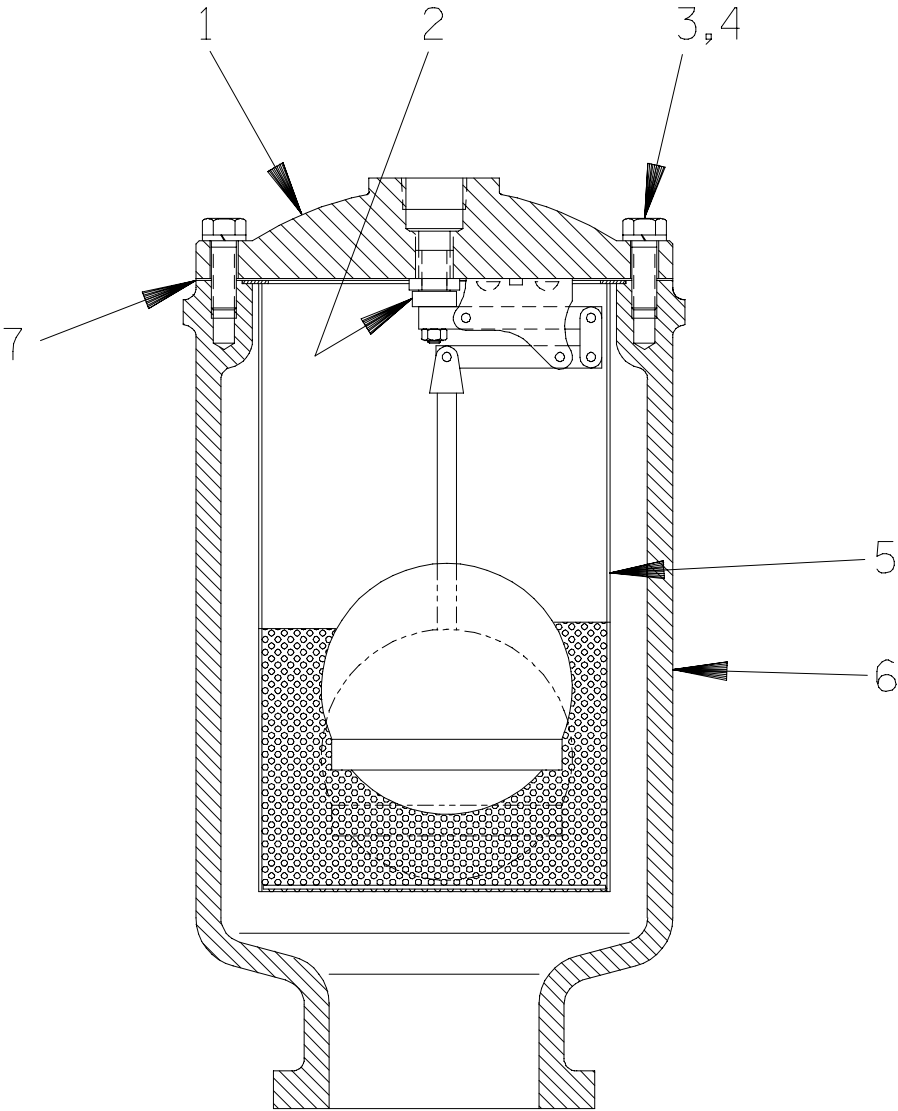


Figure C-6. Priming Chamber

Priming Chamber Assembly Part Identification List

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

ITEM NO.	PART NAME
1	PRIMING VALVE
2	-ORIFICE BUTTON
3	HEX HD CAPSCREW
4	LOCK WASHER
5	STRAINER ASSEMBLY
6	PRIMING CHAMBER
7	PRIMING VALVE GASKET

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 through C-6) 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 (12, Figure C-1) and discharge check valve assembly (7, 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 take precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pump casing by removing the casing drain plug (10, 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, disconnect the positive battery cable and take 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.

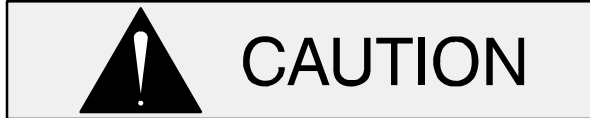


This pump is designed to handle material which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.



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-5)

Disconnect both the suction piping and the air discharge tubing from the priming chamber assembly (1). Support the priming chamber assembly using a sling and a suitable lifting device. Remove the hardware (6 and 7) and separate the priming chamber assembly, baffle (9) and gasket (8) from the pump assembly.

Remove the hardware (3 and 4) securing the priming valve (1) to the priming chamber (6). Carefully lift the valve components from the priming chamber. Remove the gasket (7) and clean the mating surfaces.

If the priming valve float is stuck or the strainer (5) is clogged, it can usually be cleaned without further disassembly.

The only serviceable part of the priming valve is the orifice button (2). If liquid continues to bypass through the priming chamber after adjusting the orifice button (see **Priming Chamber Reassembly and Installation** for adjustment), the button may require replacement. To replace the orifice button, remove one of the “e-clips” from the pivot pin closest to the orifice button and remove the pivot pin. This will allow the linkage to be raised high enough to access the orifice button.

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

Discharge Check Valve Removal and Disassembly

(Figure C-1)

Support the discharge check valve assembly (3) using a sling and a suitable lifting device. Remove the hardware (8, 9 and 10) and separate the discharge check valve assembly and gasket (11) from the pump assembly (1).

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

Separating Pump And Drive Assembly From Engine

(Figure C-4)

The intermediate and drive assembly must be separated from the engine before further disassembly. Support the intermediate using a hoist and sling, and remove the hardware securing the pump casing to the base.

Remove the hardware (6 and 7) securing the intermediate to the engine bellhousing. Remove the intermediate guards (23, Figure 4), 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 (9, Figure 4).

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.

Remove any leveling shims used under the casing mounting feet. Tie and tag the shims for ease of reassembly.

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

Draining Oil From Seal Cavity

(Figure C-2)

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

Position a **clean** container under the seal cavity drain plug (8). Remove the plug and drain the oil from the seal cavity into the container. For shorter drain time, remove the vented plug (5, Figure C-3). Clean and reinstall the drain plug and vent plug. Inspect the oil for water, dirt or a cloudy condition which could indicate seal failure.

Loosening Impeller

(Figure C-3)

With the pump end separated from the engine, wedge a block of wood between the vanes of the impeller and the pump casing to prevent rotation.

Install the shaft key (9) in the shaft keyway. Install a lathe dog on the drive end of the shaft (17) with the "V" notch positioned over the shaft key.

With the impeller rotation still blocked, see Figure C-7 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.

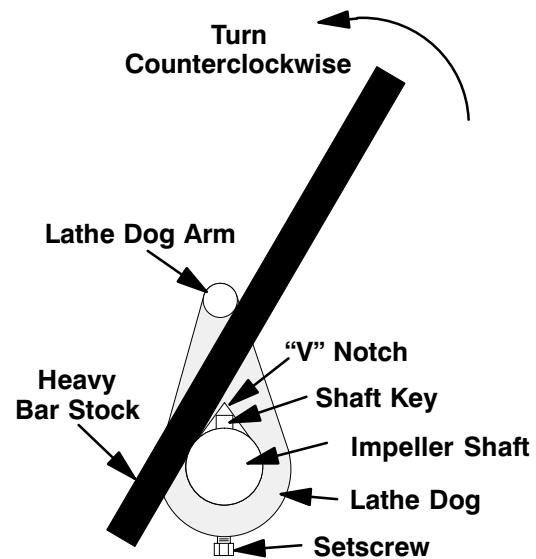


Figure C-7. Loosening Impeller

Pump Casing And Wear Plate Removal

(Figure C-2)

Remove the discharge check valve as previously described before attempting to remove the pump casing.

Support the pump casing using a suitable hoist and sling.



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

Remove the hardware (not shown) securing the pump casing to the base.

NOTE

*Drain the oil from the seal cavity before removing the pump casing. See **Draining Oil From Seal Cavity**.*

Remove the hardware (5 and 6) securing the pump casing (1) to the rotating assembly (4). Pull the pump casing straight away from the rotating assembly to prevent binding on the impeller. Remove the shims (7) and clean the contacting surfaces. Tie and tag the shims or measure and record their thickness for ease of reassembly.

Inspect the wear plate assembly (11) for excessive wear or scoring. If replacement is required, remove the hardware (12 and 13) and pull the wear plate out of the pump casing.

Impeller Removal

(Figure C-3)

With the rotating assembly removed from the pump casing, unscrew the impeller (1) from the shaft (17). Use caution when unscrewing the impeller; tension on the shaft seal spring will be released as the impeller is removed. Inspect the impeller and replace if cracked or badly worn.

Remove the impeller adjusting shims (28); tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal

(Figures C-3 and C-8)

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

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

An alternate method of removing the stationary seal components is to remove the hardware (20 and 21) and separate the seal plate (22) and gasket (3) from the intermediate (4). Position the seal plate on a flat surface with the impeller side down. Use a wooden dowel or other suitable tool to press on the back side of the stationary seat until the seat, O-rings, and stationary element can be removed.

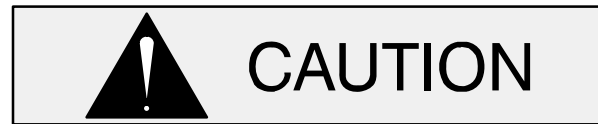
Remove the shaft sleeve O-ring (27) and seal plate O-ring (33).

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

Shaft and Bearing Removal and Disassembly

(Figure C-3)

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



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

Remove the intermediate drain plug (25) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (13 and 14) and remove the bearing cap (12), gasket (15) and bearing cap oil seal (8). Press the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft (17) and tap the shaft and assembled bearings from the intermediate. Press the inboard oil seal (19) from the intermediate.

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 ven-

tilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

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



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

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

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

If bearing replacement is required, remove the snap ring (11) and use a bearing puller to remove the inboard and outboard bearings (16 and 18) from the shaft.

Shaft and Bearing Reassembly and Installation (Figure C-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.*

NOTE

*Position the inboard bearing (18) on the shaft with the shield facing **toward** the impeller. Position the outboard bearing (16) on the shaft with the retaining ring on the bearing O.D. **toward** the drive end of the shaft.*

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

After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings against the shaft shoulders.

Secure the outboard bearing (16) to the shaft with the snap ring (11)

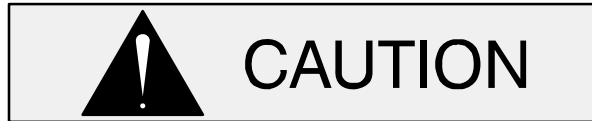
If heating the bearings is not practical, use a suitably sized sleeve, and an arbor (or hydraulic) press to install the bearings on the shaft.



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

Apply a light coating of oil to the lip of the inboard oil seal (19) and press it into the intermediate bore with the lip positioned as shown in Figure C-3. Press the oil seal into the housing until the face is **just flush** with the machined surface on the housing.

Slide the shaft (17) and assembled bearings (16 and 18) into the intermediate bore until the inboard bearing is fully seated against the bore shoulder.



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

Apply a light coating of oil to the lip of the outboard oil seal (8) and press it into the bearing cap (12) with the lip positioned as shown in Figure C-3. The face of the oil seal should be just flush with the outer face of the bearing cap.

Install the bearing cap gasket (15), and secure the bearing cap to the intermediate with the hardware (13 and 14). **Be careful** not to damage the lip of the oil seal (8) on the shaft keyway.

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

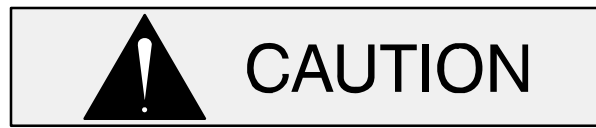
Securing Intermediate And Drive Assembly To Engine (Figure C-4)

Install the shaft key (9, Figure C-3) in the shaft keyway. Position the flexible portion of the coupling assembly (3) on the shaft as shown in Figure C-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 to the dimension shown in Figure C-4. 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 E-4. **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 recessed **.41 inch (10,4 mm)** from 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 14.6 ft. lbs. (175 in. lbs. or 2 m. kg.).

If the complete coupling assembly is being replaced, apply 'Loctite Retaining Compound No. 242' or equivalent to the threads of the hardware (4 and 5), and secure the outer ring of the coupling to the engine flywheel by torquing the hardware to 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. **Do not** use petroleum-based lubricants, or any other substance which may soften or otherwise damage the rubber.*

Install the intermediate guards (23, Figure C-3), and secure the intermediate to the engine bellhousing with the previously removed hardware (6 and 7).

Seal Reassembly and Installation

(Figures C-3, C-8, C-9 and C-10)



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

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the stationary seat bore in the seal plate for dirt, nicks and burrs, and remove any that exist. The stationary seat bore

must be completely clean before installing the seal.



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

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

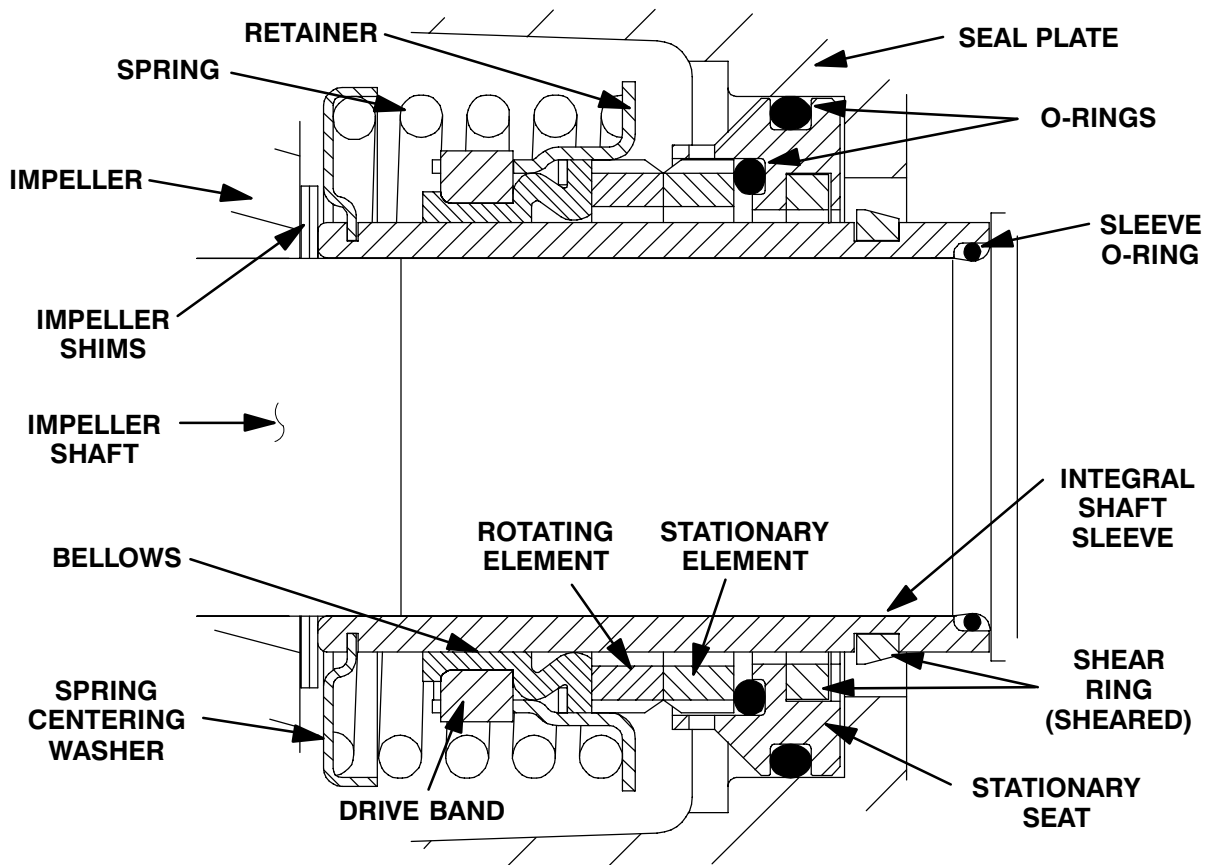


Figure C-8. Cartridge Seal Assembly



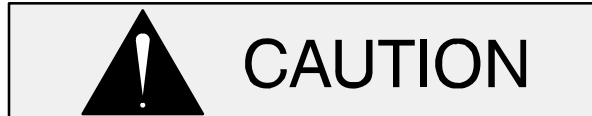
This seal is not designed for operation at temperatures above 160°F (71°C). Do not use at higher operating temperatures.

If the seal plate was removed, install the seal plate gasket (3). Position the seal plate over the shaft and secure it to the intermediate with the hardware (20 and 21).

To prevent damaging the shaft sleeve O-ring (27) on the shaft threads, stretch the O-ring over a piece of tubing 1-1/4 I.D. x 1-1/2 O.D. x 2-inches long (32

mm x 38 mm x 51 mm). Slide the tube over the shaft threads, then slide the O-ring off the tube and onto the shaft. Remove the tube, and continue to slide the O-ring down the shaft until it seats against the shaft shoulder.

When installing a new cartridge seal assembly, remove the seal from the container, and remove the mylar storage tabs from between the seal faces.



New cartridge seal assemblies may be equipped with mylar storage tabs between the seal faces. These storage tabs **must** be removed before installing the seal.

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

Clean and inspect the impeller as described in **Impeller Installation and Adjustment**. Install half of the set of impeller shims (28) provided with the seal, and screw the impeller onto the shaft until it is seated against the seal (see Figure C-9).

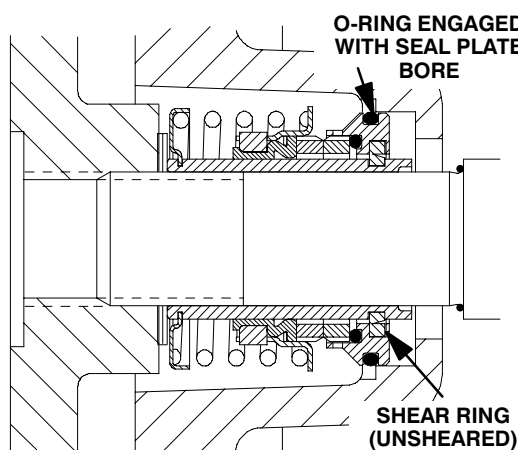


Figure C-9. Seal Partially Installed

Continue to screw the impeller onto the shaft. This will press the stationary seat into the seal plate bore.

NOTE

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

As the stationary seat becomes fully seated, the seal spring compresses, and the shaft sleeve will break the nylon shear ring. This allows the sleeve to slide down the shaft until seated against the shaft shoulder. Continue to screw the impeller onto the shaft until the impeller, shims, and sleeve are fully seated against the shaft shoulder (see Figure C-10).

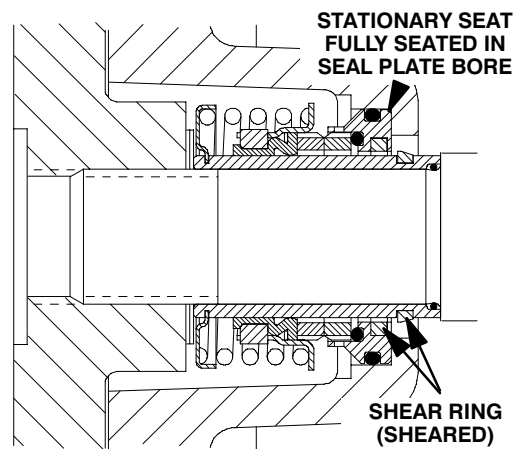


Figure C-10. Seal Fully Installed

Measure the impeller-to-seal plate clearance, and remove impeller adjusting shims to obtain the proper clearance as described in **Impeller Installation and Adjustment**.

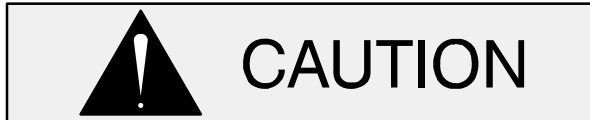
If necessary to reuse an old seal in an emergency, carefully separate the rotating and stationary seal faces from the bellows retainer and stationary seat.



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

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

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



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

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

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

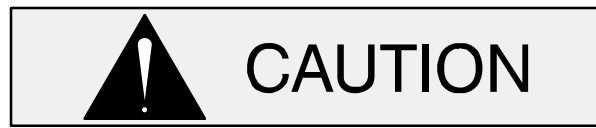
Slide the rotating portion of the seal (consisting of the integral shaft sleeve, spring centering washer, spring, bellows and retainer, and rotating element) onto the shaft until the seal faces contact.

Proceed with **Impeller Installation and Adjustment.**

Impeller Installation And Adjustment

(Figure C-3)

Inspect the impeller (1) 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.

Apply a small amount of 'Never-Seez' or equivalent anti-lock compound on the shaft threads. 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 .025 to .040 inch (0,64 to 1,02 mm) between the impeller and the seal plate is necessary for maximum pump efficiency. Measure this clearance, and add or remove impeller adjusting shims as required.

Pump Casing And Wear Plate Installation

(Figure C-2)

If the wear plate (11) was removed, position the replacement wear plate in the casing and secure it with the hardware (12 and 13).

Lubricate the O-rings (3 and 9) with light grease, and install them in the grooves in the intermediate and seal plate. Ease the rotating assembly into the pump casing. **Be careful** not to damage the O-rings.

Install the same thickness of adjusting shims (7) as previously removed, and secure the rotating assembly to the pump casing with the hardware (5 and 6). Do not fully tighten the capscrews until the impeller face clearance has been set.

A clearance of .010 to .020 inch (0,25 to 0,5 mm) between the impeller and the wear plate is also recommended for maximum pump efficiency. This clearance can be obtained by adding or removing an equal thickness of shims from each rotating as-

sembly shim set (7) until the impeller scrapes against the wear plate when the shaft is turned. After the impeller scrapes, add approximately .010 inch (0,25 mm) of shims to each shim set.

After the face clearance has been set, tighten the hardware securing the rotating assembly to the pump casing.

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

Discharge Check Valve Assembly And Installation

(Figure C-1)

If the discharge check valve (7) was disassembled to replace the flapper or cover O-ring, position the flapper in the valve body and check to ensure free movement.

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

Apply a small amount of light grease to the discharge flange gasket to hold it in place and position it against the pump casing flange. Support the discharge check valve assembly (3) using a sling and a suitable lifting device. Using the previously removed hardware, secure the discharge check valve assembly and flange gasket to the pump assembly (1).

Priming Chamber Assembly And Installation

(Figure C-6)

Clean and inspect the components of the priming valve (1). Inspect the linkage and ensure the orifice button (2) squarely engages the valve seat. Replace the orifice button if required (see **Priming Chamber Removal and Disassembly** for orifice button removal).

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

Adjust the orifice button seating as necessary by screwing the orifice button into or out of the linkage

bar. Proper adjustment is achieved when the orifice button fully seats against the orifice before the linkage bar on the float bottoms against the threads on the orifice button. When adjustment is complete, install and tighten the lock washer and hex nut securing the orifice button.

Install the strainer (5) and priming valve gasket (7).

Lower the float into the priming chamber (6) and secure the priming valve with the previously removed hardware (3 and 4).

(Figure C-5)

Install the baffle (9) and gasket (8) and use a sling and suitable lifting device to position the priming chamber assembly on the hopper spool (6, Figure 2). Secure the priming chamber assembly with the hardware (6 and 7).

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

LUBRICATION

(Figure C-3)

Seal Assembly

Before starting the pump, remove the vented plug (5) and fill the seal cavity with approximately 5 quarts (4,7 liters) of SAE No. 30 non-detergent oil or until the internal casting is covered. This can be checked by inserting a screwdriver through the vented plug opening until it bottoms out. Remove the screwdriver and the tip should have just a little oil on it. Clean and reinstall the vented plug. Maintain the oil level above the minimum oil level line indicated by the decal on the pump casing.

Bearings

(Figure C-3)

The intermediate was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (24) and maintain it at the midpoint of the gauge. When lubrication is required, remove the air vent (6) and add SAE No. 30 non-detergent oil through the opening. When lubricating a dry (overhauled) intermediate, fill the bearing cavity with approximately 28 ounces (0,8 liter). Clean and reinstall the air vent. **Do not** over-lubri-

cate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

NOTE

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

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



Monitor the condition of the bearing lubricant regularly for evidence of rust or moisture condensation. This is especially important in areas where variable hot and cold temperatures are common.

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

Power Unit

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

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