



PRIME-AIRETM **SERIES**

PA6A Model Pumps

(Including Model 66E 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 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:



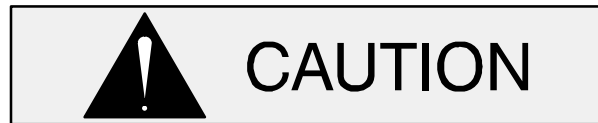
Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.



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



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 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.

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

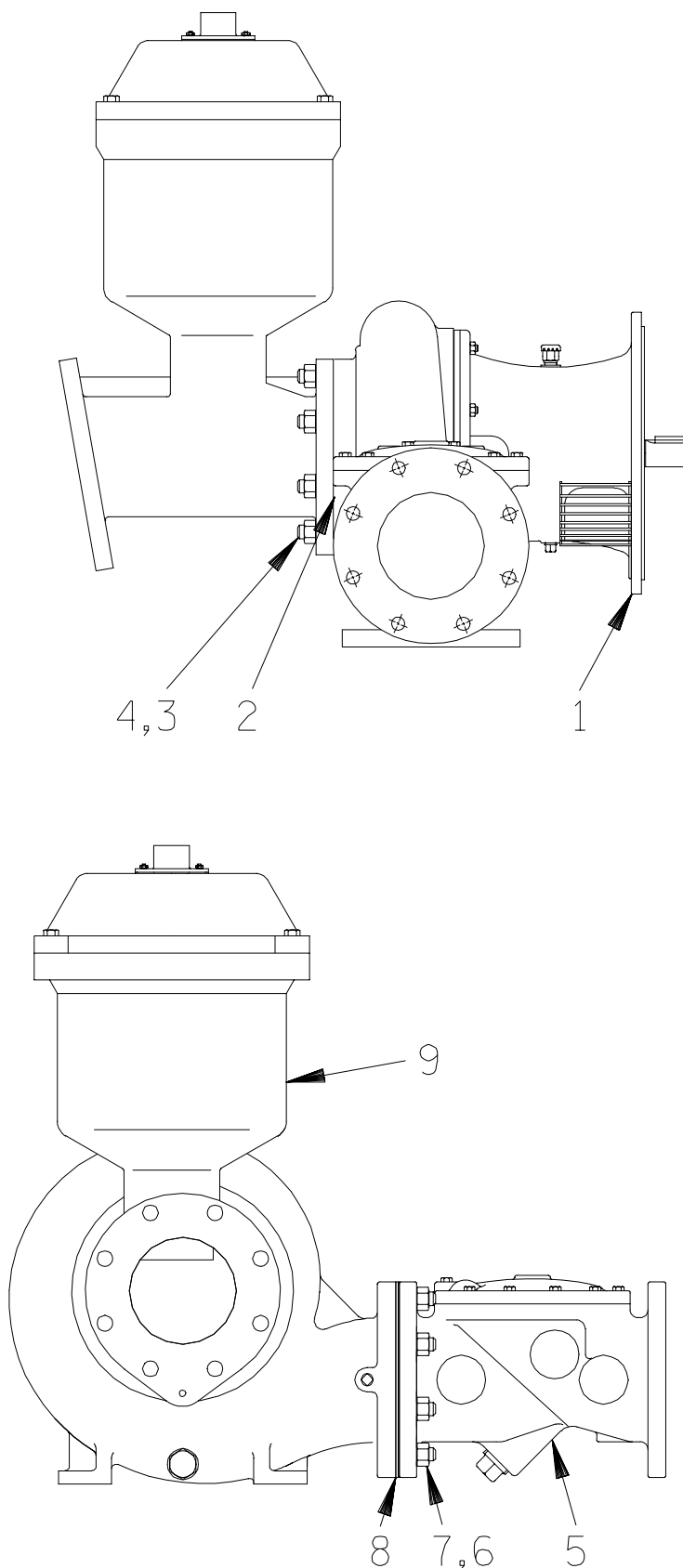


Figure C-1. PA6A60-(SAE4/10) Pump Assembly

**PA6A60—(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	66E60—(SAE 4/10) PUMP END ASSEMBLY
2	PUMP CASING GASKET
3	STUD
4	HEX NUT
5	CHECK VALVE ASSY
6	STUD
7	HEX NUT
8	GASKET
9	PRIMING CHAMBER ASSY

NOTE: The PA6A60—(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

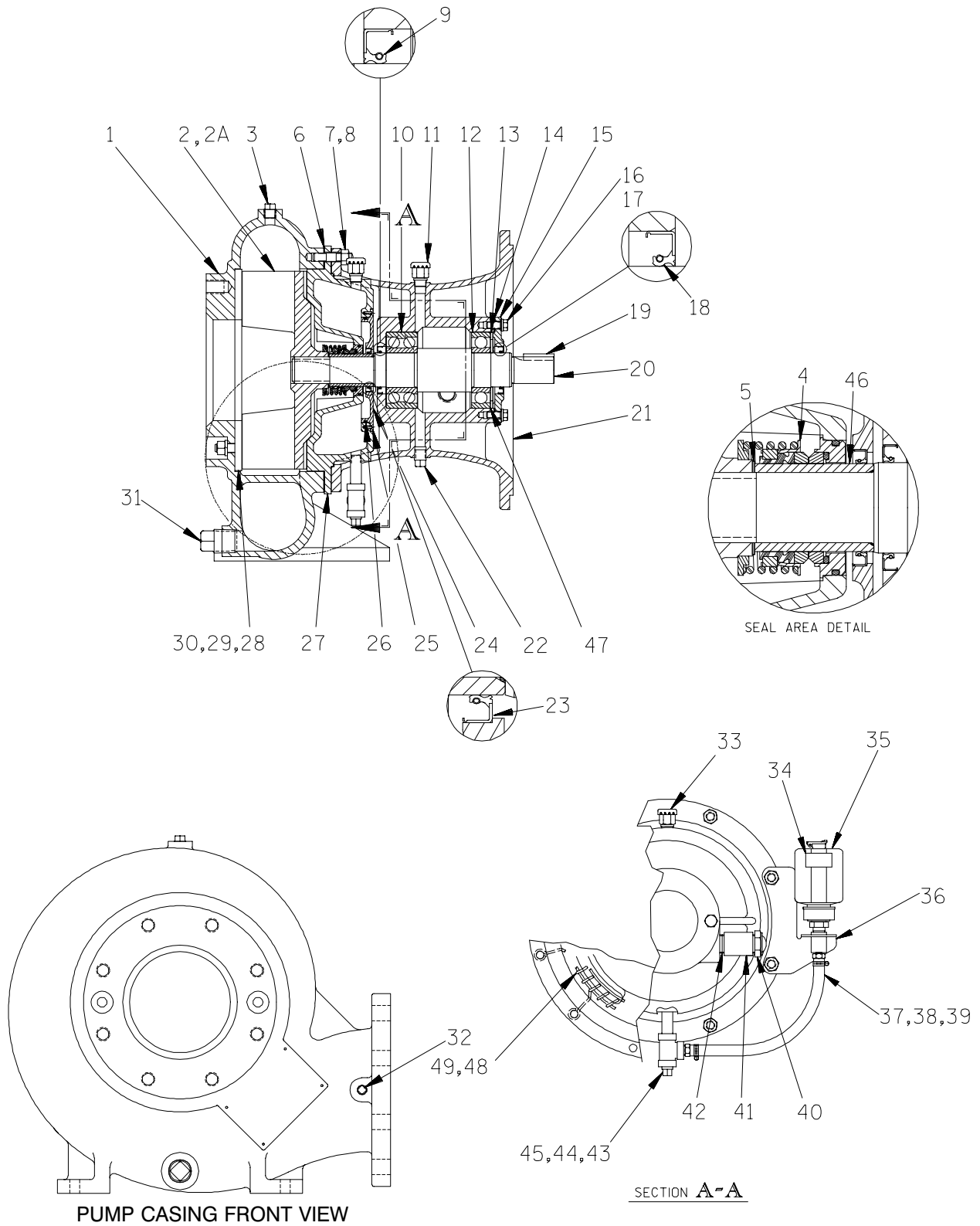


Figure C-2. 66E60-(SAE4/10) Pump Assembly

66E60—(SAE4/10) 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	25	FLAT HEAD MACHINE SCREW
2	IMPELLER	26	O-RING
2A	—SPRING RETAINER	27	SEAL PLATE
3	PIPE PLUG	28	WEAR PLATE ASSEMBLY
4	MECHANICAL SEAL	29	HEX NUT
5	ADJUSTING SHIM SET	30	LOCKWASHER
6	CASING GASKET SET	31	PIPE PLUG
7	STUD	32	PIPE PLUG
8	HEX NUT	33	AIR VENT
9	OIL SEAL	34	OIL LEVEL DECAL
10	INBOARD BALL BEARING	35	BOTTLE OILER
11	AIR VENT	36	BRACKET ASSEMBLY
12	OUTBOARD BALL BEARING	37	MALE CONNECTOR
13	THRUST WASHER	38	HOSE
14	BEARING COVER GASKET	39	HOSE CLAMP
15	BEARING CAP	40	OIL LEVEL SIGHT GAUGE
16	HEX HEAD CAPSCREW	41	PIPE COUPLING
17	LOCKWASHER	42	PIPE NIPPLE
18	OIL SEAL	43	PIPE NIPPLE
19	SHAFT KEY	44	PIPE TEE
20	IMPELLER SHAFT	45	SEAL CAVITY DRAIN PLUG
21	INTERMEDIATE	46	SHAFT SLEEVE
22	BRG CAVITY DRAIN PLUG	47	BEARING SHIM SET
23	OIL SEAL	48	INTERMEDIATE GUARD
24	SEAL PLATE COVER	49	INTERMEDIATE GUARD

SECTION DRAWING

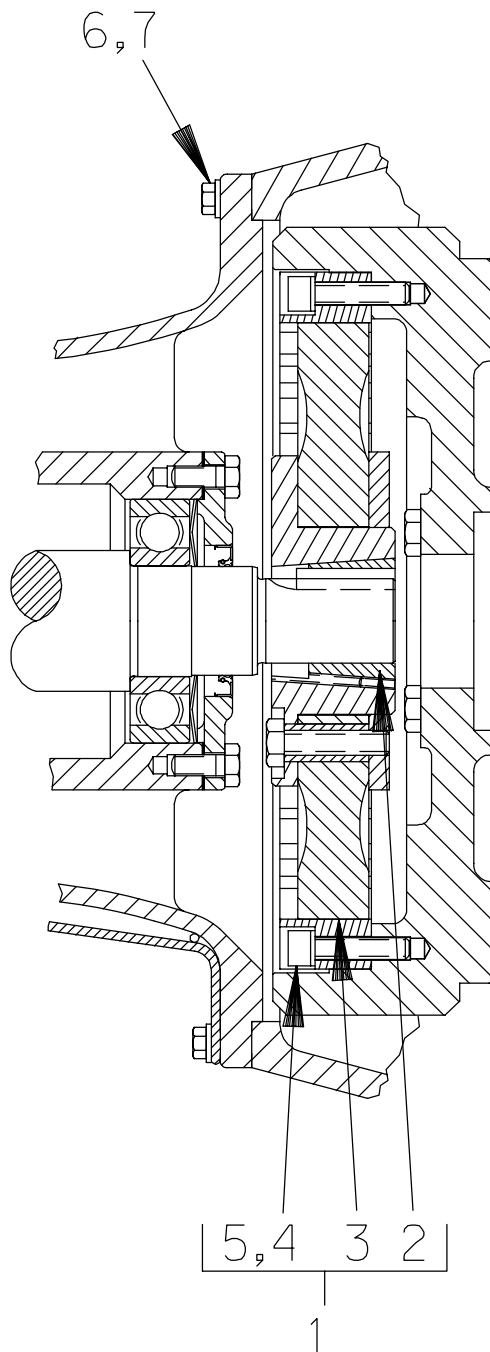


Figure C-3. SAE 4/10 Drive Assembly

**SAE 4/10 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

SECTION DRAWING

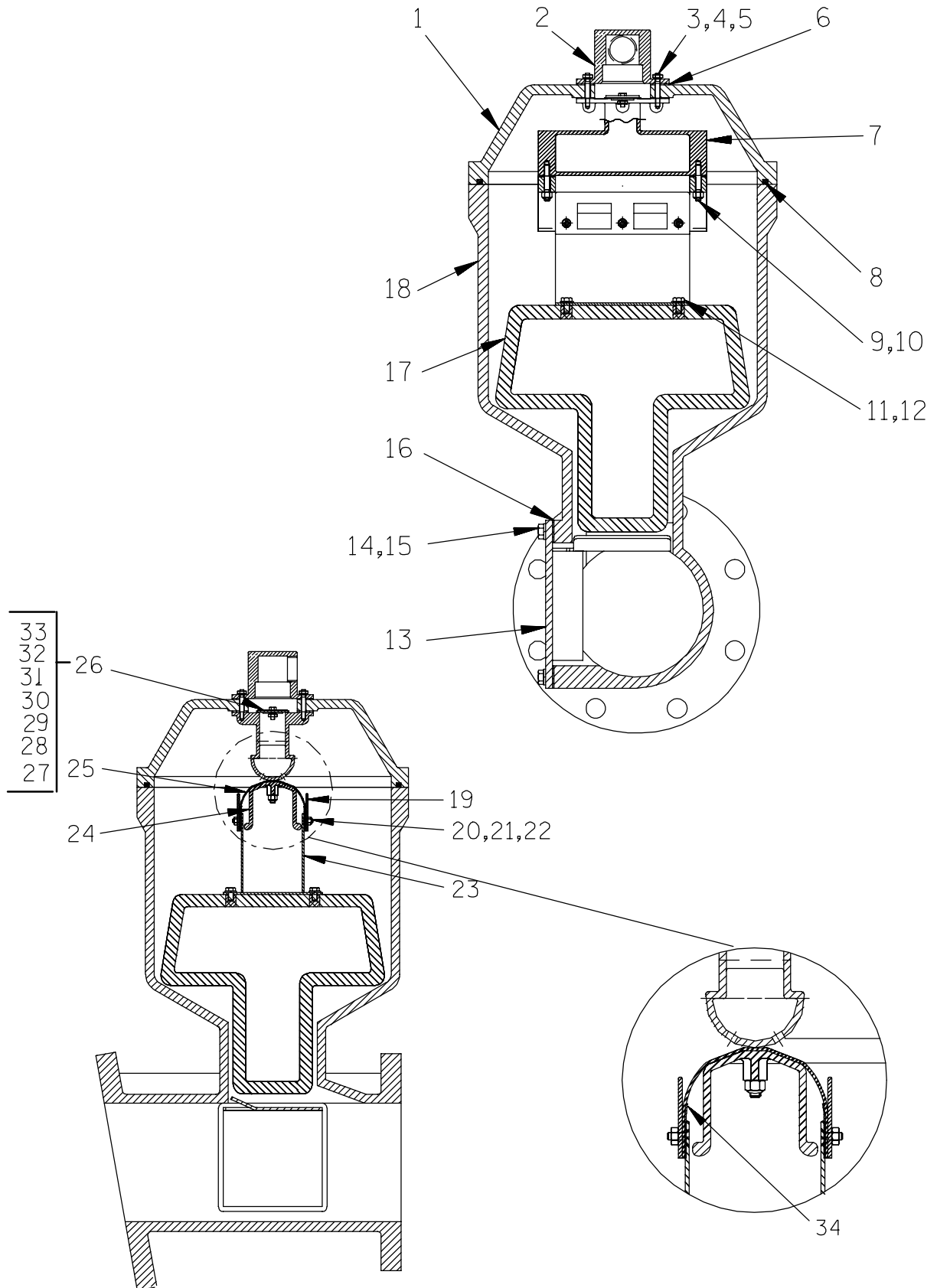


Figure C-4. Peeler Type Priming Valve

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 HEAD 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 HEAD CAPSCREW	28	–LOCKWASHER
12	LOCKWASHER	29	–HEX NUT
13	INDUCTOR GUARD ASSEMBLY	30	–SMALL VALVE WEIGHT
14	HEX HEAD CAPSCREW	31	–HEX HEAD 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, 2, 3 and 4) 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 (10, 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 take precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pulp casing by removing the casing drain plug (31, 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

pipng 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.

Air Compressor Drive Belt Tensioning For Deutz Engine Driven Models



Air compressor drive belts used on Deutz engine driven models must be properly adjusted to prevent damage to the engine stub shaft. If adjustment is required, limit tension to no more than 3/16 inch of deflection at 6 lbs. of pressure applied midway between pulleys.

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 nuts (4) and separate the priming chamber assembly and gasket (2) from the pump assembly (1).

(Figure C-4)

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.

Pump Casing And Wear Plate Removal

(Figure C-2)

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

Unless impeller or seal replacement is required, it is not necessary to drain the oil from the bottle oiler (35) or seal cavity when removing the pump casing.

Remove the nuts (8) securing the pump casing and bracket assembly (36) to the intermediate. Loop a piece of wire through one of the holes in the support and around the seal cavity air vent (33) to support the sight gauge assembly while removing the pump casing.

Pull the pump casing straight away from the intermediate to prevent binding on the impeller. Remove the casing gasket (6) and clean the contacting surfaces.

Inspect the wear plate assembly (28) for excessive wear or scoring. If replacement is required, remove the hardware (29 and 30) and pull the wear plate out of the volute casing.

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 impeller is removed.

Lower the bottle oiler (35) below the seal cavity drain plug (45) to prevent the oil in the bottle oiler from being released as the seal cavity is drained.

Position a **clean** container under the seal cavity drain plug. Remove the plug and drain the oil from the seal cavity into the container. Clean and reinstall the drain plug. Inspect the oil for water, dirt or a cloudy condition which could indicate seal failure.

With the bottle oiler below the level of the drain plug, loosen the lower hose clamp (39) and pull the

hose (38) off the connector (37) at the tee (44). Plug the end of the hose and rest the bottle oiler in a vertical position to prevent the oil from spilling.

Impeller Removal

(Figure C-2)

To remove the impeller (2), tap the vanes in counterclockwise direction (when facing the impeller) with a block of wood or soft-faced mallet. **Be careful** not to damage the impeller. When the impeller breaks loose, unscrew it from the shaft. Use caution when removing the impeller; tension on the shaft seal spring will be released as the impeller is unscrewed. Inspect the impeller and replace it if cracked or badly worn.

Seal Removal

(Figures C-2 and C-6)

This pump is designed with two seals; a primary mechanical seal (4) located directly behind the impeller and a secondary oil seal (23) located at the back of the seal plate (27). If the liquid being pumped leaks past the oil seal, both seals should be replaced immediately.

Slide the impeller adjusting shims (5) off the impeller shaft (20). Tie and tag the shims or measure and record their thickness for ease of reassembly.

Remove the seal spring. Slide the shaft sleeve (46) and rotating portion of the seal (consisting of the bellows, retainer, and rotating element) off the shaft as a unit.

Remove the rotating element. Apply oil to the sleeve and work it up under the rubber bellows. Slide the bellows and retainer off the sleeve.

Carefully slide the seal plate and stationary portion of the seal off the shaft as a unit. Remove the machine screws (25) and pull the seal plate cover (24) and oil seal (23) out of the seal plate as a unit. Use a suitable sized dowel to press the stationary portion of the seal out of the seal plate from the back side.

Inspect the oil seal and, if replacement is required, press it from the seal plate cover. Remove the O-ring (26) from the seal plate cover.

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

Separating Intermediate And Drive Assembly From Engine

(Figure C-3)

If it is necessary to separate the intermediate and drive assemblies from the engine, support the intermediate using a hoist and sling, and remove the hardware (6 and 7) securing the intermediate to the engine bellhousing. Remove the intermediate guards (48 and 49, Figure C-2), 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 (19, Figure C-2).

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.

Shaft and Bearing Removal and Disassembly

(Figure C-2)

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.

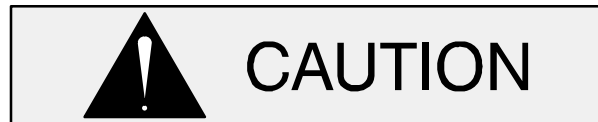
Remove the intermediate drain plug (22) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (16 and 17) and remove the bearing cap (15), gasket (14), bearing cap oil

seal (18), and thrust washer (13). Press the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft (20) and tap the shaft and assembled bearings from the intermediate. Press the inboard oil seal (9) 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 ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

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



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

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

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

If bearing replacement is required, use a bearing puller to remove the inboard and outboard bearings (10 and 12) from the shaft.

Shaft and Bearing Reassembly and Installation

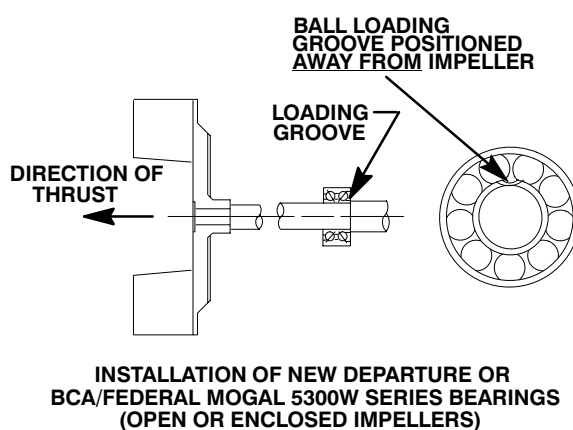
(Figure C-2)

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

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



To prevent damage during removal from



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

The bearings may be heated to ease installation. An induction heater, hot oil bath, electric oven, or hot plate may be used to heat the bearings. Bearings should **never** be heated with a direct flame or directly on a hot plate.

NOTE

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

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

NOTE

Position the inboard bearing (10) on the shaft as indicated in Figure C-5.

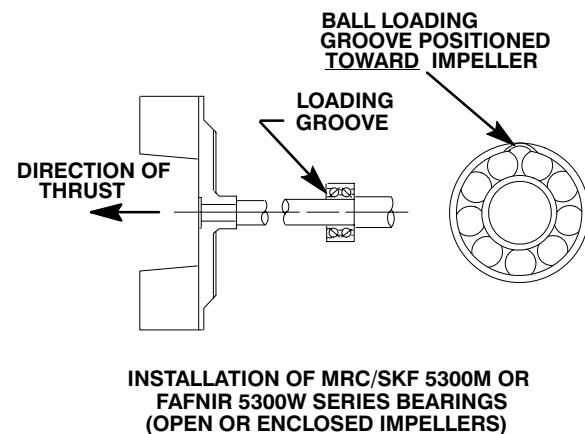
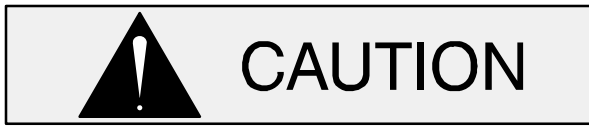


Figure C-5. Inboard Bearing Positioning

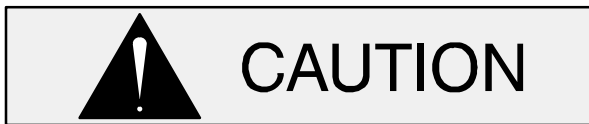
After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If movement has occurred, use a suitable sized sleeve and a press to reposition the bearings against the shaft shoulders.

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



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

Slide the shaft (20) and assembled bearings (10 and 12) 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 inboard oil seal (9) and press it into the intermediate bore with the lip positioned as shown in Figure C-2. Press the oil seal into the housing until the face is **just flush** with the machined surface on the housing.

Apply a light coating of oil to the lip of the outboard oil seal (18) and press it into the bearing cap (15) with the lip positioned as shown in Figure C-2. The face of the oil seal should be just flush with the outer face of the bearing cap.

Install the thrust washer (13) and bearing cap gasket (14), and secure the bearing cap to the intermediate with the hardware (16 and 17). **Be careful** not to damage the lip of the oil seal (18) 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-3)

Install the shaft key (19, Figure C-2) in the shaft keyway. Position the flexible portion of the coupling assembly (3) on the shaft as shown in Figure C-3.

NOTE

The flexible portion of the coupling must be properly

*ly positioned on the shaft. The heads of the cap screws in the center of the coupling **must be positioned toward the pump end of the shaft.***

Align the keyway in the bushing (2) with the shaft key, and slide it onto the shaft until it is **just flush** with the end of the shaft. Rotate the flexible portion of the coupling until the tapped holes for the two setscrews align with those in the bushing, and install the setscrews.



Make certain that the flexible portion of the coupling is mounted as shown in Figure C-3. **This is critical.** If the coupling is not properly positioned on the shaft, the coupling parts may not fully engage, or a pre-load condition can cause premature bearing failure.

The end of the shaft must be **just flush** with the face of the bushing. This will allow the two portions of the coupling to fully engage when the intermediate is secured to the engine bellhousing, without pre-loading the bearings.

With the flexible portion of the coupling and the bushing properly positioned on the shaft, tighten the two setscrews in an alternating sequence until the bushing and coupling are fully secured. Torque the setscrews to 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 (48 and 49, Figure C-2), and secure the intermediate to the engine bellhousing with the previously removed hardware (6 and 7).

Seal Reassembly and Installation

(Figures C-2 and C-6)

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 there are nicks or cuts on either end. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

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

To ease installation of the seal, lubricate the O-rings and bellows 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-6).

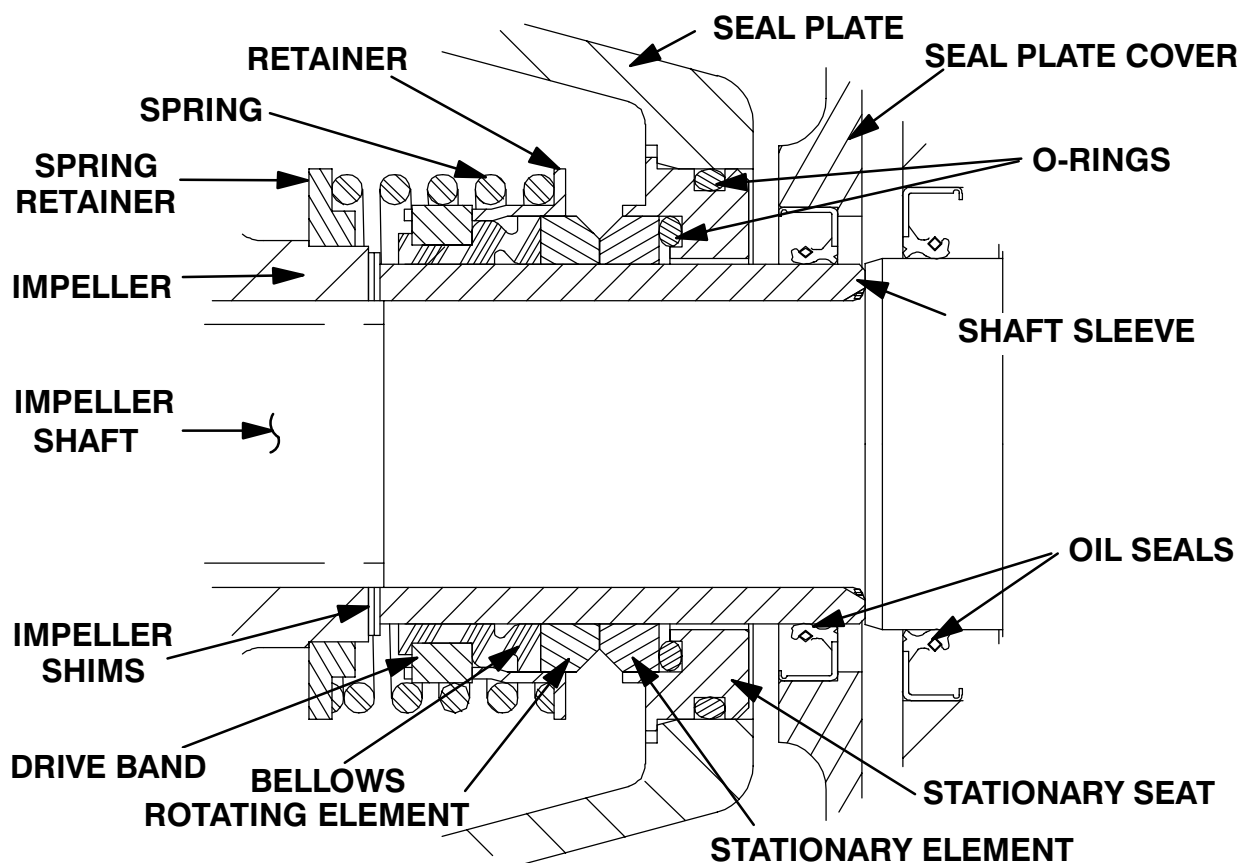
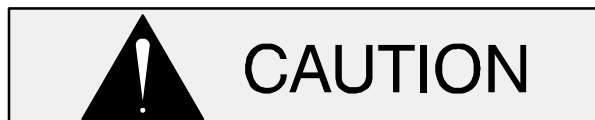


Figure C-6. Seal Assembly



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

Press the oil seal (23) into the seal plate cover (24) with the lip positioned as shown in Figure C-2. Make sure the oil seal is fully seated. Lubricate the O-ring (26) and install it in the groove in the seal plate cover. Press the seal plate cover into the seal plate and secure it with the machine screws (25).

To ease installation it is recommended that the shaft sleeve (46) be installed in the seal plate cover before installing the seal plate (27). Lubricate the sleeve and slide it through the oil seal from the intermediate side of the seal plate cover. **Be sure** to position the sleeve with the chamfered end toward the intermediate side of the cover.

Slide the assembled shaft sleeve and seal plate onto the shaft until the sleeve seats against the

shaft shoulder. Position the seal plate against the intermediate with the air vent (33) toward the top and temporarily secure the seal plate to the intermediate with two capscrews and nuts (1/2 UNC by 1-1/2 inch long, not supplied).

Assemble the O-rings into the stationary seat. Press the stationary element into the stationary seat with the chamfered side facing away from the seat. Press this subassembly into the seal plate bore until fully seated. A push tube cut from a length of plastic pipe would aid this installation. The I.D. of the tube should be approximately the same as the I.D. of the seal spring.

It is recommended that a tapered sleeve be installed over the shaft threads to ease installation of the seal. With the tapered sleeve in place, subassemble the rotating element into the rotating portion of the seal assembly with the chamfered side facing out. Lubricate the I.D. of the bellows and slide the rotating portion of the seal assembly onto the shaft sleeve until the sealing faces contact.

Remove the tapered sleeve and install the seal spring.

Lubricate the seal as indicated in **LUBRICATION**, after the impeller has been installed.

Impeller Installation And Adjustment

(Figure C-2)

Inspect the impeller assembly (2) and replace it if cracked or badly worn. The impeller assembly consists of the impeller with a spring retainer (2A) pressed onto the back side. If the retainer requires replacement, use a puller to remove the old one. Press the new retainer onto the impeller with the step toward the seal side of the impeller.



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

Install the same thickness of impeller adjusting shims (5) as previously removed and screw the impeller assembly onto the shaft until tight. **Make sure** the seal spring seats squarely over the step on the spring retainer.

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 (28) was removed, position the replacement wear plate in the pump casing and secure it with the hardware (29 and 30).

Remove the two capscrews temporarily holding the seal plate and install the same thickness of casing gaskets (6) as previously removed. Secure the seal plate and pump casing to the intermediate with the nuts (8). **Do not** fully tighten the nuts until the impeller face clearance has been set.

A clearance of .010 to .020 inch (0,25 to 0,51 mm) between the impeller and the wear plate is also recommended for maximum pump efficiency. This clearance may be determined by reaching through the suction inlet and measuring the clearance with a feeler gauge. Add or remove gaskets in the pump casing gasket set until the proper clearance is achieved.

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

Connect the hose (38) to the connector (37) and secure it with the hose clamp (39). Secure the bottle oiler (35) and bracket (36) to the back of the intermediate with the previously removed hardware.

(Figure C-1)

Apply a small amount of light grease to the gasket (8) to hold it in place and position it against the pump casing flange. Position the discharge check valve assembly (5) and secure it with the hardware (6, 7 and 9).

NOTE

When facing the discharge flange, install the stud (9) in the hole at the 11 o'clock position.

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-4)

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.

LUBRICATION

(Figure C-2)

Seal Assembly

Fill the bottle oiler (35) to the line on the glass with SAE No. 30 non-detergent oil. When lubricating a dry seal cavity, add approximately 3 quarts (2,8 L) of oil through the air vent (33) to level indicated. Check the oil level regularly and refill as required.

Bearings

The intermediate was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (40) and maintain it at the midpoint of the gauge. When lubrication is required, remove the air vent (11) and add SAE No. 30 non-detergent oil through the opening. When lubricating a dry (overhauled) intermediate, fill the bearing cavity with approximately 7.5 ounces (222 ml.). Clean and reinstall the air vent. **Do not** over-lubricate. 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 im-

portant 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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