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GORMAN-RUPP PUMPS

PRIME-AIRE® SERIES
PA8A60 And PA10A60 Models
Including
610N60-(SAE 2/11.5) And
610N60-(SAE 3/11.5) Pump Ends

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.
www.gormanrupp.com

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

Valid serial number and e-mail address required.

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

RECORD YOUR PUMP MODEL AND SERIAL NUMBER

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

Pump Model: _____

Serial Number: _____

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
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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: _____

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.

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:

DANGER!

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

WARNING!

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

CAUTION

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

NOTE

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

SAFETY – SECTION A

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.

WARNING!

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.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Lock out or disconnect the power source to ensure that the pump will remain inoperative.**
3. **Allow the pump to completely cool if overheated.**
4. **Check the temperature before opening any covers, plates, or plugs.**
5. **Close the suction and discharge valves.**
6. **Vent the pump slowly and cautiously.**
7. **Drain the pump.**

WARNING!

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

WARNING!

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.

WARNING!

After the pump has been installed, make certain that the pump and all piping or hose connections are tight, properly supported and secure before operation.

WARNING!

Do not 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.

WARNING!

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.**

WARNING!

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.

CAUTION

Use **only** replacement parts provided or approved by Gorman-Rupp. Use of non-authorized parts may result in damage to the equipment and/or injury to personnel and **will** invalidate the warranty.

CAUTION

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

DANGER!

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

WARNING!

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

WARNING!

Never tamper with the governor to gain more power. The governor establishes

safe operating limits that should not be exceeded. Refer to the pump Performance Curve for the maximum continuous operating speed.

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections. Make certain that the pump and enclosure are properly grounded; never use gas pipe as an electrical ground. Be sure that the incoming power matches the voltage and phase of the pump before connecting the power source. Do not run the pump if the voltage is not within the limits.

All electrical connections must be in accordance with The National Electric Code and all local codes. If there is a conflict between the instructions provided and N.E.C. Specifications, N.E.C. Specifications shall take precedence.

Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.

TROUBLESHOOTING — SECTION B

Review all SAFETY information in Section A.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power source 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.	Clean or replace check valve.
	Air compressor head 180° out.	Consult factory.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Eductor safety valve leaking.	Check and replace safety valve.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See **INSTALLATION**.
	Pump speed too slow.	Check driver output; consult driver operation manual.
	Eductor clogged.	Check and clean eductor.
	Air compressor damaged or belts broken.	Check and repair/replace.
	Strainer clogged.	Check strainer and clean if necessary.

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

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

PREVENTIVE MAINTENANCE

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

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

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

Preventive Maintenance Schedule

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

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

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

PUMP MAINTENANCE AND REPAIR – SECTION C

Review all SAFETY information in Section A.

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

WARNING!

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.

WARNING!

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. Maintenance of the power source 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.

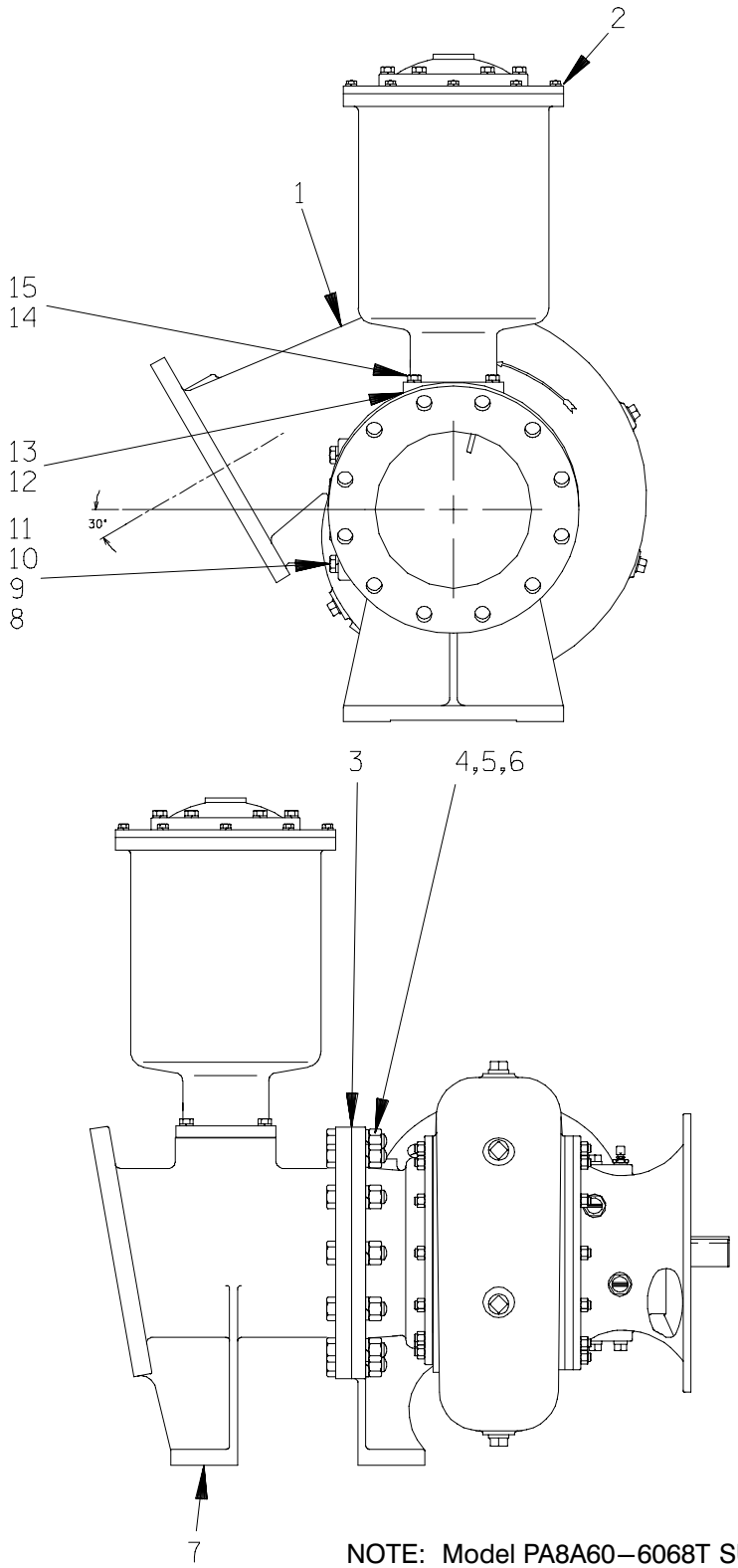
Select a suitable location, preferably indoors, to perform required maintenance. All work must be performed by qualified personnel.

Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.

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



NOTE: Model PA8A60—6068T SU Consists of Pump Model Assembly PA10A60—(3/11.5) SU With a 10” x 8” Discharge Reducer.

Figure C—1. PA10A60—(3/11.5) SU And PA10A60—(SAE 2/11.5) Pump Model Assemblies

PA10A60–(3/11.5) SU And PA10A60–(SAE 2/11.5) Pump Model Assemblies Part Identification List

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

ITEM NO.	PART NAME
1	610N60–(SAE 3/11.5) PUMP END ASSEMBLY 610N60–(SAE 2/11.5) PUMP END ASSEMBLY
2	PRIMING CHAMBER ASSY
3	GASKET
4	HEX HD CAPSCREW
5	HEX NUT
6	LOCKWASHER
7	SUCTION SPOOL
8	BLIND FLANGE ASSY
9	GASKET
10	HEX HD CAPSCREW
11	LOCKWASHER
12	GASKET
13	BAFFLE
14	HEX HD CAPSCREW
15	LOCKWASHER

NOTE: Model PA8A60–6068T SU Consists of Pump Model Assembly PA10A60–(3/11.5) SU With a 10” x 8” Discharge Reducer.

NOTE: Maintenance instructions in this manual are limited to the pump hydraulic, priming and drive components only. Maintenance of power sources and factory-supplied air compressors are detailed in separate literature provided by the manufacturer(s).

SECTION DRAWING

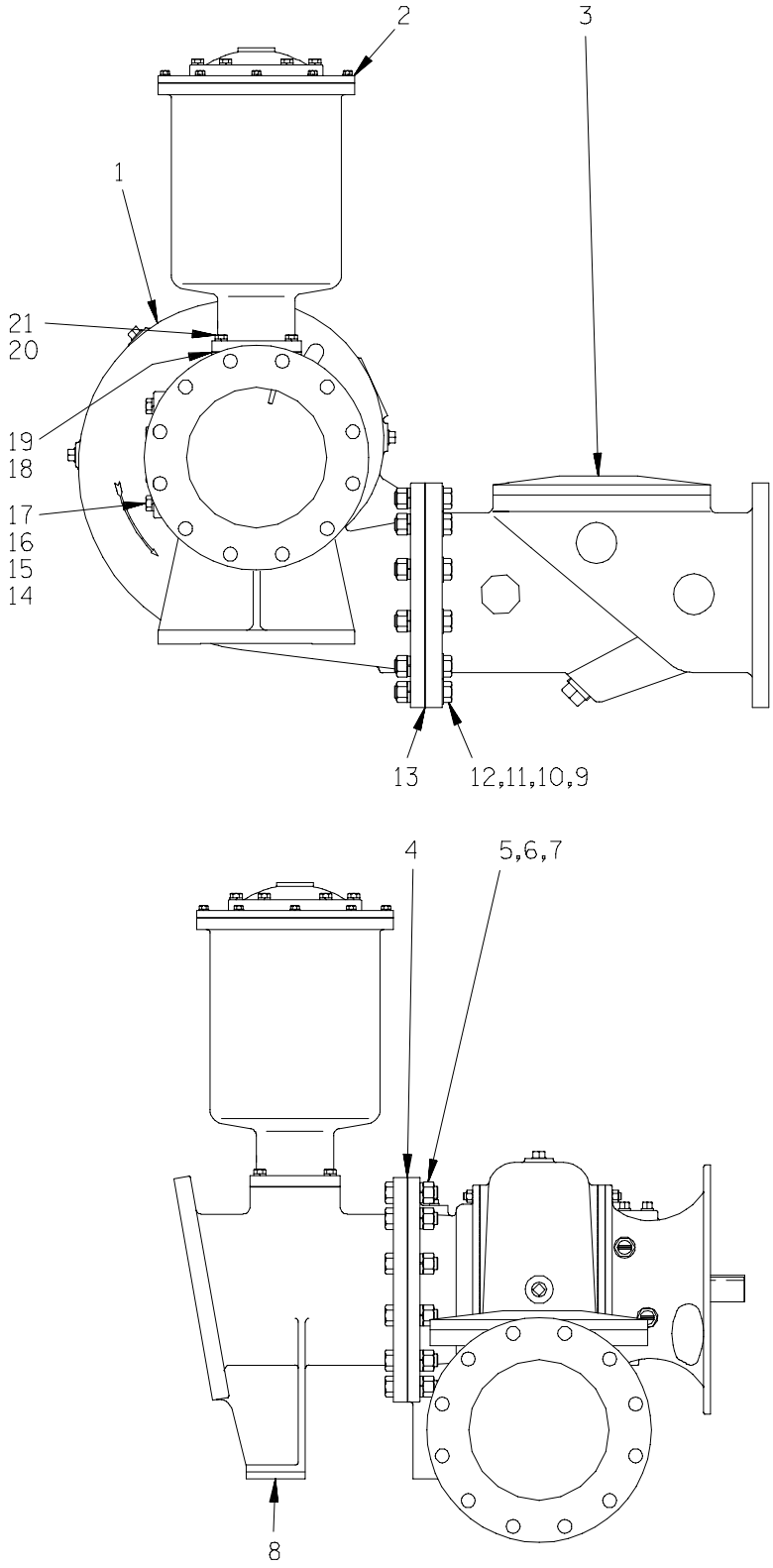


Figure C—2. PA10A60—(SAE 3/11.5) Pump Model Assembly

PA10A60—(SAE 3/11.5) Pump Model Assembly
Part Identification List

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

ITEM NO.	PART NAME
1	610N60—(SAE 3/11.5) PUMP END ASSEMBLY
2	PRIMING CHAMBER ASSY
3	CHECK VALVE
4	GASKET
5	HEX HD CAPSCREW
6	HEX NUT
7	LOCKWASHER
8	SUCTION SPOOL
9	HEX HD CAPSCREW
10	HEX NUT
11	LOCKWASHER
12	FLAT WASHER
13	GASKET
14	BLIND FLANGE ASSY
15	GASKET
16	HEX HD CAPSCREW
17	LOCKWASHER
18	GASKET
19	BAFFLE
20	HEX HD CAPSCREW
21	LOCKWASHER

NOTE: Maintenance instructions in this manual are limited to the pump hydraulic, priming and drive components only. Maintenance of power sources and factory-supplied air compressors are detailed in separate literature provided by the manufacturer(s).

SECTION DRAWING

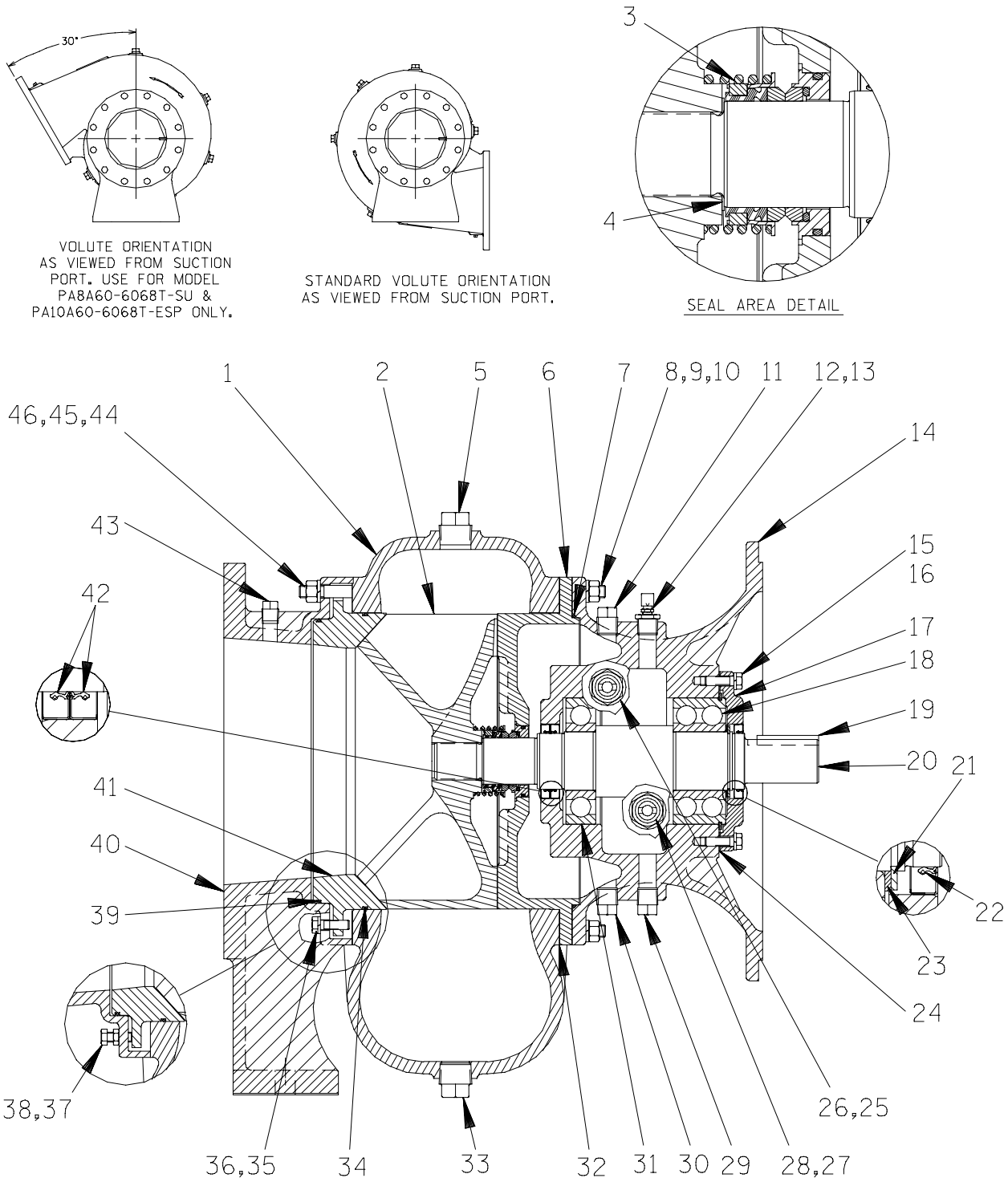


Figure C—3. 610N60—(SAE 2/11.5) And 610N60—(SAE 3/11.5) Pump End Assemblies

610N60—(SAE 2/11.5) And 610N60—(SAE 3/11.5) Pump End Assemblies
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	24	BEARING CVR GASKET
2	IMPELLER	25	SIGHT GAUGE
3	SEAL ASSY	26	PIPE PLUG
4	IMPELLER ADJ SHIM SET	27	SIGHT GAUGE
5	PIPE PLUG	28	PIPE PLUG
6	SEAL PLATE	29	BRG CAVITY DRAIN PLUG
7	SEAL PLATE O-RING	30	SEAL CVTY DRAIN PLUG
8	STUD	31	BALL BEARING
9	HEX NUT	32	PUMP CASING GASKET
10	LOCKWASHER	33	CASING DRAIN PLUG
11	VENTED PIPE PLUG	34	WEAR RING O-RING
12	RED PIPE BUSHING	35	HEX HD CAPSCREW
13	AIR VENT	36	LOCKWASHER
14	INTERMEDIATE	37	ADJUSTING SCREW
15	HEX HD CAPSCREW	38	JAM NUT
16	LOCKWASHER	39	WEAR RING O-RING
17	BEARING COVER	40	SUCTION HEAD
18	DOUBLE ROW BALL BEARING	41	WEAR RING
19	SHAFT KEY	42	OIL SEAL
20	IMPELLER SHAFT	43	PIPE PLUG
21	RETAINING RING	44	STUD
22	OIL SEAL	45	HEX NUT
23	THRUST WASHER	46	LOCKWASHER

SECTION DRAWING

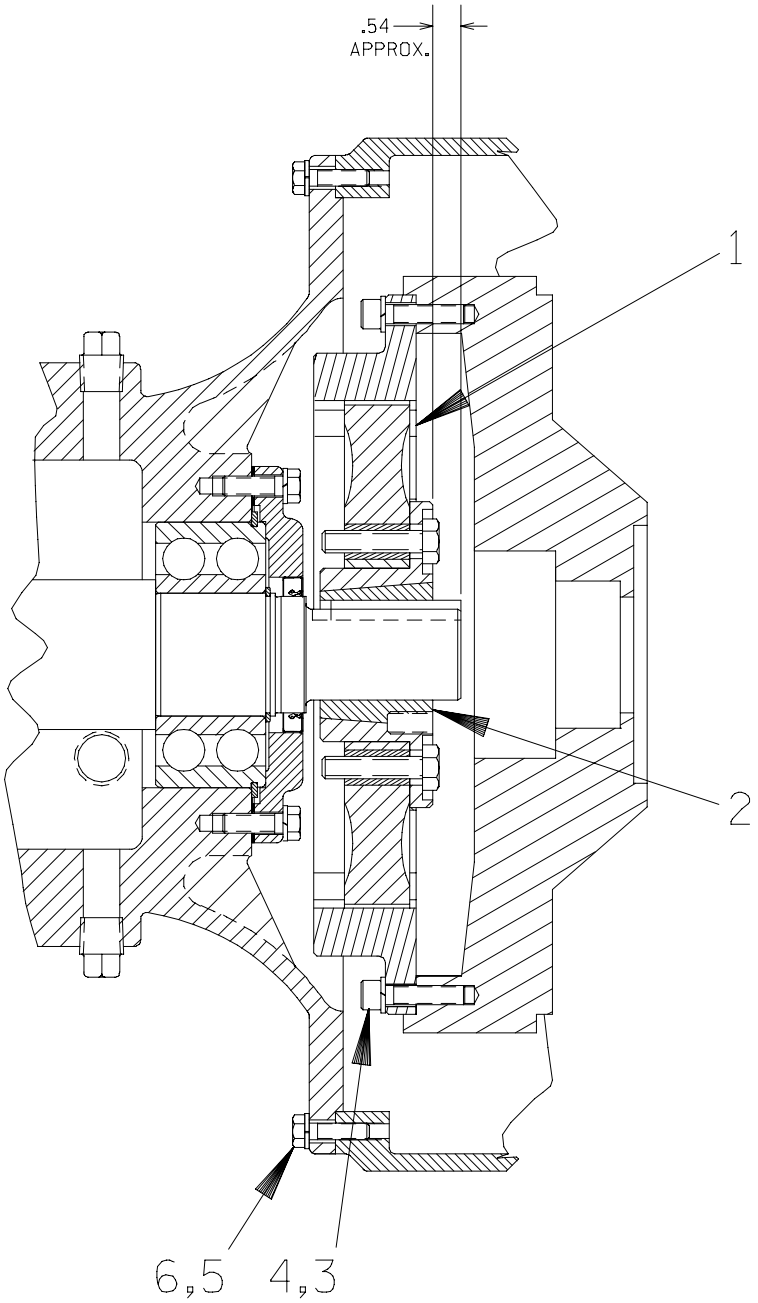


Figure C—4. Drive Assembly

Part Identification List

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

ITEM NO.	PART NAME
1	COUPLING W/O BUSHING
2	BUSHING
3	SOCKET HD CAPSCREW
4	LOCKWASHER
5	HEX HD CAPSCREW
6	LOCKWASHER

SECTION DRAWING

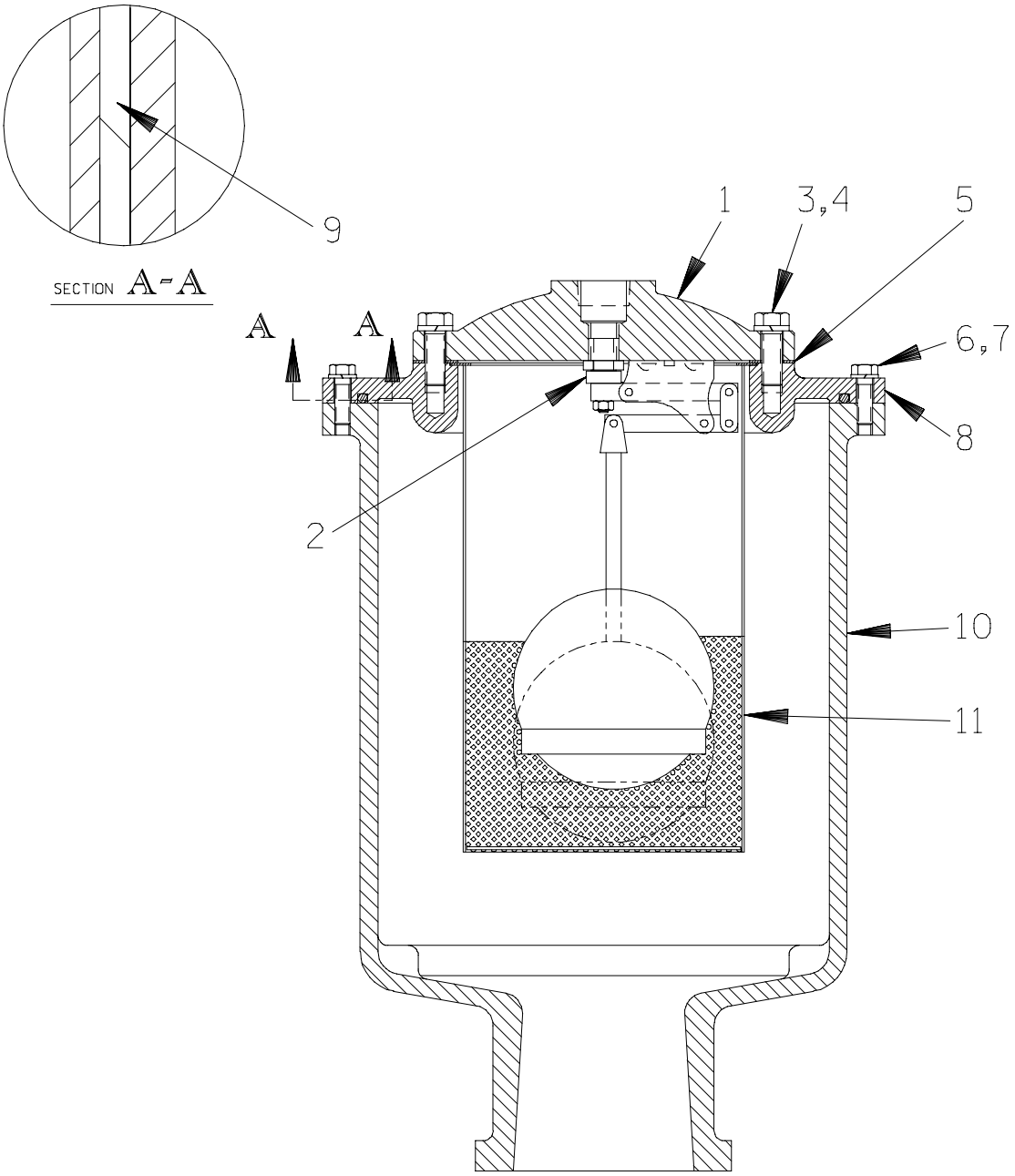


Figure C—5. Priming Chamber Assembly

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	PRIMING VALVE	7	LOCK WASHER
2	—ORIFICE BUTTON	8	PRIMING CHAMBER LID
3	HEX HD CAPSCREW	9	LINEAR O-RING
4	LOCK WASHER	10	PRIMING CHAMBER
5	PRIMING VALVE GASKET	11	STRAINER ASSEMBLY
6	HEX HD CAPSCREW		

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, 4 and 5) and the corresponding Parts Identification Lists. Maintenance and repair instructions for the power source 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 power source. However, the following instructions assume complete disassembly of the pump is required.

Before attempting to service the pump, disconnect or lock out the power source to ensure that it will remain inoperative. Close all valves in the suction and discharge lines and drain the pump casing.

WARNING!

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

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power source to ensure that the pump will remain inoperative.**
3. **Allow the pump to completely cool if overheated.**
4. **Check the temperature and make sure it is cool before opening any covers, plates, gauges, or plugs.**
5. **Close the suction and discharge valves.**
6. **Vent the pump slowly and cautiously.**
7. **Drain the pump.**

WARNING!

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.

WARNING!

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.

CAUTION

Use **only** replacement parts provided or approved by Gorman-Rupp. Use of non-authorized parts may result in damage to the equipment and/or injury to personnel and **will** invalidate the warranty.

Priming Chamber Removal And Disassembly

(Figures C–1 or C–2)

Disconnect the air discharge tubing (not shown) from the priming chamber assembly (2). Support the priming chamber assembly using a sling and a suitable lifting device. Remove the hardware (14 and 15, Figure C–1 or 20 and 21, Figure C–2) and separate the priming chamber assembly from the pump end assembly (1).

Remove the priming chamber gasket and baffle (12 and 13, Figure C–1 or 18 and 19, Figure C–2).

(Figure C–5)

Remove the hardware (3 and 4) securing the priming valve (1) to the priming lid (8). Carefully lift the valve components from the priming chamber. If the priming valve float is stuck or the strainer (11) is clogged, it can usually be cleaned without further disassembly.

If replacement is required, remove the hardware (6 and 7) securing the priming chamber lid. Replace the O-ring (9) and remove **all** of the old adhesive.

Discharge Check Valve Removal and Disassembly

(Figure C–2)

Support the discharge check valve assembly (7) using a sling and a suitable lifting device. Remove the hardware (9, 10, 11 and 12) and separate the discharge check valve assembly and gasket (13) 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. Separate the valve cap and remove the flapper and gasket.

Suction Spool Flange Removal

(Figures C–1 or C–2)

Before attempting to disassemble the pump, remove the pump casing drain plug (33, Figure C–3) and drain the pump.

Disconnect the suction piping from the suction spool flange (7, Figure C–1 or 8, Figure C–2).

Support the suction spool flange using a suitable hoist and sling. Disengage the hardware (not shown) securing the suction spool flange to the base.

WARNING!

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 (4, 5 and 6, Figure C–1 or 5, 6 and 7, Figure C–2) and separate the suction spool flange from the pump. Remove the suction spool flange gasket (3, Figure C–1 or 13, Figure C–2).

Suction Head And Wear Ring Removal

(Figure C–3)

Support the suction head (40) using a suitable hoist and sling.

Remove the hardware (45 and 46). Use a pair of pry bars or large screwdrivers to pry the suction head and wear ring (41) from the volute (1).

Inspect the wear ring. If replacement is required, or if the O-rings (34 and 39) require replacement, re-

move the hardware (35 and 36) securing the suction head to the wear ring.

Use a set of pry bars or large screwdrivers to pry the suction head and wear plate out of the volute casing.

Remove the adjusting screws and jam nuts (37 and 38). Remove the jam nuts from the adjusting screws and reinstall the adjusting screws. Use the adjusting screws to push the wear ring out of the suction head.

Remove the adjusting screws, install the jam nuts, and reinstall the adjusting screws in the suction head.

Separating Intermediate And Drive Assembly From Power Source

(Figure C—4)

Further disassembly of the pump requires separating the pump end and drive assembly from the power source. Disconnect the discharge piping from the pump casing.

Remove the hardware (5 and 6) securing the intermediate to the bellhousing. Separate the assemblies by pulling the pump end straight away from the power source.

As the assemblies separate, the flexible portion of the coupling assembly (1) 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—3).

It is not necessary to remove the outer ring of the coupling from the flywheel unless the coupling must be replaced. To remove the ring, disengage the hardware (3 and 4) securing it to the flywheel. Move the pump end to a clean, well equipped shop area for further disassembly.

Draining Oil From Seal Cavity

(Figure C—3)

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 (1 gallon [4 liter] minimum), under the seal cavity drain plug (30). Remove the drain 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.

Loosening Impeller

(Figures C—3 and C—6)

With the pump end separated from the power source, position the pump end on a flat surface with the drive end facing up. Insert a block of wood through the pump discharge and wedge it between the vanes of the impeller and the pump casing to prevent rotation.

Install the shaft key (19) in the shaft keyway. Install a lathe dog on the drive end of the shaft (20) with the “V” notch positioned over the shaft key.

With the impeller rotation still blocked, see Figure C—6 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.

NOTE

Do not remove the impeller until the rotating assembly has been removed from the pump casing.

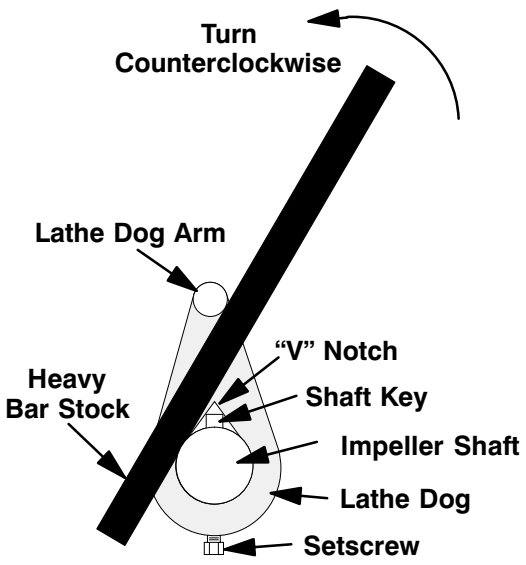


Figure C—6. Loosening Impeller

Pump Casing Removal

(Figure C—3)

With the pump end resting on a flat surface and the drive end facing up, secure a suitable lifting device to the bellhousing mounting holes in the intermediate (14).

Remove the hardware (9 and 10). Apply tension on the lifting device and use a pair of pry bars or large screwdrivers to separate the volute casing at the gasket (32).

Remove the rotating portion of the pump and place it on a clean work surface. Discard the pump casing gasket.

Impeller Removal

(Figure C—3)

To remove the impeller (2), unscrew it in a counterclockwise direction (when facing the impeller). 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—3 and C—7)

Slide the impeller adjusting shims (4) off the impeller shaft. Tie and tag the shims or measure and record their thickness for ease of reassembly.

Remove the seal spring. Lubricate the shaft sleeve with light oil and work it up under the bellows. Slide the rotating portion of the seal (consisting of the bellows, retainer, and rotating element) off the shaft as a unit.

Slide the seal plate and stationary portion of the seal off the shaft. 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, element and O-rings can be removed.

Remove the seal plate O-ring (7).

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 bearing housing should not require disassembly. Disassemble the shaft and bearings **only** when there is evidence of wear or damage.

CAUTION

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

Remove the bearing housing drain plug (29) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (15 and 16) and remove the bearing cover (17), gasket (24) and oil seal (22). Use a suitably sized dowel to press the oil seal from the bearing cover.

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 seals (42) out of the intermediate.

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

CAUTION

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

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

WARNING!

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

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

CAUTION

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

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

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

If bearing replacement is required, remove the retaining ring (21) and thrust washer (23). Use a bearing puller to remove the inboard and outboard bearings (18 and 31) 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**.

CAUTION

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

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

NOTE

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

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

After the 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.

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.

CAUTION

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

Install the thrust washer (23) and secure the outboard bearing (18) to the shaft with the retaining ring (21).

Apply a light coating of oil to the lips of the inboard oil seals (42) and press them into the intermediate with the lips positioned as shown in Figure C—3. Press the oil seals into the housing until they are centered in the intermediate bore.

Slide the shaft and assembled bearings into the intermediate bore until the retaining ring on the outboard bearing (18) is fully seated against the intermediate. Use caution not to damage the lip seals (42) on the shaft threads.

CAUTION

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

Apply a light coating of oil to the lip of the outboard oil seal (22) and press it into the bearing cover (17) 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 cover.

Install the bearing cover gasket (24) and secure the bearing cover to the intermediate with the hardware (15 and 16). **Be careful** not to damage the lip of the oil seal (22) on the shaft keyway.

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

Securing Intermediate And Drive Assembly To Power Source

(Figure C—4)

Install the shaft key (19, Figure C—3) in the shaft keyway. Position the flexible portion of the coupling assembly (1) 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 away from 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.

CAUTION

Make certain that the flexible portion of the coupling is mounted as shown in Figure C—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 coupling must be positioned 0.54 inches (13,7 mm) from the end of the shaft. This will allow the two portions of the coupling to fully engage when the drive flange is secured to the bellhousing, without preloading 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 23.3 ft. lbs. (280 in. lbs. or 3,2 m. kg.).

If the complete coupling assembly is being replaced, apply ‘Loctite Retaining Compound No. 242’ or equivalent to the threads of the hardware (3 and 4), and secure the outer ring of the coupling to the 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 rotating assembly and coupling so the flexible portion of the coupling seats inside the outer ring attached to the flywheel.

NOTE

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

Secure the intermediate to the bellhousing with the previously removed hardware (5 and 6). Make sure the intermediate guards (not shown) are installed over the openings in the intermediate.

Seal Reassembly and Installation

(Figures C—3 and C—7)

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

WARNING!

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

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

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

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Clean and polish the 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—7).

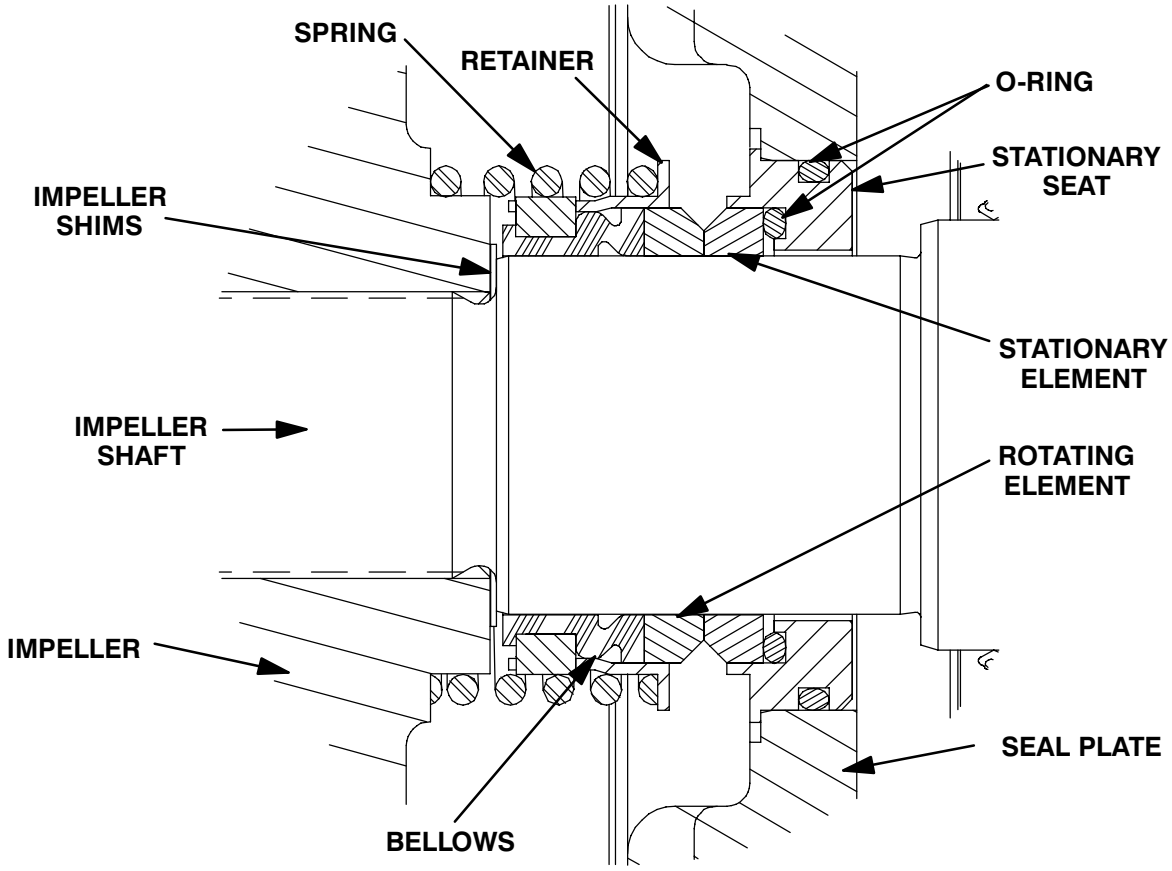


Figure C—7. Seal Assembly

CAUTION

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

Lubricate the stationary seat O-ring with water or light oil. Press the stationary seat and element into the seal plate (6) until fully seated.

Position the seal plate over the shaft and temporarily secure it to the intermediate (14) with four 1/2—UNC x 2-inch long capscrews and hex nuts (not supplied). **Be careful** not to damage the stationary portion of the seal on the shaft threads.

Lubricate the shaft with a **small** amount of light oil and slide the rotating subassembly (consisting of rotating element, bellows and retainer), onto the shaft until the seal faces touch.

Install the seal spring. Lubricate the seal as indicated in **LUBRICATION** after the impeller is installed.

Impeller Installation And Adjustment

(Figure C—3)

Inspect the impeller (2) and replace it if cracked or badly worn.

CAUTION

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 (4) as previously removed and screw the impeller assembly 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 Installation

(Figure C—3)

Remove the four capscrews and hex nuts (not supplied) securing the seal plate to the intermediate. With the volute casing (1) resting on a flat surface and the suction opening facing down, secure a suitable lifting device to the bellhousing mounting holes in the intermediate (14).

Install a new gasket (32) over the volute studs (8). Use the lifting device to carefully lower the rotating portion of the pump over the volute studs until fully seated against the volute.

NOTE

Position the rotating portion of the pump over the volute studs so the air vent (13) is properly oriented with the volute casing (see the volute orientation details, Figure C—3).

Secure the volute casing to the intermediate with the hardware (9 and 10).

Suction Head And Wear Ring Installation And Adjustment

(Figure C—3)

Lubricate the O-rings (34 and 39) with grease and install them in the grooves in the wear ring (41).

Make sure the adjusting screws (37) are fully retracted, and press the wear ring into the suction head until fully seated and the mounting holes in the wear ring align with the mounting holes in the suction head. Secure the wear ring to the suction head with the hardware (35 and 36). Do not overtighten the mounting hardware. Over-tightening the hardware can deform the wear ring, resulting in uneven clearance with the impeller.

Slide the assembled suction head and wear ring into the pump casing with the suction head mounting foot positioned as shown in the volute orientation detail for your pump in Figure C—3. Secure the suction head to the pump casing with the hardware (45 and 46).

Reach through the suction opening and use a feeler gauge to measure the gap between the wear ring and the impeller. This clearance should be between .010 and .020 inch (to mm).

To adjust the clearance, loosen the hardware securing the wear ring to the suction head. Loosen the jam nuts (38) and turn the adjusting screws (37) clockwise in an alternating pattern until the proper clearance is achieved. When the clearance is correct, tighten the jam nuts and the securing hardware.

Suction Spool Flange Installation

(Figure C—1 or C—2)

Apply a light coating of grease to one side of the suction spool flange gasket (3, Figure C—1 or 4, Figure C—2) and use the grease to secure the gasket to the pump casing flange.

Use a suitable lifting device to position the suction spool flange (7, Figure C—1 or 8, Figure C—2) against the gasket. Secure the flange to the pump casing with the hardware (4, 5 and 6, Figure C—1 or 5, 6 and 7, Figure C—2).

Secure the flange to the base with the previously removed hardware (not shown).

Discharge Check Valve Assembly and Installation

(Figure C—2)

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 (3) using a sling and a suitable lifting device. Secure the discharge check valve assembly and gasket (13) to the pump assembly (1) using the hardware (9, 10, 11 and 12)

Priming Chamber Assembly And Installation

(Figure C—5)

If the priming chamber lid (8) was removed, install the linear O-ring (9) using "3M Scotchgrip No.847" or equivalent compound in the groove. Secure the priming chamber lid and gasket with the hardware (6 and 7).

NOTE

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

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 button if required.

Adjust the seating if necessary by loosening the locknut and screwing the orifice button into or out of the linkage. Tighten the locknut when adjustment is complete.

Install the priming valve gasket (5). Install the strainer (11).

Lower the float into the priming chamber (10) and secure the valve with the previously removed hardware (3 and 4).

(Figures C—1 or C—2)

Install the baffle (13, Figure C—1 or 19, Figure C—2) and gasket (12, Figure C—1 or 18, Figure C—2) and use a sling and suitable lifting device to position the priming chamber assembly against the pump suction spool (7, Figure C—1 or 8, Figure C—2). Secure the priming chamber assembly with the hardware (14 and 14, Figure C—1 or 20 and 21, Figure C—2).

Reconnect the air discharge tubing (not shown) to the priming chamber assembly.

LUBRICATION

Seal Assembly

(Figure C—3)

Fill the seal cavity through the hole for the vented plug (11) with SAE No. 30 non-detergent oil to the line on the sight gauge (25). Check the oil level regularly and refill as required. When lubricating a dry seal cavity, add approximately approximately 112 U.S. ounces (3,3 liters) of oil to level indicated.

NOTE

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

Bearings

(Figure C—3)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (27) and maintain it at the midpoint of the gauge. When lubrication is required, remove the air vent (13) and add SAE No. 30 non-detergent oil through the opening. When lubricating a dry (overhauled) bearing housing, fill the bearing cavity with approximately 18 ounces (532 ml) of oil. 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 gauges 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.

CAUTION

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.

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